

WORLD

SILVER SURVEY

1998



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WORLD SILVER SURVEY 1998

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PREFACE

The World Silver Survey has been published annually by The Silver Institute since 1990. Copies of previous editions can be obtained by contacting The Silver Institute at the address and telephone number on the front inside cover.

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The data on which this report is based have been obtained by The Silver Institute and Gold Fields Mineral Services from sources which are generally believed to be reliable. However, this does not guarantee complete accuracy in the information presented here. It is in the nature of the precious metals markets that estimates for a number of components must be made on the basis of incomplete information. The opinions expressed here represent those of the authors of the report at the time of writing.

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This is the fourth survey of the world silver market to be produced for The Silver Institute by Gold Fields Mineral Services (GFMS), which is best known for its annual Gold Survey, now in its 31st year. As with the work on gold, the information contained here is based in part on the analysis of the GFMS database of international trade statistics, company report data and other public-domain information. More importantly, it is also based on a series of interviews with the industry's main players, carried out every year by the GFMS team of analysts and consultants, which provide the essential data to allow the compilation of reliable estimates for world supply and demand.

GFMS 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 this Survey is as complete and accurate as possible.

Gold Fields Mineral Services Ltd

May, 1998

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Units used:

supply and demand data are given in units of million troy ounces (Moz)

1 Moz = 31.103 t (metric tonnes)

1 tonne = 32,151 troy ounces

1 tonne = 1,000,000 grams (g)

Terminology:

“-” = not available or not applicable

0.0 = zero or less than 0.05

“dollar” refers to the US dollar unless otherwise stated

Prices:

Unless otherwise stated US dollar prices are for the PM fix of the London Silver Market.

Table Rounding:

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

1. Summary and Outlook

Silver's price performance in 1997 and the early months of this year enhanced its reputation as the "restless metal". For even a casual observer, there was a compelling interest in the way that the price rose from a four-year low of \$4.22 in mid-July to a nine-year high of \$6.27 only five months later. An added piquancy was provided in February, 1998, when the scale of the silver purchases made by Mr Warren Buffett's investment company was revealed. But for those involved in the business of mining and using silver, the real issues are the identification of the factors underlying this price movement and their implications for the future.

The silver market in 1997 presents the analyst with a fascinating interplay between the metal's commodity fundamentals and its attractions to the investor and speculator. The market could thus be analyzed at two distinct, if interconnected levels. In the first place there were the normal physical flows, from mines and scrap, through refineries and dealers to meet the needs of fabricators in a wide range of industries. The second level of analysis refers to the question of inventories of bullion and the way in which changes in the location, ownership and status of the diminishing quantity of these stocks began to influence the price.

Looking first at the supply/demand position as summarized in Table 1, it is at once clear that there

was again, as in every year since 1990, a statistical deficit which was filled by disinvestment. But perhaps the biggest surprise, in view of the steady rise in the price of silver in the second half of last year and the gyrations in the first months of 1998, is that the annual average price of \$4.897 in 1997 was nearly 6% lower than in the previous year.

The increase in mine production of just under 5% represented the third year of rising output after four years of decline but in spite of the rise of some 23 Moz (734 t) overall mine production failed to regain the 1990 level. The increase was the result of similar contributions from three sources of mined silver. Primary silver mines increased their output by 8%, a somewhat lower percentage gain than was seen in 1996, but nevertheless a robust performance in the light of the decline in the average price. By-product output from both gold and lead/zinc mines was also higher, though this was offset by a decline in silver generated from the world's copper mines and other by-product sources. The result was that primary mines contributed a slightly more than pro-rata increase than the by-product sources and hence fractionally increased their share of total production to 22%.

Net official sector sales showed a fall (which virtually balanced the rise in mine production) to an insignificant 3.8 Moz (118 t). In fact, even when

Table 1
World Silver Supply and Demand
(Million ounces)

	1990	1991	1992	1993	1994	1995	1996	1997
Supply								
Mine Production	520.4	508.1	483.0	462.7	450.1	483.2	489.0	512.6
Net Official Sector Sales	2.1	-	-	12.1	27.1	33.1	25.1	3.8
Old Silver Scrap	128.4	134.6	140.8	140.9	144.6	149.4	150.6	152.5
Hedging	15.2	19.0	1.3	26.7	-	5.5	-	64.9
Implied Disinvestment	50.6	53.0	104.9	138.5	151.4	103.0	161.4	129.6
Total Supply	716.7	714.7	730.0	780.9	773.2	774.2	826.2	863.4
Demand								
Fabrication								
Industrial	279.3	272.2	261.0	273.2	285.0	299.8	301.1	323.5
Photography	221.1	216.2	210.3	210.0	213.1	220.4	224.5	232.3
Jewelry and Silverware	184.2	189.5	209.9	257.1	223.0	230.2	266.1	280.2
Official Coins	32.1	29.2	33.4	40.6	43.0	23.8	22.3	27.4
Total Fabrication	716.7	707.1	714.6	780.9	764.1	774.2	814.0	863.4
Net Official Sector Purchases	-	7.6	15.4	-	-	-	-	-
Hedging	-	-	-	-	9.1	-	12.2	-
Total Demand	716.7	714.7	730.0	780.9	773.2	774.2	826.2	863.4
Silver Price (London US\$/oz)	4.832	4.057	3.946	4.313	5.285	5.197	5.199	4.897

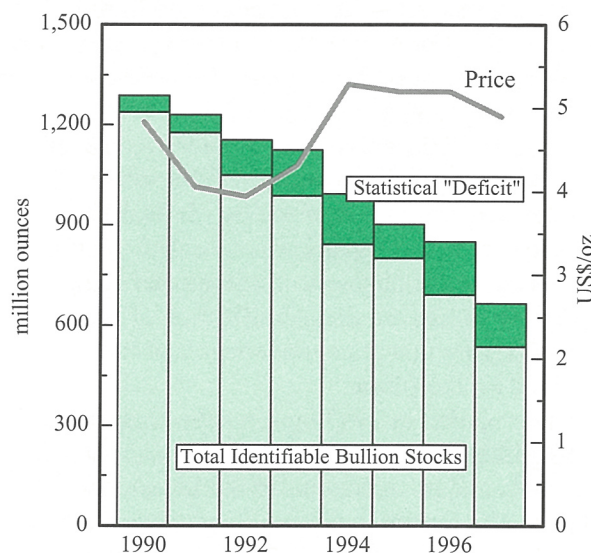
official sector sales were at comparatively high levels (as in the 1994-96 period) they have played virtually no role in influencing market sentiment. This is in sharp contrast to the gold market, where the official sector has been increasingly perceived as weighing heavily on the price, both through actual sales and indirectly, by influencing the behavior of speculators who were consistent short sellers of gold over the past two years in particular. The widening appreciation of this and other important differences between the fundamentals of the two metals helped silver to break free from the depressing influence of a continued decline in the gold price last year.

It could certainly not be expected that the modest increase in scrap recycling (even though to a new record level) would have any real influence on the price. As Table 1 shows, scrap supply has risen every year since 1990, largely due to the steady expansion of the pool of above-ground stocks of fabricated silver.

The next item, producer hedging, is one which, like the official sector, has not really been much of a factor in the silver market during the past decade, either in terms of the amount of physical metal which has had to be absorbed as a result of hedging, or due to any adverse impact on sentiment. Once again, there has been a marked difference between the gold and silver markets, with the gold price being considered as capped by the price-sensitive forward selling from the producers. Last year, however, the situation in the silver market deviated from the previous pattern of insignificant hedging activity. While the almost 65 Moz (2,019 t) of silver supply from hedging in 1997 was proportionally smaller than the kind of hedging often seen in the gold market, it was nevertheless easily the highest level so far recorded. This substantial quantity of silver had to be borrowed from the above-ground stocks of bullion. As the bulk of this hedging was stimulated by the rising price and thus concentrated in the final months of the year, the need to borrow silver rose sharply in this period. This, together with some position-taking by market players helped to drive silver leasing rates rapidly higher, eventually resulting in the market going into the first backwardation since 1980 in which the spot price was higher than the 12-month forward price.

Subtracting the total supply from all the above-mentioned components from the demand total shown in Table 1 gives the implied disinvestment of bullion, ie, the statistical deficit, of almost 130 Moz (4,031 t) needed to balance the market last year.

Figure 1
Bullion Stocks and Statistical "Deficit"



Since the end of 1990, identifiable bullion stocks have decreased by 700 Moz (21,772 t) with 154 Moz (4,790 t) of this being recorded in 1997. By comparison, the corresponding statistical deficits (ie, the implied disinvestment shown in Table 1) amount to a higher total of 842 Moz (26,182 t). The reason for the fall in identifiable stocks since 1990 being less than implied by the statistical deficit is mainly due to a parallel decline in unreported stocks. In 1997, however, the graph appears to suggest that the decline in stocks was greater than the statistical deficit. This was due in part to a transfer of stocks from the identifiable to the unreported category and also because metal was removed from stocks to fund producer hedging transactions.

Before looking at the messages about the future course of the market which can be derived from the inter-relationship between the statistical deficit and the trend in bullion stocks (as depicted in Figure 1) the next section reviews the demand side of the equation.

Of the three main fabricating sectors, it was the industrial category which showed the fastest growth last year, the jump of 7% considerably exceeding any increase during the past five years. In spite of the enormous diversity of use in industry, which makes it difficult to encapsulate in a few words the reasons for this robust growth, the one area which stands out is the increasing use of silver in the electronics industry.

The more modest growth in photographic demand of 3.5% last year was nevertheless encouraging in the face of the perceived threat from silverless digital imaging. In fact, the new technologies have by no means supplanted silver from the mainstream of

photographic applications and for the moment at least, are seen as an adjunct to, rather than a replacement for, traditional silver halide systems.

While both the industrial and photographic sectors are rightly considered to show a low short-run price-elasticity, just the opposite is true for the third main category of fabrication demand, jewelry and silverware. Although Table 1 shows that this sector grew by as much as 5% last year, mainly due to rises in Italy, India and Mexico, there is no doubt that demand in India, now by far the world's largest consumer of jewelry and silverware, fell back dramatically in the fourth quarter. This was in part due to the price rise (especially in comparison with the falling gold price which attracted buyers away from silver) but was also a reaction to the enormous inflows into the country during the second and third quarters.

The final demand component, official coins, though small in comparison, nevertheless showed a very respectable growth of 23% last year helping total fabrication to a new record of 863 Moz (26,855 t) some 6% above the 1996 level.

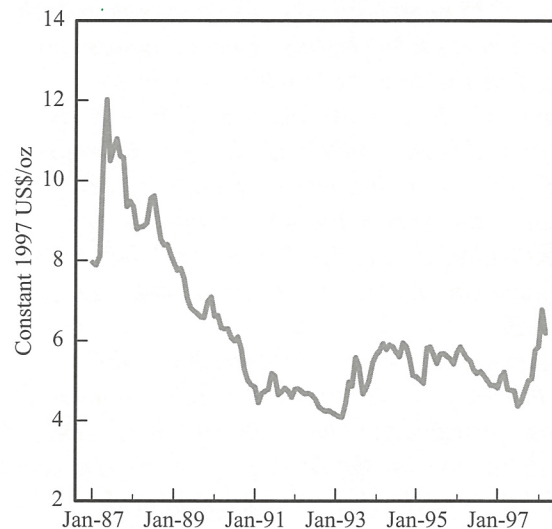
Looking now at the second level of analysis mentioned earlier, it is clear that the statistical deficit of 130 Moz (4,031 t) resulted in yet another sharp fall in bullion stocks as depicted in Figure 1. Most importantly, however, as noted in the box below the figure, the substantial supply from hedging in 1997 represents bullion stocks which have been borrowed from their owners and sold by the intermediaries of the mining companies. So this quantity has also been removed from physical bullion stocks, even though it has not actually been sold by the owner of the metal.

It was already clear a year ago that stocks were approaching the "pinch point" - the level at which the location, ownership and form of the remaining stocks start to influence the behaviour of market participants and thus the price. With the further statistical deficit in 1997, plus the use of 65 Moz of borrowed silver for hedging, it appears that stock levels have reached this point. To quote from the final sentence from the outlook section of last year's World Silver Survey:

"if the existing holders of the remaining stock of bullion should choose to maintain rather than dispose of their holdings (or perhaps even increase them) then the only way that the market will achieve a balance ... is via a significant increase in price."

With the injection of funds from a number of investment institutions into the silver market in the

Figure 2
Real Silver Price (monthly averages)



second half of 1997 (most prominently, of course, in the form of the 130 Moz purchase announced in February this year by Mr Buffett's Berkshire Hathaway company) it is clear that this readjustment process has been under way for a good part of the past year. The more difficult question is deciding whether it has gone far enough to achieve a sustainable equilibrium (in other words, without the need for further transfers from the bullion stock). The alternative could be of course that the price had already overshot that level by early February this year. In other words, with reference to Figure 2, is the silver price now heading back to the kind of trading range seen a decade ago or alternatively, by moving just beyond the range of the past eight years, has it already done enough to restore equilibrium?

Much will depend on the response of the price-elastic components of the market: in the short term, above all Indian import demand. This began to show signs of renewed life in March, 1998, when some 7.6 Moz (237 t) were imported, following a six-month period in which these imports were running at only around 2 Moz (60 t) per month, (a sixth of the monthly quantity recorded in the first eight months of 1997). But given that last year's statistical deficit exceeded the totality of Indian demand, perhaps the more relevant question concerns the fate of the bullion stocks purchased by Mr Buffett and others in the past year. If these continue to be held off-market, then, at the very least, the chances of silver losing all the gains of the past six months would seem remote.

2. Silver Prices

1997 proved to be a very dramatic year for the silver market. The price saw not only a four-year low of \$4.2235 in mid-July but also a nine-year high of \$6.2675 on 24th December, though this was soon surpassed in the New Year with the spot price being pushed up to \$7.81 in early February as the backwardation which had developed towards the end of the year became ever more severe.

In spite of the rally in the second half, the price averaged \$4.897 during 1997, almost 6% below the 1996 equivalent and the lowest annual average since 1993.

Two distinct periods were observable in the market last year. In the first half, sentiment towards silver was restrained by the steady fall in the gold price with the low for the silver price being reached on 17th July, shortly after the gold price had reached a 12-year low.

Thereafter, however, the prices of the two metals diverged sharply. Silver's increase of over \$2 in less than six months (and even further in the new year) was in stark contrast to the gold price which by December had fallen to an 18-year low. The rally in the silver market was driven by renewed investment demand based on a widening appreciation of the metal's improving fundamentals.

The silver price opened 1997 at \$4.77, only just above the 1996 low reached a month earlier. Throughout most of 1996, sentiment towards silver had been adversely affected by the fall in the gold price. Towards the end of the year, however, the silver price had begun to deviate from the gold price due to investors and speculators adopting distinct, and often opposite, positions in the two markets as awareness spread of their rather different fundamentals. This was to set the tone for 1997 and although at times the gold market continued to exert an influence on the silver price, the trends in the metals' prices proved to be more divergent than convergent during the past year.

A good example of this was seen in the first two months of 1997, during which the gold price fell by 2% (see Figure 4). Although the silver price initially followed gold down (in fact, to a two-year low of \$4.65 in mid-January) it then demonstrated the kind of spurt for which it is renowned, rising by 14% over the next six weeks to reach \$5.30 in early March. The price was boosted during this period by funds closing short positions and moving onto the long side. The higher level proved to be unsustainable, however, as the long positions were closed out, causing the price to drift down during March before collapsing during April back to the \$4.70 level at which it had started the year. For the remainder of the first half, the price

Figure 3
London Silver Market: Spot Price, Weekly Averages

US\$/oz; other currencies reindexed to 2nd January 1997 = 100

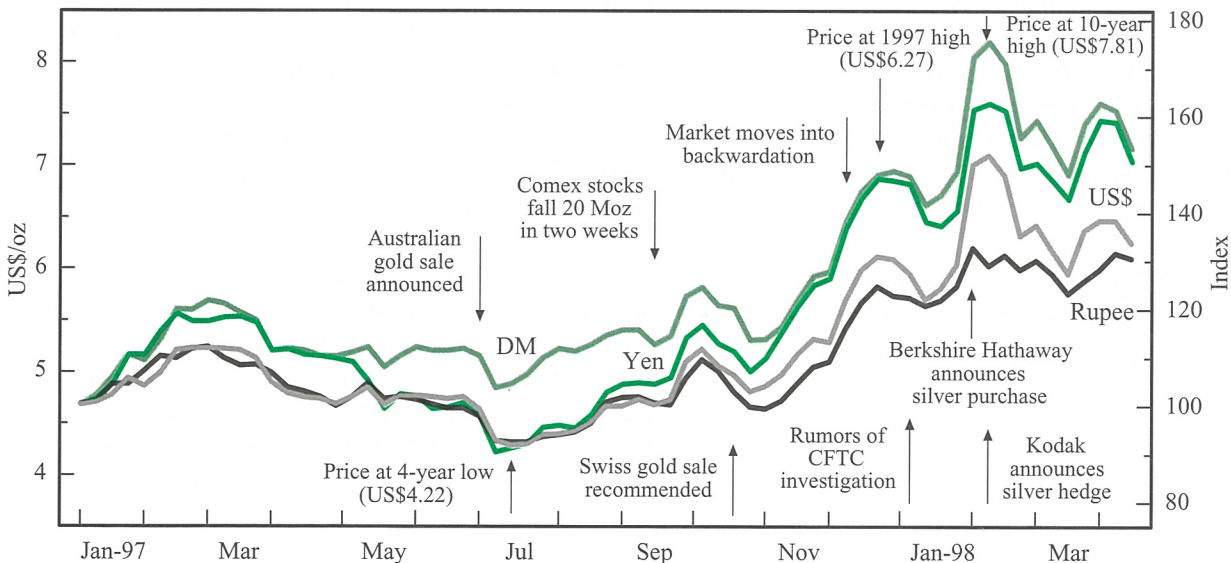


Figure 4
London Prices for Silver and Gold

Gold price reindexed to 2 January 1997 = 100

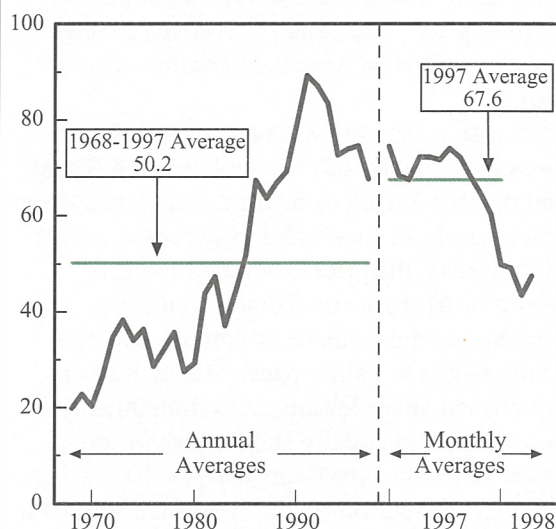


moved mostly sideways, except for a short-lived blip related to the hectic trading in the platinum group metals.

The next major move followed the Reserve Bank of Australia's announcement on 3rd July that it had sold 167 tonnes of its gold reserves, resulting in a collapse of the gold price to a 12-year low which pulled silver down with it. In three days, the silver price fell by nearly 9%, from \$4.65 to \$4.25, as the funds moved onto the short side of the market. By 17th July, the price had dropped to \$4.22, the lowest level since November 1993.

This proved to be the turning point for the silver price, however, as the funds soon returned to the long side, while maintaining large short positions in the gold market. As a result, the prices of the two metals began to diverge again and silver began to trend slowly upwards for the remainder of the third quarter, though it is notable that it took more than a month to regain the \$4.65 level. Sentiment towards the metal was boosted by the continued decline in Comex inventories, which had fallen from over 200 million ounces at the beginning of the year to 164 million ounces by the end of August. The stock fall in September was even more remarkable, at 26 million ounces, and prompted the funds to increase their long positions, with the result that the spot price jumped almost 30 cents on the last two days of the month. This sharp rally was accompanied by rumors that hedge funds were attempting to influence the physical market. Throughout the next few months, these and

Figure 5
The Gold/Silver Price Ratio



The gold/silver ratio shown in Figure 5 provides a convenient measure of the relative performance of the two metals, a low value indicating a strong silver price.

During the first half of 1997, the ratio showed little movement, except for a temporary fall in February and March. In the second half, however, it fell almost continuously, to end the year at 47 - just below its 30-year average - as a result of renewed investor interest in silver and a relentless fall in the gold price. The ratio fell briefly to 38.3 in early February 1998, its lowest level since 1983, before recovering to over 47 by the end of March. This divergence between the two prices is also shown by the fact that during 1997, the gold price fell to an 18-year low, while the silver price reached a nine-year high.

In spite of the divergent trends in 1997, the percentage correlation between daily gold and silver prices movements remained high at 71%. This suggests that there is still a strong short-term association of the two metals in the minds of traders and other market participants.

related rumors continued to exert a mostly bullish influence on the market.

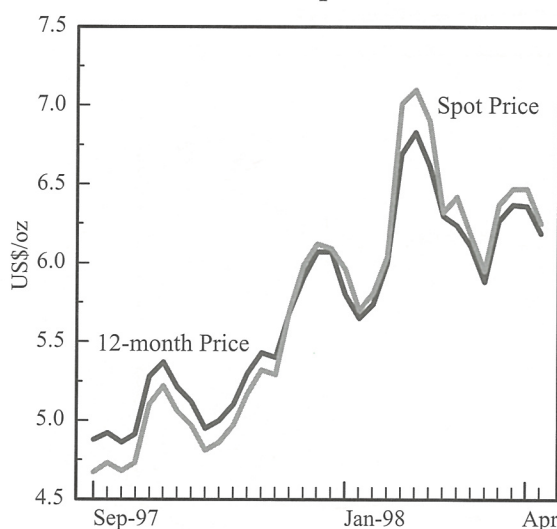
As always, however, prices did not move up in a straight line. Once again, developments in the gold market helped to push silver downwards, especially in late October, when a Swiss advisory group recommended the sale of 1,400 tonnes of the country's

gold reserves. The gold price fell sharply following the announcement and silver followed suit, dropping almost 30 cents in a week. However, in contrast to gold, the silver price soon began to recover as funds opened long positions on reports of continued stock drawdowns.

A small boost to the outlook for photographic demand was provided on 6th November when Kodak announced that the launch of its digital camera systems had not been nearly as successful as expected. Over the next few weeks, the price continued to move sharply upwards as stocks on Comex continued to decline. In the second week of December, the bull market really began to gather pace. Heavy forward borrowing pushed silver leasing rates dramatically higher, resulting in an equally sudden rise in spot prices, to above \$6 on 11th December, as the market moved into backwardation (ie the spot price above the forward price). News, on 23rd December, that Comex stocks had fallen by 4.9 million ounces in just one day, helped to push the price up sharply and the following day it fixed at \$6.2675, the highest level since 17th November 1988. Although the price subsided slightly over the following week, to close the year at just under \$6, the excitement in the market was far from over.

After remaining at around the \$6 level during the first week of the new year, the price fell by some 50 cents as a result of rumors that the Commodity Futures Trading Commission was launching an investigation into the drawdown of stocks on Comex. But higher lease rates again helped to lift the spot price in the following weeks, though the market remained in a nervous state, in part due to the news on 28th January that a lawsuit had been filed alleging that market participants had moved stocks out of Comex warehouses to give the appearance of falling stock levels. At the end of January, the New York Mercantile Exchange - the parent company of Comex - issued a statement that there had been no evidence of market manipulation. Then, on 3rd February, the investment fund Berkshire Hathaway, controlled by Mr Warren Buffett, announced that it had bought 129.7 Moz (4,030t) of silver between 25th July 1997 and early 1998. The combined impact of these statements was that in the first five trading days of February, the market saw frantic borrowing which pushed the 3-month lease rate above 30% at one point and caused the spot price to rise by an astonishing \$1.76 to fix at \$7.81 on 6th February - a new nine-year high. The spike was short-lived, however, as the price fell to

Figure 6
London Silver Prices, Spot and 12-month

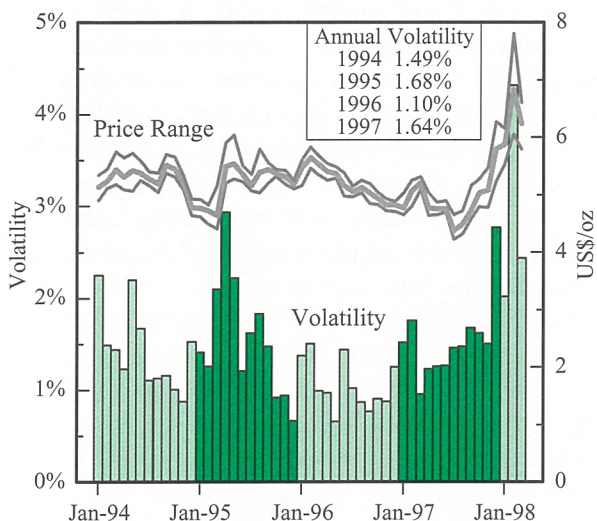


In the London Silver Market, in addition to the spot price, daily quotes are given for the forward prices at three, six and twelve months. The above graph shows how the silver price moved from being in contango in September, 1997 (the more usual situation, with the forward price above the spot price) to the opposite relationship, or backwardation, in November, which then widened sharply to reach a maximum on 6th February this year (measuring spot against the 12-month price) of more than 10%, with a February average of 3.4%. The annualized backwardation for the 3-month price was, not surprisingly, even higher, at an average of 8.5% in February, having peaked at 27% on 5th February.

While backwardations are very common in the base metals, they are extremely rare in the silver market. The only occasion in the past quarter century when there was a similar backwardation in silver (ie, against the 12-month price) was at the end of January, 1980, shortly after the silver price in London had peaked at just short of \$50. Even then, however, the maximum backwardation was only 2.6% and the duration of the squeeze (including the period of abnormal contangos before and after the backwardation itself) was only around six weeks. By comparison, the recent episode of actual backwardation extended from early December to the second half of April.

Figure 7
Silver Price Volatility

Based on London daily spot fixings



\$7.19 a few days later following an announcement from Kodak that it had hedged half of its silver requirements for 1998. Lack of liquidity in the market over this period prompted the London Bullion Market Association temporarily to extend the period for physical delivery of silver from 5 to 15 days, thereby also helping to ease the pressure in the market. Over the next few days, the price continued to subside, but remained above \$7 until the 18th of the month. The second half of February proved just as volatile as the first. Fund liquidations caused the price to fall by \$1.15 between the 16th and the 26th, before recovering to close the month at \$6.37. The price remained volatile in March, falling to \$5.80 on the 18th, the lowest level since mid-January, before recovering to \$6.34 at the end of the month.

Price Volatility and Trading Ranges

Ever since gold and silver have been freely traded, silver has generally been the more volatile of the two metals. For instance, the ratio of the two metals' volatilities averaged 1.7:1 over the 1970s and 1980s. This is because of a number of fundamental differences between the two markets.

Perhaps the most important of these is the smaller size of the silver market, which in itself makes for more volatile price movements and has at times also allowed speculators to have a greater influence on the price. However, other factors have also played a role, such as the near irrelevance of central bank stocks of silver to the supply/demand equation and the relatively small number of primary silver mining shares in the

equities market - both factors which have encouraged investors and speculators to take positions in silver bullion.

In recent years, the relative volatilities of silver and gold have moved further apart, with the above-mentioned ratio averaging as high as 3:1 in the period 1995-97. The explanation for this appears to be not only the active trading in silver in both mid-1995 and late 1997, but more importantly the widespread perception that the gold price has been effectively capped by producer hedging and official disposals. The result has been that relatively speaking, speculative forces have played a much smaller role in the gold market than in the case of silver. Another difference between the markets is the much lower short-run price-elasticity of demand for silver, because of the preponderance of industrial uses. Investors look on gold's much higher price-elasticity as also having a dampening impact on price movements in the medium term.

Another difference between the two metals is that, hedging activity, which can act as a brake on large price movements, has historically been less of a factor in the silver market than in the gold market. (In 1997, however, silver hedging reached new record levels in response to the high prices in the fourth quarter, thereby slowing the price increase.)

The difference in volatilities between the two metals over the past year can be seen in the table below.

Price Volatility (%) and Volatility Ratio

(Based on daily fixings)

	1997	97.Q1	97.Q2	97.Q3	97.Q4	98.Q1
Silver	1.64	1.42	1.26	1.54	1.97	2.93
Gold	0.70	0.73	0.43	0.64	0.82	0.86
Ratio	2.34	1.95	2.91	2.42	2.39	3.39

For most of 1997, silver price volatility remained at a moderate level, as can be seen in Figure 7, though well above the depressed level of 1996, averaging 1.6% compared with 1.1% for 1996. Towards the end of the year, however, and especially in the first months of 1998, volatility increased dramatically, reflecting the turbulent trading as the price broke through the \$6 level on its way to a nine-year high. In fact, volatility during February, at 4.3%, was the highest figure since May 1987, when the price spiked to over \$9 (and eventually went on to above \$10). Although gold volatility also rose sharply in the first quarter of 1998, the increase was much less than for silver, giving a volatility ratio as high as 3.39 for the quarter.

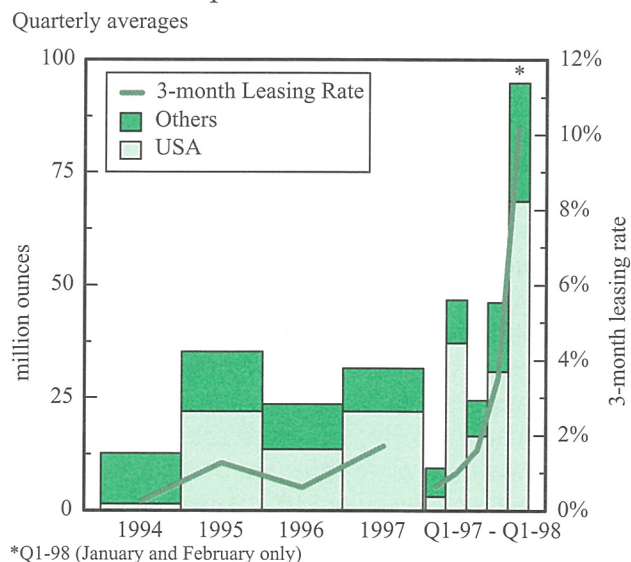
3. Silver Bullion Trade

The widening premium between the London spot price and prices in overseas markets, in particular on Comex, saw substantial flows of silver into London, especially in the fourth quarter of 1997 and the first quarter of 1998. Dubai's imports surged by 50% in 1997, suggesting continued strong demand from India. Indian bullion imports from all sources in the first half of the year were quite phenomenal, with the second quarter recording the highest ever level. The rising silver price in the second half saw a sharp decline in Indian imports, and by the fourth quarter they had fallen back to the average levels of 1991, leaving the aggregate imports for the year little changed from the 1996 record level. Singapore still acts as a major entrepôt market for the region, servicing mainly Thailand but also Indonesia. Japan's silver requirements continue to be met primarily through imports from the United States and Mexico.

Europe and North America

Local silver supply in Europe from mine production and scrap covers less than half the region's fabrication requirements. Therefore, even taking into account some additional supply from locally disinvested metal, Europe is a substantial net importer of bullion. This alone would give it an important role in the silver bullion trade but in addition, Zurich and, especially, London are important trading centers and entrepôts for the wider international market.

Figure 8
UK Bullion Imports



Figures 8 and 9 show the pattern of UK bullion imports and exports respectively. Imports last year were dominated by shipments from the United States, especially in the fourth quarter, a pattern which was repeated but with even larger numbers in the first quarter of 1998. The increased arrivals of silver in London reflected a range of factors, such as higher silver leasing rates, the widening premium between the spot silver price in London and prices in overseas markets, especially Comex, and the fact that London represented a convenient place to “park” metal which had been removed from Comex warehouses.

The generally higher level of silver prices in the final quarter of 1997 and in the first quarter of this year had an equally dramatic impact on UK silver bullion exports. These slumped suddenly in the fourth quarter as Indian import demand weakened sharply and were even lower in the first two months of 1998.

In contrast to Europe, North America was, again, a massive net exporter of silver last year. This was a reflection not only of the normal pattern of flows of silver mine production via US and Canadian refineries to the world market but also the continuing substantial run-down in Comex bullion stocks. It was the continued drawdown and transfer of these stocks to London which chiefly explains the trend and level of US exports during 1997 (see Figure 10). From May to September, namely before the real recovery in silver prices was underway, there was a significant export of bullion, both directly and via the United Kingdom, to

Figure 9
UK Bullion Exports

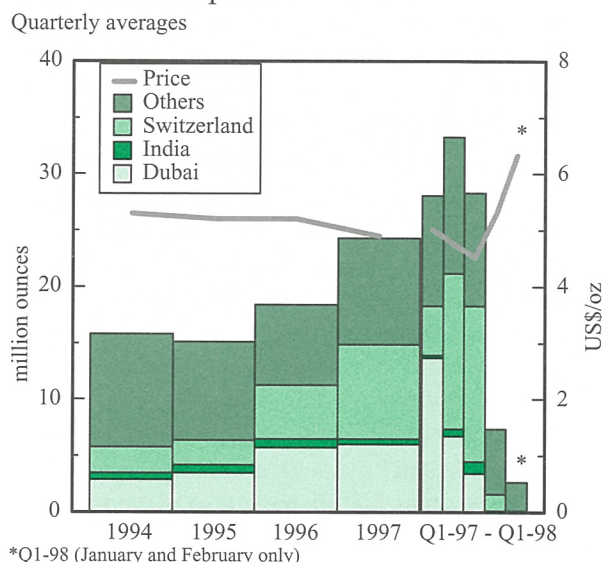
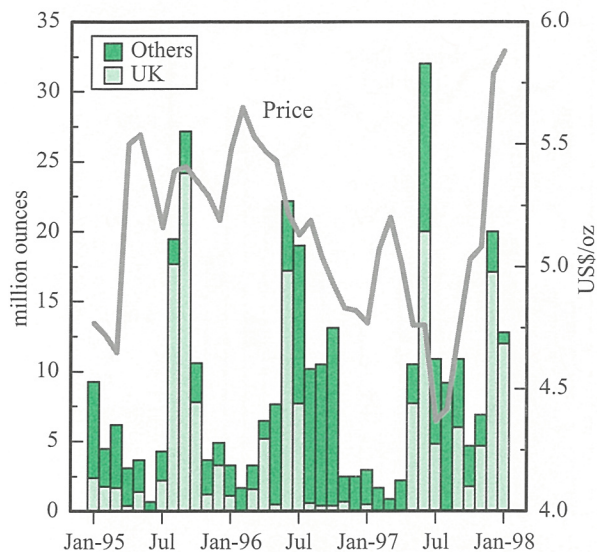


Figure 10
US Bullion Exports



Dubai for re-export to India. As the price recovered this source of demand dried up, the result being a huge net inflow to the United Kingdom in the final quarter of 1997, and even more so in the first months of this year.

Middle East

In the Middle East, silver bullion flows remain overwhelmingly dominated by Dubai, which continued to act as the primary channel of silver to the Indian sub-continent last year, partly due to a decline in direct exports from Europe to India.

Dubai Bullion Imports

Million ounces

1992	1993	1994	1995	1996	1997 (E)
53.8	76.8	48.9	45.5	48.1	72.6

In fact, as can be seen above, **Dubai's** imports leapt by some 50% in 1997, to an estimated 72.6 Moz (2,257 t), just short of the 76.8 Moz (2,388 t) imported in 1993, which in turn was surpassed only by the 85 Moz (2,647 t) recorded in 1968. However, the latter figure reflected a massive dishoarding of Indian silver, with Dubai acting as a conduit for unofficial exports back to Europe. Thus, last year's imports pointed to the continued strength of bullion demand on the sub-continent, for India in particular.

Supplies to Dubai in recent years have been

dominated by the United Kingdom and the United States, with Switzerland being relegated to the role of a minor player, reflecting the cost advantages of seaborne trade. Import statistics suggest that the United Kingdom was by far the largest source of Dubai's silver in 1997, with, for example, a share of 87% in the first half, dwarfing direct US supplies, although as indicated above, much of UK-originating metal would have been sourced originally from the United States.

Turning to the export side, only a tiny part of Dubai's imports are destined for markets other than the Indian sub-continent, though within the latter area, there was a notable increase in exports to Nepal last year. The liberalization of the import regimes in India, Pakistan and Nepal in recent years has somewhat eroded Dubai's former near monopoly status as a supplier to these countries, opening the way to direct shipments, above all from Europe. Nevertheless, Dubai has been successful in retaining a market share of almost half of the sub-continent's silver demand. This success, in spite of competition from Zurich, London, Singapore and even direct shipments of US silver to India last year, reflects a number of advantages, including:

- traditional business, family and cultural ties between traders in Dubai and those in India and Pakistan;
- an aggressive and flexible approach to pricing;
- good air-transport links to the principal Indian distribution centers, from both Dubai and the neighboring Emirate of Sharjah; and
- the ready availability of silver bullion held locally in Dubai during most of last year.

Together, these factors contributed to the sharp jump in Dubai's imports last year. But perhaps of greater interest than the aggregate quantity imported was the pattern of imports during the course of the year. This showed a peak early in the third quarter, before falling sharply in the final months of the year. The normal seasonal pattern of lower imports in mid-year (corresponding to the weakness of Indian demand during the monsoon) was, in effect, overwhelmed by the impact of the falling price during the second quarter. This is illustrated by the fact that an astonishing 16 Moz (511 t) of bullion was imported by Dubai in July alone, compared to a first half total of 38 Moz (1,168 t). Although Indian import demand started to weaken dramatically in September, Dubai's imports continued at high levels for several months, reflecting

the fact that its supplies arrive by sea, following a voyage of up to 45 days in the case of shipments from the United States. Much of the metal arriving in the port in the last months of the year had no ready market, resulting in a rapid build-up of dealer stocks. With the simultaneous surge in leasing rates in London, this subsequently led to much of the surplus being transported (often expensively, by air) back to London in the first months of 1998.

Apart from Dubai, the main flows of bullion to the Middle East reflected an increase in official supplies to the two main silver fabricating countries in the region, namely Turkey and Egypt, in both cases at the expense of unofficial flows. But even together, these imports amounted to only just over 4.5 Moz (140 t) last year.

Indian Sub-Continent

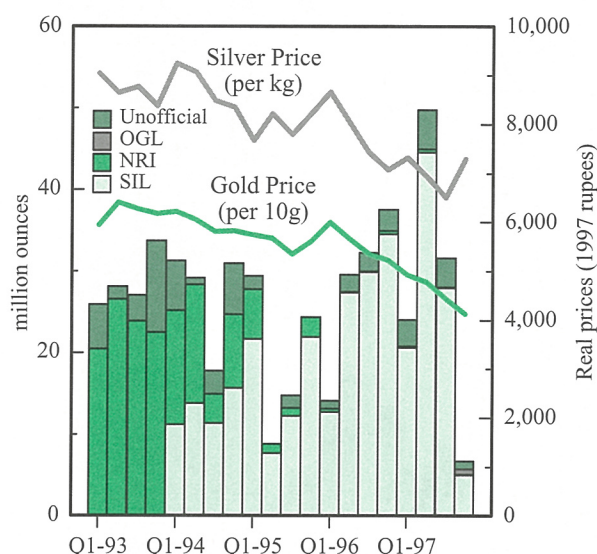
Bullion flows to the sub-continent are determined mainly by Indian demand, since Pakistan has much less of a silver-buying tradition. In recent years, however, flows to Nepal have increased steadily, both for its own fabricating industry and for re-export to India.

In **India**, a further significant liberalisation of the import regime for gold and silver was announced in October - the permission granted to eight authorised banks (including three foreign ones) and three state-owned trading agencies to import the metals under an Open General Licence (OGL). In brief, this allows the importer to bring in unlimited quantities of silver bullion, with payment of the import duty of Rupees 500 per kilogram being the only significant addition to the landed cost. This was in contrast to the Non-Resident Indian (NRI) and Special Import Licence (SIL) schemes introduced in 1992 and 1994 respectively, which in addition to the duty, involved heavy additional costs, namely the cost of couriers in the former and the cost of the import license in the latter. Under OGL, it became possible to import and supply silver to the domestic market at a very low premium to the international price.

Within a few months, OGL imports had virtually replaced supplies under both the NRI and SIL schemes and the local premium had fallen sharply, to as low as 10% in December.

Important as the above developments were, last year the main influence on Indian imports was undoubtedly the price of silver in the international market. The impact of the weakening price in the first half and the subsequent sharp recovery from July onwards can be

Figure 11
Indian Bullion Imports



seen in Figure 11. The strength of Indian bullion imports in the first half of 1997 was quite phenomenal, with the second quarter in particular showing the highest level ever recorded. After another strong performance in the third quarter, however, the effect of the rising price began to be felt and in the fourth quarter, imports fell back to around the average levels of 1991, that is before the introduction of the NRI scheme in February, 1993 which led to the blossoming of Indian demand in the following years.

Indian Bullion Imports

Million ounces

	1993	1994	1995	1996	1997
OGL	-	-	-	-	0.6
NRI	93.4	43.6	10.7	1.1	0.8
SIL	-	30.4	63.6	102.5	96.9
Replenishment [†]	1.5	1.1	0.9	1.8	1.5
Sub-total official	94.9	75.2	75.2	105.5	99.8
Smuggling	6.3	5.0	5.9	8.0	12.5
Total	101.2	80.1	81.1	113.5	112.4
Local Premium *	48%	28%	27%	23%	23%

[†] export replenishment schemes

* percentage above London price at official exchange rates

For 1997 as a whole, it can be seen from the above table that imports were little changed from the record level in the previous year but bearing in mind the sharp drop in the fourth quarter, this may raise doubts about

the future of Indian demand, especially as there were few signs of a bounce-back in the first two months of 1998. The maintenance of prices well above the \$6 level has certainly been a factor in this. It was noticeable however, that as the price weakened in March, there was a significant resumption in imports. The strong short-run price elasticity of the Indian market is amply demonstrated by the picture shown in Figure 11. Equally, however, it can also be seen that in real terms, local prices in the first quarter of 1998 are still well below the levels seen as recently as early 1996, when imports were running at around double those seen in the final months of 1997. This suggests that the recent weakness of imports has been at least in part a reaction to the enormous inflow of silver up to the third quarter of last year. Another factor lying behind this development has been the relative movements of gold and silver prices (see Figure 11) which encouraged many traditional buyers of silver to switch to gold in the second half of 1997.

The regional pattern of bullion imports shown in Figure 12 is an important indicator of the distribution of demand in the country (since, unlike gold, the high cost of moving silver means that each of the main importing centers serves a limited geographical area).

Figure 12 emphasizes the dominance of the two northern strongholds of Delhi and Ahmadabad and thus the importance of the adjacent tribal belt as the key to understanding Indian silver demand, which continues to be dominated by purchases in the rural areas, above all in the North. The above-mentioned centers imported just under 90% of India's silver in

1997 but whereas Delhi's imports declined to almost zero in the final quarter, Ahmadabad suffered a relatively minor fall and was, as a result, responsible for an estimated 88% of all-India imports in that period.

Figure 12 also shows how the local premium in Bombay (calculated at the parallel exchange rate) has fallen in the past year. This reflects two quite separate factors. The first was the trend during the year towards official rather than unofficial inflows, especially with the introduction of OGL imports in the final quarter. The second is the price-elastic decline in demand and the rise in internal recycling, especially in the first months of 1998, which resulted in the local price actually falling to a discount to international prices for a few weeks in February.

East Asia

Most of **Japan's** increased demand for silver in 1997 was met through higher levels of bullion imports, which rose by over 20% year-on-year. The other major supply of silver to the Japanese market comes from the treatment of imported base metals concentrates, and supply from this source was effectively flat year-on-year, as was domestic mine supply of silver.

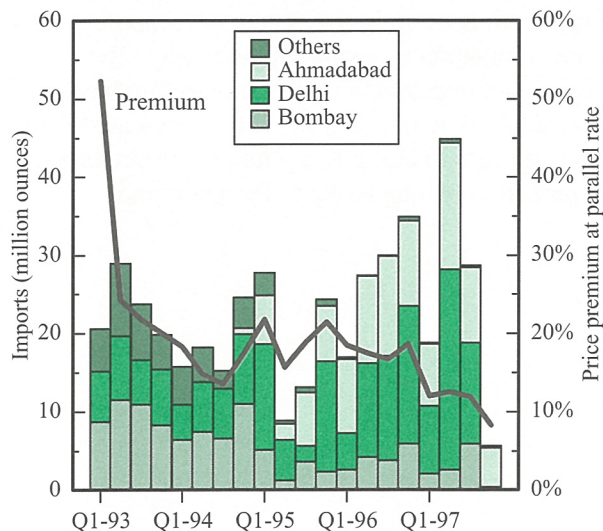
Around 70% of imports come from the United States and Mexico. However, due to the quality requirements of many of the fabricators, especially the photographic companies, much of this silver is re-refined to a higher quality.

Singapore continues to serve as a major trans-shipment point, mainly to the markets of Thailand and India, although a substantial quantity is also supplied to Indonesia. Figure 13 shows both bullion and semi-manufactured silver imports into Singapore for the years 1996 and 1997. The reason for including the semi-manufactured category in this graph is that grain, which is now the preferred form of silver for Thai manufacturers, comes in under this trade code.

Thailand's official and unofficial silver supply still arrives predominantly via Singapore. Although the Thai authorities have tried to encourage a move towards the use of more official silver, this has been hampered by the efficiency of the smuggling market and various tax disincentives to using official silver, including VAT and corporation and turnover taxes.

The sharp devaluation of the baht against the dollar since July last year has had a dual impact on silver imports. Firstly, as is discussed in Chapter 6, imports

Figure 12
Estimated Indian Bullion Imports by Port*



*excluding unofficial flows

Figure 13
Singapore Bullion and Semis Imports

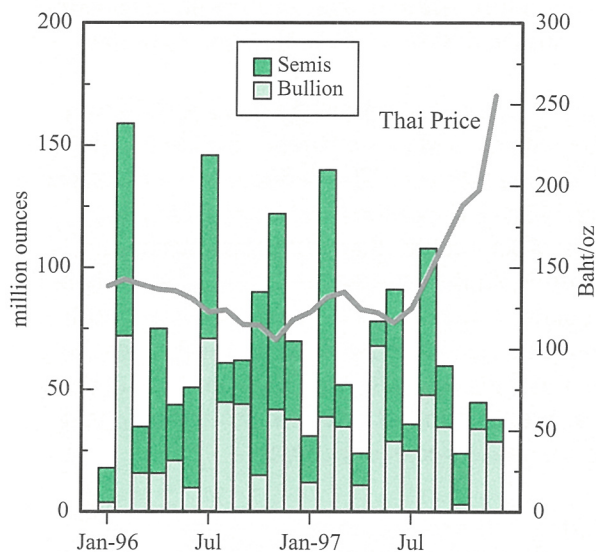
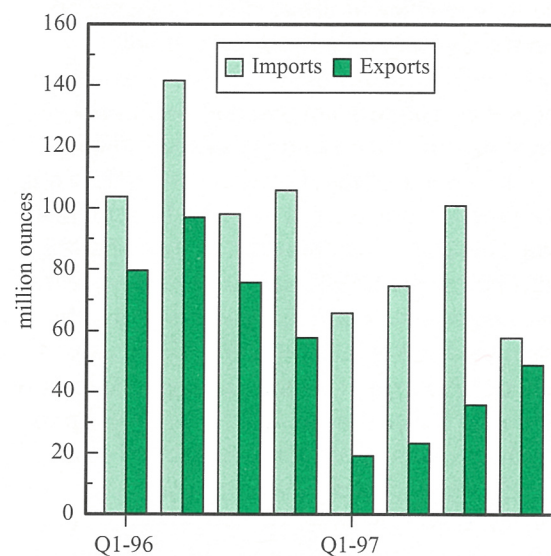


Figure 14
Korean Silver Imports and Exports



have fallen due to cash flow constraints on fabricators who have had to pay more in baht for their silver, something that many of the smaller players were unable to do. Secondly, higher baht silver prices mean that VAT has to be paid on a greater nominal baht amount for the duration of fabrication (VAT has to be paid and then reclaimed on any silver brought officially into Thailand if it is fabricated outside of the bonded warehouse scheme). Considering the extremely lengthy delays in receiving VAT refunds, the interest foregone on outstanding claims can be substantial, and many fabricators have decided to move back to using a higher proportion of unofficial silver. The fall in Singapore's imports in the second half is an indication of the impact of the devaluation.

Korean imports fell sharply in 1997, by over 30%, but this was compensated for by a close to 60% fall in exports of silver bullion. The fall in imports and exports in 1997 is shown in Figure 14.

Taiwanese bullion imports fell in 1997, but this was more than offset by imports of high quality silver in

other forms, primarily destined for the electronics industry. Most of these semi-manufactured forms were for use in Taiwan itself, but increasing amounts have been finding their way into Taiwanese joint ventures on the mainland.

The rise in the international silver price in the latter stages of 1997 and early 1998 saw increased flows of bullion from China into **Hong Kong**, due to the official buying price in China not being adjusted to international levels. Prior to that, both bullion and semi-manufactured imports into Hong Kong from other countries increased year-on-year by 27% and 25% respectively, reflecting increased demand in Hong Kong and in the joint ventures on the mainland. Although China is self-sufficient in terms of silver mine production, there is still a lack of technology and expertise to manufacture some high quality silver semi-manufactured products which therefore have to be imported. Some of these semis are fabricated from bullion and grain in Hong Kong itself, but others are trans-shipped via Hong Kong to the mainland.

4. Mine Supply

Global silver mine production increased by almost 5% in 1997 to reach 512.6 Moz (15,942 t), the second highest total ever recorded. Of this total, 78% was produced as a by-product of base metals and gold mining. Production from primary silver mines increased by 8% in the year.

The main impetus for the robust growth in world silver production came from gold and primary silver mines, where output increased by 9% and 8% respectively. Regionally, the biggest increases were recorded in North America, China and Europe. Mexico reaffirmed its position as the world's biggest producer of the metal. The main silver producing countries of the world are listed in the table below. These top fifteen countries generated around 94% of the world's silver last year.

Top Fifteen Silver Producing Countries in 1997

Million ounces
(1996 figures in brackets)

1	(1)	Mexico	86.2	(81.3)
2	(2)	Peru	66.8	(63.3)
3	(3)	United States	53.3	(50.5)
4	(4)	CIS	45.4	(45.7)
5	(5)	Canada	39.0	(39.9)
6	(9)	China	37.9	(32.2)
7	(7)	Australia	35.6	(32.8)
8	(6)	Chile	35.1	(36.8)
9	(8)	Poland	33.8	(30.6)
10	(10)	Bolivia	12.4	(12.4)
11	(13)	Sweden	8.9	(8.2)
12	(11)	Indonesia	8.5	(7.7)
13	(12)	Morocco	8.4	(6.4)
14	(14)	Spain	6.2	(5.8)
15	(15)	South Africa	5.2	(5.5)

There was no change in the ranking of the top five producing countries. However, three of these countries recorded increased production, with Canada and some of the countries which collectively constitute the Commonwealth of Independent States (CIS) suffering the consequences of difficult conditions prevailing in the base metals markets, which resulted in marginally lower by-product silver output. By contrast, China moved up to sixth place on the list as a result of a surge in that country's silver production.

Top Ten Silver Producing Companies in 1997

Million ounces
(1996 figures in brackets)

	Company	Country	Production	
1	Peñoles	Mexico	35.0	(31.3)
2	KGHM	Poland	33.1	(30.0)
3	Rio Tinto	UK	16.4	(12.2)
4	Grupo Mexico*	Mexico	14.6	(14.5)
5	Noranda	Canada	12.8	(13.6)
6	Centromin	Peru	12.5	(14.7)
7	Prime Resources	Canada	11.8	(12.1)
8	Coeur d'Alene Mines	USA	11.0	(9.5)
9	Echo Bay Mines	USA	11.0	(7.1)
10	Cominco	Canada	10.6	(12.8)

*includes IMMSA

For the second consecutive year, Mexican producer Peñoles topped the list of silver producing companies, with Polish copper miner KGHM in second position. These two producers, which between them accounted for 13% of all the silver produced in the world, both succeeded in boosting their output in 1997. In the case of Peñoles, higher production resulted from several expansions adding to existing capacity, while in the case of KGHM, silver output was determined by the grades contained in copper ores mined. Diversified producer Rio Tinto moved into third position after increasing silver output by 35%. Strong growth was also recorded by US producers Coeur d'Alene and Echo Bay. On the other hand, continuing privatization of Peruvian state mining company Centromin resulted in lower attributable output for that company.

One of the interesting features of this industry is that such a small portion of world production is produced by focused silver mining companies (illustrated by the fact that only three of the top ten producers would call themselves silver or even precious metals miners). In 1997 only 22% of total mine production was produced at primary silver mines. The largest source of silver was lead and zinc mining, which generated 37% of total production. Other sources were copper (24%) and gold mining (17%), with a marginal quantity (less than 1%) being generated by mining of other metals, including platinum, cobalt and tin. The sources of silver are discussed in some detail on pages 23 to 24 of this Survey.

Table 2
World Silver Mine Production

Million ounces	1990	1991	1992	1993	1994	1995	1996	1997
Europe								
Poland	26.7	28.9	25.7	29.4	27.6	31.6	30.6	33.8
Sweden	7.2	8.2	9.1	8.9	8.1	8.0	8.2	8.8
Spain	7.4	7.5	7.5	5.9	5.7	5.6	5.8	6.2
Romania	1.9	1.6	1.5	1.5	1.4	1.4	1.4	1.4
Serbia	3.4	3.0	2.6	0.8	0.9	1.0	1.1	1.3
Greece	2.0	2.3	2.0	1.9	1.4	1.4	0.5	1.2
Portugal	1.4	1.4	1.2	1.2	1.0	1.2	1.1	1.1
Finland	0.9	1.0	0.9	0.9	0.8	0.9	1.1	1.0
Bulgaria	3.4	1.9	2.7	3.1	1.8	1.4	1.1	1.0
Ireland	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.4
Italy	0.5	0.5	0.4	0.2	0.5	0.5	0.3	0.3
Czech & Slovak Republics	0.8	0.9	0.6	0.5	0.4	0.3	0.2	0.3
Norway	0.3	0.3	0.4	0.2	0.2	0.2	0.1	0.1
France	0.7	0.9	0.4	0.4	0.1	0.1	0.1	0.1
Other	0.7	0.3	0.1	0.1	0.1	0.1	0.1	0.1
<i>Total Europe</i>	57.6	58.8	55.4	55.3	50.5	54.2	52.2	57.0
North America								
Mexico	78.9	73.4	67.4	68.7	71.2	74.7	81.3	86.2
United States	68.3	59.4	58.0	52.9	47.6	49.8	50.5	53.3
Canada	44.4	40.6	37.6	28.3	23.8	40.0	39.9	39.0
<i>Total North America</i>	191.6	173.4	163.0	149.8	142.6	164.6	171.7	178.5
Central & South America								
Peru	62.0	67.1	53.6	53.7	56.0	61.4	63.3	66.8
Chile	21.1	21.8	33.0	31.2	31.6	33.5	36.8	35.1
Bolivia	11.5	12.1	10.2	10.7	11.3	13.8	12.3	12.4
Honduras	1.0	1.4	1.1	0.8	0.9	1.0	1.2	1.5
Argentina	2.7	2.3	1.5	1.4	1.2	1.3	1.0	1.1
Dominican Republic	0.7	0.7	0.4	0.5	0.3	0.7	0.5	0.4
Brazil	1.1	1.0	0.7	0.7	0.6	0.5	0.4	0.3
Other	0.3	0.4	0.5	0.5	1.3	0.3	0.3	0.3
<i>Total Central & S. America</i>	100.3	106.6	100.9	99.4	103.2	112.3	115.9	117.8
Asia								
Indonesia	2.1	2.5	3.2	2.9	3.1	7.7	7.7	8.5
Turkey	0.9	1.3	2.5	2.3	2.1	2.1	2.9	2.9
Japan	4.8	5.5	5.5	4.4	4.3	3.2	2.9	2.8
India	1.1	1.1	0.8	1.6	1.6	1.2	1.1	1.6
Papua New Guinea	3.4	4.0	3.1	3.1	2.5	2.1	1.9	1.6
Philippines	1.4	1.1	0.9	1.1	1.0	1.1	0.8	0.6
Saudi Arabia	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Malaysia	0.4	0.4	0.5	0.5	0.4	0.4	0.3	0.3
Thailand	0.5	0.5	0.2	0.1	0.1	0.2	0.2	0.1
Other	2.2	2.0	2.4	2.0	2.5	2.6	2.5	2.7
<i>Total Asia</i>	17.4	18.9	19.6	18.4	18.3	21.1	20.9	21.6
Africa								
Morocco	5.9	6.6	4.9	7.6	8.3	6.6	6.4	8.4
South Africa	5.1	5.5	5.9	6.3	6.2	5.7	5.5	5.2
Namibia	3.0	3.0	2.9	2.3	2.0	2.1	1.4	1.1
Zimbabwe	0.7	0.6	0.5	0.4	0.4	0.4	0.3	0.3
Zambia	0.6	0.5	0.6	0.6	0.4	0.3	0.3	0.2
Democratic Rep. of the Congo (former Zaire)	2.7	1.9	1.0	0.4	0.0	0.0	0.0	0.0
Other	0.3	0.4	0.4	0.3	0.4	0.4	0.4	0.4
<i>Total Africa</i>	18.3	18.4	16.0	17.9	17.5	15.4	14.3	15.6

Table 2
World Silver Mine Production
Million ounces

	1990	1991	1992	1993	1994	1995	1996	1997
Oceania								
Australia	37.7	37.9	39.2	37.0	33.6	31.6	32.8	35.6
New Zealand	0.3	0.4	0.7	0.8	0.8	1.0	1.0	1.0
Fiji	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
<i>Total Oceania</i>	38.0	38.3	39.9	37.9	34.4	32.6	33.9	36.6
Western World Total	423.3	414.4	394.9	378.8	366.4	400.2	409.0	427.1
Other Countries								
Soviet Union/CIS	72.0	66.8	60.9	56.4	51.3	49.7	45.7	45.4
China	22.7	24.6	24.7	24.9	29.7	30.6	32.2	37.9
North Korea	1.6	1.6	1.7	1.8	1.7	1.7	1.3	1.2
Mongolia	0.9	0.7	0.7	0.8	0.9	0.9	0.9	1.0
<i>Total Other Countries</i>	97.2	93.7	88.0	83.9	83.6	82.9	80.0	85.5
World Total	520.4	508.1	483.0	462.7	450.1	483.2	489.0	512.6

North America

Mexican silver production increased for the fifth consecutive year in 1997 to set a new record at just over 86 Moz (2,680 t), a 6% rise over 1996. Primary mines accounted for much of the increase, with the remaining growth coming primarily from gold mining. The four largest producers, Peñoles, Frisco, Grupo Mexico and Luismin, accounted for almost three-quarters of Mexican production; indeed, Peñoles alone, with its output of 35 Moz (1,089 t), generated 41% of Mexican silver at its various precious metals and polymetallic mines throughout the country.

The outlook for Mexican silver production is extremely positive, with several silver-bearing projects currently under construction or evaluation. Output from potential future mines, including Rey de Plata, Francisco I Madero, Cerro San Pedro and an expanded La Colorada, could add up to 11 Moz (344 t) to the country's production by the end of the decade. However, the majority of projects in the pipeline (with the exception of La Colorada) would not have silver as a primary product, and development thus depends on the outlook for the primary metal concerned. It is worth noting, however, that although several of Mexico's early-stage and advanced gold projects have been put on hold in the latter part of the year pending improved gold prices, most of the deposits in question were expected to have little or no silver by-product. The silver industry is thus relatively unaffected by that particular issue; the outlook for the zinc and lead markets being of far greater importance in this case.

The **United States** recorded a similar rise in output in 1997 of close to 6%, to 53.3 Moz (1,659 t). Big

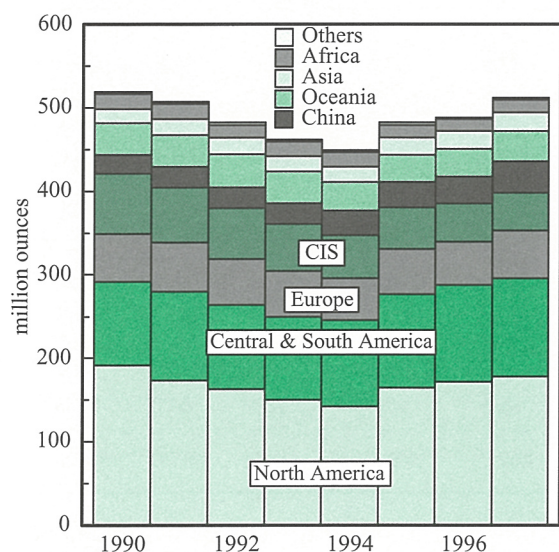
increases of over 1.5 Moz (46.7 t) each were achieved at two Idaho mines: Hecla's Lucky Friday where production began from the high grade Gold Hunter deposit and Sunshine, which returned to full capacity in 1997, with a further increase in output expected in 1998.

Renewed interest in silver mining in the United States was evident in the revitalization of a number of mothballed operations. Kennecott and Hecla's Greens Creek polymetallic mine in Alaska, placed on standby in 1993 due to poor metals prices, was successfully reopened in 1996 and approached full operating capacity during 1997, with output of close to 10 Moz (304 t). Similarly, though on a slightly smaller scale, the Coeur and Galena mines in the historic silver mining district of Idaho were resurrected by Silver Valley Mines (jointly owned by Asarco and Coeur d'Alene) after a three-year closure, to produce 3.4 Moz (106 t) last year.

The largest silver producer in the country is a gold mine: at Echo Bay's McCoy/Cove mine, silver by-product output almost recovered to its pre-1996 level, contributing a little over 11 Moz (343 t) to the 1997 US total after much lower output in 1996. However, planned scale-backs at this high-cost gold operation will lead to a marked decline in silver by-product in coming years.

Canadian silver production fell slightly in 1997 to just under 39 Moz (1,213 t). Despite being among the largest producers of silver in the world, the country has no primary silver mines. Around one-third of Canada's silver is generated each by gold, lead/zinc and copper mining. While Canadian gold production

Figure 15
World Silver Mine Production



increased in 1997, zinc output declined by almost 13% and copper production was marginally lower, resulting in the 2% drop in overall silver output.

At Prime Resources' Eskay Creek gold mine, the largest producer of silver in the country, production declined slightly from 1996's very high levels, but was still comfortably above 11 Moz (366 t). Full production from the new gravity and flotation plant, completed in December last year, is not expected to have a noticeable impact on silver output.

The combined effect of developments in North America was to cement the continent's predominance in world production, as is shown in Figure 15.

Central and South America

A further rise was seen in silver production from Central and South America in 1997, although the increase of less than 2% was more modest than in the previous year. Production in this region is dominated by three countries: Peru, Chile and Bolivia account for as much as 97% of all silver produced.

Peru recorded the strongest growth at over 5%, to reach a total of almost 67 Moz (2,078 t), thus maintaining its position as the world's second largest silver producing country after Mexico. The proportion of silver coming from primary mines increased to close to one-third of the total and accounted for 21 Moz (644 t). Several medium-sized producers managed impressive increases in output, including Huaron, Atachoa, Orcopampa and Quiruvilca, where

Pan American doubled capacity last year. The privatization of the state mining company, Centromin, continued during the year, with the sale of the Yauliyacu, Yauricocha, San Cristobal and Andaychagua mines to local interests.

In the coming year, Peruvian silver production is poised to grow dramatically. Barrick plans to commence operations at its low-cost heap-leach gold project at Pierina, which is expected to produce up to 9 Moz (280 t) of silver per year. Also in 1998, expansions at Buenaventura's Uchucchacua mine near Lima are expected to add significantly to capacity.

Chile shares a robust future growth profile with Peru: production is set to soar in 1998 with commencement of mining at Placer Dome and TVX's Chimberos deposit, which is located only 40 km from La Coipa, the gold/silver mine of the same owners. Operated by Mantos de Oro, La Coipa has for several years been the largest single producer of silver in South America. During the second half of 1998 mining will cease at La Coipa and the facilities will be used, instead, to process silver-bearing ore from the very high-grade neighboring Chimberos. A unique feature of this deposit is the fact that the owners plan to extract the entire 30 Moz (933 t) deposit within 12 to 15 months, after which mining at La Coipa will resume.

Last year, however, Chilean output was more than 4% lower than in 1996, at just over 35 Moz (1,089 t), with the decline occurring in both primary and by-product silver production. Unfavorable weather conditions apparently related to El Niño were partly to blame for low production.

Bolivian production rose slightly from 1996 levels, to reach 12.4 Moz (386 t). Almost all of Bolivia's silver is a by-product of lead and zinc mining, apart from the 0.9 Moz (28 t) produced at Inti Raymi's Kori Kollo gold mine. Output at Kori Kollo dropped 4% in 1997, partly due to torrential rain which affected production in the first months of the year, but also due to declining grades. Silver by-product from this mine is expected to taper off gradually over the next five years.

As much as half of Bolivia's silver comes from a multitude of small mines, most of which are operated on and around the mineral-rich Cerro Rico (literally, "Rich Mountain"). Small miners use various mining and processing techniques, and have over the years generated vast stockpiles of tailings. Comsur, the biggest silver producer in the country, has been

successfully extracting the remaining silver from these often high-grade stockpiles for some years.

Exploration interest has intensified in Bolivia in anticipation of and following implementation of the new mining code in April last year, and silver has been the focus of several exploration ventures in the historical mining country. This has culminated in a number of projects which have the potential to significantly enhance the country's role as a modern silver producer. Chief among these is Apex Silver's San Cristobal project where operations are planned to commence in 2001, and output could average 14 Moz (435 t) silver per year plus zinc and lead, effectively doubling Bolivia's annual silver and zinc production.

Europe

In 1997 European silver mine production increased by 1.3 Moz (40 t) or 9% from 1996. **Poland** is responsible for nearly 60% of European silver output, virtually all of which is generated as a by-product of copper mining at KGHM Polish Copper. KGHM was partly privatized during the year, and a program aimed at cutting costs and increasing efficiency was implemented soon thereafter. Despite silver's importance in containing aggregate production costs and its significant contribution to revenue, the company has clearly stated that higher silver prices will not result in increased silver production, as copper remains the driving force behind operational decisions. Silver output is nonetheless expected to be maintained at an annual level of around 31 Moz (1,000 t) for several years to come.

A small amount of Polish silver is the by-product of lead/zinc mining. Overall, Poland produced almost 34 Moz (1,051 t) of silver in 1997, more than 10% up from the previous year.

In **Sweden**, lead and zinc mining accounts for about two-thirds of silver output. Zinc production in particular rose in 1997, contributing to the 7% increase in the country's silver output to 8.9 Moz (275 t). A further 2 Moz (62 t) is generated at Boliden's Aitik gold mine; in fact, over three-quarters of Sweden's silver is produced at the various mines operated by Boliden, a division of the Trelleborg company.

Spain contributed over 6 Moz (187 t) of silver in 1997. Spanish zinc and copper output both rose, which led to higher by-product silver, while plant expansion at Caledonia Mining's Filon Sur gold operation also resulted in increased silver output. Boliden's Los Frailes zinc mine, which is expected to add to silver

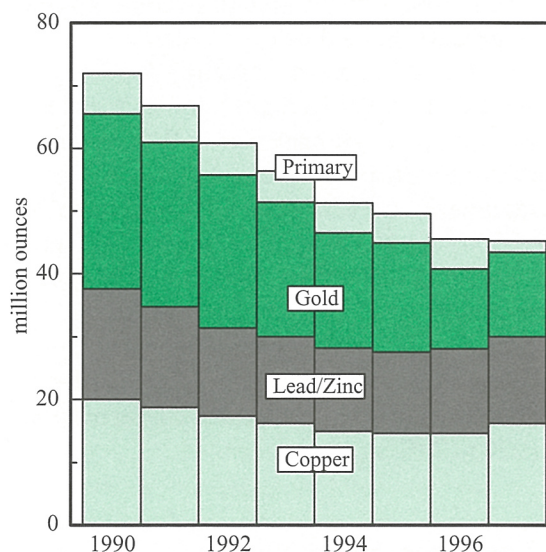
production, reached commercial production at the end of the year.

CIS

Silver production from the CIS was almost flat in 1997 after an 8% decrease the previous year. As is clearly illustrated in Figure 16, the long-term trend in CIS silver mine production is one of persistent decline.

Silver production numbers from **Russia** remain particularly difficult to estimate: contrary to gold, official silver mine production figures are still, in spite of recent reforms, a tightly-guarded state secret. Indications are, however, that production declined in 1997 by as much as 11% to reach 21.8 Moz (678 t). Today, the majority of Russia's silver is produced as a by-product of lead/zinc mining, with around 20% from copper operations and a small percentage from gold mining. With the cessation of mining at Dukat during 1997, only about 10% of all silver is now produced at primary mines. This is set to change dramatically if Dukat's new owners, Pan American Silver and Geometall, proceed with plans to redevelop this mine: Dukat is one of the largest single-mine silver deposits in the world, and potentially has the capacity to produce up to 14 Moz (435 t) of silver a year. The project is currently the subject of a feasibility study.

Figure 16
CIS Silver Mine Production (by source)



Kazakhstan was traditionally the largest producer of silver in the former Soviet Union. However, a crisis in the base and precious metals mining sectors of the country, caused in part by a lack of investment and regulatory tangles associated with the transition to a free market system, affected production of most metals during the mid-1990s. On a recent visit the first signs of recovery could already be seen, as foreign investment, particularly from Asian countries in the region, started pouring into Kazakhstan. A large increase in both zinc and copper production during 1997 boosted silver production by as much as 15%, to reach an estimated 17.8 Moz (555 t), and sustained recovery could see Kazakhstan restored to its former position as the leading silver producer in Central Asia.

China

For this issue of the Survey, the series for Chinese mine production has been significantly revised on the basis of new information which served independently to confirm our long-held impression of much higher production than was often suggested by other sources.

Production in 1997 rose by a robust 18% to reach 37.9 Moz (1,180 t). There was little change year-on-year in the production of lead and zinc, two important source metals of Chinese silver, while copper output is reported to have declined by around 5% in 1997. Nevertheless, some of the growth in silver production was apparently attributable to higher recovery from lead, zinc and copper concentrates. At this stage it is difficult to gauge whether the higher silver recovery reported by our sources relates to higher silver grades or improved processing methods.

In spite of increased capacity at many Chinese silver mines, production of silver from primary sources fell by around 4% last year. At least part of the reason for this appears to lie with antiquated and poor mining techniques utilized at these mines. By contrast, gold mine production soared during 1997, with the premium paid by the People's Bank of China over international gold prices serving as a powerful incentive for increased output. Recovery of silver from gold ores increased by a corresponding degree. Silver from gold and other sources increased from around 18% of total output in 1996 to 27% in 1997.

Africa

The decline seen in African silver production over the previous three years was arrested in 1997 and output rose by over 9% to 15.6 Moz (485 t).

The rise was due almost exclusively to **Morocco**, where production increased a considerable 30% to reach 8.4 Moz (261 t). The majority was produced by the former state-owned Société Metallurgique d'Imiter (SMI), which operates the Imiter mine in the mountains of Ouarzazate. Grades at this primary silver mine are reported to be as high as 1,000 g/t, and the remaining mine life should be at least eight years. During 1997 the Moroccan government floated a further 20% of its remaining stake in SMI; controlling interest is now in the hands of Omnium Nord Africain (ONA).

Morocco and South Africa together produce 87% of African silver. Almost half of **South Africa's** silver contribution is a by-product of lead/zinc mining, with most of the remainder resulting from gold and copper mining and a little from platinum operations. In 1997 production declined for the fourth consecutive year to 5.2 Moz (162 t), due to a combination of a sharp fall in lead and zinc output, and slightly lower gold and copper production.

Asia

Overall, silver production in Asia rose by 3% in 1997, increases in Indonesia and India being tempered by falls in Japan, the Philippines and Papua New Guinea where operations at Ok Tedi and Porgera were severely affected by the devastating drought.

Indonesia is by far the largest silver producer in Asia, generating almost 40% of the region's silver from copper and gold operations. In 1997 output grew 10% to 8.5 Moz (264 t) due to further expansion at the Grasberg mine, a record year at Mount Muro where silver recovery improved significantly, and the start-up of the Rawas gold mine. Future developments which should further increase Indonesian silver output include Aurora's Toka Tindung project, due on stream at the end of 1998, and expansion of the Pongkor gold mine in Java.

Oceania

Australia's silver output for 1997 totalled 35.6 Moz (1,107 t), an almost 9% rise over 1996. Production had been declining throughout the year, but this changed dramatically in mid-October when BHP's new Cannington lead/zinc/silver mine started up. Silver output from that mine alone in the last quarter of 1997 was 3.5 Moz (109 t), more than three times the combined annual output of neighbors New Zealand and Fiji (ie, 1.1 Moz or 34 t). At full capacity,

expected to be reached this year, Cannington will produce up to 24 Moz (747 t) of silver.

Outlook

One of the recurring themes in the preceding pages is the expectation of growth in world-wide silver mine production over the next few years. Taking into account the projects currently under construction as well those projects which are highly likely to proceed to the development stage, close to 100 Moz (3,110 t) of cumulative new capacity, due to come on stream in the next five years, has been identified. This translates into roughly 3% growth per year over the next five years (compared to the 5% increase in output seen last year). This should not be interpreted as a forecast of future production, since no account has been taken of changes in the level of production at existing operations, whether they be expansions, cutbacks or closures. The purpose of the analysis is to evaluate the price-sensitivity of new silver mine production.

As is shown in Figure 17, a significant proportion of the new capacity is associated with primary silver mines. The perceived upside potential in the silver market has served to encourage more aggressive pursuit of silver-bearing deposits and silver projects, and a handful of companies have been building up impressive portfolios of reserves, particularly in South America and Central Asia. This portion of future

silver mine production is likely to fluctuate with significant changes in the silver price. However, for around 65% of the cumulative new capacity, development decisions will be based on conditions prevailing in the gold and base metals markets, which are considered in the next section.

By-product Analysis

In its natural form, silver usually occurs with some other metal, most commonly zinc or lead (usually both), copper or gold. The scarcity of primary silver deposits large enough to exploit economically is evident in the fact that in 1997, primary silver mines generated only 22% of world production, with the rest coming from lead and zinc (37%), copper (24%) and gold mining (17%).

Whereas primary silver mine production is highly responsive to longer-term movements in the silver price, by-product production tends to fluctuate independently of developments in the silver market itself. The table below sets out production statistics for the metals from which most by-product silver is sourced.

World Mine Production of Source Metals

	1993	1994	1995	1996	1997
Lead	2,700	2,710	2,754	3,002	2,942
Zinc	6,758	6,812	7,001	7,302	7,179
Copper	9,426	9,414	10,087	11,033	11,392
Gold	2,289	2,278	2,269	2,346	2,402

Sources: ILZSG, WBMS, GFMS

As is clearly illustrated by the graph in Figure 18, silver production has tended to follow trends in lead production very closely. Both lead and zinc mine production declined by around 2% in 1997, following on robust growth in output the previous year. Lead prices performed disappointingly despite healthy demand, a tight physical market and low reported stock levels. The price has been depressed since mid-1996 (see Figure 19), resulting in closures of mines such as Faro in the Yukon. As for zinc, exceptionally strong demand, particularly in the US construction and manufacturing industries, boosted zinc prices to a seven-year high in August, before a flood of unexpected exports from China forced prices lower again and contributed to inventory build-up. The medium-term outlook for zinc is slightly more positive than for lead, but the possibility of further mine

Figure 17
Planned New Silver Mine Production
(by source metal)

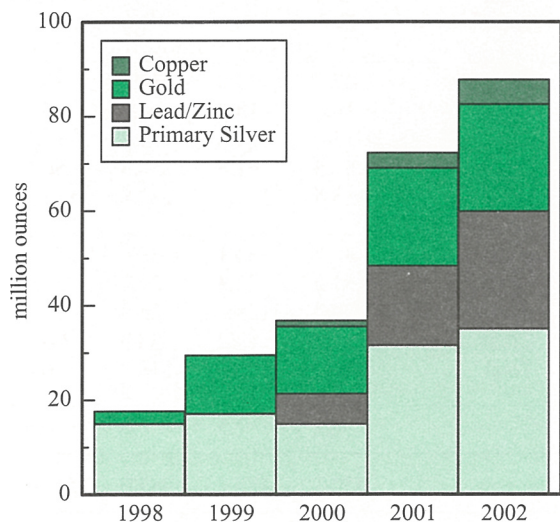
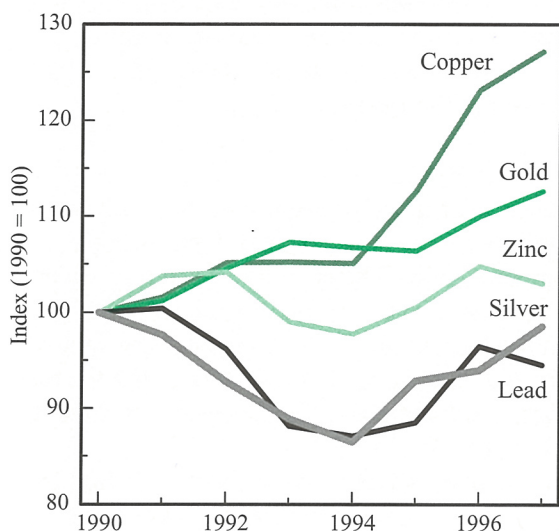


Figure 18
Mine Production of Source Metals

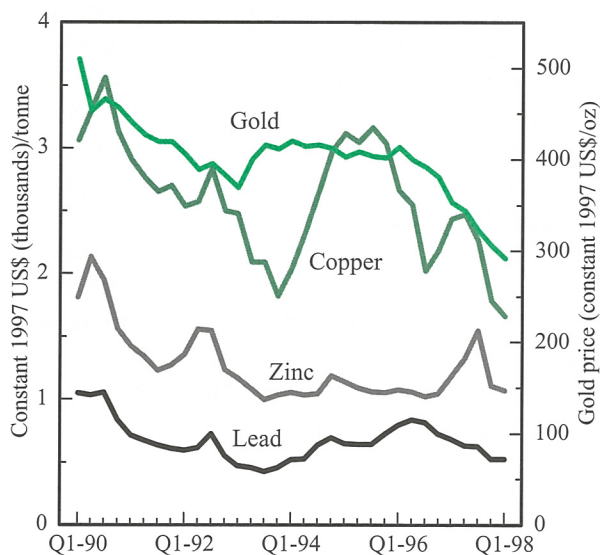


Sources: GFMS / ILZSG / WBMS

closures or cancellation of projects cannot be ruled out. This could affect around 25% of future silver production currently in the pipeline.

In contrast to lead and zinc, copper mine production increased by around 3% last year, as substantial new mining capacity came onstream in response to soaring prices during 1994 to 1996 (see Figure 19). Surplus supply, combined with the impact of the Asian crisis on demand from that region, resulted in the copper price sliding to a four-year low towards year-end. As a

Figure 19
By-product Source Metal Prices (real)



result, a number of the multitude of copper projects in the planning or development stages had to be deferred or cancelled outright. Copper mine output is nonetheless expected to increase substantially in 1998 and beyond. In this regard it is worth noting that growing copper mine production would not necessarily translate into higher silver by-product output: several of the mines under planning or construction will use solvent extraction-electrowinning to extract copper, and this method does not produce significant silver by-product. Figure 18 shows clearly how little correlation there actually is between copper and silver mine production.

In the gold market, output increased last year despite prices plummeting to 18-year lows in the face of persistent fears about selling of large central bank stocks, large-scale speculative short selling and record levels of producer hedging. Although low prices will not be manifest in lower mine production in the very short term, a lagged response could have an impact on silver output from this source.

Silver Mine Production By Source

Million ounces

		1994	1995	1996	1997
Primary*	Mexico	39.2	41.1	44.7	47.4
	United States	14.5	15.4	21.8	28.7
	Peru	17.8	19.5	20.5	20.7
	Other	17.9	17.4	18.4	16.8
	Total	89.4	93.4	105.4	113.6
Gold	Chile	14.6	14.8	18.3	18.3
	Canada	1.4	12.4	13.7	13.4
	Mexico	10.0	10.5	11.4	12.1
	Other	35.5	40.9	34.5	40.7
	Total	61.5	78.6	77.9	84.5
Copper	Poland	27.0	31.0	30.2	33.1
	Chile	16.0	18.0	18.0	16.6
	CIS	15.0	14.6	14.7	16.2
	Other	57.5	61.8	58.9	56.1
	Total	115.5	125.4	121.8	122.0
Lead/zinc	Peru	32.2	34.1	35.6	38.4
	Australia	31.2	28.3	29.4	32.0
	CIS	29.7	28.6	24.3	25.4
	Other	83.3	87.2	88.9	90.2
	Total	176.4	178.2	178.2	186.0
Other		7.3	7.5	9.6	6.5
Total		450.1	483.2	489.0	512.6

* Mines are classified as "primary" if silver generates the largest share of their revenue.

Production Costs

Meaningful research on silver mine production costs is severely constrained by the fact that only a handful of producers actually report their operating costs based on the costs of producing an ounce of silver. In the case of four-fifths of output, silver is often accounted for on a “by-product credit” basis; other producers elect to convert their silver production into, for example, gold-equivalent ounces for costing purposes; in extreme cases, silver ounces are not reported at all because the quantities or values involved are simply insignificant in the overall picture. A further complication is that among those companies that do report silver production costs, there is a noticeable lack of consistency in reporting principles, which makes comparative analysis virtually impossible. Due to these constraints, research such as the generation of cost curves must of necessity be based on estimates and assumptions to a degree which could compromise the integrity of such analysis.

Nevertheless, due to the increasing number of actual and prospective silver producers and the anticipation of interest in silver equities, growing focus is now being placed on issues such as reserves, cash flows and production costs, and there is a real need for some form of yardstick against which the efficiency of existing mines and the viability of new projects can be measured. With this need in mind, GFMS started building up a database of silver mine production costs some time ago. The analysis concentrates on primary silver mining only. For the reasons set out above, the size of the sample group is, at this stage, still limited, although it is already expanding noticeably. The table below summarizes the findings thus far.

Silver Mine Production Costs

	1996	1997
Cash costs: highest	\$8.00	\$5.47
lowest	\$2.27	\$2.31
weighted average	\$3.16	\$3.29
Average spot price	\$5.199	\$4.897
% output with costs > spot price	12.1%	8.3%
Sample size (million ounces)	34.6	45.4

Last year there was a relatively small spread between the highest and lowest production costs. Although average costs increased 4% during the year and average prices declined by 6%, almost 92% of producers managed to realize positive cash margins.

Producer Hedging

Hedging of future mine production by producers of silver has traditionally been limited to a small number of players. The reasons for this are two-fold: firstly, the pool of liquidity in the form of bullion stocks ready to be mobilized to fund forward transactions has been much smaller than, say, that available to the gold market, while limitations also applied to the terms governing such forward transactions. This issue is considered in some detail in Chapter 5.

The second reason for low levels of producer hedging relates to the composition of the producer universe: there are very few “pure silver plays” present on the stock markets of the world, and several of the handful of miners which can justifiably call themselves silver producers (or potential silver producers) typically market themselves to shareholders and prospective investors as being highly leveraged to movements in the silver price - an attribute which would naturally be compromised if those producers were to lock in future prices on their product through aggressive hedging. On the other hand, those producers which generate the remaining four-fifths of the world’s silver as by-product of mining another metal, tend to deal with silver in a similar fashion to how they market the primary product which provides the real life-blood of the operation. Thus base metals producers often hedge silver on a shorter term basis, with a view solely to meet anticipated supply and delivery obligations, much as they would, for example, their copper or zinc output. Gold producers, by contrast, tend to be the most active hedgers of silver by-product output, and they also tend to prefer large-scale, multi-year deals constituted from a variety of products which frequently have various contingencies built in - a hedging technique which has become popular in the gold market. Such synchronicity in hedging strategies often flows from the relationships which these producers have already established with their respective counterparties and the credit lines available to them by virtue of their production and hedging of the primary metal.

These and other factors have combined to reduce average accelerated supply in the form of producer hedging to a mere 1.2% of total supply to the market during the period from 1990 to 1996; while in both 1994 and 1996, outstanding positions actually declined, so that producer hedging constituted accelerated demand rather than supply.

Figure 20
Outstanding Forward Selling Positions

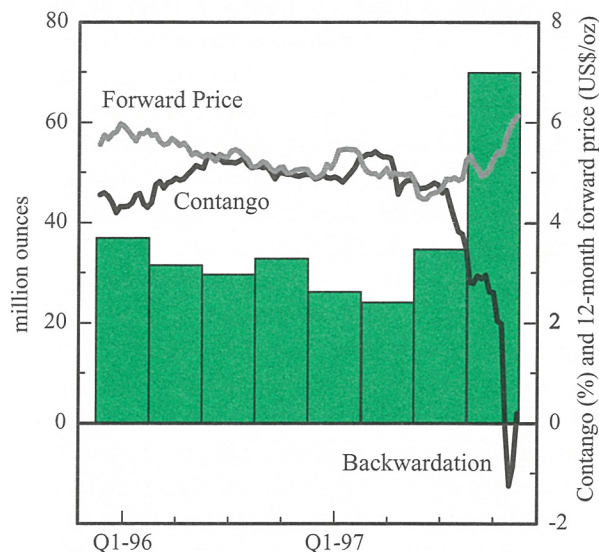
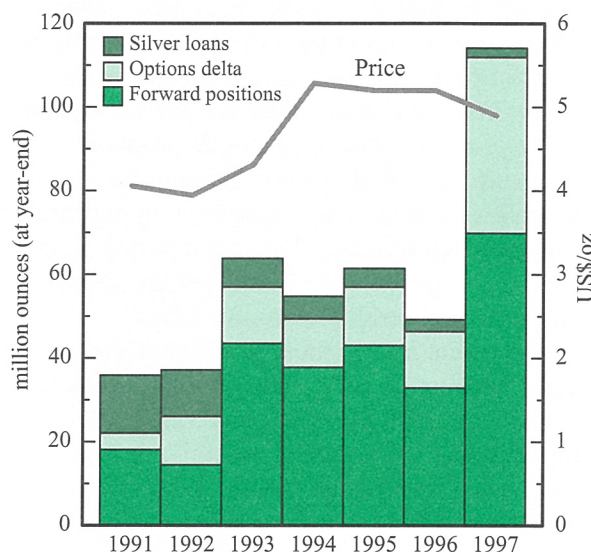


Figure 21
Silver Producer Hedging: Outstanding Positions



Many producers do not fully report their hedging activities relating to by-product metals. It would therefore be unwise to assume that we capture in our research all the silver hedging that is being done. Whereas the absolute level of outstanding hedged silver positions may be underestimated, however, we are confident that trends can be accurately identified. In estimating the change in outstanding positions from one year to the next, we are able to determine what the net impact was of such hedging on the physical market, irrespective of the absolute size of the hedged positions.

In dramatic contrast to mostly modest movements during the preceding six years, silver hedged positions surged to record levels during 1997, in response to the rising price. By year-end, forward sales had increased to almost 70 Moz (2,177 t), more than double the outstanding level at the end of the previous year. This growth was heavily weighted towards the end of the year; in fact, during both the first and second quarters of the year outstanding forward positions actually declined, while in the fourth quarter forward sales increased by more than 100% from third quarter levels.

Figure 20 shows how forward sales positions evolved intra-year. The large increase in the fourth quarter may initially appear surprising in view of the persistent squeeze on contangos, up to the point in early December when the market found itself in backwardation for the first time since 1980 as lease rates soared. However, as is clear from Figure 20, forward prices were still trending strongly upwards. Several producers perceived these prices to be very attractive despite the backwardation, and, strikingly, despite the promise of even higher prices which some

expected at the time. This was particularly true for those producers which had big silver-bearing projects coming onstream in the near future, such as Barrick's Pierina, and Chimberos for Placer and TVX. And towards the end of 1997 there were probably more unhedged silver ounces in the ground than for some time, as several would-be producers had amassed large resources in anticipation of booming investor interest in the silver market; although they would certainly not want to diminish their price exposure, the third and fourth quarters presented opportunities for some project finance-related hedging.

Equally impressive was the surge in producer options positions during 1997 (see Figure 21), to more than double the outstanding levels at the end of 1996. Again, the increase initially seems surprising as one would expect options to have been rather expensive to purchase last year, in view of the very high volatility in prices and lease rates alike. However, for those producers who sell call options to fund the purchase of puts, this was the ideal time to generate revenue which could be re-invested in the hedging program.

5. Supply from Above-ground Stocks

The above-ground stock of silver has two basic elements: bullion (bars and coins) and fabricated products. In the 1990s, the bullion component of the above-ground stock has declined continuously in line with the sustained net disinvestment of silver over the period. Growth in the above-ground stock therefore has entirely been in the form of fabricated products. This has important consequences for the silver market as the stock of fabricated products tends to be far less liquid and mobile than the stock of bullion. A much lower percentage of the stock of fabricated products is recycled every year. For instance, between 1990 and 1997, cumulative silver fabrication demand exceeded mine production by 2,226 Moz (69,235 t). The shortfall in supply was of course made up by the recycling of above-ground stocks. At 1,084 Moz (33,715 t) the contribution from bullion stocks was a little lower than that from the scrapping of fabricated silver products which amounted to 1,142 Moz (35,520 t). However, as bullion stocks are much smaller than fabricated stocks, the proportion of bullion stocks recycled in this period was much higher than that for fabricated stocks. Given the decline in stocks over recent years, it seems likely that such a large quantity of bullion could be made available to the market in the future only with an increase in silver prices. Of course, in the short term at least, a rise in the price might simply lead to increased investment demand rather than increased supply of metal out of existing bullion stocks. And, when it comes to supply from the stock of fabricated products, although there is a natural tendency for the recycling of scrap to increase proportionately to the growth in the stock of fabricated products, it would seem unlikely that, in the absence of higher prices, this alone would be enough to offset lower supply to the market from the above-ground bullion stock.

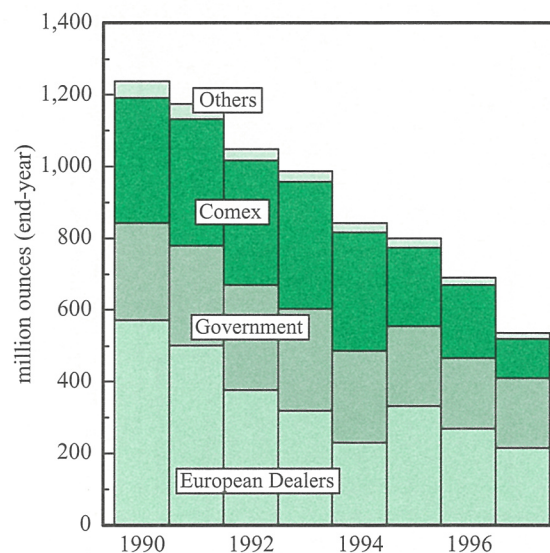
In theory, the above-ground stock of silver must equal cumulative historical mine production which by the end of 1997 had reached about 38,000 Moz (1.18 million tonnes). At some stage virtually all of this silver would have been transformed into either bullion or fabricated products. However, in practice, the above-ground stock is smaller than the theoretical total because part of the stocks of bullion and, especially, fabricated products have been irretrievably lost. For example, over time, coins and jewelry tend to suffer losses through abrasion. Also, spent photographic

fixer solutions have not always been recycled as efficiently as they are today: in the past, they were often discarded. Somewhat similarly, fabricated industrial products often end their lives in land-fill sites rather than being recycled. Thus it is necessary to adjust the figure for cumulative mine production to allow for this lost silver. Needless to say, opinion differs as to how large an adjustment is required. On some estimates over 40% of mine production has been lost. However, in such cases a broader definition of the term “lost” is usually being applied, ie, one which encompasses the silver in fabricated products that cannot be economically recycled. This silver would tend to be so widely dissipated and/or in such small quantities that its recovery is either impractical or unprofitable at virtually any silver price. Of course the quantity of metal which is “lost” due to its recovery being uneconomic as opposed to technically impossible mostly depends on what assumptions are made regarding the price level and the elasticity of supply. The other main consideration here is likely to be environmental legislation. Tighter environmental standards will generally boost the “effective” stock and thereby lead to a higher amount of recycling at any given price level.

No matter whether the broad or narrow use of the term is preferred, above-ground stocks of bullion are far less likely to have been lost than those of fabricated products. Although a large part of the bullion stock is widely distributed (especially coins) under the right circumstances, all of this silver could technically become available to the market. It is also much easier

Figure 22

Identifiable Bullion Stocks

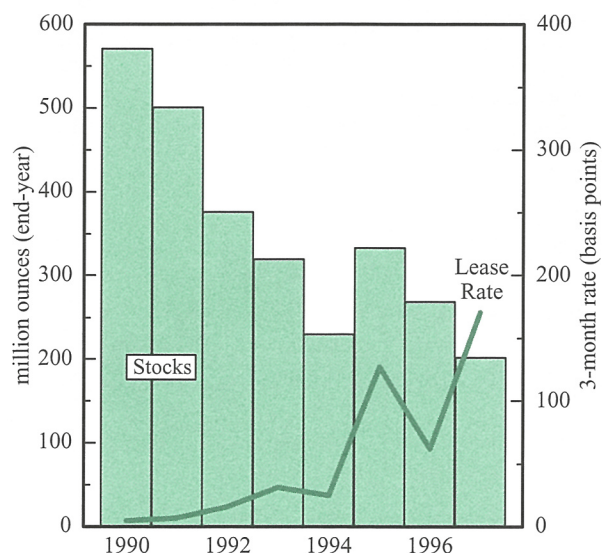


to recycle old bullion bars and coins into a form which can be mobilized and disposed of in the silver market. Yet because it is, for the most part, privately held and widely dispersed, even the above-ground bullion stock is extremely difficult to measure.

Identifiable Bullion Stocks

Although there is uncertainty over the absolute size of the above-ground stock of bullion, the part of it which is arguably nearest to the market can be identified with some degree of accuracy. Such “identifiable” bullion stocks basically consist of the inventories held on behalf of the world’s futures exchanges (dominated by the Comex division of Nymex), the physical stocks in European dealers’ vaults, other refinery stocks and government holdings. Figure 22 shows the outstanding level of these identifiable bullion stocks at year-end for the 1990-97 period. At the end of 1997, these stocks totalled 537 Moz (16,702 t) having fallen by 154 Moz (4,790 t) during the course of the year. Since the end of 1990, these “near market” stocks have declined by 700 Moz (21,772 t). Most of this bullion was disinvested and then transformed into fabricated products. Indeed, the decline in identifiable stocks undoubtedly forms the largest part (probably over two-thirds) of the 1,084 Moz (33,715 t) of mobilized bullion referred to earlier in this Chapter. However, another (smaller) part of the decline in the identifiable stocks reflects the transfer of bullion from identifiable to non-identifiable stocks, something which was especially significant in 1997.

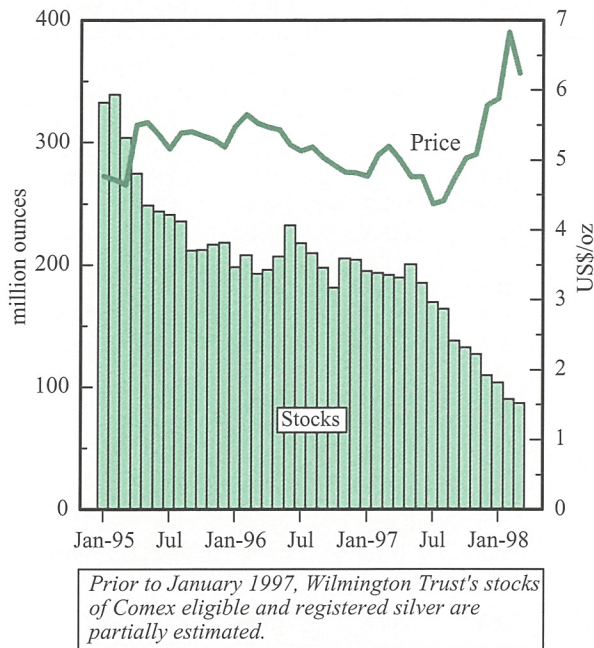
Figure 23
Bullion Stocks in Dealers' Vaults in Europe



Silver Borrowing

The spectacular rise in silver interest rates which in the first quarter of 1998 resulted in the price moving into a severe backwardation has focused attention on the silver leasing market. An analysis of this sector suggests that, by the end of 1997, the amount of silver lent and borrowed in the market had risen to around 335 Moz (10,400 t). About one-third of this outstanding quantity was probably related to producer hedging, which increased tremendously in the fourth quarter of 1997. The amount of metal borrowed by fabricators remains, however, much larger, accounting for well over half the total liquidity supplied to the market. In recent years, bullion banks have had some success in persuading manufacturers to borrow metal to fund their work-in-progress and inventory. In some cases, this has resulted in manufacturers and refiners selling and leasing back their inventory. The increased demand for borrowed silver by fabricators and producers alike has come at a time of declining bullion stocks. The supply of silver is also constrained because unlike the situation in the gold market, silver is not generally borrowed by intermediaries for a fixed term but is instead “borrowed” from customers’ unallocated accounts. The percentage of silver which can therefore safely be used by intermediaries is much lower than is the case for gold. This limiting factor, together with the decline in the overall bullion stock referred to above, resulted in a sharp reduction in the available and potential supply of liquidity to the market last year, leading to an underlying tightening in the silver leasing market and a sudden increase in borrowing costs. The realization that supplies were getting tighter encouraged precautionary and speculative borrowing which has only served to tighten the market further and drive up rates to still higher levels. Towards the end of 1997 and especially in the early months of 1998, another factor which greatly exacerbated this situation was the transfer of metal from unallocated accounts, part of which is lendable, to allocated stocks which are earmarked and therefore cannot be lent into the market. It should be noted that such allocated silver stocks may not be totally reflected in the identifiable stocks referred to above. For instance, it is likely that a large part of the 130 Moz (4,034 t) silver hoard amassed by Mr Buffett has been held in allocated form.

Figure 24
Comex Warehouse Stocks



watershed in terms of bullion stock availability and to what extent it simply reflects the acquisition of silver by Mr Buffett and others.

Comex Silver Stocks (end period)

Million Ounces	Q1	Q2	Q3	Q4
1990	252	252	260	265
1991	258	266	270	271
1992	270	268	279	275
1993	272	274	277	263
1994	239	236	255	259
1995	235	185	157	159
1996	140	168	142	146
1997	192	186	138	110
1998	87			

What is clear is that a considerable part of the silver taken out of Comex warehouses has been exported from the United States (see Figure 25). For the period since 1995 as a whole, there is little doubt that much of the stock decline and export of silver represents bullion which has been transferred either directly or via the United Kingdom to end-user markets in Europe and Asia. However, these movements also capture the transfer of stocks from one location to another. Apart from strong anecdotal evidence of this, it is also implied in the quarterly data on Comex stocks and US exports which show that there can be a lag between the decline in inventories and subsequent increased export of bullion. The data in the graph also indicate that at

European Dealers' Stocks

That there has been an underlying reduction in bullion stocks over recent years can be clearly seen from the sharp fall in European dealers' inventories (Figure 23). Stocks held in the vaults of the principal European dealers fell sharply between 1990 and 1994 before rising again in 1995 as large amounts of bullion were shipped from the United States to the United Kingdom in response to the shortage of physical metal in the London market, a shortage which led to a significant increase in silver leasing rates. In the second half of 1997 the cost of borrowing silver again increased sharply, with an even greater increase taking place in the first quarter of 1998. The arbitrage opportunity this represented between the New York and London markets resulted in a sharp increase in European dealers' stocks in the final quarter of 1997. A further substantial increase in stocks also occurred in the first few months of this year.

Comex Stocks

Figure 24 shows that until September, 1997, apart from a brief period in April/May, 1995 when delivery was taken against out-of-the money call options, declining Comex stocks have had relatively little impact on the silver price. By contrast, from September, 1997 to March, 1998 when Comex silver stocks fell by 77 Moz (2,395 t) the silver price rose by more than 50%. The key question for the silver market is to what extent this (belated) price rise signals a

Figure 25
Comex Stock Change and US Bullion Exports

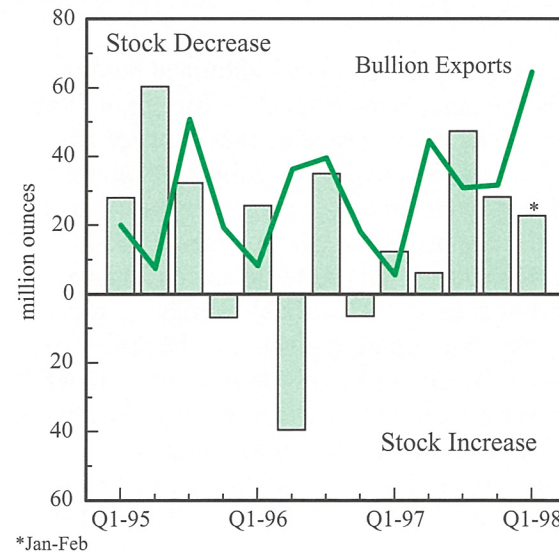


Table 3
Supply of Silver from the Recycling of Old Silver Scrap

Million ounces	1990	1991	1992	1993	1994	1995	1996	1997
Europe								
Germany	16.1	16.1	16.1	15.8	15.4	14.8	15.4	16.1
UK & Ireland	7.2	7.2	7.2	7.3	7.9	7.4	7.6	8.4
France	3.1	3.8	5.3	4.0	4.2	4.7	4.5	4.3
Italy	2.7	2.7	2.7	2.7	2.8	3.2	3.5	3.4
Austria	1.9	1.9	1.9	1.9	1.9	2.0	1.8	1.8
Netherlands	1.1	1.1	1.2	1.1	1.3	1.1	1.3	1.3
Sweden	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Norway	0.8	0.8	0.8	0.8	0.8	0.8	1.0	1.0
Czech & Slovak Republics	0.6	0.8	1.0	0.8	0.7	0.7	0.9	0.8
Switzerland	0.5	0.5	0.5	1.4	0.5	1.5	1.5	0.6
Belgium	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Denmark	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Spain	0.4	0.4	0.3	0.3	0.3	0.4	0.5	0.5
Portugal	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Romania	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.6
<i>Total Europe</i>	38.8	39.7	41.4	40.5	40.2	41.0	42.3	42.6
North America								
United States	39.1	36.9	36.5	37.4	39.6	40.5	42.1	43.6
Mexico	2.3	2.3	2.3	2.3	2.3	2.6	2.4	2.3
Canada	1.3	1.3	1.3	1.3	1.3	1.7	1.8	1.6
<i>Total North America</i>	42.7	40.5	40.1	41.0	43.2	44.8	46.3	47.4
Central & South America								
Brazil	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.6
Argentina	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Chile	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Other	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7
<i>Total Central & South America</i>	3.9	3.9	3.9	3.8	3.8	3.8	3.8	3.4
Middle East								
Saudi Arabia & Yemen	0.1	0.1	0.6	0.8	1.9	3.0	1.3	2.6
Turkey	1.8	1.9	1.9	2.0	2.3	2.3	2.4	1.6
Egypt	1.1	1.0	0.6	1.0	0.9	0.8	0.7	0.3
Other	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
<i>Total Middle East</i>	3.1	3.1	3.3	4.2	5.3	6.5	4.7	4.9

times there have been exports of additional bullion stocks which cannot be accounted for by a drawdown of Comex stocks plus the regular pattern of net US exports. For instance, exports in early 1998 greatly exceeded the run-down in Comex stocks during this period and in the preceding two quarters of 1997, implying that some of this material emanated from unreported or at least unidentifiable stocks. It was not surprising that this occurred given that the premium in London over the Comex price was at times sufficiently large (ie over 3.5 cents) to warrant moving silver by air from the United States to the United Kingdom. Finally, the proposed delisting of the Spiral Metals brand in September and the belief that other "older"

brands might also lose their Comex good-delivery status (at one stage it was rumored that up to 40% of the Exchange's stocks might effectively be delisted) also helped to swell the outflow of metal from Comex warehouse stocks.

Government Stocks

As Figure 26 shows, changes in government stocks have generally been much less dramatic than for either the Comex or European dealers' stocks. Yet although net sales out of government stocks in the 1990-97 period amounted to only 80 Moz (2,492 t) there have been some significant swings on an annual basis, eg, from 1992's net purchases of over 15 Moz (479 t) to

Table 3
Supply of Silver from the Recycling of Old Silver Scrap
Million ounces

	1990	1991	1992	1993	1994	1995	1996	1997
India	4.0	9.6	7.2	4.5	4.5	5.8	6.4	6.1
East Asia								
Japan	15.7	18.9	24.2	26.2	26.9	27.3	27.1	27.8
South Korea	1.2	1.2	1.4	1.4	1.6	1.9	1.9	2.0
Thailand	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.8
Taiwan	1.0	1.0	0.8	0.7	0.6	0.6	0.6	0.7
Philippines	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.4
Vietnam	0.3	0.3	0.3	0.2	0.3	0.4	0.4	0.4
Indonesia	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4
Singapore	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.3
Hong Kong	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2
Malaysia	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total East Asia	19.3	22.6	27.9	30.0	31.0	32.0	31.8	33.0
Africa								
South Africa	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other	0.9	0.9	1.0	0.9	0.9	1.0	1.0	0.9
Total Africa	1.0	1.0	1.1	1.1	1.0	1.2	1.1	1.1
Australia	2.3	2.3	2.3	2.4	2.5	2.5	2.3	2.3
Western World Total	115.0	122.7	127.2	127.5	131.4	137.4	138.8	140.8
Other Countries	13.3	11.9	13.6	13.4	13.1	12.0	11.9	11.7
World Total	128.4	134.6	140.8	140.9	144.6	149.4	150.6	152.5

1993's net sales of more than 12 Moz (377 t). Again, last year there was a significant year-on-year swing, with net official sector sales dropping from over 25.0 Moz (780 t) to only 3.8 Moz (118 t) despite a strong rise in US government disposals (nearly all from the Defense Logistics Agency). In essence, this came about due to higher Chinese government purchases and a marked reduction in the quantity of silver sold from Russian stockpiles.

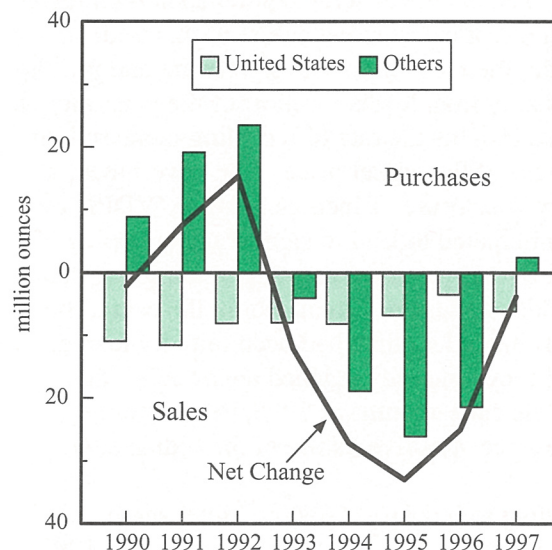
Other Stocks

Other identifiable stocks consist of those registered on the Tokyo Commodities Exchange (Tocom), the Chicago Board of Trade (CBOT) and Japanese trade stocks, the level of which is regularly reported to the Ministry of International Trade and Industry (MITI). Collectively these stocks fell by slightly over 3.3 Moz (104 t) in 1997 to a record low of 17.9 Moz (557 t).

Scrap

The quantity of old silver scrap generated in the **United States** increased slightly last year to 43.6 Moz (1,355 t). About three-quarters of the total is estimated to have come from photographic scrap, mainly in the

Figure 26
Changes in Government Stocks



form of spent fixer solutions but with a significant contribution also coming from old X-ray films.

Overall silver scrap volumes in Europe were little changed year-on-year in 1997. Increases in **Germany** and the **United Kingdom** were offset by a sharp fall in the amount of recycled silver in **Switzerland**.

In the Middle East, the principal sources of old scrap consist of stocks of traditional jewelry and coins in areas such as Egypt, Libya and the Yemen as well as the recycling of photographic film and processing solutions in the more developed urban areas. The past year saw contrasting patterns across the region. Thus there was a decline in **Turkey**, due to the lower availability of X-ray film and the operating problems of an environmental nature facing the local refiners based in central Istanbul. Scrap recycling also fell in **Egypt**, though this was simply a continuation of a longer-term trend, as stocks of old (and in many cases antique) jewelry from neighboring countries and from rural areas in the south of Egypt itself have gradually dried up. But perhaps the most interesting development in the region last year was the renewed inflow of scrapped Maria Theresia Talers from the **Yemen** into Saudi Arabia. The total quantity of silver contained in these coins amounted to some 2.4 Moz (74.6t), dwarfing local recycling in Saudi Arabia itself. The bulk of this material arrived in the final quarter of the year and as it greatly exceeded the capacity of local refiners, around half of it was exported to Europe. During the first months of 1998, the inflow and re-export of Yemeni silver scrap continued at high levels, reflecting the price-sensitive nature of this trade.

In **India**, the recovery of old silverware and jewelry remained at normal levels for most of the year, though in the final months the rate of recycling increased, in part because of the higher price. The government's Voluntary Disclosure of Income Scheme (VDIS) was widely anticipated to lead to significant scrapping of old silver by tax-payers attempting to minimize their tax liabilities under the scheme but in the event, the effect was much less than had been initially feared. Levels of recycling only reached abnormally high levels in the early months of 1998, demonstrating again the price-sensitive nature of the Indian silver market.

According to industry statistics, silver scrap recovery in **Japan** increased by close to 3% in 1997, significantly lagging behind growth in industrial fabrication but higher than the growth in photographic

uses of silver. There was no one particular reason for this growth, rather it appears to have been simply associated with the growth in the scrap pool.

An examination of the overall market for photographic materials and their recycling in Japan suggests that photographic scrap recovery may be substantially higher than is officially recorded, although the estimates in Table 3 take this into account.

One of the main reasons for this omission is that collection is conducted by numerous medium-sized informal scrap recovery firms (some evidently associated with the gangster syndicates or *Yakuza*) the largest of which process upwards of 0.3 Moz (10 t) of silver scrap per month, primarily from photographic sources. Such firms do not, needless to say, report details of their silver scrap collection data to the MITI, although the silver is finding its way back into the production chain, leading to an underestimation of demand.

The rise in the price in the final quarter and the resulting disparity between the controlled price in mainland **China** and international prices led to significant flows of silver, including some scrap, from China to Hong Kong. However, further work on the Chinese silver scrap market is needed before a time-series can be published (which means that the fabrication data for China in Chapter 6 is based exclusively on the use of *new* supplies). Most silver scrap recovery by-passes the People's Bank of China, the only officially sanctioned buyer, so there are no realistic official scrap figures available. Many of the base metal smelters take silver scrap as feed (especially electronics scrap) with the silver recovered being sold directly into the market, and possibly being counted in the official statistics as mine production. There are also innumerable small unofficial silver refineries taking scrap as feed.

Korean silver scrap recovery showed little change year-on-year in 1997, although towards the year-end, volumes did start to pick up due to the combined impact on local prices of the sharp devaluation of the *won* and the rise in the international silver price. This rise continued into 1998, partly due to the moderate success of the silver collection campaign co-ordinated by some of the banks and *chaebol*, though this had nothing like the impact of the similar campaign to mobilize stocks of gold jewelry in the first months of the year.

6. Fabrication Demand

The robust increase in demand of 6.1% to 863 Moz (26,855 t) last year was primarily due to developments in the industrialized world, in contrast to 1996 when growth in offtake was essentially accounted for by silver jewelry and silverware in just two countries, India and Mexico. In addition to this, good growth was recorded across all the sub-sectors of demand recorded in this Survey. European offtake grew by 4.5% to 234 Moz (7,266 t), while in North America, the rise was even greater, at 7.7% to almost 200 Moz (6,000 t). However, of the industrialized countries, it was Japan that demonstrated the biggest gain in absolute terms: a rise of 15 Moz to 127 Moz (3,955 t), a growth rate of 13.5%. In the developing world, India showed modest growth of 2.0%, to 131 Moz (4,075 t) while Thai demand fell for the fourth year running, dropping to 26 Moz (821 t) in 1997, only two-thirds of the high of 39 Moz (1,204 t) recorded in 1993.

Developments in the main sectors of demand are shown in Figure 27. The largest sector, industrial applications, grew by 7.4% to 323.5 Moz (10,061 t), primarily as a result of good gains in the electronics sector in the United States, France, and Japan, although China also grew strongly. Without doubt, the star performer in 1997 was the electrical and electronics sector, which was up by 12% year-on-year, with electronics, rather than electrical uses, accounting for

much of this growth. In contrast to electronics and electrical uses of silver, brazing alloys and solders only grew by a very modest 1.8% year-on-year.

Silver jewelry and silverware could not sustain the tremendous growth seen in 1996, when offtake rose by over 15.6%, although the increase of 5.3% was by no means negligible. Italy accounted for the largest absolute increase in this sector.

It would appear that the threat of digital imaging to traditional silver halide photography has yet to fully materialize (see the box later in this chapter on digital imaging), with photographic uses of silver growing by a healthy 3.5%, to 232.3 Moz (7,225 t). All of the major fabricating countries other than France recorded year-on-year gains in offtake.

Coin and medals, the smallest sector, recorded a very healthy 23% growth rate, but this was effectively accounted for entirely by Japan and China, while most of the other main coin producing countries recorded year-on-year declines in their use of silver.

A regional breakdown of silver offtake is shown in Figure 28. Taking a medium-term view, the most noticeable features shown are the rising contribution of Indian demand while at the same time the dominance of the industrialized countries in overall silver offtake continues. Interestingly, the European Union's share in total offtake has fallen quite significantly from more than 30% to just over 25% since 1990, while those of the United States and Japan have shown comparatively little change over the period.

Figure 27
World Silver Fabrication

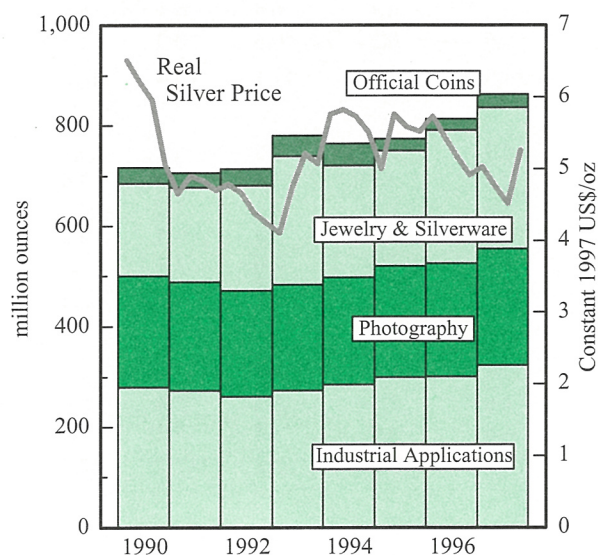


Figure 28
World Silver Fabrication

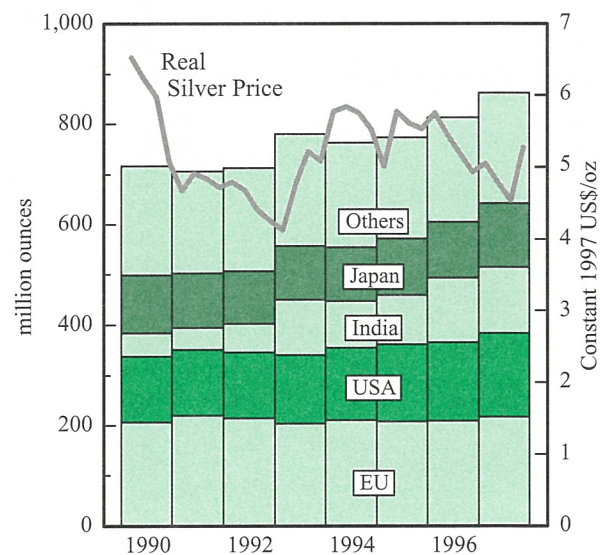


Table 4
World Silver Fabrication
(including the use of scrap)
Million ounces

	1990	1991	1992	1993	1994	1995	1996	1997
Europe								
Italy	51.8	57.1	61.4	57.7	53.4	51.5	53.6	58.3
Germany	54.3	57.9	54.8	48.4	52.8	46.0	45.6	46.0
UK & Ireland	25.0	25.4	26.8	28.4	31.2	32.3	34.4	35.5
France	26.2	28.3	30.6	29.8	27.9	30.8	26.9	28.3
Belgium	19.9	20.2	20.2	20.7	21.1	23.4	25.3	26.1
Switzerland	5.7	7.6	6.7	6.2	7.1	7.3	7.8	9.5
Spain	15.2	17.4	6.6	6.1	10.7	9.9	9.3	8.7
Greece	3.2	3.4	3.5	3.7	3.9	3.8	4.2	4.5
Poland	5.1	3.9	2.1	2.3	2.6	3.1	3.0	3.4
Portugal	2.5	2.3	2.5	2.5	2.0	2.4	2.8	2.9
Netherlands	2.8	2.2	2.1	2.1	2.6	3.2	2.2	2.1
Sweden	1.5	1.9	1.6	1.6	1.5	1.4	1.5	1.7
Austria	1.6	1.7	1.6	1.5	1.5	1.6	1.5	1.3
Norway	0.7	1.7	2.1	1.5	1.3	1.2	1.1	1.1
Denmark	1.1	1.0	1.1	1.0	1.0	1.0	1.0	1.0
Finland	1.4	1.5	1.3	0.9	1.0	0.9	1.0	0.9
Czech & Slovak Republics	1.7	1.5	1.0	0.7	0.6	0.8	0.7	0.8
Cyprus & Malta	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.4
Romania	0.7	0.6	0.5	0.5	0.4	0.3	0.4	0.4
Other	1.0	0.9	1.0	1.1	0.9	0.9	0.9	0.7
<i>Total Europe</i>	221.5	236.7	227.9	216.8	223.7	222.2	223.6	233.6
North America								
United States	131.0	130.6	131.3	135.6	145.0	152.9	156.3	167.0
Mexico	14.1	15.1	22.9	32.0	27.6	17.5	20.8	23.7
Canada	6.5	4.7	2.3	2.8	3.1	2.7	2.7	2.8
<i>Total North America</i>	151.6	150.3	156.5	170.4	175.7	173.0	179.7	193.5
Central & South America								
Brazil	6.8	6.7	6.6	6.9	8.3	9.4	8.4	8.4
Argentina	4.1	4.1	4.1	4.1	4.1	3.9	3.8	3.8
Peru	1.5	1.2	0.9	0.8	0.9	1.0	1.1	1.1
Colombia	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Ecuador	0.4	0.4	0.4	0.5	0.7	0.7	0.7	0.7
Chile	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Other	0.6	0.6	0.6	0.6	0.5	0.6	0.9	1.3
<i>Total Central & South America</i>	14.9	14.4	14.1	14.5	15.9	17.1	16.4	16.8
Middle East								
Turkey	5.2	4.9	5.8	6.3	5.8	6.2	6.3	6.8
Israel	2.1	2.3	2.6	2.8	3.1	3.4	3.7	4.0
Egypt	1.6	1.7	2.3	1.9	2.5	2.1	2.2	2.1
Saudi Arabia	0.2	0.3	0.4	0.4	0.4	0.4	0.5	0.6
Other	1.6	2.1	2.5	2.2	2.5	2.6	2.8	2.8
<i>Total Middle East</i>	10.7	11.3	13.5	13.5	14.2	14.7	15.5	16.2
Indian Sub-Continent								
India	46.8	44.8	58.1	109.9	91.8	98.7	128.4	131.0
Bangladesh & Nepal	0.6	0.6	1.0	1.6	2.3	3.2	4.8	8.0
Other	2.6	3.3	4.1	4.8	4.0	4.8	3.9	5.0
<i>Total Indian Sub-Continent</i>	50.0	48.7	63.2	116.4	98.0	106.8	137.1	144.1

Table 4
World Silver Fabrication
(including the use of scrap)
Million ounces

	1990	1991	1992	1993	1994	1995	1996	1997
East Asia								
Japan	115.8	108.8	104.9	107.9	108.4	112.7	112.1	127.2
Thailand	24.1	20.1	31.6	38.7	29.1	27.7	27.6	26.4
South Korea	6.8	9.3	9.0	15.6	16.4	18.6	18.5	18.6
Taiwan	4.5	3.6	4.3	4.8	5.3	5.7	6.4	6.9
Indonesia	1.5	1.8	2.1	2.0	2.9	3.3	3.6	3.8
Hong Kong	3.3	2.0	1.9	2.3	2.9	2.8	3.1	3.4
Myanmar, Laos & Cambodia	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.0
Vietnam	0.3	0.3	0.3	0.4	0.5	0.6	0.7	0.7
Malaysia	0.3	0.4	0.4	0.5	0.4	0.4	0.4	0.4
Other	0.5	0.4	1.1	0.4	0.3	0.3	0.3	0.3
<i>Total East Asia</i>	158.0	147.6	156.6	173.5	167.2	173.3	173.7	188.6
Africa								
Morocco	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6
Tunisia	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3
South Africa	0.5	0.3	0.3	0.6	0.4	0.5	0.3	0.3
Algeria	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2
Other	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4
<i>Total Africa</i>	2.1	1.9	1.8	2.0	1.9	2.0	1.8	1.8
Australia	5.2	5.2	6.9	7.0	6.3	5.3	5.2	5.2
Western World Total	614.0	616.3	640.5	714.2	703.0	714.6	753.0	799.8
Other Countries								
China	22.0	23.5	23.9	25.6	29.5	30.6	32.6	35.9
Soviet Union/CIS	80.6	67.2	50.2	40.9	31.7	29.0	28.4	27.8
North Korea	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
<i>Total Other Countries</i>	102.6	90.7	74.1	66.7	61.2	59.6	61.0	63.6
World Total	716.7	707.0	714.6	780.9	764.1	774.2	814.0	863.4

Industrial Applications

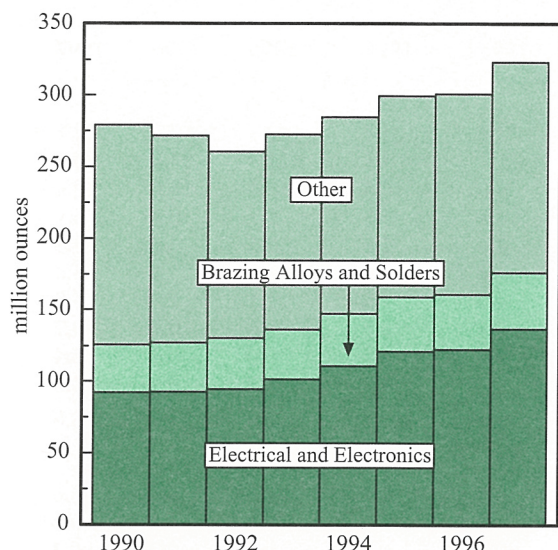
Industrial applications of silver grew by 7.4% to 323.5 Moz (10,061 t) in 1997 after a rather disappointing performance in 1996. The rise last year was mainly a reflection of gains in the electronics sector, the strongest performing countries being the United States, France and Japan, while demand in China, now the world's third largest consumer in this sector, also grew strongly. Most of the 12% growth in the combined electrical and electronics category was attributable to the strength of electronics demand, especially in the United States and Japan, with new and innovative uses helping to boost offtake. The use of silver in conventional electromechanical uses, such as contacts, showed a more modest rise. Brazing alloys and solders grew by a very modest 1.8%.

Europe

European offtake of silver for industrial applications surged by over 8% last year to 73.3 Moz (2,281 t). Growth was concentrated in a variety of electromechanical and electronic end-uses resulting in increased use of silver for the fabrication of wires, powders, pastes and plating salts.

It is interesting to compare and contrast demand in the European Union (EU) with that in the United States. At 63.9 Moz (1,987 t) in 1997, overall demand in the EU is at a similar, albeit slightly lower, level than that of the United States (70.0 Moz or 2,177 t). In both regions, the electrical and electronics sector is the dominant component of industrial demand at close to 50% and 60% respectively. However, within this category, the share of electronics is much lower in the

Figure 29
Main Components of Industrial Applications



EU, reflecting US strength in the fast-growing electronics industry. Europe's relative weakness in the "high-tech" areas is perhaps a corollary of its continued industrial bias towards the production of more traditional electromechanical technologies.

Germany is Europe's largest fabricator of silver for industrial applications. After falling in 1996, offtake increased last year by some 4%, broadly in line with the improvement in overall industrial production. However, although silver demand from the industrial sector has recovered, it remains below the peak levels recorded in the early 1990s. Electrical and electronics end-uses, above all powders and solid components for the manufacture of contacts, account for two-thirds of German industrial consumption. Contact demand from the automotive industry was noticeably stronger in 1997.

In **France**, the amount of silver required by manufacturers of raw materials for the electronics sector rose sharply. Much of the increase was seen in higher production of plating salts, a large part of which is exported to end-users in Asia. Silver demand for electromechanical products was also stronger last year, especially for the production of solid contacts.

Italian fabrication for industrial applications rose to 13.2 Moz (411 t) last year. The main sub-category, electrical and electronics end-uses, increased by 9.6% thanks to good home and export demand for wires and other materials used in the manufacture of contacts.

By contrast, the amount of silver used in brazing alloys fell by 11.2% due to weaker exports.

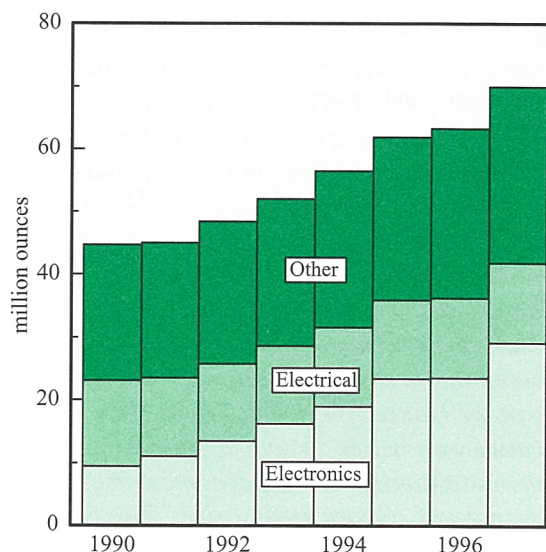
In the **United Kingdom** offtake edged up slightly as a result of growing demand from the electronics sector, much of this initially taking the form of silver nitrate. The other main areas of demand, namely electrical contacts and brazing alloys, were reported to be little changed from the previous year's level.

Demand for silver in **Switzerland** increased by 25% to 8.6 Moz (269 t) buoyed by higher exports to East Asia and also to other European countries. A large part of the volume is accounted for by the electromechanical sector which makes wires, extruded strip and powders for the production of contacts.

North America

Over the past five years, silver demand for industrial applications in the **United States** increased by more than 40% to reach a record 70.0 Moz (2,177 t) in 1997. Most of this growth has been driven by the development of new technologies and products which rely on silver's properties of electrical and thermal conductivity. Indeed, if last year's rate of growth were to be maintained in 1998, US silver demand for industrial applications would almost match the amount used in photography. This would be a particularly important milestone as very little silver is recycled from scrapped industrial products, in contrast to the large quantity of raw material recovered from spent

Figure 30
US Industrial Fabrication



The Main Uses of Silver

Silver's unique properties include its strength, malleability and ductility, its electrical and thermal conductivity, its sensitivity to and high reflectance of light and, despite it being classed as a precious metal, its reactivity which is the basis for its use in catalysts and photography. This versatility means that there are few substitute metals in most applications, particularly in high-tech uses in which reliability, precision and safety are paramount.

Industrial

Silver is the best electrical and thermal conductor of all metals and is hence used in many **electrical** applications, particularly in conductors, switches, contacts and fuses. Contacts provide junctions between two conductors that can be separated and through which a current can flow, and account for the largest proportion of electrical demand.

The most significant uses of silver in **electronics** are in the preparation of thick-film pastes, typically silver-palladium for use as silk-screened circuit paths, in multilayer ceramic capacitors, in the manufacture of membrane switches, silvered film in electrically heated automobile windshields, and in conductive adhesives.

The ease of **electrodeposition** of silver from a double-alkali metal cyanide, such as potassium silver cyanide, or by using silver anodes accounts for its widespread use in coating. Silver solutions are made up of a cyanide, a carbonate, silver and a brightener. The silver is usually added as the single salt, silver cyanide, or the double salt, potassium silver cyanide. Various forms of silver are used as anodes and may be in the form of plates, bars, rods, grain or in custom-designed shapes. The plating thickness of some items, such as fuse caps, is less than one micron although the silver then tarnishes more easily, and coatings of two to seven microns are normal for heavy duty electrical equipment.

The unique optical reflectivity of silver, and its property of being virtually 100% reflective after polishing, allows it to be used both in **mirrors and coatings** for glass, cellophane or metals.

Many **batteries**, both rechargeable and non-rechargeable, are manufactured with silver alloys as the cathode. Although expensive, silver cells have superior power-to-weight characteristics than their competitors. The most common of these batteries is the small button shaped silver oxide cell (approximately 35% silver by weight) used in watches, cameras and similar electrical products.

Silver, usually in the form of mesh screens but also as crystals, is used as a **catalyst** in numerous chemical reactions. Silver catalysts are particularly important in the production of formaldehyde which is used in the manufacture of housings for television sets, computers and electrical switch boxes.

Silver is employed as a bactericide and algacide in an ever

increasing number of **water purification** systems in hospitals, remote communities and domestic households.

The joining of materials (called **brazing** when done at temperatures above 600 degrees Celsius and **soldering** when below) is facilitated by silver's fluidity and strength. Silver brazing alloys are used widely in applications ranging from air-conditioning and refrigeration equipment to power distribution equipment in the electrical engineering sector. It is also used in the automobile and aerospace industries.

Bearings electroplated with high purity silver have greater fatigue strength and load carrying capacity than any other type and are hence used in various hi-tech and heavy-duty applications.

Photography

The photographic process is based on the presence of light-sensitive silver halide crystals, prepared by mixing a solution of soluble silver, usually silver nitrate, with a soluble alkali metal halide such as sodium chloride or potassium bromide. These grains are then suspended in the unexposed film. The effect of light on the silver halide disturbs the structure of this compound rendering it selectively reducible to metallic silver by reducing agents called developers. The resulting negative image is converted to the positive by repeating the process under specific conditions. Photographic film is used in radiography, the graphic arts, and in consumer photography. Photographic film manufacturers demand very high quality silver.

Jewelry and Silverware

Silver possesses working qualities similar to gold, enjoys greater reflectivity and can achieve the most brilliant polish of any metal. Consequently, the silversmith's objective has always been to enhance the play of light on silver's already bright surface. Pure silver (999 fineness) does not tarnish easily, but to make it durable for jewelry, it is often alloyed with small quantities of copper. It is also widely used with base metals in gold alloys. Sterling silver, at a fineness of 925, has been the standard of silverware since the 14th century, particularly in the manufacture of "hollow-ware" and "flatware". Plated silverware usually has a coating of 20-30 microns, while jewelry plating is only 3-5 microns.

Coins

Historically, silver was more widely used in coinage than gold, being in greater supply and of less value, thus being practical for everyday payments. Most nations were on a silver standard until the late 19th century with silver coin forming the main circulating currency. But after the gold rushes, the silver standard increasingly gave way to the gold. Silver was gradually phased out of regular coinage, although it is still used in some circulating coins and especially in American, Australian, Canadian and Mexican bullion coins for investors.

Table 5
Silver Fabrication: Industrial Applications
(including the use of scrap)

Million ounces

	1990	1991	1992	1993	1994	1995	1996	1997
Europe								
Germany	22.3	21.1	20.0	18.6	18.0	18.5	17.2	17.8
France	10.1	11.1	12.8	11.3	11.6	12.0	11.7	13.4
Italy	9.9	10.3	10.5	11.1	11.5	12.0	12.6	13.2
UK & Ireland	10.5	10.8	11.1	11.4	11.7	11.9	12.2	12.5
Switzerland	5.1	5.7	6.0	5.6	6.5	6.6	6.9	8.6
Spain	1.9	1.9	1.8	1.8	1.7	1.8	2.0	2.9
Netherlands	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Poland	0.6	0.5	0.5	0.6	0.8	0.8	0.8	0.7
Austria	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6
Czech & Slovak Republics	0.8	0.7	0.5	0.5	0.4	0.5	0.5	0.4
Sweden	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Belgium	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Other	0.8	0.8	0.7	0.7	0.8	0.8	0.8	0.8
<i>Total Europe</i>	65.0	65.7	67.0	64.7	66.0	68.0	67.6	73.3
North America								
United States	44.8	45.1	48.5	52.1	56.5	62.0	63.3	70.0
Mexico	2.6	2.6	2.6	2.6	2.8	2.5	2.6	2.9
Canada	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.6
<i>Total North America</i>	48.1	48.4	51.8	55.4	59.9	65.3	66.6	73.5
Central & South America								
Brazil	2.4	2.4	2.4	2.5	3.2	3.5	3.3	3.4
Argentina	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2
Colombia	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Other	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
<i>Total Central & South America</i>	4.4	4.4	4.4	4.5	5.2	5.4	5.2	5.3
Middle East								
Turkey	1.0	1.0	1.1	1.2	1.1	1.2	1.2	1.4
Israel	0.4	0.6	0.7	0.8	0.9	1.0	1.0	1.0
Egypt	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<i>Total Middle East</i>	1.5	1.7	1.9	2.2	2.1	2.3	2.4	2.5

photographic materials.

Figure 30 shows that by far the largest part of the rise in industrial demand has come from electronics. Demand was hit in 1996 by the mundane performance (by their own standards) of the computer and the electronics industries. Although the decline turned out to be more in terms of prices rather than volumes, the inventory cycle amplified the effect of this period of slower growth on demand for raw materials such as silver, gold and, especially, palladium. Similarly, but with the opposite effect, the strong recovery in the electronics industry last year had an even greater impact on silver demand. Most of the silver consumed by the electronics industry is first converted into powder, flake and paste form, with these materials then being used for multilayer ceramic capacitors, keypad contacts, adhesives and shielding. In addition, a

smaller quantity of silver in the form of strip, wire, sputtering targets and plating solutions is required for a variety of electronic end-uses such as lead frames and wet tantalum capacitors. The overall growth in electronics demand is being driven by the increased production of mobile phones, pagers and other devices incorporating electronic components. Electronics demand for silver is largely price insensitive as the raw material cost is usually tiny compared to the cost of the device itself. Furthermore, silver's particular qualities and performance characteristics cannot easily (or cheaply) be replaced by other materials. However, where silver is associated with palladium (eg, in silver-palladium powders), demand could eventually be hit as users of such compounds focus on the palladium price and, especially, the problems of security of supply. Paradoxically though, in the short run, silver may have

Table 5
Silver Fabrication: Industrial Applications
(including the use of scrap)

Million ounces	1990	1991	1992	1993	1994	1995	1996	1997
Indian Sub-Continent								
India	18.1	19.8	19.4	28.9	31.7	34.1	35.5	35.2
Other	1.4	1.7	2.2	2.5	2.1	2.3	2.1	2.4
<i>Total Indian Sub-Continent</i>	19.5	21.5	21.6	31.4	33.8	36.4	37.6	37.6
East Asia								
Japan	46.6	47.5	44.1	45.8	51.1	53.6	52.1	59.4
South Korea	2.3	4.0	4.0	8.4	10.0	11.9	11.9	12.3
Taiwan	3.0	3.1	3.7	4.2	4.7	5.2	5.8	6.3
Hong Kong	2.4	1.0	0.9	1.3	1.9	1.9	2.2	2.4
Indonesia	0.4	0.6	0.7	0.4	0.4	0.4	0.4	0.5
<i>Total East Asia</i>	54.6	56.2	53.4	60.1	68.1	73.0	72.4	80.9
Africa								
Morocco	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
South Africa	0.5	0.3	0.2	0.5	0.3	0.3	0.2	0.2
Other	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
<i>Total Africa</i>	0.8	0.6	0.5	0.8	0.6	0.7	0.6	0.6
Australia	2.0	1.9	2.0	2.0	2.2	2.4	2.3	2.1
Western World Total	196.0	200.4	202.6	221.2	237.8	253.6	254.7	275.8
Other Countries								
China	17.3	17.7	18.8	20.1	23.2	24.3	25.4	27.0
Soviet Union/CIS	66.0	54.1	39.5	31.9	24.0	21.9	21.1	20.6
<i>Total Other Countries</i>	83.3	71.8	58.4	52.0	47.2	46.2	46.5	47.7
World Total	279.3	272.2	261.0	273.2	285.0	299.8	301.1	323.5

benefited from the turmoil in the palladium market due to manufacturers choosing (at the margin) to substitute palladium with silver. Yet in the long run, there must be some risk that in certain applications, silver-palladium alloys will be substituted by base metals. In addition, during the first quarter of 1998 there was a marked decline in demand for silver due to the electronics inventory cycle turning down, something which appeared to be exacerbated by the economic crisis affecting East Asia.

As Figure 30 shows, silver use in contacts and other electrical applications has remained broadly stable over recent years. There has been a tendency for the average silver use per contact to show a slight decline but this has been compensated by an increase in the number of contacts produced. The combined effect last year resulted in a small rise in overall silver usage prompted, in part, by higher offtake in a number of sectors, such as residential construction (light switches and, especially, circuit breakers), consumer products and the automotive sector. The bulk of silver use

continues to be for the larger contacts used for high tension and high power applications. Low voltage applications are believed to account for less than 25% of US contact demand. It is here, however, that a sustained increase in the silver price could encourage the development of solid-state alternatives.

Use of silver in brazing alloys and solders has increased during the 1990s and last year there was a further small rise in fabrication.

Excluding electrical and electronics uses and brazing alloys and solders, overall demand in all the other industrial applications recorded just under 5% growth in 1997. A very wide range of applications falls into this category, the single most important one being the use of silver in catalysts. Most of the silver catalysts are used to make ethylene oxide which, in turn, is used in the manufacture of glycol, plastics and polyester. Silver use in catalysts remained stable in 1997. Each year, a high percentage of the existing catalyst population is recycled (in many cases, as much as two-thirds) so annual replacement demand is quite

significant. On the other hand, very little silver is lost during the life of the catalyst or when it is scrapped. Therefore what can be termed “new” silver demand for catalysts is actually relatively minor.

Silver use by the battery industry was reported to be little changed in 1997. The same is true for consumption in mirrors. By contrast, last year there was reasonably good growth in decorative electroplating. Over recent years, a number of other silver applications have been growing rapidly and although (especially individually) they are still relatively small end-uses, they have the potential to become more important sources of demand in future. An example of this is the use of silver in glass coating where a thin film of silver is applied, increasingly these days through the use of sputtering targets. Demand for glass coating is being encouraged by tighter environmental regulation, such as the measures introduced by Texas and California last year requiring all new buildings to have low energy emissivity. Another potential future growth area for silver coated glass is in automobiles, for example in head-up displays. Water purification also holds the prospect for rapid increases in silver use, both at the individual or household level and in communal systems as, eg, to maintain water free from bacteria and algae in swimming pools and in municipal water treatment.

India

In **India**, industrial demand was held back in the first half by the “money crunch” which has afflicted the economy for the past two years, with the resulting high rates of interest and the unwillingness of industrialists to borrow having a stifling effect on industrial production. The situation was alleviated to some extent when bank rates were reduced by 1% in mid-April last year, though exporters in particular complained about the high value of the rupee, especially in the second half, with the outbreak of the currency crises in South East Asia. Although the rupee did show a modest weakening (of around 10%) in the final quarter, to some extent because of the increased inflow of gold after the introduction of Open General Licence imports, this was nowhere near enough to satisfy the exporters. Nevertheless, the economy could hardly be described as in a recessionary state last year and offtake of purely industrial products, such as brazing alloys, batteries and catalysts showed reasonable growth. Demand in the electrical sector was boosted by the government’s continued targeting

of rural electrification as a priority development area.

But for the most part, industrial silver demand in India is related neither to the export sector nor to the needs of industry. Instead, consumer items such as foil (which is incorporated into chewing tobacco and related products as well as being used for the decoration of foodstuffs) constitute a large part of demand. The foils are produced by hand-beating, employing many thousands of workers organized as a cottage industry. A significant threat to part of this sector was revealed in mid-year in the form of a proposal to ban the sale of *ghutka* - a mixture of tobacco, spices and crushed areca and betel nuts, which is sold mixed with flakes of silver foil - because it is thought to cause mouth and throat cancer. Banning *ghutka* would have a significant impact on silver demand, since around 6 Moz (200 t) per year are used in this product.

East Asia

Total industrial demand in **Japan** rose by well over 10% in 1997, to 59.2 Moz (1,840 t). The strong rise in industrial demand is somewhat surprising considering the overall weakness of the Japanese economy, and is mainly attributable to a robust performance from the electronics sector (electrical uses of silver grew less robustly), although the weakening of the yen has also contributed to some extent by raising exports.

One indicator of the strength of electrical and electronics demand (see Figure 31) was the 9% rise in nitrate production for non-photographic uses.

Japanese Non-photographic Nitrate and Contact Production

Million ounces	1994	1995	1996	1997
non-photo nitrates	9.1	10.6	9.6	10.5
contacts	8.6	9.32	8.7	9.5

Nitrate demand for use in multilayer ceramic capacitors accounted for much of this growth, and at present, well over 50% of non-photographic nitrate production is going into capacitors of one form or another. Final products in which these electrical components are used include mobile telephones and computer games, production of which increased substantially in 1997.

The balance of nitrate is consumed in mirrors,

fabrication of which was flat year-on-year, due to the slowdown in the construction industry, catalysts (also flat year-on-year) and antibacterial uses. The last of these three uses has shown tremendous growth over the past three to four years, indicating the extent to which Japanese consumers are concerned about hygiene and health risks. Close to 10% of all non-photographic nitrate production is now finding its way into antibacterial applications (one growing application is the incorporation of a silver compound into children's playpen sand to kill bacteria).

Contact production also rose robustly year-on-year, by 9% to 9.5 Moz (295 t). Electronics demand accounted for much of this growth, as did vehicle production, which was around 6% higher year-on-year in spite of the weakness in some of Japan's export markets. Severe production cuts in automobile output were only implemented in late 1997 and early 1998, too late to affect demand for contacts last year. However, demand for contacts for use in the construction industry, eg, for use in switches, did show a significant year-on-year decline.

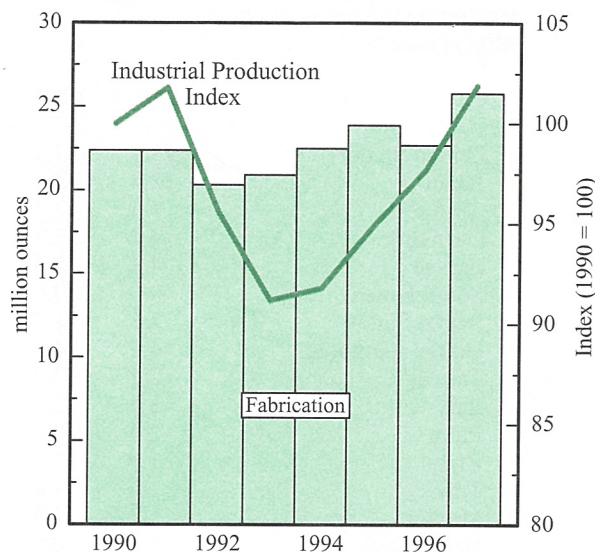
The manufacturing of electroplating solutions, mainly for use in electronics applications, rose by well over 10% year-on-year to 3.7 Moz (115 t). As in 1996, this rise was due to both higher local and export demand. In particular, most of the export demand was for electronics plating in the East Asian region (where there is relatively little local production of high quality plating salts suitable for the electronics industry). Growth in lead frame fabrication in Japan and in the East Asian electronics packaging industry boosted the demand for electroplating solutions.

The only category of industrial silver use to fall year-on-year was brazing alloys and solders, by around 2% to 5 Moz (155 t). Most of this fall was accounted for by weakness in the construction sector, in particular falling demand for air-conditioning and refrigeration units. The decline in the construction sector was partly offset by increased demand from the motor vehicle industry. However, the motor vehicle industry's consumption of brazing alloys has declined in recent years, with the result that increases in vehicle production have not been matched by corresponding increases in brazing alloy demand.

Dental alloy offtake increased by 3% in 1997, the same rate as in 1996, to 2.4 Moz (74 t). Part of the increase was due to changes in the national insurance scheme which encouraged the use of cheaper, more silver-intensive alloys (the increase in the palladium

Figure 31

Japan: Electrical & Electronics Fabrication



price also played a role in this). The change in the consumption tax in April boosted demand as users stocked up on alloys to avoid the price increases.

There is not yet sufficient data to separate out jewelry and silverware from industrial demand in **China**, although it is most certainly the case that the former uses are small considering that neither form of silver is very popular amongst the Han majority. However, non-Han minorities, especially in Yunnan in south-west China, do have a strong affinity for silver jewelry, but at this stage it is too difficult to accurately estimate how much silver is being consumed in these areas. Consequently, silver jewelry and silverware demand is included under the industrial category.

Most silver is used in industrial applications (the trend in offtake being shown in Figure 32) which increased by a robust 6% in 1997, surpassing the already healthy growth of more than 4% the previous year. At least part of the additional growth in 1997 can be attributed to progress in addressing the quality problems that have plagued much of Chinese manufacturing in the past. Instead of simply relying on higher-quality, imported semi-manufactures, as in past years, there has been a noticeable shift towards the use of locally fabricated semis, which can increasingly approach or even match the quality of imports. Perhaps the greatest impetus to this shift in sourcing has come from joint venture investment and production on the mainland. Although much of the production of higher end final goods is still carried out on an assembly basis using imported components,

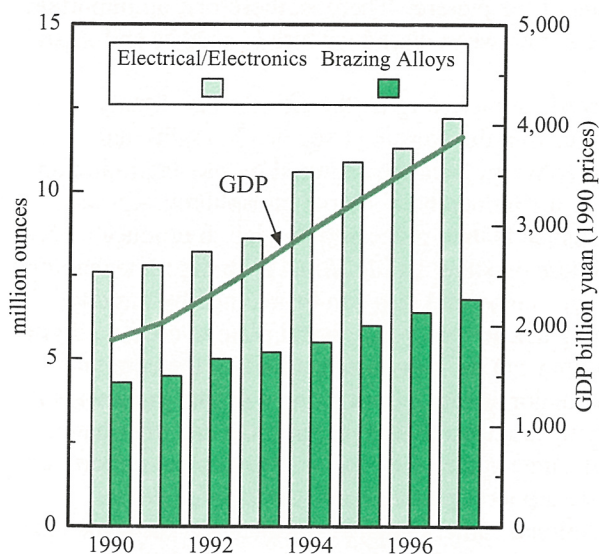
Table 5a
Silver Fabrication: Electrical and Electronics
(including the use of scrap)
Million ounces

	1990	1991	1992	1993	1994	1995	1996	1997
United States	23.3	23.5	25.8	28.6	31.6	36.0	36.3	41.9
Japan	22.4	22.4	20.3	20.9	22.5	23.9	22.7	25.8
China	7.6	7.7	8.2	8.6	10.6	10.9	11.3	12.2
Germany	13.5	12.7	12.1	11.3	10.9	11.9	11.6	11.9
France	4.8	5.3	6.2	5.0	5.4	6.1	6.3	7.7
South Korea	0.0	0.6	0.5	4.5	5.3	6.4	6.4	6.5
Switzerland	1.3	1.9	2.6	2.8	3.5	3.8	4.1	5.5
United Kingdom	4.2	4.4	4.5	4.5	4.6	4.7	5.0	5.1
Taiwan	2.2	2.2	2.7	2.9	3.3	3.6	4.2	4.7
Italy	3.4	3.4	3.5	3.6	3.5	3.5	4.1	4.5
India	2.3	2.4	2.4	2.4	2.6	3.0	3.2	3.5
Brazil	1.0	1.0	1.0	1.0	1.5	1.6	1.4	1.4
Turkey	1.0	1.0	1.1	1.2	1.1	1.2	1.2	1.4
Mexico	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.2
Hong Kong	1.9	0.5	0.3	0.5	0.7	0.7	0.8	1.1
Spain	0.8	0.9	0.9	1.0	0.9	0.9	0.9	0.9
Netherlands	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Australia	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5
Austria	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Romania	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Egypt	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	92.5	92.8	94.8	101.5	110.7	120.9	122.2	136.8

Table 5b
Silver Fabrication: Brazing Alloys and Solders
(including the use of scrap)
Million ounces

	1990	1991	1992	1993	1994	1995	1996	1997
United States	5.8	5.6	6.5	7.2	7.7	8.0	8.2	8.4
China	4.0	4.5	5.0	5.2	5.5	6.0	6.4	6.8
Japan	4.5	4.8	4.2	3.8	4.7	4.8	5.1	5.0
Germany	5.4	5.1	4.8	4.5	4.0	3.5	2.9	3.1
Italy	1.8	1.9	2.1	2.3	2.4	2.7	2.7	2.4
United Kingdom	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
India	1.1	1.4	1.4	1.4	1.6	1.9	2.1	2.3
Switzerland	2.4	2.6	2.4	1.8	1.8	1.8	1.7	1.7
France	1.8	2.1	2.4	1.8	1.4	1.3	1.4	1.4
South Korea	0.1	0.2	0.3	0.8	1.0	1.2	1.2	1.1
Taiwan	0.5	0.5	0.6	0.7	0.8	1.0	1.1	1.1
Spain	0.6	0.6	0.5	0.4	0.3	0.3	0.6	0.9
Mexico	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9
Brazil	0.5	0.5	0.5	0.6	0.8	0.9	0.9	0.8
Australia	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.6
Canada	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4
Netherlands	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Austria	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1
Israel	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Total	33.1	34.4	35.4	35.2	36.9	38.4	38.9	39.6

Figure 32
Chinese Industrial Uses of Silver



there is evidence to suggest that this is changing.

This was particularly evident in the production of paste for use in electrical components such as multi-layer ceramic capacitors, and to a lesser extent in the production of contacts, which was stimulated by demand from the still rapidly growing construction and automobile industries. However, very high growth rates in electronics and electrical goods fabrication in 1997 (of well over 20% year-on-year) suggests that there are still substantial imports of semi-finished silver products for use in assembly plants.

The production of brazing alloys and solders increased by around 5% to 6.8 Moz (210 t). As in the past few years, most of this increase was accounted for by increased demand for air-conditioning equipment. Evidence of the penetration of air-conditioners into urban houses and flats was provided by the brown-outs experienced in cities like Beijing during the very hot summer of 1997. Regular visitors to cities like Beijing cannot help noticing the proliferation of individual air-conditioning units on the exteriors of apartment and office blocks.

The ongoing trend which has seen non-electrical plating applications moving to the mainland from areas like Taiwan and Hong Kong continued in 1997. Part of the reason for this is related to cheaper labor costs, but equally if not more importantly, this trend has been driven by weaker environmental controls in China.

Total **Korean** industrial demand increased by a modest 3% in 1997. However, this masks markedly

different performances from the two main sectors of industrial demand, namely contacts and plating salts for electronics use.

Contact fabrication remained flat year-on-year, the result of a stagnant motor vehicle market. On the other hand, demand from the electronics industry grew by more than 8%. As in 1996, the weakness in electronics prices, in particular DRAMS, did not impact negatively on silver offtake. The continued fall in memory chip prices (a standard memory chip selling for around \$8 at the beginning of 1997 was selling for around \$3.50 at the beginning of 1998) has resulted in, and been the consequence of, increased production to maintain cash flows by the large memory producers (the currency crisis at the end of the year has only served to compound the move towards higher production). Increased production of electronics components such as processors and memory chips coupled to robust final demand for electronics goods such as mobile telephones, resulted in high levels of silver paste and plating solution offtake.

Brazing alloys and solder production fell slightly in 1997 for the second year in a row, and as in 1996, most of this decline was attributable to lower demand from China. Silver nitrate production for use in mirrors remained flat.

In spite of the turmoil in East Asia and competition from increased Korean electronics production, the **Taiwanese** electronics industry remains financially sound and turned in a strong performance in 1997. Sales were up by over 11% in US dollar terms although silver use in electronics rose by over 12% due to the impact of falling prices of components such as integrated circuits.

Other non-electronics and electrical industrial demand was essentially flat year-on-year, with the only exception being brazing alloys and solders which fell modestly, by around 1%, as a consequence of falling exports of consumer durables.

Total **Hong Kong** industrial fabrication rose by over 9% in 1997, matching the previous year's growth rate. As in 1996, most of this growth was attributable to increased production of silver potassium cyanide for use in the electronics industry across the entire South East Asian region. Most of the growth has been concentrated in the electronics packaging industries in Singapore, Malaysia and the Philippines, where there is relatively little production of high quality plating solutions.

Digital Technology in the Photographic Market

In contrast to the use of silver halide film in conventional photography, digital technology converts images directly into electronic form thereby avoiding the need for silver. Since photographic demand accounts for 28% of total silver fabrication, digital imaging is widely considered a potential threat to the silver market (though, in practice, due to the large amount of photographic scrap generated every year, the market's "vulnerability" is considerably less than this percentage would imply).

In film-based photography, light is focused through a lens onto a silver-halide-coated piece of plastic (the film) thereby causing a photochemical reaction that creates an image of the original picture. The film is then chemically processed to produce negatives which can be printed onto silver halide paper. **Digital technology** replaces the film with a charge-coupled device (CCD) which contains hundreds of thousands of resistors that convert incoming light into binary, ie, digital form. As a rule of thumb, the more photocells the better the final picture quality, although there are many other factors that influence the quality of the final image.

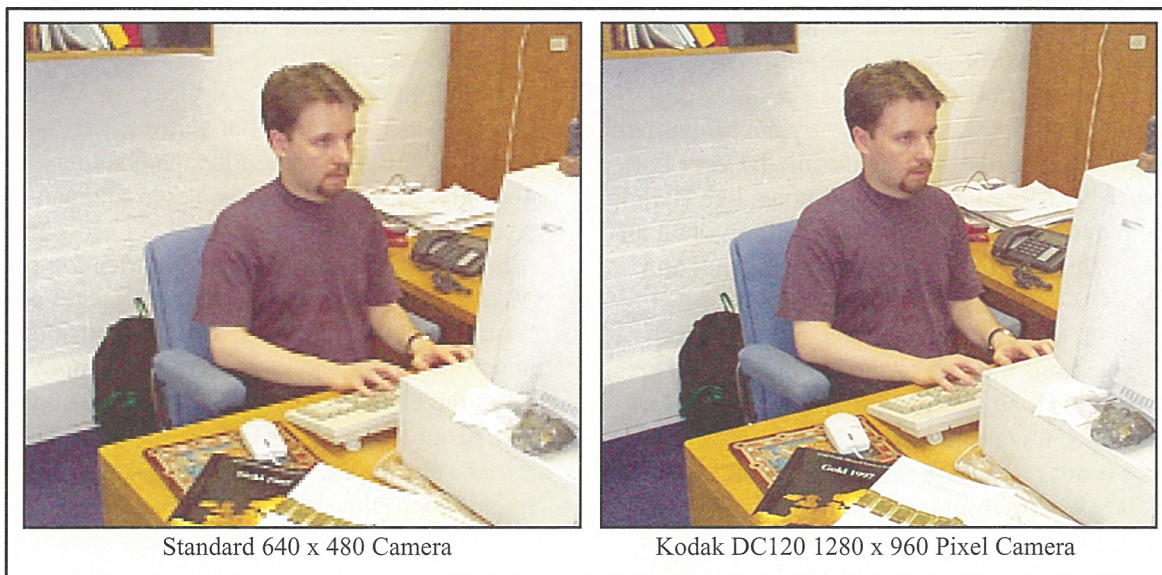
The real power of digital technology is that once pictures have been digitized they can be manipulated on a standard PC using readily available software. There are two separate ways in which pictures can be digitized. Firstly, there are digital cameras, which capture pictures into digital form immediately, eliminating the need for silver in the photographic process. Secondly, standard

silver halide pictures can be scanned into electronic form which necessitates the use of silver in the taking and printing of the picture. There is, therefore, an important distinction between digital capture of images and digital imaging.

In medical radiography, the situation is slightly different from the consumer sector. In traditional radiography, pictures are captured by passing radiation through the human body onto a phosphorous-crystal plate, which is then processed in a lab to produce an X-ray picture on silver halide film. With digital technology, however, the second step can be avoided by directly scanning the phosphorous-crystal plate to create a digital image that can be viewed and stored on the computer.

The major advantages of using a **digital camera** is the ability to capture a digital picture. On the other hand, digital cameras are still expensive and, most importantly, produce a poorer picture quality compared with a conventional camera having, for instance, the same lens quality. A typical CCD in an amateur digital camera contains around 350,000 photocells (producing an image of 640 x 480 pixels), while even top-of-the-range professional versions are limited to around 6 million pixels. By comparison, silver halide film produces a picture equivalent to 20 million pixels. Figure 33, of GFMS analyst, Philip Newman, provides an indication of how the quality of an image is affected by the number of pixels. As a result, digital camera images are, except in the case of the high-end professional models, of inadequate quality to be printed although they are good

Figure 33
Photos at Different Pixel Densities



enough for most electronic uses. Printer quality is also a constraint on printing high-resolution digital pictures.

From their commercial introduction in the early 1990s, digital camera sales in the consumer photographic market have grown sharply (as shown in Figure 34) driven partly by a fall in camera prices and also by enhanced picture quality. Sales are, however, still tiny in comparison with the over 30 million film-using cameras and 200 million single-use cameras sold annually worldwide. Sales have, furthermore, been concentrated in the United States and Japan, and have been limited to highly computer-literate consumers (in the United States around 40% of purchases are from computer stores compared to only 25% from camera stores). One further limitation has been the reluctance of consumers to purchase technology which may rapidly become out-of-date.

Despite nearly doubling in size each year, sales have actually been below expectations. Reflecting this, Kodak announced late last year that it had made substantial losses on its digital camera business. An explanation for the poor sales of digital cameras was provided in late 1997 by Fuji CEO, Minoru Ohnishi "...an alarming number of consumers who recently purchased digital still cameras at mass merchandisers in the United States, are returning their cameras to the stores because they are disappointed with the poor picture quality. They incorrectly believed that their digital still camera could take the place of a silver halide camera". Certainly, the ease of use of traditional photography can be understated, and this is another reason why digital cameras have had a larger impact at the professional end of the consumer

market, particularly where the ease in sending pictures electronically is important.

In **medical photography**, digital imaging allows for the central storage of images such that all of the patient's records can easily be accessed in a cost-effective manner. On the other hand, these systems can be prohibitively expensive. Furthermore, hard-copy pictures often still need to be produced as these make analysis better and easier, relative to looking at pictures on computer screens which often do not have adequate graphical capabilities. In radiography, hard-copy pictures are the normal X-ray silver halide film, implying a continued use of silver in this field. Overall, therefore, silver demand is unlikely to be greatly affected by digital technology in the near future, since even if digital imaging becomes commonplace in hospitals, the need for high quality silver halide pictures will remain until adequate and cost-efficient computer monitors become available.

In the **graphic arts** sector, demand for silver has already begun to be negatively affected by digital technology. This is not so much through the use of digital cameras, but rather because of the elimination of wasteful trial runs by using digital technology to transfer images to computers where they can be easily retouched without the need for more shots to be taken. In other words, images continue to be captured with silver halide technology, but the power of digital imaging is nevertheless reducing the need for film. This trend is expected to continue in future as users of the traditional silver halide technology turn to digital imaging to reduce costs and lead-times.

There is little doubt that the use of digital imaging will continue to grow in future, being boosted by improvements in software, the continued growth in the popularity of the internet, and the expansion of the computer industry in general. Rather than being a threat to the photographic market, companies such as Kodak believe digital imaging will drive increased demand for photographic products by making it easier to organize, view, improve and share photographs. But it is likely that the continued decline in the cost and the improving quality of digital cameras will increase the pressure on traditional technologies. However, given the current rate of decline in the "cost-per-pixel" for digital cameras, it will be many years before a similar quality picture could be taken at the same cost as a standard silver halide camera.

The fears, therefore, of the imminent demise of silver photographic demand appear to be exaggerated, although digital technology will continue to make inroads into those areas of demand where having rapidly digitized pictures is an advantage.

Figure 34
Digital Cameras: Sales and Cost per Pixel

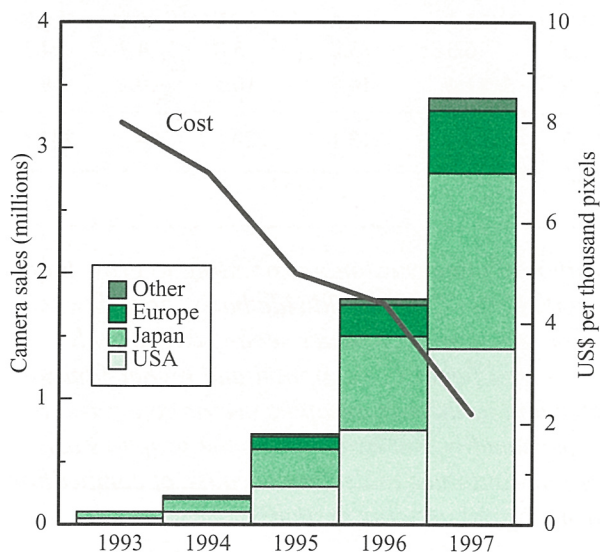


Table 6
Silver Fabrication: Photographic Use
(including the use of scrap)

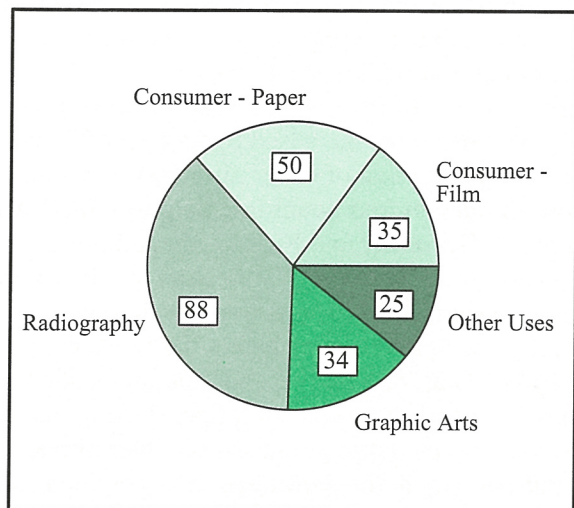
Million ounces	1990	1991	1992	1993	1994	1995	1996	1997
Europe								
Belgium	19.0	19.4	19.7	20.1	20.6	22.8	24.8	25.5
UK & Ireland	12.1	12.3	13.1	13.6	15.9	16.7	18.2	19.0
Germany	16.1	16.6	15.8	15.4	16.1	14.8	13.8	14.5
France	12.5	13.4	14.3	14.7	13.7	15.9	13.2	12.7
Poland	2.9	2.3	0.5	0.5	0.5	0.5	0.3	0.2
Hungary	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2
Romania	0.5	0.4	0.3	0.3	0.2	0.1	0.2	0.2
Czech & Slovak Republics	0.6	0.5	0.2	0.0	0.0	0.0	0.0	0.1
Spain	1.6	1.4	0.6	0.4	0.2	0.1	0.0	0.0
<i>Total Europe</i>	65.7	66.6	64.8	65.2	67.4	71.0	70.7	72.4
North America								
United States	67.0	65.0	63.5	64.0	67.8	70.3	74.4	79.0
Mexico	2.3	2.3	2.6	3.2	3.2	3.3	3.4	4.1
Canada	2.9	1.9	0.0	0.0	0.0	0.0	0.0	0.0
<i>Total North America</i>	72.1	69.2	66.1	67.2	71.0	73.7	77.8	83.1
Central & South America								
Brazil	2.6	2.6	2.6	2.6	3.2	4.0	3.4	3.4
Argentina	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
<i>Total Central & South America</i>	4.4	4.4	4.4	4.4	5.0	5.8	5.2	5.2
India	5.6	2.6	2.6	2.3	1.6	0.6	0.6	0.6
East Asia								
Japan	56.5	57.8	58.0	57.2	55.1	56.9	57.9	58.6
Indonesia	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
Taiwan	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
<i>Total East Asia</i>	56.7	58.0	58.3	57.5	55.4	57.2	58.1	58.8
Australia	2.3	2.3	2.3	2.1	1.9	1.6	1.6	1.6
Western World Total	206.7	202.9	198.4	198.6	202.3	209.9	214.1	221.8
Other Countries								
China	4.3	4.4	4.7	5.1	5.6	5.6	5.8	6.0
Soviet Union/CIS	10.0	8.8	7.2	6.3	5.2	5.0	4.7	4.5
<i>Total Other Countries</i>	14.3	13.2	11.9	11.4	10.8	10.5	10.4	10.5
World Total	221.1	216.2	210.3	210.0	213.1	220.4	224.5	232.3

Photography

The fabrication of silver in photographic uses rose by 3.5% to 232.3 Moz (7,225 t) in 1997. Most of the increase occurred in the United States, where output grew by over 6%, primarily as a result of Japanese manufacturers establishing production facilities in the country. Notwithstanding the poor statistical picture of the Japanese market caused by the trade dispute with the United States, it appears that local fabrication in Japan also rose in 1997,

with preliminary estimates pointing to growth of around 1%. On a worldwide basis, growth was strongest in the consumer sector, due to both increased paper consumption and higher film sales. Demand in the radiographic sector continues to grow steadily, but by contrast, the graphics arts sector continues to decline because of competition from digital imaging systems.

Figure 35
Photographic Uses of Silver, 1997
million ounces



Around 75% of the silver used in photographic fabrication is accounted for by two almost equally sized sectors, namely consumer photography (using both film and paper) and radiography (see Figure 35). The only other significant sector is graphic arts, which accounts for around 15% of fabrication, with the remainder of silver being used in a variety of other photographic applications.

Consumer photography has been the fastest growing sector of photographic demand over the past few years. As a result, major manufacturers have significantly increased their film and paper production capacity throughout the world. Both production and demand remain concentrated in the industrial countries, with local manufacturers remaining dominant in both the United States and in Japan.

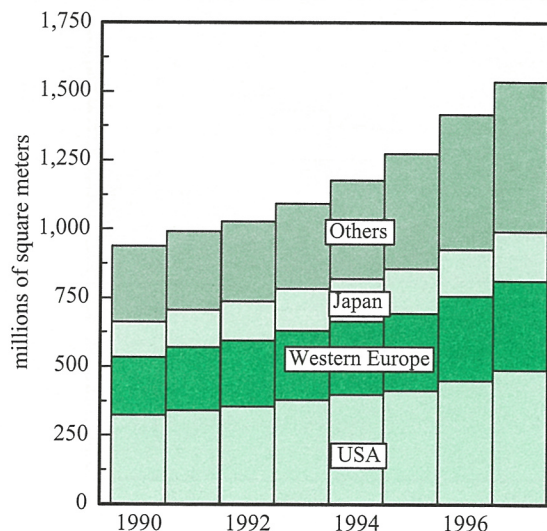
Just over 60% of the silver used in consumer photography is in paper, with film accounting for the remainder. In recent years, paper consumption has been growing at a faster rate than film sales, rising by over 8% in 1997 alone. Demand has been boosted by the trend for users to order more prints per film, increasing average print size, and by reprints becoming more popular. Demand has been particularly strong in the developing world (see Figure 36). A common feature to both film and paper loadings has been for the intensity of silver usage to decline, so that silver usage has not matched the overall growth in paper production.

The demand for film has, on average, been growing at over 3% per annum in the 1990s, but this has

accelerated in recent years (as can be seen in Figure 37). Although the industrial world still accounts for over 70% of total demand, the fastest growing areas of demand are in the developing world. Research carried out for The Silver Institute suggests that the number of photographs taken in countries like India and China has grown in recent years by around 30%. The actual silver usage, however, has not grown by quite the rate of overall film sales because of the decline in average silver loadings. The new Advanced Photo System (APS), for example, uses almost one-third less silver than a standard 35mm film. In 1997, APS accounted for less than 10% of total film sales, although demand for these cameras has been so strong in the past year that it has outstripped manufacturing capacity. The increasing use of the less silver-intensive APS is not necessarily a negative for silver demand as the cameras are likely to be used more extensively and they also have a built-in tendency to promote higher paper demand. Another area that has contributed to greater offtake is single-use cameras, sales of which have been growing strongly, exceeding 230 million units in 1997.

Demand in the radiography sector, (which includes all X-ray uses of silver; medical, dental and industrial) continues to grow steadily. Medical uses constitute by far the biggest of these uses, accounting for around two thirds of offtake in the sector. The quantity of film produced for dental and industrial uses is, in fact, fairly small, although silver loadings are heavy. In the

Figure 36
World Color Photographic Paper Consumption



Source: Photofinishing News Inc., GFMS

industrial world, demand has been boosted by the ageing of the population and by the trend towards more frequent medical examinations, while increased spending on health care has boosted offtake in the developing world. As in consumer photography, the average silver loadings in radiographic film has tended to decline.

The use of silver in the graphic arts sector has been declining in recent years, this being the only major photographic use to show a decline last year. Demand has been adversely affected by the use of digital imaging, which has reduced the need for multiple shots to be taken. Offsetting this to some extent have been the overall growth of the graphic arts industry and the increased use of color which requires higher silver usage.

The **United States** is both the world's largest manufacturer and consumer of photographic products. In terms of silver use, fabrication demand increased last year by just over 6% to 79 Moz (2,457 t). Output has been boosted by Japanese manufacturers establishing production facilities in the United States. Over the last two years, these new plants have started to source their raw material (silver nitrate) from US suppliers. Thus the underlying growth rate of fabrication and indeed of consumption has been rather lower than that suggested by the headline figure mentioned above. In terms of the growth in consumption of photographic products, something in

the order of 3 to 4% seems probable last year, a reflection perhaps of the relative maturity of the US market. The growth in silver offtake, as opposed to unit demand, would have been lower still, maybe in a 1 to 2% range, due to slight reductions in the average silver loading of both film and paper.

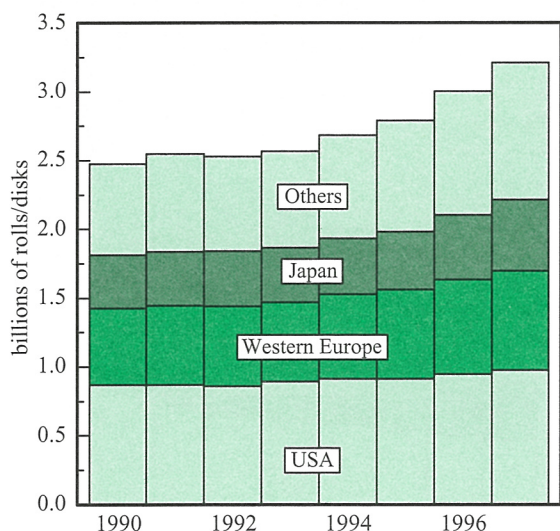
Silver demand from photographic manufacturers' European operations increased by just over 2% last year. The production of silver nitrate for the industry is concentrated in four countries: **Belgium, the United Kingdom, Germany and France**. In addition to supplying local operations, fabricators of silver nitrate also make significant exports to plants in other countries, notably those located in the **Netherlands and Italy**. Thus, to a large extent, the regional changes for last year shown in Table 6 reflect shifting market shares among the large producers of silver nitrate.

Transparency in the **Japanese** photographic industry over the past few years has been hampered by the ongoing dispute between the United States and Japan over access to the Japanese market. In October of 1997, delegations from both countries presented evidence to a three-member panel of the World Trade Organisation (WTO) in Geneva for consideration. Some of the more contentious evidence presented concerned the statistics supplied by each side to the panel in support of their arguments.

Needless to say, the sensitivity surrounding the true statistical picture has meant that detailed and complete numbers for the Japanese market have not always been available (and it remains to be seen whether the WTO ruling in favor of Japan will result in greater statistical transparency). The dispute process has, no doubt, resulted in some dissembling on the part of those involved, and consequently implies that compiling accurate estimates of Japanese photographic production from official data is likely to be incomplete.

An analysis of the current official data for Japanese silver use in photographic applications suggests that they *understate* the true level of fabrication, and although at this point, it is not possible to derive an accurate figure for the magnitude of the underestimation, it could be as high as 10%. The available evidence points strongly towards the source of this being an underestimation of the levels of scrap recovery from photographic waste and solutions. It is worth putting this into perspective by noting that according to official estimates, *total* Japanese scrap

Figure 37
World Consumer Film Sales



Source: Photofinishing News Inc., GFMS

recovery is around 10 Moz (300 t) while in the United States, silver recovery from photographic waste *alone* stands at around 30 Moz (1,000 t). Even adjusting for higher film sales in the US market and the fact that some Japanese scrap is included in other supply categories (for instance, in the MITI figures under the “other” category), it does suggest that officially recorded Japanese scrap is too low because of the omission of a portion of photographic scrap.

The point about scrap is that if, as seems likely, the recovery of photographic silver is higher than currently estimated, and that it makes its way back into the production cycle via a network of scrap collectors linked informally to the photographic companies, then photographic offtake of silver would also be higher.

Notwithstanding these considerations, it would appear that Japanese fabrication rose slightly in 1997. The estimates in Table 6 suggest that silver use rose by just over 1% to 58.5 Moz (1,820 t). At first sight, this may appear surprising considering that production was shifted from Japan to the United States in 1997, and secondly, that the East Asian economic crisis had a negative impact on some of Japan’s more important export markets. Thus, exports to Thailand in the second half certainly dipped sharply, but less so than did those to Indonesia, when the crisis took hold there later in the year. However, exports to these countries were substantially stronger in the first half of 1997 than in the first half of 1996, the result being that total demand for the year showed only modest declines. In addition, aggressive price cutting in the Asian markets in the second half of 1997 moderated the impact of the currency-induced price rises, so that the volume of sales did not fall by as much as might have been expected. Furthermore, a weaker yen contributed to the increased competitiveness of Japanese photographic products relative to their major competitors. Finally, and possibly most importantly, the large markets of “Greater China” (China, Hong Kong and Taiwan) all effectively escaped the currency turmoil (the depreciation of the NT dollar in Taiwan was mild in comparison to other regional currencies) and so demand was not hit by price increases. In fact, indications are that final photographic demand in China and Hong Kong increased year-on-year.

In Japan itself, APS use has increased significantly both in traditional-style and in single-use cameras, indicating that last year’s flat growth was not necessarily a sign of market maturity. Apart from the consumer market, most of the other photographic

sectors showed little change year-on-year with the exception of X-ray film, production of which increased sharply in 1997, thus boosting silver offtake.

Chinese photographic fabricators continue to struggle in the face of competition from imported film. It is estimated that upwards of 65% of the film and paper supplied to the amateur market in China is smuggled in, mainly from Hong Kong, and that the largest and only profitable domestic producer, has seen its market share drop precipitously in the past few years in the face of this competition. However, local fabrication demand did increase in 1997, by around 4%, primarily for X-ray and industrial film.

Rising unofficial imports of film into China have placed local photographic producers under increasing competitive pressure in recent years. As a result, local fabricators have been looking to the legislature and to strategic alliances to help them survive. Although an alliance led by the National Association of Light Industry spent much of 1997 lobbying the government to subsidize and provide soft loans to local producers, it appears that strategic alliances/joint ventures have been chosen as the preferred route to solving the industry’s problems. In April, Kodak and the State Council announced that joint venture agreements had been signed with all of China’s small and medium-sized photographic producers, leaving only one large Chinese company to operate completely independently. Under the terms of the agreement, Kodak will inject money into, and eventually transfer some of its technology to, these companies.

Jewelry and Silverware

After a spectacular 15.6% increase in silver use in jewelry and silverware in 1996, it was perhaps to be expected that growth would slow in 1997. This was indeed the case, although growth was still a respectable 5.3%, taking total offtake to 280 Moz (8,716 t). Virtually all of this growth was accounted for by Italy, where offtake increased by 10.5% to 44.8 Moz (1,392 t), and India, where the corresponding increase was 3.2% to 95.2 Moz (2,961 t). The 3.6% fall in Thai offtake was the most notable decline in 1997.

Europe

Last year, fabrication in Europe increased by 6.6% to 78.6 Moz (2,527 t). Nearly all of this growth came from Italy which in 1997 accounted for 57% of the region’s production of jewelry and silverware.

Table 7
Silver Fabrication: Jewelry and Silverware
(including the use of scrap)

Million ounces	1990	1991	1992	1993	1994	1995	1996	1997
Europe								
Italy	41.5	46.3	50.4	46.2	41.4	39.0	40.5	44.8
Germany	13.2	14.5	13.5	11.6	11.6	10.3	10.0	10.0
Greece	3.2	3.4	3.5	3.7	3.9	3.8	4.2	4.5
Spain	11.3	13.0	3.7	3.7	4.0	4.1	4.5	4.0
UK & Ireland	2.0	1.9	2.2	2.7	2.9	3.0	3.3	3.4
Poland	1.4	1.0	1.0	1.0	1.1	1.6	1.8	2.3
Portugal	2.2	2.2	2.2	2.1	1.5	1.7	1.9	1.9
France	1.4	1.4	1.4	1.7	1.7	1.7	1.7	1.8
Sweden	1.2	1.6	1.3	1.2	1.2	1.0	1.1	1.3
Norway	0.6	1.2	1.2	1.2	1.2	1.2	1.1	1.1
Denmark	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Finland	1.2	1.3	1.0	0.8	0.9	0.7	0.8	0.8
Austria	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4
Cyprus & Malta	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.4
Czech & Slovak Republics	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Other	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.9
<i>Total Europe</i>	82.2	90.6	84.4	78.7	74.1	70.9	73.7	78.6
North America								
Mexico	8.0	8.7	9.0	9.2	8.7	11.0	14.2	16.3
United States	9.8	9.7	10.9	11.3	12.0	12.5	12.4	12.5
Canada	1.0	1.2	0.9	0.9	1.0	1.2	1.3	1.5
<i>Total North America</i>	18.8	19.5	20.8	21.3	21.6	24.8	28.0	30.4
Central & South America								
Brazil	1.8	1.7	1.6	1.8	1.8	1.9	1.8	1.6
Peru	1.5	1.1	0.7	0.8	0.8	0.9	1.0	1.1
Argentina	1.0	1.0	1.0	1.0	1.0	0.9	0.8	0.8
Colombia	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Ecuador	0.3	0.3	0.3	0.5	0.6	0.6	0.6	0.6
Other	0.7	0.7	0.7	0.7	0.6	0.7	1.0	1.4
<i>Total Central & South America</i>	6.0	5.6	5.1	5.5	5.7	5.9	6.0	6.3
Middle East								
Turkey	4.1	3.9	4.6	5.0	4.6	5.0	5.1	5.4
Israel	1.7	1.7	1.8	2.0	2.1	2.3	2.6	3.0
Egypt	1.5	1.6	2.2	1.8	1.8	2.0	2.1	2.0
Saudi Arabia	0.2	0.3	0.4	0.4	0.4	0.4	0.5	0.6
Other	1.6	2.1	2.5	2.2	2.5	2.6	2.8	2.8
<i>Total Middle East</i>	9.1	9.6	11.4	11.3	11.5	12.4	13.1	13.7

Italy used 44.8 Moz (1,392 t) of silver last year, 10% more than it did in 1996. Of this total, 25.7 Moz (800 t) was used in jewelry and 19.1 Moz (592 t) in silverware. The production of jewelry, over 60% of which was in the form of chain, once again showed double-digit growth, rising by no less than 21%. Since 1991, the country's jewelry output has more than doubled. As Figure 38 shows, exports have been the driving force behind this growth. Last year, the fine silver content of jewelry exports rose by 22% to an estimated 20 Moz (623 t). The United States continues to take just over half the total, with a further 20%

going to Italy's partners in the European Union. In recent years there has also been rapid growth in shipments to a variety of other entrepôt and end-markets, these notably including Panama, Brazil, Turkey, Israel and Dubai.

As regards silverware production, a continuing decline in the output of heavy traditional wares was offset by growing fabrication of a vast range of objects and decorative pieces including small boxes, candlesticks, picture frames and assorted silver ornaments. Exports of these articles have grown rapidly; around 20% of output is now destined for

Table 7
Silver Fabrication: Jewelry and Silverware
(including the use of scrap)

Million ounces	1990	1991	1992	1993	1994	1995	1996	1997
Indian Sub-Continent								
India	23.0	22.5	36.1	78.7	58.5	63.9	92.2	95.2
Bangladesh & Nepal	0.6	0.6	1.0	1.6	2.3	3.2	4.8	8.0
Other	1.2	1.5	1.9	2.3	1.9	2.6	1.8	2.6
<i>Total Indian Sub-Continent</i>	24.8	24.7	39.0	82.7	62.7	69.7	98.8	105.8
East Asia								
Thailand	24.1	20.1	31.6	38.5	28.9	27.4	27.1	26.2
South Korea	4.5	5.3	5.0	7.2	6.4	6.8	6.6	6.3
Indonesia	1.1	1.1	1.2	1.4	2.3	2.7	2.9	3.1
Japan	3.8	3.5	2.8	2.5	2.2	2.2	2.1	1.9
Hong Kong	0.9	1.0	1.0	1.0	1.0	0.9	0.9	1.0
Myanmar, Laos & Cambodia	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.0
Vietnam	0.3	0.3	0.3	0.4	0.5	0.6	0.7	0.7
Taiwan	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5
Malaysia	0.3	0.4	0.4	0.5	0.4	0.4	0.4	0.4
Other	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.3
<i>Total East Asia</i>	36.7	33.3	44.0	53.2	43.3	42.7	42.6	41.4
Africa								
Morocco	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Tunisia	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
Algeria	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
Other	0.5	0.5	0.5	0.4	0.5	0.5	0.4	0.4
<i>Total Africa</i>	1.4	1.4	1.3	1.2	1.3	1.3	1.2	1.2
Australia	0.5	0.5	0.5	0.6	0.6	0.6	0.5	0.6
Western World Total	179.6	185.2	206.5	254.4	220.7	228.3	264.0	278.0
Soviet Union/CIS	4.6	4.2	3.4	2.6	2.3	2.0	2.1	2.3
World Total	184.2	189.5	209.9	257.1	223.0	230.2	266.1	280.2

foreign markets compared to just 5% five years ago. Without this growth in exports, silverware fabrication would have fallen by even more than the 37% decline registered between 1992 and 1997, which was the result of changing consumer tastes, higher local silver prices and the weakness of the Italian economy.

Output of jewelry and silverware was sharply lower in the first quarter of 1998 due in large part to the dramatic increase in silver borrowing costs which has adversely affected many manufacturers. In addition, the higher price (in lire terms up 37% year-on-year in the first quarter) has negatively affected sales of heavy silverware.

German production of jewelry and silverware was unchanged in 1997 at 10 Moz (310 t). Jewelry fabrication accounted for approximately one-third of the total demand and increased quite strongly. Silver jewelry is currently fashionable, especially among

younger buyers who, among other reasons, are often buying 925 sterling silver articles as "real" precious metal products instead of 8 carat gold jewelry. Much of the local jewelry demand is satisfied by imports, especially from Italy and Thailand. As the table below shows, silver jewelry imports rose by 4.6% to reach 4.8 Moz (149 t) last year.

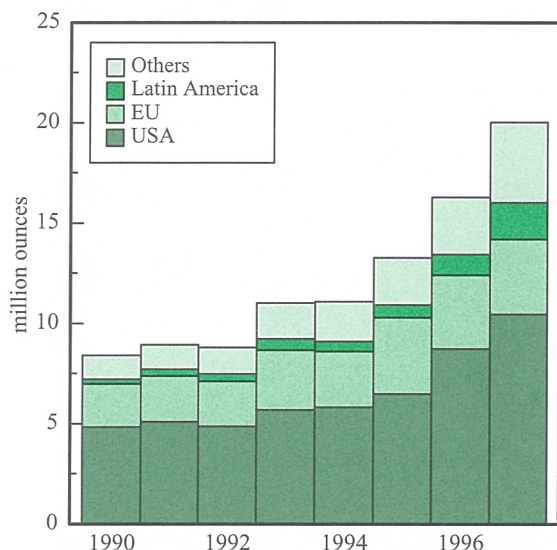
German Silver Jewelry Imports

(estimated fine quantities in Moz)

	1992	1993	1994	1995	1996	1997
Thailand	1.04	1.56	1.38	1.39	1.76	1.76
Others	1.50	2.09	1.89	2.59	2.83	3.04

Thailand provided 37% of Germany's recorded imports last year. Italy was in second place with 10%.

Figure 38
Official Italian Jewelry Exports



However, it is most likely that the official import statistics understate the amount of Italian jewelry entering Germany as unofficial shipments have almost certainly increased over recent years.

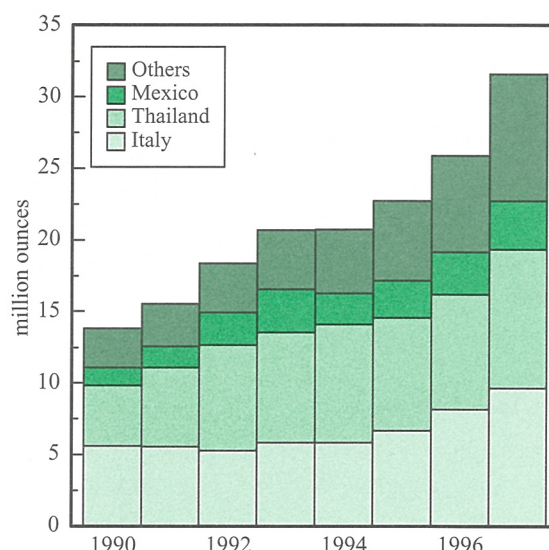
In contrast to the growth in jewelry sales, consumer demand for solid silverware has tended to shrink in the 1990s. As a result, German production of silverware has fallen sharply over this period and continued a slow decline last year.

Greece overtook Spain in 1997 as Europe's third largest producer of jewelry and silverware. Silverware accounted for a little over 70% of the 4.5 Moz (140 t) used by Greek manufacturers in 1997. In the domestic market silverware remains a preferred gift for weddings and many other social occasions. Sales of locally made silver jewelry were also buoyant last year with tourist purchases accounting for nearly half of the total.

Meanwhile in Spain last year, output of jewelry and silverware declined by more than 11% as market share was lost to Italian competitors in both the domestic and export markets. In addition, fabrication was hit by a general downturn in demand for silverware and by Spanish jewelry manufacturers shifting resources away from silver into gold production.

Silver jewelry sales have continued to grow in the **United Kingdom**. The hallmarking statistics summarised in the table below show that in 1997 local output of jewelry and silverware advanced by just 1.4% while imports rose by nearly one-third. The data imply that UK consumption of jewelry and silverware

Figure 39
US Silver Jewelry Imports



has grown by nearly 79% over the last five years.

UK Hallmarking of Jewelry & Silverware
(fine quantities in Moz)

	1992	1993	1994	1995	1996	1997
Home	1.96	2.39	2.51	2.58	2.92	2.96
Import	0.31	0.45	0.53	0.64	0.83	1.10

North America

Over the last two years, jewelry and silverware fabrication in the **United States** has shown no growth. A moderate rise in the jewelry component has offset a continued decline in silverware production. From near parity with silverware in 1995, jewelry has since risen to account for approximately 53% of overall fabrication demand in 1997. Whereas much of the US silverware manufacture has historically been centered in the North East, the heartland of America's silver jewelry industry is the South West, particularly the state of New Mexico and its cities of Albuquerque and Gallup where over 120 manufacturers are located. This industry originally grew out of the region's colonial Spanish and Native American handcrafted jewelry traditions. Since then, although many of the industry's workers are still Native Americans, much of the production has been automated. Furthermore, in recent years, traditional jewelry styles have tended to give way to more varied and affordable modern jewelry.

Although the United States is the world's fifth largest manufacturer, its impact on the market is far greater in that it is the world's foremost importer and second largest consumer of silver jewelry. Indeed, on the basis of the upward revision to the estimates for imports (see Figure 39) it appears that last year the United States consumed well over 38 Moz (1,180 t) of silver in the form of jewelry (an increase of more than 18% year-on-year). More than 80% of this jewelry was imported, with Thailand and Italy the two largest suppliers and Mexico remaining in third place. However, in addition to the officially registered imports from Mexico, a further large quantity of silver jewelry enters the United States from its southern neighbor every year. Finally, imports from other countries have grown rapidly in recent years, principally from China, Indonesia, Canada and India.

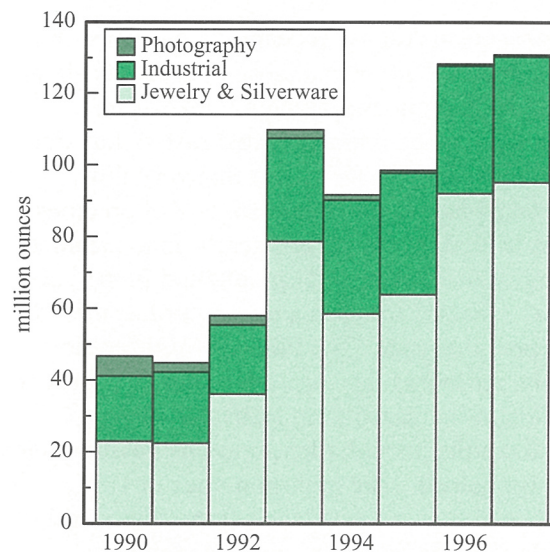
Middle East

The region's largest fabricator of silver, **Turkey**, had a mixed year with the use of silver for jewelry increasing quite sharply, while domestic demand for the products of the traditional silverware sector stagnated. There seemed to be fewer middle class buyers who could afford silverware and the younger generation, apart from having other spending priorities, no longer have the patience to maintain and clean silverware. On the other hand, silverware exporters gained market share in countries such as Italy and Germany due to Turkey's lower labor costs.

By contrast the use of silver in both gold and jewelry was very buoyant for a number of reasons. In both the export and the domestic market, the increased fabrication of 14 carat gold jewelry (which has a high silver content) required a sharp increase in silver use. The manufacture of silver ornaments and jewelry for sale to tourists also increased, benefiting from the fact that tourist numbers had increased and - somewhat paradoxically - because many of the tourists were not wealthy enough to buy gold as gifts and souvenirs but could still afford silver.

Silver use in **Israel** saw another year of strong growth in fabrication of silverware with increased exports, mainly to the United States and northern Europe, more than compensating for some weakness in the domestic market. The sector has benefited from the introduction of new technology and a focus on design in the past few years. Interestingly, the second half of 1997 was stronger than the first in spite of the rise in silver prices.

Figure 40
Indian Silver Fabrication



In **Egypt** the main use of silver is for utensils, ranging from simple dishes to elaborate tea-sets, with the former being sold mainly to tourists and the latter to locals. A smaller quantity is used for gift items and jewelry which is sold almost exclusively to visitors. Demand was running at high levels for the first ten months of last year, both due to an increase in tourist arrivals and the continuing success of the country's economic reforms and the government's privatisation program. However, after the massacre of tourists at Luxor in November, the resulting wave of cancellations led immediately to a sharp downturn in manufacturing activity for the tourist sector.

Indian Sub-Continent

Once again **India** was the focus of much of the silver market's attention last year, with its demand for silver appearing insatiable for the first three quarters but then collapsing spectacularly in the final months of the year. While clearly much of the explanation for this extraordinary turnaround stems from the price movements described in Chapter 2, other factors were also at work. Around two-thirds of overall Indian demand takes the form of jewelry, silverware and gift items (the latter mostly in the form of small bars, coins and medallions). In addition, buyers in the rural areas, especially in the north of the country, represent the bulk of "heavy" purchasers of jewelry, ie, those who buy with investment or savings as a prime motive behind purchase. As a result, offtake depends not only on the number of marriages (for which gifts such as

silver utensils are an indispensable part) but perhaps more importantly, on the performance of the rural economy.

Developments in August appeared to be critical for the silver market. With the collapse of gold and silver prices in early July, the following month saw an unseasonal and indeed unprecedented rush to buy both precious metals, in spite of the fact that very few weddings take place at this time. Buying of precious metals was helped by the government's announcement in mid-August that agricultural production in the year to June was expected to reach a new record, some 7% above the previous year. The Finance Minister, not surprisingly, attributed this positive outcome largely to the provision of increased farm loans and other agricultural credits, though plentiful rains the previous year had also helped. The monsoon rains in 1997, which had been somewhat delayed at the start of the season in June, were beginning to verge on the excessive side by the end of August.

At the same time, the collapse of the real estate and stock markets were seen as positive for precious metals demand.

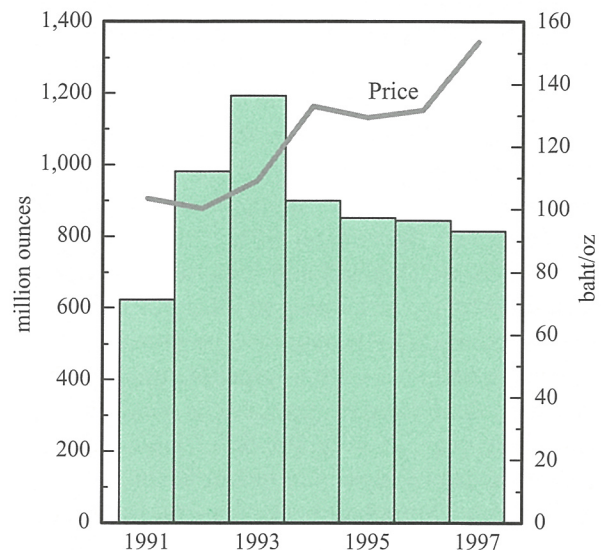
This seemed to mark the high point for silver demand. In the following months, festival demand was poor, in part because corporate purchasers had bought their requirements for seasonal gifts following the price dip in July. The divergence of the gold and silver prices also gathered pace from October onwards, with the result that gold purchases were favored and reports of increased recycling of old silver became ever more frequent. Finally, towards the end of the year, the weather turned for the worse with storms and heavy rains causing widespread crop damage across many parts of central and northern India.

East Asia

Thai jewelry and silverware fabrication fell by over 3% in 1997, the fourth year in a row in which a fall in offtake was registered (see Figure 41). As might have been expected, the collapse of the Thai baht in July, 1997 underpinned this fall, but not for the reasons that may at first sight spring to mind.

It is useful to begin by making the observation that most of Thailand's jewelry is produced for the export markets of Europe, the United States and Japan. It may seem counterintuitive then that production fell in the face of a rapidly weakening baht, as this might have been expected to facilitate exports to these markets (as indeed it did for gold jewelry). In fact, the

Figure 41
Thai Jewelry and Silverware Fabrication



precipitous fall in the baht had the perverse effect of assisting one group of exporters while adversely affecting others, and the reason for this lies in cash flow and capital.

Thai silver jewelry fabricators vary widely in size and formal structure. The largest fabricators use well over 1.6 Moz (50 t) per annum on average within very formally structured businesses and with access to lines of bank credit due to their strong market positions and assets. On the other hand, there are many smaller fabricators catering to the export market but working on a less formal basis, and who consequently do not have access to formal lines of credit.

The impact of the baht devaluation on the latter group of fabricators was marked, and many found that they could not finance the same level of production as before. The reason for this was that although their US dollar commitments were effectively unchanged (eg, the price of the silver in dollar terms required for producing jewelry), their baht commitment had increased significantly (put simply, substantially more baht were needed to buy the same amount of silver). Consequently, these fabricators found themselves with insufficient working capital, and because they were generally unable to access lines of credit from banks, it was not possible for them to maintain production levels. The massive devaluation of the baht also affected production in another way. Exporters operating outside the bonded warehouse system have to pay Valued Added Tax (VAT) on imported silver that can be reclaimed at a later (often substantially later) date as well as import duty. These additional

financial commitments also impacted negatively on production levels.

By contrast, larger producers working within the bonded warehouse system, where VAT is not payable, and producers with access to lines of credit were able to weather the currency storm. In addition, the collapse of the baht did make exports markedly more competitive. For example, exports to the United States were extremely strong, not only in the second half after the devaluation, but before it too (exports to Germany were, however, flat). Furthermore, many of the larger formal fabricators claim to have picked up some of the business forgone by the smaller players, and consequently there was only a relatively modest fall in total offtake.

Indonesian use of silver in jewelry is concentrated in Bali for pure silver jewelry and the gold jewelry fabrication centres like Surabaya for alloying. Gold jewelry demand and hence the demand for alloys was severely affected in the latter stages of 1997 by the collapse of the rupiah, and indications are that offtake fell in this application year-on-year. By contrast, silver jewelry demand is tied very closely to the tourist trade in Indonesia, and demand from this sector was strong throughout the year, boosting overall silver offtake by around 6% year-on-year.

Both jewelry and silverware demand fell in **Korea**, by a combined total of around 4%. Falling demand for so-called "gift" items was symptomatic of the general economic malaise in the Korean economy, and began well before the collapse of the *won* in late 1997.

Japanese silver offtake for jewelry and silverware has fallen continuously throughout the 1990s, and in 1997 stood at around 50% of the 1990 level. Part of this is explained by rising import penetration, but more recently, falling demand has been primarily due to economic difficulties. Following a 17% decline in hallmarking in 1996, the Mint reported a further 33% fall in the number of items stamped in 1997.

Coins and Medals

Fabrication in 1997 reversed the trend of the previous two years, with the production of coins and medals rising by 23% to 27.4 Moz (852 t). More than three-quarters of coin production in 1997 was accounted for by just five countries: Germany, Spain, the United States, Japan and China. Higher mintage in Japan and China more than compensated for lower production in Europe and North America.

Most of the silver used in the combined category of coins and medals consists of official coins. Fabrication of medals accounted for only 6% of the combined total, the main production of medals being dominated by two countries, the United States and Switzerland, which together accounted for over half of this small market.

In the silver coin market, last year's highlight was the Nagano Winter Olympics coin in **Japan**, which consumed over 7 Moz (225 t). The series consisted of three issues, each of five million sterling silver (925 fineness) coins weighing 15 grams, with a 5,000 yen face value. However, only the first two issues were released in 1997, with the third series being issued in 1998. The supply of silver for the coins was from a mixture of tenders and official stocks.

The only other country to record significantly higher mintage last year was **China**. Coin fabrication for the commemorative and bullion coin market doubled last year to 2.8 Moz (88 t). The most successful issue commemorated "Hong Kong's Return to China", using 1.1 Moz (33 t), a record for a Chinese commemorative series in recent years. Other themes included the "Year of Tourism" and the Chinese New Year, while the popularity of the Panda coins remained undiminished with a record 0.5 Moz (16 t) of silver being used in 1997. The minting of the latest commemorative series, to mark the "Return of Macao to China" began in late 1997 and this is expected to have similar success to the Hong Kong series.

In contrast, last year saw European fabrication fall by 20% to 9.2 Moz (286 t). Two countries accounted for most of the decline, namely, Spain and Germany. In **Spain**, the fall in the number of the Pta 2,000 coins minted, from 8 million in 1994 to 2.5 million in 1997, has occurred for two main reasons. Firstly, the market appears to have been approaching saturation recently. Secondly, there is a perception that European Monetary Union and the introduction of the Euro may remove the validity of this legal tender coin.

The **German** silver coin market is dominated by circulating coins. Last year, 10.5 million coins, including proof issues, were minted with an average weight of 15.5 grams and a fineness of 625. However, from 1998, the coins will be minted in sterling silver (925) because of a preference for higher quality coins and because the coins are absorbed in the collector rather than the circulation market.

North American coin production also declined last year, to just 6.6 Moz (205 t). In the **United States**,

Table 8
Silver Fabrication: Coins and Medals
(including the use of scrap)

Million ounces	1990	1991	1992	1993	1994	1995	1996	1997
Europe								
Germany	2.6	5.7	5.6	2.8	7.1	2.4	4.6	3.7
Spain	0.4	1.1	0.4	0.3	4.8	4.0	2.8	1.8
Portugal	0.1	0.0	0.1	0.3	0.4	0.5	0.8	0.8
Switzerland	0.2	1.6	0.4	0.3	0.3	0.4	0.6	0.6
UK & Ireland	0.4	0.4	0.5	0.7	0.8	0.7	0.6	0.6
Italy	0.4	0.6	0.4	0.4	0.5	0.5	0.5	0.4
Austria	0.5	0.6	0.5	0.5	0.5	0.6	0.4	0.3
France	2.1	2.3	2.1	2.1	1.0	1.1	0.3	0.3
Belgium	0.5	0.3	0.0	0.0	0.0	0.2	0.1	0.1
Poland	0.3	0.2	0.1	0.1	0.2	0.2	0.1	0.1
Netherlands	0.7	0.1	0.0	0.0	0.6	1.1	0.2	0.1
Czech & Slovak Republics	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.1
Finland	0.2	0.2	0.2	0.0	0.1	0.1	0.1	0.1
Norway	0.0	0.5	0.9	0.3	0.0	0.0	0.0	0.0
Denmark	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0
Other	0.1	0.1	0.2	0.4	0.1	0.2	0.3	0.1
<i>Total Europe</i>	8.6	13.8	11.7	8.3	16.3	12.3	11.5	9.2
North America								
United States	9.4	10.8	8.4	8.2	8.7	8.1	6.1	5.5
Canada	1.9	0.9	0.8	1.2	1.5	0.7	0.7	0.7
Mexico	1.2	1.6	8.7	17.1	13.0	0.6	0.5	0.4
<i>Total North America</i>	12.6	13.2	17.9	26.5	23.2	9.3	7.3	6.6
Middle East								
Israel	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1
Egypt	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
<i>Total Middle East</i>	0.0	0.0	0.1	0.0	0.7	0.1	0.1	0.1
East Asia								
Japan	8.9	0.0	0.0	2.4	0.0	0.0	0.0	7.2
Thailand	0.0	0.0	0.1	0.2	0.2	0.3	0.5	0.2
Singapore	0.1	0.0	0.9	0.1	0.1	0.1	0.1	0.0
Taiwan	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Total East Asia</i>	10.0	0.1	1.0	2.7	0.3	0.4	0.6	7.5
Australia	0.4	0.5	2.1	2.3	1.6	0.7	0.8	0.8
Western World Total	31.8	27.8	33.0	39.9	42.2	22.8	20.3	24.2
Other Countries								
China	0.4	1.4	0.4	0.4	0.7	0.8	1.4	2.8
Soviet Union/CIS	0.0	0.0	0.1	0.1	0.2	0.1	0.6	0.4
North Korea	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
<i>Total Other Countries</i>	0.4	1.4	0.5	0.7	0.9	0.9	2.0	3.2
World Total	32.1	29.2	33.4	40.6	43.0	23.8	22.3	27.4

coin fabrication fell by almost 10% in 1997 despite a 5% increase in Eagle production. Lower mintage of commemorative coins accounted for the decline.

Mexican coin fabrication declined to 0.4 Moz (12 t) in 1997. Between 1992 and 1994, nearly 30 Moz (930 t) of Peso circulating coins were minted for the mass market. However, since 1995, the program has been largely made up of Libertad bullion coins, with new limited issues targeted at collectors.

In **Canada**, production was unchanged in 1997 at 0.7 Moz (20 t). Throughout the year, strong demand

for the gold Maple Leaf affected production of its silver counterpart, which declined by 70%. By contrast, commemorative coin production rose by almost 25%, despite a weak final quarter due to a national postal strike.

In **Australia**, the first in the Olympic 2000 series of coins was introduced in late 1997. The coins will be marketed until May 2000, during which time a total of 1.6 Moz (49 t) of silver will be required for sixteen designs, with a maximum mintage of 100,000 coins per set.

US Circulating Coins

From the late 1700s until 1970, the United States produced silver circulating coins in a variety of denominations, ranging from one dollar to three cent pieces, consuming approximately 3.2 billion ounces (104,046 t) of silver. During this period, the silver content was changed on only three occasions. Initially, the composition was established at 89.24% of silver but this changed to 90% in 1837. In 1965, this was reduced to 40% and in 1970 the silver, in all regular

issue coins, was replaced with a nickel alloy.

The silver dollar, first produced in 1794 as a standardized monetary unit, was minted until 1935, although, of the approximately 973 million coins minted, around two-thirds were produced during the 1878-1921 period when the Morgan Liberty Head Dollar was in production.

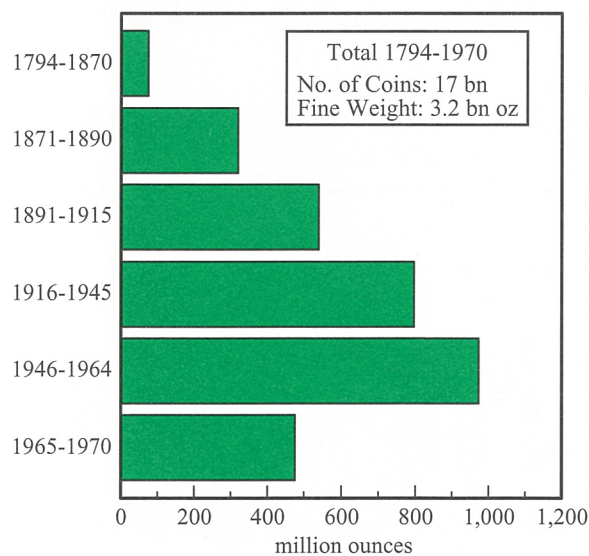
Of the 13 varieties of half-dollars (50 cents) the largest mintages occurred during the period 1916-1947 for the production of the Walking Liberty half-dollar, and subsequently for the Benjamin Franklin coin which was produced until 1963. In all, roughly 1.4 billion half dollars were minted.

Silver quarters (25 cents) were produced from 1796 to 1964. The last silver quarter-dollar to be produced, from 1932 to 1964, was the George Washington which, at 0.7 billion ounces (20,607 t), accounted for 85% of the total output of silver quarters.

Silver dimes (10 cents) were first minted in 1796. The largest mintages occurred between 1892 and 1916, when approximately half a billion Barber Liberty Head Dimes were minted, the "Mercury" Dime from 1916 to 1945 and, finally, the Franklin D. Roosevelt coin which was minted until 1965 when the composition was changed to a copper-nickel alloy. In all, roughly ten billion silver dimes were produced.

From 1965 to 1970, a total of 474 Moz (14,752 t) of silver was used for the "40%" Kennedy half dollar. Although silver-clad circulating coins were produced after this date, they were destined mainly for the collectors' market.

Figure 42
US Silver Circulating Coin Fabrication



7. Investment

Net disinvestment in 1997 totalled 129.6 Moz (4,031 t) bringing the accumulated net sales from the private sector over the 1990-97 period to 889 Moz (27,654 t). Although there were some offsetting purchases last year, most notably, the much publicized investment in silver bullion by Berkshire Hathaway, these were outweighed by net disinvestment from a variety of other sources. These included the liquidation of long positions which had been held in the over-the-counter market and the disposal of bullion bars and coins by the public. This year, the key question for the market is whether Mr Buffett's example will serve to persuade other private investors to move into silver and thus possibly even reverse the 1990-97 trend of net disinvestment.

Comex

It is surprising, given the increased volatility in the silver price last year, that the total number of futures contracts traded on the Comex division of the New York Mercantile Exchange increased by just 0.5% from the previous year's total (see the table on page 60). Just as odd is the fact that options turnover on the exchange actually fell by more than 11% year-on-year. Similarly, despite soaring at year-end, average open interest in both futures and options was subdued; respectively up and down slightly on the previous year's levels. Also, when comparing the two years, it is worth remembering that the turnover and open

interest figures for 1996 were themselves well down on those recorded in the 1994-95 period. Neither does it seem that the annual average data are misleading. Looked at instead on a monthly basis, as in Figure 43, it is clear that average daily futures turnover and open interest never exceeded the kind of levels reached during the busiest months of 1996. A similar picture applies when it comes to monthly options turnover and open interest. Thus, despite the increased speculative activity in the silver market from the second half onwards, only in the first quarter of 1998 was this reflected in higher turnover and open interest on Comex. Part of the explanation could be that last year an increased proportion of investor driven business was conducted in the over-the-counter (OTC) market.

The trend in non-commercial net open interest on Comex is a good proxy for the stance taken by funds and other investors on the Exchange. Figure 44 shows that after remaining broadly neutral in the first half (apart from a brief excursion onto the long side in February/March), there was a significant change in net positions during the third quarter of last year. At the end of July, the market reached its shortest point, although this only just exceeded the 10,000 contract level, in spite of the price slipping below \$4.30. Then in August, investors and speculators covered these short positions before moving decisively onto the long side at the end of September (net longs exceeding the 30,000 contract level by the end of the month). Looked at over the entire period shown in Figure 44,

Figure 43
Comex Silver Futures

Average Daily Turnover and Open Interest

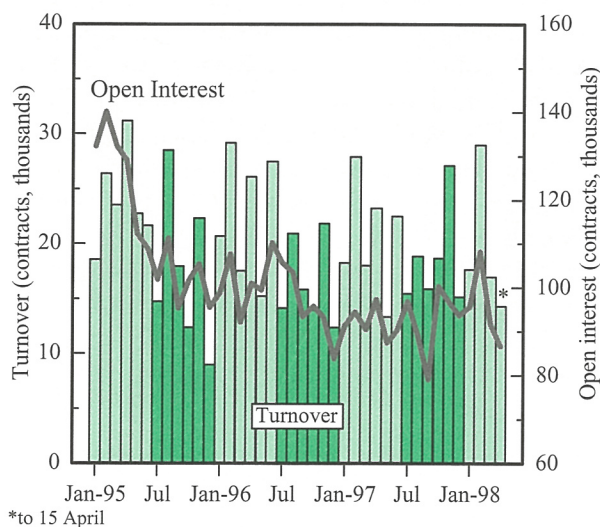
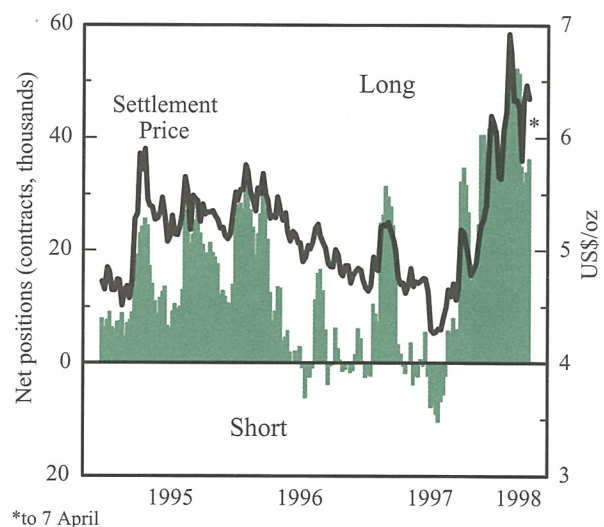


Figure 44
Comex: Non-commercial Net Open Interest

Weekly Net Positions and Settlement Price

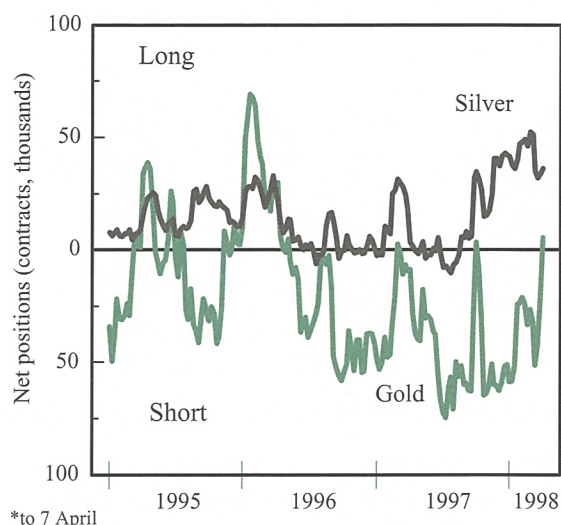


the trend in non-commercial net open interest highlights an important characteristic of the silver market: namely that funds and other investors generally prefer either to play on the long side of the market or not to take part at all. This in turn helps to explain the relatively low numbers for Comex turnover and open interest during much of 1996 and 1997. These conclusions are supported by anecdotal evidence that even during the middle of the year, when the price was under greatest pressure, those funds and CTAs (Commodity Trading Advisors) still active on Comex were mostly just trading very short-term positions, usually purely on a technical basis. To the extent that there were any large bets against silver at this time, these appear to have been in the OTC market rather than on the futures exchange.

As Figure 45 shows, speculators and investors on Comex have been far more ready to short the gold market. While net positions in silver have only occasionally been short and then barely so, in gold they have frequently been on the short side and, since the middle of 1996, overwhelmingly so. Thus, although the net fund or investor positions on Comex in both gold and silver have tended to move in the same direction, their starting levels have been very different. To a large extent this stems from the very different bullion stock environments of the two metals. Silver bullion stocks are arguably smaller relative to fabrication demand and they are certainly far less concentrated. The decline in near-market bullion stocks over recent years has also been far sharper for silver than for gold. By contrast, central bank bullion stocks are perceived to be "overhanging" the gold market. These have not only encouraged short selling of gold but, by providing liquidity, they have also greatly facilitated such sales. In the silver market on the other hand, the lack both of lending and the prospect of additional supply from the official sector has greatly reduced the attractiveness of short positions and served to encourage investors onto the long side of the market.

On Comex, 1997 ended with funds and other investors' net long positions exceeding 42,000 contracts, compared to a near-neutral situation at the end of 1996. Once more, this strongly suggests that Comex was not itself a direct source of net disinvestment during 1997. In January, 1998 some of the long positions were liquidated. To an extent, this was caused by profit-taking but it also resulted from stop-loss sales when the price fell back below the \$6.00 and \$5.90 levels. However, although there was

Figure 45
Comex: Non-commercial Net Open Interest
Weekly Net Positions



some liquidation of long positions, very few new short positions were established. This suggested that investors as a whole still remained bullish on the prospects for silver. Such optimism appeared justified when, on 3rd February, Berkshire Hathaway announced that it had acquired 129.7 Moz (4,034 t) of silver. In the wake of this announcement, new long positions were established in February. Subsequently, during March, some of these longs were in turn liquidated, again probably as a result of profits being taken, amid some speculation that Berkshire Hathaway had sold part of its holdings. This would seem improbable given the only limited and temporary fall in the silver price at the time. Indeed, by early April, fresh longs were established on the Comex.

OTC Market

The OTC market for silver appears to be a good deal smaller (absolutely and relative to futures markets) and less liquid than its counterpart in gold. For instance, it is noteworthy that in 1997 the ratio of turnover on the London Bullion Market to that on the Comex was 10:1 in gold, yet 3:1 in silver. Although throughout the year a proportionately higher amount of silver business tended to be conducted on Comex, the indications are that this picture changed somewhat in the second half. The resulting strains in the OTC market caused dramatic swings in silver prices and, especially, leasing rates. An indication of the changing trend in the OTC market is given by the jump in the London Bullion Market's clearing turnover from September,

Futures Turnover and Open Interest

Turnover Contracts	Number of Contracts			Silver Equivalent			Open Interest Number of Contracts Comex
	Comex 5000 oz	Tocom*	Other	Comex	Others	Total	
	1988	4,664,655	2,302,428	497,794	23,323	1,255	
1989	4,376,611	643,891	270,672	21,883	709	22,592	94,843,474
1990	3,913,609	504,332	192,062	19,568	688	20,256	84,343,422
1991	4,154,704	1,057,598	128,014	20,774	1,151	21,924	96,843,484
1992	3,016,339	231,864	62,018	15,082	288	15,369	76,264,381
1993	4,855,924	671,452	101,149	24,280	753	25,032	115,772,579
1994	5,994,345	1,042,185	116,111	29,972	1,162	31,134	130,451,652
1995	5,183,236	1,440,297	98,604	25,916	1,522	27,438	98,555,493
1996	4,870,808	752,995	50,083	24,354	777	25,131	84,693,423
1997	4,893,520	793,344	39,760	24,468	1,278	25,746	98,906,495

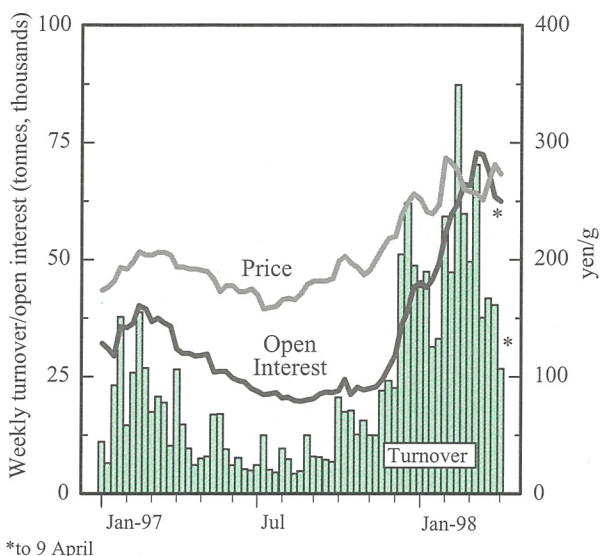
*10kg contracts to June 1989, 30kg contracts to April, 1997, thereafter 60kg contracts

1997 onwards. In large measure this signalled the entry of Berkshire Hathaway into the market. But it would be misleading to regard all activity in the OTC market last year, even in the second half, as dominated by Mr Buffett's purchases. Not only would these purchases have represented someone else's sales (there was after all net disinvestment once again in 1997) but it would also seem highly likely that the OTC market saw substantial net disinvestment last year as a whole. For example, it appears that a large position was sold in the OTC market in May. There was also evidence that a large short position which had been put on earlier in the year was covered in October. Prior to Berkshire Hathaway entering the market in July, sales of silver in the OTC market last year would have effectively been picked up either by other investors or fabricators. During the second half, with the market's "deficit" probably narrowing, Berkshire Hathaway would have taken on the bulk of the silver disinvested. The strong two-way business in the market at this time explains both the rise in turnover and also why the price failed (at least initially) to soar given the reported scale of Mr Buffett's purchases.

Berkshire Hathaway indicated in its press release of 3rd February, 1998 that it had amassed 129.7 Moz (4,034 t) since 25th July, 1997. Of this total, it had already taken delivery of 87.5 Moz (2,722 t) by the end of 1997. In addition, it had contracted for delivery of the balance of 42.2 Moz (1,312 t) by 6th March. There are two different but related explanations for this purchase. Firstly, Mr Buffett and his advisors were persuaded of the longer-term merits of investing in silver (especially at prices below \$5) by the metal's strong fundamentals. Secondly, they believed that the

small size of the near-market bullion stocks meant that the silver market was small enough to be squeezed in a similar fashion to the way that the platinum group metals had been earlier in 1997. Which of these two explanations is most justified is a matter of speculation although they are not mutually exclusive. In any case, it seems that the Berkshire Hathaway purchases were effected through the OTC market in London and had the effect of increasing the spread between silver prices quoted in London and on the Comex. This made it profitable for arbitrageurs to move bullion from New York to London, resulting in the decline in Comex stocks described in Chapter 5. Most of this metal appears to have been placed on allocated account in London and thus unavailable for lending. The shortage of unallocated metal in London also had the effect of driving up silver leasing rates as borrowers scrambled to cover their needs from what was (initially at least) a diminishing pool of loco-London liquidity. Increased producer hedging in this period also exacerbated the tightening of the leasing market. A similar picture was seen in early 1998, although on this occasion it was played out on a far larger scale in terms of price and leasing rate movements, the London-Comex spread and the size of the subsequent inflow of bullion into London. A key factor in all of this was the conversion of formerly unallocated stocks in London into allocated form. It is highly probable that a large part of this allocated silver belonged to Berkshire Hathaway and was not being lent into the market. Whether intended or not, the result was a severe squeeze on the market's liquidity. Leasing rates were thus driven up to record levels (hitting 75% on a 1-month basis in February) which forced at least some

Figure 46
Tocom Silver Futures



shorts (including some industrial borrowers) to cover themselves in the market, thereby driving up the silver price. In early 1998, just prior to this second squeeze, large call option purchases were made in the OTC market (on some estimates, these amounted to a nominal 20 to 30 Moz). This helped further to intensify the squeeze which became so intense that on 5th February the London Bullion Market Association introduced a temporary extension to the allowed time for physical delivery of silver from 5 to 15 days.

Physical Investment

Although fund selling via the OTC market contributed the largest part of the net disinvestment last year, a significant amount of silver also came out of individual metal accounts or certificate programs and from direct physical sales of bars and coins from private hoards. However, there appear to have been much lower sales from such sources in the first three quarters of 1997. Instead, the disinvestment during this period was almost entirely due to fund activity, both via moderate increases in the short positions held on Comex and more significantly, through new short positions and the liquidation of long ones in the OTC market. By contrast, towards the end of 1997 and even more so in early 1998, there was a very noticeable increase in physical disinvestment of coin-bags and hundred-ounce bars in the United States and also reports of a smaller quantity of material, including kilobars, being sold from long-dormant stocks in

Europe. In addition, silver was coming out of stocks in the Middle East and East Asia into London. Part of this represented disinvestment out of (long-held) positions but a possibly larger element reflected a decline in commercial, industrial and consignment stocks (especially those held in Dubai). These stocks were mobilised as a result of the reduced demand from intermediaries and fabricators for spot and borrowed metal caused by the twin spikes in the silver price and leasing rate in the London market.

Tocom

Turnover and open interest on the Tocom rose in January and February 1997 due to the weakening of the yen against the dollar, although the local silver price was essentially unchanged. Both turnover and open interest started to decline from April, the former recording its lowest weekly average of 4,245 contracts for the week ending 15th August and the latter recording its lowest level of 19,712 for the week ending 22nd August.

It was only towards year end, in late November, that activity started to pick up. This coincided with a rising international silver price and a tightening of lease rates. What is particularly interesting at this time was the shift in dealers' positions from net short to net long. This occurred in mid-November, and since then the dealers' aggregate net position has moved periodically from the long to the short side, reflecting uncertainty about both the direction of the silver price and the yen-dollar exchange rate.

Options Turnover and Open Interest

	Open Interest	Turnover		Total Silver	
	(end year)	(total)		Equivalent (Moz)	
	No. of Contracts	No. of Contracts		Comex	Other
	Comex	Comex	Other	Comex	Other
1988	38,657	872,106	25,781	4,361	12
1989	63,382	752,645	18,182	3,763	10
1990	67,209	747,499	3,281	3,737	2
1991	73,046	1,019,093	4,878	5,099	3
1992	61,483	676,543	30,042	3,431	20
1993	71,307	1,094,702	18,268	5,480	13
1994	111,938	1,316,650	19,720	6,585	12
1995	67,924	1,146,513	8,057	5,734	7
1996	59,319	949,239	8,410	4,747	8
1997	106,258	842,923	4,388	4,215	4

WORLD SILVER SURVEY 1998

Appendix I

Silver Prices in 1997 in US dollars per ounce

1. London Prices

	London Silver Market - Spot			London Silver Market - 3-Months		
	High	Low	Average	High	Low	Average
January	5.0300	4.6540	4.7736	5.0910	4.7105	4.8310
February	5.2525	4.8000	5.0722	5.3155	4.8570	5.1321
March	5.3075	5.0925	5.2032	5.3710	5.1575	5.2681
April	5.0350	4.6425	4.7726	5.0995	4.7010	4.8333
May	4.8735	4.6575	4.7594	4.9360	4.7160	4.8178
June	4.9000	4.7050	4.7552	4.9240	4.7575	4.8045
July	4.6540	4.2235	4.3724	4.7080	4.2705	4.4218
August	4.7250	4.3250	4.4962	4.7765	4.3745	4.5462
September	5.1675	4.5870	4.7319	5.2135	4.6210	4.7691
October	5.2800	4.7935	5.0348	5.3180	4.8250	5.0705
November	5.4750	4.7825	5.0779	5.5100	4.8145	5.1130
December	6.2675	5.2350	5.7945	6.2910	5.2675	5.8119
Average	6.2675	4.2235	4.8972	6.2910	4.2705	4.9450

	London Silver Market - 6-Months			London Silver Market - 12-Months		
	High	Low	Average	High	Low	Average
January	5.1525	4.7675	4.8891	5.2800	4.8850	5.0090
February	5.3785	4.9160	5.1941	5.5080	5.0360	5.3203
March	5.4350	5.2260	5.3335	5.5660	5.3635	5.4671
April	5.1670	4.7635	4.8975	5.3005	4.8920	5.0298
May	4.9975	4.7755	4.8785	5.1345	4.9030	5.0102
June	4.9970	4.8160	4.8632	5.1185	4.9290	4.9824
July	4.7645	4.3205	4.4740	4.8780	4.4225	4.5797
August	4.8320	4.4255	4.5993	4.9480	4.5330	4.7086
September	5.2630	4.6675	4.8165	5.3640	4.7740	4.9214
October	5.3575	4.8585	5.1063	5.4405	4.9290	5.1820
November	5.5230	4.8460	5.1413	5.5810	4.9205	5.2074
December	6.2675	5.2905	5.7950	6.2355	5.3410	5.7871
Average	6.2675	4.3205	4.9891	6.2355	4.4225	5.0906

2. US Prices

	Comex Spot Settlement			Handy & Harman		
	High	Low	Average	High	Low	Average
January	5.0270	4.6130	4.7600	5.0250	4.6500	4.7639
February	5.3100	4.8250	5.0835	5.2600	4.8400	5.0876
March	5.2920	5.0520	5.1871	5.3150	5.1250	5.2071
April	5.0050	4.6100	4.7310	5.0050	4.6400	4.7683
May	4.8430	4.6500	4.7343	4.9100	4.6700	4.7588
June	4.8070	4.6000	4.7159	4.8450	4.6400	4.7474
July	4.6330	4.1550	4.3261	4.6450	4.2100	4.3595
August	4.6770	4.2970	4.4936	4.7800	4.3600	4.5043
September	5.1870	4.5610	4.7118	5.2050	4.5650	4.7239
October	5.2620	4.7170	4.9839	5.2700	4.6950	5.0117
November	5.4120	4.8250	5.0510	5.3950	4.8300	5.0600
December	6.3070	5.2400	5.7687	6.2050	5.2000	5.7153
Average	6.3070	4.1550	4.8716	6.2050	4.2100	4.8825

WORLD SILVER SURVEY 1998

Appendix II

Silver Prices, 1977-97, in US dollars per ounce

1. London Prices

	London Silver Market - Spot			London Silver Market Averages		
	High	Low	Average	3-Month	6-Month	12-Month
1977	4.9750	4.3130	4.6333	4.6956	4.7764	4.9355
1978	6.2640	4.8180	5.4218	5.5190	5.6269	5.8559
1979	32.2000	5.9350	11.0679	11.3306	11.5396	11.9393
1980	49.4500	10.8900	20.9837	21.4906	21.9717	22.8673
1981	16.3030	8.0300	10.4869	10.9114	11.3460	12.1741
1982	11.1100	4.9010	7.9219	8.1590	8.4065	8.9233
1983	14.6680	8.3700	11.4301	11.6935	11.9697	12.5365
1984	10.1100	6.2200	8.1446	8.3564	8.5877	9.0810
1985	6.7500	5.4500	6.1319	6.2519	6.3815	6.6681
1986	6.3100	4.8530	5.4645	5.5515	5.6417	5.8253
1987	10.9250	5.3600	7.0156	7.1405	7.2674	7.5325
1988	7.8215	6.0500	6.5324	6.6611	6.7952	7.0762
1989	6.2100	5.0450	5.4999	5.6273	5.7554	6.0152
1990	5.3560	3.9500	4.8316	4.9307	5.0308	5.2493
1991	4.5710	3.5475	4.0566	4.1115	4.1719	4.3023
1992	4.3350	3.6475	3.9464	3.9821	4.0200	4.1070
1993	5.4200	3.5600	4.3130	4.3449	4.3805	4.4593
1994	5.7475	4.6400	5.2851	5.3435	5.4077	5.5607
1995	6.0375	4.4160	5.1971	5.2574	5.3241	5.4688
1996	5.8275	4.7100	5.1995	5.2618	5.3244	5.4535
1997	6.2675	4.2235	4.8972	4.9450	4.9891	5.0906

2. US Prices

	Comex Spot Settlement			Handy & Harman		
	High	Low	Average	High	Low	Average
1977	4.9760	4.2850	4.6235	4.9600	4.3000	4.6230
1978	6.3170	4.8110	5.4068	6.2960	4.8290	5.4009
1979	34.4500	5.9230	11.1135	28.0000	5.9610	11.0938
1980	48.7000	10.8000	20.6568	48.0000	10.8000	20.6316
1981	16.2900	7.9850	10.5014	16.4500	7.9500	10.5116
1982	11.2100	4.9800	7.9311	11.2100	4.8850	7.9473
1983	14.7150	8.4000	11.4340	14.7450	8.3400	11.4413
1984	10.0640	6.2950	8.1585	10.0350	6.2600	8.1407
1985	6.8350	5.5250	6.1459	6.7350	5.5700	6.1454
1986	6.2850	4.8540	5.4653	6.1950	4.8700	5.4679
1987	9.6600	5.3790	7.0198	10.2000	5.3600	7.0192
1988	7.8270	5.9980	6.5335	7.9900	6.0100	6.5369
1989	6.1940	5.0300	5.4931	6.1700	5.0150	5.4940
1990	5.3320	3.9370	4.8174	5.3900	3.9300	4.8182
1991	4.5450	3.5080	4.0355	4.5300	3.5800	4.0407
1992	4.3180	3.6400	3.9334	4.3150	3.6300	3.9366
1993	5.4430	3.5230	4.3026	5.3700	3.5450	4.3018
1994	5.7810	4.5730	5.2808	5.7550	4.6250	5.2873
1995	6.1020	4.3750	5.1850	6.0100	4.2500	5.1872
1996	5.8190	4.6760	5.1783	5.7900	4.6700	5.1885
1997	6.3070	4.1550	4.8716	6.2050	4.2100	4.8825

WORLD SILVER SURVEY 1998

Appendix III

Silver Prices, 1977-97

The Effects of Exchange Rates and Inflation

1. Actual Prices * (money of the day)

	London US\$/oz	India * Rupee/kg	Thailand Baht/oz	Japan Yen/10g	Korea Won/10g	Italy Lire/g	Germany DM/kg	Mexico Peso/oz
1977	4.633	1,120	94.52	400	721	131	346	0.10
1978	5.422	1,393	110.26	367	844	148	350	0.12
1979	11.068	1,896	225.99	780	1,722	296	652	0.25
1980	20.984	2,783	429.67	1,530	4,098	578	1,226	0.48
1981	10.487	2,650	228.83	744	2,296	383	762	0.26
1982	7.922	2,675	182.20	634	1,862	344	618	0.45
1983	11.430	3,435	262.89	873	2,851	558	938	1.37
1984	8.145	3,514	192.53	622	2,111	460	745	1.37
1985	6.132	3,880	166.53	470	1,715	376	580	1.58
1986	5.465	4,105	143.71	296	1,549	262	382	3.34
1987	7.016	5,124	180.46	326	1,855	292	405	9.67
1988	6.532	6,231	165.23	269	1,536	273	369	14.85
1989	5.500	6,803	141.34	244	1,187	243	332	13.54
1990	4.832	6,779	123.62	225	1,099	186	251	13.59
1991	4.057	6,993	103.51	176	956	162	216	12.24
1992	3.946	7,580	100.24	161	991	156	198	12.21
1993	4.313	6,163	109.15	154	1,110	214	229	13.44
1994	5.285	6,846	132.92	174	1,365	274	276	17.84
1995	5.197	6,864	129.49	157	1,289	272	239	33.36
1996	5.199	7,291	131.79	182	1,345	258	252	39.52
1997	4.897	7,009	153.60	191	1,498	268	273	38.76

* Prices are calculated from the London price and the average exchange rate for the year.
In the case of India, the price shown is the one actually quoted in the Bombay market.

2. Real Prices ** (Constant 1997 money)

	London US\$/oz	India Rupee/kg	Thailand Baht/oz	Japan Yen/10g	Korea Won/oz	Italy Lire/g	Germany DM/kg	Mexico Peso/oz
1977	12.268	6,068	290.67	622	3,415	707	611	95.29
1978	13.343	7,366	314.27	548	3,492	710	602	112.49
1979	24.483	9,438	586.09	1,122	6,023	1,236	1,078	183.71
1980	40.885	12,429	930.87	2,043	11,135	1,991	1,922	250.96
1981	18.511	10,467	439.97	946	5,145	1,106	1,124	116.90
1982	13.177	9,789	332.87	786	3,890	853	866	116.17
1983	18.422	11,242	462.91	1,061	5,758	1,206	1,273	185.07
1984	12.586	10,618	336.15	739	4,168	897	987	110.55
1985	9.151	11,107	283.79	548	3,306	672	752	80.76
1986	8.001	10,805	240.50	343	2,914	442	496	91.50
1987	9.912	12,400	294.77	378	3,377	471	525	114.64
1988	8.869	13,782	259.87	309	2,610	419	472	82.14
1989	7.122	14,174	210.96	274	1,908	350	414	62.38
1990	5.936	12,963	174.17	245	1,627	252	304	49.47
1991	4.782	11,740	138.00	185	1,293	206	253	36.32
1992	4.515	11,385	128.30	167	1,262	189	223	31.37
1993	4.793	8,704	134.90	158	1,349	249	248	31.46
1994	5.723	8,773	155.97	177	1,562	306	289	39.04
1995	5.473	7,981	144.31	160	1,412	289	247	54.09
1996	5.322	7,780	138.83	185	1,405	263	256	47.68
1997	4.897	7,009	153.60	191	1,498	268	273	38.76

** Derived from the actual prices shown above using consumer price indices.

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