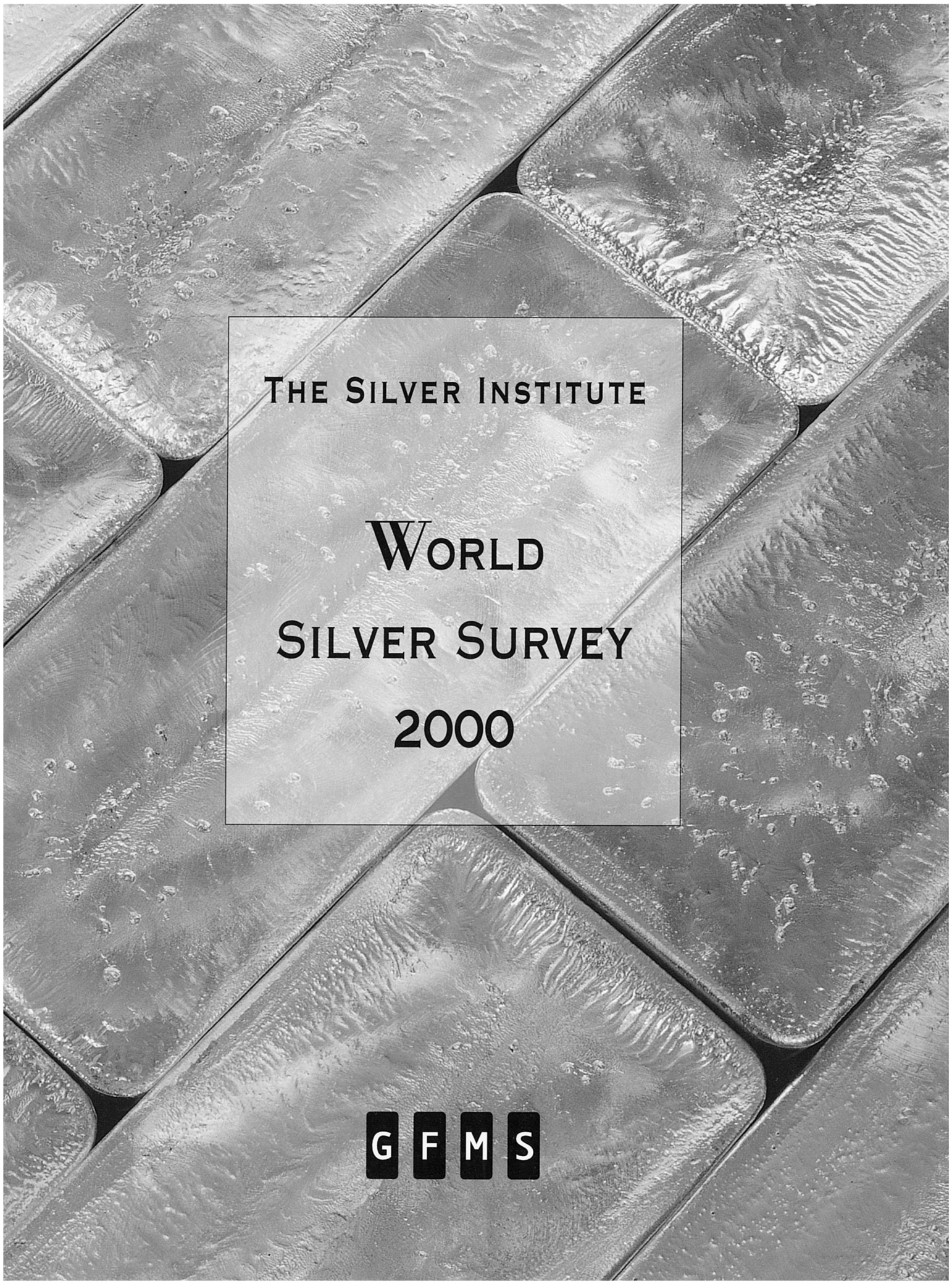
THE SILVER INSTITUTE
WORLD
SILVER SURVEY
2000
GFMS

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The data on which this report is based have been obtained by The Silver Institute and Gold Fields Mineral Services (GFMS) 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. A number of figures may have been revised from last year's Survey in the light of new 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 sixth annual survey of the world silver market to be produced for The Silver Institute by Gold Fields Mineral Services (GFMS), the London-based analysts of global precious metals markets. 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. But 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 the *World Silver Survey* is as complete and accurate as possible.

Gold Fields Mineral Services Ltd, London **May, 2000**

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Units used:
supply and demand data are given in units of million troy ounces (Moz) rounded to one decimal place.
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 London Silver Market fixing.

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

1. Summary and Outlook

Silver showed considerable resilience in the face of massive supply side pressure last year. That the average price fell only 6% to $5.22 in spite of unprecedented selling from Chinese stocks was largely due to record fabrication demand for the metal, with the electronics sector shining particularly brightly.

The supply side story of 1999 was the surge in Chinese official sales, which are estimated to have totalled 61 Moz (1,900 t). A large amount of this metal was exported to arbitrage the difference between prices in China and the rest of the world. This reduction in Chinese bullion stocks was by far the largest component of the net government sales figure shown in Table 1. Fortunately for the silver price, fabrication demand was sufficiently strong to absorb the increased supply available from the outflow of Chinese bullion and a rise in net disinvestment. The combination of record fabrication on the one side and lower mine production and scrap on the other, resulted in the market "deficit" between these components of demand and supply rising to 155.7 Moz (4,843 t). It seems clear that, had there not been such a large reduction in Chinese bullion stocks last year, the price would have been forced higher for the market to have been in balance.

In the light of this, and with the prospects for demand looking very promising this year, the key questions for the market focus on whether Chinese government sales will continue on the same scale as in 1999, and, if not, where the additional supply would come from to replace these official sector sales and, effectively, fill the "deficit"?

Forecasting future Chinese supply to the market is difficult, to say the least. Nevertheless, it is hard to believe that last year's level of official sales could be sustained over the longer run. Yet, on the other hand, it seems unlikely that Chinese bullion stocks will run out during the course of 2000. Thus the more relevant question is, whether the authorities will call a halt to or, at least, slow the decline in their inventories? The full-scale liberalization of the Chinese market that began at the start of this year has not made it any easier to gauge how official policy will develop towards the remaining government silver stocks. What is clear, however, is that on a purely technical basis, it would be easy to reduce the outflow of metal. Simply raising the internal selling price to closer to the world level would choke off the purchase and resale of official bullion stocks by arbitrageurs. (Last year the local selling price discount at times exceeded 10%, which provided intermediaries with a powerful incentive).

Chinese government sales accounted for nearly 7%

Table 1
World Silver Supply and Demand
(Million ounces)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Supply										
Mine Production	524.5	512.8	487.6	470.1	452.0	479.7	487.8	526.6	547.8	546.8
Net Official Sector Sales	-	-	-	6.0	17.6	25.3	18.9	-	40.0	87.0
Old Silver Scrap	135.1	141.9	148.3	148.5	151.9	162.9	158.4	169.3	193.7	174.9
Producer Hedging	15.2	19.0	1.3	26.7	-	9.2	-	69.1	5.5	-
Implied Net Disinvestment	49.4	51.5	102.6	129.3	153.8	100.2	158.8	92.5	49.0	79.5
Total Supply	724.2	725.2	739.8	780.7	775.3	777.4	823.9	857.5	836.0	888.2
Demand										
Fabrication										
Industrial Applications	273.5	266.8	259.3	269.8	281.4	295.3	297.3	320.4	316.7	343.2
Photography	221.1	216.2	210.3	210.1	213.1	220.5	224.6	233.0	244.6	246.4
Jewelry & Silverware	188.7	194.5	211.8	259.3	227.9	236.9	263.9	274.9	248.7	260.8
Coins & Medals	34.0	31.3	33.5	41.5	43.8	24.7	23.3	28.5	26.1	27.0
Total Fabrication	717.4	708.9	714.9	780.7	766.2	777.4	809.1	856.8	836.0	877.4
Net Official Sector Purchases	6.8	16.3	24.9	-	-	-	-	0.7	-	-
Producer Hedging	-	-	-	-	9.1	-	14.8	-	-	10.8
Total Demand	724.2	725.2	739.8	780.7	775.3	777.4	823.9	857.5	836.0	888.2
Silver Price (London US$/oz)	4.832	4.057	3.946	4.313	5.285	5.197	5.199	4.897	5.544	5.220

of world silver supply last year and this begs the question as to what would happen if supply from China were to decline or cease altogether? The answer is, almost certainly, higher prices to bring supply and demand into equilibrium, i.e. through stimulating sales of other bullion stocks and scrap and by reducing the level of demand.

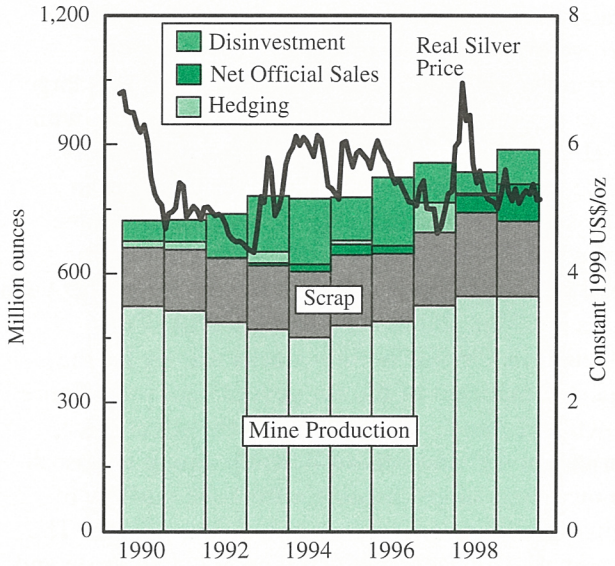
In this regard, it is worth noting that rising official sector sales in the past two years have masked an underlying decline in private sector bullion stocks. Over the past 10 years, sustained net disinvestment and growth in producer hedging have combined to reduce private holdings of silver by no less than 1,078 Moz (33,524 t). What remains of the large stocks built up during the 1970s and early 1980s is now more widely dissipated and further from the market than ever before. The one major exception to this are those stocks controlled by Warren Buffett and others.

In last year's *World Silver Survey* we estimated that in early 1999 Mr Buffett and other investors were controlling around 200 Moz (6,220 t) of near-market stocks. A year later our information is that, although there has been some selling out of these positions, most of them are intact (including it would seem the majority, if not all, of Mr Buffett's own holdings of 129.7 Moz or 4,030 t). That said, these bullion stocks are viewed by many as "overhanging" the market rather than representing a vote of confidence in the long-term future course of the silver price. If true, then there is the potential for some further sales out of these stocks, especially if reduced supply from China were to give a sufficient boost to silver prices. This would tend to limit the scope for higher prices, at least until the market had absorbed the fresh supplies of bullion. Thereafter, there would presumably be room for some increase in silver prices, particularly given the positive outlook for fabrication demand referred to above.

Supply

- Total supply in 1999 was 6% higher year-on-year at 888.2 Moz (27,624 t).
- Mine production declined fractionally, due to a large drop in Mexican and US silver output.
- Official sector sales increased dramatically to 87.0 Moz (2,706 t), the highest level ever recorded by GFMS.
- Scrap declined almost 10% due to falling prices in most currencies.
- Disinvestment surged to 79.5 Moz (2,473 t), a 62% increase year-on-year.

Figure 1
World Silver Supply

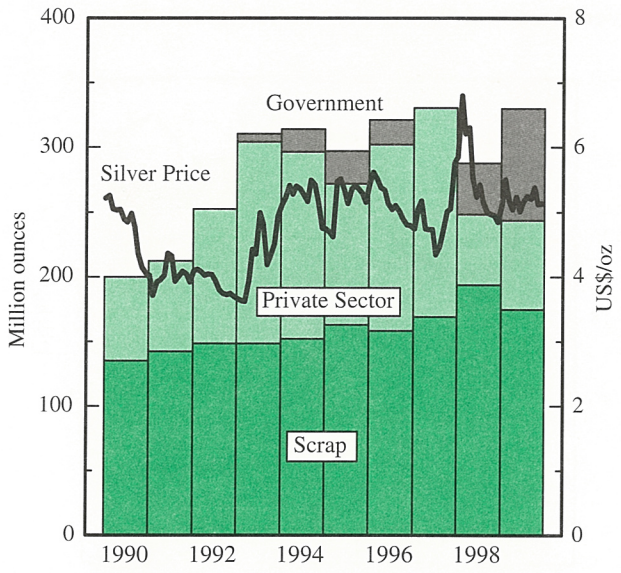


Total supply of silver to the market increased in 1999, but not due to increased mine production or scrap, the "traditional" sources of physical supply. Instead, more silver was mobilized through sales by the official sector and disinvestment by the private sector (see Figures 1 and 2). These increased physical flows were met by robust demand, but nevertheless resulted in a lower average price being required to bring the market into balance.

The most significant change in the supply/demand balance last year was the enormous increase in **official sector sales**, which leapt 117% to 87 Moz (2,706 t). This was the highest level of official sector sales ever recorded by GFMS, and stood in stark contrast to the average annual level of sales from 1990 to 1997 of 2.4 Moz (75 t). The main reason for the dramatic change was the shift during the last two years in the silver stocks management policy of the People's Bank of China, away from being net buyers of domestic mine production, to being net sellers, mostly out of officially held stocks. As mentioned above, the sheer volume of stocks mobilized in this way during 1999 - estimated to have reached 61 Moz (1,900 t) - put enormous pressure on the price for much of the year.

Somewhat surprisingly, **mine production** did not increase in 1999, for the first time in five years, but instead declined marginally to 546.8 Moz (17,007 t). An otherwise inevitable expansion in world silver mining was averted because of a unique and unexpected situation which had developed in Mexico, the world's largest producer of silver. Following a pollution scare, one of the country's major processing

Figure 2
Mobilization of Above-ground Stocks



facilities, Peñoles' Met-Mex complex at Torreon, was unable to accept material from a multitude of small miners who produce (silver-bearing) concentrates. Many of these operators stopped mining as a result. Mexican silver output ended the year almost 18% down on 1998, at 75.2 Moz (2,338 t). Peñoles was nevertheless still the biggest producer of silver from its own precious metals and polymetallic mines.

Declining production from several primary silver mines saw primary silver's share of total output drop back to 23%. Copper by-product also declined, though by only 2%. On the other hand, 1999 witnessed increases in silver generated as a by-product of lead-zinc mining (with full production from Cannington in Australia, the biggest silver-producing operation in the world in 1999) and gold mining (due to higher output from the gold mines of North and South America).

Scrap supply also receded last year, to 174.9 Moz (5,439 t). This was the predictable result of lower prices in most silver-consuming countries, as well as the absence of distress sales in markets such as Korea. Scrap sales out of India declined particularly sharply, though the 40% fall should be interpreted in the light of the record level of scrap sales seen in 1998 on the back of high local prices.

Considering the disappointing price performance in 1999, it was perhaps not surprising that the market witnessed such a high level of **disinvestment**. Implied net disinvestment from private sector sources increased 62% to 79.5 Moz (2,473 t) last year. But this was still well below the disinvestment levels that the market had to deal with in the period 1992 to 1997. Funds generally did not seem to show a great degree of interest in the market last year, as the perception appeared to have been that the price would remain locked into a range until Mr Buffett and other large holders gave some indication of what their intentions were. Such disinvestment as there was, seemed to have been effected via the Over-The-Counter market. Towards the end of last year and in the early months of 2000 there were strong indications that investor sentiment was deteriorating as the price continued to disappoint.

As for physical investment, declining sales back into the market by small investors in the United States and healthy demand for coins and small bars in anticipation of a "Y2K" crisis, combined with muted prices, contributed to a much lower net disinvestment number for this market segment last year.

Demand

- Total fabrication demand grew 5% last year, driven mainly by growth in industrial applications, and jewelry and silverware.
- Photographic demand was up less than 1% at 246.4 Moz (7,664 t).
- Demand for silver coins and medals recovered some of 1998's lost ground with a 4% increase.
- Net outstanding producer hedging positions declined year-on-year, adding 10.8 Moz (335 t) to physical demand.

Silver fabrication demand was buoyant in 1999, expanding by 41.4 Moz (1,286 t) to a new record level of 877.4 Moz (27,289 t). Much of the overall increase was generated by recovering demand in East Asia and India, following on a weak performance in 1998.

As far as the individual sectors of the silver fabrication market are concerned, the strongest performance was reported in the area of **industrial applications**, which accounts for over 39% of all fabrication. Industrial demand surged ahead on the back of very healthy offtake in the United States and Japan, which contributed to an overall increase of more than 8% in this sector. Silver use in electrical and electronic products absorbed 148.5 Moz (4,619 t), benefiting from the robust global economic environment, as well as the development of new products and end-uses.

Strong growth was also reported in demand for **jewelry and silverware**. After a rather disappointing

Figure 3
World Silver Demand

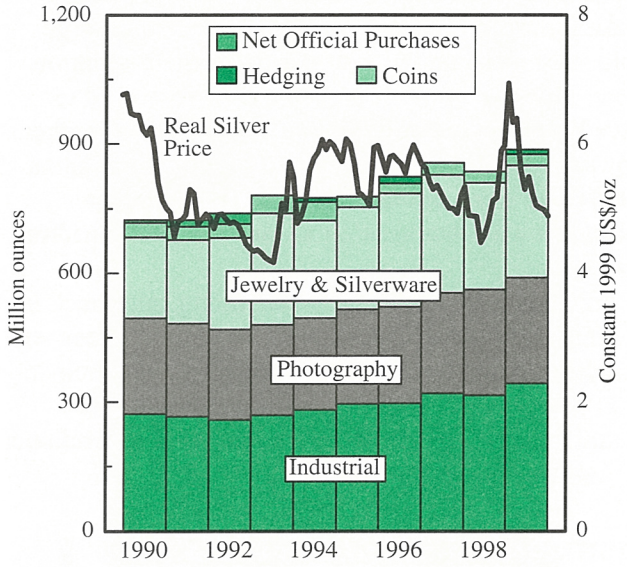
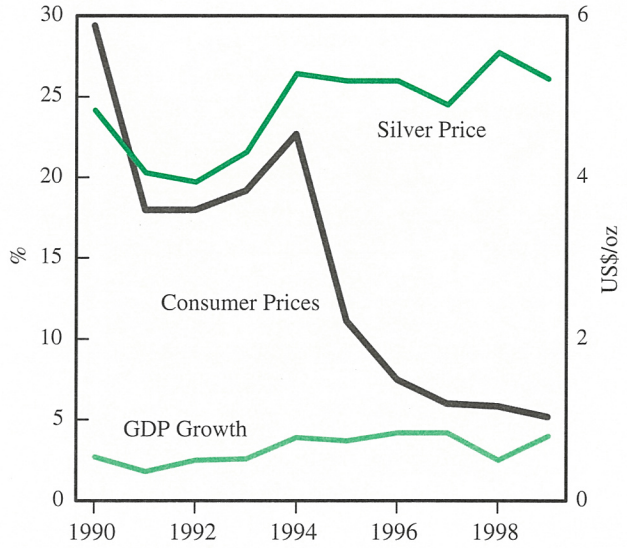


Figure 4
Silver Price and World Economic Indicators



performance in 1998, silver usage in this area increased 5% last year to reach 260.8 Moz (8,113 t), recovering much of the ground lost. This result came about despite the fact that demand for jewelry and silverware in India, the largest consuming country in this sector, was virtually flat year-on-year. In the very price-sensitive Indian market, buying behavior reflected the fact that average prices in rupee terms were actually marginally higher than in 1998. In addition, floods affected offtake in some of the major consuming regions. On the other hand, a major recovery was recorded in the East Asian markets. Fabrication demand in this region was still slightly below record levels, but the 16% growth to 38.8 Moz (1,209 t) was nevertheless impressive. Much of the products fabricated in East Asia were destined for eventual consumption in the United States and Europe, and exports to these regions consequently soared. The domestic fabrication market in Europe also posted strong results in the jewelry and silverware sector, with offtake expanding by 7%. Production in Italy recorded especially strong growth of 13%, most of it for export.

The third major area of silver demand, the **photographic** industry, increased only marginally (up less than 1% to 246.4 Moz or 7,664 t) although this was enough to lift fabrication in this area to a new record level. The almost flat total number masks significant growth in individual markets, with silver use in photography in the United States, in particular, increasing by over 5% during the year. Declines in a number of the major European markets and a sharp fall in Chinese photographic offtake effectively neutralized the growth in the US market. Digital photography, though expanding rapidly, thus far does not seem to have had much of an impact on the continuing growth in the market for traditional photographic products.

Fears of a "Y2K" inspired crisis seems to have been the major driving force behind a 4% increase in the market for silver **coins and medals**. This sector's share of fabrication has been declining in recent years, and in 1999 accounted for only 3% of all silver used.

A surprising development occurred in the area of **producer hedging**. Despite persistent rumors of high levels of hedging, and announcements of several large deals, net outstanding producer hedging positions were lower at the end of 1999 than a year earlier. Producer hedging thus constituted a source of accelerated demand, rather than supply. This result came about despite rather high levels of intra-year activity, with several producers adding to their books on spikes above $5.50, and the conclusion of some new deals of significant size. There were several reasons for the net decline. Firstly, producers' appetite for hedging was generally lower due to high lease rates and a lack of longer-term liquidity. Secondly, a number of those deals that were concluded were structured in such a way that the net impact on the market was minimal. Thirdly, producers were not only active on the selling side, but were also active buyers on the lows. And lastly, falling prices and volatility reduced the average delta on some of the large call options positions that were still outstanding.

2. Silver Prices

- Substantial flows of silver out of China helped keep the price in check during 1999. The average dollar price fell by 5.8% year-on-year, to $5.220. Both the trading range and price volatility declined.

After a rather eventful 1998, last year's silver price performance turned out to be somewhat of a disappointment. The average price fell by 5.8% to $5.220 in 1999, while its trading range decreased to a paltry 17.4% compared to the previous year's 56.3%. Volatilities during the year were similarly muted (see Figure 7), at only 23.1% compared to the 37.4% recorded in 1998 (and an average of 25.3% for the previous 5 years). However, silver did manage to finish the year up 6.7% on its starting level (ending the year at $5.330 having begun it at $4.995).

As is usual, movements in local currency and dollar prices differed quite markedly from one another. Importantly from the perspective of demand, the rupee price actually rose, albeit very slightly. India was the only major consuming and/or fabricating country where the price increased last year. Won and yen silver prices decreased sharply, by 20% and 18% respectively. By contrast, euro prices only fell by around 1.6%. The impact of changes in prices and incomes on demand are discussed in the Focus Box at the end of this chapter.

Having started the year at quite low levels (of around 1.5% for 3-month rates), leasing rates rose and then remained steady throughout much of the year. Although 3-month rates were slightly more volatile than the longer tenures, much of the liquidity pressure was seen at the longer end of the yield curve. Notably, although average 3-month rates for 1999 were lower than in 1998, 12-month averages in 1999 were higher.

US$ Silver Price

	1969	1979	1989	1999
Annual Average	1.803	11.068	5.500	5.220
Maximum	2.055	32.200	6.210	5.790
Minimum	1.559	5.935	5.045	4.880
Range:Average	27.5%	237.3%	21.2%	17.4%

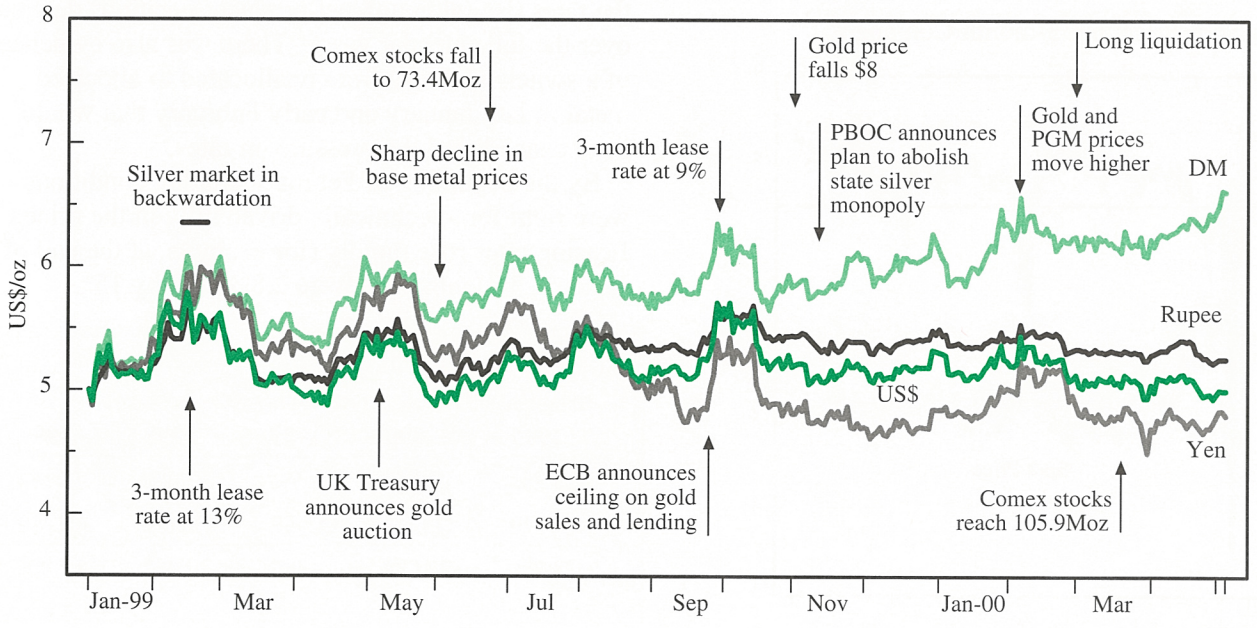
The Silver Price in Other Currencies

	US$/oz	Euro/kg	Rupee/kg	Yen/10g
Annual Average	5.220	157.6	8,021	190.8
Maximum	5.790	173.1	8,600	217.0
Minimum	4.880	134.0	7,445	167.4
Range:Average	17.4%	24.8%	14.4%	26.0%

Figure 5

London Silver Market: Spot Price

US$/oz; other currencies reindexed to 4th January 1999



As was argued in Chapter 1, any discussion of the price in 1999 has to be conducted against the backdrop of the large and sustained flows of silver coming out of China throughout the year. It seems highly likely that the price would have been higher if it had not been for major destocking by the Chinese.

The Summary Chapter outlines just how robust physical demand was in 1999, and also points out that there was a small decline in mine production and a close to 10% fall in scrap year-on-year. Viewing these events in isolation, one would have been forgiven for expecting the price to have risen year-on-year (if not above the full-year average for 1998, then at least above the average of $5.29 for the last three quarters, i.e. stripping out the effects of the price spike in the first quarter of the year). That it did not is testament to the magnitude of the silver flows out of China.

The sale of Chinese silver substituted for a large swath of supplies of metal from the world market. Silver from the traditional supply sources (like the United Kingdom and Switzerland) that would normally have satisfied Indian demand was no longer needed. Figure 8 points to the main reason why so much silver has come out of China. Both official buying and selling prices were below the international level for sustained periods in 1999 (indeed, the buying price was below the international price for the whole year), encouraging flows out of China into the world market. Chapters 4 to 7 discuss the reasons for the sales of Chinese silver in more detail.

Notwithstanding these observations, 1999 actually got off to quite a promising start. Although the first few weeks of January were relatively quiet, towards the end of the month, pressure on leasing rates across all maturities emerged. A combination of factors contributed to the rise in rates and eventually prices. One of the more important influences was the technically driven squeeze seen on the Comex at the time, with a number of funds subsequently coming into the market as buyers (CFTC figures showed a big push on the long side in early February, with new positions rising by around 117 Moz (3,600 t) in the space of only two weeks). But other forces were at work too. GFMS believe that there was some producer hedging activity at the time which would have contributed to the rates rise (although net producer positions declined over the full calendar year). There was also evidence of a switch in stocks from unallocated to allocated metal in late January and early February that would have exacerbated the pressure on rates.

By the beginning of February, market conditions were right for a technically driven rally in the price. Leasing rates rose rapidly (for example, at the end of January, 3-month rates were 2.8%, and by 15th

Figure 6

London Spot Price and 3-month Contango

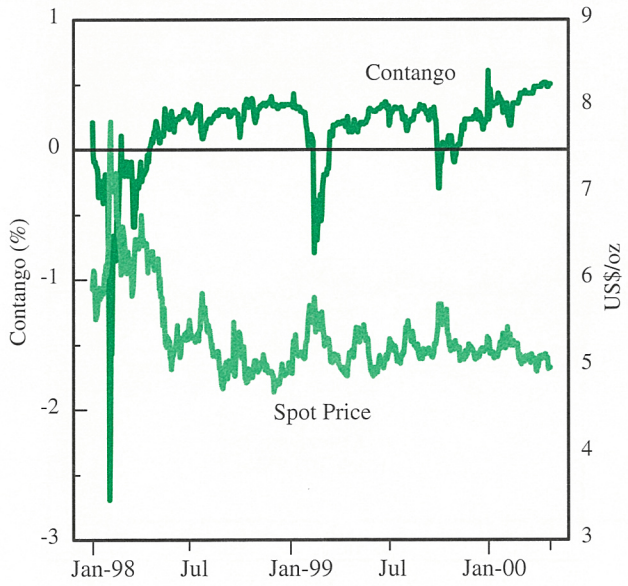
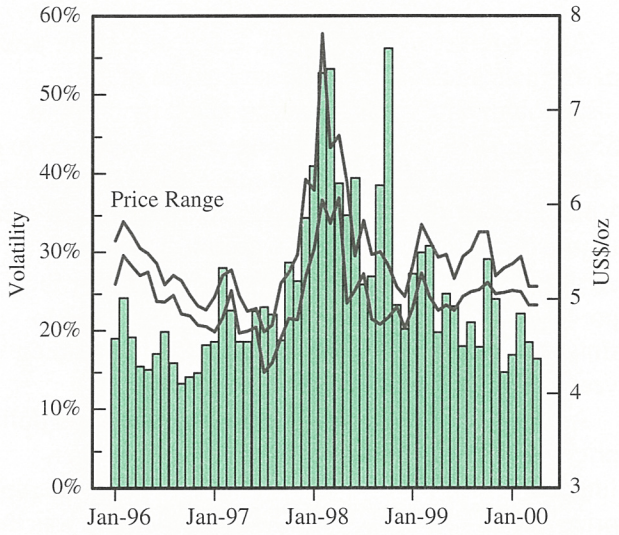


Figure 7

Daily Silver Price Volatility

Based on London fixings (30-day rolling average)

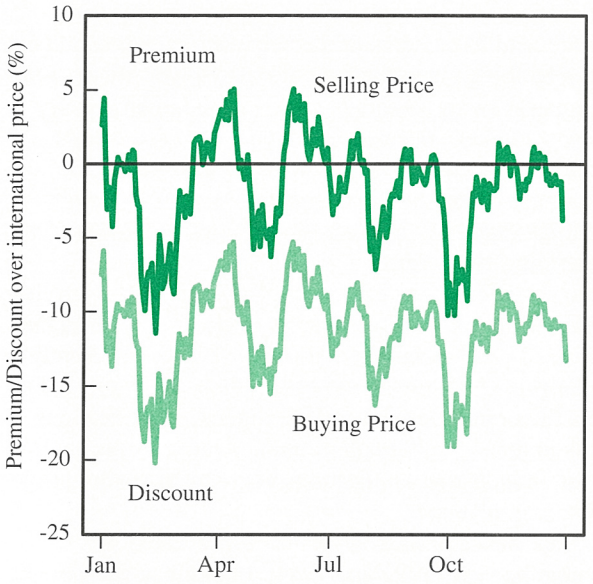


Volatility (US$ price)

Based on London fixings (30-day rolling average)

1995	1996	1997	1998	1999
25.2%	17.1%	23.5%	37.4%	23.1%
Q1-99	**Q2-99**	**Q3-99**	**Q4-99**	**Q1-00**
28.7%	22.7%	19.0%	22.4%	19.0%

Figure 8
Chinese Silver Prices, 1999



February were up at 13%), prompting fears of yet further increases (no doubt influenced by memories of rates above 30% in 1998). Worries about rising interest rate exposure saw buyers come into the market, and by 15th February, the price had risen to its high for the year (of $5.790, up by close to 10% on the beginning of the month).

The spike turned out to be short-lived, however, and both prices and leasing rates retreated rapidly. Just over a month later, the price was moving ominously towards $5.00, and by the beginning of April, it had fallen below this level (3-month leasing rates were by then back around 3%).

Just as it was difficult to pinpoint a single reason for the rise in prices and lease rates in February, so there was no single factor that appears to have precipitated the sharp fall in prices seen after the rally.

As is usually the case when it comes to explaining a fall in price, the physical markets played an important role. For example, in February, imports into India fell to just over 3.9 Moz (120 t), compared to an average of 7.8 Moz (243 t) during the previous six months. In addition to this, GFMS data point to there having been a surge in shipments of silver out of China (via Hong Kong) in February and March on the back of the spike. Throughout the year, shipments of silver out of China ratcheted up dramatically whenever the price moved above $5.25, and this level was breached at the beginning of February.

Although the response of the physical markets was of pivotal importance in determining the direction of the price, other factors played a role as well. As noted already, the rally was technically driven, and was marked by a lack of genuine investment interest (indeed, "buy-and-hold" demand was absent from all of the rallies last year).

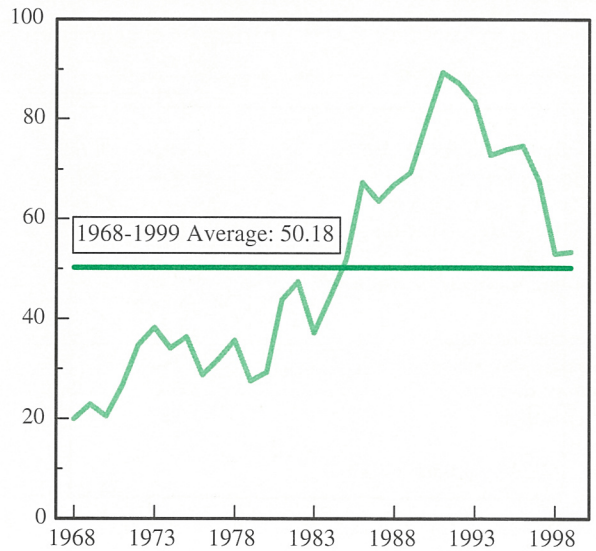
For the following few months, silver traded in a range of $4.90 to $5.50, and leasing rates remained relatively subdued. For example, 3-month rates averaged around 3% over this period compared to 1998's average of close to 5%. Yet rates were well up on 1997's average of just under 2%, suggesting a continued shortage of liquidity. Any forays above $5.30 were relatively short-lived, mainly due to large shipments of silver out of China.

It was not until the European Agreement on Gold, announced on 26th September, that the price managed a slightly more dramatic, and sustained, break out on the upside. Quite why silver should have responded to the announcement is difficult to fathom, considering that it said nothing at all about the metal itself.

But respond it did. From having been trading comfortably below $5.20, the price rose rapidly, reaching a high for the second half of the year of $5.71 on 29th September (it should nevertheless be noted that the rally in silver was rather muted compared to what was happening in gold at the time). Silver managed to stay above $5.50 for over 10 days on the back of the uncertainty surrounding where gold was about to go, but by November was trading below $5.20 again. The price ended the year at $5.33.

In 2000 to date, silver has generally remained under pressure, making regular forays into the $4.90s, apparently on the back of plenty of liquidity returning to the market (in April and May, for example, 3-month rates dipped well below the 1.5% level).

Figure 9
The Gold/Silver Price Ratio



Determinants of Silver Supply and Demand

This focus box looks at some of the major factors that have influenced silver scrap supply and fabrication demand over the last decade. Whilst prices and incomes are important explanatory variables, they do not operate in isolation of other influences such as tastes, technological change and market liberalization.

The table below suggests, not surprisingly, that industrial and photographic demand for silver is relatively price inelastic. What this says is that in the short term, a given percentage change in the price will elicit a smaller (percentage) change in demand (of course, in the opposite direction). In part, this is because the price of silver represents a very small share of the final price of an end product, for example, a computer. But technological factors play a role too. Often, there are few substitutes for silver in industrial or photographic applications in the short term (this is not to say that users of silver will not look to economize on silver use in the longer term). What the table does point to is that in the short term, demand in these sectors is influenced more by changes in incomes, rather than prices.

The years 1991 and 1992 were good examples of this phenomenon. In spite of the fall in the silver price, comparatively low income growth at the time conspired to drive down both industrial and photographic demand. This stands in contrast to 1994, a year in which prices rose dramatically, but industrial demand increased on the back of strong income growth.

1996 is the one real exception in the sample. Industrial demand increased by just 0.7% in that year in spite of it recording the largest increase in income over the 10 years shown (shared with 1997). Not only were incomes rising quickly, but prices fell, which should have reinforced the income effect. However, as already mentioned, prices and incomes are not the only influences on demand, and in 1996 it appears as if technological changes, and the major economization of raw material use in some European countries, helped to keep silver demand growth in check.

The price sensitivity of silver jewelry contrasts sharply with industrial and photographic demand. Jewelry and silverware tend to be items of discretionary spending and can therefore be foregone in the face of rising silver prices. One of the greatest swing factors in silver is the Indian jewelry (and scrap) market. Because jewelry is sold on a weight basis, buyers are more price sensitive, as opposed to in Europe or the United States where retail jewelry prices contain high mark-ups, and are less affected by changes in the underlying silver price.

When considering the effects of price changes on jewelry demand, it is important to look at local prices as well as the US$ price. Local prices can and do move quite differently to the dollar price. Following the earlier discussion, this is far less of a factor in industrial and photographic applications than it is in jewelry, although in India, a large proportion of silver use in industrial applications is in fact also very price sensitive (e.g. plating).

The importance of local prices is best revealed by examining the years 1993 and 1994. Looking at the table, it is difficult to reconcile why jewelry demand increased so robustly in those years. Indeed, the table shows that there was a 6% increase in the US$ silver price. Instead of world-wide jewelry fabrication falling, as might have been expected, demand surged by over 20%.

A large part of the increase was the result of events in India. Market liberalization facilitated a 24% *drop* in the local price in this year, resulting in a huge increase in Indian demand that pulled up the global total.

What the table does not show explicitly is the impact of changing tastes on jewelry demand. For example, recently in the United States, Europe and Asia the "white" look has become fashionable. What this means is that even if price and income moves in the "right" direction, the expected growth in underlying demand might not materialize.

On the supply side, the table suggests that silver scrap is quite price elastic. In 1998, higher average silver prices led to a corresponding increase in scrap. In 1999, this swung round to a 10% reduction in recycled silver, as the price fell.

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Silver - Real Price (1999 US$/oz)	4.962	4.686	4.974	5.939	5.680	5.523	5.082	5.664	5.220
Price change year-on-year	-19.4%	-5.6%	6.1%	19.4%	-4.4%	-2.8%	-8.0%	11.5%	-7.8%
World GDP - Real (US$ bn)	23,178	23,641	24,185	25,080	25,983	27,048	28,157	28,854	29,806
World GDP change year-on-year	1.8%	2.0%	2.3%	3.7%	3.6%	4.1%	4.1%	2.5%	3.3%
Supply and Demand Variables									
Industrial demand	-2.4%	-2.8%	4.1%	4.3%	4.9%	0.7%	7.8%	-1.2%	8.4%
Photographic demand	-2.2%	-2.7%	-0.1%	1.4%	3.5%	1.9%	3.7%	5.0%	0.7%
Jewelry demand	3.0%	8.9%	22.4%	12.1%	4.0%	11.4%	4.2%	9.5%	4.9%
Scrap supply	5.1%	4.5%	0.2%	2.3%	7.2%	-2.8%	6.9%	14.4%	-9.7%

Sources: IMF, World Bank, GFMS

3. Investment

- Net implied disinvestment increased in 1999 by 62% to 79.5 Moz (2,473 t).
- Indications that some sales took place in the fourth quarter of 1999 and, to a greater extent, the first quarter of 2000, out of physical positions established in late 1997/early 1998.

Overview

Net disinvestment from private sector sources totalled 79.5 Moz (2,473 t) in 1999. Although this represented a 62% increase over the previous year's figure, as Table 1 shows, it was still considerably lower than the level of disinvestment recorded annually from 1992 to 1997. In part, this was a consequence of the shake-out from more loosely held inventories that had taken place on higher prices in 1998 - by contrast, the silver price never reached sufficiently attractive heights in 1999 to stimulate additional investor sales. The lower level of disinvestment in 1999 may also have indicated that most near-market bullion stocks were still being tightly held through most of the year. This appears to be confirmed by the fact that identifiable private sector holdings in European Dealers' vaults and Comex warehouses increased last year. Nevertheless, to the extent that existing stockholders start to become impatient with the relatively lackluster performance of the silver price, 2000 could see some increase in private sector disinvestment.

Certainly the mood among investors has become less positive than it was in early 1999. After February, when silver reached its high for the year of $5.79, the price moved lower, dipping below the $5.00 mark in early April. This left some investors feeling disillusioned about silver's price prospects, which in turn may help to explain why subsequent rallies in the price seemed to be somewhat half-hearted. Whatever the case, for most of the year funds were trading silver in a relatively narrow range. No large bets were made and investors concentrated on following short-term trends in the price. To some extent this was because the perception was widespread that silver would remain range-bound until the holders of large positions (chiefly but not exclusively Mr Buffett) decided to either add to or liquidate their holdings.

There was a brief flurry of interest at the end of September when the silver price was dragged up in sympathy with the dramatic developments in the gold market. The mechanics behind the rise in the silver price were fairly similar, insofar as the rally was fuelled by liquidity drying up, leasing rates soaring and shorts being squeezed out of the market. The spike in the silver price was, however, rather feeble compared to what occurred in gold. Apart from the obvious point that silver was largely reacting to developments in another market, there are several reasons why the price rise was so modest and short-lived. Firstly, unlike gold, most speculators were already long silver at the end of September and thus the short position that had to be covered was relatively small. Secondly, the silver market had nothing like the producer hedging crisis that boosted a mere short covering rally in gold into something a lot bigger. Thirdly, investors had to contend with the fact that the private sector stocks arguably overhanging the silver market were not subject to any sales quota similar to the European central banks' agreement.

The growing realization that existing large holders of silver bullion stocks could not be relied upon to sit tight forever in the face of higher (or even lower) prices was an important reason behind the downgrading of investors' price expectations last year. And, the recognition that what were once perceived to be tightly held stocks might come into play under the right circumstances undoubtedly grew in the first quarter of 2000. Along with the pressure on the market from Chinese bullion sales, this probably explains the very muted response of the silver price (a high of $5.45) to the rally in gold during February 2000. Indeed, rumors began to emerge in the following month that Warren Buffett had started to sell some of his 129.7 Moz (4,034 t) silver hoard - some commentators in early April were even suggesting that 50% of this position had been liquidated. Our information is that this was almost certainly <u>not</u> the

Silver Price and Investment Indicators

	1998 Average	1999 Average	Change y-o-y
Silver Price	5.544	5.220	-6%
Contango (3-mth annualized)	0.64%	1.54%	n/a
US$ Libor (3-mth annualized)	5.56%	5.41%	n/a
S&P 500 Index	1,085	1,327	22%
CRB Index	213	195	-9%
XAU Index	73	66	-9%
World Inflation	5.8%	5.2%	n/a
World GDP	2.5%	3.3%	n/a

London Bullion Market (LBM) and Comex Turnover
(daily averages)

	LBM No. of Transfers	Comex Turnover Moz	Turnover Moz	LBM/ Comex Ratio
Jan-99	420	214	83	2.6:1
Feb	514	277	145	1.9:1
Mar	448	189	77	2.4:1
Apr	423	198	101	2.0:1
May	454	189	69	2.8:1
Jun	400	161	85	1.9:1
Jul	387	191	69	2.8:1
Aug	413	196	96	2.0:1
Sep	371	176	78	2.3:1
Oct	407	182	76	2.4:1
Nov	322	126	86	1.5:1
Dec	300	120	38	3.1:1
Jan-00	329	149	68	2.2:1
Feb	344	173	106	1.6:1
Mar	288	134	50	2.7:1
Apr	277	107	84	1.3:1

World's 10 Largest Commodity Trading Advisors, 1999*

	CTA Assets (US$ billion)
John W Henry & Co	2.2
Astmax Co Ltd	1.9
Allied Irish Capital Management	1.4
Campbell & Co	1.4
Chesapeake Capital	1.3
Quantitative Financial	1.0
Willowbridge Associates	0.9
Dunn Capital Management	0.9
Millburn Ridgefield Corp	0.8
FX Concepts	0.6

*Source: MAR/Hedge (does not include CTAs which report on a confidential basis)

World's 10 Largest Hedge Funds, 1999*

	Fund Equity (US$ billion)
Soros Fund Management	12.4
Moore Capital Management	9.0
Zweig-Dimenna Associates	5.5
Tiger Management	4.0
Maverick Capital	3.8
Kingdon Capital Management	2.7
Marshall Wace Asset Management	2.3
CDC Investment Management	2.2
Perry Corp	2.1
Spectrum Asset Management	2.0

*Source: MAR/Hedge (does not include Funds which report on a confidential basis)

case. Given other supply pressures at the time, it seems improbable that the market could have absorbed such large investor sales without the silver price moving lower than it did ($4.94 in late March). Furthermore, even though silver bullion stocks were undoubtedly on the move in the first quarter of 2000, much of this would have reflected the London-New York arbitrage and new lending on higher lease rates that is covered in greater detail in Chapter 5. This is not to say that there may not have been sales by disillusioned silver bulls both in the fourth quarter of 1999 and, probably, to a greater extent in the first quarter of this year. Our view, however, is that it is more likely that these sales came from investors other than Mr Buffett. In *World Silver Survey 1999* we stated that, in addition to Berkshire Hathaway's purchases, another 50 to 80 Moz (1,560 to 2,490 t) was being physically held by other large investors at the end of 1998. It is possible that there was some decline in these positions towards the end of 1999, and particularly in early 2000.

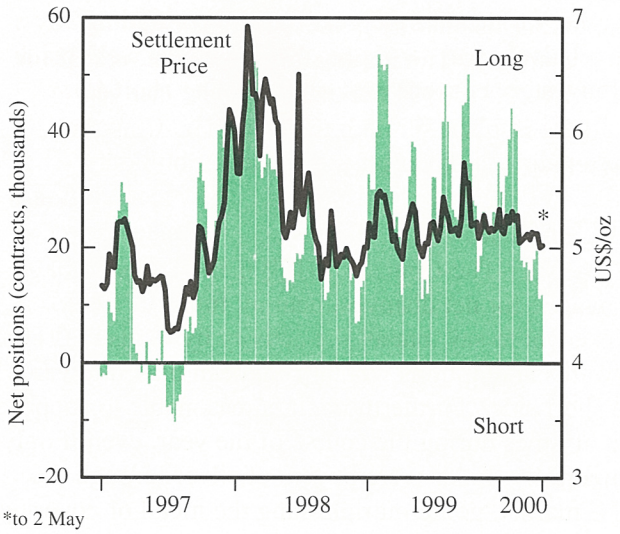
Comex

At 16,630 contracts, average daily futures volume on Comex was marginally higher in 1999 than it had been the previous year. Overall open interest, on the other hand, tended to be down a little last year. Curiously, however, fund open interest (as measured by the CFTC data on non-commercial net open

Figure 10

Comex: Non-commercial Net Open Interest

Weekly Net Positions and Settlement Price

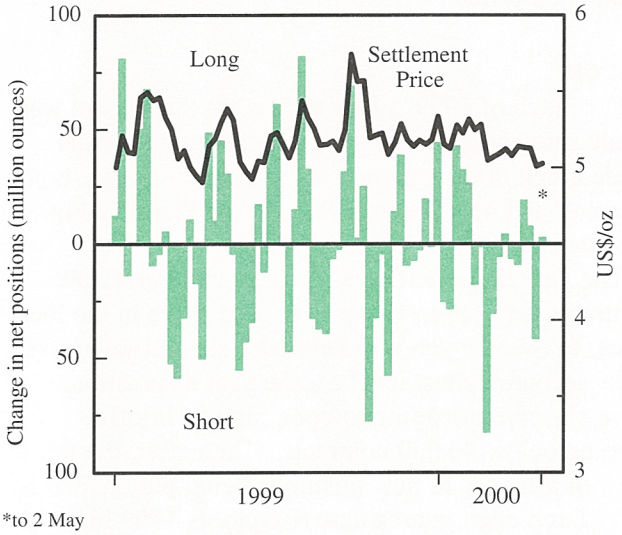


*to 2 May

Figure 11

Comex: Non-commercial Net Open Interest

Changes in Weekly Net Positions



*to 2 May

interest, which is the best proxy available) was, generally, higher than it had been in 1998. Indeed, according to the published official data, the average net long position of funds on the exchange rose to 30,153 contracts in 1999 from 25,513 contracts the year before. Similarly, comparing the two year-ends shows a rise in net long positions from end-December 1998 of nearly 11,800 contracts to a level of 26,035 contracts at end-December 1999. Even though the data on non-commercial open interest is not an entirely reliable measure of fund positions, it does suggest that, on the Comex at least, there was, if anything, a tendency towards investment rather than disinvestment in silver last year. (And, the fact that Comex silver inventories were little changed year-on-year - see Chapter 5 - also hardly points to large scale disinvestment). The implication, therefore, is that the 79.5 Moz (2,472 t) of net disinvestment last year mostly took place through the Over-The-Counter market and via direct physical sales of bullion.

OTC Market

The Over-The-Counter (OTC) market was probably an avenue for net disinvestment by funds in 1999. This is not to say that all the activity by funds in OTC forwards and options would have been biased towards the short side. Furthermore, it is reasonable to suppose that at times during the course of the year, even if only temporarily, funds were buyers of silver through the OTC market, going outright long the metal or covering short positions. Nevertheless, particularly towards the end of the year, and, in the first quarter of 2000, the likelihood is that some of the sales out of stocks referred to earlier in this chapter would have been made using OTC instruments.

As mentioned above, rumors surfaced in late March and early April 2000 of sales by Mr Buffett and others. Our view is that these rumors were not without foundation but that they were exaggerated with, in addition, it unlikely on balance, that Berkshire Hathaway made any significant disposals. It is probable, however, that there were some sales out of the other 50-80 Moz (1,560 to 2,490 t) of core long positions that had been purchased on the coat tails of the Buffett move in late 1997/early 1998.

Similarly, our view is that much of the commentary last year on the activities of the prominent silver "bear" Martin Armstrong was exaggerated. Although Mr Armstrong was by all accounts an aggressive short seller of silver, the size of his fund's exposure, certainly by the time of his being charged with fraud in September 1999, was not as great as some at the time alleged (i.e. several billion dollars worth of gold and silver). A simple "reality check" against such claims is to observe what did not happen to the silver price following the collapse of Mr Armstrong's business (a stellar rise as the alleged positions were closed-out!).

Caution is also required when it comes to assessing rumors of Tiger Management's silver exposure which were doing the rounds in the wake of Julian Robertson's decision to wind down his fund. It is quite likely that, if Tiger had any position in silver (which is by no means certain), it would have been closed-out prior to any fundamental change in strategy being announced. The same observation applies to John W. Henry & Company's decision to exit the silver market, which was publicized in February 2000 (although here it may be reasonable to assume that prior to this date Mr Henry's fund was tending to trade silver from the long side). In any case, the exit of such a well-known player from the market lends weight to the argument that fund commitment to silver (particularly through the OTC market) had definitely declined in early 2000 compared to the situation the year before.

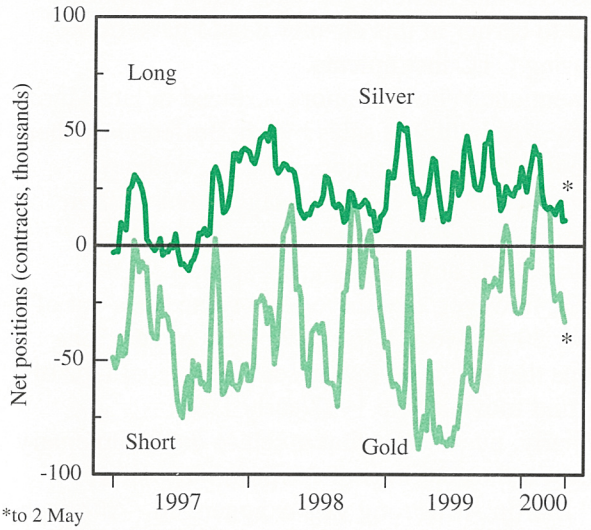
Physical Investment

Physical investment or disinvestment of silver at a retail level tends to be dominated by developments in the United States; as in Europe, and indeed, most of the rest of the world, gold has been the traditional

Figure 12

Comex: Non-commercial New Open Interest

Weekly Net Positions



precious metals investment of choice. In 1999 it was therefore no surprise that the decline in sales back to the market from US small investors was the most significant development on the retail investment front. Indeed, throughout the year there were strong purchases of US Eagle coins by retail investors (see Chapter 7), which spilled over into healthy demand for 90% coin bags. Similarly, at times, there was good buying interest for 100 oz bars. Many of these purchases of bars and coins were from individuals concerned about the perceived "Y2K" computer problem. And, although since the second half of 1999, demand for physical bullion has weakened, the market has held up very well compared to gold where small investors have sold back bullion products to dealers in the first few months of 2000. Thus, notwithstanding the slight downtrend in new purchases of physical silver by small investors, any overall net disinvestment in 1999 as a whole is likely to have been quite modest. Certainly, the amount of metal returned to the market would have fallen far short of the 10 Moz (310 t) that we estimated was disinvested on a net basis in 1998. Not only did the price never move high enough in 1999 to tease out private holdings of coins and bars but it must be assumed that after the previous year's heavy disinvestment there was simply less loosely held material available for sale.

LME Silver Contract

The London Metal Exchange (LME) launched its new 5,000 oz futures and options contracts on 10th May 1999. However, turnover in the first calendar year to end-December 1999 was so low (only 1,733 lots were traded) that it is questionable whether the contract in its present form will develop much of a following, in spite of it providing scope for users to trade metal in granulated form.

Tocom

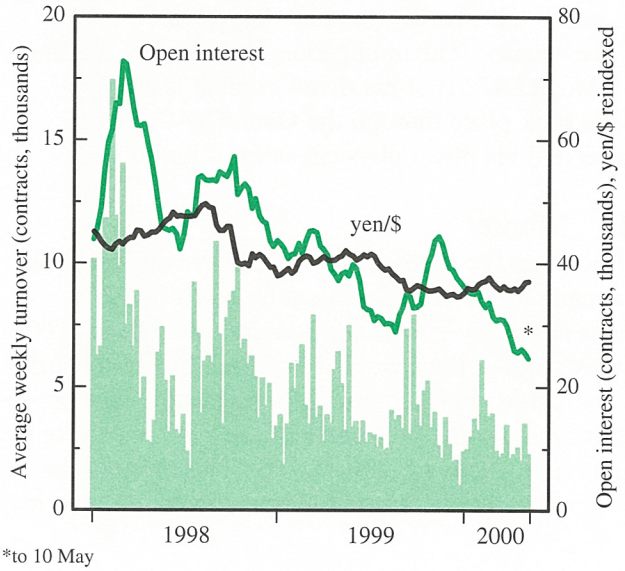
For much of 1999, silver trading on the Tocom was a side show as gold and the platinum group metals made much of the running. As Figure 13 shows, both turnover and open interest fell sharply from the highs recorded in 1998.

The year began with open interest at over 42,000 contracts yet with turnover low. The spike in the local price, to over 20 yen/g in February, saw turnover rise to its second highest level for the year as positions were closed-out leading to open interest briefly dipping below 40,000 contracts. Thereafter, the fall in the yen price led to new positions being put on, and by 18th March open interest had risen to its 1999 high of 45,485 contracts. From then it moved down steadily, hitting its 1999 low of 28,453 contracts on 26th August.

Turnover peaked at the end of September, recording over 13,800 contracts on the 28th, spurred on by the spike in the gold price. Open interest also rose strongly at the time. However, the boost to turnover was short-lived, and it quickly fell back to well below the 10,000 contracts per day level. Although open interest rose steadily into November, towards the end of the year there was active closing out of positions, which led to it falling below 37,000 contracts on 28th December.

Figure 13

Tocom Futures Turnover and Open Interest



4. Mine Supply

- World mine production of silver was virtually unchanged last year, declining by a barely noticeable 1 Moz (31 t) to reach 546.8 Moz (17,007 t).
- Primary silver's share of total production dropped back to 23%, generating 124.5 Moz (3,872 t). Much of the decline was due to lower output from North America's primary silver mines.
- Weighted average cash production costs increased 5% to $3.18/oz.
- Net outstanding silver producer hedging positions declined by 10.8 Moz (335 t).

Top 20 Silver Producing Countries in 1999

Ranking 1999	Ranking 1998		Output (Moz) 1998	Output (Moz) 1999
1	1	Mexico	91.6	75.2
2	3	Peru	65.1	71.3
3	2	United States	66.2	62.9
4	4	Australia	47.2	55.3
5	6	Chile	43.1	44.8
6	7	CIS	40.9	44.3
7	5	China	43.4	44.2
8	8	Canada	36.4	37.5
9	9	Poland	36.0	35.8
10	10	Bolivia	13.1	12.3
11	13	Sweden	8.6	8.9
12	12	Morocco	9.8	8.7
13	11	Indonesia	10.0	8.6
14	14	South Africa	5.1	4.8
15	16	Turkey	2.8	3.5
16	17	Argentina	2.2	3.3
17	15	Japan	3.0	3.0
18	20	India	1.7	1.9
19	19	Papua New Guinea	1.9	1.9
20	21	Honduras	1.5	1.6

Top 20 Silver Producing Companies in 1999

Ranking 99	Ranking 98	Company Name	Country	Output (Moz) 1998	Output (Moz) 1999
1	1	Industrias Peñoles SA	Mexico	39.7	42.1
2	2	KGHM Polska Miedz	Poland	35.3	35.1
3	3	BHP Minerals	Australia	18.1	25.4
4	5	Grupo Mexico	Mexico	16.1	20.1
5	4	Rio Tinto plc	UK	16.2	16.0
6	8	Homestake Mining	USA	11.7	13.1
7	6	Cominco Ltd.	Canada	13.3	12.0
8	7	MIM Holdings Ltd.	Australia	12.5	11.9
9	9	Noranda Inc.	Canada	11.3	11.7
10	10	Cia. de Minas Buenaventura	Peru	11.2	11.4
11	12	Placer Dome Inc.	Canada	10.4	10.8
12	20	Codelco	Chile	7.3	10.4
13	11	Coeur d'Alene Mines Corp.	USA	10.7	9.6
14	13	TVX Gold Inc.	Canada	9.9	8.7
15	15	Boliden AB	Sweden	8.2	8.5
16	14	Echo Bay Mines Ltd.	USA	9.4	8.4
17	17	ONA Group	Morocco	7.7	7.7*
18	21	Hecla Mining Company	USA	7.2	7.6
19	18	Asarco Inc.	USA	7.5	7.5*
20	22	Minas de Arcata	Peru	6.0	6.2

*estimate

Silver Mine Production

- Despite a dramatic 18% decline in Mexico's output, it was still the world's top producing country.
- Further growth in Peru's production and lower output in the United States saw Peru move into second place among top silver mining countries.
- Industrias Peñoles reaffirmed its position as the world's leading silver producer.

Contrary to expectations of significant growth in world mine production of silver in 1999, output was virtually unchanged last year. This surprising outcome was largely the result of lower production in two major producing countries, namely Mexico (down 16.4 Moz/ 510 t) and the United States (down 3.3 Moz/104 t). These and other declines fully cancelled out the strong growth generated in countries such as Peru, Australia and the Central Asian Republics.

Last year's flat output follows after four years of consistent growth in world silver production (output increased by an average 5% per year from 1995 to 1998). But rather than signalling a levelling-off in mine production, the absence of growth last year should be interpreted in the light of the highly unusual circumstances which prevailed in the Mexican silver mining industry (discussed on page 19). Had the world's biggest producer maintained its production levels, or reported an increase, global output would have expanded once again last year.

There was very little change in the ranking of the top silver producing companies. Despite the problems experienced by Industrias Peñoles at their processing facility, silver output from their own mines still increased, and with total production of more than 42 Moz (1,310 t) Peñoles reaffirmed its position as the world's leading producer of silver.

Poland's KGHM Polska Miedz remained firmly in second position, despite a marginal decline in the silver produced as by-product of their copper mining. BHP Minerals, in third position for the second

Table 2
World Silver Mine Production
Million ounces

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Poland	26.7	28.9	25.7	29.4	27.6	31.6	30.6	33.8	36.0	35.8
Sweden	7.2	8.2	9.1	8.9	8.1	8.0	7.7	8.5	8.6	8.9
Greece	2.0	2.3	2.0	1.9	1.4	1.4	0.5	1.2	2.1	1.4
Romania	1.9	1.6	1.5	1.5	1.4	1.4	1.4	1.4	1.2	1.4
Spain	7.4	7.5	7.5	5.9	5.7	4.0	3.3	2.1	0.8	1.4
Finland	0.9	1.0	0.9	0.9	0.8	0.9	1.1	1.0	1.0	1.0
Serbia	3.4	3.0	2.6	0.8	0.9	1.0	1.1	1.2	1.1	0.9
Portugal	1.4	1.4	1.2	1.2	1.0	1.2	1.1	1.1	1.0	0.9
Bulgaria	3.4	1.9	2.7	3.1	1.8	1.4	1.1	1.0	0.8	0.7
Ireland	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.3	0.5
Czech & Slovak Republics	0.8	0.9	0.6	0.5	0.4	0.3	0.2	0.3	0.3	0.3
Italy	0.5	0.5	0.4	0.2	0.5	0.5	0.3	0.1	0.1	0.1
Norway	0.3	0.3	0.4	0.2	0.2	0.2	0.1	0.1	0.1	0.1
France	0.7	0.9	0.4	0.4	0.1	0.1	0.1	0.1	0.0	0.0
Other	0.7	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Total Europe	57.6	58.8	55.4	55.3	50.5	52.6	49.2	52.3	53.5	53.3
North America										
Mexico	78.9	73.4	67.4	71.2	71.2	72.6	81.3	86.9	91.6	75.2
United States	68.3	59.4	58.0	52.9	47.6	50.2	50.5	70.1	66.2	62.9
Canada	44.4	40.6	37.6	28.3	23.8	40.0	39.9	39.0	36.4	37.5
Total North America	191.6	173.4	163.0	152.3	142.6	162.8	171.7	195.9	194.2	175.6
Central & South America										
Peru	62.0	67.1	53.6	53.7	56.0	61.4	63.3	66.8	65.1	71.3
Chile	21.1	21.8	33.0	31.2	31.6	33.5	36.8	35.1	43.1	44.8
Bolivia	11.5	12.1	10.2	10.7	11.3	13.8	12.3	12.4	13.1	12.3
Argentina	2.7	2.3	1.5	1.4	1.2	1.2	1.0	1.1	2.2	3.3
Honduras	1.0	1.4	1.1	0.8	0.9	1.0	1.2	1.5	1.5	1.6
Brazil	1.1	1.0	0.7	0.7	0.6	0.5	0.4	0.3	0.3	0.3
Dominican Republic	0.7	0.7	0.4	0.5	0.3	0.7	0.5	0.4	0.2	0.2
Other	0.3	0.4	0.5	0.5	1.3	0.3	0.3	0.3	0.3	0.3
Total Central & South America	100.4	106.6	101.0	99.5	103.1	112.3	115.9	117.8	125.9	133.9
Asia										
Indonesia	2.1	2.5	3.2	2.9	3.1	7.7	7.7	8.5	10.0	8.6
Turkey	0.9	1.3	2.5	2.3	2.1	2.1	2.9	2.9	2.8	3.5
Japan	4.8	5.5	5.5	4.4	4.3	3.2	2.9	2.8	3.0	3.0
Papua New Guinea	3.4	4.0	3.1	3.1	2.5	2.1	1.9	1.6	1.9	1.9
India	1.1	1.1	0.8	1.6	1.6	1.2	1.1	1.6	1.7	1.9
Philippines	1.4	1.1	0.9	1.1	1.0	1.1	0.8	0.6	0.6	0.6
Saudi Arabia	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.3
Thailand	0.5	0.5	0.2	0.1	0.1	0.2	0.2	0.1	0.1	0.2
Malaysia	0.4	0.4	0.5	0.5	0.4	0.4	0.3	0.3	0.2	0.1
Other	2.2	2.0	2.4	2.0	2.5	2.6	2.5	2.6	2.8	2.8
Total Asia	17.4	18.9	19.6	18.4	18.3	21.1	20.9	21.5	23.6	23.0
Africa										
Morocco	5.9	6.6	4.9	7.6	8.3	6.6	6.4	8.4	9.8	8.7
South Africa	5.1	5.5	5.9	6.3	6.2	5.7	5.5	5.2	5.1	4.8
Zambia	0.6	0.5	0.6	0.6	0.4	0.3	0.3	0.2	0.2	0.2
Zimbabwe	0.7	0.6	0.5	0.4	0.4	0.4	0.3	0.3	0.2	0.2
Namibia	3.0	3.0	2.9	2.3	2.0	2.1	1.4	1.2	0.4	0.0
Dem. Republic of Congo	2.7	1.9	1.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.3	0.4	0.4	0.3	0.3	0.3	0.4	0.3	0.3	0.4
Total Africa	18.3	18.4	16.0	17.9	17.5	15.4	14.2	15.7	16.1	14.2
Oceania										
Australia	37.7	37.9	39.2	37.0	33.6	29.6	32.5	35.6	47.2	55.3
New Zealand	0.3	0.4	0.7	0.8	0.8	1.0	1.0	1.0	0.8	0.9
Fiji	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Total Oceania	38.0	38.3	39.9	37.9	34.4	30.6	33.5	36.7	48.1	56.3
Western World Total	423.3	414.5	394.9	381.4	366.4	394.7	405.5	440.0	461.4	456.2

Table 2
World Silver Mine Production
Million ounces

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Other Countries										
Soviet Union/CIS	69.9	64.7	58.9	54.3	49.3	47.6	43.6	41.4	40.9	44.3
China	28.8	31.4	31.4	31.7	33.8	34.7	36.5	43.0	43.4	44.2
Mongolia	0.9	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.1	1.1
North Korea	1.6	1.6	1.7	1.8	1.7	1.7	1.3	1.2	1.0	0.9
Total Other Countries	101.2	98.4	92.7	88.7	85.6	85.0	82.3	86.6	86.5	90.5
World Total	524.5	512.8	487.6	470.0	452.0	479.7	487.8	526.6	547.8	546.8

consecutive year, produced 25.4 Moz (790 t) from a single operation, the new Cannington lead-zinc-silver mine in Queensland. Cannington was the biggest silver-producing operation in the world last year. Another Mexican miner, Grupo Mexico, increased its attributable production substantially with the successful acquisition towards the end of the year of Asarco and, with it, a stake in the Southern Peru Copper Corporation, which also produces silver.

Last year 77% of silver was produced at non-silver mines, as the share of primary mines fell back to 23% due to lower output from the primary silver producers of North America. Several primary mines in Mexico and the United States scaled down production or closed altogether during the year. On the other hand, lead-zinc and gold mines increased their output of silver by-product, contributing 40% and 13% of the total, respectively. Our by-product silver production analysis is set out in pages 24 to 25.

North America

Mexico, the United States and Canada generate almost one-third of global silver production. Last year, the region's combined output fell by a substantial 10%, to 175.6 Moz (5,462 t). Most of the decline was due to lower output in **Mexico**, the world's biggest producer of silver.

One company dominates the local silver mining scene: Industrias Peñoles produced 56% of the country's output last year. Yet Peñoles was in the news not because of its stellar production results, but rather because of the problems experienced at its major refinery and smelter, the Met-Mex processing facility at Torreon. The Torreon complex, the largest of its kind in Latin America, produces lead, zinc, silver, gold, cadmium and bismuth from material produced at Peñoles' own mines as well as at several other Mexican operations. The plant was temporarily shut down in May last year following a sulphur dioxide and lead pollution scare, and then functioned at partial capacity for the remainder of the year while a clean-up operation was completed and emission levels were being monitored. While restrictions on the lead and bismuth smelter were in place, Peñoles resorted to buying material on the international market which it could process through the refinery without having to use the smelter. As a result, it was unable to accept concentrates from the many, often small, local producers that used to have their material processed at Torreon. These miners had little access to alternative processing facilities and, as a result, were forced to stockpile their output or, in many cases, cease operations altogether. The impact was sharply felt in the 18% decline in Mexico's silver output, to 75.2 Moz (2,339 t) after six years of growth.

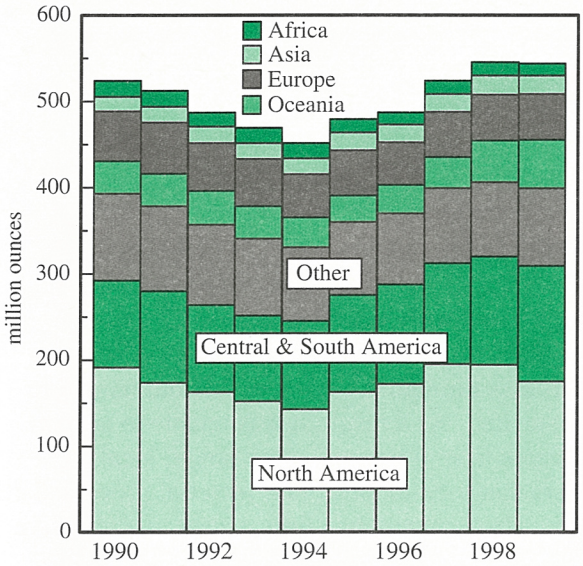
The closure of Corporativos Frisco's large Real de Angeles primary silver mine due to exhaustion of economic reserves at the end of 1998 contributed further to the drop in Mexican silver production. But indications are that the country's output will recover substantially this year, with Torreon running at full capacity once again.

In the **United States,** silver production fell last year by 5% to 62.9 Moz (1,956 t). Primary mines, which generate more than half of the country's silver, produced 7% less than the previous year. While the Lucky Friday, Galena and Greens Creek mines reported modest increases, two primary operations closed, Delamar at the end of 1998 and Candelaria in February, and two others, Rochester and Sunshine, recorded lower production.

By-product silver also declined, though by only 3% to 28.9 Moz (899 t). Silver from gold operations fell to 13.8 Moz (428 t), just over one-fifth of the total, with both the McCoy-Cove and Denton-Rawhide mines reporting reduced amounts. The Ken Snyder gold-silver operation started up at the end of 1998 but experienced lower grades than expected in the first half of 1999, resulting in less silver than planned. Changes are in hand which should boost output this year.

Copper mining provided almost 2 Moz less silver at 8.8 Moz (274 t), 14% of the US total. Kennecott's

Figure 14
World Silver Mine Production



Bingham Canyon mine suffered lower grades and silver production was almost 9% below the previous year's level, at 3.9 Moz (120 t).

Only silver by-product from lead-zinc mining increased, by over 20% to 6.3 Moz (196 t), mainly as a result of record zinc production at Cominco's Red Dog mine in Alaska.

Canada produced 37.5 Moz (1,166 t) of silver last year, a 3% increase. All the silver was produced as by-product, with the largest share (41%) derived from gold mining. Equal amounts (27%) came from copper operations and from lead-zinc, with the remaining 5% emanating from other mining, predominantly nickel.

The amount of silver produced from gold mines increased noticeably in 1999, mainly due to a rise in output from Homestake's Eskay Creek mine, where over 13 Moz (408 t) of silver was recovered compared with 11.7 Moz (364 t) the previous year. Silver obtained from copper operations fell 13%, largely due to the four months' suspension at Cominco's Highland Valley copper mine mid-year.

Central and South America

Central and South America represents the second-biggest silver producing region (see Figure 14), and reported a 6% increase in its combined output last year. Most of the region's silver is produced at lead-zinc mines, though last year's growth was mainly the result of increased silver by-product from a number of gold mines (the gold mines of Latin America often contain high grades of silver as well).

Peru experienced a 10% surge in silver production to 71.3 Moz (2,217 t). Almost all of the growth occurred at gold mines, which increased their silver output by 3.7 Moz (116 t) and now generate 8% of the country's silver (versus 3% up until 1998). Three gold mines, in particular, contributed to this: Barrick's new Pierina mine produced 2.3 Moz (71 t) of silver in its first full year of operations; Hochschild's Ares mine added 1.7 Moz (53 t) and Yanacocha doubled its silver output to 0.8 Moz (26 t).

As was reported in last year's *Survey*, state-owned Centromin, which used to be the leading producer in the country, continued its privatization program with the sale of the 97-year old Paragsha (formerly Cerro de Pasco) lead-zinc mining complex to Volcan Cia. Minera. Volcan has purchased several of Centromin's silver-producing polymetallic mines, and is now among the top silver producers in the country (and the largest zinc producer). Buenaventura, still the leading Peruvian silver producer, increased its attributable production as output at the newly-expanded Uchucchacua mine increased almost 30% to 7.1 Moz (222 t), making it the biggest silver-producing mine in the country in 1999.

In **Chile** silver production also increased, though by a more modest 4%. As in 1998, last year much of Chile's silver was mined from primary deposits - or, more specifically, a single primary deposit. Minera Mantos de Oro continued to extract high-grade silver material from the Chimberos deposit adjacent to their La Coipa gold mine until August, when the deposit was exhausted. This year should see Chilean silver revert to the familiar patter of around 50% being generated by gold mines, and virtually nothing from primary deposits, as silver from gold mines should surge in 2000. Mining has resumed from the gold-silver deposit at La Coipa, and Meridian Gold commenced operations at their El Peñon mine in the Atacama desert, which could produce as much as 3 Moz (93 t) this year. But this new mine pales in comparison with Barrick's new $950 million project on the Chile-Argentina border: Pascua-Lama, expected to commence production in 2003, is planned to produce an average of 36 Moz (1,120 t) per year.

Silver by-product from copper mining has remained remarkably stable during the last four years despite the strong growth in Chilean copper output. Many of the new copper mines use solvent extraction processing technology with very little silver by-product.

Bolivian silver production dropped back more than 6% last year to 12.3 Moz (382 t), which is related to

the very substantial reported drop in the country's lead production (lead-zinc mines produce 94% of Bolivia's silver). The Kori Kollo gold mine, which generates the remainder of the country's silver, also reported markedly lower silver grades and output last year.

Further south, **Argentina** experienced another surge in its silver output, which had doubled in 1998. Last year production was 48% higher as the Bajo de la Alumbrera copper-gold mine and Cerro Vanguardia gold-silver mine added their output to silver by-product from the Aguilar lead-zinc mine, for a total of 3.3 Moz (103 t). The only other significant silver producer in the region, **Honduras**, witnessed a 7% increase in output due to higher by-product production at Breakwater Resources' El Mochito lead-zinc mine.

Europe

The European continent contributed 10% of the world total last year (see Figure 14). Production remained fairly steady in 1999. In **Poland**, the largest producer on the continent, silver output declined marginally to 35.8 Moz (1,115 t) largely due to grade fluctuations at the copper deposits mined by KGHM Polska Miedz. KGHM generates 98% of the country's silver at its copper mines.

The next-biggest European silver producer, **Sweden**, generates only around one-quarter as much silver as Poland. Output increased for the third consecutive year, by almost 3% to reach 8.9 Moz (275 t), due to higher output at several of the polymetallic and base metals mines operated by Boliden and North Ltd. In **Spain**, output appears to have recovered in 1999 following six years of reported decline. Much of the recovery was related to the re-opening of Boliden's Los Frailes zinc operation. Mining operations at Los Frailes were halted in April 1998 after a tailings dam had failed, but were resumed in April last year, and the mine plans to produce 2.9 Moz (90 t) of silver by-product this year. Higher output from two other base metals operations, Aguas Tenidas and Filon Sur, contributed further to the increase.

CIS

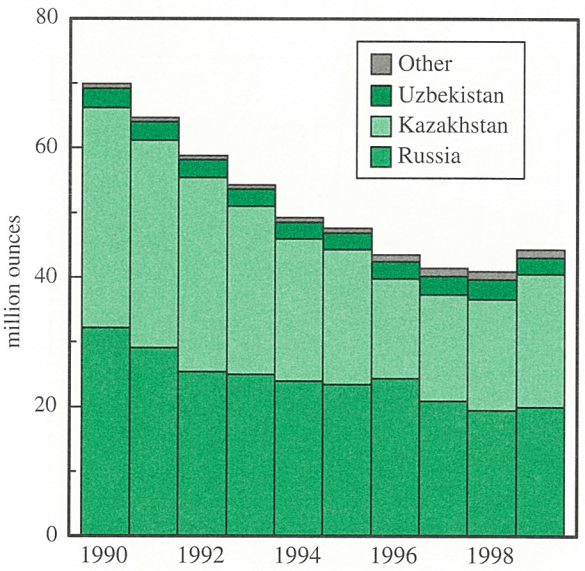
Silver mine production in the countries collectively known as the Commonwealth of Independent States (CIS) increased by 8% last year, to 44.3 Moz (1,378 t). More than half of this region's silver is produced as a by-product of lead-zinc mining, while a further quarter is extracted from gold mines.

Although actual silver production levels in **Russia** remain a state secret, anecdotal information suggests that output increased marginally last year on the back of higher lead-zinc and gold production (see Figure 15). Though 2% higher than 1998, at 19.9 Moz (620 t), production is still well below levels reported until 1997, when mining at the enormous primary silver mine Dukat was suspended and negotiations to find a new owner and operator for this 256 Moz (7,962 t) deposit commenced. The mining license for Dukat was eventually awarded to ZAO Serebro-Dukat, 70% owned by Pan American Silver Corp from Canada with local partner Geometall. Serebro-Dukat also won a presidential decree to export the Dukat concentrates, and secured the participation of the International Finance Corporation in the redevelopment of the mine. However, in a surprise move, Moscow-based Kaskol group made a successful bid at a public auction held in November for a number of strategic assets from the bankrupt Dukat operating company, including the Omsukchansk processing facility. Kaskol soon began to exert claim over the entire silver property.

A frustrating stalemate situation has now developed. Without the Dukat mining license, the mill is of little use; on the other hand, without the mill, the mine could only be re-started with substantial additional investment. Pan American initially indicated that it would commission a study into construction of a new mill, but is now reviewing that idea. At the time of writing it was unclear how this situation would be resolved, and uncertain whether or when the Dukat re-development project would proceed.

Figure 15

CIS Silver Mine Production



Last year, silver production in **Kazakhstan** made a strong recovery, increasing by a reported 20%. During the Soviet era Kazakhstan used to be the Union's largest producer of silver (see Figure 15), but the weakness in the local base metals industries saw silver output drop off sharply in the mid-1990s. Last year's growth back up to 20.6 Moz (640 t) seemed to suggest that the local mining industry was starting to see the benefit of the renewed investment and upgrading of facilities and technology by local and international operators which has been taking place in the country.

Reliable information on silver production is hard to come by throughout Central Asia. In the case of **Uzbekistan**, production levels are never publicly confirmed, and contradictory statements from various parties make accurate assessment of developments very difficult. The majority of evidence seems to suggest though that production declined last year, due to lower silver output at the Almalyk copper complex, which generates up to 90% of the country's silver. Uzbek silver output is estimated to have dropped 15% to 2.6 Moz (82 t).

China

Chinese silver mine production is estimated to have grown by just under 2% to 44.2 Moz (1,375 t) in 1999. The country generates 8% of global silver mine output.

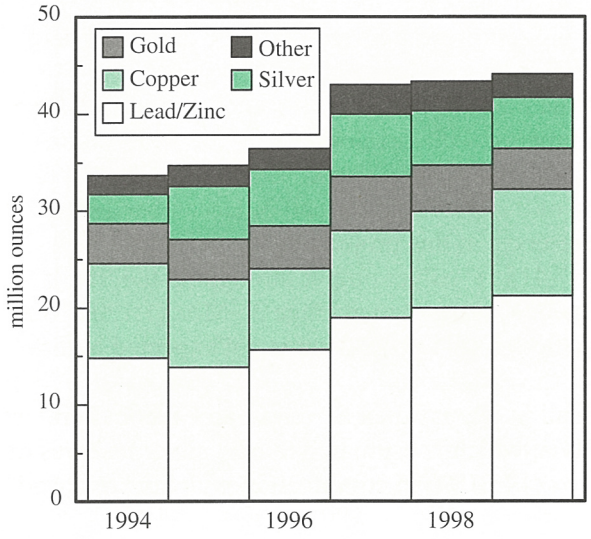
It is important to highlight the fact that the time-series for silver mine production has been revised upwards on the basis of new data. The dearth of good information on China over the past decade has made the estimation of silver mine production difficult. However, GFMS's unique access to information on the China market has enabled us to construct, with a relative degree of confidence, a time series on Chinese mine production - a series which suggested that annual production was significantly higher than what had previously been reported by various observers.

The liberalization drive which started at the beginning of 2000 (and which has completely opened up the domestic silver market) has been accompanied by the release of new information on the market. Among other facts, the actual levels of Chinese silver mine production have been announced in public and reported by various sources. These statements confirmed that annual Chinese silver mine production was high - indeed, even higher than we had been suggesting. We have therefore adjusted our historic series upwards since last year's *World Silver Survey* to allow for this. As can be seen from Figure 16, this information has also been used to revise the series showing silver production by source metal.

Figure 16

Chinese Silver Mine Production

By source metal



Oceania

Australia's silver output came almost entirely from lead/zinc mines in 1999, with less than 2% being derived from copper and gold operations. There was a 17% increase in mine supply to total 55.3 Moz (1,720 t), almost half of which was produced from one source, BHP's Cannington lead-zinc-silver mine, where zinc and silver vied for the role of prime revenue earner. Cannington operated at full capacity all year and was the world's largest silver producer, beating Peñoles' Fresnillo mine in Mexico into second place. The mine will be supplying the silver for the medals at the 2000 Olympic and Paralympic Games in Sydney.

An increase in silver by-product from MIM's McArthur River zinc mine was almost balanced by a fall from the Mount Isa copper operation where silver is produced from a lead-zinc deposit, now nearing depletion. Production from the George Fisher lead-zinc-silver deposit should fully replace this material.

The start-up of Pasminco's Century zinc mine at the end of 1999 could result in a further increase in Australia's silver contribution this year. In addition, full operations at WMC's newly-expanded Olympic Dam polymetallic mine are expected to result in a doubling of annual silver output at this operation.

All silver production in **New Zealand** is a by-product of gold mining. Since the closure of Golden Cross at the end of 1997, only two operations recover gold, namely Macraes and Martha Hill. A significant

increase at the latter resulted in a 10% rise in New Zealand's silver output last year to 0.9 Moz (28 t).

Asia

Asia produces only 4% of the world's silver. Output in the region declined by almost 3% last year, to 23 Moz (715 t), largely due to a 14% drop in **Indonesia**. Around 44% of that country's silver is a by-product of copper mining at the Grasberg copper-gold complex, where lower silver grades saw recoverable output fall despite increased production from the fourth concentrator mill expansion. Grasberg produced 3.8 Moz (118 t) of silver last year.

The rest of Indonesia's silver is generated at the country's gold-silver mines, where several problems were experienced last year which affected silver output. Bad weather and disputes with local landowners, as well as regular occupations by illegal miners, plagued Aurora's Mount Muro mine and saw its silver output fall by almost 40% to 2.7 Moz (83 t). Similar problems were experienced at Rio Tinto's Kelian mine, which was recently forced to close due to a blockade by local villagers of the access road to the mine (the situation has subsequently been resolved). Increased production from Gunung Pongkor, Rawas, and Minahasa and additional production from Newcrest's new Gosowong gold mine was insufficient to cancel out these declines.

Turkey reported a strong increase in silver output last year. Much of the growth was the result of what appears to be record production at the country's only primary silver mine, the 100th Anniversary mine operated by Etibank, where output reached 2.8 Moz (88 t) in 1999. Combined with increased output from the copper and lead-zinc mines which also generate silver, this resulted in a 27% surge in Turkey's silver production to 3.5 Moz (110 t), the highest level recorded this decade.

Silver production in **Japan** dropped back very slightly last year, due to lower by-product output from a number of lead-zinc mines; while in **India**, growth of 16% was recorded and record production of 1.9 Moz (60 t) achieved. Again, this appeared to be the result of higher lead-zinc mine output.

In **Papua New Guinea**, a small improvement in gold production had the side-effect of higher silver output, which grew by an estimated 2% to reach 1.9 Moz (59 t). On the other hand, silver production contracted substantially in the **Philippines**, due to the closure of the Sibutad, Maricalum and Longos operations, all of which used to produce silver. Despite increased silver production at the Bulawan and Victoria gold mines, total silver production was left 7% lower than in 1998 at 0.6 Moz (18 t).

Africa

There are only two silver producers of note on the African continent: Morocco and South Africa. More than half of the continent's silver is generated at the Imiter primary silver mine in **Morocco**, operated by Societe Metallurgique d'Imiter (SMI), a subsidiary of the ONA Group. Although there is a serious lack of information about Morocco's output, indications are that Imiter's silver production dropped in 1999, partly due to a two-month stoppage in June and July to raise treating capacity. This could see production increase in 2000. We estimate that Morocco's total output was around 12% lower last year, at 8.7 Moz (270 t).

In **South Africa**, silver production also fell, though by only 6% to 4.8 Moz (148 t). Around 49% of the country's silver is a by-product of lead-zinc mining, while gold mines account for around 29% of the total.

Outlook

For most metals, the outlook for mining depends largely on trends in the price of the metal mined, as this would determine levels of exploration and development of projects and, to an extent, the life of existing operations. But for silver there are more factors to be considered. Future levels of silver mine production depend not only on the outlook for silver, but also the markets for gold, lead, zinc and copper. The prognosis for these markets is discussed in the by-product analysis on pages 24 to 25. Below we will focus on a number of projects currently in various stages of advancement, which could potentially impact on the silver market in the near future.

The biggest project currently on the drawing board is Barrick's Pascua-Lama complex on the Chile-Argentina border. Barrick has recently announced that it will proceed with development of the $950 million gold-silver project, and that construction will start at the end of this year. At the end of December 1999, silver reserves at this project were estimated at 560 Moz (17,418 t). Silver output throughout the life of the project is planned to average 36 Moz (1,120 t) per year, although first production is not expected before 2003 at the earliest.

Second in line is Apex Silver's San Cristobal project in Bolivia, which is estimated to host silver reserves of 470 Moz (14,618 t) in combination with zinc and lead.

The owners have announced planned silver output of 24 Moz (746 t) per year at very low costs for the first five years, starting in 2002 at the earliest. But the feasibility study completed last year estimated that the project would require a capital investment of $413 million. Raising this financing through debt and equity is proving to be difficult in the current market. However, Apex recently announced that they have secured the participation of two multilateral agencies, which should support their financing efforts.

The third big potential future producer is the Dukat primary silver mine in Russia, part-owned by Pan American Silver Corp, and discussed on page 21. Dukat is believed to contain 256 Moz (7,962 t) of silver, and it was planned to produce 16 Moz (498 t) per year from as early as 2001, but the future of this project is currently in the balance. At the very least, the start-up date has been pushed back significantly.

A number of other projects with smaller silver output are slated to commence production in the next three years. On the other hand, the effect of closures should not be underestimated. The last two years witnessed the closure of a number of large silver mines, including Candelaria and Delamar in Canada, Real de Angeles in Mexico and, at the end of 1999, Julcani in Peru. A few other large deposits are fast running out of economic reserves, including Mount Isa, and the McCoy/Cove mine in Nevada.

By-product Analysis

One of the unique features of the silver mining industry is that relatively little of the metal is extracted from primary silver mines: in 1999, 77% of silver was produced as a by-product of the mining of another metal. 40% of silver is generated by lead-zinc mining, while significant volumes are produced in the process of extracting copper and gold. Other mining, including nickel, cobalt and platinum group metals, generates marginal quantities of silver. (A small quantity of silver production remains "unclassified" due to a lack of information about its source).

The biggest change which occurred during 1999 was the declining share of primary silver in the overall portfolio. Primary silver mine output declined by 10.2 Moz (317 t), due to the closure of primary mines such as Real de Angeles, Julcani, Candelaria and Delamar, as well as lower output from some of the large primary mines in the United States. The small decline in silver from copper was partly the result of lower silver by-product produced at Grasberg in Indonesia and Highland Valley in Canada, though these declines were cancelled out to some extent by increased output from the large copper mines of South America.

Silver Output by Source Metal

Million ounces

	1998		1999		
	Output	% of total	Output	% of total	Change y-o-y
Primary	134.7	25%	124.5	23%	-8%
Lead-zinc	212.7	39%	220.7	40%	4%
Copper	125.0	23%	123.0	22%	-2%
Gold	66.7	12%	71.4	13%	7%
Other	5.2	1%	4.6	1%	-12%

Silver-from-gold increased again last year and gold's share of the total expanded to 13%, as a number of large gold mines in the Americas produced substantial volumes of silver along with their gold (Peruvian mines Pierina, Ares and Yanacocha being prime examples). Lead-zinc mines' contribution to the total increased somewhat with the addition of 25.4 Moz (790 t) from Cannington in Australia (which, for purposes of this analysis, has been classified as a lead-zinc mine).

With so much silver being produced as a by-product, it is interesting to note how little correlation there is between trends in the production of the source metals and that of silver. For example, Figure 17 illustrates the explosive growth in copper mine production over the last decade compared to the other source metals. Copper mine production in 1999 was up 40% over 1990, and yet the share of silver produced during copper mining was identical in 1990 and 1999, at 22% (in 1990 this represented 114.4 Moz (3,558 t)).

Part of the explanation for this apparent anomaly is that many of the new copper mines which have been brought into production in recent years make use of extraction technology which does not favor silver; thus more copper has not automatically implied more silver. This has obvious implications for the future: new copper mines should increasingly make use of the relatively cheap solvent extraction technology, so that the future levels of silver output become less and less dependent on trends in copper mining.

But an equally important factor in the divergent trends has been the dramatic decline in primary silver output during most of the 1990s. In the earlier part of the decade, the steep fall in primary silver output (which by 1993 had declined almost 40% since 1990) neutralized much of the effect of higher copper, gold

and zinc production. As the graph shows, since the mid-1990s total silver production has started to follow more closely the trend in gold mining, a reflection of the fact that so many of the large new gold mines commissioned in recent years exploit deposits with a high silver content.

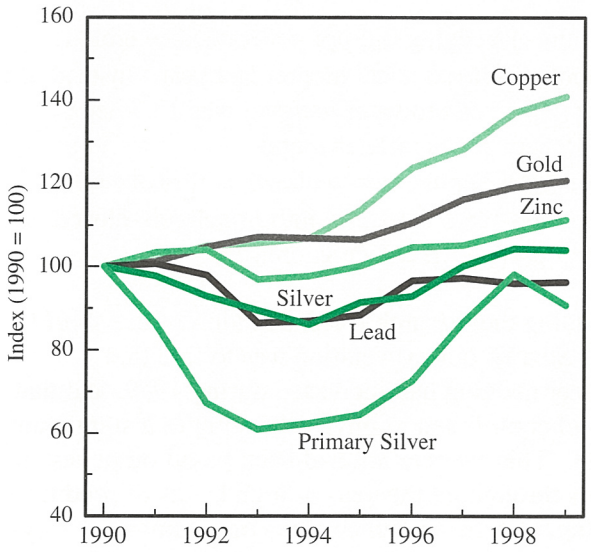
Despite the fact that the correlation between silver and other metals mining is quite loose, silver mining's fortunes are clearly linked to those of the major source metals. The markets for copper, lead, zinc and gold all faced different challenges during last year. The Asian economic crises of 1997 and 1998 affected the demand for and prices of all the source metals in 1998, with the aftermath continuing into the first part of 1999. Nonetheless, each of the markets in question witnessed increasing production last year (see Figure 17).

World **zinc** mine output rose 3% to 7.8 million tonnes while mined **lead** production was roughly flat at almost 3 million tonnes. These two metals are often co-existent in ore deposits, although in recent years lead has come to be considered more as a by-product at many deposits. The price of lead has decreased in real terms partly because of the well-developed secondary (recycling) market, which nowadays provides more than half of total supply, and also due to rising exports from China. Zinc, in contrast, was in deficit in the western world for the fifth consecutive year in 1999, and the market was again heavily reliant on supplies from China and other former Eastern bloc producers.

In coming months, mine supply increases should be balanced by continuing strong economic growth in much of the world and the low level of zinc stocks, and the zinc price is expected to remain robust in 2000. While lead supply is expected to remain in surplus, prices are not expected to fall much further due to improved demand and relatively low stock levels.

Figure 17

Mine Production by Source Metals



Sources: GFMS / ILZSG / WBMS

Average Prices of Source Metals

	1995	1996	1997	1998	1999	Change
Lead ($/t)	631	774	624	528	503	-5%
Zinc ($/t)	1,031	1,025	1,313	1,023	1,077	5%
Copper ($/t)	2,937	2,290	2,276	1,652	1,575	-5%
Gold ($/oz)	384	388	331	294	279	-5%

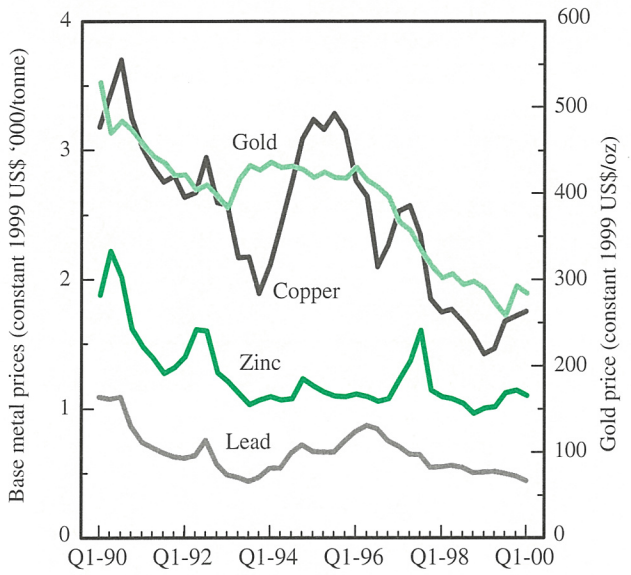
Sources: LME, GFMS

After three years of a market deficit, in 1997 **copper** production started to outweigh demand, resulting in rising stocks and causing prices to halve within two years. Producers responded to the falling prices by closing high cost production and putting several projects and expansions on hold. Despite this, western world mined copper production rose almost 3% last year due to new operations that came on stream or reached full capacity. In Australia, the Olympic Dam expansion started up, as did the Batu Hijau mine in Indonesia, while Los Pelambres in Chile shipped its first concentrates in January this year. All of these have silver by-production. A further contribution to silver output should be made by the Antamina copper-zinc project in Peru, which is expected to start up in the third quarter of 2001 and produce 6 Moz (187 t) of silver by-product annually.

Continued strong economic growth in North America and Europe as well as parts of Asia during the coming year should result in growth in copper consumption. As mine output will increase relatively moderately, the copper market is forecast to move into deficit in 2001 with a beneficial impact on prices, which may encourage some operators to resurrect stalled projects.

Gold production increased again in 1999, although only by just over 1%, despite a further drop in price. Globally, several high cost and depleted gold mines are closing and the number of new projects in the pipeline is declining. Gold deposits vary widely as to their silver content, and therefore future silver output from gold operations will depend on gold production from silver-rich ores such as those found in Chile, Argentina, the United States and Russia. The Pascua-Lama gold-silver mine, discussed on page 23, is of a scale large enough to impact on gold's contribution to total silver output once it starts producing in 2003.

Figure 18
Source Metal Prices (real terms)



Production Costs

- Weighted average production costs were $3.18, up 5% year-on-year.
- No silver producers reported cash costs which were higher than the average spot price in 1999 of $5.22.

The weighted average cash cost calculation for this year's *Survey* was based on costs reported at only 12 operations, generating 87.7 Moz (2,729 t) of silver production. This figure represents only 16% of total output, but within the universe of primary silver mines and co-product silver-gold mines, the sample size is undoubtedly meaningful.

Silver Mine Production Costs

		1998	1999
Cash costs:	highest	$5.34	$5.09
	lowest	$1.90	$1.99
	weighted average	$3.03	$3.18
Average spot price		$5.544	$5.220
% output with costs > spot price		0.0%	0.0%
Sample size (million ounces)		81.3	87.7

Why is the sample size not bigger? Firstly, this is entirely in keeping with the fact that only 23% of the world's silver is produced at mines where silver is the primary metal being extracted. Primary mines are the only ones that would tend to report the costs per ounce of producing silver. But not all of them do: it is almost impossible to obtain information about production costs - at least in a format which makes comparison possible - at primary mines in China, Morocco, Turkey and the CIS. Secondly, very few gold-silver mines report their costs in a way which makes possible the calculation of costs on a silver-equivalent basis. As for the polymetallic and base metals mines that produce silver, most of these would analyze and report their production costs on the basis of the primary metal(s) being mined.

Returning to the sample size analyzed above and what it indicates, it is significant that average reported cash costs of producing silver increased by 5%, in a year that saw the average price fall 6%. With expenditure increasing and revenues declining, producers saw their cash margins eroded by 20%. Thus most silver miners faced substantially tougher financial and operating conditions last year, a situation which is bound to impact on future output.

The lowest cash costs in 1999 were reported at the Greens Creek silver-gold-lead-zinc mine in Alaska, jointly owned by Kennecott Minerals, a subsidiary of Rio Tinto (70.3%) and Hecla Mining (29.7%). Silver output at Greens Creek increased by 8% last year to reach 10.3 Moz (319 t), which contributed to the 30% decline in its reported cash costs. The mine benefited from the ongoing implementation of productivity improvements and output consistently exceeded design capacity.

Low costs were once again reported at Peñoles' Fresnillo mine, while Eskay Creek also seems to have achieved sub-$3 costs on a silver equivalent basis.

Producer Hedging

- Producer hedging did not generate accelerated supply to the physical market last year. Instead, the net impact of producer hedging was 10.8 Moz (335 t) of accelerated demand.
- Outstanding positions declined as forward sales contracts were delivered into or actively closed out, and options expired un-exercised.

In doing the research for this section of the *World Silver Survey*, our expectation was to find that producer hedging had increased during 1999, and that this had contributed to physical supply to a significant degree. This expectation had been based on persistent rumors throughout the year of high levels of producer hedging, and the announcements of a number of very large deals.

However, closer inspection revealed that reality was rather different. Although several sources confirmed that last year was quite active on the producer hedging front, the unanimous view was that, at 31st December 1999, outstanding positions were no higher than a year earlier. Indeed, the evidence suggests that, on a net basis, producer hedging contributed to physical demand last year, not supply. This came about because outstanding positions declined year-on-year, as forward sales contracts were delivered into or actively closed out, and options expired without having been exercised. Also, falling prices and volatilities meant that the average delta on some of the large call options positions were much lower than a year ago, which further reduced the outstanding hedged position.

There are two main reasons why the signals given by the market during last year were misinterpreted by observers. Firstly, the rumor mill made quick work of distributing news of new hedges being put in place, but was silent about buy-backs or deliveries into contracts without replacing them.

Secondly, there seems to have been a degree of misunderstanding about the exact nature of a number of the deals announced during the year, particularly their net impact on the market. For example, some of the larger hedge transactions completed in 1999 appear to have been executed in such a way that there was very little net physical impact on conclusion of the deals. Although we are not in a position to discuss the details of the transactions, GFMS believe that certain offsetting actions were taken at the same time which minimised the physical market impact of the deals.

Yet there was quite a lot of intra-year activity, as was pointed out above. For example, Meridian Gold confirmed that it had hedged 9.3 Moz (289 t) of future silver output from its newly opened El Peñon gold-silver mine in Chile. During the course of the year Pasminco, MIM and Boliden all announced that they had concluded large transactions. A number of other silver producers were active in the market on every small spike in the price, with $5.50 to $5.60 acting as the "hedge trigger" for much of the year. Increased activity no doubt contributed at times to the tightness in silver lease rates.

But these same producers took advantage of lower prices to close out some of the hedges put on earlier, or allowed their short-dated structures to run down without replacing them, leaving their outstanding positions lower at year-end. Banks reported that there was a degree of reluctance on the part of producers to lock in prices below $6.00, with memories of 1998's rally still fresh. As for the banks, they, too, had fresh memories of the price spike in early 1998 and particularly the surge in lease rates, which created problems for many hedgers and their counterparties. Fear of a repetition of the late 1997/early 1998 squeeze resulted in a general lack of appetite to do longer-term hedging. Also, the high leasing rates that prevailed made contangoes unattractive for most of the year.

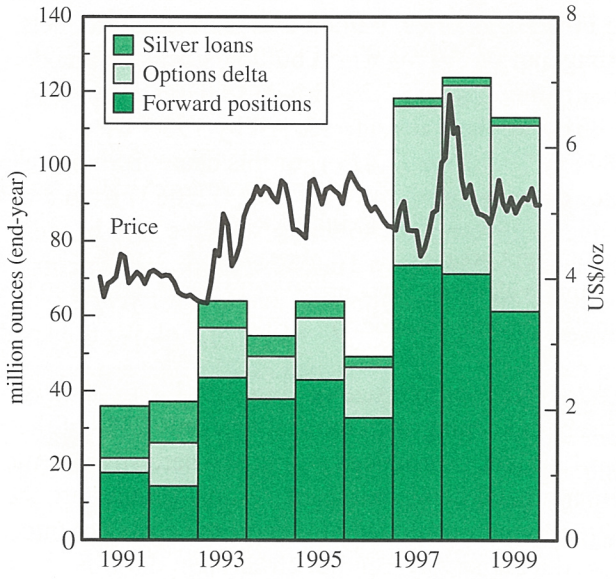
One popular hedging instrument in the last two to three years has been the writing of call options by producers, often close-to-the-money. This strategy can be a useful cash generator in times of falling prices (although without proper safeguards, it can also go terribly wrong when the market turns suddenly - a lesson learnt by Australian Gold Fields in 1997). Last year a number of producers sold call options, Boliden's 30 Moz (933 t) deal being one example. As the price has in the main been trending downwards, many of these options have been expiring without being exercised, while the average delta on the remaining positions has also been declining.

The combination of producer buying on price dips; expiry of out-of-the-money call options; and producers not replacing positions established at higher price levels in the last two years, was more than sufficient to cancel out the effect of new hedging during the year.

Coming months may see increased activity in this area, as the operators of a number of large-scale new silver projects may commence hedge programs to secure financing for development or to lock in future revenue streams.

Figure 19

Silver Producer Hedging: Outstanding Positions



5. Supply from Above-ground Stocks

- Supply to the market from above-ground stocks increased by 15% last year to 330.6 Moz (10,282 t).
- Private disinvestment rose to 79.5 Moz (2,473 t), most of it from unidentified inventories, as Comex stocks were little changed and the amount of bullion held for investors by European dealers grew year-on-year.
- Net government sales increased by 47.0 Moz (1,461 t) to 87.0 Moz (2,706 t), over two-thirds of the total accounted for by a reduction in Chinese official bullion inventories.
- Scrap supply dropped back to 174.9 Moz (5,439 t) after the previous year's price-induced rise.

Summary

By definition, the above-ground stock of silver equals total cumulative mine production less the amount of metal that has been "lost" over the same period. GFMS estimate that historical mine production reached approximately 39,000 Moz (1.21 million tonnes) at the end of 1999. How much silver has been lost over the ages is far more difficult to determine. Certainly the quantity would be a great deal higher than, say, for gold, where only 1% of historical production has genuinely been lost over the aeons. Silver's lower unit value and its very different end-uses compared to gold have led to a much higher percentage of lost metal. For example, until comparatively recently, a large amount of the silver going into photography was lost due to spent fixer solutions being discarded rather than recycled. As a rule, whereas it almost always pays to recover gold from products at the end of their useful lives, it is often not economically feasible to do this in the case of items containing silver. Consequently, a lot of silver ends up in landfill sites, effectively returned to the earth and so lost to the market.

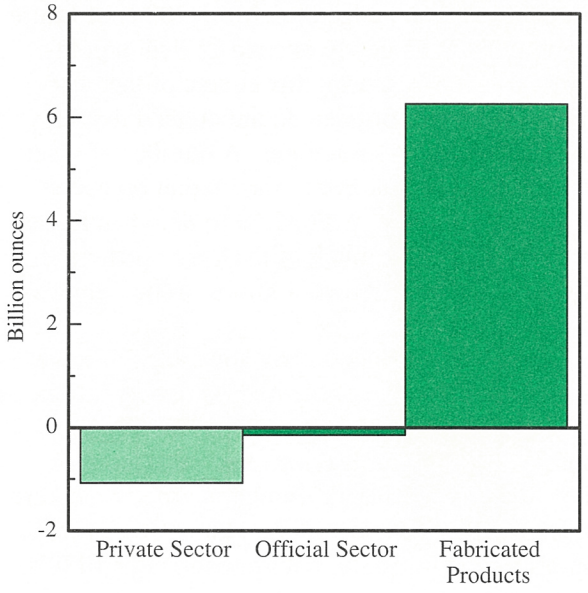
The above-ground stock of silver can be divided into two broad categories: bullion and fabricated products. Throughout the 1990s world bullion stocks declined, the fall amounting to 1,224 Moz (38,076 t). In 1999, for instance, these inventories fell by 155.7 Moz (4,844 t); 79.5 Moz (2,473 t) of this came from private sector disinvestment and 87.0 Moz (2,706 t) from a net decline in government holdings, with the sum of these two partially offset by a 10.8 Moz (335 t) decline in producers' hedge positions. Although last year's net disinvestment out of private stocks was above the level recorded in 1998 of 49.0 Moz (1,523 t) it was still well below the peak quantities for the decade in 1992 to 97 when around 100 to 150 Moz (3,100 to 4,700 t) was being annually disinvested. Figure 20 shows that from 1990-99 the cumulative net supply to the market out of private sector bullion stocks in the form of net disinvestment and the sale of borrowed silver for producer hedging came to 1,078 Moz (33,524 t).

By contrast with the relatively modest amount of private disinvestment last year, net sales out of government inventories were at an exceptionally high level in 1999. Both in 1998, and even more so last year, reductions in Chinese official stocks were the most important factor behind these declines. Over the last 10 years overall net government sales have amounted to 146 Moz (4,548 t).

The second main category of above-ground stocks, fabricated products, not surprisingly has increased over the past decade. Growth in the stock of fabricated products came to 6,260 Moz (194,698 t) from 1990-99. This remarkable increase was supplied from two sources: mine production and the net dishoarding of private and government bullion stocks referred to above. Of course, the growth in stocks of fabricated products is net of scrap supply over the period, which amounted to 1,585 Moz (49,297 t) - gross fabrication

Figure 20

Changes in Above-ground Stocks, 1990-99



from 1990-99 came to 7,845 Moz (243,995 t). Last year, as expected, the lower silver price resulted in scrap supply declining 9.7% year-on-year to 174.9 Moz (5,439 t).

Identifiable Bullion Stocks

Net supply to the market from sales of above-ground bullion stocks came to 155.7 Moz (4,844 t) last year. Of this, 87.0 Moz (2,706 t) can be identified as government sales (see section below). This leaves the balance of 68.7 Moz (2,138 t) as having come from a net fall in private sector holdings of bullion (assuming the entire decline in producers' hedge positions last year went into private stocks). However, as Figure 21 implies, private disinvestment was not at the expense of identifiable bullion inventories: their two largest components, Comex and European Dealers' stocks were, in aggregate, up year-on-year. The mathematical conclusion has to be that all the private disinvestment last year came from stocks that were unidentified (even if in practice this was not the case because of turnover in reported inventories with new positions replacing those sold). These unidentified stocks would include sizeable bullion holdings that have never been reported (e.g. in GFMS' survey of European Dealers' stocks or as Comex inventories). In addition, they would incorporate bars and coins held in scattered, privately held inventories.

Figure 21

Identifiable Bullion Stocks

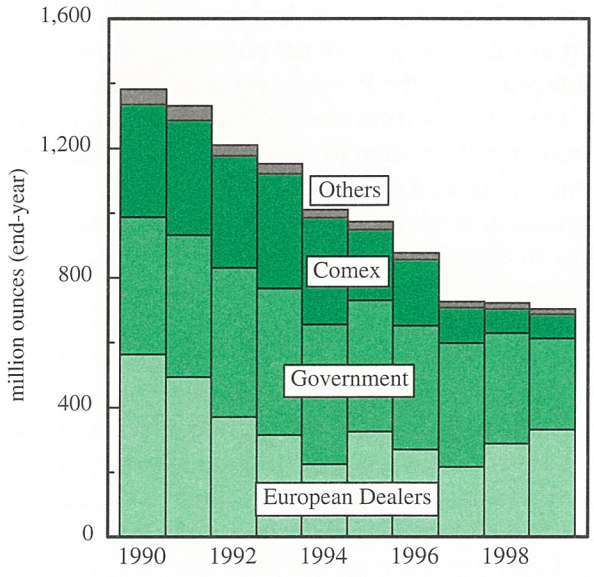
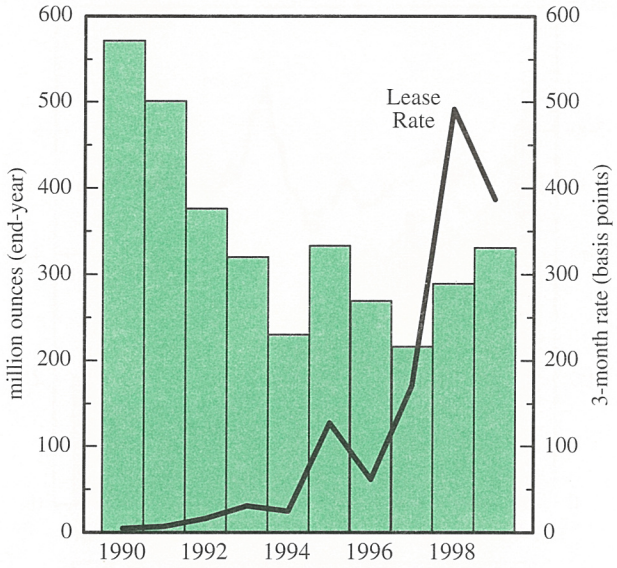


Figure 22

Bullion Stocks in Dealers' Vaults in Europe



European Dealers' Stocks

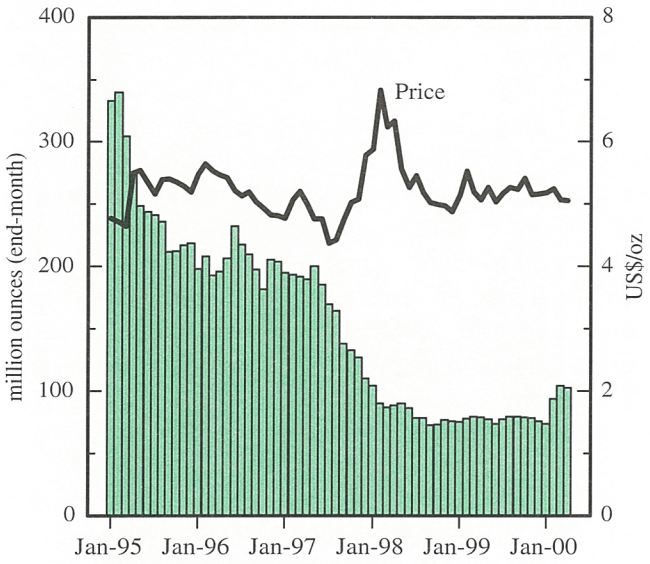
GFMS' survey of European Dealers' Stocks shows that during 1999 they increased by some 40 Moz (1,240 t) to around 330 Moz (10,260 t), although growth was smaller than in 1998 (see Figure 22). Furthermore, there were indications that the level of these inventories had begun to fall towards the end of last year, and even more so in the first quarter of 2000. The recognition that stocks were "on the move" was a factor behind market rumors that Warren Buffett had started to liquidate at least part of his 129.7 Moz (4,034 t) silver position. Although, at this stage, it cannot entirely be ruled out that Mr Buffett himself was a seller - if there were indeed any sales, as opposed to the mere relocation and/or additional lending of silver at this time - it seems more probable that other parties were selling out of long positions that they had established in the metal during late 1997 and early 1998.

Comex Stocks

Comex stocks were remarkably stable in 1999 (see Figure 23). At the end of 1998 they had totalled 75.8 Moz (2,358 t) and a year later were at roughly the same level, 76.0 Moz (2,364 t). What is more, during 1999 they fluctuated in a range of just 6 Moz (187 t) compared to over 30 Moz (933 t) in 1998. Interestingly, in the first quarter of 2000 Comex inventories leapt by over one-third, at the end of March reaching 104.3 Moz (3,244 t). This rise in stocks

Figure 23

Comex Warehouse Stocks

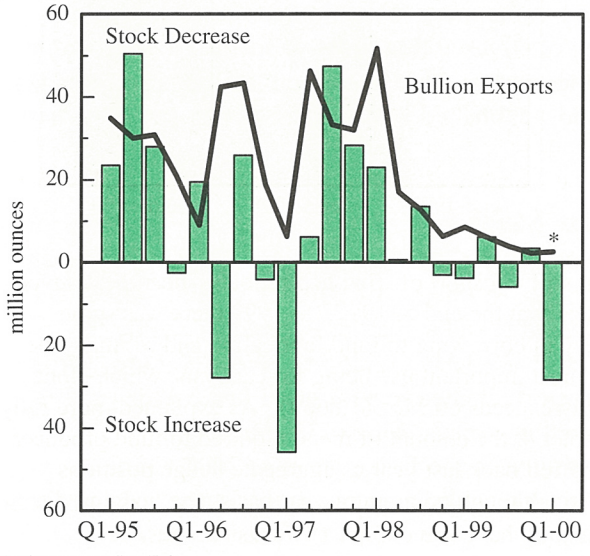


Prior to January 1997, Wilmington Trust's stocks of Comex eligible and registered silver are partially estimated.

appears to have come about because of the "short squeeze" on the exchange in February and the associated price premium in New York over London that attracted metal into Comex from the European market. As Figure 24 shows, this was a reversal of what had occurred in 1998, when there were massive exports of bullion stocks from Comex warehouses and other sources, mostly to the United Kingdom.

Figure 24

Comex Stock Change and US Bullion Exports



*US Exports: Jan-Feb

Comex Silver Stocks (end period)

Million Ounces

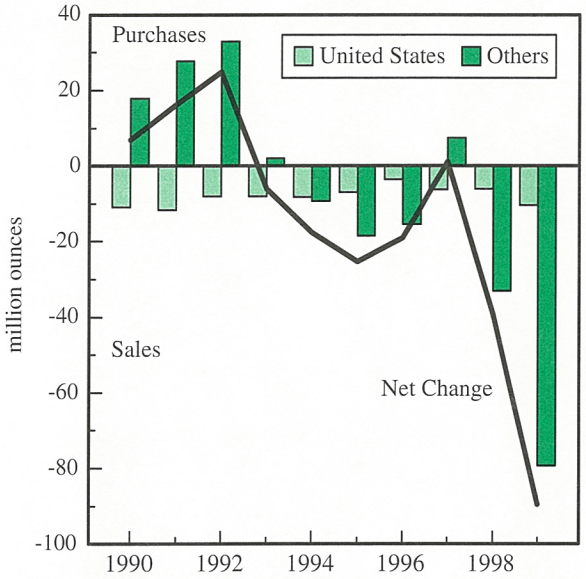
	Q1	Q2	Q3	Q4
1991	258	266	270	271
1992	270	268	279	275
1993	272	274	277	263
1994	239	236	255	259
1995	235	185	157	159
1996	140	168	142	146
1997	192	186	138	110
1998	87	86	73	76
1999	80	74	79	76
2000	104			

A notable development in the second quarter of 1999 was the closure of Morgan Guaranty's Comex warehouse. This leaves HSBC (which acquired Republic National Bank of New York last year) and ScotiaMocatta as the only two institutions providing storage facilities.

Government Stocks

Net sales out of government stocks are estimated to have reached 87.0 Moz (2,706 t) last year. There is little doubt that this extraordinarily high level of disposals played a large part in depressing the silver price. Unlike gold, the silver market had until 1998 been little troubled by official sector selling. Indeed, GFMS data show that from 1990-97 net official sector sales averaged only 2.4 Moz (75 t) per annum, partly because, as Figure 25 indicates, in the earlier part of the decade there were several years of net government purchases. The main reason for the higher level of government disposals seen in the last two years was the shift in China away from net purchases of local mine production by the People's Bank of China (PBOC) to net sales from stocks. The reasons for this about-turn in policy seem to be varied. Particularly in 1998, there appeared to be a certain degree of opportunism at work as the Chinese took advantage of the spike in the silver price to export and sell stockpiled metal. But, subsequently, it looks as if a more fundamental reassessment has taken place of the country's need to hold very large inventories of silver. The decision to offload surplus stocks must also have been influenced by the progressive liberalization of the Chinese silver market that has taken place over the last year or so. In any case, in terms of the overall supply of silver to the market in 1998 and, especially, 1999 the result has been nothing less than spectacular.

Figure 25
Changes in Government Stocks



GFMS estimate that net sales out of Chinese stocks amounted to a (revised) 11.9 Moz (370 t) in 1998, the annual total soaring to 61.1 Moz (1,900 t) in 1999. Fortunately for the price, Chinese supply to the market has been price sensitive, last year, for example, tending to dry up whenever silver fell below the $5.10 level.

Nevertheless, a key issue for the market is whether Chinese sales will remain an important factor on the supply side. An important consideration here has to be the existing level of government bullion stocks held by the country, something that is currently impossible to determine with any certainty. Just taking the 1990-97 period, however, GFMS estimate that the PBOC could have acquired no less than 90 Moz (2,800 t) of surplus mine production. Prior to the 1990s it is also highly probable that the Chinese authorities were amassing excess local mine production. Add to this former monetary silver stocks - China was on a silver standard until 1935 - and it becomes clear that the country's bullion hoard must still be significant even after the total, it still fell short of what had probably been peak levels historically at the end of 1997. In 1999 there was some recovery in borrowing to fund fabrication and refining, the single most important use being for catalysts, which alone probably exceeds 60 Moz (1,866 t). As explained more fully in Chapter 4, the amount of metal required to fund producer hedging fell back last year as aggregate hedge positions declined, although on an intra-year basis new hedging did occasionally have some impact on leasing rates.

Silver Borrowing

The average level of silver leasing rates in 1998 was skewed by the very high cost of borrowing metal in the first quarter of the year. In the light of this, the fall of 1% in average leasing rates in 1999 (on a 3-month basis) was not very significant. Indeed, the implication is that the lending market continued to be fairly tight last year, certainly when compared to the situation prior to the Buffett-inspired squeeze that began in the latter part of 1997.

At times in 1999 there were even brief echoes of the liquidity shortage that had struck the market the previous year. In the second half of February, for instance, 3-month leasing rates were often above the 10% level, peaking at 13% in mid-month. Again at the end of September and in part of October silver went into a temporary backwardation as borrowing costs soared. On the other hand, in May and June of 1999 and also from March into May this year, liquidity at the short end was fairly abundant, with 3-month rates below 2%.

Movements in silver leasing rates appear to have at times reflected market squeezes; this would be particularly true for the spike in February 1999 (but curiously not so during the "short squeeze" experienced in February 2000 when leasing rates moved up by less than 2%).

In terms of liquidity supply, it appears as if there was a willingness on the part of holders of stocks to increase the amount of metal they were prepared to lend to the market, although mostly for shorter terms. This seems to be borne out by the fact that average 12-month rates were actually higher in 1999 than they had been the previous year.

As Figure 26 shows, on the borrowing side, demand increased last year to nearly 315 Moz (9,797 t), although in

Figure 26
Silver Borrowing

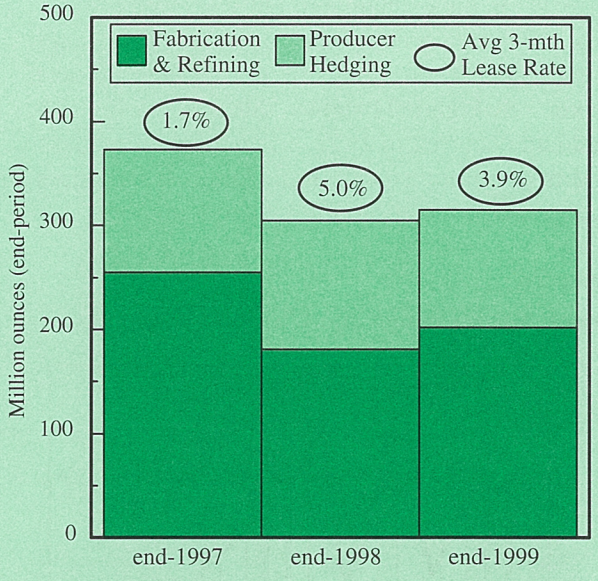


Table 3

Supply of Silver from the Recycling of Old Scrap

Million ounces

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Germany	16.1	16.1	16.1	15.8	15.4	14.8	15.4	16.1	16.4	16.1
UK & Ireland	7.2	7.2	7.2	7.3	7.9	7.4	7.6	8.4	10.8	11.5
France	3.1	3.8	5.3	4.0	4.2	4.7	4.5	4.3	4.1	4.0
Italy	2.7	2.7	2.7	2.7	2.8	3.2	3.5	3.4	4.7	3.4
Austria	1.9	1.9	1.9	1.9	1.9	2.0	1.8	1.8	1.8	1.7
Netherlands	1.1	1.1	1.2	1.1	1.3	1.1	1.3	1.3	1.3	1.3
Sweden	1.1	1.1	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	0.8	0.9
Belgium	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Czech & Slovak Republics	0.6	0.8	1.0	0.8	0.7	0.7	0.9	0.8	0.7	0.6
Denmark	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Portugal	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5
Spain	0.4	0.4	0.3	0.3	0.3	0.4	0.5	0.5	0.4	0.4
Switzerland	0.7	0.7	0.7	1.5	0.6	1.6	1.7	0.8	0.4	0.3
Romania	0.1	0.1	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	1.5	1.5
Total Europe	38.9	39.8	41.5	40.6	40.3	41.1	42.5	42.7	45.9	44.6
North America										
United States	44.8	42.7	42.3	43.2	45.2	46.0	48.4	51.8	55.7	57.4
Mexico	2.3	2.3	2.3	2.3	2.3	4.8	2.4	4.3	10.6	2.4
Canada	1.3	1.3	1.3	1.3	1.3	1.7	1.8	1.6	1.9	1.6
Total North America	48.3	46.3	45.9	46.7	48.7	52.5	52.6	57.7	68.3	61.4
Central & South America										
Brazil	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.6	1.6	1.8
Argentina	0.6	0.6	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	0.5	0.4
Other	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.9	0.9
Total Central & South America	3.9	3.9	3.9	3.8	3.8	3.8	3.8	3.4	3.7	3.7
Middle East										
Turkey	1.8	1.9	1.9	2.0	2.3	2.3	1.9	1.6	1.7	1.4
Saudi Arabia & Yemen	0.1	0.1	0.6	0.8	1.9	3.0	1.3	3.2	2.1	1.1
Egypt	1.1	1.0	0.6	1.0	0.9	0.8	0.7	0.3	0.2	0.2
Other	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4
Total Middle East	3.1	3.1	3.4	4.2	5.4	6.5	4.3	5.5	4.3	3.0
Indian Sub-Continent										
India	4.0	9.6	7.2	4.5	4.5	9.6	6.4	9.6	11.9	6.7
Other	0.1	0.1	0.2	0.2	0.2	0.3	0.2	0.3	0.5	0.4
Total Indian Sub-Continent	4.1	9.8	7.4	4.7	4.7	9.9	6.6	10.0	12.4	7.0
East Asia										
Japan	15.7	18.9	24.2	26.2	26.9	27.3	27.1	27.8	29.2	29.5
South Korea	2.1	2.3	2.6	2.9	3.0	3.3	3.4	3.6	7.8	5.3
Taiwan	1.0	1.1	0.9	0.8	0.7	0.7	0.7	0.8	0.8	0.9
Philippines	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.4	0.4
Indonesia	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4
Singapore	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4
Thailand	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.8	1.0	0.4
Vietnam	0.3	0.3	0.3	0.2	0.3	0.4	0.4	0.4	0.4	0.4
Hong Kong	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.4
Malaysia	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total East Asia	20.2	23.9	29.3	31.5	32.4	33.4	33.4	34.9	41.0	38.1
Africa										
South Africa	0.1	0.1	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	1.0	1.0
Total Africa	1.0	1.0	1.1	1.1	1.0	1.2	1.1	1.1	1.1	1.1

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Oceania										
Australia	2.3	2.3	2.3	2.4	2.5	2.5	2.3	2.3	2.4	2.4
Total Oceania	2.3	2.3	2.3	2.4	2.5	2.5	2.3	2.3	2.4	2.4
Western World Total	121.8	130.0	134.7	135.1	138.7	150.9	146.5	157.6	179.1	161.3
Other Countries										
China	2.5	1.5	3.7	3.7	4.1	4.3	4.5	4.6	5.8	5.9
Soviet Union/CIS	10.8	10.4	10.0	9.7	9.0	7.7	7.4	7.1	8.8	7.7
Total Other Countries	13.3	11.9	13.6	13.4	13.1	12.0	11.9	11.7	14.6	13.6
World Total	135.1	141.9	148.3	148.5	151.9	162.9	158.4	169.3	193.7	174.9

high level of sales in 1998 and 1999.

Three other countries were responsible for nearly all the other government sales last year (a fourth one's stocks declined by a little over 120,000 oz). The United States Defense Logistic Agency sold 10.3 Moz (320 t) bringing its remaining silver holdings in the National Defense Stockpile down to 21.2 Moz (659 t). The silver was used by the US Mint for its various coin programs, most importantly the Eagle bullion coin.

Russian government sales are estimated to have come to some 5 Moz (156 t), well down on 1998's high level.

One other country sold more than 10 Moz (310 t) in 1999 having acquired this silver from the local market in the preceding two years.

Other Stocks

Other identifiable stocks not covered above (though featured in Figure 21 as "others"), consist of those registered on the Tokyo Commodities Exchange (Tocom), the Chicago Board of Trade (CBOT) and Japanese trade stocks, which are reported to the Ministry of International Trade and Industry. The overall level of these other identifiable stocks was barely changed year-on-year at the end of 1999, due to a small rise in Japanese trade stocks cancelling out declines in Tocom and CBOT inventories.

Scrap

The focus box in Chapter 2 examines the role of silver scrap in price determination and vice versa. As is argued there, silver scrap can be an important factor in inhibiting upward price movements, and those who ignore this feature of the market do so at their peril.

Silver is similar to gold, in that there are a number of markets where jewelry and ornaments are sold on a mark-up on the weight basis, with these items often of very high purity. The mark-up on the metal content is usually quite modest, and can often be as low as 10%. What this means is that consumers are acutely aware of what the prevailing price is, and are well placed to respond to upward movements in the price by selling back articles at a profit.

Fortunately for silver, the sale of jewelry and silverware on this basis is not nearly as widespread as it is for gold. Whereas in gold, it is difficult to find a market in the Middle East and Asia where jewelry is not sold by weight, the same is not true for silver, largely because consumption of silver jewelry and silverware is relatively low in these regions. For instance, in the Middle East, Turkey is the only important fabricator of silver, and even then, a significant (albeit minority) portion of this goes into gold karat jewelry. Consequently, the available pool of above-ground silver in jewelry and silverware form is comparatively small. The same holds true for many of the countries in East Asia. In spite of the fact that Thailand is a major fabricator, most of the jewelry produced is for export to the United States and Europe, so that the majority of the locally available scrap is from jewelry manufacturing (process scrap), and therefore not counted in GFMS' statistics. Even in very large markets with substantial amounts of scrap, like Japan, changes in volumes are relatively price inelastic (for example, silver scrap from spent photographic processing fluids tends to be quite price insensitive).

There are only two Asian markets where there is a substantial stock of near-market fabricated products, namely India and Korea. Both have a long tradition of jewelry and silverware fabrication and consumption in their local markets, although the split between jewelry

and silverware in the two countries is rather different. Whereas in India silver jewelry is very popular, in Korea the bulk of non-industrial fabricated silver is in the form of silverware (for example chopsticks and bowls). However, India is by far and away the single largest fabricator and consumer of jewelry and silverware in the world, and completely dwarfs consumption elsewhere in the Asian region. Much of the jewelry and silverware is sold on the mark-up basis described above.

Indian scrap volumes fell back last year by over 40% from the 11.9 Moz (370 t) recorded in 1998. However, it is worth noting that this was the highest level recorded in the last decade, and coincided with a 14% year-on-year rise in the local silver price (and a price high for the year that was over 30% above the low), so it was not too surprising that volumes declined in 1999. However, considering that the average rupee price last year was actually above the level in 1998 (albeit very marginally), it seems odd that the fall in scrap supply was so great. There are no immediately obvious reasons for the decline, but it may have something to do with consolidation by consumers and the trade after the very large scale de-stocking seen in late 1997 and much of 1998.

Total silver scrap in East Asia fell by just over 7% last year. Most of this was accounted for by the sharp decline in **Korean** scrap, which was down by well over 30%. As in the case of India, this fall needs to be seen in context. However, unlike in India where it was only the large price moves that resulted in a surge in scrap in 1999, in Korea there was a "distress" selling element as well. At the beginning of 1998, facing economic collapse and a rapidly depreciating won, certain Korean institutions started a gold collection campaign to save the currency. The huge success of the gold campaign encouraged attempts to reproduce it in silver. Although this was far less of a success, it did manage to raise a significant amount of silver scrap.

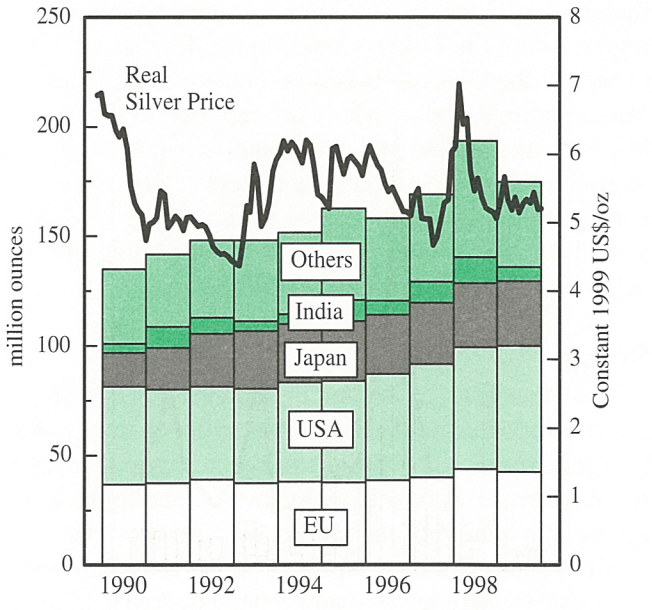
Interestingly, in spite of the recovery in the economy and in the won, the indications are that average scrapping levels have remained high, reflected in a total scrap number for 1999 that is well above the average for the decade.

For the first time, GFMS have published scrap estimates for **China** (previously, these were included in the "other" category). The main reason for this is that we are now more confident of the estimates and methodology used in compiling the historical series. Of course, comprehensive data from China is very difficult to come by, especially on scrap, and the series should be viewed in this light. We estimate that there has been steady growth in Chinese scrap as the available pool of above-ground metal has increased. It is important to note that GFMS estimate that much of this silver was not bought by the People's Bank of China (strictly speaking the only official purchaser of scrap until the beginning of 2000 when the silver market was liberalized).

Scrap supply in the **United States** rose by 3% last year to 57.4 Moz (1,785 t). Over 60% of this is estimated to have come from recycled photographic materials, mostly X-ray scrap and spent fixer solutions. Scrap from this source is tending to increase over time in line with the growth in US consumption of films and paper. Tighter environmental controls have also contributed to this trend. The second largest component of US scrap supply was silver won from ethylene oxide catalysts. These catalysts are regularly recycled, with only a few percent (in fact usually no more than 1%), of the precious metal contained lost in the process. Our information is that the historical GFMS numbers on catalyst recycling may actually be too conservative, although in terms of the overall supply/demand balance for silver this would be of no importance, as an equivalent amount of catalyst fabrication would also have to be taken into account in any revised series. In other words, there is only effective fabrication demand when new catalysts are built, something that is, for example, fully reflected in the 1999 US industrial fabrication data.

Figure 27

World Scrap Supply



6. Silver Bullion Trade

- The key development in silver bullion trade in 1999 was the massive increase in exports from China. The total outflow from the country is estimated to have reached over 100 Moz (3,100 t) last year.

Europe

Europe remains a substantial net importer of silver. Although the region's mines produced 53.3 Moz (1,656 t) this fell well short of European fabrication demand of 248.0 Moz (7,714 t) in 1999. Even taking into account additional supply from scrap and local disinvestment, it is likely that there was a regional "deficit" last year, which would have been filled by imports of bullion from other parts of the world.

Furthermore, Europe, particularly the United Kingdom and Switzerland, remains an important entrepôt for the silver trade. Besides importing metal for local manufacture, each year a large quantity of silver is processed by European refiners and exported to other markets, principally in Asia. Last year, however, there was a reduction in overall deliveries from Europe to its traditionally largest export customer, India, due to the massive inflow of Chinese silver into that country.

Europe also looms large in the international silver trade because of London and Zurich's importance as markets for the sale, purchase, lending and storage of physical metal. Much of the world's investment stocks are held loco-Europe and movements in and out of these positions account for a substantial percentage of Europe's imports and exports of bullion, especially when it comes to trade with the United States.

Significantly, in 1999 and again, on a far larger scale, in the first quarter of this year there were substantial flows of metal from Europe to the United States, reversing the usual pattern of trade.

In 1997, and to an even greater extent in 1998, an exceptional amount of silver bullion was imported into the **United Kingdom**. This was the result of the transfer of investors' positions from Comex to London and the severe market "squeeze" in the first quarter of 1998, which led to leasing rates spiking up into double-digit territory. It was no surprise, therefore, that UK bullion imports dropped back significantly in 1999, especially from the United States (Figure 28). For the year as a whole the total at 74.4 Moz (2,314 t) was down by no less than 65%.

UK bullion exports also fell last year but by a more modest 24% (see Figure 29); almost this entire decline was accounted for by lower shipments to Belgium and Germany. The other noteworthy development in 1999, which was repeated on a larger scale in the first quarter of this year, was the export of bullion to the United States. The usual pattern of trade is for surplus bullion to flow from the United States to Europe, however, for brief periods, the silver price in London has traded below that in New York, encouraging a reversal of the customary arbitrage. Besides the influence of technical factors, related to contract rollovers on the

Figure 28

UK Bullion Imports

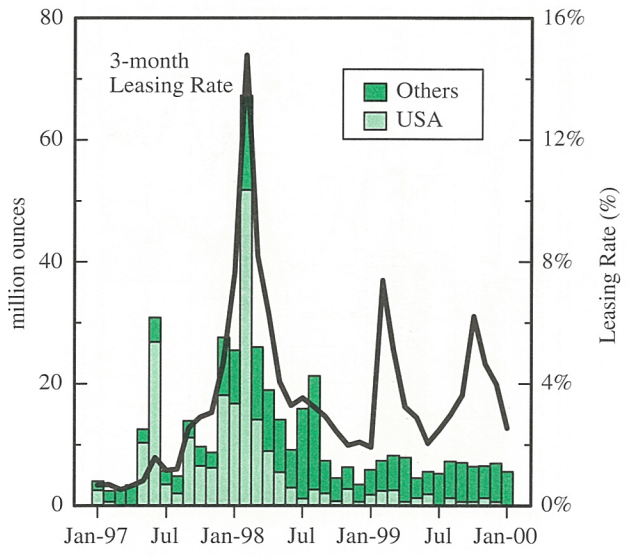
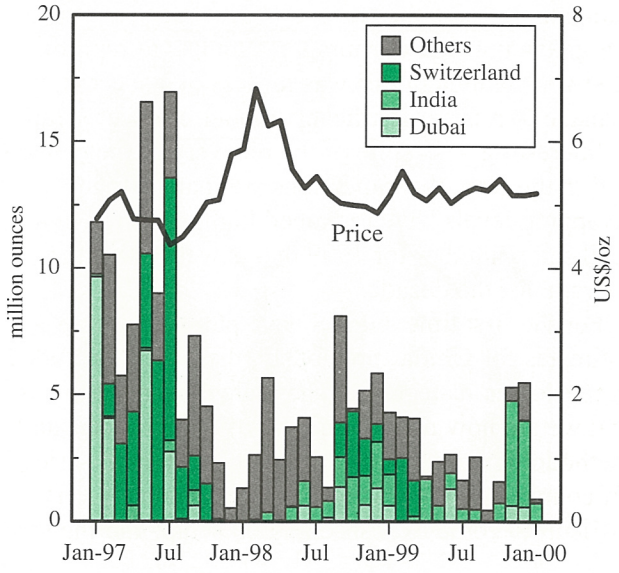


Figure 29

UK Bullion Exports



Comex, the principal underlying cause of these flows and of London moving to a discount, was the differing supply/demand situation on the two sides of the Atlantic. In the United States less metal has been available from mine production, scrap and disinvestment while fabrication demand has been very strong. In Europe, although fabrication demand has also advanced, supply has generally been more abundant. For the most part this has been a consequence of the silver outflow from China into markets traditionally served by Europe. In addition, and, particularly more recently, it could reflect higher disinvestment through the London and Zurich markets.

Figure 30 shows that **Italian** official bullion imports increased in 1999: GFMS estimate that for the full year they surged by 46% to an estimated 38.2 Moz (1,188 t). Strong demand from local jewelry and silverware manufacturers plus some substitution of unofficial by official imports explains this increase. Changes in the system for applying Value Added Tax to bullion that have come into force in 2000 should see a further reduction in unofficial imports and provide a boost to recorded trade.

North America

On a regional basis, North America (including Mexico) used to generate a large "surplus" of silver – local mine production and scrap exceeding fabrication demand – in 1990, for example, of no less than 82 Moz (2,558 t). During the 1990s, however, this surplus has been whittled away and, last year, all but disappeared. This has had profound implications for local silver prices and bullion trade. In 1998, this underlying change in the market was overwhelmed and masked by the massive transfer of stocks from the United States to Europe. However, in 1999 and again this year the relative tightness of the North American, and specifically, United States market was visible from the fact that silver prices in New York have occasionally traded above those quoted in London. As mentioned above, this has sporadically led to silver flowing from the United Kingdom to the United States. It has also been a factor in the massive reduction in **United States** bullion deliveries to the United Kingdom (see Figure 31). The collapse in shipments to the London market accounted for nearly all the 76% decline in US bullion exports last year.

Middle East and Indian Sub-Continent

As in past *Surveys*, the Middle East and the Indian sub-continent are treated together in this section. Primarily, it is the links between the sub-continent and Dubai that make this association sensible. Over the past 35 years, the Emirate has witnessed massive flows of silver both into and out of the sub-continent.

As the mini-table shows, imports into **Dubai** have fallen dramatically over the past two years, and the reason is simple: the introduction of Open General Licence (OGL) imports into India which started in late 1997. Developments in silver imports have, to a large extent, paralleled what has happened in gold. As a percentage of total imports, OGL shipments are by far

Figure 30

Italian Bullion Imports

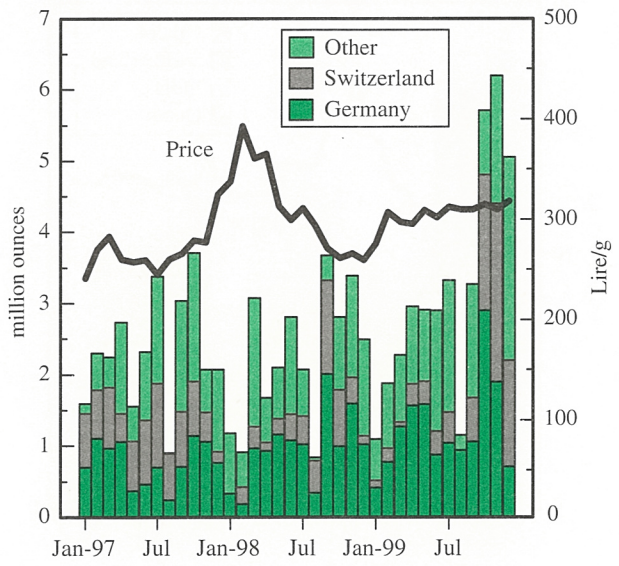


Figure 31

US Bullion Exports

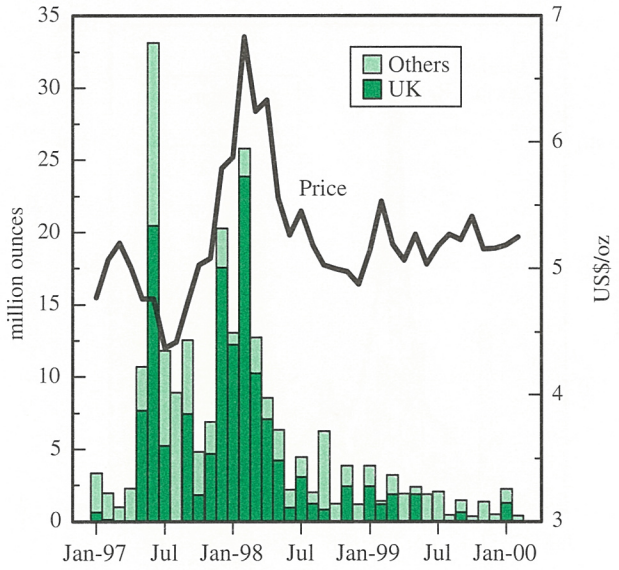
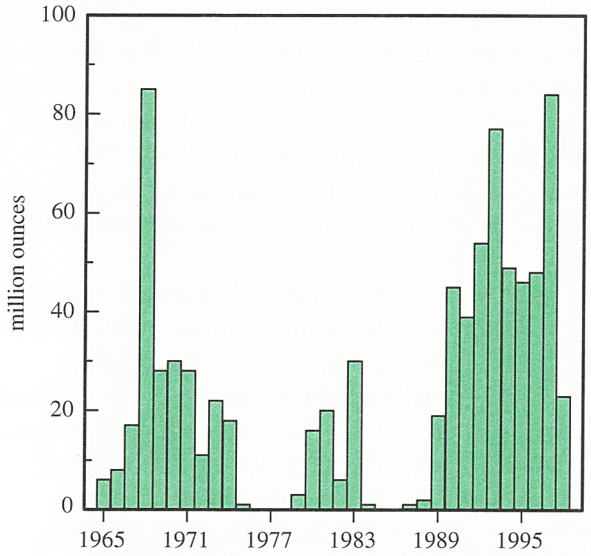


Figure 32

Dubai Bullion Imports



and away the most dominant in both metals. However, silver imports into Dubai have fallen much more sharply than they have for gold. This is because Dubai has always been almost completely reliant on the Indian market for silver demand, whereas this is not the case in gold. In addition to supplying India, Dubai has been, and still is, a major supplier of gold to the markets of the Gulf and the Middle East.

Dubai - Bullion Imports

Million ounces

1994	1995	1996	1997	1998*	1999*
48.9	45.5	48.1	84.2	23.3	20.2

*includes GFMS estimates

A particularly notable feature of the fall in Dubai's imports of silver is that not all of the decline appears to have been due to the rise in direct shipments into India. Part of the weakening stems from an unwillingness on the part of the trade to risk holding large silver stocks, either loco-Dubai or on ships destined for the Emirate (when leasing rates were low the bulk of the silver coming into Dubai was by ship). This reluctance stems directly from the price and leasing rate spike seen in late 1997 and early 1998.

Before moving on to the precise events at that time, it is worth examining why it is that Dubai's silver dealers were able to take such a grip on supplies to the Indian market. Other than the Emirate's obvious proximity to India, an important advantage has always been dealers' ability to finance and break up large shipments to service regional demand.

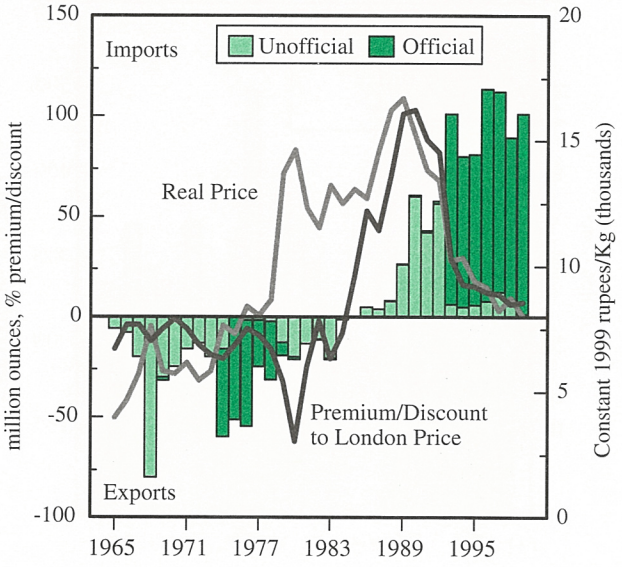
Logistically Dubai can satisfy demand more quickly than the original source countries (for bullion) in Europe and North America, especially at times of tightness in physical supplies. Consignment stocks of metal in Dubai are able to smooth out short-term supply and demand imbalances. More importantly, though, is the financing role played by the Emirate. Dubai is not, and probably never has been, simply a trans-shipment center. It has developed into an important regional bullion center because of the additional services it can provide, including structuring financing packages and the extension of credit, amongst others.

It is this financing role, in addition to the move to mainly direct OGL shipments to India, that explains the acuteness in the fall of imports since 1997 (at the same time, providing useful lessons for the industry as a whole). During the squeeze in 1997 and early 1998, there were substantial volumes of silver in transit to Dubai, mainly by sea. Prior to this time, leasing rates had been running comfortably below 2% for most of the year, a factor which had facilitated shipping by sea.

However, the surge in leasing rates, combined with the price spike in early 1998, caught most traders by surprise, and what followed turned out to be extremely painful financially. Suddenly they found themselves in the position of either having to buy the metal at inflated prices and/or having to ship silver, at great expense, back to Europe and the United States (demand in India having collapsed on the back of the price spike, leaving idle stocks in Dubai).

Figure 33

Indian Bullion Imports and Exports



Having been so adversely affected by the price and leasing rate spike, most traders decided that the margins made on physical trading simply did not warrant the leasing rate risk of running large stock positions, and effectively withdrew from the market. Those who have remained now hold substantially smaller stocks than in the past. Consequently, liquidity, and the overall efficiency of the physical supply market, has been adversely affected.

Turning to other countries in the Middle East, in **Egypt**, the contrast between gold and silver bullion imports (including in the case of silver, grain) could not be greater. The gold market is predominantly sourced by unofficial flows of bullion, largely from the Middle East. The silverware and silver jewelry industries, on the other hand, are serviced by official flows, mainly from Europe. Despite the 21% import duty on silver bullion and grain the cost per kilogram of officially imported silver is still less than for unofficial metal. For gold the cost of official imports is far greater.

One of the most notable developments in the **Turkish** silver market last year was the change in the import regime. From March 1999, bullion imports, which were previously imported and sold directly to fabricators or wholesalers, have been channelled through the Istanbul Gold Exchange.

In general, supplies of imported silver are determined by two factors, the level of domestic fabrication and local mine production. Last year, lower offtake (see Chapter 7) and substitution by higher domestic mine production contributed to a decline in bullion imports.

The introduction of OGL imports has completely altered the preferred means of shipping silver into **India**; as the minitable shows quite clearly, OGL imports now exceed the total for the Non-Resident Indian (NRI) and Special Import Licence (SIL) routes combined (as is also the case with gold). As might be expected, the reason for this is price related. OGL imports avoid the costs either of an import license (incurred with SIL imports) or of a courier (incurred with NRI imports).

Although there are many parallels between what has happened to gold and silver imports into India, there is one stark difference, namely, the almost complete absence of unofficial imports of the latter. By contrast, unofficial shipments of gold are still quite high relative to total imports (accounting for around 12% of total imports into India in 1999, versus less than 1% for silver). Two major factors underpin this difference.

Indian Bullion Imports

Million ounces

	1995	1996	1997	1998	1999
OGL	-	-	0.6	81.8	99.3
NRI	10.7	1.1	0.8	0.1	0.1
SIL	63.6	102.5	96.9	1.4	0.7
Replenishment	0.9	1.8	1.5	0.1	0.1
Sub-total official	75.2	105.5	99.8	83.6	100.2
Smuggling	5.9	8.0	12.5	6.4	1.2
Total	81.1	113.5	112.4	90.5	101.3
Local premium*	27%	23%	23%	9%	11%

* percent above London price at the official exchange rate

Figure 34

Estimated Indian Bullion Imports by Scheme

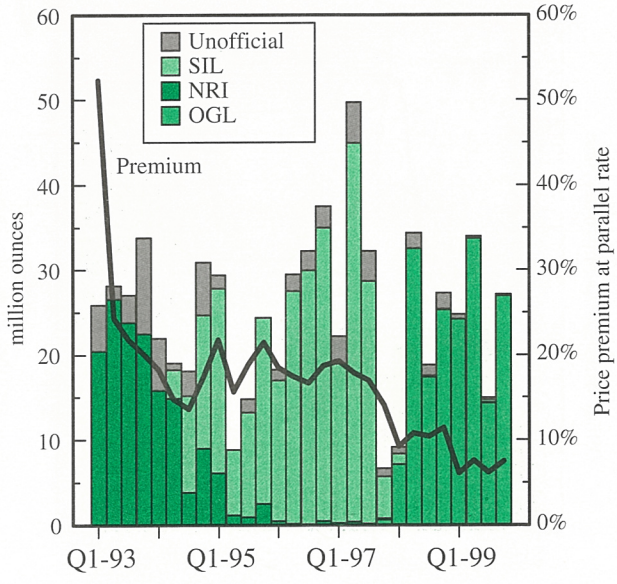
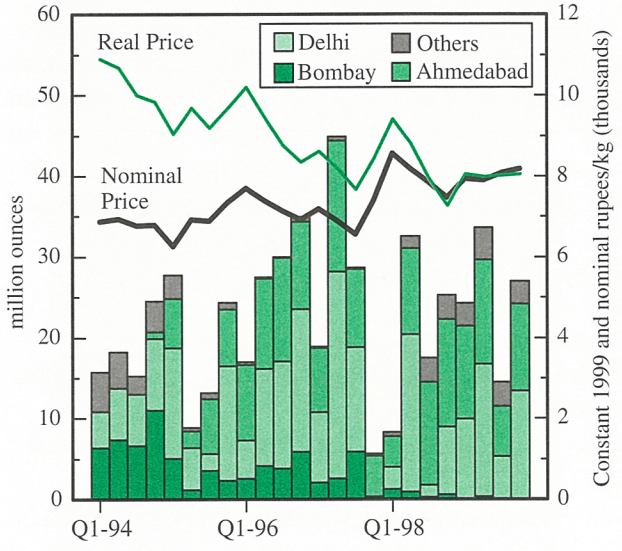


Figure 35

Estimated Indian Bullion Imports by Center*



*excluding unofficial flows

Firstly, import duties on silver (at 500 rupees per kilogram) were unchanged in 1999 while duties on gold rose by 60% (from 250 to 400 rupees per 10 grams) which encouraged a rise in smuggling of the latter. Secondly, gold's value-to-weight ratio makes it more attractive to smuggle than silver. Figure 35 shows the estimated imports into India by center since 1993, and illustrates that there have been some dramatic changes. Imports of silver into Ahmedabad (in Gujarat State) have grown phenomenally; they were effectively zero in 1993 but in 1999 stood at over 38 Moz (1,200 t), whilst in other centers, for example Mumbai (in Maharashtra State), they have fallen dramatically, from around 38 Moz (1,200 t) in 1993 to only around 0.5 Moz (15 t) in 1999. In effect, Ahmedabad has taken away Mumbai's business (the fall in one has simply mirrored the rise in the other).

The reasons for this are physical location and price. Ahmedabad is more conveniently located for the main silver consuming regions in the north of the country than Mumbai. But although physical location is important, prices matter even more, and Ahmedabad has a more favorable taxation regime.

The federal structure of India means that many states have different local tax regimes. Commonly, states apply different taxes to gold and silver (and other) imports. In the case of Mumbai, an additional tax, known as an octroi (a local import tax) is added. As would be expected, if the octroi and/or sales tax rates drive a wedge between the prices of landed metal in various import centers, shipments will tend to gravitate towards the cheapest port of entry (and are then distributed unofficially to the more expensive states).

This is precisely what has happened in Mumbai and Ahmedabad. The more favorable taxation regime in Gujarat State compared to the one prevailing in Maharashtra State has resulted in a complete shift in the bullion trade away from the latter to the former. Recently, active lobbying by the Bombay Bullion Association has seen a reduction in the gold octroi, although at the time of writing, the position of silver is still not clear. Even if the silver octroi were to be reduced, however, it remains to be seen if this will be too little, too late.

One final comment on Indian silver imports is appropriate. Over the past decade, the bulk of India's silver demand has been fed by imports from just four countries, namely Switzerland, the United States, the United Kingdom and Dubai (although most of the metal flowing through the Emirate actually originated from Switzerland, the United States and the United Kingdom initially). This picture started to change, however, in late 1998, and by 1999, it had been transformed dramatically.

As is discussed in more detail below, there have been massive outflows of silver from China to the rest of the world over the past two years, with much of this going to India. GFMS estimate that around two-thirds of the flow of silver into India in 1999 was of Chinese origin. The magnitude of these imports from China has been staggering, and GFMS have spent considerable time checking and cross-checking the numbers. The hard data available to us is, however, further verified by anecdotal evidence from the bazaars themselves. At times last year it was impossible to find silver other than Chinese material in major import centers like Ahmedabad.

East Asia

The single most important development in the East Asian region in 1999 was the rise in silver flows out of **China** into the world market. Most of the data on these flows have not been available in the public domain, and so have been systematically missed by most other commentators and analysts. The volumes have been phenomenal, and go a long way to explaining why the silver price did what it did last year (see Chapters 2 and 5 for more on this).

Underpinning this has been the *de facto* opening up of the market since around 1995 (i.e. well in advance of the official liberalization of the market at the beginning of 2000). Silver has been flowing out of

Figure 36

Singapore Bullion and Semis Imports

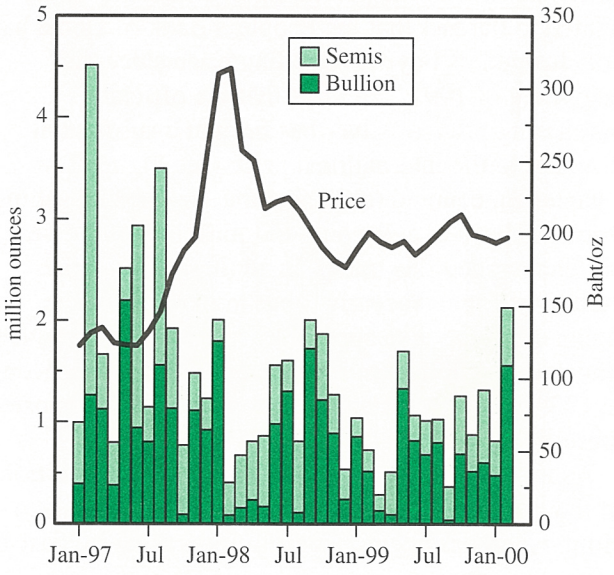
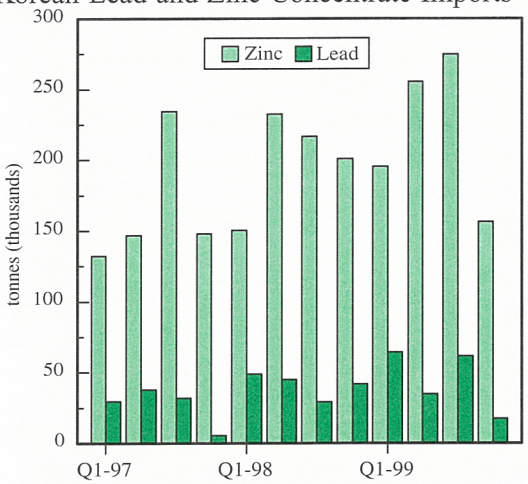


Figure 37

Korean Lead and Zinc Concentrate Imports



China on a regular basis since that time, but the really large volumes started in 1998 and rose steadily throughout 1999. There have been three categories of exports: one strictly official, the other of a quasi-official nature and the third, re-exports of silver bullion produced as a by-product from imported base metal concentrates.

Most of the strictly official flows from China have been directly to destinations outside of Asia, and as we discuss in Chapter 5, have been related more to location swaps than to outright sales (although it is clear that some of this metal has been upgraded and sold). Although these volumes are large, they pale in comparison with the quasi-official flows from the mainland. Most of this has been shipped to Hong Kong in the first instance, and then to other destinations (although GFMS information points to some of this metal having been shipped directly).

These quasi-official movements of silver have been quite sensitive to the prevailing international price, related to the fact that the People's Bank of China has not changed its buying or selling price since the beginning of 1997. The fact that the official purchasing price of silver has been at a substantial discount to the international price (see Figure 8 in Chapter 2), coupled to the fact that the official selling price has been at a discount too for much of the year, has encouraged this trade. In addition to this, the system of export incentives put in place since the Asian crisis has also applied to certain silver products (much of the gold coming out of China to Hong Kong in 1999 was shipped on this basis), which has boosted these flows.

As mentioned above, a very substantial proportion of the quasi-official metal coming out of China into Hong Kong has been shipped to India over the past 18 months. The form of silver being shipped, and the quality, has been quite variable. The bulk has been in 15 kg bar form, but a significant proportion has been in grain and small bars as well. The silver has come out in two distinct ranges of grade depending on its original source. One set has graded around 995, whilst the other has graded 9995 and above.

While the shipments of Chinese silver to India was the physical flow story of 1999, there were also large quantities shipped to other destinations, and Chinese silver substituted for imports into **Hong Kong** itself. Of the officially recorded imports into Hong Kong in 1999, over 70% came from China. But the real impact has been felt elsewhere.

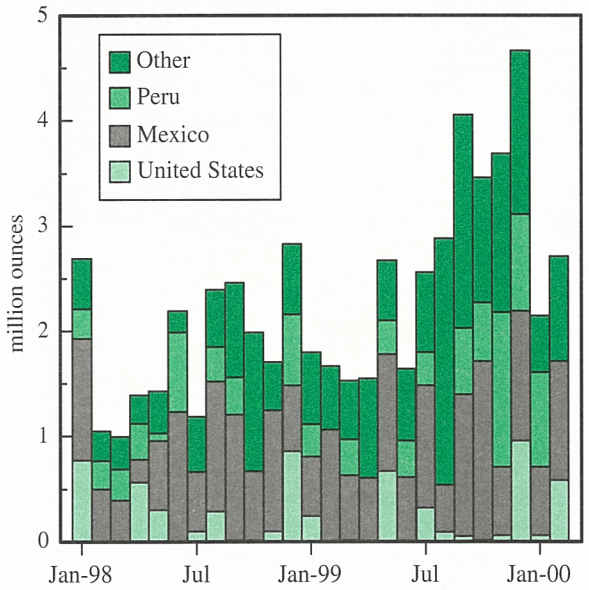
In **Thailand**, feedstock for jewelry and silverware manufacturing has been increasingly sourced from Hong Kong instead of Singapore (which has traditionally been an important source of supply to Thailand). As a consequence, shipments of bullion and semi-manufactured silver into Singapore have fallen sharply. In 1999, combined shipments into the city-state fell by over 20% (in spite of the recovery in fabrication demand there - see Chapter 7). More startling though is that combined imports in 1999 were down over 50% on 1997's level.

In **South Korea** "core" silver available for export has increased, due to the expansion of base metals processing (Figure 37 shows how imports of zinc concentrates have risen since 1997).

Japanese imports of silver rose markedly in 1999. Bullion imports were up by over 40%, whilst other imports (including silver in concentrates) increased by around 3%.

Figure 38

Japanese Bullion Imports



7. Fabrication Demand

- World silver fabrication came back strongly last year, increasing by 5% to 877.4 Moz (27,289 t), the highest level recorded in the last decade.
- East Asian and Indian demand recovered, rising by 11% and 5% respectively. Fabrication in North America was up over 8%.
- Industrial demand for silver surged by 8.4% in 1999 to 343.2 Moz (10,673 t) on the back of increasing use in the three largest fabricating countries; the United States, Japan and India.
- After exceptional growth in 1998, photographic demand increased marginally by 0.7% to 246.4 Moz (7,664 t) last year. Offtake in the United States grew by 5% year-on-year, whilst Europe saw a decline of 0.6%.
- Jewelry and silverware fabrication grew by 5% in 1999 to 260.8 Moz (8,113 t). European demand grew by 7% whilst Indian demand was effectively flat. Although East Asian fabrication increased by 16% to 38.9 Moz (1,209 t), but this was below the peak in 1996/97.
- Coins and medals fabrication rose by 3.5% in 1999 to 27.0 Moz (840 t).

As the supply/demand table in Chapter 1 shows, all components of silver demand increased last year. Industrial applications remained the dominant factor in 1999, with silver being substituted for other metals in some industrial processes. Jewelry and Silverware and Photography make up the other main categories (see Figure 39 below).

Four regions continued to dominate silver demand. Figure 40 shows the United States has gained ground on the European Union, the largest consuming region, whilst Japan has overtaken India to claim third place in 1999. Of those in the Others category, Mexico and Thailand recorded substantial increases in fabrication, whilst China and the CIS declined last year.

Figure 39
World Silver Fabrication

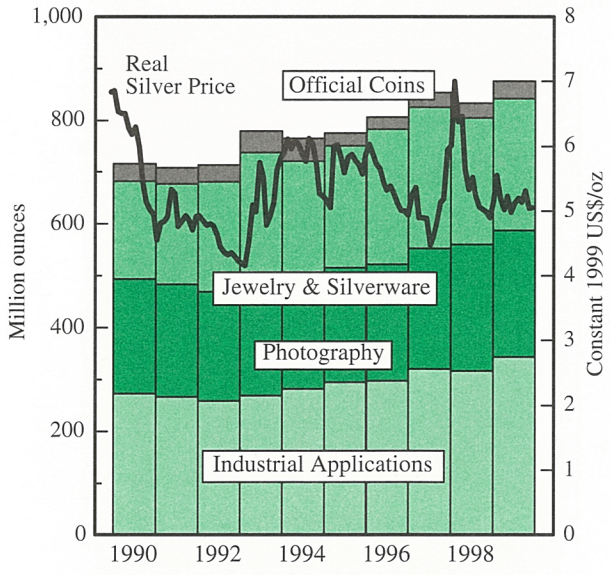


Figure 40
World Silver Fabrication

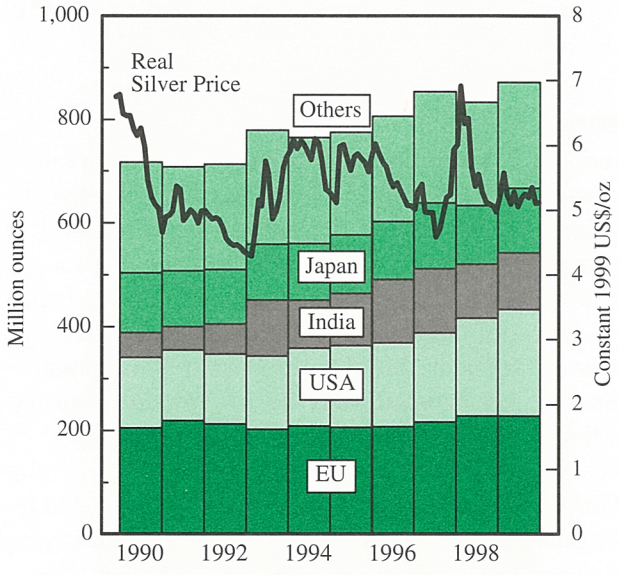
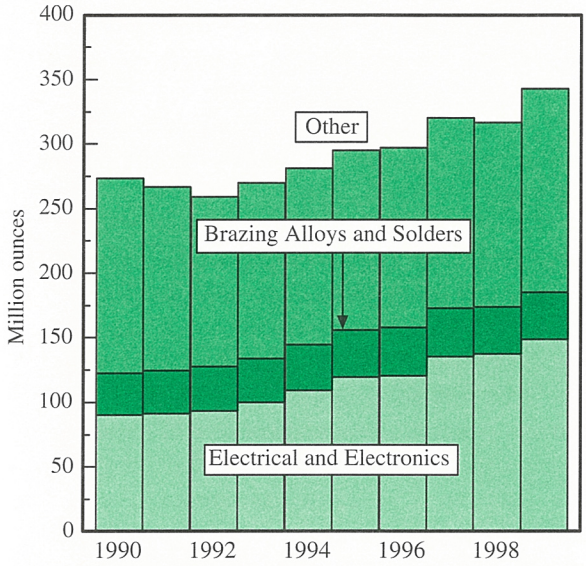


Figure 41

Main Components of Industrial Applications



Industrial Applications

- World industrial demand increased by a stunning 8.4% last year to a record 343.2 Moz (10,673 t).
- Silver use in North America was up by over 11% for industrial applications. Demand also recovered strongly in East Asia to exceed its former pre-crisis peak. Fabrication in Europe by contrast grew only marginally.
- Much of the growth in industrial demand last year was for electrical and electronics uses, global offtake of silver in this category rising by over 8% to 148.5 Moz (4,619 t).

Europe

Industrial fabrication in **Germany** was effectively unchanged at 18.3 Moz (571 t). The most significant development was the 3% decline in the use of silver for brazing alloys and solders. Solders account for only a small percentage of total offtake in this category and so most of the decline was seen in brazing alloys. Lower silver use in this area was due to two separate trends: weaker demand from the construction industry and the substitution of non-precious materials for silver, for example, in the plumbing sector.

United Kingdom industrial demand is estimated to have fallen by almost 7% to 15.2 Moz (472 t) last year. The use of silver in both the electrical and electronics and brazing alloys and solders markets fell sharply by 15% and 10% respectively. The high value of sterling adversely affected both direct and indirect exports in these sectors. One of the few areas to record higher demand last year was the use of silver in anodes, notably for mobile phones and ground stations (due to demand for improved network coverage), both of which recorded significant growth rates last year.

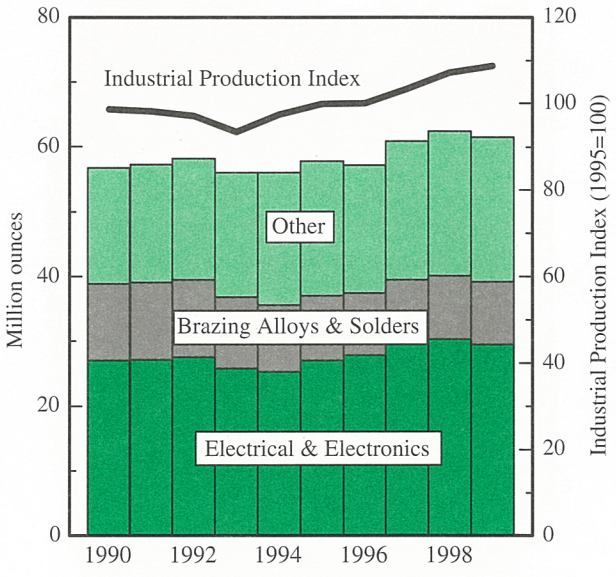
Industrial demand in **Switzerland** increased by nearly 4% to 10.4 Moz (322 t). The majority of this fabrication is destined for export. As a result, Switzerland has benefited from the economic upturn in East Asia and robust demand in a number of European Union markets.

Silver use for industrial applications in **France** rose by just under 4% to 11.6 Moz (360 t) after falling by almost 20% in 1998. Although growth in electrical and electronics fabrication was just 1% there were two noticeable trends last year. Firstly, despite a second half recovery in electromechanical products, demand was lower year-on-year, due to the impact of the stock overhang that had come about in the aftermath of the collapse in European industrial demand during the last quarter of 1998. Secondly, the ongoing recovery in East Asian demand ensured a return to pre-crisis levels in the electronics sector, which was boosted by a strong rise in the export of silver salts.

The use of silver for industrial applications in **Italy** rose 2% to 10.8 Moz (337 t). Growth was constrained by the weakness of industrial production. The main area of strength was in exports of brazing alloys.

Figure 42

EU Industrial Fabrication



EU Industrial Production
Index (1995=100)

1995	1996	1997	1998	1999
100.0	104.8	111.1	115.7	119.8

Source: OECD

North America

Demand for silver in industrial applications in the United States rose consistently throughout the 1990s. Last year's total of 88.5 Moz (2,753 t) was over 80% above the level recorded in 1990. Figure 43 shows that growth in silver offtake has comfortably outstripped the rise in US industrial production over the same period. (In 1999 this tendency was magnified: silver demand surging by over 9% year-on-year compared to a 1.5% rise in overall US industrial production). This remarkable increase in demand has principally been driven by the electronics sector but, in addition, the use of silver has grown across an increasing variety of end-uses, some of which simply did not exist a decade earlier (e.g. CD-R discs).

Figure 43 also illustrates how the share of electronics has grown over the past 10 years from less than 20% to nearly 40% of total industrial demand. In 1999, the amount of silver used for electronics alone is estimated to have risen by 8% to 33.3 Moz (1,036 t). The generally positive state of most of the electronics industry was behind the rise in raw materials use (an indication of this is that worldwide semi-conductor shipments rose by over 15% last year). Most importantly, the volume of electronics products manufactured that typically contain silver, e.g. for shielding and conductive applications in cellphones, continued to rise. This has offset any tendency towards substitution of silver by base metals in certain specific applications. Furthermore, demand has been boosted as new uses for silver are discovered or where lower cost silver can be substituted for other precious metals such as gold. Last year saw a very good example of this process in the case of Compact Disc-Recordable Discs (CD-Rs).

United States Industrial Production
Index (1995=100)

1995	1996	1997	1998	1999
100.0	100.5	104.3	108.0	109.6

Source: OECD

Until 1999 nearly all CD-Rs were gold plated. When this product was originally developed it was in practice "over-engineered", partly to ensure the concept would work well (e.g. resulting in a theoretical 200 year product life!). However, as production grew and competition increased, manufacturers sought to reduce costs and technological advances made it possible to substitute gold with silver. From using 35-40 cents of gold per disc, the industry has shifted to using at most 1 cent of silver per disc. The resulting change in output for US manufacturers of the plating materials such as sputtering targets was dramatic. In the space of just a few months demand for gold targets collapsed and silver ones exploded, in the latter case also because the overall quantity of CD-Rs manufactured increased tremendously last year.

Electrical demand remained solid with steady growth in contact production for the construction (housing starts were up 2.9%) and automotive sectors (car and light truck production rose 6.7% in 1999). Growth was lower from the heavier end of the contact market, such as for industrial power control. This reduced the overall increase in electrical-related demand to 3% in 1999.

More silver is being used in catalysts. The increase in demand has come from new ethylene oxide (EO) catalysts coming on stream in various parts of the globe. Two new catalysts were manufactured in 1999, together requiring several million ounces of new metal. In addition, each year a number of EO catalysts are taken out of service and recycled, although here the effect on silver demand is, in practice, limited to the

Figure 43
US Industrial Fabrication

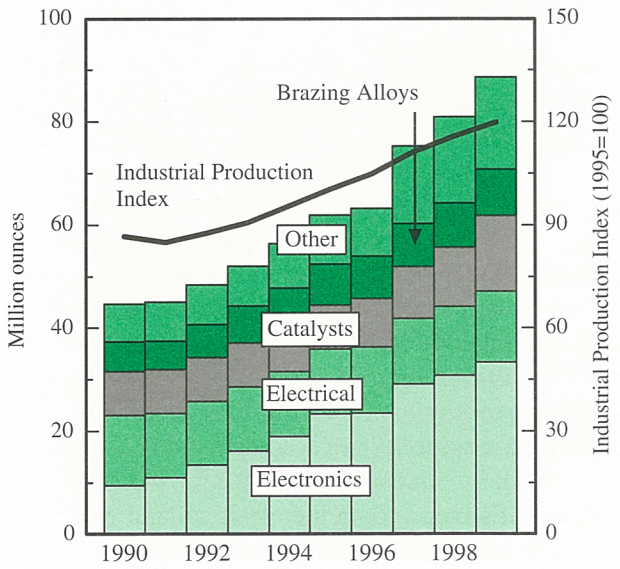


Table 4
World Silver Fabrication
(including the use of scrap)
Million ounces

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Italy	51.0	56.3	60.5	56.7	52.1	50.1	52.2	56.5	56.3	62.4
Germany	54.3	57.9	54.8	48.4	52.8	46.0	45.6	46.0	46.8	40.5
UK & Ireland	25.0	25.4	26.8	28.4	31.2	32.3	34.4	35.5	39.2	39.9
Belgium	19.9	20.2	20.2	20.7	21.1	23.4	25.3	27.2	33.8	37.5
France	26.5	28.6	30.9	30.2	28.2	31.1	27.2	28.7	28.6	26.5
Switzerland	5.7	7.6	6.7	6.2	7.1	7.3	7.8	9.6	10.7	11.1
Spain	15.2	17.4	6.6	6.1	10.7	9.9	9.3	8.7	8.8	7.5
Greece	3.2	3.4	3.5	3.7	3.9	3.8	4.2	4.5	4.1	4.1
Poland	5.1	3.9	2.1	2.3	2.6	3.1	3.0	3.4	3.6	3.7
Portugal	2.5	2.3	2.5	2.5	2.0	2.4	2.8	2.9	3.1	3.2
Norway	1.0	2.0	2.5	1.9	1.6	1.6	1.4	1.5	1.5	3.0
Netherlands	2.8	2.2	2.1	2.1	2.6	3.2	2.2	2.1	2.1	2.1
Sweden	1.5	1.9	1.6	1.6	1.5	1.4	1.5	1.7	1.4	1.4
Austria	1.6	1.7	1.6	1.5	1.5	1.6	1.5	1.3	1.4	1.2
Denmark	1.1	1.0	1.1	1.0	1.0	1.0	1.0	1.1	1.0	1.0
Czech & Slovak Republics	1.7	1.5	1.0	0.7	0.6	0.8	0.7	0.8	0.9	0.8
Finland	1.4	1.5	1.3	0.9	1.0	0.9	1.0	0.9	0.7	0.7
Romania	0.7	0.6	0.5	0.5	0.4	0.3	0.4	0.4	0.5	0.4
Cyprus & Malta	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4
Other	1.0	1.0	1.0	1.1	0.9	0.9	0.9	0.8	0.8	0.8
Total Europe	221.4	236.6	227.7	216.6	223.0	221.5	222.8	233.8	245.5	248.0
North America										
United States	137.0	136.9	135.5	140.8	149.9	157.7	162.1	172.8	188.9	205.1
Mexico	14.1	15.1	22.9	32.0	27.6	17.5	20.8	23.7	22.2	23.4
Canada	6.5	4.7	2.3	2.8	3.1	2.7	2.7	2.8	3.4	3.5
Total North America	157.7	156.7	160.7	175.5	180.6	177.9	185.6	199.3	214.4	232.0
Central & South America										
Brazil	6.8	6.7	6.6	6.9	8.3	9.4	8.4	8.4	8.1	7.7
Argentina	4.1	4.1	4.1	4.1	4.1	3.9	3.8	3.8	3.1	2.7
Dominican Republic	0.0	0.0	0.0	0.1	0.0	0.1	0.4	0.8	1.1	1.3
Peru	1.5	1.2	0.9	0.8	0.9	1.0	1.1	1.1	1.1	1.0
Colombia	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.9
Ecuador	0.4	0.4	0.4	0.5	0.7	0.7	0.7	0.7	0.7	0.5
Chile	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Other	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total Central & South America	14.9	14.4	14.1	14.5	15.9	17.1	16.4	16.8	16.2	15.0
Middle East										
Turkey	4.9	4.7	5.5	5.9	5.2	6.1	6.4	6.5	6.2	5.5
Israel	2.1	2.3	2.6	2.8	3.1	3.4	3.7	4.0	3.9	3.9
Egypt	1.6	1.7	2.3	1.9	2.5	2.2	2.3	2.1	1.9	2.0
Saudi Arabia	0.2	0.3	0.4	0.4	0.3	0.4	0.4	0.6	0.5	0.6
Other	1.6	1.9	2.7	2.0	2.4	2.5	2.6	2.6	2.5	2.6
Total Middle East	10.4	10.9	13.4	13.2	13.5	14.5	15.4	15.8	14.9	14.5
Indian Sub-Continent										
India	46.8	44.8	58.1	108.8	93.9	101.3	122.2	122.9	104.3	109.0
Bangladesh	1.8	2.0	2.6	3.9	4.5	5.1	5.8	6.4	5.1	5.7
Other	1.7	2.3	2.8	3.4	2.8	3.8	2.7	4.1	2.8	3.4
Total Indian Sub-Continent	50.2	49.1	63.5	116.0	101.2	110.2	130.7	133.5	112.3	118.1
East Asia										
Japan	115.8	108.8	104.9	107.9	108.4	112.7	112.1	127.2	112.8	125.2
Thailand	24.1	20.1	31.6	38.7	29.1	27.7	27.6	27.1	24.2	26.7
South Korea	6.8	9.3	9.0	15.6	16.4	18.6	18.5	18.6	13.8	16.7
Taiwan	4.5	3.6	4.3	4.8	5.3	5.7	6.4	6.9	6.8	6.8
Hong Kong	2.4	2.1	2.3	2.6	3.4	3.4	3.7	4.4	3.6	3.9
Indonesia	1.4	1.7	1.9	1.8	2.7	3.1	3.4	4.1	2.7	3.2

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Myanmar, Laos & Cambodia	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.0	0.8	0.9
Vietnam	0.3	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.6	0.7
Malaysia	0.3	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.5
Other	0.5	0.4	1.2	0.4	0.4	0.4	0.3	0.3	0.3	0.4
Total East Asia	157.1	147.6	156.9	173.7	167.5	173.7	174.2	190.6	165.9	184.8
Africa										
Morocco	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.5
Tunisia	0.2	0.2	0.2	0.2	0.3	0.3	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	0.3	0.3
Algeria	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2
Other	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.3	0.4	0.4
Total Africa	2.1	1.9	1.8	2.0	1.9	2.0	1.8	1.8	1.7	1.7
Oceania										
Australia	5.2	5.2	6.9	7.0	6.3	5.3	5.2	5.2	5.6	5.8
Total Oceania	5.2	5.2	6.9	7.0	6.3	5.3	5.2	5.2	5.6	5.8
Western World Total	619.0	622.4	645.1	718.5	709.9	722.4	752.1	796.7	776.5	820.0
Other Countries										
China	17.8	19.2	19.6	21.1	24.6	26.0	28.6	32.2	33.9	32.8
Soviet Union/CIS	80.6	67.2	50.2	40.9	31.7	29.0	28.4	27.8	25.6	24.6
North Korea	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Total Other Countries	98.4	86.4	69.8	62.2	56.3	55.0	57.0	60.0	59.5	57.4
World Total	717.4	708.9	714.9	780.7	766.2	777.4	809.1	856.8	836.0	877.4

amount of metal lost in the recycling process (typically no more than 1% in the United States).

The amount of silver used for brazing alloys and solders rose to 8.9 Moz (276 t) last year. Demand from the automotive sector increased but was under pressure in some other areas due to substitution by alternative materials.

As Figure 43 shows, besides electronics, electrical, catalysts and brazing alloys and solders, a growing amount of silver has been required by US manufacturers for a variety of "other" industrial applications. Growth in this "other" category (which includes everything from mirrors and batteries to water purification and musical instruments) came to nearly 7% in 1999, taking its sum-total to 17.9 Moz (557 t). Most of the increase last year came from the glass-coating sector where demand rose by 25%. More silver was used by the automotive industry for windshields but the largest increase was seen in architectural glass used in commercial buildings. Although more expensive than conventional glass, the silver coated product can generate considerable energy savings while also keeping out harmful infra-red and ultra-violet light. Demand is in large part being driven by tougher environmental legislation in states such as California. There were no changes of note in demand from the myriad of other end-uses in the "other" category, save for water-purification where offtake continued to grow last year from what remains a low level.

India

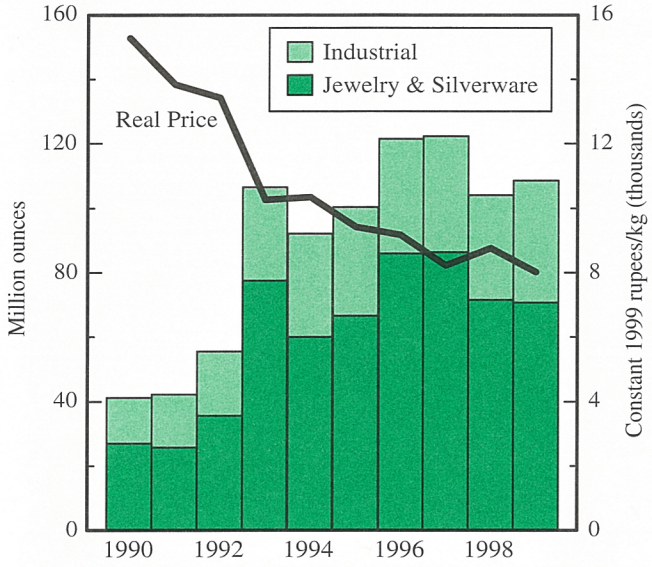
The 17% increase in **Indian** industrial fabrication, to 37.9 Moz (1,180 t), was consistent with economic developments during the year. 1999 saw robust economic growth, with GDP rising by over 6% (and certain reports suggesting it may have been as high as 7%). Industrial production also grew strongly in 1999, by close to 5%.

Coupled to this, a solid export performance, and relatively weaker growth in imports, helped to maintain the value of the rupee against the dollar (which depreciated by a modest 2.4% compared to 1998's 13.6%). Of particular importance, urban incomes appear to have been buoyant, which has boosted demand for many industrial uses of silver.

Most of the industrial categories tracked by GFMS showed year-on-year increases last year. The biggest

Figure 44

Indian Fabrication



rise was seen in pharmacy and chemical uses of silver (of around 20%). One important component of this source of demand is the use of silver in ayurvedic medicines, a tradition that is not particularly well known outside of India, but permeates everyday living there.

Ayurveda is a Sanskrit word, derived from two roots: ayur, which means life, and veda, knowledge. Ayurveda is an ancient clinical art of diagnosing the disease process, and has both preventative and curative elements to it. The preventative component emphasizes the need for a strict code of personal and social hygiene, the details of which depend upon individual, climatic, and environmental needs. Bodily exercises, the use of herbal preparations, and Yoga form a part of the remedial measures. The curative aspects of Ayurvedic medicine involve the use of herbal medicines and external preparations, many of which contain precious metals like gold and silver, together with physiotherapy and diet.

Ayurvedic practitioners are estimated to provide health services to a phenomenal 500 million or more people in India, and are a major force for primary health care. The shear numbers of people treated by practitioners using ayurvedic medicines points to why so much silver (and gold) is consumed in this way.

Turning to other components of industrial demand, the use of silver in foils also increased strongly last year, rising by over 14% to around 6.4 Moz (200 t). Foils are used widely in the embellishment of food stuffs (for example, it is common to see sweets in India covered with a thin film of silver foil), and it seems that rising urban incomes have resulted in increased consumption of silver in this form. Although the use of ghutka (chewing tobacco mixed with nuts and spices together with silver foil) is now often proscribed, it is still consumed widely, so the anticipated fall in this category has not yet materialized.

Plating applications, which is the largest sector, rose by around 11% last year. The data point to a rise in both "pure" industrial uses of silver for plating as well as a rise in decorative applications. The use of silver in jari (gilded silver thread used in embroidery, produced predominantly in Surat in southeastern Gujarat State) however, remained stable year-on-year. Somewhat surprisingly, production did not recover from 1998's sharp fall, which was due to extensive flooding in Surat, and the latter may have resulted in weaker rural incomes (see the jewelry section later in the chapter for more on this).

Turning to the uses of silver in "proper" industrial applications, both electronics/electrical and brazing alloys rose year-on-year, but by less than the other industrial categories.

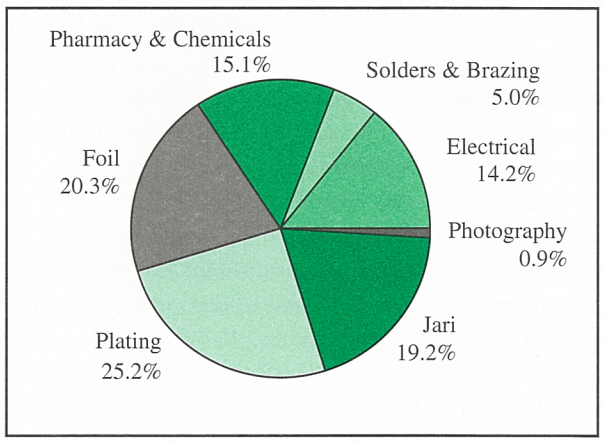
East Asia

In 1999, **Japan** recorded a very strong increase in total industrial demand of over 20%, to 63.5 Moz (1,974 t). Considering the 11% fall in 1998's offtake, and last year's slightly better economic performance, a recovery was to have been expected. However, such strong growth was not.

Not surprisingly, the reasons for this tremendous turnaround cannot be found by simply looking at the

Figure 45

Indian Industrial Fabrication, 1999



economy as a whole, or in isolation from what has been happening in the rest of Asia.

For instance, Japanese macroeconomic data point to a somewhat muted recovery last year, something that could well have been consistent with a further *fall* in silver demand, rather than a large increase. Furthermore, as the minitable below shows, manufacturing production managed a rather paltry 0.4% rise year-on-year, and GDP growth was not noticeably better, rising by only around 0.5% over 1998. At best, it is difficult to explain such a large recovery in industrial silver demand on the basis of domestic economic growth in 1999. The answer, of course, lies elsewhere.

The major contribution to last year's growth came about because of the recovery in the Asian economies. However, of almost equal importance was the tremendous growth in electronics demand, both locally and globally.

Japanese Manufacturing Production
Index (1995=100)

1995	1996	1997	1998	1999
100.0	102.3	106.0	98.5	98.9

Source: OECD

To start with, it is worth recalling that the collapse of the East Asian economies in late 1997 had a dual effect on demand for industrial silver products in Japan. The immediate impact of the crisis was on Asian consumption and investment, which fell sharply. Consequently, demand for products either built in Japan or containing silver bearing materials made there, declined. A secondary effect was seen in the increasing competition from countries in the region which suddenly found themselves with huge excess capacity, and so needed to look to export markets to survive. The best example of this was Korea, which aggressively pursued export markets to sell its excess production, including amongst other things, silver industrial products. (It is interesting to note that a similar pattern of behavior was seen in the gold jewelry market at the time. Most non-Asian jewelry fabricators reported heightened competition from Korea and the rest of the region during 1998).

The tremendous recovery of many Asian economies during 1999 undoubtedly helped to fuel demand for Japanese industrial products, both directly (through demand for finished products) and indirectly (through reduced competition).

Japanese Non-Photographic Nitrate and Contact Production
Million ounces

	1996	1997	1998	1999
non-photo nitrates	9.6	10.5	10.5	13.7
contacts	8.7	9.5	9.1	9.5

Turning to the second factor spurring offtake last year, electronics' uses of silver, in the form of nitrates, plating salts and contacts amongst others, were of central importance. GFMS estimate that electrical and electronics uses of silver rose by a staggering 26% in 1999 (see Table 5(a)), to 30 Moz (933 t). As can be deduced from the mini-table above, much of this growth was to be found in the production of non-photographic nitrates (for use in electronics applications).

Mobile phone and computer demand underpinned this, although the strength of overall electronics demand played a role too. For instance, the Semiconductor Industry Association reports that Japanese shipments increased by close to 25% last year.

Demand for multilayer ceramic capacitors (MLCCs) accounted for a substantial portion of silver demand in electronics. Presently, Japan is the largest supplier of MLCC products, which appear in a huge array of applications. For instance, mobile phones can use over 150 MLCC products, and they are also key components in the manufacture of TFT-LCD (thin film transistor-liquid crystal display) products (with each TFT-LCD requiring a large number of MLCC products).

MLCCs are so ubiquitous that it is probably worthwhile devoting some time to discussing what it is that they actually do.

Capacitors are devices that store electric energy in the form of an electric field generated in the space between two separated, oppositely charged electrodes. Their capacity to store energy makes them essential components in many electric circuits, and that capacity can be greatly increased by inserting ceramic material into the space separating the electrodes. The performance of ceramic disk capacitors can be increased by using thinner capacitors, but this results in fragility.

The advantage of MLCCs is that they overcome this problem by interleaving ceramic and electrode layers. Importantly, from the perspective of this *Survey*, is that

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Germany	22.3	21.1	20.0	18.6	18.0	18.5	17.2	17.8	18.4	18.3
UK & Ireland	10.5	10.8	11.1	11.4	11.7	11.9	12.2	12.5	16.3	15.2
France	10.1	11.1	12.8	11.3	11.6	12.0	11.7	13.4	11.2	11.6
Italy	9.1	9.5	9.6	10.1	10.2	10.6	11.2	11.4	10.6	10.8
Switzerland	5.1	5.7	6.0	5.6	6.5	6.6	6.9	8.6	10.0	10.4
Spain	1.9	1.9	1.8	1.8	1.7	1.8	2.0	2.9	3.1	2.7
Netherlands	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Norway	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1.4
Poland	0.6	0.5	0.5	0.6	0.8	0.8	0.8	0.7	0.7	0.7
Austria	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.5	0.5
Czech & Slovak Republics	0.8	0.7	0.5	0.5	0.4	0.5	0.5	0.4	0.4	0.5
Sweden	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4
Belgium	0.3	0.3	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	0.8	0.8
Total Europe	64.6	65.3	66.5	64.1	65.0	67.0	66.6	71.9	74.6	75.3
North America										
United States	49.0	49.3	52.7	56.3	60.6	65.9	68.2	75.3	81.0	88.5
Mexico	2.6	2.6	2.6	2.6	2.8	2.5	2.6	2.9	3.2	5.1
Canada	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.5	0.5
Total North America	52.2	52.6	55.9	59.6	64.0	69.2	71.4	78.8	84.8	94.2
Central & South America										
Brazil	2.4	2.4	2.4	2.5	3.2	3.5	3.3	3.4	3.5	3.2
Argentina	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.0
Colombia	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2
Other	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total Central & South America	4.4	4.4	4.4	4.5	5.2	5.4	5.2	5.3	5.4	4.8
Middle East										
Israel	0.4	0.6	0.7	0.8	0.9	1.0	1.0	1.0	1.0	0.9
Turkey	0.8	0.7	0.9	0.9	0.8	0.9	0.9	1.0	0.9	0.8
Egypt	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Middle East	1.3	1.4	2.0	1.9	1.8	2.0	2.1	2.1	2.0	1.9
Indian Sub-Continent										
India	14.1	16.6	20.0	29.0	32.1	34.1	35.5	36.0	32.4	37.9
Bangladesh & Nepal	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.3	0.4	0.5	0.6	0.5	0.6	0.5	0.7	0.5	0.6
Total Indian Sub-Continent	15.5	17.0	20.4	29.5	32.6	34.8	36.0	36.7	32.9	38.5
East Asia										
Japan	46.6	47.5	44.1	45.8	51.1	53.6	52.1	59.4	52.8	63.5
South Korea	2.3	4.0	4.0	8.4	10.0	11.9	11.9	12.3	11.2	12.2
Taiwan	3.0	3.1	3.7	4.2	4.7	5.2	5.8	6.3	6.2	6.3
Hong Kong	1.5	1.1	1.3	1.6	2.4	2.5	2.8	3.4	3.0	3.3
Indonesia	0.4	0.6	0.7	0.4	0.4	0.4	0.4	0.5	0.5	0.5
Total East Asia	53.8	56.3	53.8	60.4	68.6	73.6	73.1	81.9	73.7	85.8
Africa										
Morocco	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
South Africa	0.5	0.3	0.2	0.5	0.3	0.3	0.2	0.2	0.2	0.2
Other	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1
Total Africa	0.8	0.6	0.5	0.8	0.6	0.7	0.6	0.6	0.6	0.6
Oceania										
Australia	2.0	1.9	2.0	2.0	2.2	2.4	2.3	2.1	2.3	2.4
Total Oceania	2.0	1.9	2.0	2.0	2.2	2.4	2.3	2.1	2.3	2.4
Western World Total	194.6	199.5	205.6	223.0	240.1	255.2	257.2	279.4	276.3	303.4

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Other Countries										
China	12.9	13.2	14.1	14.9	17.3	18.2	19.1	20.3	20.7	20.9
Soviet Union/CIS	66.0	54.1	39.5	31.9	24.0	21.9	21.1	20.6	19.6	18.8
Total Other Countries	78.9	67.3	53.6	46.8	41.3	40.1	40.1	41.0	40.4	39.8
World Total	273.5	266.8	259.3	269.8	281.4	295.3	297.3	320.4	316.7	343.2

the electrode layers are usually palladium or a palladium-silver alloy. Furthermore, with palladium prices having rocketed over the past few years, the incentive has been to substitute away from using this metal to other materials, usually containing silver in some form or another. The Japanese are leading the way in this migration, and are increasingly using silver nickel alloys as substitutes (the substitution effect has worked together with the growth in total demand for MLCCs to boost overall silver offtake).

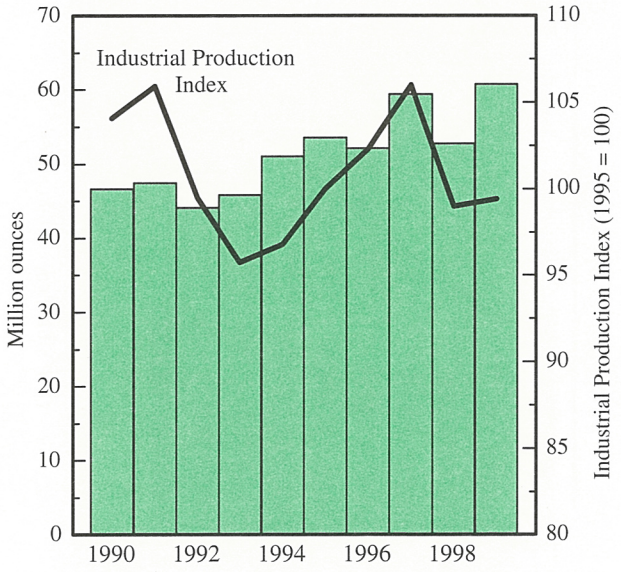
Antibacterial applications of nitrates grew in 1999, having stabilized in 1998. What is truly remarkable is that these uses now account for around 10% of total non-photographic nitrate consumption. It seems that the Japanese appetite for novel ways to protect themselves from bacteria knows no bounds. In addition to bacteria proof pens, playpit sand for children and ceramic tiles glazed with silver containing antibacterial compounds, it is now possible to buy silver bearing wet-wipes and laundry powder to beat the bugs. Top of the list, though, has to be the incense produced by a company in Japan which contains ionized silver. When burnt it spreads bacteria killing ions through the room (see the Silver Institute Newsletter of September 1999 for more on this).

More serious antibacterial applications of silver can be found in the water-purification systems that are becoming ever more popular, and in a variety of medical applications (although these are not unique to Japan).

Indications are that the use of nitrate in mirrors was at best flat year-on-year, and may in fact have fallen slightly again (having dropped over 20% in 1998). Data on the construction industry point to there having been a fall (total new building orders fell by close to 9% year-on-year in yen terms), but many nitrate suppliers to the mirror industry reported offtake as having been flat.

Contact production rose by a modest 4% year-on-year, nearly offsetting the 4% drop seen in 1998. As opposed to 1998, which saw falling vehicle production and weak electronics offtake working in the same direction to drive demand down, 1999 witnessed the two working in opposite directions. The phenomenal recovery in electronics demand is reflected in the fact that it helped drive up total contact production by 4% in spite of the 1.5% fall in Japanese vehicle production (see the mini-table below) and the weakness in the construction sector. Certain larger fabricators of contacts for heavy electrical uses reported that demand was down markedly year-on-year (some as much as 13%), making the overall increase all the more remarkable.

Figure 46
Japanese Industrial Fabrication



Japanese Motor Vehicle Production
Year-on year percent change

1995	1996	1997	1998	1999
-3.4	1.5	6.1	-8.4	-1.5

Source: JAMA

As would have been anticipated given the strength of the electronics sector, electroplating solution demand rose markedly in 1999, by around 20%, to take it to the highest level yet recorded for Japan. At this juncture it is important to comment on where many of these silver products are actually consumed.

As we have noted in past *Surveys*, GFMS count demand at the point of fabrication. For example, if nitrate is fabricated in Japan for use in an electronics application in say, Malaysia, it is counted as Japanese demand. The observant reader may have wondered, for instance, why GFMS show such a low number for silver electronics fabrication in Malaysia and the Philippines. The reason is that most of these products are imported from, for example, Japan.

The fabrication of brazing alloys and solders rose modestly year-on-year, up by around 1% to 4.2 Moz (131 t). This was primarily related to the weakness in domestic demand in Japan (alloys and solders, especially for "old economy" products like airconditioners, are not as widely exported as materials used in electronics applications, and so are more sensitive to the strength of the local economy).

Before moving on to the other East Asian fabricators, it is important to note that the evidence does point to there having been a degree of stock building in Japan in 1999, of both bullion and finished product, but primarily of the latter. For instance, in the case of non-photographic nitrate, GFMS data indicate a marked rise in stock building by both fabricators and the end-consumers. For the purposes of this *Survey*, the build-up of finished stock has been counted in the fabrication numbers.

For the first time GFMS have been able to separate out jewelry and silverware from industrial demand in **China**. One of the major factors underpinning this has been the development of a reliable time series for Chinese silver jewelry exports (which, as is discussed later in this chapter, have grown rapidly over the past few years). As a consequence of this, the industrial series has been adjusted down.

GFMS estimate that Chinese fabrication of silver for industrial applications rose by a modest 0.9%, to 20.9 Moz (651 t) in 1999. It is necessary to see the trend in Chinese offtake in the context of some important structural changes that have been taking place internally. The most significant of these has been the liberalization of the silver market, something that occurred, for all intents and purposes, some years back. The other is the technological shifts that have taken place in recent years as Chinese industry has geared up to face increasing international competition.

There can be little doubt that a large proportion of the growth in offtake over the past decade has been stimulated in part by the *de facto* liberalization of the silver market since around 1995. The increasingly *laissez-faire* attitude of the People's Bank of China to making allocations to the market from this time has facilitated the use of silver across a wider range of applications than otherwise might have been the case.

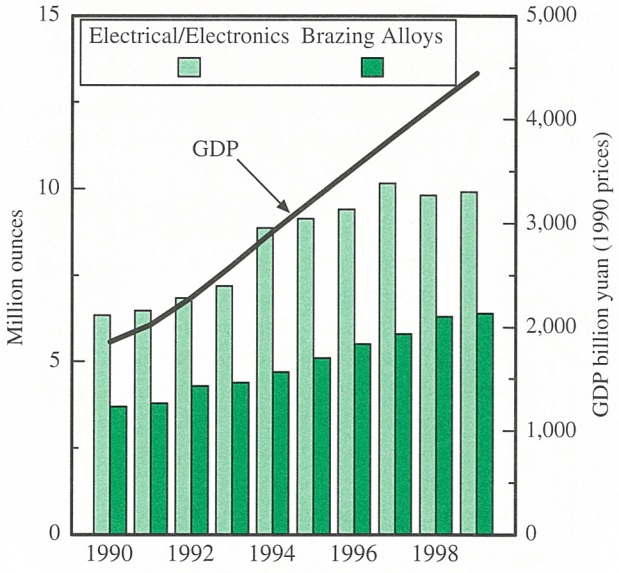
Of equal importance, however, has been the progress made in producing ever higher quality silver bearing industrial products. For a number of years, fabricating countries like Korea have experienced rising competition from mainland Chinese fabricators in supplying products to the domestic market (instead of imported components such as contacts being used in assembly plants, locally produced ones are being used). Of course, this competition is generally focused at the lower end of the market, but it parodies Chinese fabrication to suggest that it is only here that they can compete with international products.

These changes, coupled to other developments such as economic liberalization and economic growth, have ensured that Chinese offtake has increased steadily over the past decade.

A sign of the changes taking place in the Chinese market can be seen in the increasing shares being taken by domestic appliance manufacturers (they are in fact taking a rising share of an expanding market). For

Figure 47

Chinese Industrial Uses of Silver



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. For example, silver is used in formaldehyde catalysts for the manufacture of plastics and, to an even greater extent, in ethylene oxide catalysts for the petrochemical industry.

Silver is employed as a bactericide and algaecide 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.

instance, a survey of major medium and large sized stores across China (by China Daily Business Weekly) indicated that local brands Changhong, Konka and TCL accounted for 50 per cent of colour TV sales, Haier and Small Swan shared 50 per cent of the automatic washing machine market, and over 60 per cent of refrigerators sold last year were made by Haier, Rongsheng or Meiling. Many of these fabricators will now use only domestically manufactured materials such as contacts in their own fabrication.

The primary reason for the modest growth in industrial offtake last year was the weakness of the domestic economy. Although the economy grew by around 7% according to official statistics, it was the lowest rate recorded since 1990, and masks what was actually a weak year on the whole. Remarkably, considering the inflationary times of the early and mid-1990s, China experienced deflation last year of close to 3%.

The extent of the underlying weakness of the economy is evident from a wealth of economic statistics. For example, by December, actual foreign direct investment had fallen by 9.7%, investment in fixed assets in 1999 increased just 7.8% from 1998, a much lower rate than the 14% growth recorded in that year, and the growth in consumer spending was estimated at just 6.8% for the year.

South Korean industrial demand rose by 8.6% in 1999, up to 12.2 Moz (379 t), close to the record of 12.3 (382 t) posted in 1997. There were two driving forces behind this robust growth: economic recovery and vibrant electronics demand.

The economy expanded 10.7% in 1999, the fastest rate since 1987. According to Bank of Korea data, year-on-year growth in the last quarter of 1999 was a phenomenal 13%. And after a dismal 1998, higher employment has spurred consumer spending, which has now replaced exports and public spending as the primary engine of economic growth. The strength of the recovery in the industrial sector was reflected in vigorous 24% year-on-year production growth (see the minitable below).

There was also tremendous growth in the electronics industry, driven both by final demand within Korea itself (i.e. manufacturers such as Samsung Electronics producing final products like TV's for both the local and export market) and by export demand (by, for example, the packaging industry in the Philippines taking industrial silver products like silver potassium cyanide).

Korean Industrial Production
Index (1995=100)

1995	1996	1997	1998	1999
100.0	108.5	113.5	106.2	132.0

Source: OECD

Remarkably, South Korea's computer market grew by 65 per cent in 1999, boosted by economic recovery and expansion of the Internet sector. It was no coincidence that Samsung Electronics (one of the world's largest makers of memory chips), the country's largest publicly traded company and flagship of the Samsung Group, posted a record 3.2 trillion won ($2.8 billion) profit in 1999 as sales of mobile phones, computer displays and computer memory chips surged.

GFMS estimate that electronics and electrical uses of silver rose by close to 10%. By contrast, brazing alloys and solders use increased by a more modest 4% year-on-year.

After having fallen by around 2% in 1998, industrial applications of silver in **Taiwan** rose by 1.6% to take total silver offtake to just under the record set in 1997 of 6.3 Moz (196 t). At first sight, the modest increase in Taiwanese fabrication demand appears to contradict the data showing tremendous growth in, especially, the electronics sector.

The key thing to recognize about silver industrial demand in Taiwan is that a substantial proportion is met from imported semi-manufactured products like silver potassium cyanide and contacts. Because these products are not fabricated in Taiwan itself, GFMS do not count them in that country's statistics (they are, of course, counted elsewhere, for example in Japan's fabrication numbers).

As we have noted in previous *Surveys*, Taiwan has a huge OEM (Original Equipment Manufacturer) fabrication infrastructure, catering primarily for electronics, but specializing in computers. Taiwan is a dominant force in the global market, manufacturing around 40 per cent of the notebook PCs sold in the world, two-thirds of the motherboards, keyboards and mice, and close to 60 per cent of the monitors. As a country, Taiwan ranks as the first or second largest manufacturer of 14 categories of PC components, including PC motherboards and chipsets, CD-Rom drives, graphics cards and scanners. However, much of this is produced using imported components, and so relatively speaking, Taiwan's use of industrial silver for electronics applications recorded in GFMS

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
United States	23.3	23.5	25.8	28.6	31.6	36.0	36.3	41.9	44.1	47.1
Japan	22.4	22.4	20.3	20.9	22.5	23.9	22.7	25.8	23.7	30.0
Germany	13.5	12.7	12.1	11.3	10.9	11.9	11.6	11.9	12.2	12.2
China	6.3	6.5	6.9	7.2	8.9	9.1	9.4	10.2	9.8	9.9
Switzerland	1.3	1.9	2.6	2.8	3.5	3.8	4.1	5.5	7.3	7.5
France	4.8	5.3	6.2	5.0	5.4	6.1	6.3	7.7	6.7	6.8
South Korea	0.0	0.6	0.5	4.5	5.3	6.4	6.4	6.5	6.0	6.6
UK & Ireland	4.2	4.4	4.5	4.5	4.6	4.7	5.0	5.1	6.8	5.7
Taiwan	2.2	2.2	2.7	2.9	3.3	3.6	4.2	4.7	4.8	4.8
India	2.4	2.4	2.4	2.4	2.6	3.0	3.2	4.2	4.2	4.5
Italy	3.0	3.1	3.1	3.2	2.7	2.7	3.3	3.2	2.9	3.0
Hong Kong	1.2	0.8	0.9	1.2	1.8	1.9	2.2	2.7	2.5	2.9
Mexico	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.2	1.3	2.9
Brazil	1.0	1.0	1.0	1.0	1.5	1.6	1.4	1.4	1.4	1.3
Spain	0.8	0.9	0.9	1.0	0.9	0.9	0.9	0.9	1.0	1.0
Turkey	0.8	0.7	0.9	0.9	0.8	0.9	0.9	1.0	0.9	0.8
Netherlands	0.6	0.6	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	0.5	0.6
Austria	0.2	0.2	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	0.1	0.1
Egypt	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	**89.9**	**91.2**	**93.3**	**100.0**	**109.0**	**119.2**	**120.5**	**135.4**	**137.2**	**148.5**

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
United States	5.8	5.6	6.5	7.2	7.7	8.0	8.2	8.4	8.6	8.9
China	3.7	3.8	4.3	4.4	4.7	5.1	5.5	5.8	6.3	6.4
Japan	4.5	4.8	4.2	3.8	4.7	4.8	5.1	5.0	4.2	4.2
Germany	5.4	5.1	4.8	4.5	4.0	3.5	2.9	3.1	3.1	3.0
Italy	1.4	1.5	1.6	1.7	1.9	2.1	2.1	1.9	1.8	2.2
UK & Ireland	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.4	2.2
India	1.3	1.5	1.5	1.5	1.6	1.9	2.1	1.6	1.5	1.6
Switzerland	2.4	2.6	2.4	1.8	1.8	1.8	1.7	1.7	1.6	1.5
Spain	0.6	0.6	0.5	0.4	0.3	0.3	0.6	0.9	1.0	1.1
Taiwan	0.5	0.5	0.6	0.7	0.8	1.0	1.1	1.1	1.0	1.0
France	1.8	2.1	2.4	1.8	1.4	1.3	1.4	1.4	1.0	0.9
South Korea	0.1	0.2	0.3	0.8	1.0	1.2	1.2	1.1	0.8	0.8
Australia	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.7	0.7
Brazil	0.5	0.5	0.5	0.6	0.8	0.9	0.9	0.8	0.8	0.7
Mexico	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	1.0	0.6
Canada	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.3	0.3
Netherlands	0.3	0.3	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	0.1	0.1
Israel	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	**32.6**	**33.3**	**34.2**	**33.9**	**35.6**	**36.9**	**37.3**	**37.4**	**36.6**	**36.7**

numbers can seem low.

One particularly important growth area in Taiwan that is fed through local fabrication of silver semis is recordable compact discs (CD-Rs). As was discussed in the North American section above, whilst only a few years ago the industry produced the bulk of CD-Rs using gold coatings, this is now almost never the case, with silver now being the preferred material. The statistics for Taiwanese production of CD-Rs are as impressive as those for computer production. Taiwan now has between 60% and 70% of the global market. In terms of final uses, around 25% are used in personal computers and audio recorders respectively, with the balance being used for "video" recorders. A proportion of the silver sputtering targets used in producing CD-Rs in Taiwan are produced locally, and so are counted in the GFMS statistics.

Industrial demand for silver in **Hong Kong** rose robustly in 1999, up by 9.2% to 3.3 Moz (101 t). Most of this production was destined for use in electronics (up by well over 17% to 2.9 Moz (90 t)) around the Asian region, primarily in countries with large packaging industries like Malaysia, Korea, Singapore and the Philippines.

Photography

- Total photographic demand rose by 0.7% in 1999, after strong growth the previous year of 5%.
- Production declined by 0.6% in Europe but rose by nearly 4% in North America.
- Japanese demand increased modestly year-on-year, up 3% to59.9 Moz (1,864 t).

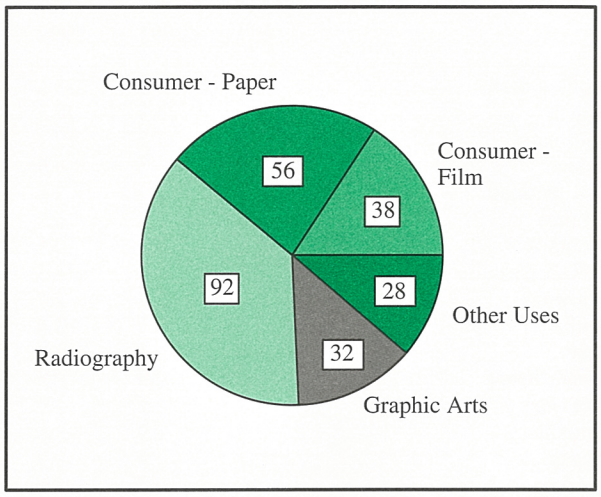
There were no substantial changes in the composition of photographic demand in 1999. Figure 48 shows the breakdown of the main components. In comparison with 1998, there was a decline in graphics arts in both absolute and percentage terms, continuing a trend of both relative and absolute decline that has been in evidence for some time now.

Demand for silver in the **United States** is estimated to have increased by a little under 5% to 92.3 Moz (2,872 t) last year. Part of this growth was accounted for by higher output of photographic paper and film for the amateur market. Local consumption of color paper and film increased by 4% and 9% respectively in 1999. (The associated rise in fabrication would have been somewhat smaller due to ongoing economization in silver use by manufacturers).

Figure 48

Photographic Uses of Silver

million ounces



Silver nitrate purchases last year were also boosted by strong demand from radiography. In no small measure the increasing use of silver in the X-ray sector has reflected the success of dry-imaging, a technology pioneered by Imation Corp, and subsequently acquired by Kodak in August 1998.

Finally, fabrication in the United States continued to rise at a fast pace because of the continued impact of the new facilities established in the country by the two Japanese companies Fuji and Konica.

As Table 6 shows, all the main producers of silver nitrate for photography in Europe recorded double-digit swings in their output last year. In the main, these were related to corporate restructuring and changes in raw material sourcing across the region by the major photographic companies. For example, during 1999 Agfa-Gevaert AG announced that it would close its Neu-Isenburg plant in Germany by year-end. This development contributed to the sharp decline in **German** output, although shifts in regional trade arguably accounted for most of the 32% fall. Changes in trading patterns also explained most of the 11.1% rise in silver nitrate production in **Belgium** last year.

In **France**, exports of silver nitrate were adversely affected by lower requirements from certain traditional markets. Also, consumer demand for film and paper declined in 1999 in the aftermath of the World Cup, which had pushed up commercial film output the year before. Overall last year, weakness in export and home markets resulted in fabrication falling by 18% to 11.9 Moz (370 t).

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Belgium	19.0	19.4	19.7	20.1	20.6	22.8	24.8	26.6	33.2	36.9
UK & Ireland	12.1	12.3	13.1	13.6	15.9	16.7	18.2	19.0	19.1	21.0
France	12.5	13.4	14.3	14.7	13.7	15.9	13.2	12.7	14.5	11.9
Germany	16.1	16.6	15.8	15.4	16.1	14.8	13.8	14.5	9.9	6.7
Romania	0.5	0.4	0.3	0.3	0.2	0.1	0.2	0.2	0.3	0.2
Hungary	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
Czech & Slovak Republics	0.6	0.5	0.2	0.0	0.0	0.0	0.0	0.1	0.3	0.0
Bulgaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Poland	2.9	2.3	0.5	0.5	0.5	0.5	0.3	0.2	0.0	0.0
Spain	1.6	1.4	0.6	0.4	0.2	0.1	0.0	0.0	0.0	0.0
Total Europe	65.7	66.6	64.8	65.2	67.4	71.1	70.7	73.5	77.4	76.9
North America										
United States	67.0	65.0	63.5	64.0	67.8	70.3	74.4	78.4	88.2	92.3
Mexico	2.3	2.3	2.6	3.2	3.2	3.3	3.4	4.1	3.4	2.9
Canada	2.9	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total North America	72.1	69.2	66.1	67.2	71.0	73.7	77.8	82.5	91.7	95.3
Central & South America										
Brazil	2.6	2.6	2.6	2.6	3.2	4.0	3.4	3.4	3.2	3.2
Argentina	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.6
Total Central & South America	4.4	4.4	4.4	4.4	5.0	5.8	5.2	5.2	5.0	4.8
Indian Sub-Continent										
India	5.6	2.6	2.6	2.3	1.6	0.6	0.6	0.6	0.3	0.3
Other	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.4	0.4
Total Indian Sub-Continent	5.8	2.8	2.8	2.5	1.8	0.9	0.9	1.0	0.7	0.7
East Asia										
Japan	56.5	57.8	58.0	57.2	55.1	56.9	57.9	58.6	58.2	59.9
Taiwan	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total East Asia	56.6	57.9	58.1	57.3	55.2	56.9	57.9	58.6	58.2	60.0
Oceania										
Australia	2.3	2.3	2.3	2.1	1.9	1.6	1.6	1.6	1.6	1.7
Total Oceania	2.3	2.3	2.3	2.1	1.9	1.6	1.6	1.6	1.6	1.7
Western World Total	206.8	203.0	198.4	198.7	202.3	209.9	214.2	222.5	234.7	239.3
Other Countries										
China	4.3	4.4	4.7	5.1	5.6	5.6	5.8	6.0	6.1	3.7
Soviet Union/CIS	10.0	8.8	7.2	6.3	5.2	5.0	4.7	4.5	3.8	3.4
Total Other Countries	14.3	13.2	11.9	11.4	10.8	10.5	10.4	10.5	9.9	7.1
World Total	221.1	216.2	210.3	210.1	213.1	220.5	224.6	233.0	244.6	246.4

GFMS estimate that **Japanese** photographic demand increased modestly in 1999, by around 3%, to 59.9 Moz (1,864 t). Estimating production in 1999 was made more difficult by the fact that in the first eight or nine months of the year, Japanese photographic companies were running down both their stocks of film, nitrate and raw silver.

The indications are that the rise in stocks of finished product in 1998 might have been somewhat bigger than we have estimated (implying higher fabrication). The corollary of this is that consumption in 1999 might in fact be somewhat larger than is implied by the fabrication statistics as these stocks were run down. This difficulty arises because of the wedge that is driven between fabrication and consumption statistics by stockbuilding, a phenomenon that has been very

much in evidence over the past two years.

Although the precise magnitude of the changes in consumption and fabrication are difficult to determine, it is certainly the case that last year witnessed substantial shifts in stocks by the photo companies in the first three quarters. Over this period they were procuring substantially less silver than even flat production would have suggested they needed, pointing to a run down of bullion, nitrate and finished product stocks. A particularly striking feature of last year's stock rationalization was the fact that photographic companies were reported to be engaging in spot sales of silver bullion early in the year.

It appears, however, that the industry allowed stocks to run down more than they had initially anticipated, and by the final quarter of the year, found themselves with far less inventory of silver, nitrate and finished product than they were comfortable with. The primary reason for this was the surge in photographic demand from the Asian region in the second half of 1999, and towards the end of the third quarter, stocks had fallen so low that there was a degree of "panic" buying by the industry to build them up again. The overreaction manifested itself in contracts being signed for silver supplies for some considerable time into the future.

The major impetus to growth in Japanese fabrication last year came from the recovery in the Asian markets, including Japan itself. After a weak year of offtake in 1998 caused by the Asian economic crisis, 1999, especially the second half, turned out to be unexpectedly strong. Although Chinese offtake did not change dramatically year-on-year, Indian, Thai and Indonesian consumption of photographic products registered good growth last year.

Turning to the sub-sectors of fabrication, graphic arts fell again year-on-year, continuing a trend seen over the past few years as competition from digital technologies has increased. Computer to Plate (CTP) technologies have had a profound influence on the graphics arts sector in Japan (and indeed the world), and continue to eat away at the conventional analog market. What has been revealing about the Japanese experience is the relatively slow decline in silver used in the graphics arts sector, a consequence of both the overall growth in the total market for these services and the cost of replacing existing (analog based) systems with new equipment. Digital technologies have made in-roads into the Japanese market on an incremental basis because companies are reluctant to

Worldwide Film and Paper Consumption and Photographic Fabrication Demand

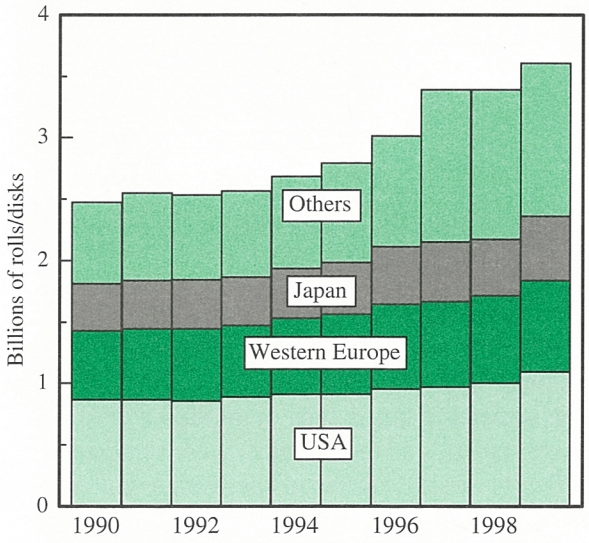
**Millions of rolls, ^millions square meters, *Moz

	1995	1996	1997	1998	1999
Film**	2,795	3,015	3,390	3,392	3,610
Paper^	1,276	1,417	1,500	1,547	1,592
Fabrication*	221	225	233	245	246

Source: Photofinishing News, GFMS

Figure 49

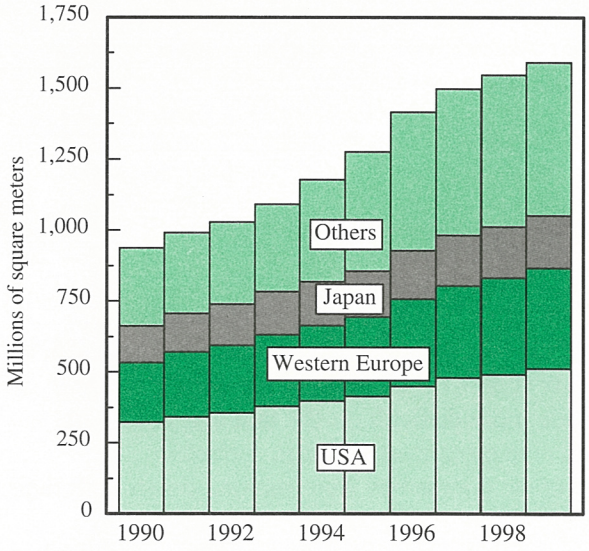
World Consumer Film Sales



Source: Photofinishing News Inc., GFMS

Figure 50

World Color Photographic Paper Consumption



Source: Photofinishing News Inc., GFMS

Digital Technology and the Photographic Market

Digital technology is capturing a growing share of expenditure on photography. However, so far, overall growth in the photographic market has been rapid enough to allow for a parallel, though more modest, increase in demand for silver-based photography.

In the consumer sector, traditional technology, generally, is still less expensive, easier to use and produces superior images. However, prices of digital cameras are falling and image quality is improving. In most countries the latest models aimed at the amateur market typically now retail for well under $1,000. And, by the end of 1999 the average number of pixels in the CCD sensors carried by many of these cameras had risen to 2.1 million. Figure 51 shows how these trends of higher quality and lower price have driven down the cost-per-pixel of digital cameras. Nevertheless, the price of digital photography remains high relative to traditional silver-based technology. This is an important consideration because much of the expected growth in photography will occur in developing countries where consumers' budgets are far more limited.

In terms of the outlook for silver demand in consumer photography, most forecasts are for annual growth of 0%-3% over the next few years. This takes into account an increase in the quantity of silver used in photographic paper, and a decrease in the amount of silver going into color films. When it comes to paper, although the quality of ink jet printers is expected to improve sufficiently for them to become more widely used to produce prints from digitally captured images, currently there is no real alternative to silver-bearing photographic paper. A more immediate issue for the silver market is the threat posed by digital photography to demand for color film. To a large extent this hinges on the extent to which, and how rapidly, digital cameras replace conventional ones. At present there is little indication that this will happen in the near term – indeed industry forecasts are for the number of traditional cameras to increase, even if their share of the world's camera population is set to fall. However, in the next few years there could be enough of a swing towards digital cameras to restrict growth for color film. The other factor expected to cause slightly lower silver demand for consumer film is a further decline in loadings, i.e. in the amount of silver used in the average film roll, as even at current low silver prices manufacturers continue to seek economies in their raw materials' usage.

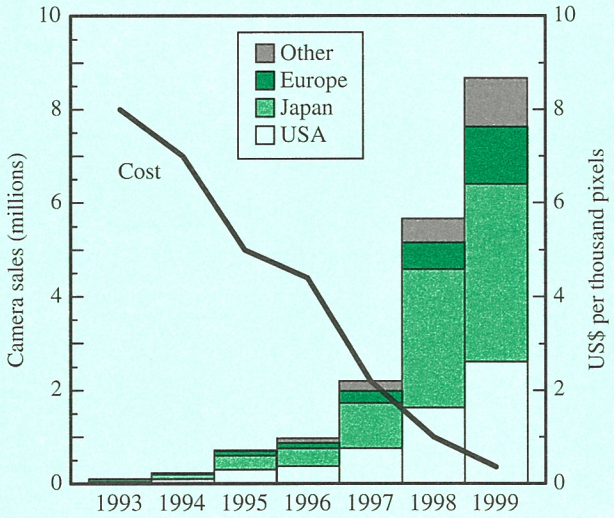
Notwithstanding competition from digital technology, over the next few years, at least, industry sources foresee strong growth in the amount of silver going into X-ray and motion picture film. In radiography traditional technology is usually far more cost-effective. Furthermore, it seems that, in most cases, digital systems are being introduced on a complementary rather than replacement basis. Similarly, the high capital investment required to convert theaters to show films in digital format is an important reason why silver halide technology is expected to dominate the movie industry for several years to come. The situation is less positive when it comes to the future of graphic arts-related uses for silver. Yet here too, introducing new digitally based technology is expensive, with the result that substitution is piecemeal, as can be seen from the largely stable demand for silver in graphic arts products over recent years.

Online Photography

"Online photography" is the buzz word for 2000: more than a dozen new internet companies have started up in the past six months alone offering photo-printing services for digital images. These companies will transform digital images into 35-mm quality prints and post them to customers and, their relatives and friends. Digital images are easily uploaded onto the internet, and sent electronically to plants equipped with high capacity machines for processing and printing onto standard photographic paper (containing silver). The new processes overcome problems with digital cameras to-date, such as images varying in color and saturation depending on camera model. Advantages of digital processing via the internet over conventional camera film processing are that images cost less to develop; consumers can save on the cost of film, and select only those pictures they want; companies offer free storage of images and options for creating products such as greetings cards or calendars. Online photography will probably be one of the solutions to the problem of supplying high quality prints from digital outputs – a problem that arguably must be overcome before digital photography can appeal to the mass-market.

Figure 51

Digital Cameras: Sales* and Cost per Pixel



*Includes toy cameras

Source: Lyra Research, Inc., GFMS

incur investment costs when existing equipment still does the job.

In the amateur field, production increased year-on-year, driven by higher Asian and local Japanese demand. The consensus in the Japanese industry is that digital technologies are having an impact on the amateur market domestically, but that the effect is seen in the rate of growth rather than in an absolute decline in offtake (i.e. if digital were not around, traditional photographic consumption would have grown faster than it did). Of course, much of the domestic Japanese production of amateur film is destined for overseas markets like China where digital photography is still a rarity due to its "infrastructure" costs.

Worryingly for the silver market is the fact that some manufacturers are now devoting most of their R&D to digital technologies, with little or nothing being channelled into traditional silver halide research. The received wisdom is that, for instance, the loadings of silver on film are now close to the technical limit, so there is less economic incentive to reduce them further. Research into traditional silver halide is not expected to pay dividends in the future.

GFMS estimate that **Chinese** photographic fabrication fell sharply in 1999, by around 40% to 3.7 Moz (114 t). The reasons for this decline are discussed below, suffice to note here that the fall is tied to Kodak's entry into the Chinese market .

In March, 1998, Kodak announced a US$1.2 billion investment to manufacture, distribute and market sensitizing products and photochemicals in China. Under the agreement signed, Kodak was allowed to acquire most of China's state-owned enterprises in the photographic industry. Kodak (China) Company, Ltd and Kodak (Wuxi) Company, Ltd were established. Effectively, Kodak acquired the entire Chinese photographic industry except Lucky Film, the largest domestic producer.

Shortly after the completion of the deal, construction commenced on Kodak's new factory in Xiamen and photochemical plant in Wuxi. Kodak's operations in Xiamen (a paper and film plant) and Shantou (an X-ray manufacturing facility) came on stream in September 1999. Xiamen is Kodak's largest photographic film and paper manufacturing site in Asia.

Production at these plants commenced in 1999, and output has consisted of consumer film, paper for consumer and professional use, as well as medical X-ray film. These products have been sold both into the domestic market as well as being exported to some Asian markets.

What is crucial for the statistics in this *Survey* is the fact that although photosensitized products are being produced by Kodak in China, the nitrate has not been sourced locally. Due to difficulties in obtaining high quality local nitrates, production has been proceeding using imports, and these imports are not counted in the GFMS fabrication statistics for China (but are counted in the statistics of the country producing the nitrates). Consequently, last year saw a big fall in Chinese fabrication, even though they were making finished film and paper products.

Jewelry and Silverware

- East Asia recorded a 15.6% increase in jewelry and silverware fabrication last year, but output was still below pre-crisis levels.
- Demand in India was effectively flat in 1999, at 70.7 Moz (2,200 t).
- Fabrication in Europe increased by 7% to 85.3 Moz (2,652 t), this primarily a result of growth in the Italian market of 13% to 51.2 Moz (1,592 t).
- In North America the decline in Mexican fabrication of 3% last year to 15.0 Moz (465 t) outweighed growth in the United States of 4% to 13.1 Moz (407 t).

Figure 52

Official Italian Jewelry Exports

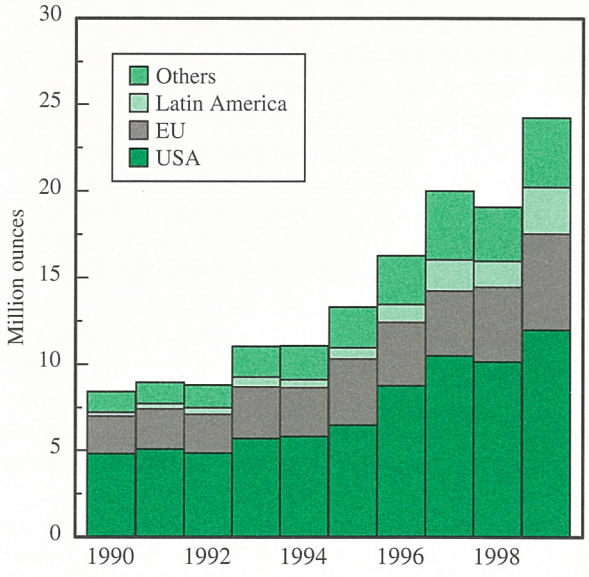


Table 7
Silver Fabrication: Jewelry and Silverware
(including the use of scrap)
Million ounces

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Italy	41.5	46.3	50.4	46.2	41.4	39.0	40.5	44.8	45.3	51.2
Germany	13.2	14.5	13.5	11.6	11.6	10.3	10.0	10.0	10.1	10.0
Greece	3.2	3.4	3.5	3.7	3.9	3.8	4.2	4.5	4.1	4.1
Spain	11.3	13.0	3.7	3.7	4.0	4.1	4.5	4.0	4.1	3.4
UK & Ireland	2.0	1.9	2.2	2.7	2.9	3.0	3.3	3.4	3.3	3.1
Poland	1.4	1.0	1.0	1.0	1.1	1.6	1.8	2.3	2.7	2.9
France	1.8	1.8	1.7	2.0	1.9	2.0	2.0	2.2	2.6	2.7
Portugal	2.2	2.2	2.2	2.1	1.5	1.7	1.9	1.9	1.9	2.1
Norway	0.6	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.5
Sweden	1.2	1.6	1.3	1.2	1.2	1.0	1.1	1.3	1.0	1.0
Denmark	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9
Finland	1.2	1.3	1.0	0.8	0.9	0.7	0.8	0.8	0.6	0.6
Cyprus & Malta	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4
Austria	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.5	0.4
Czech & Slovak Republics	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Other	1.4	1.3	1.3	1.2	1.2	1.2	0.9	0.9	1.0	0.9
Total Europe	82.5	90.9	84.7	79.0	74.3	71.2	74.0	79.2	79.7	85.3
North America										
Mexico	8.0	8.7	9.0	9.2	8.7	11.0	14.2	16.3	15.3	15.0
United States	9.8	9.7	10.9	11.3	12.0	12.5	12.4	12.5	12.6	13.1
Canada	1.0	1.2	0.9	0.9	1.0	1.2	1.3	1.5	1.8	1.5
Total North America	18.8	19.5	20.8	21.3	21.6	24.8	28.0	30.4	29.7	29.6
Central & South America										
Brazil	1.8	1.7	1.6	1.8	1.8	1.9	1.8	1.6	1.4	1.3
Peru	1.5	1.1	0.7	0.8	0.8	0.9	1.0	1.1	1.0	1.0
Colombia	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.6
Ecuador	0.3	0.3	0.3	0.5	0.6	0.6	0.6	0.6	0.6	0.5
Argentina	1.0	1.0	1.0	1.0	1.0	0.9	0.8	0.8	0.2	0.2
Other	0.7	0.7	0.7	0.8	0.7	0.8	1.1	1.5	1.8	2.0
Total Central & South America	6.0	5.6	5.1	5.5	5.7	5.9	6.0	6.3	5.8	5.4
Middle East										
Turkey	4.1	3.9	4.6	5.0	4.3	5.1	5.5	5.5	5.2	4.7
Israel	1.7	1.7	1.8	2.0	2.1	2.3	2.6	3.0	2.8	2.9
Egypt	1.5	1.6	2.2	1.8	1.8	2.0	2.1	2.0	1.7	1.9
Saudi Arabia	0.2	0.3	0.4	0.4	0.3	0.4	0.4	0.6	0.5	0.6
Other	1.6	1.9	2.4	2.0	2.4	2.5	2.6	2.6	2.4	2.5
Total Middle East	9.1	9.5	11.4	11.2	11.0	12.4	13.3	13.6	12.8	12.6
Indian Sub-Continent										
India	27.1	25.7	35.6	77.5	60.2	66.6	86.0	86.3	71.6	70.7
Bangladesh & Nepal	0.6	2.0	2.6	3.9	4.5	5.1	5.8	6.4	5.1	5.7
Other	1.2	1.7	2.1	2.5	2.1	2.9	2.0	3.1	1.9	2.4
Total Indian Sub-Continent	28.9	29.3	40.3	83.9	66.8	74.6	93.8	95.8	78.7	78.9
East Asia										
Thailand	24.1	20.1	31.6	38.5	28.9	27.4	27.1	26.8	23.9	26.5
South Korea	4.5	5.3	5.0	7.2	6.4	6.8	6.6	6.3	2.6	4.5
Indonesia	1.1	1.1	1.2	1.4	2.3	2.7	2.9	3.6	2.2	2.7
Japan	3.8	3.5	2.8	2.5	2.2	2.2	2.1	1.9	1.8	1.8
Myanmar, Laos & Cambodia	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.0	0.8	0.9
Vietnam	0.3	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.6	0.7
Hong Kong	0.9	1.0	1.0	1.0	1.0	0.9	0.9	1.0	0.6	0.6
Malaysia	0.3	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.5
Taiwan	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4
Other	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total East Asia	36.7	33.3	44.0	53.2	43.4	42.8	42.6	42.5	33.6	38.9

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Africa										
Morocco	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3
Tunisia	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3
Algeria	0.3	0.3	0.3	0.2	0.2	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	0.4	0.4
Total Africa	1.4	1.4	1.3	1.2	1.3	1.3	1.2	1.2	1.2	1.1
Oceania										
Australia	0.5	0.5	0.5	0.6	0.6	0.6	0.5	0.6	0.7	0.7
Total Oceania	0.5	0.5	0.5	0.6	0.6	0.6	0.5	0.6	0.7	0.7
Western World Total	184.0	190.0	208.0	256.0	224.6	233.5	259.4	269.6	242.1	252.5
Other Countries										
China	0.1	0.2	0.4	0.7	1.0	1.4	2.4	3.1	4.7	6.3
Soviet Union/CIS	4.6	4.2	3.4	2.6	2.3	2.0	2.1	2.3	1.9	2.1
Total Other Countries	4.7	4.4	3.8	3.3	3.3	3.4	4.5	5.3	6.6	8.4
World Total	188.7	194.5	211.8	259.3	227.9	236.9	263.9	274.9	248.7	260.8

Europe

Italian jewelry and silverware manufacture used 13% more silver in 1999 reaching 51.2 Moz (1,592 t), thereby bringing silver offtake in this sector back up to and beyond its former peak in 1992. The big difference is that in 1992, silverware accounted for 70% of the total, while in 1999, the inverse was true. In terms of volume, jewelry now outstrips silverware by far. The other big difference is that the industry has become strongly export-oriented. In 1992, only 30% of jewelry and silverware production was exported, whereas in 1999 more than 60% was delivered to markets outside Italy.

Since 1992, there has been a huge fall in the volume of silver used for the production of traditional hollowware and flatware for the Italian market. The reasons for this decline are both socio-cultural and economic. Changes in social customs mean that the previously ubiquitous, classic, solid-silver table sets today are no longer a "must" for marriage gifts. Another factor is that Italian households' income and thus, propensity for discretionary expenditure, has been curtailed since the mid-to-late 1990s when Italy strove (successfully) to become part of the European Monetary Union.

Fortunately, the fall in traditional silverware consumption has been compensated by a doubling of production of silver jewelry, in particular chains, and the growing output of a multitude of silver objects and knick-knacks. A good example is the increasing popularity of golf competition trophies and photo frames, which between them now use over 6.4 Moz (200 t) of silver!

Silver jewelry grew by 27% in 1999 to over 32 Moz (1,000 t). The bulk of production is for export and is made up of silver chain but also includes growing volumes of fashionable and chunkier jewelry items with much higher value-added. Italian producers are creating world fashion and design trends in silver jewelry just as they do in gold. More than half the exports go to the United States. The Italian home market is also showing a greater interest in silver jewelry.

Spanish manufacturers of jewelry and silverware were victims last year of both the inventory cycle (high stocks had been built in 1998) and continued pressure from imports of Italian merchandise.

United Kingdom fabrication declined by 4% to 3.1 Moz (98 t). Given the high value of sterling it was perhaps not surprising that local manufacture would be adversely affected by a further rise in imported items, notably from Italy and Thailand.

Jewelry and silverware fabrication in **Germany** experienced a decline of 1%, taking the total for last year to 10.0 Moz (312 t). As the table below shows domestic manufacturing was affected by increasing competition from imported goods, notably from Thailand and China.

German Silver Jewelry Imports
(estimated fine quantities in Moz)

	1995	1996	1997	1998	1999
Thailand	1.39	1.76	1.76	1.75	2.11
Others	2.59	2.83	3.04	3.53	5.68

Silverware fabrication also recorded a modest decline. For example, silver use by the cutlery industry (including materials for plating) fell markedly in 1999 for two reasons. Firstly, silver cutlery demand has been on a declining trend for a number of years and, secondly, there has been a move to fewer purchases of heavier items.

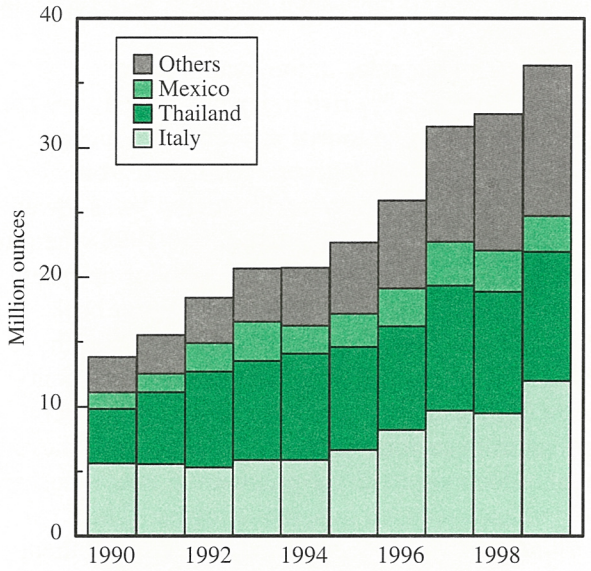
An increase in **French** jewelry exports compensated for lower production for the home market. The main export destinations were Japan, other European Union countries and Tunisia. Production for the home market was adversely affected by increasing competition from imported products, notably from Thailand and Italy. Overall, jewelry and silverware production rose 4% to 2.7 Moz (84 t).

North America

Jewelry and silverware fabrication in the **United States** increased by close to 4% last year to 13.1 Moz (407 t). The driving force behind this growth was jewelry, demand for which rose by 0.5 Moz (17 t) to 7.3 Moz (227 t). Silverware was little changed year-on-year at 5.8 Moz (180 t).

The bulk of the growth in the jewelry category has come from giftware. Sales of a wide variety of solid silver gifts (ranging from, small boxes to mens' cufflinks) have been strong, in large measure helped by retailers skills in marketing and in packaging products for the modern consumer. Although individually these gifts tend to be small, their average silver content is generally greater than for the typical jewelry article. They are also being produced and sold in growing numbers. Fabrication of silver jewelry also rose in 1999 with output of chain and, particularly, beaded articles noticeably higher. However, as in 1998, growth in US silver jewelry consumption was once again slower than the hectic pace recorded in the 1995-97 period. Besides this, competition from imports has not let up. GFMS estimates show US jewelry imports rising over 11% in 1999 (see Figure 53). Shipments from the two largest suppliers, Thailand and Italy, rose but they declined from

Figure 53
US Silver Jewelry Imports



America's third largest trading partner Mexico.

Mexican jewelry fabrication declined in 1999 for the second year in succession. The local industry is to a large extent reliant on exports to the United States and on tourist purchases. In both areas Mexican companies have faced growing competition from lower-cost manufacturers based in East Asia and also, closer to home, in countries like the Dominican Republic. The slower growth in US consumption in the last couple of years, and in 1999 the stability of the peso, has also meant that this competition has intensified. Analysis of the official US jewelry import data reveals, for instance, that in 1999 deliveries from Mexico fell by around 13% year-on-year.

Middle East

Turkish offtake declined by 10% to 4.7 Moz (147 t). At first sight the decline appears modest given the difficulties faced by Turkey last year. Tourist arrivals were markedly lower following the much-publicised arrest in February of Abdullah Oçalan, the PKK leader, which led to demonstrations throughout Europe. In addition, the poor economic climate, which prevailed throughout the year, "worsened" in the wake of the devastating earthquakes, which struck during August and September. Despite these conditions, local demand remained remarkably upbeat, thereby lessening the impact of sharply lower tourist purchases.

Israeli fabrication of jewelry and silverware edged

up by just 2% to 2.9 Moz (89 t). Despite the poor economic environment, higher fabrication for the domestic market compensated for lower exports to the United States.

In **Egypt**, higher sales in the local market contributed to the 7.7% rise in jewelry and silverware fabrication. Although tourist arrivals were higher, year-on-year, (including groups redirected from Turkey, see above) their overall "quality" was lower. This phenomenon can be traced back to 1998 when, in the aftermath of the November 1997 Luxor massacre, accommodation rates were reduced to tempt back tourists although this merely attracted less wealthy visitors. On a more positive note, fixed investment appears to be gathering pace in the gold and silver manufacturing sectors. This has partly been achieved through relocation to larger premises in new industrial developments, situated in satellite towns. The government has been encouraging this development by offering a five-year tax-free period for companies who relocate. And despite the advantages of being located in downtown Cairo, for example, close to both a supply source and customer base, a number of larger companies have taken the opportunity to open larger premises in these new locations.

Indian Sub-Continent

The importance of the **Indian** jewelry and silverware market was highlighted in the focus box in Chapter 2. This stems from the fact that not only is it the largest market in the world (accounting for around 28% of world demand), but it is also arguably the most price sensitive market.

At first sight then, it may appear rather surprising that offtake fell year-on-year, given the dollar silver price reduction of close to 6% in 1999. GFMS estimate that offtake in India dropped by around 1.3%, to 70.7 Moz (2,200 t). There were a number of reasons for this, and not surprisingly one of these was price related.

In contrast to the dollar silver price, in nominal rupee terms, the average price did not fall in 1999. Indeed, it rose, albeit marginally (by around 0.1%), to 8,021 rupees per kilogram. This was the highest nominal price level recorded in the past decade. In real terms, the price did fall, but only by 4%, a change that was evidently not enough to offset the "money illusion" of a nominal price increase. The price was not, though, the primary driving force, and other factors conspired to drive demand down.

Of particular importance was the relatively weak state of the rural economy. The evidence points to urban growth as being the engine behind India's comparatively good economic performance last year, rather than the agricultural sector as has often been the case in recent years. The data point to agricultural output as having been at best flat last year, and prices have not been particularly supportive either.

Of particular significance was the cyclone that devastated the eastern state of Orissa in October and the flooding in the north of the country. Crucially, silver demand in India is not uniformly distributed, and much of the country's jewelry and silverware demand is found in the north of the country and the eastern states (where Orissa is located), both of which were severely affected by the floods (it is no coincidence that the largest import centers for silver are in the north of the country, namely Delhi and Ahmedabad).

In these northern and eastern areas, most of the buying is done by the rural population who are "heavy" buyers of silver for investment/savings reasons. Unlike in gold where "essential" wedding purchases are made almost irrespective of the prevailing circumstances, silver purchases tend to be discretionary in that they are more closely tied to the economic cycle. In the so-called tribal belt of the north, the bulk of consumption is in the form of very simple, heavyweight jewelry, with low making charges. The kadia (leg rings) worn by women in these areas are often little more than a silver bar (or part of a bar) bent into the form of a ring to fit around the leg (it is not unusual for the kadia to be fitted around the leg with no fastener to take it off, and it remains with the woman until such time that she needs to sell it for cash, or wishes to upgrade to a heavier piece of silver, or is wealthy enough to migrate to gold).

One other factor that may have played a role in the relative weakness of jewelry offtake last year is competition from gold. Given the right economic and price conditions, consumers will substitute gold for silver jewelry. Rising incomes over the past decade have increased consumer budgets, and with the gold price falling to levels last seen in the 1970s, there appears to have been some substitution, especially in the first three quarters of the year.

A final comment on the Indian jewelry and silverware market concerns issues of quality. The purity of jewelry and silverware sold in India can vary tremendously. The disappearance of official curbs

with the ending of silver control in 1990 resulted in a steady decline in quality over the decade. As a consequence, it is now not uncommon to find jewelry and silverware with a meltdown assay of as low as 70% silver (and in some cases even lower). This is one of the main reasons why so much Chinese silver has come into India over the past 18 months. As we highlighted in Chapter 6, around two-thirds of the silver coming into India last year was from China, and most of this was used directly in jewelry fabrication because there are few concerns about purity.

East Asia

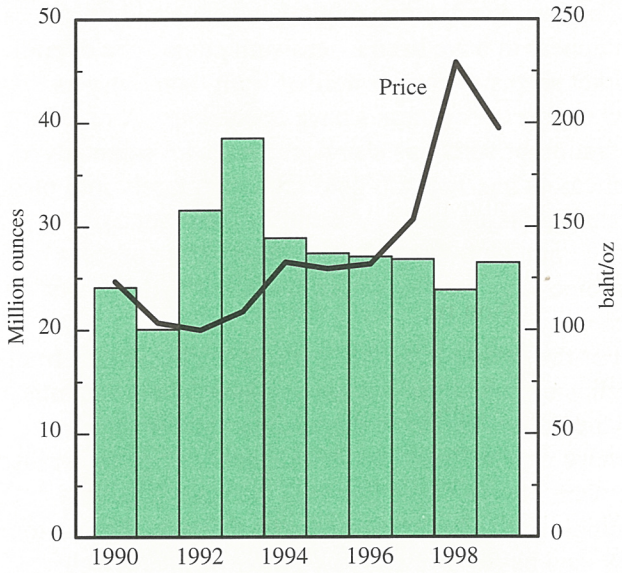
After five years of decline, **Thai** silver jewelry fabrication rose in 1999, by close to 11%, reaching 26.5 Moz (825 t). This may mark an end to a difficult period in the Thai market caused by rising international competition and the severe economic problems resulting from the collapse of the baht in mid 1997. However, the past decline in silver use should not be seen simply in this light. There was also a "positive" reason for the decline. In response to competitive pressures, most Thai fabricators have moved up market and increasingly away from simple, plain 925 jewelry, to gemset.

Thai silver jewelry fabrication is for all intents and purposes exclusively export oriented. To the extent that there are local sales, these are usually to tourists who then "export" the items when they leave (there is, however, some domestic consumption in the northern parts of the country). Last year was a good one in terms of exports, and in dollar terms, they are reported to have increased by over 10% to around $223 million.

The United States is by far and away the largest export market. GFMS estimate that on a weight basis, the US market accounts for around 40% of Thai production. The other large export market is Europe, which accounts for a significant proportion of the balance.

Although there is some overlap in the styles demanded in these two centers, there are important differences too. The perception amongst Thai manufacturers is that consumers in the United States are generally less fashion conscious than their European counterparts, and as a result, the styles of jewelry shipped to these markets can differ noticeably. As might be expected, price is a major driver in the US market, so that pieces can be of lower quality finish and lighter in weight. Gemset jewelry tends to use smaller and cheaper stones.

Figure 54
Thai Jewelry and Silverware Fabrication



The Europeans, by contrast, prefer jewelry with a higher quality finish, and in the case of gemset, prefer pieces set with larger, center stones as opposed to lots of small stones. And whilst the US market prefers highly polished finishes, the European look at the moment is for rougher finishes (for example, using sandblasting).

As Thai manufacturers move up the value-added chain, they are producing an ever increasing proportion of gemset jewelry, and it not surprising that Bangkok is a key center in the precious and semi-precious industry. The varieties of stones used in jewelry are enormous, but some of the most popular include amethyst, blue topaz, pink synthetics, dark garnet, cubic zirconia, onyx and mother of pearl.

One particular growth area recently has been OEM (Original Equipment Manufacturing) production, that is manufacturing done by Thai fabricators on behalf of mainly European brands. For instance, it is now not uncommon for European manufacturers to commission Thai fabricators to produce jewelry which they then sell under their own brand name.

One final comment on the Thai market concerns the traditional split between gold and silver jewelry fabricators in Thailand. Three or four years ago it would have been unusual to find a single company doing both metals (it was not uncommon to find members of the same family running gold and silver fabrication facilities, but these were usually run as distinct businesses). However, since the economic

crisis of 1997, more gold jewelry manufacturers have moved into silver.

Contrary to what one might have expected, this does not appear to have been a zero-sum game - the overall market seems to have benefited from their entry as new export opportunities have opened up. A reverse migration of sorts has also occurred, with some silver fabricators moving into gold (although rarely into pure or carat gold jewelry). As part of their strategies to move upmarket, these manufacturers have begun to combine silver and gold into so-called "gold accent" pieces.

For the first time GFMS have been able to construct a reliable time series for jewelry fabrication in **China**. As mentioned earlier in this chapter, in past *Surveys* jewelry was included in the industrial category because we were not confident that data we were receiving distinguished adequately between the two. Access to new data has allowed us to separate out the jewelry series from the industrial category. As the series shows, GFMS estimate that China produced around 6.3 Moz (195 t) in 1999, up well over 30% on 1998.

What really stands out about the series for China is the fact that its fabrication has risen so sharply over the decade. Although some of this jewelry is making its way into the domestic market, the primary driving force behind this growth has been exports, mainly to the United States and Europe (in particular Germany).

As is the case in gold jewelry, the expertise and backing behind these export-oriented silver jewelry fabricators has come from Hong Kong (although there are joint venture arrangements with companies from other geographical locations). As with gold, it is almost impossible to systematically strip out Hong Kong from mainland based fabrication. Sometimes a piece of jewelry will be cast in say Shenzhen, shipped to Hong Kong for stone setting and possibly even shipped back to Shenzhen for finishing. Quite where to count this as fabrication is difficult to decide, but GFMS believe that the bulk of "core" manufacturing takes place on the mainland, and consequently, fabrication there is shown to be far larger than in Hong Kong.

Indonesian jewelry fabrication rose strongly in 1999, by over 22% to 2.7 Moz (83 t). In contrast to previous years where export/tourist demand has effectively been the only factor boosting offtake, last year saw a contribution coming from the local market.

Coins and Medals

- Coins and medals fabrication recouped some of the losses of the previous year, rising by 3.5% in 1999.
- The two largest markets experienced contrasting fortunes. Offtake in the United States rose by 59% while German demand fell by nearly 36%.

At first sight, the 3.5% rise last year in the fabrication of coins and medals may appear surprising given the huge growth in North American offtake. However, European demand was markedly weaker, falling by around 23% to 10.6 Moz (328 t) in 1999.

North American fabrication was up almost 56% to 13.0 Moz (404 t) last year. In terms of higher volume, the **United States** led the way adding 4.2 Moz (129 t) in 1999. US Eagle bullion coin fabrication accounted for almost 80% of the total of 11.2 Moz (348 t) of silver used last year. Including Eagle proof coins and proof sets took the share closer to 93%.

Fabrication of the silver Eagle coin more than doubled to 8.8 Moz (275 t) as a result of two separate trends. Firstly, "Y2K" related demand boosted offtake especially during the first half of the year. At times, during this period, supply could not match demand resulting in markedly higher purchases of silver coin bags in the secondary market. Secondly, the sale of painted Eagle coins, which often attracted prices significantly above the face value of the coin, may well have accounted for over half of the 8.8 Moz referred to above. Demand for these coins appears to have been notably buoyant for a twelve month period, stretching back to the second quarter of 1999 and may explain the high coins sales so far this year (see Figure 56).

Sales of proof sets more than doubled last year to approximately 1 Moz (31 t), due to the launch of the 50 State Quarters program. This involves a new quarter being released every ten weeks for the next ten years, in contrast with previous years when one quarter was issued per annum. As a result, the number of coins in the silver proof set, which contains an example of every coin released during a given year, was increased from five to nine (one half dollar, five quarters, one dime, in addition to two non-precious coins; the proof set). A combination of the interest generated by this program, and the increased silver content of each set, resulted in higher minting last year.

Canadian offtake rose by 30% to its highest level since 1994. Last year's total was boosted by increased fabrication of both bullion and commemorative coins. Higher sales of the Maple Leaf bullion coin were due to two separate factors. Firstly, stronger demand in the United States fed through to the Maple Leaf. Secondly, for the first time a privacy mark, normally reserved for private orders, was introduced onto bullion coins designated for general sale. These coins were also the first silver bullion coins, issued in Canada, to be "double-dated", in other words, stamped with both 1999 and 2000. The release of such a unique issue encouraged significant collector purchases and may have accounted for as much as 0.2 Moz (6.4 t) of bullion coin sales last year.

Turning to Europe, silver coin fabrication in **Germany** is dominated by production of the circulating coin program. Last year, three issues were produced each consisting of 3.8 million coins (of which 0.8 million were struck in proof quality). Each issue was minted in sterling silver with an individual coin weight of 15.5 grams. As we pointed out last year, the fine quality of the silver used was changed in 1998 from 625 to 925, reflecting the fact that the majority of these coins are purchased by collectors. Both the number and size of the issues was reduced last year (four issues of 4.5 million coins were minted in 1998) and, as a result, offtake in Germany declined by over one-third. The issues produced in 1999 commemorated, in order of their release: the 50th anniversary of the founding of the Deutsche Bundesbank; the 50th anniversary of "Children in Need" in Germany and the 250th anniversary of the birth of Goethe.

Elsewhere in Europe, **Spanish** silver coin fabrication continued to decline. Production of the Pta 2000 silver circulating coin, fell by over 14% last year to around 1.5 Moz (46 t).

In Asia, a significant decline in domestic **Chinese** demand contributed to the 21% fall in offtake to 1.9 Moz (60 t). The main commemorative programs last year included: the 50th anniversary of the founding of the People's Republic of China; the third set of Macao's return to China; celebration of the Peking Opera; and a set of coins featuring a famous Tang Dynasty painting.

Australian offtake edged lower to 0.9 Moz (29 t), despite the ongoing Olympic coin program. However, coin demand is expected to quickly recover this year as the Sydney 2000 Olympics draw nearer.

Figure 55
World Coin Fabrication

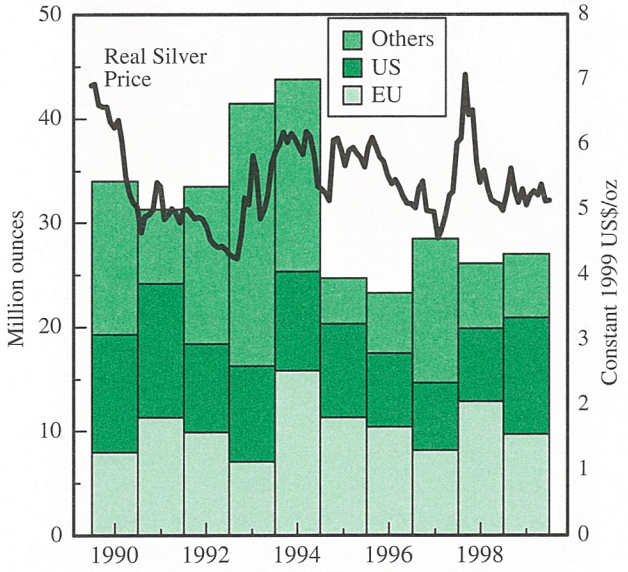


Figure 56
US Silver Eagle Coin Sales

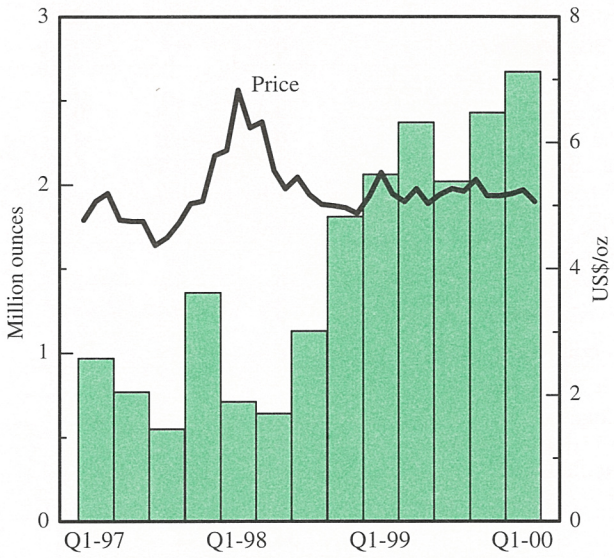


Table 8
Silver Fabrication: Coins and Medals
(including the use of scrap)
Million ounces

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Germany	2.6	5.7	5.6	2.8	7.1	2.4	4.6	3.7	8.4	5.4
Spain	0.4	1.1	0.4	0.3	4.8	4.0	2.8	1.8	1.7	1.5
Portugal	0.1	0.0	0.1	0.3	0.4	0.5	0.8	0.8	1.0	0.9
UK & Ireland	0.4	0.4	0.5	0.7	0.8	0.7	0.6	0.6	0.6	0.6
Switzerland	0.2	1.6	0.4	0.3	0.3	0.4	0.6	0.6	0.3	0.4
Italy	0.4	0.6	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.4
France	2.1	2.3	2.1	2.1	1.0	1.1	0.3	0.3	0.3	0.3
Austria	0.5	0.6	0.5	0.5	0.5	0.6	0.4	0.3	0.3	0.3
Poland	0.3	0.2	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1
Belgium	0.5	0.3	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1
Netherlands	0.7	0.1	0.0	0.0	0.6	1.1	0.2	0.1	0.1	0.1
Czech & Slovak Republics	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1
Finland	0.2	0.2	0.2	0.0	0.1	0.1	0.1	0.1	0.0	0.1
Norway	0.0	0.5	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Romania	0.0	0.0	0.0	0.0	0.0	0.0	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	0.0	0.0
Other	0.1	0.1	0.2	0.4	0.1	0.2	0.2	0.1	0.2	0.1
Total Europe	8.6	13.8	11.7	8.3	16.3	12.3	11.5	9.2	13.7	10.6
North America										
United States	11.3	12.9	8.5	9.2	9.5	9.0	7.1	6.5	7.0	11.2
Canada	1.9	0.9	0.8	1.2	1.5	0.7	0.7	0.7	1.1	1.4
Mexico	1.2	1.6	8.7	17.1	13.0	0.6	0.5	0.4	0.2	0.4
Total North America	14.4	15.4	17.9	27.5	24.0	10.3	8.3	7.6	8.3	13.0
Central & South America										
Other	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Central & South America	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Middle East										
Turkey	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Israel	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Egypt	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Total Middle East	0.0	0.0	0.1	0.0	0.7	0.1	0.1	0.1	0.1	0.1
East Asia										
Thailand	0.0	0.0	0.1	0.2	0.2	0.3	0.5	0.3	0.2	0.1
Singapore	0.1	0.0	0.9	0.1	0.1	0.1	0.1	0.0	0.1	0.1
Japan	8.9	0.0	0.0	2.4	0.0	0.0	0.0	7.2	0.0	0.0
Other	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total East Asia	10.0	0.1	1.0	2.7	0.3	0.4	0.6	7.5	0.3	0.2
Oceania										
Australia	0.4	0.5	2.1	2.3	1.6	0.7	0.8	0.8	1.0	0.9
Total Oceania	0.4	0.5	2.1	2.3	1.6	0.7	0.8	0.8	1.0	0.9
Western World Total	33.6	29.9	33.0	40.8	42.9	23.8	21.3	25.3	23.5	24.8
Other Countries										
China	0.4	1.4	0.4	0.4	0.7	0.8	1.4	2.8	2.4	1.9
Soviet Union/CIS	0.0	0.0	0.1	0.1	0.2	0.1	0.6	0.4	0.2	0.2
North Korea	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Total Other Countries	0.4	1.4	0.5	0.7	0.9	0.9	2.0	3.2	2.6	2.1
World Total	**34.0**	**31.3**	**33.5**	**41.5**	**43.8**	**24.7**	**23.3**	**28.5**	**26.1**	**27.0**

Appendix I

Table 1
World Silver Supply and Demand
Tonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Supply										
Mine Production	16,315	15,951	15,166	14,619	14,059	14,921	15,171	16,380	17,039	17,007
Net Official Sector Sales	-	-	-	187	548	788	589	-	1,245	2,706
Old Silver Scrap	4,202	4,415	4,613	4,620	4,724	5,066	4,926	5,267	6,025	5,439
Producer Hedging	473	591	40	832	-	287	-	2,150	171	-
Implied Net Disinvestment	1,537	1,597	3,191	4,023	4,785	3,118	4,940	2,873	1,523	2,474
Total Supply	22,526	22,553	23,010	24,281	24,116	24,179	25,627	26,670	26,003	27,625
Demand										
Fabrication										
Industrial Applications	8,507	8,299	8,064	8,391	8,752	9,185	9,247	9,965	9,849	10,674
Photography	6,878	6,726	6,542	6,535	6,628	6,857	6,986	7,246	7,608	7,664
Jewelry & Silverware	5,871	6,048	6,588	8,064	7,088	7,368	8,208	8,551	7,735	8,113
Coins & Medals	1,058	974	1,041	1,291	1,363	769	725	886	811	840
Total Fabrication	22,314	22,048	22,235	24,281	23,832	24,179	25,166	26,648	26,003	27,290
Net Official Sector Purchases	212	505	775	-	-	-	-	22	-	-
Producer Hedging	-	-	-	-	284	-	461	-	-	335
Total Demand	22,526	22,553	23,010	24,281	24,116	24,179	25,627	26,670	26,003	27,625
Silver Price (London US$/oz)	4.832	4.057	3.946	4.313	5.285	5.197	5.199	4.897	5.544	5.220

Figure 57
World Silver Supply

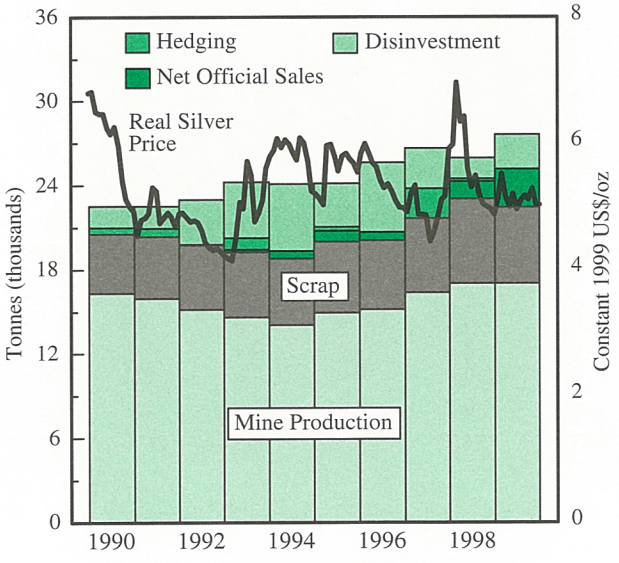


Figure 58
World Silver Demand

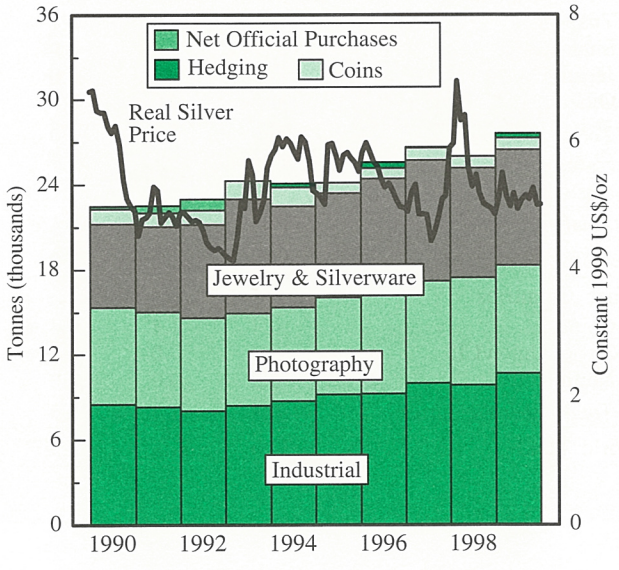


Table 2
World Silver Mine Production
Tonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Poland	832	899	798	915	859	984	953	1,050	1,119	1,115
Sweden	224	254	282	278	252	250	241	265	268	275
Spain	230	233	233	183	176	124	103	66	25	45
Greece	63	70	61	59	45	45	16	36	64	44
Romania	60	50	48	45	42	44	44	43	39	43
Finland	29	30	27	29	26	27	34	32	30	31
Portugal	42	43	38	36	32	39	34	34	32	27
Serbia	106	92	80	25	28	31	34	38	34	27
Bulgaria	106	59	84	96	56	44	35	31	25	21
Ireland	9	11	13	13	17	14	15	13	11	15
Czech & Slovak Republics	26	28	20	16	12	10	7	8	8	8
Italy	14	14	12	5	14	14	9	4	4	2
Norway	9	10	11	7	7	5	4	4	4	2
France	21	28	13	12	3	4	3	2	1	1
Other	21	8	2	2	2	2	0	0	0	0
Total Europe	1,792	1,829	1,722	1,721	1,571	1,636	1,530	1,626	1,663	1,656
North America										
Mexico	2,453	2,284	2,096	2,215	2,215	2,258	2,529	2,701	2,848	2,338
United States	2,125	1,848	1,804	1,645	1,480	1,560	1,570	2,180	2,060	1,957
Canada	1,381	1,262	1,169	879	740	1,245	1,243	1,213	1,131	1,166
Total North America	5,959	5,394	5,069	4,739	4,435	5,063	5,341	6,094	6,039	5,461
Central & South America										
Peru	1,927	2,087	1,668	1,671	1,742	1,908	1,968	2,077	2,025	2,217
Chile	655	677	1,025	970	983	1,042	1,144	1,091	1,342	1,392
Bolivia	358	376	317	333	351	429	383	386	407	382
Argentina	83	70	46	43	38	37	31	34	69	103
Honduras	31	43	35	24	27	30	38	45	45	48
Brazil	35	30	21	21	18	15	14	9	8	8
Dominican Republic	23	22	13	17	9	21	17	12	7	5
Other	10	12	16	16	40	11	10	11	10	11
Total Central & South America	3,121	3,317	3,141	3,094	3,208	3,492	3,604	3,665	3,915	4,166
Asia										
Indonesia	66	78	100	90	97	238	239	263	311	269
Turkey	28	40	78	72	67	65	90	90	87	110
Japan	149	171	172	137	134	100	89	87	95	94
India	35	34	26	51	50	38	36	50	52	60
Papua New Guinea	107	124	95	96	77	66	60	49	58	59
Philippines	45	35	29	33	31	33	25	20	19	18
Saudi Arabia	15	14	15	16	16	17	16	16	14	11
Thailand	14	17	5	3	4	7	8	3	4	5
Malaysia	12	13	15	14	13	11	10	10	7	3
Other	69	61	76	61	79	80	77	81	88	86
Total Asia	540	587	611	573	568	655	649	670	735	714
Africa										
Morocco	185	206	152	237	258	204	200	260	306	270
South Africa	160	171	182	195	192	178	171	163	157	148
Zambia	19	14	18	18	11	8	9	7	8	8
Zimbabwe	21	19	17	12	11	11	10	10	6	5
Dem. Republic of Congo	84	59	30	11	1	1	1	1	1	1
Namibia	93	92	89	72	62	66	42	39	14	0
Other	9	12	11	10	11	11	11	10	11	11
Total Africa	571	573	499	555	545	479	443	489	502	443

Table 2
World Silver Mine Production
Tonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Oceania										
Australia	1,173	1,180	1,218	1,152	1,045	920	1,010	1,106	1,469	1,720
New Zealand	9	11	23	26	24	30	31	33	26	28
Fiji	1	0	1	1	1	2	2	2	2	2
Total Oceania	1,183	1,191	1,242	1,179	1,070	952	1,043	1,141	1,496	1,750
Western World Total	13,166	12,892	12,284	11,861	11,397	12,277	12,611	13,685	14,350	14,191
Other Countries										
Soviet Union/CIS	2,174	2,013	1,831	1,690	1,532	1,482	1,356	1,289	1,274	1,378
China	896	975	975	986	1,050	1,080	1,134	1,339	1,350	1,375
Mongolia	28	21	23	26	27	28	29	31	33	33
North Korea	50	50	53	56	53	53	40	36	32	29
Total Other Countries	3,149	3,059	2,882	2,758	2,662	2,643	2,560	2,695	2,689	2,816
World Total	16,315	15,951	15,166	14,619	14,059	14,921	15,171	16,380	17,039	17,007

Figure 59
World Silver Mine Production

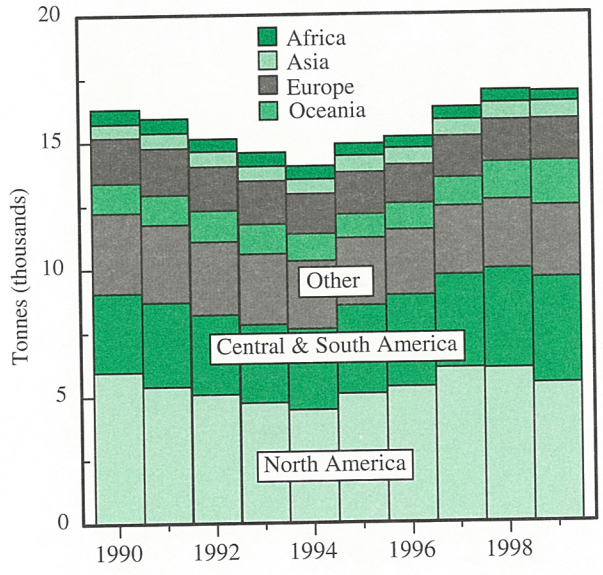


Figure 60
Silver Producer Hedging: Outstanding Positions

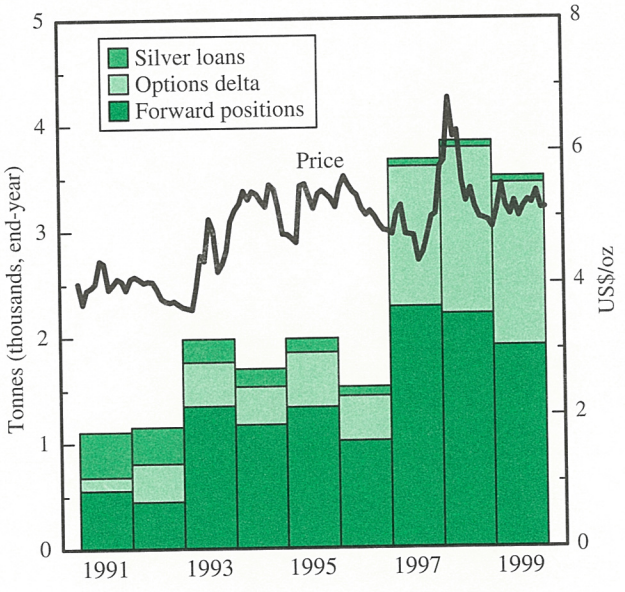


Table 3
Supply of Silver from the Recycling of Old Scrap
Tonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Germany	500	500	500	490	480	460	480	500	510	500
UK & Ireland	225	225	225	228	245	231	236	261	337	358
France	96	118	166	124	130	145	140	133	127	124
Italy	85	85	85	85	87	100	110	105	145	105
Austria	60	60	60	60	60	63	55	56	57	52
Netherlands	35	35	36	35	39	35	39	40	40	40
Sweden	34	34	34	34	34	34	34	35	34	34
Norway	24	24	24	24	24	24	30	30	25	29
Belgium	20	20	20	20	20	20	20	20	20	20
Czech & Slovak Republics	20	26	30	24	22	23	28	25	22	19
Denmark	21	20	20	20	20	19	19	19	19	19
Portugal	12	12	12	12	12	12	13	14	14	14
Spain	12	11	10	10	10	12	14	14	13	12
Switzerland	21	21	21	48	19	51	52	24	14	10
Romania	3	3	3	3	3	3	3	3	3	3
Other	42	44	46	47	48	46	48	49	48	48
Total Europe	1,210	1,238	1,292	1,264	1,253	1,278	1,321	1,328	1,428	1,387
North America										
United States	1,392	1,329	1,317	1,343	1,405	1,432	1,505	1,612	1,733	1,785
Mexico	70	70	70	70	70	150	75	134	330	75
Canada	41	41	41	41	41	52	55	50	60	50
Total North America	1,503	1,440	1,428	1,454	1,516	1,634	1,635	1,796	2,123	1,910
Central & South America										
Brazil	60	60	60	60	60	60	60	50	50	55
Argentina	20	20	20	20	20	20	20	20	20	20
Chile	14	14	14	14	14	14	14	14	17	13
Other	26	26	26	25	23	23	23	23	29	27
Total Central & South America	120	120	120	119	117	117	117	107	116	115
Middle East										
Turkey	55	58	60	63	70	72	60	50	53	43
Saudi Arabia	2	2	19	25	58	94	40	101	64	35
Egypt	35	31	20	32	28	25	22	10	5	5
Other	6	6	6	11	11	11	11	11	12	11
Total Middle East	98	97	105	131	167	202	133	172	134	94
Indian Sub-Continent										
India	124	300	225	140	140	300	200	300	370	207
Other	2	4	5	7	6	9	5	10	15	11
Total Indian Sub-Continent	126	304	230	147	146	309	205	310	385	218
East Asia										
Japan	487	589	752	816	836	850	842	865	908	917
South Korea	64	73	81	90	92	102	107	111	244	164
Taiwan	30	33	28	24	22	22	22	24	26	28
Philippines	4	4	5	5	5	10	12	13	13	13
Indonesia	4	5	7	7	9	10	11	11	12	13
Singapore	9	9	9	9	12	12	11	11	12	12
Thailand	10	10	10	10	10	10	11	25	30	12
Vietnam	8	8	8	7	10	11	11	12	12	12
Hong Kong	8	8	8	8	8	9	9	11	15	11
Malaysia	3	3	3	3	3	3	3	3	4	3
Total East Asia	627	742	911	979	1,007	1,039	1,039	1,086	1,276	1,185
Africa										
South Africa	4	4	3	4	4	4	4	4	4	4
Other	28	28	30	29	27	33	31	29	30	30
Total Africa	32	32	33	33	31	37	35	33	34	33

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Oceania										
Australia	71	71	71	75	78	78	73	71	74	75
Total Oceania	71	71	71	75	78	78	73	71	74	75
Western World Total	3,787	4,044	4,189	4,202	4,315	4,693	4,557	4,903	5,570	5,017
Other Countries										
China	79	46	114	115	128	135	139	143	180	182
Other	336	325	310	303	281	238	230	220	275	240
Total Other Countries	415	371	424	418	409	373	369	363	455	422
World Total	4,202	4,415	4,613	4,620	4,724	5,066	4,926	5,267	6,025	5,439

Figure 61
World Scrap Supply

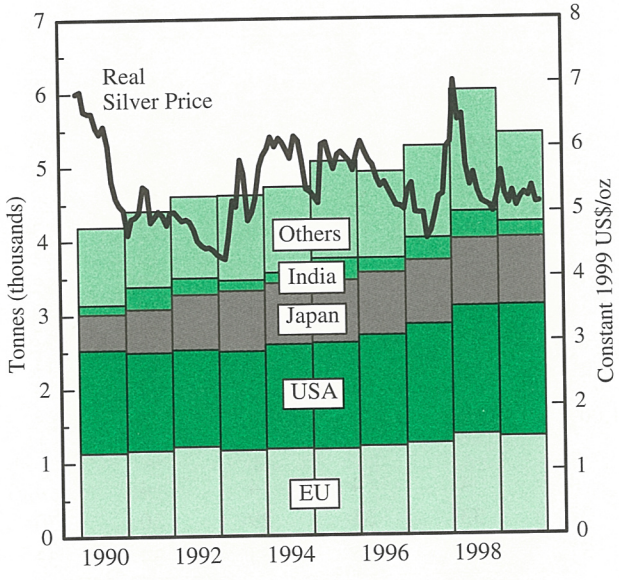


Figure 62
World Scrap Supply, 1999

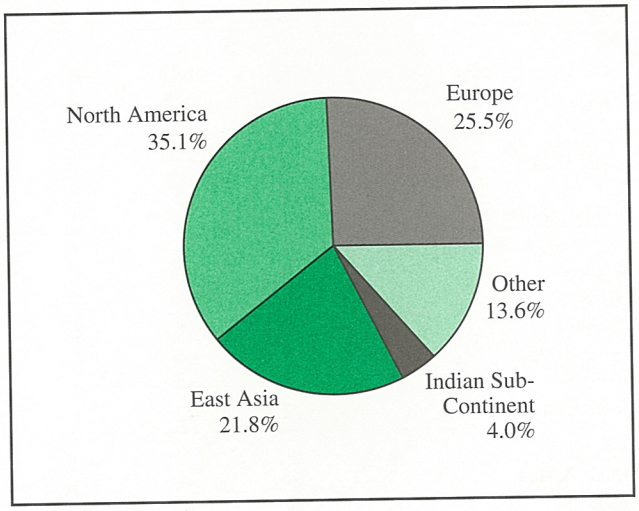


Table 4
World Silver Fabrication
(including the use of scrap)
Tonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Italy	1,586	1,752	1,882	1,765	1,619	1,557	1,624	1,757	1,752	1,940
Germany	1,688	1,800	1,706	1,507	1,642	1,431	1,419	1,431	1,455	1,259
UK & Ireland	777	790	835	882	971	1,005	1,071	1,104	1,219	1,241
Belgium	619	628	629	642	655	728	788	847	1,053	1,168
France	825	891	962	938	876	968	845	891	890	824
Switzerland	178	237	208	194	221	229	243	298	332	344
Spain	472	542	206	191	333	309	288	271	275	234
Greece	100	105	110	115	120	118	130	140	126	126
Poland	159	120	64	70	79	96	94	104	111	117
Portugal	77	72	78	77	64	76	88	89	96	100
Norway	33	63	78	60	51	50	45	46	47	94
Netherlands	86	68	66	65	81	98	67	65	65	64
Sweden	47	60	51	49	47	43	46	52	43	42
Austria	48	53	50	48	46	51	46	42	42	38
Denmark	33	30	33	30	30	33	31	35	32	31
Czech & Slovak Republics	54	47	31	21	18	24	23	24	28	24
Finland	43	46	40	28	31	27	30	29	21	21
Romania	23	19	16	14	13	9	13	11	16	13
Cyprus & Malta	7	7	8	8	11	12	13	12	11	12
Other	30	29	32	34	27	28	28	23	24	23
Total Europe	6,886	7,359	7,083	6,737	6,935	6,890	6,929	7,272	7,636	7,714
North America										
United States	4,263	4,259	4,215	4,378	4,663	4,906	5,043	5,375	5,874	6,380
Mexico	438	468	712	994	859	544	646	736	690	727
Canada	203	145	73	88	96	83	83	87	106	109
Total North America	4,904	4,873	5,000	5,460	5,618	5,533	5,771	6,198	6,670	7,217
Central & South America										
Brazil	211	208	206	215	257	291	262	260	253	238
Argentina	126	126	126	126	126	122	118	118	97	84
Dominican Republic	1	1	1	2	0	3	11	25	34	40
Peru	48	37	29	26	28	31	34	35	34	32
Colombia	33	33	34	33	33	33	33	33	33	27
Ecuador	12	12	12	17	21	21	21	21	21	17
Chile	15	15	15	15	15	15	15	15	15	14
Other	18	17	16	16	15	16	16	16	5016	16
Total Central & South America	464	449	438	451	495	532	510	523	503	468
Middle East										
Turkey	153	145	170	185	161	189	198	203	191	173
Israel	65	73	80	88	95	105	116	125	120	120
Egypt	50	54	72	59	78	67	70	65	58	63
Saudi Arabia	7	9	12	14	10	12	12	20	16	18
Other	50	60	83	64	76	79	82	81	77	80
Total Middle East	325	339	417	409	420	452	479	493	462	452
Indian Sub-Continent										
India	1,455	1,395	1,808	3,383	2,920	3,152	3,801	3,824	3,245	3,390
Bangladesh	55	62	82	120	140	160	180	200	160	178
Other	52	70	86	105	88	117	84	127	87	105
Total Indian Sub-Continent	1,562	1,527	1,976	3,608	3,148	3,429	4,065	4,151	3,492	3,673
East Asia										
Japan	3,601	3,383	3,263	3,356	3,373	3,504	3,487	3,955	3,508	3,894
Thailand	751	625	984	1,205	905	862	859	843	751	829
South Korea	211	290	280	484	510	579	575	579	429	519
Taiwan	140	111	134	149	164	179	198	214	210	210
Hong Kong	75	65	71	81	106	107	117	138	112	120
Indonesia	45	53	60	57	83	97	104	126	84	99

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Myanmar, Laos & Cambodia	31	31	31	31	31	33	34	30	25	28
Vietnam	9	9	9	12	16	20	21	22	19	22
Malaysia	9	11	12	14	11	12	12	13	12	15
Other	14	13	36	12	11	11	12	10	11	12
Total East Asia	4,886	4,590	4,879	5,402	5,210	5,404	5,418	5,928	5,161	5,749
Africa										
Morocco	14	15	15	14	14	17	18	20	18	17
Tunisia	6	6	6	7	8	8	9	10	10	10
South Africa	16	10	9	18	12	14	9	8	8	8
Algeria	12	11	10	9	9	9	8	7	6	6
Other	18	18	17	16	16	15	13	12	12	12
Total Africa	66	60	57	64	59	63	57	56	53	53
Oceania										
Australia	161	163	214	217	196	166	162	161	176	180
Total Oceania	161	163	214	217	196	166	162	161	176	180
Western World Total	19,253	19,360	20,064	22,347	22,081	22,469	23,392	24,781	24,153	25,505
Other Countries										
China	552	596	609	657	765	809	890	1,003	1,055	1,019
Soviet Union/CIS	2,508	2,090	1,562	1,271	985	901	884	864	795	766
North Korea	0	2	0	7	0	0	0	0	0	0
Total Other Countries	3,060	2,688	2,171	1,935	1,751	1,710	1,774	1,866	1,850	1,785
World Total	22,314	22,048	22,235	24,281	23,832	24,179	25,166	26,648	26,003	27,290

Figure 63
World Silver Fabrication

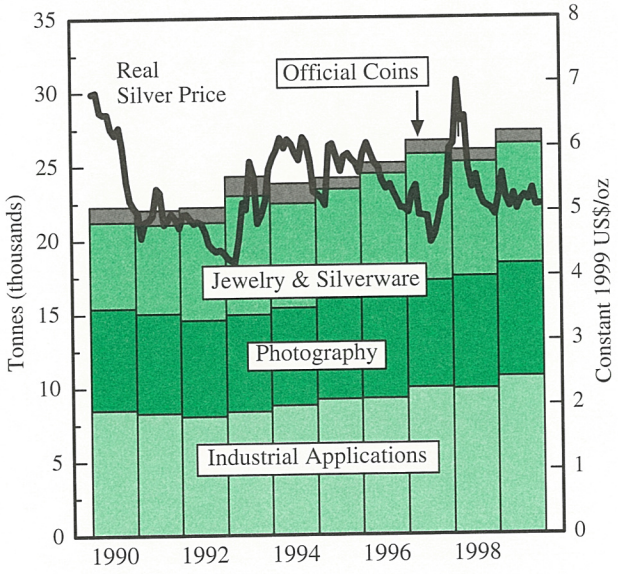


Figure 64
World Fabrication, 1999

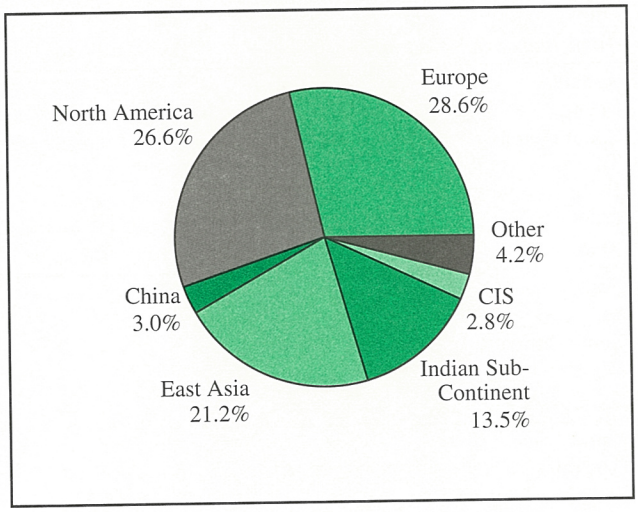


Table 5
Silver Fabrication: Industrial Applications
(including the use of scrap)
Tonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Germany	695	656	622	580	560	575	535	555	571	571
UK & Ireland	326	335	344	354	363	371	381	388	506	472
France	315	346	399	352	360	374	363	417	347	360
Italy	283	294	300	315	316	329	348	354	331	337
Switzerland	159	177	188	174	203	206	215	269	311	322
Spain	59	59	57	57	54	55	61	91	95	83
Netherlands	54	54	54	54	54	54	54	52	52	52
Norway	13	13	13	13	13	13	12	12	11	45
Poland	19	14	15	19	24	26	24	23	23	23
Austria	19	19	19	19	19	22	19	18	17	17
Czech & Slovak Republics	24	21	17	16	13	16	17	13	13	16
Sweden	10	10	10	10	10	10	10	11	11	11
Belgium	10	10	10	10	10	10	10	10	10	10
Other	24	23	22	22	23	23	23	22	24	23
Total Europe	2,010	2,031	2,070	1,995	2,022	2,084	2,071	2,235	2,322	2,342
North America										
United States	1,523	1,533	1,638	1,751	1,886	2,050	2,120	2,343	2,520	2,753
Mexico	80	80	80	80	86	79	81	89	100	160
Canada	22	22	22	23	20	23	20	20	17	17
Total North America	1,625	1,635	1,740	1,854	1,992	2,152	2,221	2,452	2,637	2,930
Central & South America										
Brazil	75	75	75	78	100	108	102	105	108	98
Argentina	40	40	40	40	40	38	36	36	36	30
Colombia	9	9	9	9	9	9	9	9	9	7
Other	14	14	14	14	14	14	14	14	14	14
Total Central America	138	138	138	141	163	169	161	164	167	149
Middle East										
Israel	13	18	21	26	28	30	33	31	31	30
Turkey	24	23	27	29	26	29	28	31	28	24
Egypt	3	3	4	3	3	3	4	3	4	4
Other	0	0	9	0	0	0	0	1	1	1
Total Middle East	40	44	61	58	57	63	64	66	63	58
Indian Sub-Continent										
India	438	517	621	901	999	1,062	1,105	1,120	1,007	1,180
Bangladesh	35	0	0	0	0	0	0	0	0	0
Other	9	12	15	18	15	20	14	22	15	18
Total Indian Sub-Continent	482	529	636	919	1,014	1,082	1,119	1,142	1,022	1,198
East Asia										
Japan	1,448	1,477	1,371	1,425	1,591	1,667	1,622	1,848	1,643	1,975
South Korea	71	125	125	260	311	369	370	382	349	379
Taiwan	94	96	115	131	146	163	181	197	193	196
Hong Kong	47	35	41	51	76	79	88	107	93	101
Indonesia	12	18	22	12	11	12	13	15	16	16
Total East Asia	1,672	1,751	1,674	1,879	2,135	2,289	2,273	2,549	2,294	2,667
Africa										
Morocco	2	2	2	2	2	5	7	7	7	7
South Africa	15	9	7	16	10	10	5	5	5	5
Other	7	7	7	7	7	7	7	5	5	5
Total Africa	24	18	16	25	19	22	19	17	17	17
Oceania										
Australia	61	60	61	63	67	76	70	66	72	76
Total Oceania	61	60	61	63	67	76	70	66	72	76
Western World Total	6,052	6,205	6,395	6,935	7,468	7,937	7,999	8,691	8,594	9,437

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Other Countries										
China	401	410	439	464	538	567	593	632	645	651
Soviet Union/CIS	2,054	1,684	1,230	992	746	682	655	642	610	586
Total Other Countries	2,455	2,094	1,669	1,456	1,284	1,249	1,248	1,274	1,255	1,237
World Total	**8,507**	**8,299**	**8,064**	**8,391**	**8,752**	**9,185**	**9,247**	**9,965**	**9,849**	**10,674**

Figure 65
Main Components of Industrial Usage

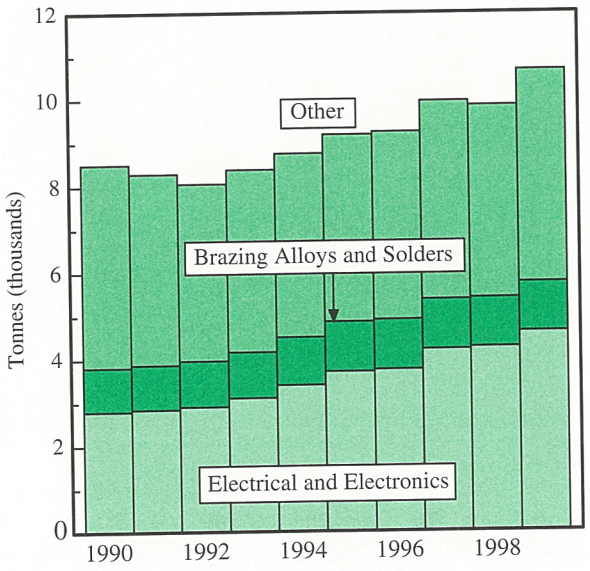


Figure 66
World Industrial Fabrication, 1999

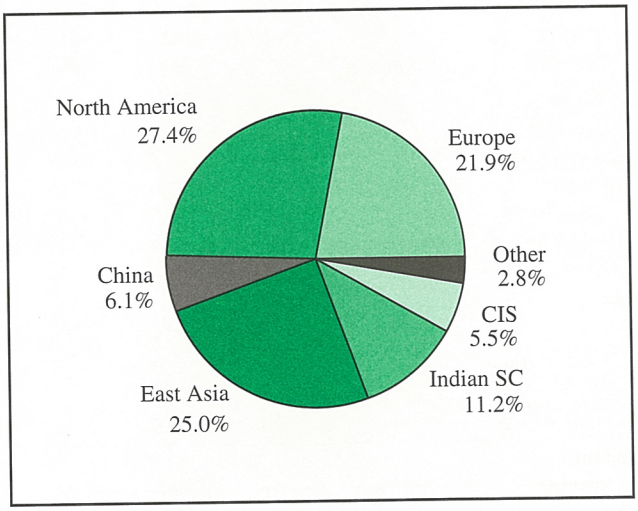


Table 5a
Silver Fabrication: Electrical and Electronics
(including the use of scrap)
Tonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
United States	725	731	802	890	983	1,120	1,129	1,303	1,373	1,464
Japan	697	697	631	650	701	743	706	804	738	933
Germany	419	396	375	350	340	370	360	370	380	380
China	197	202	213	223	276	284	293	316	305	308
Switzerland	40	60	80	86	108	117	127	172	228	232
France	150	165	193	155	168	190	195	238	207	210
South Korea	0	19	16	140	164	200	199	201	188	206
UK & Ireland	132	138	139	141	143	145	155	160	210	179
Taiwan	69	70	85	89	102	113	130	146	148	150
India	73	76	76	76	80	92	100	130	130	140
Italy	93	95	96	100	85	85	103	100	90	92
Hong Kong	39	26	27	37	57	59	68	85	77	90
Mexico	36	36	36	36	38	34	34	36	40	90
Brazil	31	31	31	32	46	49	45	45	45	40
Spain	26	28	28	30	28	28	28	29	30	30
Turkey	24	23	27	29	26	29	28	31	28	24
Netherlands	20	20	20	20	20	20	20	18	18	18
Australia	13	13	13	14	14	17	16	15	17	18
Austria	7	7	7	7	7	7	7	7	7	7
Romania	4	3	3	3	3	3	3	3	4	4
Egypt	3	3	4	3	3	3	4	3	4	4
Total	**2,797**	**2,838**	**2,902**	**3,112**	**3,391**	**3,709**	**3,749**	**4,212**	**4,266**	**4,618**

Table 5b
Silver Fabrication: Brazing Alloys and Solder
(including the use of scrap)
Tonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
United States	180	174	202	224	239	249	255	260	269	276
China	115	119	132	138	146	159	170	179	196	198
Japan	140	148	130	119	147	150	160	155	130	131
Germany	168	158	150	140	125	110	90	95	97	94
Italy	42	46	50	54	58	66	65	59	56	68
UK & Ireland	70	70	70	71	72	72	72	72	75	68
India	40	45	45	45	50	60	65	50	47	50
Switzerland	75	80	75	55	56	56	52	52	49	48
Spain	20	18	15	11	9	9	18	29	32	33
Taiwan	16	16	20	23	25	32	35	34	31	32
France	55	65	74	55	45	40	42	43	32	29
South Korea	3	6	9	25	30	38	36	35	25	26
Australia	18	18	18	19	20	23	21	20	22	23
Brazil	17	17	17	18	26	27	27	25	25	23
Mexico	28	28	28	28	31	27	27	28	30	20
Canada	13	13	13	13	13	16	13	13	10	10
Netherlands	8	8	8	8	8	8	8	8	8	8
Austria	5	5	5	5	4	4	3	3	3	3
Israel	1	1	1	2	2	2	3	3	3	3
Total	**1,014**	**1,036**	**1,063**	**1,053**	**1,106**	**1,149**	**1,161**	**1,163**	**1,140**	**1,142**

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Belgium	590	602	614	626	640	708	770	828	1,034	1,149
UK & Ireland	375	383	406	422	495	519	566	592	593	652
France	390	417	445	458	425	495	411	395	452	370
Germany	500	515	490	480	500	460	430	450	307	208
Romania	15	12	10	8	6	2	6	5	8	6
Hungary	12	11	10	8	8	8	7	7	6	6
Czech & Slovak Republics	20	15	5	0	0	0	0	3	8	1
Bulgaria	1	1	1	1	1	1	1	1	0	0
Poland	90	70	15	15	15	15	9	7	0	0
Spain	50	45	20	11	6	3	0	0	0	0
Total Europe	2,043	2,071	2,016	2,029	2,096	2,210	2,200	2,287	2,408	2,392
North America										
United States	2,084	2,022	1,975	1,991	2,109	2,187	2,314	2,440	2,744	2,872
Mexico	70	70	82	98	98	104	107	127	107	91
Canada	90	60	0	0	0	0	0	0	0	0
Total North America	2,244	2,152	2,057	2,089	2,207	2,291	2,421	2,567	2,851	2,963
Central & South America										
Brazil	80	80	80	82	100	123	105	105	100	100
Argentina	56	56	56	56	56	56	56	56	56	49
Total Central & South America	136	136	136	138	156	179	161	161	156	149
Indian Sub-Continent										
India	175	80	80	70	50	20	20	20	10	10
Other	5	6	6	8	7	8	9	10	12	12
Total Indian Sub-Continent	180	86	86	78	57	28	29	30	22	22
East Asia										
Japan	1,757	1,796	1,805	1,779	1,713	1,770	1,800	1,822	1,810	1,864
Taiwan	3	3	3	3	3	1	1	1	1	1
Indonesia	0	0	0	0	0	0	0	0	0	0
Total East Asia	1,760	1,799	1,808	1,782	1,716	1,771	1,801	1,823	1,811	1,865
Oceania										
Australia	70	70	70	65	60	50	49	51	51	52
Total Oceania	70	70	70	65	60	50	49	51	51	52
Western World Total	6,432	6,314	6,172	6,181	6,291	6,529	6,661	6,919	7,299	7,443
Other Countries										
China	135	138	146	159	174	174	180	187	190	114
Soviet Union/CIS	311	274	224	195	163	154	145	140	119	107
Total Other Countries	446	412	370	354	337	328	325	327	309	221
World Total	**6,878**	**6,726**	**6,542**	**6,535**	**6,628**	**6,857**	**6,986**	**7,246**	**7,608**	**7,664**

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Italy	1,290	1,440	1,568	1,436	1,288	1,212	1,260	1,392	1,410	1,592
Germany	411	451	420	360	360	320	310	310	315	312
Greece	100	105	110	115	120	118	130	140	126	126
Spain	350	403	115	115	125	127	140	124	126	105
UK & Ireland	63	59	69	85	89	92	104	105	102	98
Poland	42	30	31	32	35	49	57	71	83	89
France	55	55	53	63	60	63	62	69	81	84
Portugal	69	67	69	64	47	54	58	59	60	66
Norway	20	36	36	37	37	37	33	33	35	47
Sweden	36	49	40	36	37	32	35	40	31	30
Denmark	27	27	27	27	27	27	28	32	29	28
Finland	37	40	32	26	27	23	26	26	18	18
Cyprus & Malta	7	7	8	8	11	12	13	12	11	12
Austria	15	15	15	15	12	12	13	13	15	11
Czech & Slovak Republics	7	7	6	5	5	5	5	6	5	5
Other	38	36	35	33	31	32	28	29	32	30
Total Europe	2,567	2,827	2,634	2,457	2,311	2,215	2,302	2,462	2,480	2,652
North America										
Mexico	250	270	280	285	270	343	442	508	477	465
United States	305	302	339	351	373	389	387	389	391	407
Canada	31	36	27	27	30	38	41	47	55	48
Total North America	586	608	646	663	673	770	870	944	923	920
Central & South America										
Brazil	56	53	50	55	57	60	55	50	45	40
Peru	46	35	23	24	26	29	32	33	32	30
Colombia	24	24	24	24	24	24	24	24	24	20
Ecuador	10	10	10	15	19	19	19	19	19	15
Argentina	30	30	30	30	30	28	26	26	5	5
Other	21	21	21	22	20	23	31	45	54	59
Total Central & South America	187	173	158	170	176	183	187	197	179	169
Middle East										
Turkey	128	122	143	156	134	160	170	171	163	147
Israel	52	54	57	61	66	72	82	92	88	89
Egypt	47	51	68	56	55	64	67	62	54	58
Saudi Arabia	7	9	12	14	10	12	12	20	16	18
Other	50	60	74	63	75	79	82	80	76	79
Total Middle East	283	295	354	350	341	386	412	425	397	391
Indian Sub-Continent										
India	842	798	1,107	2,412	1,871	2,070	2,676	2,684	2,228	2,200
Bangladesh	20	62	82	120	140	160	180	200	160	178
Other	38	52	65	79	66	89	61	95	60	75
Total Indian Sub-Continent	900	912	1,254	2,611	2,077	2,319	2,917	2,979	2,448	2,453
East Asia										
Thailand	750	624	982	1,199	899	852	844	834	744	825
South Korea	140	165	155	224	199	210	205	197	80	140
Indonesia	33	35	38	45	72	85	92	111	68	83
Japan	118	109	87	77	69	67	65	60	55	55
Myanmar, Laos & Cambodia	31	31	31	31	31	33	34	30	25	28
Vietnam	9	9	9	12	16	20	21	22	19	22
Hong Kong	28	30	30	30	30	28	29	31	19	19
Malaysia	9	11	12	14	11	12	12	13	12	15
Taiwan	12	12	16	15	15	15	16	16	16	13
Other	11	11	8	8	7	8	9	9	9	9
Total East Asia	1,141	1,037	1,368	1,655	1,349	1,330	1,326	1,322	1,047	1,209

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

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Africa										
Morocco	12	13	13	12	12	12	11	13	11	10
Tunisia	5	5	5	6	7	7	8	9	9	9
Algeria	10	9	8	7	7	7	7	6	5	5
Other	15	15	14	13	14	15	12	11	11	11
Total Africa	42	42	40	38	40	41	38	39	36	35
Oceania										
Australia	17	17	17	18	19	19	17	18	22	23
Total Oceania	17	17	17	18	19	19	17	18	22	23
Western World Total	5,723	5,911	6,471	7,962	6,986	7,263	8,069	8,385	7,530	7,852
Other Countries										
China	4	6	13	21	32	45	75	96	145	195
Soviet Union/CIS	143	132	105	82	70	61	65	70	60	66
Total Other Countries	147	138	118	103	102	106	140	166	205	261
World Total	**5,871**	**6,048**	**6,588**	**8,064**	**7,088**	**7,368**	**8,208**	**8,551**	**7,735**	**8,113**

Figure 67
World Jewelry Fabrication

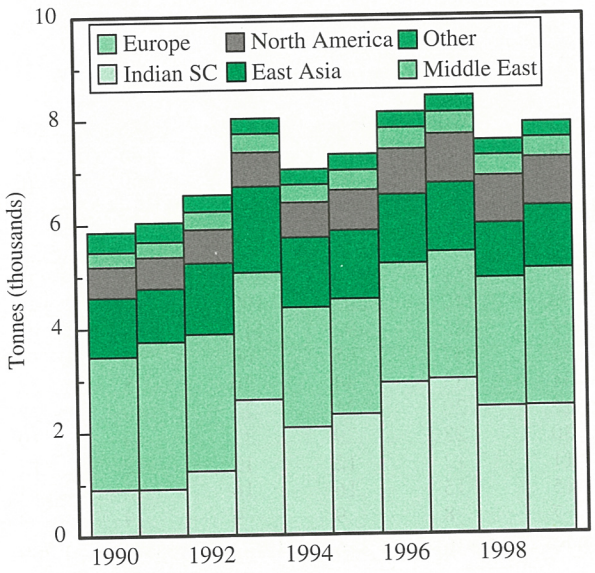


Figure 68
World Jewelry Fabrication, 1999

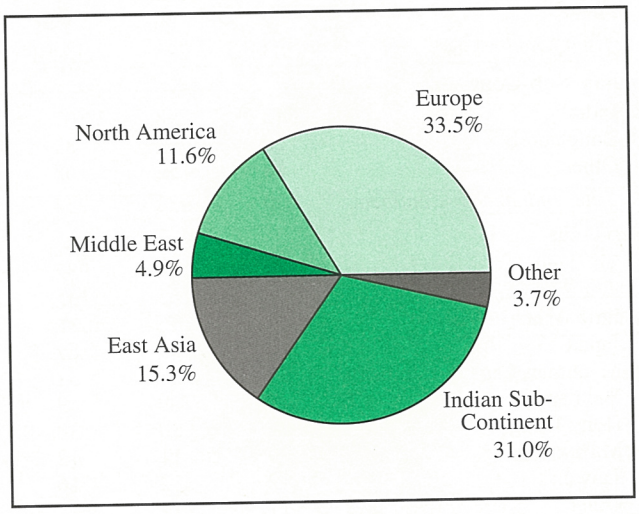


Table 8
Silver Fabrication: Coins and Medals
(including the use of scrap)
Tonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Europe										
Germany	82	178	174	87	222	76	144	116	262	168
Spain	13	35	14	8	148	124	87	56	54	46
Portugal	3	0	4	8	12	17	25	25	31	29
UK & Ireland	13	13	16	21	24	23	20	19	18	19
Switzerland	6	50	11	10	9	13	18	20	9	12
Italy	13	18	14	14	15	16	16	11	11	11
France	65	73	65	65	31	36	9	10	10	10
Austria	14	19	16	14	15	17	14	11	10	10
Poland	8	6	3	4	5	6	4	3	5	5
Belgium	14	11	0	1	0	5	3	4	4	4
Netherlands	21	2	0	1	18	35	5	3	3	3
Czech & Slovak Republics	3	4	3	0	0	3	1	2	2	2
Finland	5	5	7	1	3	3	3	2	2	2
Norway	0	15	29	10	1	1	0	0	0	1
Romania	0	0	0	0	0	0	1	0	1	1
Denmark	3	0	3	0	0	3	0	0	0	0
Other	3	3	7	13	4	6	9	5	6	6
Total Europe	267	430	364	257	507	382	357	288	427	328
North America										
United States	351	402	263	285	295	280	222	203	219	348
Canada	60	27	24	38	46	22	22	20	34	44
Mexico	38	48	270	531	405	18	16	12	6	11
Total North America	449	478	557	854	746	320	259	235	259	404
Central & South America										
Other	3	2	6	2	0	1	1	1	1	1
Total Central & South America	3	2	6	2	0	1	1	1	1	1
Middle East										
Turkey	1	0	0	0	0	0	0	1	0	2
Israel	0	1	2	1	1	3	2	2	2	2
Egypt	0	0	1	0	20	0	0	0	0	0
Total Middle East	1	1	3	1	21	3	2	2	2	4
East Asia										
Thailand	1	1	2	6	6	10	15	9	7	4
Singapore	3	2	28	4	4	3	3	1	2	3
Japan	277	0	0	75	0	0	0	225	0	0
Other	32	0	0	0	0	0	0	0	0	0
Total East Asia	312	3	30	85	11	13	17	234	10	7
Africa										
South Africa	0	0	1	0	0	1	1	0	0	0
Total Africa	0	0	1	0	0	1	1	0	0	0
Oceania										
Australia	13	16	66	71	50	21	26	26	31	29
Total Oceania	13	16	66	71	50	21	26	26	31	29
Western World Total	1,046	930	1,026	1,270	1,335	740	663	787	729	773
Other Countries										
China	12	43	12	13	21	24	43	88	75	60
Soviet Union/CIS	0	0	3	2	6	4	19	12	6	7
North Korea	0	2	0	7	0	0	0	0	0	0
Total Other Countries	12	44	15	22	27	28	62	99	81	67
World Total	1,058	974	1,041	1,291	1,363	769	725	886	811	840

Appendix II

Silver Prices, 1979-99
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
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	39.51
1997	4.897	7,009	153.60	191	1,498	268	273	38.78
1998	5.544	8,016	229.30	233	2,498	309	314	50.65
1999	5.220	8,022	197.54	191	1,995	305	309	49.90

* 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 1999 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
1979	25.406	11,123	614.02	1,125	6,261	1,280	1,096	247.06
1980	42.427	14,650	975.24	2,049	11,574	2,062	1,955	337.51
1981	19.209	12,336	460.94	949	5,348	1,146	1,143	157.22
1982	13.674	11,538	348.73	788	4,043	884	881	156.23
1983	19.116	13,250	484.97	1,064	5,985	1,249	1,294	248.89
1984	13.061	12,514	352.18	742	4,333	929	1,004	148.67
1985	9.496	13,091	297.31	550	3,437	697	765	108.61
1986	8.303	12,735	251.97	344	3,028	458	504	123.05
1987	10.286	14,615	308.82	379	3,510	488	534	154.17
1988	9.203	16,244	272.25	310	2,713	434	480	110.47
1989	7.390	16,705	221.02	275	1,983	362	421	83.89
1990	6.159	15,279	182.47	246	1,691	261	309	66.52
1991	4.962	13,837	144.58	186	1,344	214	258	48.85
1992	4.686	13,419	134.41	167	1,312	196	227	42.19
1993	4.974	10,259	141.33	158	1,403	258	252	42.30
1994	5.939	10,340	163.40	177	1,624	317	294	52.51
1995	5.680	9,406	151.18	161	1,468	299	251	72.75
1996	5.523	9,169	145.44	185	1,460	273	260	64.11
1997	5.082	8,225	160.92	191	1,557	278	278	52.15
1998	5.664	8,321	229.99	233	2,518	315	316	58.76
1999	5.220	8,021	197.54	191	1,995	305	309	49.90

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

Appendix III

Silver Prices, in US dollars per ounce

1. London and US Prices

	London Silver Market - Spot			Comex Spot Settlement		
	High	Low	Average	High	Low	Average
1975	5.2110	3.9280	4.4256	5.2500	3.9200	4.4193
1976	5.0840	3.8300	4.3532	5.1370	3.8340	4.3506
1977	4.9750	4.3130	4.6333	4.9760	4.2850	4.6235
1978	6.2640	4.8180	5.4218	6.3170	4.8110	5.4068
1979	32.2000	5.9350	11.0679	34.4500	5.9230	11.1135
1980	49.4500	10.8900	20.9837	48.7000	10.8000	20.6568
1981	16.3030	8.0300	10.4869	16.2900	7.9850	10.5014
1982	11.1100	4.9010	7.9219	11.2100	4.9800	7.93
1983	14.6680	8.3700	11.4301	14.7150	8.4000	11.4340
1984	10.1100	6.2200	8.1446	10.0640	6.2950	8.1585
1985	6.7500	5.4500	6.1319	6.8350	5.5250	6.1459
1986	6.3100	4.8530	5.4645	6.2850	4.8540	5.4653
1987	10.9250	5.3600	7.0156	9.6600	5.3790	7.0198
1988	7.8215	6.0500	6.5324	7.8270	5.9980	6.5335
1989	6.2100	5.0450	5.4999	6.1940	5.0300	5.4931
1990	5.3560	3.9500	4.8316	5.3320	3.9370	4.8174
1991	4.5710	3.5475	4.0566	4.5450	3.5080	4.0355
1992	4.3350	3.6475	3.9464	4.3180	3.6400	3.9334
1993	5.4200	3.5600	4.3130	5.4430	3.5230	4.3026
1994	5.7475	4.6400	5.2851	5.7810	4.5730	5.2808
1995	6.0375	4.4160	5.1971	6.1020	4.3750	5.1850
1996	5.8275	4.7100	5.1995	5.8190	4.6760	5.1783
1997	6.2675	4.2235	4.8972	6.3070	4.1550	4.8716
1998	7.8100	4.6900	5.5442	7.2600	4.6180	5.4894
1999	5.7900	4.8800	5.2198	5.7600	4.8720	5.2184

2. US Prices

	Comex Spot Settlement		
	High	Low	Average
January	5.3210	4.9020	5.1383
February	5.7600	5.2950	5.5201
March	5.5280	4.9800	5.1748
April	5.4070	4.8720	5.0924
May	5.5430	4.8850	5.2519
June	5.2910	4.9230	5.0467
July	5.4420	5.0550	5.2071
August	5.4850	5.0910	5.2738
September	5.7430	5.0730	5.2397
October	5.6300	5.1800	5.3866
November	5.2850	5.0530	5.1595
December	5.4130	5.0750	5.1731

3. Leasing Rates

	Monthly Averages		
	3-month	6-month	12-month
January	1.92%	2.82%	3.11%
February	7.38%	7.47%	7.30%
March	5.12%	5.53%	5.96%
April	3.23%	3.91%	4.46%
May	2.78%	3.56%	4.84%
June	2.04%	3.16%	4.66%
July	2.48%	3.87%	5.10%
August	2.98%	5.05%	5.73%
September	3.62%	5.45%	6.17%
October	6.20%	6.67%	7.23%
November	4.65%	5.24%	6.11%
December	3.97%	4.58%	5.58%

Appendix IV

Leading Primary Silver Mines

Rank	Mine	Country	Owner(s)	Output (Moz) 1998	1999
1	Proaño*	Mexico	Industrias Peñoles SA de CV	21.2	21.2
2	Chimberos/La Coipa	Chile	Cia Minera Mantos de Oro**	19.8	20.6^
3	Greens Creek	United States	Kennecott/Hecla Mining Co	9.5	10.3
4	Imiter	Morocco	SMI	7.7	7.7^^
5	Uchucchacua	Peru	Cia. de Minas Buenaventura SA	5.5	7.1
6	Rochester	United States	Coeur d'Alene Mines Corporation	7.2	6.2
7	Arcata	Peru	Minas de Arcata SA	6.0	6.2
8	Tizapa	Mexico	Industrias Peñoles SA de CV	5.7	5.3
9	Sunshine	United States	Sunshine Mining and Refining Company	5.8	5.2
10	Lucky Friday	United States	Hecla Mining Co	4.1	4.4
11	Galena	United States	Coeur d'Alene Mines Corporation	3.3	3.7
12	Quiruvilca	Peru	Pan American Silver Corp	3.1	3.3
13	La Encantada	Mexico	Industrias Peñoles SA de CV	2.3	2.5
14	San Martin	Mexico	First Silver Reserves Inc	2.3	2.3
15	Orcopampa	Peru	Cia. de Minas Buenaventura SA	2.9	1.3

*part of the Fresnillo Group, which includes Naica and El Monte
**Placer Dome Inc/TVX Normandy Americas joint venture
^including some production from La Coipa
^^estimate

Silver Mine Production by Source

Million ounces

	1996	1997	1998	1999
Primary				
United States	22.2	36.2	36.6	34.4
Mexico	37.6	43.2	44	34.2
Peru	20.6	21	21.2	22.2
Other	19.1	18.3	32.9	33.7
Total	99.5	118.7	134.7	124.5
Gold				
Canada	13.7	13.3	12	15.2
United States	11.7	17.1	13.6	13.2
Chile	18.3	18.3	10.2	9.6
Other	29.9	31.3	30.9	33.4
Total	73.6	80	66.7	71.4
Copper				
Poland	30	33.1	35.3	35.1
Chile	18.1	16.6	16.7	18
CIS	12.4	12.8	13.2	13.7
Other	57.6	59.1	59.8	56.2
Total	118.1	121.6	125	123
Lead-zinc				
Australia	31.3	34.6	46.4	54.5
Peru	35.7	38.4	36.1	37.3
Mexico	32.1	31.1	34.9	29.3
Other	90.8	94.4	95.3	99.6
Total	189.9	198.5	212.7	220.7
Other	6.7	7.8	8.7	7.2
TOTAL	487.8	526.6	547.8	546.8

Silver Mine Production by Main Region and Source Metal

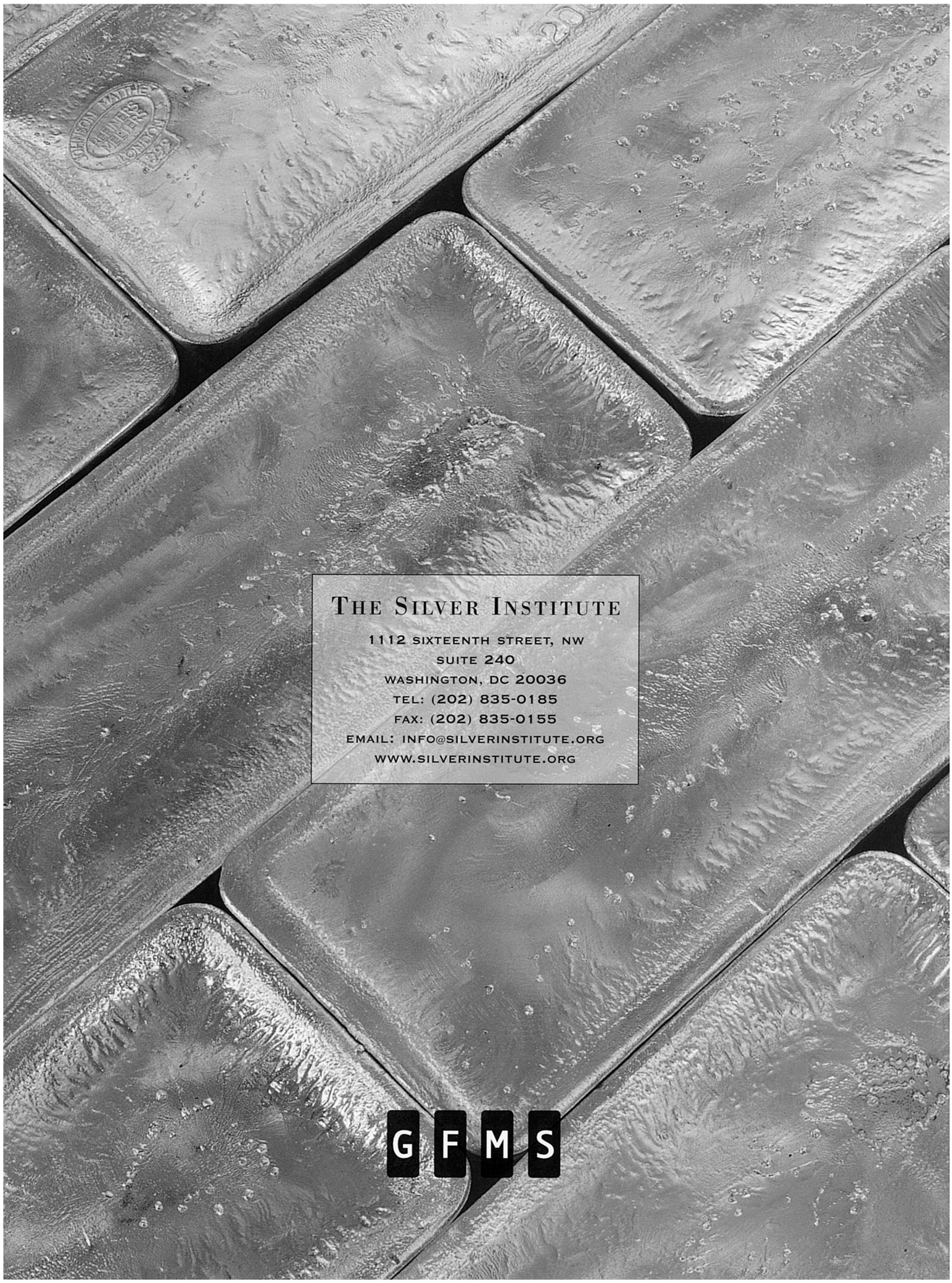
Million ounces

	1996	1997	1998	1999
North America				
Primary	59.8	79.4	80.6	68.6
Gold	33.7	39.7	34.7	37.1
Copper	26.9	26.5	26.2	22.2
Lead-zinc	49.3	48.5	50.8	45.8
Other	2.0	1.9	1.9	1.9
Total	171.7	196.0	194.2	175.6
Central & South America				
Primary	20.9	21.1	37.4	39.3
Gold	21.5	21.1	14.5	18.2
Copper	23.8	22.9	23.0	24.7
Lead-zinc	49.5	52.5	50.9	51.5
Other	0.2	0.2	0.2	0.2
Total	115.9	117.8	126.0	133.9
Europe				
Gold	0.5	0.3	0.2	0.3
Copper	36.6	39.9	40.8	40.5
Lead-zinc	11.5	10.8	10.4	11.0
Other	0.6	1.2	2.1	1.5
Total	49.2	52.2	53.5	53.3
Rest of World	151.0	160.6	174.1	184.0
Total	487.8	526.6	547.8	546.8

Appendix V

Comex Futures and Option Turnover and Open Interest, and LBMA Turnover

	Comex				LBMA Clearing Turnover		
	No. of Contracts						
	Futures		Options		Ounces transferred (millions)	Value (US$bn)	Number of transfers
	Turnover	Open Interest	Turnover	Open Interest			
Jan-97	401,995	89,932	63,588	70,746	294.4	1.4	557
Feb	530,514	90,704	89,431	61,542	275.0	1.4	565
Mar	360,871	91,324	64,742	70,477	284.1	1.5	562
Apr	493,999	85,175	68,202	65,112	253.0	1.2	482
May	280,536	91,933	53,886	80,008	236.5	1.1	455
Jun	472,306	91,277	53,607	56,400	270.5	1.3	513
Jul	340,245	97,043	64,131	74,762	270.6	1.2	528
Aug	425,471	77,625	61,832	69,619	263.3	1.2	503
Sep	335,400	95,589	67,412	85,120	314.3	1.5	481
Oct	430,397	94,671	100,228	107,010	345.5	1.7	592
Nov	488,024	90,126	60,272	82,173	327.9	1.7	671
Dec	333,762	98,906	95,592	106,258	395.8	2.3	691
Jan-98	352,688	105,152	84,147	116,984	330.4	1.9	630
Feb	550,800	101,987	132,311	117,511	347.8	2.4	690
Mar	368,127	85,986	74,310	119,826	272.1	1.7	581
Apr	360,130	76,882	64,626	89,894	230.7	1.5	520
May	310,130	91,571	76,681	106,995	266.5	1.5	583
Jun	393,971	79,898	56,802	79,783	217.9	1.1	484
Jul	278,774	81,144	67,854	89,839	233.5	1.3	474
Aug	367,257	80,983	52,059	75,667	223.4	1.2	441
Sep	283,475	71,779	66,718	89,108	232.2	1.2	466
Oct	280,066	74,722	62,102	95,772	249.4	1.2	443
Nov	319,216	74,758	43,630	57,240	169.1	0.8	341
Dec	229,982	75,353	36,813	60,858	202.2	1.0	389
Jan-99	315,165	80,995	54,145	72,202	214.2	1.1	420
Feb	550,271	98,954	71,617	64,476	277.3	1.5	514
Mar	355,559	78,260	72,105	77,834	188.8	1.0	448
Apr	424,822	75,328	53,915	67,547	198.2	1.0	423
May	274,002	75,735	52,214	70,271	189.0	1.0	454
Jun	373,662	76,274	46,312	52,076	161.3	0.8	400
Jul	288,480	82,457	42,827	54,589	191.3	1.0	387
Aug	422,653	73,844	70,670	55,928	196.1	1.0	413
Sep	328,907	91,223	73,260	73,130	176.3	0.9	371
Oct	318,256	79,505	86,082	88,505	182.4	1.0	407
Nov	344,289	71,574	56,365	57,902	125.9	0.6	322
Dec	161,434	76,387	46,373	64,209	119.9	0.6	300



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