WORLD SILVER SURVEY 1995

THE SILVER INSTITUTE

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PREFACE

The World Silver Survey has been published by The Silver Institute since 1990. Copies of the 1990, 1991, 1992, 1993 and 1994 editions are available by contacting The Silver Institute at the address and telephone number on the front inside cover.

The cover photograph shows a silver ingot in the form of an image of the Hindu goddess Maha Lakshmi, the divine consort of Maha Vishnu. Lakshmi is considered to be the goddess of wealth and prosperity. These cast figures are produced in silver of 999 fineness (which resists tarnishing) and are popular as gifts on occasions such as house-warmings. We are grateful to Vummidi Nandagopal & Sons of Madras, India, for their assistance in preparing the illustration.

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

Contents

This is the first survey of the world silver market to be produced for The Silver Institute by Gold Fields Mineral Services (GFMS), which is best known for its annual Gold Survey, now in its 28th year. As with the work on gold, the analysis here is based on a series of interviews carried out world-wide by the GFMS team of analysts and consultants, which has been augmented for this silver study. GFMS is grateful not only to The Silver Institute for the opportunity to broaden its research in this way, but also to the miners, refiners, bullion bankers and fabricators throughout the world who have responded so positively to its enquiries.

- This year's report presents for the first time a truly global picture of the world silver market. It is more comprehensive than any previous edition of the World Silver Survey, being based on nearly 750 interviews in the field in 56 countries and shows for the first time fabrication data for the CIS and China.

- Consequently, it is difficult to make simplistic comparisons between the statistics for the period since 1990, generally prepared by GFMS, with those for the period up to 1989, which are mostly taken from last year's edition of the World Silver Survey.

Gold Fields Mineral Services **May 1995**

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Units used:
supply and demand data are given
in units of million troy ounces (Moz)
1 Moz = 31.103 t (metric tonnes)
1 tonne = 32,151 troy ounces
1 tonne = 1,000,000 grams (g)

Terminology:

"-" = not available or not applicable
0.00 = zero or less than 0.005
"dollar" refers to the US dollar
unless otherwise stated

1. Summary and Outlook

Initially, 1994 may be remembered as the year in which the silver price picked itself up to turn in the best performance since 1989, with an average of $5.285 per ounce for the year. The price improvement, however, was but a reflection of a developing statistical scenario for the metal. World mine production has been falling steadily since 1990, as have stocks, especially in Europe. Fabrication demand, although overall showing a slight decline, because of a sharp drop in silverware and jewelry manufacture in India, Thailand and Italy, improved in industrial and decorative uses, photography and coins. The industrial and decorative sector is now the largest consumer of silver, due to the metal's application in a wide variety of products, many of them in domestic appliances purchased world-wide. As a result, the "gap" between fabrication demand and the regular supply of silver, mainly from new mine production and scrap, has continued to widen (see Figure 1). That gap has been met only by destocking, as shown by the implied disinvestment figures in the table below and, to a lesser extent, by sales from government stocks. This improved position which helped to attract more speculative investment interest in the first half of 1994 and again in April 1995, from hedge funds and other investors, eventually pushing the price briefly to a six-year high of $5.915 on 19th April.

The overall world silver supply and demand situation is shown in Table 1 below. The statistics are global, for the first time in the Silver Survey. Research in both the CIS (the former Soviet Union) and China has enabled estimates to be made for supply and demand there. The reappraisal of China, has revealed higher silver output than previously estimated and a substantial level of fabrication. The dividing line, marked between 1989 and 1990 in the Supply and Demand table, is because previous Silver Institute surveys showed no estimates for fabrication or scrap in either China or the then Soviet Union prior to 1990. Thus, to achieve a global balance for 1985-1989, it has been necessary to estimate total supply in the former communist bloc, subtract its known exports to the West, giving implied estimates for fabrication which are included in the Table under Demand as "Other" pre-1990.

Table 1
World Silver Supply and Demand
(million ounces)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	**1994**
Supply										
Mine Production	428.0	421.2	439.6	453.6	468.8	514.2	504.6	499.4	468.4	**444.2**
Official Sector Sales	13.0	14.0	20.0	8.3	10.7	11.0	11.5	8.1	13.8	**32.4**
Old Silver Scrap	154.3	142.6	151.1	157.8	149.2	114.2	120.6	124.7	128.6	**132.5**
Hedging	-	-	-	-	-	15.2	22.9	-	23.6	**-**
Implied Disinvestment	-	-	-	-	-	28.8	21.7	82.0	126.7	**150.2**
Total Supply	595.3	577.8	610.7	619.7	628.7	683.4	681.2	714.2	761.1	**759.3**
Demand										
Fabrication										
Industrial & Decorative	133.6	140.3	150.0	154.1	167.8	263.5	270.8	268.8	263.7	**279.4**
Photography	152.7	157.8	172.1	185.1	185.9	219.2	213.7	212.6	212.9	**219.3**
Jewelry & Silverware	49.5	68.9	88.6	93.0	118.1	168.1	168.5	197.8	244.7	**208.3**
Official Coins	13.5	26.9	27.9	22.9	24.6	31.6	28.1	33.3	39.5	**42.9**
Other *	164.1	175.2	130.9	138.6	129.1	-	-	-	-	**-**
Total Fabrication	513.4	569.1	570.5	593.7	625.5	683.4	681.2	712.5	761.1	**749.3**
Hedging	-	-	-	-	-	-	-	1.7	-	**9.9**
Implied Investment	81.9	8.7	41.2	26.0	3.2	-	-	-	-	**-**
Total Demand	595.3	577.8	610.7	619.7	628.7	683.4	681.2	714.2	761.1	**759.3**
Real Silver Price (1994 US$/oz)	8.451	7.389	9.154	8.190	6.577	5.481	4.416	4.170	4.427	**5.285**

* Includes unclassified Western and estimated communist bloc demand
Throughout the tables, totals may not add due to independent rounding

Supply

Taking the broad overview of supply, the continued decline of mine production and the growing significance of implied disinvestment are the key features. Output declined in Mexico, Peru and the CIS, the three leading producers, which alone account for 40% of production. However, this has been offset by rising output especially in Bolivia, China (which now ranks among the top ten producers), Indonesia and Poland. While amounts supplied by new producers are modest, the growing diversity is helping to maintain supply. Moreover, in 1995, the declining trend could be reversed with a number of new projects, such as the gold/silver mine at Eskay Creek in Canada, coming on-stream.

Eskay Creek, in fact, reflects how silver production continues to evolve essentially as a by-product of other metals. Primary silver mines accounted for only 14% of output in 1994: the rest was as a by-product of gold, copper or lead/zinc operations (a special study of by-product silver appears on pages 24-25). Thus, mine production of silver, unlike most other metals, shows only a limited response to changes in its market price; it happens anyway. But there is an important benefit to silver's price directly as a result. The investor or speculator who likes silver has little choice but to buy the metal, either physically or through derivatives (silver warrants gained some vogue in 1993 and early 1994). This is in direct contrast to gold, where nowadays investors have an array of Australian, North American and South African gold shares on offer and often prefer them to the metal. Silver, with few primary mines, benefits at once from investor interest because it is largely channelled into the metal. This contributes not just to the volatility of the silver price over time, but may have caused silver's better performance relative to gold in 1994 and the price surge in April 1995.

The hedging of silver through forward sales by mines has also been significant in the past 5 years, although, in 1994 this contributed not to supply, but to demand due to a decline in producer hedging positions and the payback of silver loans.

While scrap is an important component of the silver equation, the supply has fluctuated remarkably little over the last decade. Clearly this is because silver has been in a longer-term bear trend: scrap is generated by price spikes (as, on occasion, in the 1980s) and at lower price levels recycling is sometimes not profitable. However, in any significant rally over $6.00, scrap supplies could rapidly rise. Indeed, the higher average price of the last two years may be partly responsible for a marginal increase.

With scrap relatively static, the running down of stocks held by exchanges and in private or dealers' vaults has become a steady source of supply. The decline of stocks in Europe is the most noticeable; they have fallen by over 300 Moz (9,300 t) since 1990. This is because the burgeoning Indian demand has largely been met from London and Zurich. But stocks in the United States were also falling late in 1994 and early 1995, as dealers mobilized metal for future dispatch to India (and to meet a sudden surge of buying from Japan). While stocks on both sides of the Atlantic can still meet any market shortfall for some time, they are being whittled away year by year. Although government silver stocks are relatively small, official sales increased in 1994, partly as a result of disposal by former communist nations.

Demand

Silver's strength is the diversity of its use. The three mainstays of fabrication - industrial and decorative uses, photography and jewelry/silverware - each require 200 Moz (6,220 t) or more annually; even the modest coinage sector has grown by one-third in the 1990s to reach over 40 Moz (1,240 t). Although photography was long the foremost user of silver, it has shown little growth in recent years, while industrial and decorative demand has forged ahead to be the principal user. The versatility of silver in many new industrial applications is more than off-setting any decline due to miniaturization or more selective plating in electrical components.

The long-standing reliance of photography on silver remains. While demand for X-ray film has been declining, the broad commercial sector for color film thrives. Digital imaging does not yet pose a serious threat, while the potential for growth in new markets, such as China, which is assessed for the first time in this survey, is considerable. And as the movie industry celebrates its centenary in 1995, it is worth noting that the relatively new Hollywood policy of blanket distribution of key movies, to enable them to open in many locations simultaneously, is calling for more silver to make prints.

Clearly, in the last two years, one of the most crucial factors in the silver market has been the liberalization of silver imports into India. While silver had been going into India unofficially for some years (after massive dishoarding from the mid-1960s to the mid-1980s), the true dimension is now seen.

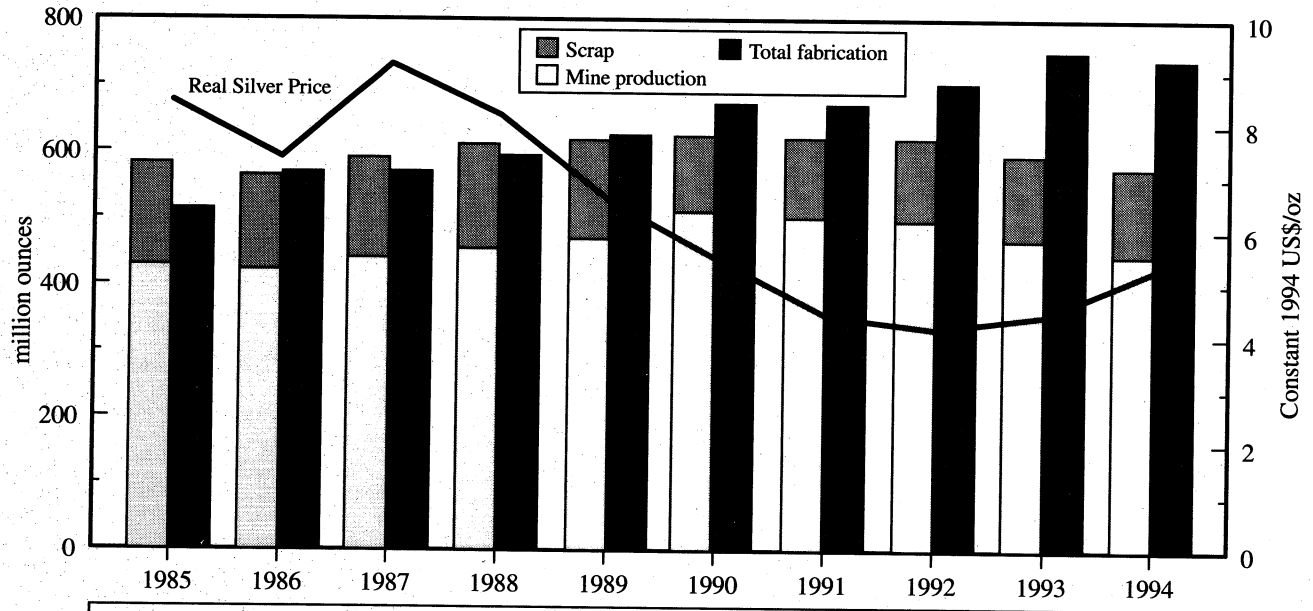
India has the capacity to absorb 100 Moz (3,110 t) or more annually; only two other countries do that - the United States and Japan. The fourth biggest consumer, Germany, is only at 50 Moz (1,555 t). Thus, India has won a special place as a swing factor in silver and its sudden demand is eroding stocks. Much of this metal is going into silverware and jewelry and, along with Thailand, India underpins this sector. The decline in Indian manufacture in 1994, partly because of excessive trade inventory at the end of 1993, was one reason for fabrication overall to fall. But this may well have been a temporary setback and use could rise again in 1995.

What will be crucial this year is the attitude of the hedge funds, who are the driving force in the silver market, just as they are in gold and base metals. No market is now isolated from their attentions. Indeed, through their use of derivatives, they have irrevocably changed the markets. Funds are attracted by volatility and seek performance. Silver's trading range in 1993, 1994 and already in 1995 has provided that. The decline in the price from September 1994 to the low of $4.42 in March 1995 once again gave them the opportunity to move in and eventually propel the Comex price by $0.56 in a single day on 31st March. Thus, although the price averaged $4.71 in the first quarter of 1995, it averaged $5.31 for the first two weeks of April before jumping to $5.92 on 19th April. While the funds' interventions and expectations are usually relatively short-term, the uncertainties created already this year, with the crisis of the Mexican peso, the collapse of Barings Bank and the weakness of the dollar, have stimulated the search for quality investments.

Since silver went into this period with the price well below last year's high, it offered an opportunity which was taken. The test for silver in 1995 and beyond is the extent to which its regular consumers, and most notably those in India, where there is considerable price sensitivity, can accept a longer-term higher trading range. The evidence of the last year or so is that generally they can, as shown by the growth in silver offtake across a range of uses last year despite the average price being 22% higher in dollar terms than in 1993. Silver is used, after all, for its performance in industry and photography; price is not a deterrent at current trading ranges. Moreover, in key currencies such as the yen and the DM, it is actually getting cheaper. Thus the perception of silver in the mid-1990s is that the broadly-based growth in demand seen in the past decade should continue to be supported.

Figure 1

World Silver Market: from surplus to deficit



The silver market has moved in the last decade from mine supply and scrap exceeding fabrication to an increasing deficit, as fabrication outstrips conventional supply.

2. Silver Prices and Trade

The silver price not only fluctuates throughout trading hours but different prices are quoted in different markets. There are three primary price references:

***London** spot price, based upon the daily London silver fix at 12.15pm;*

***Comex** settlement price in New York for the nearest due month;*

***Handy & Harman** price, which has been a North American benchmark for over a century as the daily silver cash quotation accepted by many commercial users.*

In the accompanying section, the London spot price is generally quoted unless, for purposes of comparison, particularly at times of volatility, when a late rise or fall in New York presents a more accurate reflection of a new trend.

Silver Prices in 1994/95

Silver once again lived up to its reputation as "the restless metal" in 1994, turning in its highest price since 1989 at $5.75 per ounce on 28th March, against a low of $4.64 on 6th December. Although this trading range of $1.11 was much lower than in 1993, which was $1.86, the average price was comfortably up at $5.285 (compared with $4.313), the best annual performance since 1989. Although the price averaged only $4.71 in the first three months of 1995, the rebound to $5.92 in mid-April has already provided a good range this year.

The upward momentum in 1994 took place essentially in the first three months. Spurred on by unrest in Mexico (the largest producer) and reports that India had imported substantial quantities of silver in 1993, thereby sharply reducing European stocks, the price lifted easily off its opening level of $4.96 to reach $5.31 by 17th January and briefly touched $5.45 on 4th February. Comex stocks, which had started to decline from the previous October, continued to fall sharply; they dropped by 35 Moz (1,090 t) between October 1993 and March 1994. This created the impression that the silver was genuinely being consumed or at least shipped to India. In reality, it was being moved to other vaults in New York and Delaware as part of a carefully conceived plan involving some speculators to drive up the price. Their aim was to push silver towards and through $6, at the same time narrowing the gold-silver ratio, which had already narrowed from 86:1 in June 1993 to 70:1 by March 1994. The apparent goal of the speculators was reported to be a ratio of 63:1.

Figure 2

London Silver Market: Spot Price

US$/oz; other currencies reindexed to 3rd January 1994 = 100

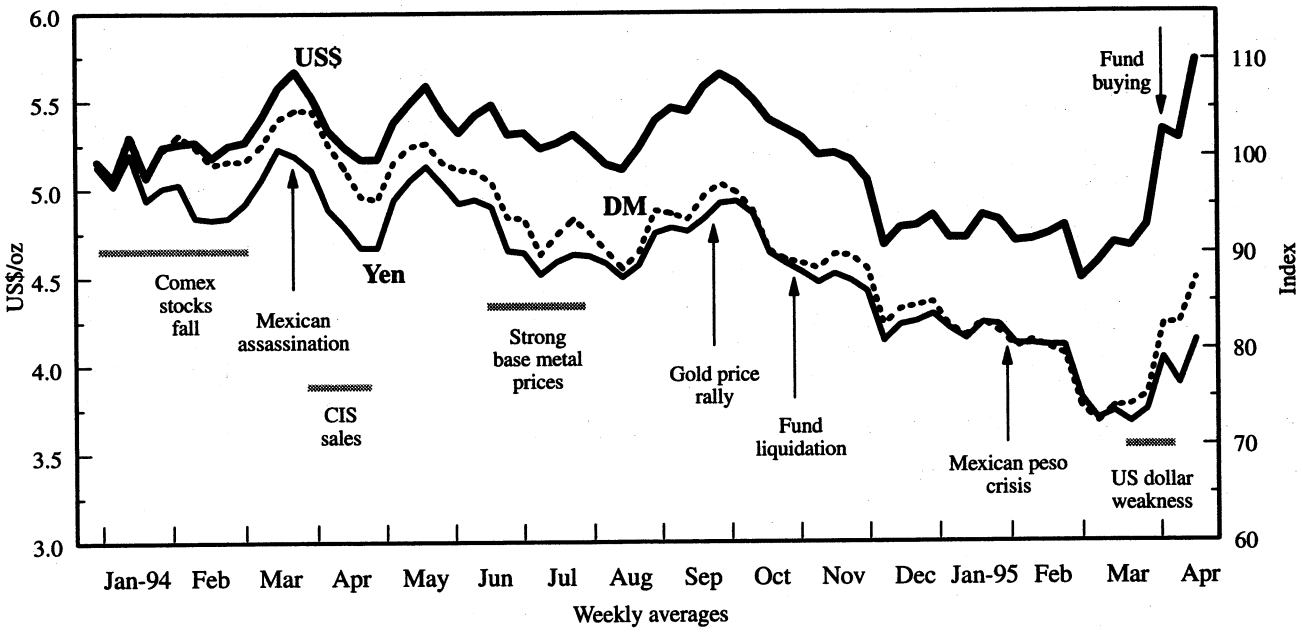
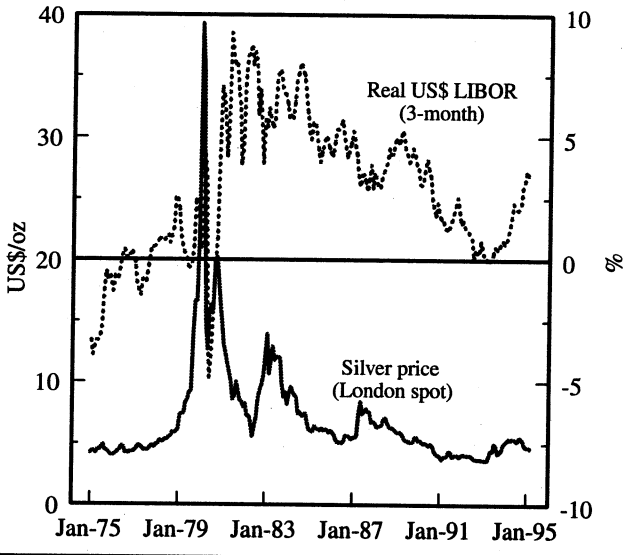


Figure 3
Silver Price and Real Interest Rates
Monthly averages: to March 1995



The comparison between the silver price and real interest rates over the last twenty years (see Figure 3) reveals an interesting pattern. Initially in the 1970s silver's price responded to inflation in a period effectively of negative real interest rates. After the exceptional silver price of 1980, the high interest rate era of the 1980s killed inflation and caused recession (thus weakening the demand for silver fabrication). But in the early 1990s, lower real interest rates initially provided a basis from which the silver price could improve and even when they rose did not really inhibit silver because of the strong fabrication demand (which has fully recovered from the immense setback of the high 1980 price), coupled with the emergence of India as a major buyer. In short, silver is currently resilient enough, because of underlying demand, to withstand interest rate rises.

The momentum was helped in mid-March by articles in the financial press describing the funds' targeting of silver and by the assassination in Mexico on 24th March of the potential presidential candidate Luis Donaldo Colosio in Tijuana. This pushed the price in London to the year's high of $5.75 on 24th March and to a Comex settlement of $5.78 on 25th March. The rally, however, could not be sustained. Not only had demand in India slowed down once the price went over $5, but significant sales took place from various sources in the CIS and Eastern Europe, helping to replenish stocks in London and Zurich. Producers elsewhere also took the opportunity to sell forward. The price slipped rapidly to $5.07 by 22nd April.

Some speculators and funds, however, remained bullish, encouraged in part by continued strong performances in base metals and other commodities such as oil and coffee. The silver price re-bounded to $5.73 by 24th May (Comex settlement $5.76 on 23rd May), narrowing the gold-silver ratio to 67:1, within sight of the target conceived six months earlier. However, the technical barrier of $5.75 could not be breached and the speculators' enthusiasm was waning. So was Indian demand, one cornerstone on which expectations had been built; silver imports into Dubai and Singapore, the two entrepôts serving India, had fallen by 33% in the first five months compared with the same period in 1993.

After May, silver became increasingly detached from the continued bull market in base metals with the funds reducing their positions to seek volatility elsewhere. As expectations cooled, producers were much readier to sell forward into any rally over $5.30, especially as higher interest rates offered a better contango. Despite the lower prices, there was no real recovery in Indian demand. Comex stocks also began to rise again, from 223.1 Moz (6,939 t) at the end of the first quarter to 253.2 Moz (7,876 t) by the end of the third. Thus in August, the average price was only a modest $5.19, with a low of $5.05.

One good rally remained. In September, on the back of an improved gold price, as the funds sought to test the $400 barrier for gold, silver advanced to push through $5.60 by the third week and just touched $5.71 on 28th September. The rise, however, was taken as an opportunity to get out of long holdings; one position, said to be over 50 Moz (1,560 t), was liquidated. By mid-October, the price was back in the $5.30 range, with most debate centered on how long it could stay that high.

The collapse came with weak New York prices in late November. The Comex settlement of 30th November was $4.90; the next day silver closed in

London at $4.91, the lowest since January. On 5th December, Comex closed at $4.57 and London the following day was $4.64. And the gold/silver ratio had widened to 81:1 by 8th December.

Thus silver went into 1995 facing more modest price forecasts, although well sustained by a rising Indian demand and substantial (and unforeseen) buying from Japan. Then, in late January, concern about the Mexican economy helped to lift the price towards $4.90, but lack of serious interest from the hedge funds meant the rally could not be maintained. The price slipped back in February, unaffected by the collapse in London of Barings Bank, breached $4.50 and bottomed out at $4.42 by 2nd March. At that level, not only was physical demand good, with forward orders being booked for India, but the potential for a sharp rise from the low base brought silver back into the funds' focus, especially because of the weakness of the dollar. Comex stocks also began to fall rapidly, losing almost 45 Moz (1,400 t) in March. The price kept moving, breaking $5.00 easily on 30th March and pressing on to $5.92 by 19th April.

Price Volatility

Although the price was not quite so volatile during 1994 as in the previous year (see Figure 4), the pattern of a more active price has been well maintained. Indeed, taken together, 1993 and 1994 show a livelier price than at any time during the last decade, save for the highly speculative flurry in early 1987, when silver momentarily reached $10.92, responding to a switch into precious metals ahead of the stock market collapse. The significance of the increased volatility of the last two years reflects the return of more serious investment money to the market from the funds. Volatility attracts them; indeed, the improved volatility again in the first quarter of 1995 confirms this, together with the rise in the price from $4.42 to over $5.92, in scarcely six weeks, a jump of over 35%.

Gold/Silver Ratio

Historically the gold/silver ratio (Figure 5) was maintained over centuries at close to 15:1 in Europe, as long as both metals served as currencies and were

Figure 4

Silver Price Volatility in US Dollars

Ratio of mean daily change to monthly average

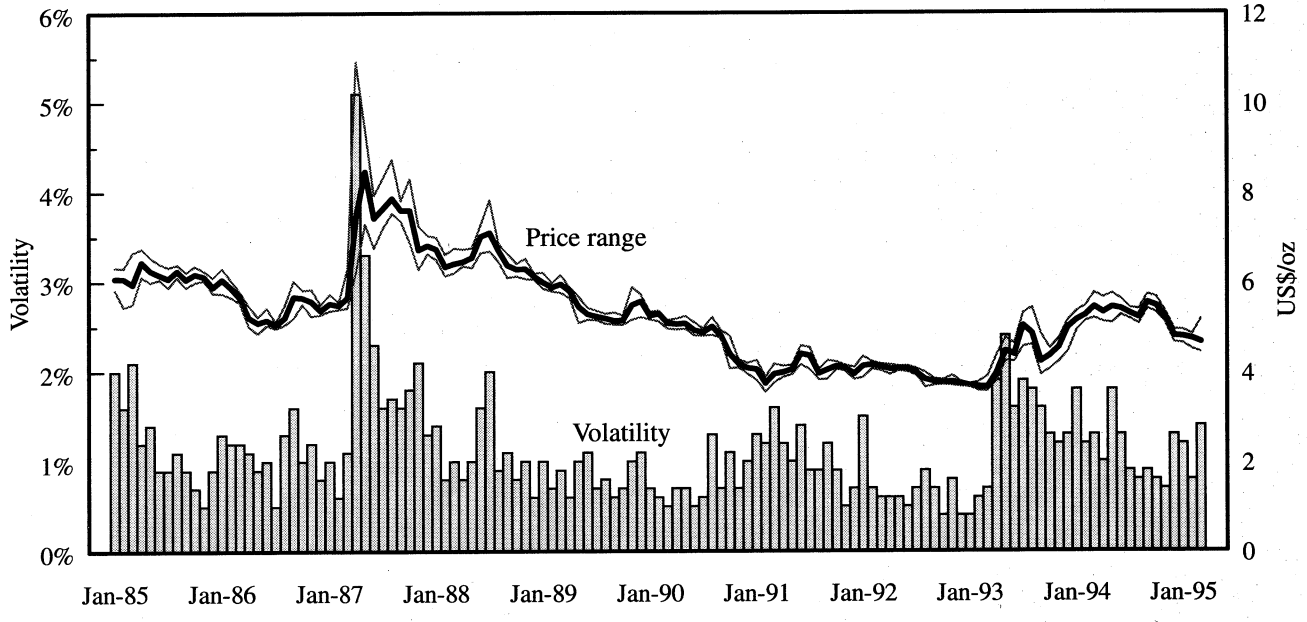
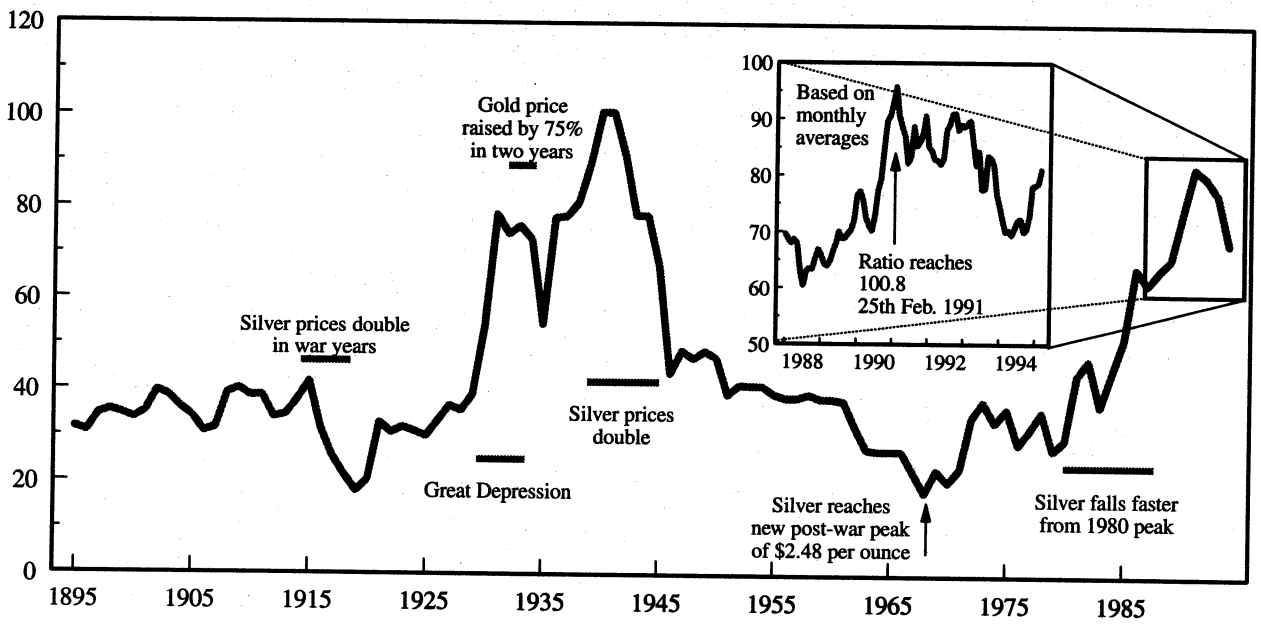


Figure 5

Gold/Silver Price Ratio - the 100-year view - 1895-1994

Based on annual average prices



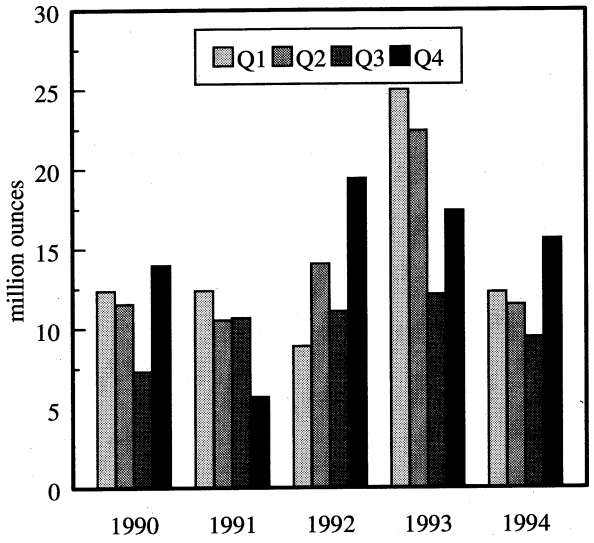
essentially wedded together by the gold and silver standards. But the divorce of silver from being a monetary metal in the late 19th century broke that link. Throughout the 20th century, therefore, the ratio has fluctuated widely, going out to over 100:1 in the mid-1930s and again briefly in 1991. But many market participants have continued to play the ratio, buying silver and selling gold, or vice-versa. In the 1990s, the significant factor has been a recovery from the wide margin of 101:1 in February 1991. And it was a sustained and concerted attempt to narrow the margin further that was a key feature of the market during 1994. The intention was to bring it down to 63:1. In the event it narrowed to 67:1 in May 1994, relatively close to the target, although it then slipped back again at over 80:1. However, the strong rally in the silver price in late March and April 1995 again brought the ratio into play, squeezing it to 66:1. While the ratio continues to intrigue many professionals and players in the market, its importance should not be over-emphasized today. Many newcomers, whether Commodity Trading Advisors or hedge funds, will move into silver from other commodities or currencies, and not because they judge the gold/silver ratio to be interesting. However it does remain a weather-gauge of attitudes to gold and silver.

Silver Trade in Regional Markets

The imports of silver to the two major regional markets, **Dubai** and **Singapore**, fell sharply in 1994 after reaching record levels the previous year. However, this was partly because both distribution centers were already holding excessive stocks at the end of 1993.

In Dubai, the port at the southern end of the Arabian Gulf, which is the prime supplier for the Indian sub-continent, imports declined from 77 Moz (2,395t) in 1993 to 48.9 Moz (1,520 t). This 1994 total is actually less than Dubai imported in the first half of 1993, when silver prices were still under $4.00 and the Indian market was first liberalized, resulting in a significant fall in local prices there. Dubai's imports from mid-1993 until October 1994 were, in fact, running at much more modest levels. Compared with 14.9 Moz (463 t) in March 1993, the monthly totals were more usually between 3-5 Moz (93-155 t). Indeed, it was only in the last three months of 1994,

Figure 6
Dubai Silver Bullion Imports
Quarterly



once the silver price came back towards and then below $5.00, that imports improved. Virtually one-third of imports arrived in the final quarter of 1994.

During the last two years, most of the silver from Dubai to India was carried by Non-Resident Indians (NRIs), each entitled to take 100 kg (3,215 oz) of silver with them on a visit. However, in the second half of 1994, an increasing amount was dispatched to India in bulk under Special Import Licences (SILs).

In Singapore, imports were down from 63 Moz (1,960 t) in 1993 to 29 Moz (902 t) last year, the lowest level since 1991. This fall reflected a decline in demand in both the Indian sub-continent and in Thailand, which are the major destinations. However, the actual re-export was slightly more evenly spread. Silver stocks in Singapore were at least 8 Moz (249 t) at the end of 1993 and these were run down during the first half-year of 1994, when fresh imports were under 7 Moz (218 t). Imports were also deliberately kept low during this period, because of uncertainties about the imposition of a 3% Goods and Service Tax (GST) from April 1994. In the event, the GST is not levied on silver (or gold) that is re-exported and, since very little silver is required for fabrication in Singapore itself, the trade generally has not been affected. However, one or two smaller traders supplying the NRIs going to India have withdrawn from the business because of the necessity now to deliver silver at the airport instead of in their own offices. And, as in Dubai, the Indian orders in the latter part of the year were shifting more to larger shipments against SILs.

Thailand also took much less silver from Singapore, as the jewelry industry there experienced a difficult year. However, both Singapore and Dubai came back with good imports by February 1995.

In fact, the position of both Singapore and Dubai in the silver trade is being somewhat undermined by more shipments of metal directly from Europe to India. Close to 20 Moz (622 t) went direct in 1994. This trend is likely to continue. The situation in Thailand is also changing, as more silver is imported officially direct from Australian and other suppliers. Thus the long-standing tradition of Dubai, in particular, as a market through which silver to and from India flows, could be changing.

Japan's imports of silver bullion increased sharply in 1994, with monthly imports higher throughout the second half of the year in response to a fall in silver production by domestic smelters. Total imports at 32.4 Moz (1,008 t) reached their highest level since 1990. At year-end, there was a further surge in imports, with December and January 1995 each recording over 6.4 Moz (200 t).

The base metal smelters, from whom 60% of silver

Figure 7
Singapore Silver Imports and Exports
Monthly

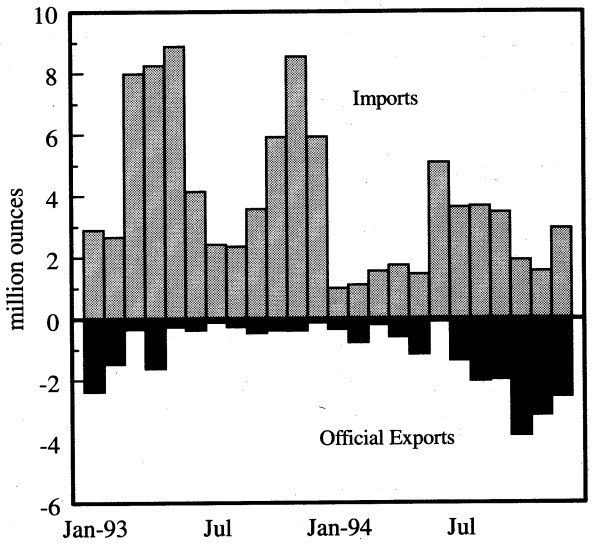
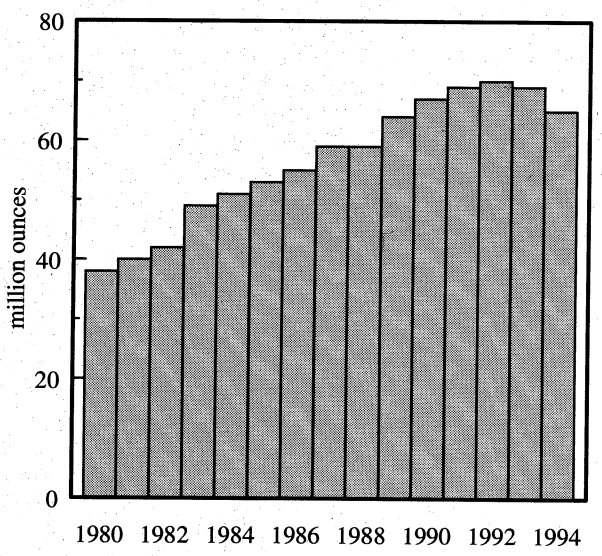


Figure 8
Japanese Silver Smelter Production
Annually

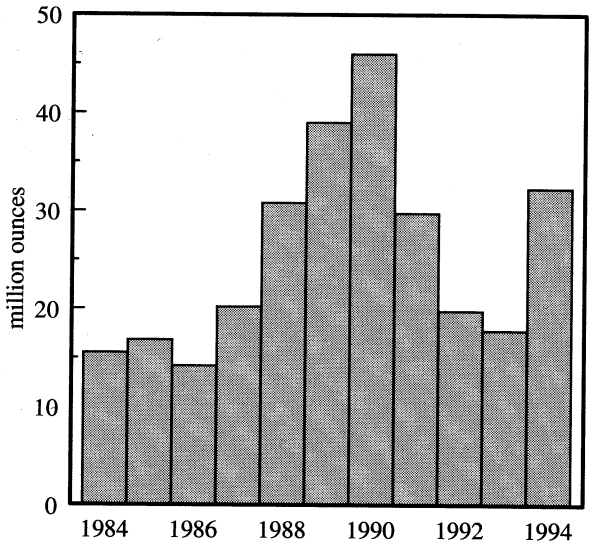


derives from imported concentrates, have been the main suppliers to the Japanese market. However, in the last few years the yen's appreciation, together with high local overheads, has reduced the competitiveness of the smelters and has forced restructuring with some reduction of capacity. The effect was felt first by the lead smelters, which have historically been the major contributors of silver from concentrates. One lead smelter closed in April 1994 and at year-end another changed its feed material from lead concentrate to lead scrap (which contains little or no silver). The production of silver from imported concentrates, therefore, is likely to fall further in 1995.

Given the smelter supply, Japan has long operated what amounted to a dual silver market, with a clear distinction between domestically refined silver and imported metal, with domestic silver commanding a premium. This domestic premium increased from June 1994, due to the first perceptions that falling output from the smelters might lead to tightness in the market. In December, the premium rose again, mainly due to strong physical demand as consumers took advantage of low prices to build inventory, and it became increasingly profitable also to import silver from the United States. Despite this, loyalty to silver from domestic smelters remains, when it is available. Japanese industrial customers are very brand-conscious, preferring 999.9 purity silver from local smelters, a preference that originally arose from the stringent quality requirements of the domestic photographic industry.

Hong Kong is something of a turntable in the silver market, importing and re-exporting silver; a role that is being enhanced by the emerging importance of China as a producer and fabricator of silver. Besides importing silver bullion and grain (4.8 Moz, 149 t in 1994), other products such as potassium silver cyanide and silver nitrate are imported, mainly from Europe, for use within the colony or, increasingly, over the border in China. The interaction between Hong Kong and China in precious metals has increased significantly in recent years, with actual fabrication often being completed on behalf of Hong Kong manufacturers in factories in China, where labor costs are cheaper. Newly mined silver and old coin have also come out of China from time to time, notably in 1993, in response either to higher prices outside or comparatively low prices offered by the People's Bank of China for domestic production. Up to 6 Moz (187 t) came out in 1993, some officially, some unofficially. While China is becoming the major partner in silver, Hong Kong also re-exports bullion and grain to Thailand and, to a lesser extent, India.

Figure 9
Japanese Silver Bullion Imports
Annually



Within **China** itself, 1994 may well have marked a turning point in the local silver market, as it moves from being a periodic exporter of silver to that of a potential importer as its own internal silver supplies are exceeded by a rapid rise in demand from domestic industries. An immediate sign was the decision by the People's Bank of China, to which all domestic silver output should be sold, to nearly double its buying price from Rmb 800 per kilogram, to Rmb 1,480 per kilogram ($5.43 per ounce) from 1st August 1994. This had important repercussions in halting the channelling of silver out of the country. The People's Bank then allocates the metal to industry. There were also small imports of silver bullion into China in 1994, a sharp reversal of the exports noted the previous year. Demand in the photographic and electronics industries is growing (see Chapter 5), so that during the second half of the 1990s China's impact may be felt quite positively on the world silver market, as it is already in gold.

South Korea has grown in importance both as a fabricator and as an importer of concentrates and exporter of bullion and grain. Bullion imports, subject to a duty of 3%, rose by as much as 30% in 1994 to 7.1 Moz (220 t), while imports of concentrates, chiefly lead and copper, to domestic smelters were also up 30% to 7.7 Moz (240 t). Re-exports increased 90% to 2.9 Moz (90 t), destined for Singapore, Thailand and Taiwan.

Indian Silver Price

The liberalization of silver imports into **India** in February 1993 brought a fundamental change in the relationship between the Bombay price and the international price. (Bombay, as the premier market in India for silver for generations, sets the main price, but there are variations in other cities). In recent years, Bombay had been at a substantial premium to the international price and earlier at a substantial discount between 1965 and 1984. The first opportunity to judge this new era objectively came in 1994, because the previous year was essentially a period of adjustment.

The Bombay price has settled down at a modest premium, usually between $1.05 and $1.30 per ounce above the international price, largely reflecting import duty and transport costs. But on the higher prices prevailing in much of 1994, the premium, and thus profitability, narrowed and India imported less silver. However, it is clear that the larger quantity imported in 1993 was not just as a result of relaxation of controls, but also of a sharp fall in the domestic price the moment imports were permitted. To understand the real significance of the change, it is worth glancing back over the period when the legal import of silver (except in nominal amounts) was banned.

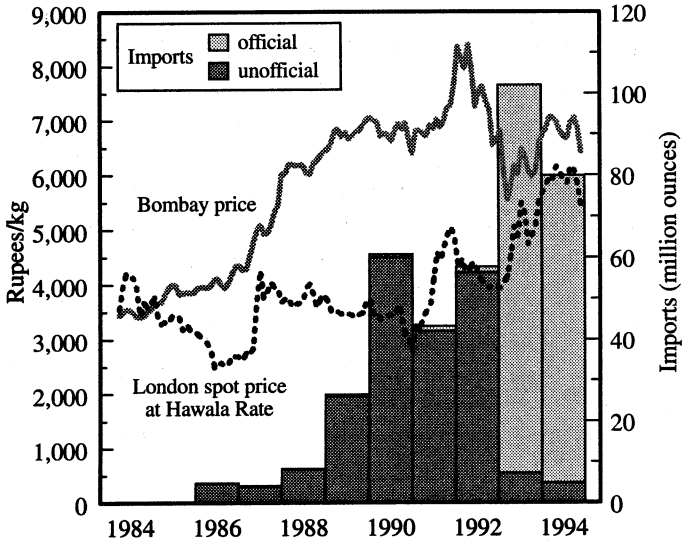
The pattern of silver flows out of and into India over the last thirty years has varied enormously. Initially, during the period of silver's great price volatility from the mid-1960s, Bombay was often at a discount, or below "parity" as the Indians call it, to the international price; substantial quantities were exported, mostly unofficially. And with stocks in India having built up for more than three centuries to nearly 4,000 Moz (124,000 t), the country became a significant supplier to world markets. Almost 430 Moz (13,400 t) of silver was exported.

However, after 1985 as the international price fell, while domestic Indian dishoarding declined and demand increased with economic growth, so Bombay moved to a premium (Figure 10). Local recycling no longer met industrial and decorative uses. While international prices continued in a bear trend through the late 1980s and early 1990s, the Indian price increased, spurred on also by the devaluation of the rupee. The average annual price there was 6,779 rupees per kilogram ($9.80 per ounce at the official exchange rate) in 1990, rising to an average of 7,580

Figure 10

Indian Silver Prices and Imports

Monthly average prices and annual imports



rupees ($7.18 per ounce) in 1992. The peak was 8,358 rupees per kilogram in January 1992, equivalent to $8.02 per ounce, when the London average price was $4.11 per ounce - a premium of 100%. This premium was sufficient to attract over 50 Moz (1,555 t) of unofficial imports in 1992.

The premium was abruptly cut by the relaxation of regulations in February 1993, which permitted Non-Resident Indians (NRIs) returning home to import with their baggage up to 100 kg (3,215 oz) on payment of a small duty of 500 rupees per kilogram (between $0.45 to $0.50 per ounce, according to exchange fluctuations). The costs of moving the silver with the NRIs, who usually carry it from Dubai or Singapore, is also up to 900 rupees per kilogram ($0.80 per ounce). They include part or all of the NRI's air ticket (usually paid by silver traders), a small fee, and the handling charges of making up thousands of packages of 100 kg of silver and delivering them to the airports at Dubai and Singapore. These costs, plus duty, can add up to $1.30 per ounce to the international price for delivery into India. Silver arriving in Bombay has also been subject to a local import tax, or *octroi*, of 2% from late-1994, so that much of the silver movement is now to Delhi, which has no local tax.

In March 1993, the first full month of liberalization, the Bombay price fell to 5,554 rupees per kilogram or $4.99 per ounce, compared with the international price of $3.74 per ounce, a margin of $1.25. During 1993 as a whole, Bombay averaged 6,163 rupees per kilogram, or $5.55 per ounce, against the international average of $4.33. From the Indian standpoint, this was a fall of almost 20% on the previous year's price and in itself was one reason why so much silver was absorbed that year. Many buyers, in rural areas especially, have a limited amount of rupees to spend on special occasions, such as marriages. If the price is 20 per cent lower, they buy 20% more silver. Similarly, when 1994 ushered in higher prices, their rupees acquired less silver.

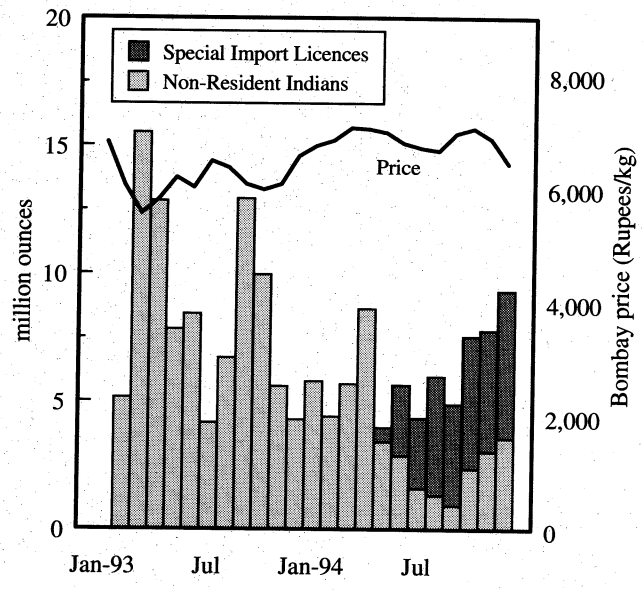
The average Bombay price for 1994 was 6,847 rupees per kilogram, equal to $6.13 per ounce against the London average price of $5.28. The highest monthly average came in March at 7,046 rupees per kilogram, or $6.40 per ounce on a London price of $5.44. The margin between the Bombay and international prices has fallen to below 20%, compared with 100% two years previously, but at the same time the profitability of importing silver by the NRIs was also reduced in 1994. And the most significant trend in the second half of 1994 (see Figure 11) was that much more silver was imported into India under Special Import Licences (SILs) in bulk, direct from Europe. The delivery costs are thus reduced to about $0.09 per ounce.

The SILs are essentially competitive tenders for foreign exchange, which can be bid for by dealers to import a range of products from precious metals to luxury cars, aircraft fuel and chemicals. The premium on these foreign exchange licences usually varies between 2.5% and 10% but may rise to as much as 13.5%, if potential profit on the re-sale of the goods is high. Thus, SILs are a somewhat erratic way to import silver, because profits are assured only if the combined costs of the SIL, duty and transport are below the Bombay premium.

The SILs and NRIs account for most of the silver now imported into India. Unofficial imports are limited, because the costs (and risk) outweigh sending metal by NRIs and only the duty is avoided. Unofficial imports are confined to small quantities from Nepal, some of which is silver coin originating from China or Tibet. But the overall effect of India's liberalization has been to transform a market which was previously largely unofficial into one which is essentially official and with local prices now moving in line with those in London.

Figure 11

Official Indian Imports: 1993 - 94



3. Mine Supply

Silver production in the Western World fell by 5.3% to 367.9 Moz (11,444 t) in 1994, continuing the downward trend of the last two years. When the production of the former Soviet Union (now the CIS) is included, together with China (for which a considerable re-evaluation has been made) and North Korea, the world total was 444.2 Moz (13,817 t). Primary output is estimated to account for only 14% of this silver, as a special study of by-product operations, on pages 24-25, reveals. The table below shows the world's top ten producing nations for 1994.

The Top Ten Silver Producers in the World
Million ounces
(1993 figures in brackets)

1	(1)	Mexico	74.8	(77.7)
2	(2)	Peru	55.6	(58.0)
3	(3)	CIS	48.2	(53.2)
4	(4)	United States	44.4	(52.9)
5	(5)	Australia	33.6	(37.0)
6	(6)	Chile	31.6	(31.2)
7	(7)	Poland	29.8	(28.7)
8	(9)	China	26.2	(24.9)
9	(8)	Canada	23.6	(28.3)
10	(10)	Bolivia	11.3	(10.7)

Output fell in all three of the leading producing countries, Mexico, Peru and the CIS; indeed, among the top ten countries, it rose only in Bolivia, Chile, China and Poland. But the increasing diversity of silver's worldwide production is emphasised by steady growth in countries such as Indonesia, Iran, Morocco and New Zealand, although actual quantities are often modest and cannot counterbalance declining output from the major producers. However, the situation may change in 1995 with additional silver production coming on-stream, often as a result of the development of new gold operations. The higher average price for silver in 1994, and an improved price in April 1995, has encouraged the forward selling of silver; while this is not so extensive as the hedging of gold, its impact on supply is included in the supply/demand table in Chapter 1 on the basis of the assessment shown on page 23.

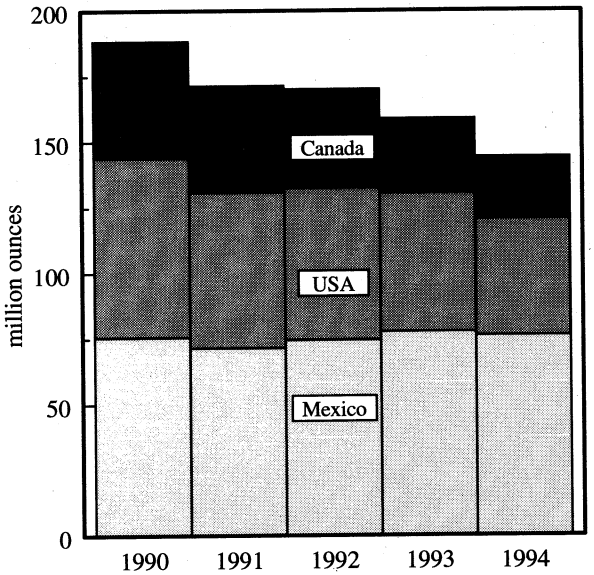
North America

There has been a substantial upward revision of **Mexican** silver mine production, which has strengthened the country's position as the world's largest silver producer. However, after two years of rising production, last year saw silver output fall back slightly to 74.8 Moz (2,326 t).

Output in Mexico is concentrated mainly in three states, Zacatecas (with around 40%), Durango and Chihuahua, accounting in all for over 70%. Although many of the smaller silver mines have closed over the last few years, the loss of output from this source has, to some extent, been offset by development of other mines by local and foreign companies. While gold deposits have tended to be the preferred target of these foreign companies, silver deposits have not been completely ignored. A number of US and Canadian junior companies have entered into agreements to undertake further work on promising projects. Although some of these deposits are considered marginal, the substantial devaluation of the peso has increased the chances that they will be brought into production. Furthermore, the higher prices in local currency terms may result in a pick-up in output from the small mining sector.

Silver mine production in the **United States** fell 16% in 1994 to 44.4 Moz (1,381 t). This is the fourth consecutive year that output has fallen, with last year's decline being the largest in both percentage and volume terms. However, the drop in 1993 production

Figure 12
North American Silver Mine Production



was mitigated somewhat by much higher output from the country's largest producer, Echo Bay's McCoy/ Cove mine. Last year, though, production from the mine dropped by 2 Moz (62 t) to 10.4 Moz (323 t), primarily due to lower grades of the heap leached material.

In Nevada, the largest producing state, the most significant development in 1994 was the reopening of the Candelaria mine, which had been acquired by Kinross Gold. A drilling program completed last year has led to a sizeable reserve increase which should allow the company to maintain production at about 3.6 Moz (112 t) per annum for the next four years.

In Idaho, the second biggest producing state, Hecla's Lucky Friday mine, which opened over 50 years ago, poured its 100 millionth ounce (3,110 t) during the first quarter of 1994. However, output was affected by a hoisting accident which disrupted operations in the latter part of the year, although production has now returned to normal. Hecla has also been investigating the possibility of developing the Gold Hunter deposit, a silver-rich lead/zinc orebody situated close to the Lucky Friday mine. Elsewhere in the state, Hecla opened the Grouse Creek mine last year, together with its minority partner Great Lakes Minerals, which is forecast to produce around 0.5 Moz (15.6 t) this year. Also in Idaho, another of the major producers, Kinross Gold, is expected to start construction of the Stone Cabin deposit this year, with ore being trucked back to the company's Delamar mill for processing.

On the corporate front, two of the world's largest silver producers, Coeur d'Alene and Asarco, formed a new company, Silver Valley Resources Corporation, which will hold several silver mines currently on care and maintenance while awaiting higher prices.

All these developments suggest that the decline in US silver production may come to an end.

Mirroring its neighbor, **Canada**'s silver mine production continued its downward trend for the fourth consecutive year. Output was down 16% to 23.6 Moz (737 t) from 28.3 Moz (880 t) in the previous year. In general, the decline continues to be as a result of a drop in base metal production, although the closure of the Equity Silver Mines' mining and milling operations also contributed to the fall.

The outlook, however, is certainly much brighter, with silver output expected to rebound this year. This is partly the result of some smaller operations which began producing in 1994, such as Aur Resources' Louvicourt zinc mine and Audrey Resources Lens' 1100 polymetallic mine, where pre-production commenced in the latter part of 1994. These will be supplemented by a full year's production from both the Similco copper mine in British Columbia, which reopened last year, as well as the Myra Falls copper mine where a labor dispute had disrupted operations for over a year. However, by far the greatest contribution will come from the high-grade Eskay Creek mine which began producing in January 1995. This gold-silver deposit is one of the most significant new mines to come on-stream in recent years, with first year silver output expected to be over 7 Moz (218 t).

Central & South America

Peru, the largest silver producer in South America, saw its output fall by 4% to 55.6 Moz (1,729 t) in 1994.

The introduction of a new mining law in 1992, together with the more stable political environment and the improved economic situation, has led to much interest from foreign mining companies in the potential of the country's mining industry. Many

Figure 13

Central & South American Mine Production

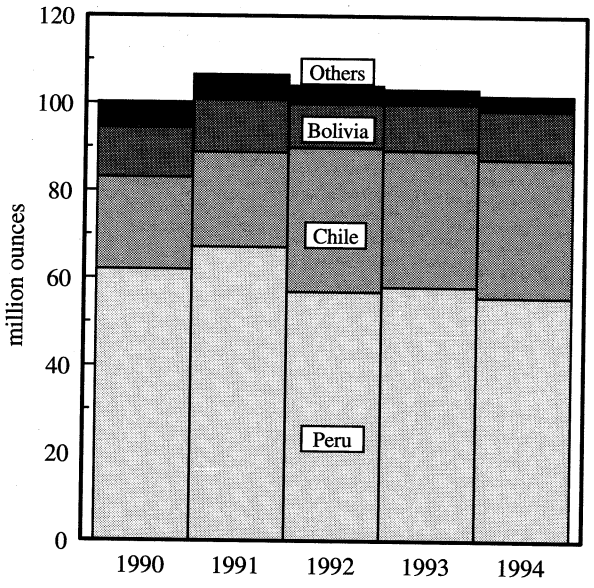


Table 2
World Silver Mine Production
Million ounces

	1985	1986	1987	1988	1989	1990	1991	1992	1993	**1994**
Europe										
Poland	26.72	26.65	26.72	34.18	34.00	26.78	27.89	29.39	28.68	**29.77**
Sweden	8.04	7.55	8.52	7.20	6.10	7.19	8.13	9.06	8.92	**8.10**
Spain	6.41	5.56	6.88	7.30	7.09	7.40	7.50	7.50	5.14	**5.15**
Greece	1.63	1.73	1.67	1.98	1.67	2.01	2.26	1.96	1.90	**1.93**
Serbia (Yugoslavia)	5.02	5.70	4.86	4.47	4.28	3.39	2.96	2.57	1.13	**1.29**
Portugal	0.11	0.18	0.12	0.12	0.12	1.36	1.37	1.23	1.16	**1.02**
Bulgaria	0.84	2.32	2.48	2.73	3.05	3.22	3.05	3.05	1.40	**1.00**
Finland	1.57	1.19	1.42	1.00	1.00	0.93	0.96	0.87	0.94	**0.84**
Czech Republic	1.03	1.06	1.10	1.13	1.10	0.84	0.90	0.64	0.64	**0.64**
UK & Ireland	0.28	0.26	0.23	0.18	0.23	0.37	0.36	0.42	0.42	**0.57**
Romania	0.81	0.74	0.64	0.69	0.67	0.39	0.39	0.39	0.40	**0.40**
France	0.87	0.83	0.83	0.68	0.63	0.67	0.89	0.43	0.38	**0.32**
Italy	0.51	0.58	0.45	0.51	0.51	0.45	0.44	0.39	0.16	**0.16**
Germany	2.42	2.20	2.31	1.93	2.00	0.26	0.23	0.06	0.06	**0.06**
Denmark	0.43	0.39	0.40	0.46	0.47	0.31	0.00	0.00	0.00	**0.00**
Total Europe	56.65	56.93	58.62	64.54	62.90	55.55	57.32	57.95	51.32	**51.24**
North America										
Mexico	69.20	69.40	69.80	70.00	70.00	75.60	71.48	77.51	77.66	**74.80**
United States	39.36	34.22	39.80	53.40	60.80	68.33	59.42	58.00	52.88	**44.43**
Canada	38.49	34.98	38.10	44.10	41.30	44.41	40.54	37.59	28.27	**23.61**
Total North America	147.04	138.60	147.70	167.50	172.10	188.34	171.44	173.10	158.81	**142.84**
Central & South America										
Peru	54.85	59.92	63.60	47.70	56.80	61.97	67.08	56.89	58.00	**55.64**
Chile	16.64	16.08	16.07	16.30	17.70	21.05	21.74	32.95	31.19	**31.60**
Bolivia	3.61	3.06	4.57	7.23	7.72	11.46	12.08	10.14	10.70	**11.32**
Argentina	2.17	2.13	1.90	1.61	1.55	2.66	2.25	1.46	1.37	**1.45**
Honduras	2.77	1.75	0.74	0.80	0.80	0.99	1.38	1.14	0.78	**0.87**
Brazil	2.30	1.91	1.97	2.25	2.06	1.10	1.00	0.68	0.67	**0.58**
Colombia	0.16	0.19	0.17	0.21	0.22	0.21	0.26	0.27	0.24	**0.25**
Ecuador	-	-	-	-	-	0.02	0.02	0.15	0.19	**0.07**
Dominican Republic	1.61	1.32	1.15	1.40	0.70	0.74	0.71	0.43	0.06	**0.00**
Other	0.07	0.05	0.05	0.04	0.04	0.07	0.09	0.10	0.11	**0.11**
Total Central & S. America	84.18	86.40	90.20	77.54	87.58	100.26	106.60	104.20	103.29	**101.86**
Asia										
Japan	10.91	11.31	9.03	8.10	5.01	4.82	5.49	5.50	4.40	**4.29**
Indonesia	1.18	1.37	1.53	1.99	2.01	2.12	2.51	3.22	2.89	**3.11**
Papua New Guinea	1.49	1.80	2.00	2.10	1.97	3.42	4.00	3.07	3.09	**2.50**
Turkey	0.22	0.29	0.28	0.51	0.51	0.90	1.30	2.50	2.30	**2.50**
Iran	-	-	-	-	-	1.22	1.53	1.93	2.00	**2.20**
India	0.82	1.14	1.22	1.32	1.29	0.87	1.11	1.52	1.68	**1.62**
Philippines	1.74	1.69	1.64	1.76	1.85	1.45	1.15	0.91	1.04	**0.97**
Saudi Arabia	-	-	-	-	-	0.48	0.46	0.48	0.52	**0.52**
Malaysia	0.52	0.45	0.50	0.64	0.64	0.40	0.43	0.49	0.45	**0.43**
South Korea	3.99	2.58	2.82	1.57	2.76	0.39	0.39	0.39	0.39	**0.39**
Thailand	-	-	-	-	-	0.66	0.64	0.64	0.32	**0.32**
Arabian Gulf States	-	-	-	-	-	0.33	0.28	0.22	0.20	**0.20**
Myanmar, Laos & Cambodia	0.57	0.44	0.40	0.38	0.32	0.23	0.23	0.25	0.08	**0.13**
Taiwan	0.37	0.41	0.37	0.27	0.27	0.13	0.00	0.00	0.00	**0.00**
Total Asia	21.81	21.47	19.80	18.63	16.62	17.42	19.50	21.12	19.36	**19.18**

Table 2
World Silver Mine Production
Million ounces

	1985	1986	1987	1988	1989	1990	1991	1992	1993	**1994**
Africa										
Morocco	2.73	1.57	4.30	7.27	8.30	5.92	6.62	4.69	7.59	**8.33**
South Africa	6.72	7.14	7.20	5.76	5.72	5.18	5.52	5.87	6.34	**6.32**
Namibia	3.40	3.98	3.33	3.47	4.44	2.99	2.96	2.88	2.31	**2.07**
Zimbabwe	0.80	0.84	0.82	0.90	0.77	0.68	0.62	0.54	0.39	**0.40**
Zambia	0.63	0.84	0.96	0.94	0.89	0.60	0.46	0.59	0.58	**0.39**
Zaire	1.52	1.50	1.40	1.40	1.50	2.70	1.89	0.95	0.35	**0.30**
Other	0.16	0.17	0.18	0.18	0.18	0.30	0.36	0.34	0.34	**0.35**
Total Africa	15.95	16.04	18.18	19.91	21.79	18.35	18.42	15.86	17.88	**18.14**
Oceania										
Australia	34.92	32.89	35.91	35.82	37.30	37.71	37.94	39.16	37.04	**33.60**
New Zealand	0.04	0.04	-	0.06	0.16	0.28	0.36	0.73	0.84	**1.00**
Fiji	0.02	0.02	-	-	0.03	0.03	0.02	0.03	0.04	**0.05**
Total Oceania	34.97	32.94	35.91	35.87	37.48	38.01	38.31	39.91	37.91	**34.64**
Western World Total	360.6	352.4	370.42	384.01	398.50	417.94	411.61	412.17	388.58	**367.93**
Other Countries										
Soviet Union/CIS	63.00	64.00	64.40	64.50	64.70	71.99	66.81	60.94	53.15	**48.19**
China	2.80	3.21	3.21	3.50	4.00	22.63	24.63	24.63	24.92	**26.20**
North Korea	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.70	1.80	**1.90**
Total Other	67.4	68.8	69.21	69.60	70.30	96.22	93.03	87.26	79.86	**76.29**
World Total	428.00	421.20	439.63	453.61	468.80	514.16	504.64	499.43	468.44	**444.22**

have now established a presence and have initially been targeting gold and copper deposits, although some of these do contain significant amounts of silver. These new ventures should lead to some pick-up in future output.

Silver production in **Chile** rose marginally in 1994 to 31.6 Moz (982 t), with lower by-product output from the country's gold producers being more than offset by increased levels from the copper mines.

The large jump shown in Figure 13 in 1992 was due to the expansion of the La Coipa mine. Since then, however, La Coipa's silver output has fallen, but should level out in 1995. Thereafter, by-product from gold operations should increase again, helped by new projects. One of the largest silver producers among these new operations will be the gold-silver Fachinal mine, managed by Coeur d'Alene, which is scheduled to come on-stream in late 1995, with first year output forecast at 2.6 Moz (81 t). Silver output should also receive a boost from the expansion of the copper mining sector.

Bolivia's silver production registered a 6% rise in 1994 to 11.3 Moz (351 t) as a result of higher output from the lead/zinc mines. Comsur's silver output continued its recent rises and there were also a number of other base metal producers showing increased output. By contrast, silver output from Inti Raymi's Kori Kollo mine remained at 1993 levels, despite gold production being at higher levels.

Following several years of decline, **Argentina**'s silver output is estimated to have recovered slightly in 1994 to nearly 1.5 Moz (46.6 t). As with much of the rest of Central and South America, recent reforms to the country's mining laws have led to a surge of interest from foreign mining companies, which should ensure good growth in the mining sector.

In **Honduras**, production edged higher to reach almost 0.9 Moz (28 t) as a result of increased output from the El Mochito lead/zinc mine. Production in **Brazil** has fallen gradually over the last few years due to the decline in the country's lead production. The expected easing of the investment laws in Brazil should attract some interest into the mining sector, although it is unlikely to have much impact on the country's silver production in the short term. In **Ecuador**, silver production dropped following the

closure of the San Bartolome mine in mid-year. There has been no silver production from the **Dominican Republic** since the closure of the Pueblo Viejo mine in early 1993.

Asia

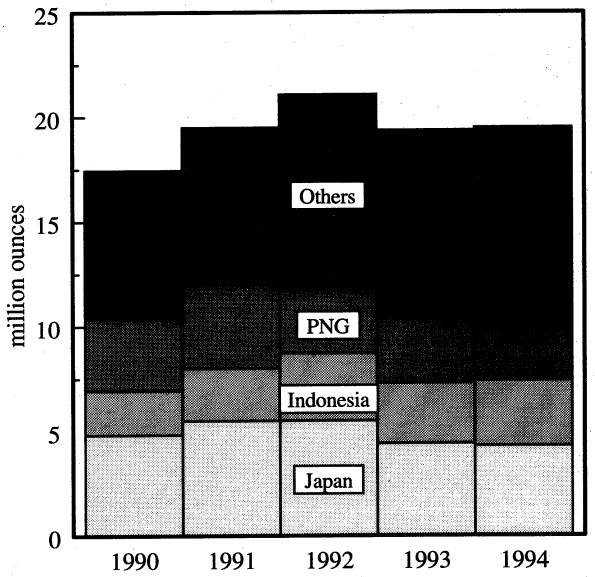
A substantial re-evaluation of **China**'s silver production has elevated it to the eighth largest producer in the world, with 1994 output at 26.2 Moz (815 t). Most of the silver is produced as a by-product of lead and zinc operations and, to a lesser extent, from copper and gold mines. One major source is the Zhuzhou zinc/lead smelter in Hunan province, which yielded 4.2 Moz (130 t) in 1994. Another is the Jiangxi complex, China's largest copper enterprise, which processes material from the Dexing mine, the country's biggest open-pit copper mine, and other projects. A significant amount is also coming from the China National Gold Corporation as a by-product of gold mining. The prospect of further silver output in China was underlined last year when a list of mines "offered" to foreign mining companies included several potential silver mines, for example: the Fuwan mine in Guangdong province; the Xiasai silver/lead mine; and the Dabaiduishan silver/manganese mine in Shanxi province with the latter deposit having a reported silver grade of 14.7 oz/t (456 g/t).

Officially, all silver should be sold to the People's Bank of China; in a significant move last year, they raised their buying price in August by over 80% to Rmb 1,480 per kilogram ($5.43 per ounce). Prior to this, a good deal of silver had been channelled out of the country unofficially. The more realistic price has enabled the People's Bank to secure more silver, which it allocates to the growing needs of industry.

Silver output from **Japan**, the second biggest producer in the region, fell slightly to 4.3 Moz (134 t). Lower production was as the result of several closures of base metal operations last year, due to reserve depletion and weak metal prices. In addition, the strength of the yen has increased the problems of the domestic producers.

Indonesia's silver production rose 7.5% to 3.1 Moz (96 t). Although output from the largest producer in the country, Freeport's copper-gold Ertsberg/Grasberg mine, has been declining, this is likely to change this year as a major expansion program comes on-stream. Meanwhile, by-product output from gold operations

Figure 14
Asian Silver Mine Production



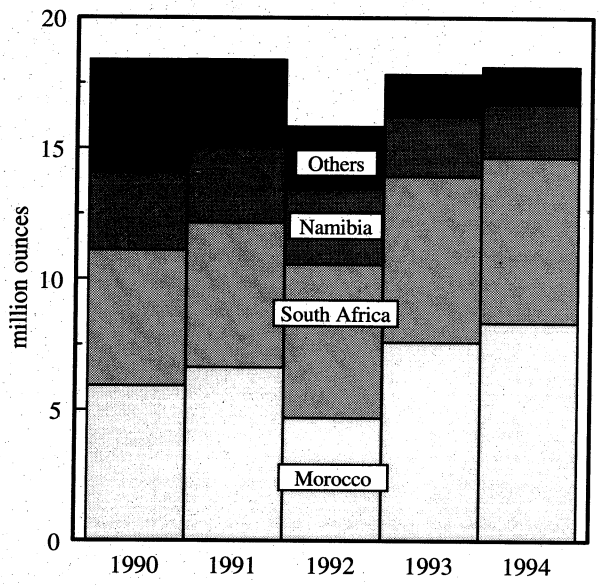
grew strongly last year with higher levels from, in particular, Prima Lirang (Lerokis). This sector was also aided by the start-up of the Gunung Pongkor mine as well as the Mt Muro mine which began producing in December 1994. The Mt Muro mine will add significantly to production this year, with over 2 Moz (62 t) forecast annually from the operation. In addition, other new mines currently being developed will maintain rising output over the next few years.

Silver production in **Papua New Guinea** fell to 2.5 Moz (77 t) having been over 3 Moz (93 t) since 1990. Lower throughput, together with a decline in grade at the Misima mine, which accounts for over half the country's output, was the main reason.

Turkey's silver output advanced around 9% in 1994 to 2.5 Moz (77 t) due to higher base metal production. **Iran**'s silver output increased for the same reason to reach an estimated 2.2 Moz (68 t). Increased levels of copper and lead production were behind these rises.

In the **Philippines**, silver output dropped marginally to just below 1 Moz (31 t). Although some of the country's mines did record increased output of silver, together with a return to profitability due to higher copper and gold prices, the country's overall production declined, principally through the closure of first Atlas's Cebu copper mine, which was followed later in the year by the suspension of operations at the company's Masbate gold mine.

Figure 15
African Silver Mine Production



Africa

Silver production has grown in **Morocco** over the last 2 years to reach 8.3 Moz (259 t) in 1994. La Société Métallurgique d'Imiter (SMI) accounts for over 80% of output at its silver/cobalt mine at Bou Azzer. The balance comes as by-product of lead/copper mining by Fonderies de Plomb de Zellidja (FPZ) and from zinc/copper operations by Société de Développement du Cuivre de l'Anti Atlas (SODECAT).

South Africa, the second largest producer on the continent, registered a slight decrease in silver output, despite the country's gold production falling sharply. The gold producers, in fact, only contribute about a third of the country's silver output; most production stems from Gold Fields of South Africa's Black Mountain lead/zinc mine situated in the northern Cape, which recorded marginally higher output.

A continued fall in copper production from **Namibia** was reflected in silver production dropping for the fifth consecutive year.

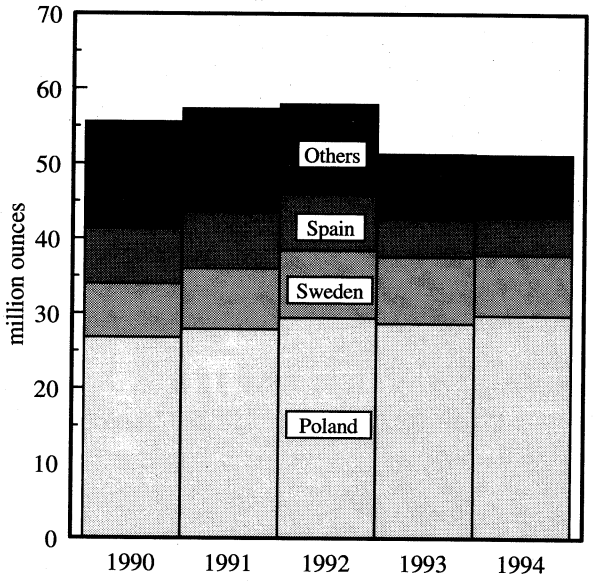
Europe

Poland's output of 29.8 Moz (927 t) is a by-product of copper mining. Silver production has been undertaken at the new Polska Miedz refinery, developed with technical assistance and equipment from Boliden. The refinery treats copper anode slimes from KGHM, producing silver grain and good-delivery bars. Output is forecast to rise by about 3.2 Moz (100 t) in 1995 and 1996.

Silver production in **Sweden** fell 9% to just above 8.0 Moz (249 t). In spite of this, the country remains the second largest producer in Europe with most of the by-product being derived from the lead, zinc and copper mines managed by Trelleborg's subsidiary Boliden Minerals.

Production in **Greece** has been steady at just under 2 Moz (62 t) for the past three years, while **Serbia (Yugoslavia)**, another of the region's producers, recovered slightly to an estimated 1.3 Moz (40 t) following the large drop in 1993.

Figure 16
European Silver Mine Production



Oceania

Australia's silver production, deriving almost entirely from base metal operations, suffered a 9% fall in 1994 to 33.6 Moz (1,045 t). The main factor behind this was a drop in output from the premier producer, the Mt Isa mine in Queensland. However, output could receive a significant boost if the go-ahead for the Cannington deposit, located near the Mt Isa mine, is given. This lead/zinc/silver mine may develop into the world's largest silver producing operation by the turn of the century.

Silver output from **New Zealand** edged higher, reaching 1 Moz (31 t) last year. The two major producers in the country, the Martha Hill and Golden Cross gold mines, both contributed to this higher level.

CIS

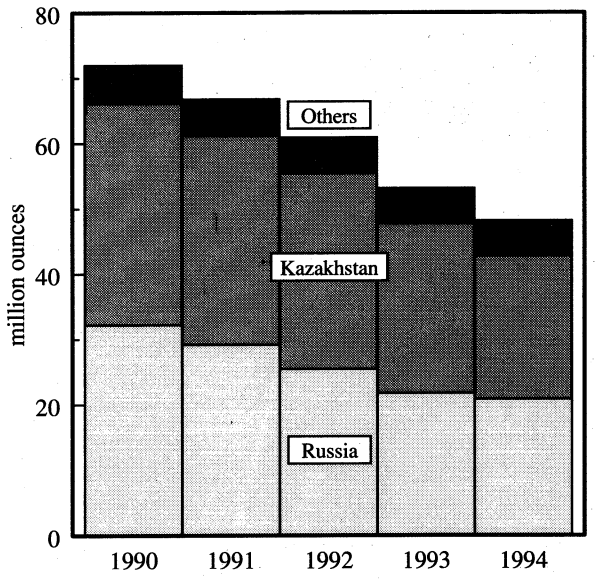
Silver output in the Commonwealth of Independent States continued to fall in 1994, although the decline was not as great as in the previous year. Total CIS output was 48.2 Moz (1,499 t).

In **Russia**, production continued the downward trend that began in the late 1980s. However, the considerable slowing in the rate of decline suggests that output is now stabilizing, albeit at under 50% of the level five years ago.

Russian silver output is derived mainly as a by-product from base metal operations but the contribution from primary sources is by no means insignificant, representing around 25% of the total. The largest silver producer is believed to be the Dukat polymetallic mine situated in Magadan, although reports suggest that output has declined over the past few years and the operation badly needs new investment. Early this year, morale at the mine had reached a low ebb as the mineworkers had not been paid for six months. However, the regional authorities are now attempting to address these problems and are seeking new investment for the enterprise, which may enable the operation to fulfil earlier plans to increase output through a major expansion. There has been some interest from foreign companies looking into the possibility of purchasing the mine. Indeed, if the interest shown in general by Western companies in developing gold deposits is followed up by actual investment, then silver output, largely as a by-product from these projects, could begin to move higher.

Kazakhstan's silver output fell further in 1994 as a result of continuing declines in base metal production. While there has been some interest in the country's mineral potential by Western companies, few deals have been struck. However, Pegasus and Goldbelt Resources did recently announce the establishment of a joint venture project which will re-treat the old lead/zinc tailings at the Leninogorsk metallurgical complex situated in the north eastern part of the country. The operation is scheduled to begin producing in mid-1996, with annual output forecast at over 0.64 Moz (20 t) of silver along with nearly 0.16 Moz (5 t) of gold.

Figure 17
CIS Silver Mine Production



Production Costs

Establishing the costs of production for silver is more difficult and the result less meaningful than for gold because so much of the world's production is derived as a by-product from base metal operations. Consequently, the managing company invariably calculates its operating cost in terms of the main product (for example, cents per pound in the case of copper) with the silver revenue taken as a credit against these costs. This tends to be the practice even if the contribution from silver represents a sizeable portion of the total revenue. In fact, in a number of cases, without the contribution from silver, the base metal deposit would have been uneconomic.

Although some cash costs can be obtained for primary operations around the world, the sample is not sufficient to construct a cost curve which could be used to assess the impact on the level of production of price fluctuations. Certainly these primary mines, as with any predominantly single metal operation, are very sensitive to price changes. But as most production is a by-product, silver is, if anything, more sensitive to base metal prices, as these generally determine whether or not a mine remains open or whether the decision is taken to develop a deposit.

Hedging

The forward selling of silver and the use of silver loans as a means of financing a mining operation is less widespread than the hedging of gold, since most output comes as a by-product. This is also reflected in the number of companies that hedge; unlike gold producers, where the majority of companies are engaged in the forward selling of at least a portion of their production, hedging of silver output is confined to the world's major producers. Nevertheless, hedging is an important aspect of supply and must be accounted for in any supply/demand analysis.

Figure 18 shows outstanding hedged positions for the past five years. As can be seen, these have grown considerably since 1990 to reach an estimated level of 50 Moz (1,555 t) at the end of 1994. Incidentally, the significant increase in 1993 was mainly as a result of much higher levels of hedging from Echo Bay (the largest US silver producer), although a number of other companies also raised positions, but not to the same extent.

By comparison in 1994, there was a significant reduction in producer hedging positions, which actually had the effect of putting hedging on the demand side of the equation, as the mines delivered to bullion banks, rather than the market.

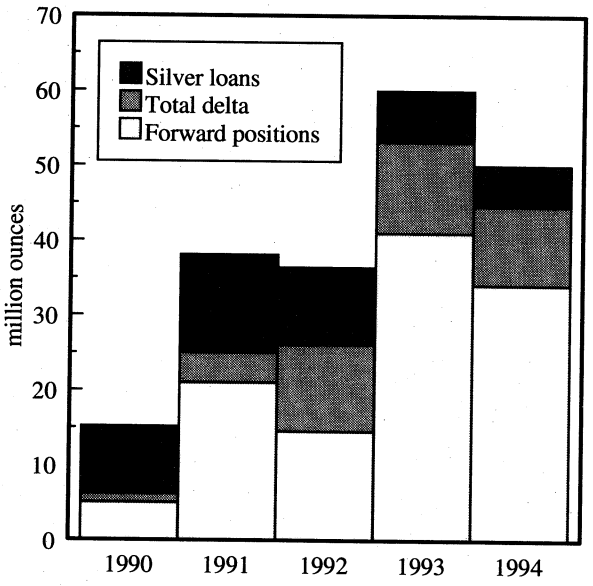
In terms of tonnages, the amount of silver sold forward is estimated to be at similar levels to the amount of gold sold forward. However, when measured in terms of percentage of annual production a very different picture emerges; in gold's case around 50% of total annual world output has been sold forward, while in silver's case it represents only 8%. But if the evolution of gold hedging is anything to go by, the forward selling of silver could become more widespread.

An additional issue is the impact on the market of option positions taken out by mining companies over the past five years. Analysis of these positions involves firstly establishing the size of the total outstanding option positions, both puts as well as calls, and then determining the quantity of silver sold or bought by the counterparty (the delta hedge) to offset the exposure in the event that the option is exercised. This calculation takes into account price volatility and expiry date of the option, as well as the option's strike price compared to the current spot price. For the purposes of this survey we have had to make a number of assumptions and therefore the figures arrived at should be viewed as an indication of the likely impact on the market, rather than a firm number. Nevertheless, the analysis indicates that over 10 Moz (311 t) has entered the market from these option activities over the last five years.

The use of silver loans as a means of financing has been limited to a handful of projects. This is probably because, apart from the use of a silver loan being a relatively new instrument unfamiliar to mining companies, the declining silver price in the late 1980s and early 1990s has deterred the development of primary silver mines, which would be the most obvious candidates for the use of these loans. Our analysis reveals that, after peaking in 1991, the payback of existing silver loans has exceeded the drawdown of any new loans. In 1994, this resulted in 2.2 Moz (68 t) being returned to the original lenders.

Figure 18

World Silver Hedging: outstanding positions



Sources of Silver Mine Production (Million ounces)

Country	Mine Type	1991	1992	1993	1994
Australia	Gold	0.97	0.94	0.77	0.69
	Copper	20.55	22.91	20.87	19.32
	Lead & Zinc	16.42	15.31	15.40	13.59
Bolivia	Gold	0.33	0.35	1.49	1.43
	Lead & Zinc	11.75	9.79	9.21	9.89
Canada	Primary Silver	11.41	5.51	1.88	0.07
	Gold	2.91	2.66	1.13	1.07
	Copper	10.78	10.22	13.18	11.18
	Lead & Zinc	15.44	19.20	12.08	11.29
Chile	Primary Silver	0.61	0.57	0.42	0.84
	Gold	6.99	18.19	16.40	14.58
	Copper	14.04	14.09	14.28	16.06
	Lead & Zinc	0.10	0.10	0.09	0.12
Dominican Rep	Gold	0.71	0.43	0.06	0.00
Fiji	Gold	0.02	0.03	0.04	0.05
Finland	Copper	0.96	0.87	0.94	0.84
Ghana	Gold	0.05	0.05	0.06	0.07
Honduras	Lead & Zinc	1.38	1.14	0.78	0.87
India	Gold	0.43	0.27	0.24	0.24
	Copper	0.54	0.50	0.48	0.45
	Lead & Zinc	0.14	0.75	0.93	0.93
Indonesia	Gold	0.94	1.57	1.35	1.81
	Copper	1.57	1.64	1.54	1.31
Ireland	Lead & Zinc	0.34	0.42	0.42	0.57
Malaysia	Gold	0.01	0.01	0.01	0.01
	Copper	0.43	0.49	0.44	0.42
Mexico	Primary Silver	17.74	16.51	20.24	20.91
	Gold	7.63	13.40	10.64	11.90
	Copper	3.26	3.39	4.59	4.36
	Lead & Zinc	42.85	44.21	42.19	37.62
Namibia	Gold	0.00	0.01	0.00	0.00
	Copper	2.96	2.87	2.31	2.07
New Zealand	Gold	0.36	0.73	0.84	1.00
Papua New Guinea	Gold	2.58	2.13	2.19	1.92
	Copper	1.42	0.94	0.90	0.58
Peru	Primary Silver	21.11	11.96	10.21	12.97
	Gold	0.00	0.00	0.45	0.64
	Copper	5.14	5.06	5.63	6.12
	Lead & Zinc	40.83	39.87	41.71	35.91
Philippines	Gold	0.18	0.15	0.18	0.18
	Copper	0.97	0.76	0.86	0.79
Poland	Copper	27.89	29.39	28.68	29.77
Saudi Arabia	Gold	0.46	0.48	0.52	0.52
South Africa	Gold	2.03	2.09	2.04	1.93
	Copper	0.66	0.58	0.51	0.51
	Lead & Zinc	2.80	3.18	3.77	3.88
Spain	Gold	0.15	0.14	0.09	0.07
	Copper	7.35	7.36	5.05	5.08
Sweden	Gold	0.05	0.00	0.00	0.00
	Copper	1.24	1.77	1.63	1.51
	Lead & Zinc	6.84	7.29	7.29	6.59
United States	Primary Silver	13.94	12.94	11.70	12.55
	Gold	18.75	19.14	20.91	15.46
	Copper	13.51	14.59	13.88	11.12
	Lead & Zinc	13.22	11.33	6.39	5.30
Total		375.76	380.28	359.90	338.94

By-product Trends

The amount of by-product silver has increased in recent years as a proportion of total silver production. This reflects the depletion of high-grade silver-bearing ores and the closure of some long-established primary mines, as well as a rise in by-product silver production in those countries with increasing output of gold, lead/zinc and copper with which by-product silver is associated. Last year around 14% of silver production was primary, with 14% also coming from gold mines, 32% from copper production and 40% from lead/zinc operations (see Figure 19). Because of the high proportion of silver extracted as a by-product of other metal mining, the demand for, and thus prices of, these metals influences the trend in silver production.

Any investigation of by-product silver production is not straightforward. As formal statistics are almost non-existent, our analysis was undertaken using original data in the form of individual company reports and other published sources. The coverage of national production recorded in published data varies widely and there is frequently a considerable time-lag between production periods and the publication of company reports. Thus, our research is concentrated on a detailed analysis of available company data for calendar years 1992 and 1993. The individual mines were classified as primary or co-product/by-product according to the metal generating the largest share of revenue and thus classification may change from year to year according to metal prices and output. The estimates for 1991 and 1994 were then derived by using the known mine production data for copper, lead/zinc and gold in the countries concerned to project the silver by-product data forward from 1993 and back from 1992. With the projected time-span of only one year, any distortion is unlikely to be significant.

Having determined by-product silver mine output, primary silver production for 1991 was calculated as the difference between the estimated by-product silver output and the total silver mine output for each country, obtained from national statistical data or assessed by us independently. This same method was used for 1994 except for Mexico, the United States, Peru, Canada and Chile for which the actual primary product output figures were available.

A high proportion of total world mine production could be analysed using this method. The table on the

opposite page, covering twenty-five countries, provides a breakdown of 360 Moz (10,500 t) of production in 1993, about three-quarters of world output.

However, in a few countries, notably China and Japan, by-product information was either lacking or too unreliable to be included this year. In the case of the CIS, we also evaluated by-product output, but as the quality of the data was lower, we did not include the results in the main table, although they are included in the following summary table, which covers 88% of world silver production in 1993.

Sources of Silver Production*
Moz

	1991	1992	1993	1994
Primary Silver	73.27	54.88	50.76	53.39
Gold	47.80	64.78	61.21	55.28
Copper	130.32	132.52	128.98	124.21
Lead & Zinc	191.18	189.04	172.10	154.25
Total of above	**442.58**	**441.22**	**413.06**	**387.13**
% of World Total	87.7	88.3	88.2	87.1

* Including estimated CIS production

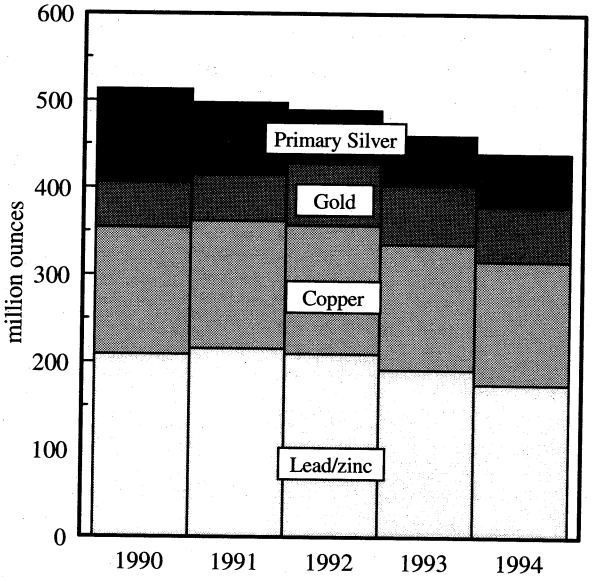
In 1994, total World silver mine production (see Table 2) declined by 24 Moz (746 t) from the 1993 level. Gold and copper by-product production declined significantly during these two years, but the bulk of the fall in silver output was from lead/zinc operations, as the above table indicates.

Figure 19 shows estimated levels of total world silver mine production by source over the past five years. The 1990 figures were back-projected from the 1991 estimates using the same method as described above. Using the data from the table on page 24, total world production by source was then estimated by extrapolating from the calculated production figures to the world totals. Although small errors are unavoidable with such an extrapolation, this method provides a reasonable representation of the sources of world mine production over the full five-year period.

The countries producing the most silver from gold operations are the United States, Chile and Mexico, which together account for approximately 70% of the world's silver output from gold mines.

Looking at trends in these five years, it can be seen

Figure 19
World Mine Production by Source



that the current output of by-product silver from gold production was substantially higher than in 1991. This is the result of the steady growth of gold mine production in recent years.

The United States, Chile, Canada, Poland and Australia produce significant amounts of silver by-product from their copper operations and together account for over 60% of world by-product silver from copper mining. Copper prices have fallen sharply since mid-1990, but during 1994 made an extremely strong comeback to previous high levels. Taking this enormous price swing into account compared to the relatively flat level of by-product copper production, it appears that the surge in copper prices has not yet had a strong influence on by-product silver output.

Silver produced as a by-product of lead/zinc operations has declined by 19% since 1991. Australia, Canada, Mexico and Peru's by-product operations total over 55% of world silver production from lead/zinc mines.

But although the decrease in silver production from lead-zinc mines was substantial, primary silver production has fallen even more, by roughly 25% from 1991 to 1994, with Canada and Peru experiencing the most significant drops. On the other hand, Mexico, the world's largest primary producing country, has experienced an estimated 3 Moz (93 t) increase in this period.

4. Supply from Above-ground Stocks

Silver Stocks

Silver stocks comprise four broad categories: government holdings, official exchange/dealers' stocks, individual holdings of silver coins or bullion bars owned by investors and industrial inventories. In general, these stocks have been run down in the 1990s, as fabrication demand has exceeded conventional mine supply and recycling. And 1994 was no exception; both government and exchange/dealers' stocks, the most clearly identifiable sectors, fell. Government stocks fell by 32.4 Moz (1,008 t) and exchange/dealers' stocks by an estimated 100 Moz (3,110 t). On a longer view, exchange/dealers' stocks, which are the most flexible sector, have fallen by at least 300 Moz (9,300 t) since 1990 and stood at just over 700 Moz (21,800 t) at the end of 1994.

Among **government stocks**, the principal holding is in the United States, divided between the National Defence Stockpile and Treasury Reserves. The National Defence Stockpile declined by 8.1 Moz (252 t) in 1994 to 53.7 Moz (1,670 t); the Treasury Reserves fell only marginally by 15,000 oz to 24.6 Moz (756 t). Sales by other governments or their central banks, which have not always been made public, were a net 24.3 Moz (756 t).

Exchange/dealers' stocks are located primarily in the United States, the United Kingdom and Switzerland and, to a lesser extent, in Germany and Japan. They include the published stocks of exchanges and the unpublished holdings of bullion banks, other traders and investors. This is the metal most readily available to the market. These stockpiles have been drawn on to fill the supply/demand "gap" that has opened up during the 1990s.

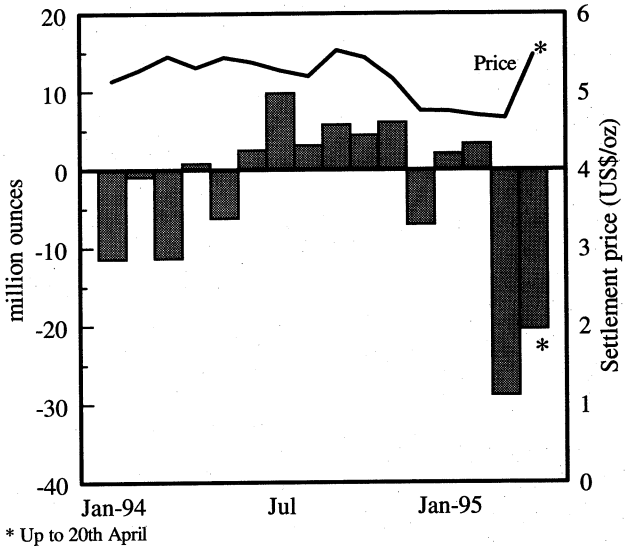
In the **United States**, these stocks are dominated by the five recognised Comex depositories, by the Chicago Board of Trade, and in the vaults of Wilmington Trust in Delaware. Armored carrier companies and banks also store modest quantities.

The most important identifiable stocks are those of Comex (now merged with Nymex), where changes are published daily and which are thus monitored closely for significant changes in the market. Comex stocks fell by 4.5 Moz (140 t) in 1994 to 258.6 Moz (8,044 t) but then rose in early 1995 to 264 Moz (8,212 t) at the end of February, before falling again to 214.7 (6,678 t) by the middle of April. This is the lowest level to-date of the 1990s, suggesting there may finally be some erosion of US stocks, although not so marked as in Europe, as indicated below.

Figure 20

Comex Silver Stocks

Changes in stock, monthly



* Up to 20th April

Comex stocks, incidentally, comprise "registered" and "eligible" metal. Registered metal has been assayed and meets Exchange specifications. Eligible stocks usually also meet Comex's good-delivery specifications but have not been through the (costly) assay and registration procedure. Industrial users, however, will normally insist on registered metal when they take delivery but inter-depository movements do not require it.

The close watch kept on Comex stocks by market observers means that occasionally metal may be moved into or out of stocks simply to create an impression. The sharp decrease of 35 Moz (1,089 t) in Comex stocks between October 1993 and March 1994, for instance, came about because speculators were moving silver to private warehouses, whose stocks are not published, to suggest that overall stocks were falling more rapidly than they were. Once that speculative foray was over, and as positions were unwound, the Comex stock surged back virtually to its original level.

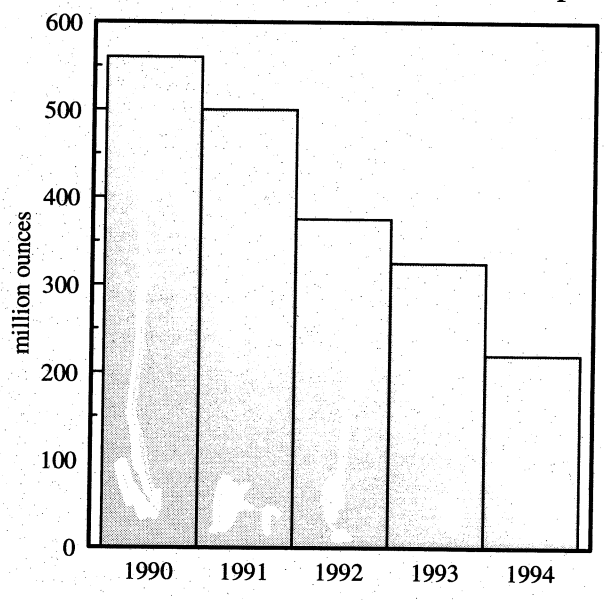
At the Chicago Board of Trade (CBoT), which also has a small silver stock, a decline was likewise noted in the first quarter of 1994 but again, the year ended with a level of 9.7 Moz (302 t), precisely where it had been 12 months earlier.

The Wilmington Trust in Delaware is the other principal warehouse for silver in North America. Besides tax advantages in Delaware, Wilmington Trust is able to offer competitive costs and a convenient location for shipment of silver. Wilmington Trust's stocks grew substantially during the late 1980s and were augmented by absorbing those of the Bank of Delaware in 1992. The Trust does not publish stock figures (another attraction for dealers and investors), but they are felt to have declined in late 1994, as metal was shipped to London to meet rapidly falling stocks there.

However, it is in **London** and **Zurich** that stocks have fallen most significantly in recent years, as these two markets have shouldered most of the task of supplying the rising demand in India. The impact of India and, to a lesser extent, Thailand in changing silver's statistical position in the 1990s should not be underestimated. From placing virtually no demands on the market prior to 1990 (indeed India was a substantial supplier of dishoarded silver for many years), India and Thailand have absorbed nearly 500 Moz (15,500 t) in the five years 1990 to 1994. This is the single most important factor in the running down of silver stocks.

Figure 21

Bullion Stocks in Dealers' Vaults in Europe



Europe's stock position (see Figure 21) reflects this. Although there are no published statistics for bullion stocks in Europe our research indicates that, at the end of 1990, stocks in the United Kingdom, Switzerland and Germany were just under 500 Moz (15,500 t); whereas at the end of 1994 they had declined towards 200 Moz (6,220 t). These estimates, however, comprise only silver held in vaults in major markets on account of bullion banks, other traders or investors. They do not include metal that is leased out to fabricators, nor private holdings by investors in safety deposits. These main stocks include, of course, silver that comes regularly into London or Zurich from producers in Eastern Europe or the CIS, as well as from Central and South America. And much of it today is a "working" stock, merely passing through the vaults in transit from producer to fabricator.

While regional markets in the Middle East and Asia do not normally carry much inventory, Singapore and, to a lesser extent, Dubai were holding excess stocks at the end of 1993 - a year in which they had imported record amounts - because the rising silver price curtailed demand in India, their main export client. Stocks amounted to at least 9.5 Moz (295 t) at the beginning of 1994 but were then run down during the first six months. By the beginning of 1995, they were at no more than normal working levels of around 2 Moz (62 t). In India itself, trade inventory (mostly fabricated jewelry and silverware, not bullion) was estimated at 19.3 Moz (600 t) at the end of 1993 but declined to 15 Moz (467 t) by the end of 1994. Much of this metal is in the inventory of thousands of newly opened shops.

In **Japan**, inventory on the Tokyo Commodity Exchange (Tocom) continued the steady decline of the last four years. From a peak of 14.2 Moz (442 t) at the end of 1990, they were down to 6.2 Moz (193 t) at the end of 1994. However, the inventories held by Japanese trading houses and fabricators increased in late 1994 and early 1995, as they took advantage of an exceptionally low yen price. The buying on the international market was also prompted by the closure of a local lead smelter leading to fears of a shortage of by-product silver from domestic smelters. Inventories rose by over 10 Moz (311 t).

Other than Japan, there were few significant changes in industrial inventories during 1994. The US Bureau of Mines estimates that US industrial stocks rose by about 6.2 Moz (193t) to 29.9 Moz (930 t). But, amongst European countries, such inventories are

usually kept very low because of the cost of financing and the ready availability of silver from traders' stocks or bullion loans. In the United Kingdom, for instance, industrial stocks usually amount to little more than 2 Moz (62 t). Even then such stocks may consist partly of manufacturers' work-in-progress and there is a danger of double-counting the metal in both fabrication and stock increase.

The least tangible stocks, of course, are those dispersed among private investors, either as bars or coins. In aggregate, they amount to a large but elusive quantity of silver. During the last few years, there has been considerable selling back of silver bars in the United States and Canada that were originally purchased in the 1970s and 1980s. But the US public is still believed to hold in excess of 500 million circulating silver coins; in Germany and France there are also significant quantities of legal tender coins. Even in Yemen, where Maria Theresa silver coins still circulate widely and are used in many transactions, there is a substantial stock (although 1.7 Moz (53 t) were exported for melting in 1994). While they surely exist, such widely dissipated holdings cannot really be classified as "stocks" in any meaningful sense. They are not readily available to a trader making up container loads of silver for India or a photographic film-maker assessing his annual needs. This silver becomes available haphazardly, either for reasons of distress (as in Yemen last year) or the lure of high prices (as in 1979/80).

In summary, the most significant statistical change in silver's stock position, as seen in the mid-1990s, is the steady erosion of the inventories existing, especially in Europe, at the beginning of the decade. While the overhang that existed then has not been eliminated, it will be slim by the end of the century, at even current rates of erosion.

Scrap

The supply of silver from the recycling of old (as opposed to process) scrap in the Western World increased by 3% in 1994 to 132.5 Moz (4,122 t). An initial estimate has also been made for the CIS, where there is a so far modest level of recycling, not least of obsolete military equipment which often contains considerable quantities of silver. Two countries, the United States and Japan, account for almost 50% of this scrap and the addition of Germany brings this up to 60% (see Table 3 which has been expanded, as a result of field-work, to include more countries from 1990 onwards). The major source of scrap comes from the photographic industry, where the collection and recycling of waste material is well organised, even in many small countries which have no photographic manufacturing of their own, but where recovery of a few thousand ounces of silver provides a cheap local source of the metal.

Tracking scrap is complex. In developing countries, like India, much of it passes through small back-street refineries and thence to local fabricators. Even in industrial countries it is difficult for refiners to distinguish between genuine old scrap and regular process scrap. Moreover, low grade scrap is often exported to specialist refineries in countries such as Belgium. However, the analysis presented here counts the scrap in the country in which it originates. The price of silver also determines whether it is worth recovering the metal, especially from electronic equipment, and in some countries, from photographic waste. The low silver prices of the 1990s have curtailed some recovery, or led to stock-piling of obsolete electronic equipment pending a higher price. The competition for such material is particularly intense in South-East Asia, where operators based in China have acquired considerable stocks.

The **United States**, as the world's largest fabricator of silver and also as an importer of many products, whether industrial or silverware and jewelry, naturally presents a major but somewhat complex source of scrap. Establishing the origins and pattern of scrap is made more difficult because refiners often find it difficult to distinguish between normal process scrap and genuine old scrap, a situation that is particularly complex in the photographic industry (where even process scrap may come from foreign plants). Furthermore, while high-grade scrap (eg, material with more than 30% silver) is usually recovered and refined in the United States, most low-grade scrap is dispatched to Europe.

Focusing in on old silver scrap originating within the United States, the picture for 1994 shows a total of just over 29 Moz (910 t), up 6% from 1993. The principal source is photographic scrap, amounting to 22.5 Moz (700 t) (not counting just over 11 Moz (342 t) of process scrap recycled within the photographic industry). The second source of scrap is from old silverware and jewelry, estimated at 4.3 Moz (134 t), followed by electronics at 2.1 Moz (65 t) and plated articles and miscellaneous items at 0.1 Moz (3 t). The electronics scrap is won from reprocessed circuit

boards (typically 20 ounces per short ton, 622 grams per metric tonne), connectors, solders, and conductive adhesives (55 ounces per short ton, 1.7 kg/t). Electronics scrap has increased in both quantity and, surprisingly, in grade in the last two years, due to imports of high-grade material from the CIS, more military scrap from US sources and improved smelter facilities leading to better recovery rates. However, silver recovery from electronics scrap is largely a by-product from the recycling of gold and, to a lesser extent, platinum. Electronics scrap is seldom treated for its silver content alone.

Scrap silver recovery in **Japan** has risen over the past few years by virtue of the growth in recycling of photographic materials. However, while published figures hint at this trend, the absolute volumes being recovered greatly exceed those given in official data. It is estimated that in 1994 scrap recycling reached close to 26.7 Moz (837 t), the majority of which was recovered from spent photographic materials. Despite a lack of published data, industry sources unanimously agree that, especially from the photographic sector, the volume of scrap recycling is huge and that a significant proportion (perhaps as much as 50%) of silver required by that industry is now simply being repeatedly processed, used and recovered in a closed loop. The participants involved in this trade include a number of secondary refiners specializing in the collection and processing of photographic waste materials and in particular discarded X-ray films. Evidence suggests that today a high proportion of medical X-rays are processed to recover silver, although statistics again appear to fall outside the scope of official surveys. Additionally, the volume of silver recovered from film, especially color print film, has risen in the past few years, in part through the growth in the market for single-use cameras. Consumers buying these cameras return the entire unit for processing to the manufacturer, enabling the recovery not only of the camera itself but almost all the silver from the processing stage. Tighter environmental controls have also encouraged greater silver recovery from the photo laboratories, now found in every town center, many of which also have equipment to recover silver in-house to a purity in excess of 90%. With silver recoveries from color film processing already estimated to be near 90%, it may be that recovery rates are approaching a plateau.

The high quality of refining facilities available in **Germany** means that it imports considerable amounts of scrap, not only from its European Union neighbors but also from the Middle East, the Far East and the United States. However, in this Survey, the scrap is counted in the country of origin, not Germany. Thus, in 1994, although total scrap available was 23.9 Moz (743 t), only 15.4 Moz (479 t) came from domestic sources and, of this, photographic scrap was the largest component. This continues a slight downward trend in domestic metal noticeable since 1992, when 16 Moz (498 t) was available.

The recycling of domestic scrap in the **United Kingdom** was steady at around 6.7 Moz (210 t) in the early 1990s but has risen slightly in the past two years to 7.1 Moz (222 t). The major component is photographic waste and that is the main reason scrap supply was level for some years, because during the recession from 1990-1993, UK sales of commercial film declined by almost 30%. The scrap won from medical X-rays also continues to decline due to improvements in the film itself, coupled with flat offtake. The modest increase recently has more to do with low-grade electronic scrap, much of which is actually sent to Sweden, Belgium and Canada for refining, but is counted in the UK as country of origin. UK refiners are also treating considerable amounts of imported photographic scrap, but, again, this is counted in its country of origin.

Although **Belgium** is a major center for the refining of low-grade scrap, virtually all of this material is imported from France, Germany, the United Kingdom and the United States, where it is counted. The fine silver content of this imported scrap approaches 15 Moz (466 t), but scrap generated within Belgium itself is a modest 0.6 Moz (20 t) as shown in Table 3.

Scrap in **France** is principally recovered from photographic film and is relatively steady at 4.18 Moz (130 t). Part of the photographic recovery is achieved through a French system using electrolytic tanks, which is installed at 4,000 locations, including hospital X-ray departments, industrial users, movie film makers and film processors, enabling over 90% of the silver dissolved in a fixing bath to be recovered. Other scrap sources are limited, because the silverware market is small.

Italy's scrap levels are also static at 2.73 Moz (85 t). This is mainly due to a fall in recycling from X-ray and graphic film, but has been offset by the melting of unsold silverware stocks.

Table 3
Supply of Silver from Fabricated Old Silver Scrap
Million ounces

	1985	1986	1987	1988	1989	1990	1991	1992	1993	**1994**
Europe										
Germany	-	-	-	-	-	16.08	16.08	16.08	15.75	**15.43**
UK & Ireland	-	-	-	-	-	6.75	6.75	6.75	6.82	**7.14**
France	-	-	-	-	-	4.18	4.18	4.18	4.18	**4.18**
Italy	-	-	-	-	-	2.73	2.73	2.73	2.73	**2.73**
Austria	-	-	-	-	-	1.93	1.93	1.93	1.93	**1.93**
Sweden	-	-	-	-	-	1.29	1.29	1.29	1.29	**1.29**
Netherlands	-	-	-	-	-	1.13	1.13	1.13	1.19	**1.29**
Belgium	-	-	-	-	-	0.64	0.64	0.64	0.64	**0.64**
Norway	-	-	-	-	-	0.64	0.64	0.64	0.64	**0.64**
Switzerland	-	-	-	-	-	0.07	0.07	0.07	1.42	**0.50**
Spain	-	-	-	-	-	0.39	0.35	0.32	0.32	**0.32**
Czech Republic	-	-	-	-	-	0.32	0.48	0.58	0.39	**0.32**
Denmark	-	-	-	-	-	0.23	0.23	0.23	0.23	**0.23**
Other	-	-	-	-	-	0.83	0.77	0.80	0.83	**0.83**
Total Europe	-	-	-	-	-	37.21	37.27	37.37	38.36	**37.46**
North America										
United States	-	-	-	-	-	28.94	27.33	27.01	27.65	**29.26**
Mexico	-	-	-	-	-	2.25	2.25	2.25	2.25	**2.25**
Canada	-	-	-	-	-	0.96	0.96	0.96	0.96	**0.96**
Total North America	-	-	-	-	-	32.15	30.54	30.22	30.86	**32.47**
Central & South America										
Brazil	-	-	-	-	-	1.93	1.93	1.93	1.93	**1.93**
Argentina	-	-	-	-	-	0.64	0.64	0.64	0.64	**0.64**
Venezuela	-	-	-	-	-	0.29	0.29	0.29	0.26	**0.23**
Chile	-	-	-	-	-	0.23	0.23	0.23	0.23	**0.23**
Other	-	-	-	-	-	0.54	0.54	0.54	0.54	**0.51**
Total Central & S. America	-	-	-	-	-	3.63	3.63	3.63	3.60	**3.54**
Middle East										
Turkey	-	-	-	-	-	1.77	1.86	1.93	2.03	**2.25**
Saudi Arabia & Yemen	-	-	-	-	-	0.06	0.08	0.61	0.81	**1.87**
Egypt	-	-	-	-	-	1.12	1.00	0.64	1.02	**0.93**
Total Middle East	-	-	-	-	-	2.95	2.94	3.18	3.86	**5.05**
India	21.00	16.00	15.00	13.00	5.00	4.00	9.65	7.23	4.50	**4.50**
Far East										
Japan	-	-	-	-	-	15.47	18.73	24.09	26.15	**26.69**
South Korea	-	-	-	-	-	1.20	1.20	1.25	1.35	**1.51**
Taiwan	-	-	-	-	-	0.96	0.96	0.80	0.71	**0.64**
Malaysia/Singapore	-	-	-	-	-	0.40	0.40	0.40	0.40	**0.50**
Thailand	-	-	-	-	-	0.32	0.32	0.32	0.32	**0.32**
Indonesia	-	-	-	-	-	0.13	0.17	0.21	0.23	**0.29**
Hong Kong	-	-	-	-	-	0.26	0.26	0.26	0.26	**0.26**
Philippines	-	-	-	-	-	0.13	0.14	0.14	0.15	**0.16**
Total Far East	-	-	-	-	-	18.86	22.17	27.47	29.57	**30.37**

Table 3
Supply of Silver from Fabricated Old Silver Scrap
Million ounces

	1985	1986	1987	1988	1989	1990	1991	1992	1993	**1994**
Africa										
South Africa	-	-	-	-	-	0.14	0.14	0.11	0.13	**0.14**
Other	-	-	-	-	-	0.45	0.45	0.51	0.57	**0.57**
Total Africa	-	-	-	-	-	0.59	0.59	0.61	0.69	**0.71**
Australia	-	-	-	-	-	2.29	2.27	2.28	2.39	**2.52**
Other Western World	119.90	113.30	123.40	130.70	131.40	-	-	-	-	-
Western World Total	140.90	129.30	138.40	143.70	136.40	101.69	109.07	112.01	113.84	**116.63**
Other Countries	13.40	13.30	12.70	14.10	12.80	12.54	11.48	12.67	14.71	**15.90**
World Total	154.30	142.60	151.10	157.80	149.20	114.23	120.55	124.68	128.55	**132.53**

Scrap recovery is well organized in **Turkey** through several small refiners, located mainly in Istanbul, handling photographic material from both commercial and X-ray films. There is also recycling of silverware. In all, recovery is estimated at 2.2 Moz (68 t) in 1994, up 10% on the previous year.

A significant proportion of silver needed for fabrication comes from scrap in **Egypt**, where annual recovery is almost 1 Moz (31 t). Some years ago much of the scrap came from the large domestic stock of coins, but the main source today is old items of silverware (often beautiful antique pieces) and the traditional *kokal* ankle bracelets worn by Bedouin women in Upper Egypt, which can weigh between 30 and 60 oz (0.9 - 1.9 kg).

The recovery of photographic scrap has started in **Saudi Arabia**, but is scarcely 0.1 Moz (3 t). More significant are the Maria Theresa silver dollars that come out of **Yemen** into the southern border areas of Saudi Arabia. The quantity of these coins has increased in the last two years: 0.7 Moz (22 t) in 1993 and 1.7 Moz (53 t) in 1994. These coins were sent to Europe for melting and refining. Although there is recovery of photographic and jewelry scrap in other Middle East countries, the quantities are limited.

During the past two years, the quantity of old scrap recycled in **India** has been stable at 4.5 Moz (140 t). There is a network of dealers which collects, sorts and channels old silver-bearing scrap materials back to the principal refineries concentrated in the Bombay area. Apart from the scrap which can be identified as being recycled at an industrial level, there is also a substantial, but unquantifiable amount, of recycling carried out amongst very small, "back street" refineries, with the silver being absorbed by local fabricators. To this extent, the fabrication data shown in this report undoubtedly understates the total for India, in that the unrecorded recycling does contribute to the country's total offtake. However, in this analysis, these unquantifiable figures are excluded from both the demand and the supply sides. During periods of either higher silver prices or uncertainty, whether political or economic, the amount of recycling can rise significantly. This was last seen in India during the period 1991-92, when large quantities of old scrap were received by the principal refiners.

Hong Kong generates a small amount of scrap, 0.3 Moz (9 t), mainly from photographic waste, but in **China** recovery is starting to reach a more significant volume. Again, this is mainly from photography, and includes imported material. The securing of scrap is a highly competitive business in Asia, from both photographic and other sources, and China's lower labor costs and overheads often enable it to win contracts. **Singapore** is also a competitor, handling up to 0.5 Moz (15 t) of scrap from local and Malaysian photographic wastes. Recovery is also rising in **South Korea** to reach 1.5 Moz (47 t), from photographic sources and the recycling of silverware.

Scrap recovery in **Taiwan** was quite substantial in the mid-1980s, as much as 1.6 Moz (50 t), but had declined year by year to a modest 0.6 Moz (19 t).

5. Fabrication Demand

The Versatility of Silver

Silver has few substitutes in the majority of its applications. Where cheaper metals of similar characteristics have been found, substitution has usually occurred at the expense of one or more attributes. Although classified as a precious metal, in the fabrication sector this title changes to an "industrial metal" - a necessary element, whatever the cost. This attitude has been enhanced by the development of high-tech uses in which reliability, precision and safety are paramount. At current trading ranges, performance is considered more important than cost.

Silver's unique properties include :

- *strength;*
- *electrical and thermal conductivity (ability to conduct electricity and heat);*
- *photo-sensitivity (sensitivity to light);*
- *optical qualities (high reflectance of light and low emissivity);*
- *malleability (the ease of deformation by hammering, rolling etc without fracture, eg silver leaf);*
- *ductility (the property that enables metals to undergo cold, plastic deformation under tension, allowing the drawing of fine silver wire);*
- *immunity to oxygen corrosion;*
- *resistance to arcing (sparking) in electrical applications;*
- *ability to endure extreme temperature ranges;*
- *its role as a bactericide in both medical/dental and water purification applications;*
- *ability to act as a catalyst (particularly in the manufacture of plastics);*
- *superior chemical stability.*

The fabrication of silver in the Western World fell by 1.9% in 1994 to 682.6 Moz (21,232 t); with the inclusion of the former communist bloc, the world total was 749.3 Moz (23,306 t). This fall however, masks the fact that in most sectors of silver use, there was a marked improvement (see Figure 22). Industrial and decorative, photographic and coin demand rose significantly, whereas jewelry and silverware declined due to lower fabrication in Thailand and India.

The most positive performance came in the industrial and decorative sector, which was up over 8% in the Western World, and almost 6% world-wide. Industry is now the foremost user of silver, edging ahead of photographic and silverware and jewelry demand. The increasingly diverse uses of silver in industrial applications, especially in a wide variety of domestic appliances and in fast growing special areas like water purification, should maintain this leading position.

The statistics for individual countries, shown in Table 4, count the silver use in the country in which it is initially fabricated from bullion or grain into an alloy or special product such as silver nitrate or silver potassium cyanide, even though these products may then be exported to an end-user elsewhere. For this reason, the major industrial countries, such as the United States, Japan, Germany, the United Kingdom and France, are most prominent (see Figure 23), while

Figure 22

World Silver Fabrication

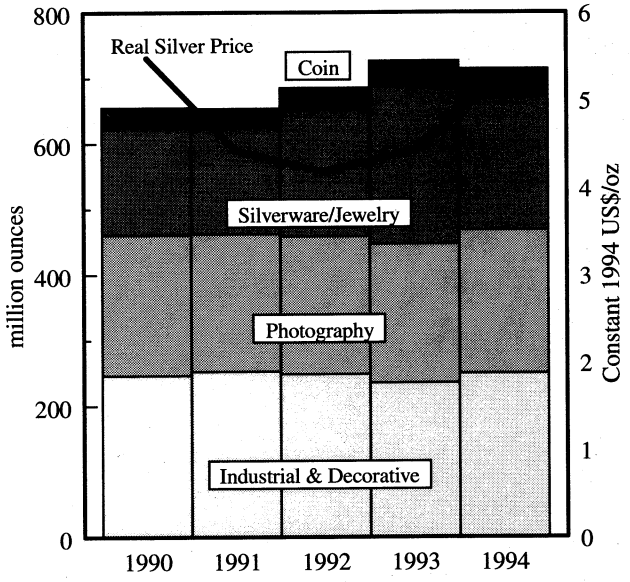
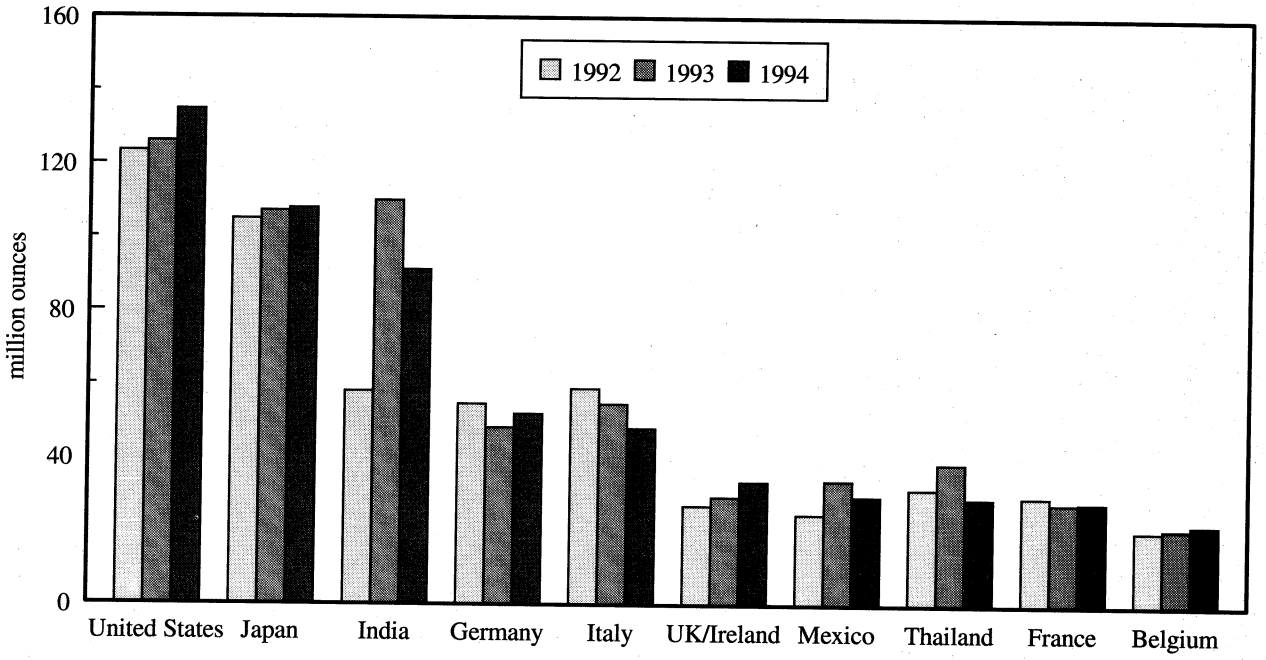


Figure 23
The Ten Largest Silver Fabricators, 1992-94



many developing countries like Hong Kong or Malaysia, which are end-users, show small levels of fabrication, because they rely largely upon imported products.

The United States is the largest fabricator of silver at 134.7 Moz (4,190 t) in 1994 representing a rise of 6.9% on the previous year. Photography accounts for 50% of this silver offtake (see Figure 24 for a breakdown of US silver by category). Japan, the second major fabricator, shows only a marginal rise of 0.6% to 107.8 Moz (3,353 t) in 1994, again virtually half being for the photographic industry (see Figure 25 for a breakdown Japan use by category).

India, which was the second largest fabricator in 1993, slipped into third place with 91.1 Moz (2,833 t), down from 110.0 Moz (3,420 t), reflecting the fact that in the first year of liberalization of imports in 1993, a substantial trade inventory was built up, which was partly run down in 1994. Unlike the United States and Japan, the main applications in India are in silverware and jewelry, which accounted for over 75% of the total consumed. But these three countries, the United States, Japan and India, are in a league of their own, accounting for no less than 45% of world fabrication.

By comparison, Germany, in fourth position, used 52.0 Moz (1,617 t), with industry and photography as the main consumers. Italy is in fifth position at 48 Moz (1,493 t), by virtue of its substantial role in silverware and jewelry, followed by the United Kingdom, which showed good growth of 13.9% to reach 33.5 Moz (1,042 t) last year. Thereafter, Mexico and Thailand are at just over 29 Moz (902 t). While Thailand continues to stand out as a major fabricator of jewelry (rather than silverware), output fell sharply to 29.1 Moz (905 t), compared with 38.6 Moz (1,197 t) in 1993. But this may well have proved a temporary setback as silver shipments to Thailand were strong again in the first quarter of 1995.

Fabrication in Eastern Europe is included in this survey for the first time, based upon visits to the former communist-ruled nations. While the quantities of silver required remain small, there is considerable potential for growth in this region as economies revive and factories are modernized. Demand in the Commonwealth of Independent States (CIS) and China are also covered for the first time. They present a contrasting picture. In the CIS, the virtual collapse of many areas of the economy has led to a substantial fall in silver use, from an estimated 72.6 Moz (2,258 t) in 1990 to 38.1 Moz (1,185 t) last year, while in China, rapid economic growth has

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

	1985	1986	1987	1988	1989	1990	1991	1992	1993	**1994**
Europe										
Germany	34.10	36.30	42.30	47.20	49.90	54.05	57.66	54.63	48.26	**51.97**
Italy	24.40	33.90	38.80	38.10	43.30	45.85	50.86	58.88	54.73	**48.09**
UK & Ireland	19.50	19.80	22.40	24.40	26.20	25.76	25.60	27.00	29.44	**33.55**
France	19.20	19.30	19.80	23.50	24.30	24.59	23.87	29.51	27.81	**28.06**
Belgium	16.40	17.60	17.90	19.20	19.20	20.22	20.31	20.35	21.10	**22.18**
Switzerland	-	-	-	-	-	6.14	8.07	7.17	6.56	**7.52**
Spain	-	-	-	-	-	7.74	8.63	6.45	5.81	**9.59**
Greece	-	-	-	-	-	3.22	3.38	3.54	3.71	**3.86**
Netherlands	1.00	1.30	2.40	1.20	1.20	2.75	2.17	2.08	2.07	**3.09**
Poland	-	-	-	-	-	5.60	3.88	3.09	2.73	**2.62**
Portugal	-	-	-	-	-	2.26	2.13	2.31	2.24	**1.86**
Austria	5.60	1.90	1.30	1.30	1.20	1.56	1.72	1.62	1.55	**1.48**
Denmark	-	-	-	-	-	1.08	0.97	1.07	0.97	**0.97**
Finland	-	-	-	-	-	1.35	1.42	1.24	0.89	**0.96**
Sweden	-	-	-	-	-	0.84	0.84	0.84	0.88	**0.87**
Czech Republic	-	-	-	-	-	1.96	1.75	1.19	0.83	**0.80**
Norway	-	-	-	-	-	0.67	1.14	1.65	1.06	**0.74**
Romania	-	-	-	-	-	0.64	0.55	0.48	0.42	**0.39**
Cyprus & Malta	-	-	-	-	-	0.23	0.23	0.26	0.27	**0.35**
Hungary	-	-	-	-	-	0.61	0.56	0.58	0.57	**0.32**
Bulgaria	-	-	-	-	-	0.16	0.16	0.23	0.32	**0.18**
Other	9.50	14.50	11.30	11.50	12.00	0.20	0.16	0.19	0.16	**0.20**
Total Europe	129.70	144.60	156.20	166.40	177.30	207.46	216.06	224.37	212.39	**219.64**
North America										
United States	119.10	129.20	127.30	119.90	126.80	128.01	123.47	123.33	126.01	**134.72**
Mexico	11.50	9.70	9.20	9.10	8.90	15.37	16.33	24.75	33.95	**29.61**
Canada	9.40	10.90	11.60	12.10	15.30	5.97	3.96	1.75	2.09	**2.25**
Total North America	140.00	149.80	148.10	141.10	151.00	149.35	143.76	149.82	162.04	**166.58**
Central & South America										
Brazil	-	-	-	-	-	6.79	6.69	6.62	6.92	**8.76**
Argentina	-	-	-	-	-	3.05	3.05	3.05	3.05	**3.05**
Peru	-	-	-	-	2.60	1.48	1.15	0.94	0.83	**0.90**
Ecuador	-	-	-	-	-	0.42	0.42	0.42	0.58	**0.71**
Colombia	-	-	-	-	-	0.68	0.68	0.70	0.68	**0.68**
Chile	-	-	-	-	-	0.32	0.32	0.32	0.32	**0.32**
Other	-	-	-	-	-	0.90	0.87	0.84	0.85	**0.80**
Total Central & S. America	-	-	-	-	2.60	13.64	13.17	12.89	13.22	**15.22**
Middle East										
Turkey	-	-	-	-	-	5.15	4.89	5.72	6.21	**6.19**
Israel	-	-	-	-	-	0.62	0.67	0.76	2.54	**2.93**
Egypt	-	-	-	-	-	1.59	1.73	2.33	1.90	**2.50**
Saudi Arabia & Yemen	-	-	-	-	-	0.21	0.28	0.36	0.37	**0.34**
Arabian Gulf States	-	-	-	-	-	0.29	0.29	0.29	0.29	**0.29**
Other	-	-	-	-	-	0.20	0.20	0.20	0.20	**0.20**
Total Middle East	-	-	-	-	-	8.06	8.05	9.65	11.50	**12.45**

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

	1985	1986	1987	1988	1989	1990	1991	1992	1993	**1994**
Indian Sub-Continent										
India	-	-	20.10	22.40	25.56	42.28	42.77	58.02	109.97	**91.12**
Other	-	-	-	-	-	2.57	3.28	4.08	4.82	**4.02**
Total Indian Sub-Continent	-	-	20.10	22.40	25.56	44.85	46.04	62.10	114.79	**95.13**
Far East										
Japan	72.60	84.90	90.90	100.40	100.80	115.79	108.79	104.89	107.09	**107.81**
Thailand	-	5.90	7.30	8.20	11.20	24.12	20.09	31.64	38.56	**29.12**
South Korea	-	-	-	-	5.30	6.80	9.35	9.00	16.11	**15.95**
Taiwan	-	-	-	-	-	4.50	3.27	3.98	4.21	**5.16**
Hong Kong	3.20	3.20	3.20	2.90	3.10	3.20	1.50	1.83	2.25	**2.89**
Indonesia	-	-	-	-	-	1.54	1.85	2.10	1.98	**2.83**
Vietnam	-	-	-	-	-	0.30	0.30	0.30	0.40	**0.50**
Malaysia	-	-	-	-	-	0.32	0.35	0.39	0.45	**0.35**
Philippines	-	-	-	-	-	0.23	0.25	0.26	0.27	**0.29**
Singapore	-	-	-	-	-	0.29	0.25	0.99	0.23	**0.14**
Other	2.50	3.00	9.30	9.60	14.30	1.00	1.00	1.00	1.00	**1.00**
Total Far East	78.30	97.00	110.70	121.10	134.70	158.07	146.99	156.37	172.55	**166.03**
Africa										
Morocco	-	-	-	-	-	0.47	0.46	0.45	0.42	**0.42**
South Africa	-	-	-	-	-	0.53	0.32	0.29	0.57	**0.38**
Algeria	-	-	-	-	-	0.38	0.35	0.32	0.29	**0.29**
Libya	-	-	-	-	-	0.38	0.35	0.32	0.29	**0.29**
Other	-	-	-	-	-	0.41	0.41	0.41	0.41	**0.41**
Total Africa	-	-	-	-	-	2.17	1.89	1.78	1.97	**1.79**
Australia	-	-	-	-	-	5.17	5.26	6.88	6.97	**5.71**
Other Western World	52.90	45.10	25.90	25.10	15.64	-	-	-	-	-
Western World Total	400.90	436.50	461.00	476.10	506.80	588.78	581.26	623.90	695.46	**682.57**
Other Countries										
Soviet Union/CIS	-	-	-	-	-	72.60	76.50	64.70	40.00	**38.10**
China	-	-	-	-	-	22.03	23.46	23.88	25.60	**28.67**
Total Other Countries	112.50	132.60	108.10	117.80	118.70	94.63	99.96	88.58	65.60	**66.77**
World Total	513.40	569.10	569.10	593.90	625.50	683.41	681.22	712.48	761.06	**749.34**

pushed silver fabrication from 22.0 Moz (684 t) to 28.7 Moz (898 t) in the same period. However, demand in the CIS should now stabilize and slowly improve. China is anticipated to require more substantial amounts of the metal as its industrial base grows and the people there can afford for the first time to buy household appliances such as refrigerators and electrical consumer goods containing silver.

The Main Industrial Uses of Silver

Electrical

Silver possesses the best electrical and thermal conductivity properties of all metals and is used in contacts, switches, conductors and fuses. Contacts refers to a junction between two conductors that can be separated and through which a current can flow. These perform three main functions, closing a circuit, opening a circuit or simply remaining closed indefinitely. Contacts are found in virtually every domestic environment, from washing machines to televisions and from wall sockets to cellular telephones.

Silver-cadmium oxide (85% to 97% silver) is currently the most widely used of all contact materials, providing excellent non-sticking qualities, high electrical conductivity, low electrical erosion over prolonged periods and economic advantages. However, due to environmental pressures, research is continuing into finding replacements for this alloy. Silver-tin-oxide and indium-tin-oxide, more expensive and arguably more difficult to use, already replace silver-cadmium-oxide in some products, notably in the automotive industry.

Fuses, similar to circuit breakers, are manufactured from fine silver wire although sterling silver and copper eutectic may also be used. These are used in the protection of transformers, lines, cables, capacitor banks in distribution substations and other fields within the high-voltage sectors, normally found in utilities, power plants and factories.

Electronics

The most significant uses 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.

Low current membrane switches have universal practicality for use in computer keyboards, telephone dialing keys, control panels on domestic appliances, industrial controls, facsimile and photocopy machines. Two polyester sheets are held slightly apart, and the opposing faces coated with thick ink made of silver flake, carbon and polyester, containing between 80% and 95% silver. When the surfaces are lightly pressed together, a contact is made and the circuit is completed. Being sealed, these are ideal for industrial use or in polluted environments.

Conductive adhesives are being used increasingly as connectors between electronic components attached to circuit boards and between chips themselves as in 3D memory stacks. Conductive adhesives consist of polymers filled with metal particles or flakes, typically silver, developed originally as replacements for metallurgical solders and as such contain no lead and require no cleaning. Anisotropic conductive adhesives have been designed to conduct electricity only in the vertical direction. As a result, less precision is needed in the adhesive's application. Assemblers can flood-coat an area with adhesive in the knowledge that the material will not conduct laterally between conductors, but rather vertically to the component contacts.

Electroplating

The ease of electrodeposition of silver from a double-alkali metal cyanide, such as potassium silver cyanide, or from silver anodes accounts for its widespread use in coating. Silver solutions are made up of a cyanide, a carbonate, silver and a brightener and this is the preferred method for plating. 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. Jewelry plating is usually between three and five microns, and tableware between twenty and thirty microns. The marking "EPNS" on silver tableware refers to the electroplating of silver onto nickel silvers or "Germanic Silvers", a group of alloys comprising copper, zinc and nickel. An article manufactured from any base metal and on to which silver is electroplated is termed "silver plated" and cannot be referred to as "silver plate".

Batteries

Many batteries, both primary (non-rechargeable) and secondary (rechargeable), are manufactured with silver alloys as the cathode. The inclusion of silver serves to increase current discharge within a light and narrow weight range.

Silver cells are more expensive than their competitors by virtue of the higher silver contents but have superior power density. This power-to-weight advantage currently places the silver cell above its competitors, assisting electronic device manufacturers in their quest for smaller and more portable machines. 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 consumer electronic products. Its high-density power, high voltage, long life-span and relatively low cost, make it ideal for such applications.

The silver-zinc cell (approximately 40% silver by weight) possesses a higher energy density but shorter duration and is used to power torpedoes and torpedo targets, space launch vehicles, satellites, sounding balloons, submarine guidance systems and rocket self-destruct systems.

Silver-cadmium batteries (approximately 40% silver by weight) have a lower energy density but are lighter and have an increased cycle life. Applications include space exploration (GEOS satellites), solar vehicles and aircraft.

Magnesium-silver-chloride cells are used in sea-water and fresh-water environments, with the water acting as the electrolyte. They are suitable for buoys, flares, beacons, torpedoes and shipboard emergency lighting.

Brazing and Soldering Alloys

Brazing is the joining of two or more dissimilar materials through the application of heat, a flux and a filler metal, the melting temperature of which is below that of the parent bodies. Brazing normally occurs at temperatures in excess of 600°C. At lower temperatures it is known as soldering.

Silver not only facilitates the joining of materials at lower temperatures, but creates naturally smoother, leak-tight joints with good corrosion resistance. Silver brazing alloys have diverse uses ranging from air conditioning and refrigeration equipment to plumbing and heating, the automobile industry, aircraft engines, space and missile programmes, electrical appliances and the silverware and jewelry industries.

Until recently, cadmium-bearing silver alloys (35% silver) were most widely used. Environmental regulations, however, have restricted this alloy resulting in the silver-copper-zinc alloy and silver-tin cadmium-free alloy groups benefiting, despite higher costs. Brazing materials are manufactured in sheet, wire, rod, powders, pastes and custom designed stock shapes.

Silver solders are used predominantly in electronics for high-speed surface mounting and for the bonding of silicon chips to metallic lead-frames. This alloy comprises 65% tin, 25% silver and 10% copper. As with brazing, it is the original equipment manufacturers who dictate which alloys are necessary. The electronics industry is currently in a transition phase between tin-lead alloys and tin-silver alloys. Circuits are getting progressively smaller rendering lead alloys obsolete. Space is now critical and lead solders are not as free flowing as silver-tin. Other new initiatives are the manufacture of microscopic silver connectors and the use of "snap-on" components which, in turn, will facilitate scrap recovery.

Catalysts

Silver is used as a catalyst in numerous chemical reactions, serving to increase the efficiency of the process without entering the reaction itself. These catalysts normally appear in the form of circular screens containing a mesh of 0.35mm diameter silver wires, but may also be in the form of silver crystals.

Silver catalysts are particularly important in the manufacture of formaldehyde which is used with phenol to produce hard and flame-resistant thermoset resins used in the manufacture of housings for television sets, computers and electrical switch boxes. The oxidation of ethylene to ethylene oxide is performed using a silver catalyst, which oxide is then used in the manufacture of polyester fibres, plastic film, molded items such as computer key-tops and electrical appliance components, solvents, detergents and anti-freeze (ethylene glycol). Silver-beryllium catalysts may be used for a similar purpose. Silver and silver-iron-palladium catalysts in motor vehicle exhausts reduce nitrious oxide emissions. Silver-palladium serves as a catalyst in the reduction of nitro-benzine to azobenzine, an insecticide, and in the process of converting paraffin petroleum distillates into high octane petrol. Silver also improves the chemical activity of platinum and rhenium catalysts at low temperatures.

Mirrors and Other Coatings

Silver has unique optical reflectivity and responds so well to polishing that it reflects virtually 100% of light falling on it.

The current mirror manufacturing system involves two separate solutions, dissolved silver, normally silver nitrate, and a reducing agent. This second solution causes the metallic silver to be deposited from its dissolved state. The two solutions are mixed together just prior to use and the prepared glass surface is covered with the reacting mixture, from which the silver precipitates. A protective coating is then applied to prevent damage to this layer of silver.

Technologies for coating glass, cellophane, metals or other materials vary according to size and shape. Conveyor spraying, sputtering and vacuum sputtering are the most common techniques. Solar control and reflective films are widely used on windows in warmer climates serving to reduce air conditioning costs, while low emissivity coatings are best suited to colder climates in which heat is retained. In addition to coating glass for windows, thin film coatings are used in automotive glass, computer and other electronic displays and various specialised manufacturing processes. Injection coating is used in the case of angular or spherical articles such as Christmas tree decorations and thermos bottles.

Apart from decorative mirrors, mirror technology is used in telescopes, cameras, televisions, heliostats, fluorescent optical reflectors, domestic water heating systems, bottle caps, picture frames and battery plate separators.

Water Purification

Silver is employed increasingly as a bactericide and algicide in water purification systems. Silver-infused carbon elements combined with ion resins or ceramic filters impregnated with metallic silver are placed in cartridges through which drinking water passes. The bactericidal property of silver kills any micro-organisms that may exist whilst contributing only minuscule quantities of silver to the actual water supply.

Hospitals, airlines, remote communities and, more recently, domestic households with cartridges attached to the incoming supply beneath sinks, use this technology in treating water. Significant growth is expected in this sector over the next five years.

Bearings

Steel bearings electroplated with high purity silver have greater fatigue strength and higher load-carrying capacity than any other type and are used in aircraft and rocket engine applications. For heavy-duty uses these bearings are plated with an overlay as silver itself possesses poor surface characteristics. In the main engines of the space shuttle, silver seals reduce friction and prevent sparks capable of igniting the shuttle's explosive liquid-oxygen propellant.

Table 5
Silver Fabrication in Industrial and Decorative Uses
(including the use of scrap)
Million ounces

	1985	1986	1987	1988	1989	1990	1991	1992	1993	**1994**
Europe										
Germany	17.10	17.40	17.40	19.20	21.50	22.31	21.09	20.00	18.64	**18.00**
France	6.60	6.60	6.90	7.60	8.60	8.70	8.50	11.67	10.51	**11.80**
Italy	6.40	6.90	6.90	7.40	7.60	8.00	8.30	10.64	11.19	**11.41**
UK & Ireland	9.00	9.20	8.70	8.50	9.40	10.29	10.13	9.97	10.29	**10.45**
Switzerland	-	-	-	-	-	5.30	5.95	6.21	5.76	**6.69**
Netherlands	0.50	0.80	0.70	0.70	0.70	1.66	1.66	1.66	1.66	**1.66**
Spain	-	-	-	-	-	1.93	1.93	1.86	1.83	**1.64**
Poland	-	-	-	-	-	0.64	0.45	0.45	0.51	**0.77**
Austria	0.50	0.50	0.50	0.50	0.60	0.62	0.62	0.62	0.62	**0.62**
Czech Republic	-	-	-	-	-	0.96	0.90	0.71	0.64	**0.61**
Belgium	0.40	0.40	0.50	0.40	0.40	0.32	0.32	0.32	0.32	**0.32**
Sweden	-	-	-	-	-	0.32	0.32	0.32	0.32	**0.32**
Other	-	-	-	-	-	0.72	0.72	0.72	0.72	**0.72**
Total Europe	40.50	41.80	41.60	44.30	48.80	61.77	60.88	65.15	63.01	**65.01**
North America										
United States	51.50	55.00	46.90	43.10	49.00	42.09	38.29	40.79	42.79	**46.71**
Mexico	1.20	1.20	1.00	1.00	1.10	3.85	3.85	3.85	3.85	**4.05**
Canada	9.10	9.60	10.40	11.00	12.00	0.54	0.54	0.54	0.58	**0.48**
Total North America	61.80	65.80	58.30	55.10	62.10	46.48	42.68	45.18	47.22	**51.24**
Central & South America										
Brazil	-	-	-	-	-	2.42	2.42	2.42	2.51	**3.22**
Argentina	-	-	-	-	-	1.29	1.29	1.29	1.29	**1.29**
Colombia	-	-	-	-	-	0.39	0.39	0.39	0.39	**0.39**
Peru	-	-	-	-	0.20	0.19	0.19	0.19	0.19	**0.19**
Other	-	-	-	-	-	0.55	0.55	0.55	0.55	**0.55**
Total Central & S. America	-	-	-	-	0.20	4.84	4.84	4.84	4.93	**5.64**
Middle East										
Turkey	-	-	-	-	-	1.03	0.98	1.14	1.24	**1.24**
Israel	-	-	-	-	-	0.61	0.65	0.71	0.77	**0.96**
Other	-	-	-	-	-	0.08	0.09	0.12	0.09	**0.09**
Total Middle East	-	-	-	-	-	1.71	1.71	1.96	2.10	**2.29**
Indian Sub-Continent										
India	-	-	9.70	11.20	9.86	13.61	17.89	19.32	28.92	**30.51**
Other	-	-	-	-	-	2.57	3.28	4.08	4.82	**4.02**
Total Indian Sub-Continent	-	-	9.70	11.20	9.86	16.18	21.16	23.40	33.74	**34.52**
Far East										
Japan	29.00	29.80	37.40	40.60	42.50	46.57	47.49	44.07	44.99	**50.52**
South Korea	-	-	-	-	1.00	2.30	4.00	4.00	8.47	**9.55**
Taiwan	-	-	-	-	-	3.00	2.77	3.38	3.63	**4.08**
Hong Kong	2.30	2.30	2.30	2.10	2.20	2.30	0.54	0.87	1.29	**1.93**
Indonesia	-	-	-	-	-	0.37	0.59	0.72	0.37	**0.34**
Thailand	-	0.60	0.70	0.80	1.10	0.00	0.00	0.00	0.00	**0.00**
Total Far East	31.30	32.70	40.40	43.50	46.80	54.54	55.39	53.04	58.75	**66.42**

Table 5
Silver Fabrication in Industrial and Decorative Uses
(including the use of scrap)
Million ounces

	1985	1986	1987	1988	1989	1990	1991	1992	1993	**1994**
Africa										
South Africa	-	-	-	-	-	0.48	0.28	0.22	0.53	**0.32**
Other	-	-	-	-	-	0.27	0.27	0.27	0.27	**0.27**
Total Africa	-	-	-	-	-	0.75	0.55	0.49	0.80	**0.58**
Australia	-	-	-	-	-	1.97	1.94	1.96	2.04	**2.16**
Western World Total	133.6	140.3	150.00	154.10	167.76	188.25	189.18	196.03	212.60	**227.88**
Other Countries										
Soviet Union/CIS	-	-	-	-	-	58.00	64.00	54.00	31.00	**29.00**
China	-	-	-	-	-	17.29	17.66	18.80	20.10	**22.50**
Total Other Countries	-	-	-	-	-	75.29	81.66	72.80	51.10	**51.50**
World Total	246.10	272.90	258.10	271.90	286.46	263.54	270.84	268.83	263.70	**279.38**

Industrial and Decorative

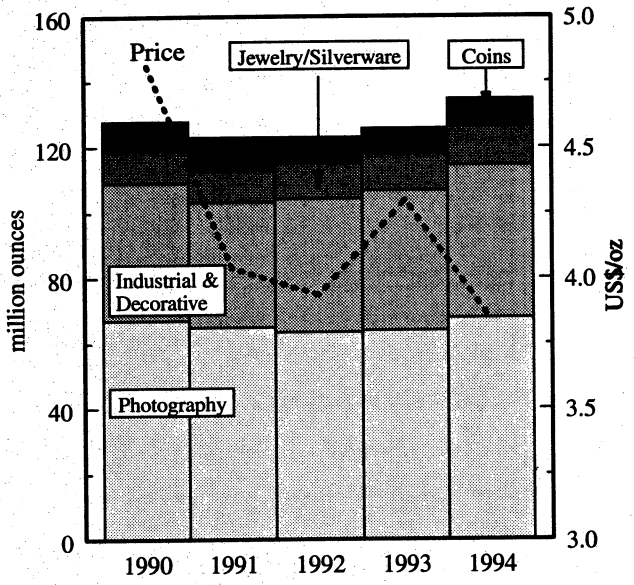
Industrial and decorative demand for silver in the Western World rose by 8.4% to 227.9 Moz (7,089 t) in 1994, thus confirming this sector as the premier user ahead of photography and silverware and jewelry. With the CIS and China included, the world total is 279.4 Moz (8,690 t). But this fabrication is concentrated; almost 77% takes place in just ten countries (including the CIS and China) and nearly 35% in just two, Japan and the United States. Japan is ahead of the United States as the largest user, while South Korea appears in the top ten because its fabrication has more than doubled in two years since 1992.

The definition of industrial and decorative is necessarily a broad one. Although electronics and brazing alloys are the major consumers, the strength of silver's industrial base is the diversity of its applications, some of which, like water purification, are experiencing fast growth. Overall, the category includes batteries, bearings, catalysts, dental, electroplating, glass coating, jari (the Indian silver thread), medical, mirrors, and musical instruments. In some countries it is not always possible to break out individual statistics for all these uses, but this has been done where possible. The statistics also show the total fabrication within a country, even though items like contacts, silver potassium cyanide or semi-fabricated products may be exported to end-users elsewhere.

The overall industrial demand for silver in the **United States** rose by 9% to 46.7 Moz (1,453 t), comfortably maintaining a steady upward trend for the second year in succession (see Figure 24).

All categories reflected the improvement, with *electronics* and *electrical*, the largest, improving by just over 14% to 20.9 Moz (650 t). Contacts performed particularly well, despite further research into minimizing contact areas and silver content in alloys. Growth was strong throughout 1994, with some manufacturers reporting rises of 8-15%. These levels of growth are expected to continue through to 1996, driven primarily by improving economics, increasingly complex devices and ever-increasing mechanization trends. These trends have been most noticeable in the automotive sector in which new models, with increased standard features, more options and improved safety measures, have been responsible. Similar trends have been recorded in the cellular telephone and electrical appliance industries. The Environmental Protection Agency's (EPA) campaign against cadmium has not been entirely successful, although where manufacturers have moved to the silver-tin-oxide alternative, this has not

Figure 24
US Silver Fabrication



so far resulted in any drop in silver consumption or content.

The increased consumption of silver in the manufacture of conductive adhesives, membrane switches and silver-palladium silk-screened circuit paths (the latter two using thick film paste) for both domestic and industrial appliances, account for much of silver's increase in the electronics sector. The rise in palladium prices during 1994 resulted in a move towards using higher silver content in circuit paths and solders. Demand for silver fuses and contacts in high-voltage utility applications has remained stable despite government deregulation of this industry. One supplier of silver powder and flakes to the electronics industry reported that growth rates had picked up to 20% year-on-year, above the trend of 10 - 15% per annum. The Semiconductor Industry Association (SIA) has reported a 40% rise in shipments last year, but miniaturization is limiting the impact on silver demand. In the contacts field, the shift away from silver-cadmium oxide alloys is not rapid, apart from the auto industry, which has basically eliminated the use of cadmium-bearing alloys. The principal reason that substitution is a slow process is cost: fabrication charges on silver-tin are up to three times greater than for silver-cadmium oxide.

Silver use in *batteries* is estimated at 3.4 Moz (106 t). The major application continues to be the small button-shaped silver oxide cell found most commonly in watches and hand-held electronic devices. The increased consumption of silver in this market has been due to the silver-oxide cell's size, price and power density advantage over its nearest competitors. With the continuing trend to smaller, more compact and more portable devices being manufactured both within the United States and in South East Asia, most of which are still being designed around the silver oxide cell, increasing consumption of silver will continue. This is particularly true of hand-held cameras for TV news, in which maximum power and minimum weight are paramount considerations. Rechargeable alkali cells and development of the lithium-ion cell will, however, impact negatively on silver usage in the future, as these systems are improved and their cost of manufacture is reduced. The manufacture of other silver batteries, including silver-zinc, silver-cadmium and magnesium silver cells, used predominantly in military applications, is also decreasing. This has been attributed to the loss of foreign market share to local manufacturers and global down-sizing of military operations.

Brazing alloys increased at a rate similar to that of the electrical and electronics sector, some manufacturers registering a record year. Total demand was 7.7 Moz (239 t). Despite EPA restrictions on certain alloys as environmentally hazardous, the strong economy has led to better sales of automobiles, motors and generators, while successive hot summers have helped demand for refrigerators and air conditioners. This has increased consumption of brazing materials necessary for their manufacture. Specifically, increased consumption was noted in the silver-based cadmium-free and copper phosphate high-temperature filler metals used in the heat control sectors. Increased exports of brazing materials were also recorded as expansion into developing economies, similarly experiencing an economic upturn, continued.

Measures aimed at reducing the consumption of tin-lead solders have not yet forced a full shift to the tin-silver alternative. The low price of lead and the capital invested in machinery suited to manufacturing and utilizing this alloy have slowed the move. As with brazing alloys, it is the original equipment manufacturer who ultimately dictates which solders will be used. Until they move to the more expensive

silver-based solders, estimated to take place within the next five years, increases in silver consumption will be modest. The use of silver-based solders in electronics, however, is growing. Due to practicalities such as the grain size of lead and the decreasing size of electronic devices, silver solders are proving more popular. Silver-filled epoxies, or conductive adhesives, are replacing solders in an increasing number of joining applications.

Demand for silver used in *mirrors* is relatively stable, at 1.4 Moz (44 t), with potential only for nominal growth. But at current silver price levels, little effort is being given to searching for substitutes for silver and, with its superior reflective properties, it is unlikely that consumption will drop. The use of silvered polyester film in televisions, light reflectors and domestic solar energy units account for the modest increase in consumption.

Consumption of silver in *catalysts* has risen by approximately 0.3 Moz (9 t) per year over the past six years to reach 4.3 Moz (134 t). This has been driven by increasing demand for plastics used in the manufacture of domestic electrical devices, polyester films and automotive paints.

Bearings account for 0.5 Moz (16 t) with good growth in recent years. Usage of silver bearings was in the past limited to high-performance, high-speed-and-load applications. These included wrist-pin bushings in locomotives and master rods in aircraft engines. Demand is increasing, too, in the plating of anti-friction high-speed turbine engines and in silver used as a dry-film lubricant in the space shuttle's engines. With technological advancements in space travel, demand for this component will increase.

Water purification use has risen to 2 Moz (62 t). Last year 20 million cartridges were sold in the United States, each containing on average 0.1 oz (3.5 g) of silver. Growth in demand for water purification systems in both industrialized and developing countries has been significant over the last three years. The manufacture of inexpensive domestic systems recorded growth rates of up to 60% during 1994 and were available in more than 60 countries. The EPA continues to issue stricter control measures relating to waste fluid emissions, and will not permit the use of silver infused carbon elements in the industrial sector. Growth has therefore been in under-the-sink type systems found in domestic households, accounting for approximately 90% of this sector.

Silver use in *musical instruments* is estimated at 75,000 oz (2.3 t). Growth of between 5% and 8% was experienced in the number of hand-made silver and nickel-silver instruments, particularly flutes and piccolos. This was attributed to a weakening dollar/yen exchange rate which has led to increasing exports to South East Asia and a decline in Japanese sales in that region.

Decorative *electroplating* continues to grow reaching 3.3 Moz (102 t) in 1994.

Glass coating absorbed 0.2 Moz (6 t). The consumption of silver in the manufacture of low emissivity glass experienced significant growth of approximately 10-15% during 1994. This glass serves to reflect radiant heat outwards, maintaining internal temperatures constant whilst allowing high percentages of natural light in. Energy conservation legislation is the driving force. This legislation set specific limits for building energy consumption, which took effect at the beginning of 1995. These limits require that total heat loss for an entire building be less than certain values. Only silvered glass will be able to meet these and further restrictions, which are now being implemented by Federal and state agencies. Architects have been restricted in the amount of non low-emissivity glass they can use on the exterior of buildings, so demand should increase. Silvered glass for use in automobile windshields is also increasing as pressure on CFCs, used in car air conditioners, increases. EPA restrictions curtailing vehicle exhaust emissions are putting pressure on vehicle manufacturers to develop electric models. In this event, power that is consumed for heat control purposes will severely hinder the performance of such vehicles.

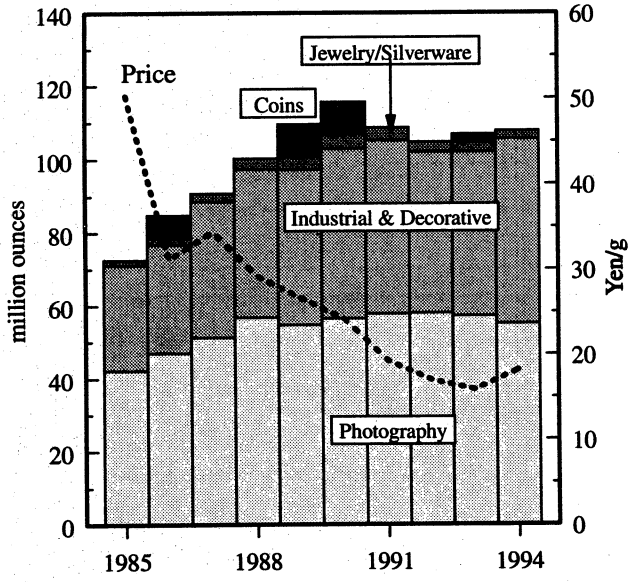
Dental/medical use is estimated at 1.4 Moz (44 t), of which amalgams require 1 Moz, dental reconstruction 0.3 Moz and medical 0.1 Moz. Growth in amalgams has been slow for several years and is now marginal. The issue of mercury content in amalgams has yet to be resolved and alternatives developed have proved brittle, with relatively short life-spans and requiring regular maintenance work. In reconstruction, although gold and palladium are often preferred as bases for porcelain, the sharp increase in palladium prices is causing more silver to be used.

Industrial fabrication in **Japan** rose by 12% to 50.5 Moz (1,570 t), helped by strong improvements in silver nitrate for non-photographic applications and in brazing alloys and solders (see Figure 25). Indeed, silver nitrate for electronics has now overtaken contacts as the principal industrial use, rising by 20% to 9.1 Moz (283 t). This increase is primarily due to the growing replacement of gold by silver for plating on lead frames, used extensively in the semi-conductor industry. The manufacture of contact points, requiring 8.6 Moz (267 t) of silver, remains well below its 1990 peak, but was stable in 1994. Local fabricators report rather conflicting trends in demand for different categories of contacts; modest growth for those used in high current applications, while for low current applications there was continued substitution. Furthermore, because of the strength of the yen, exports of contacts are now limited to those essential for specialized uses.

Brazing alloys registered an increase of over 20% to 4.7 Moz (146 t), boosted by a very hot summer in Japan which had manufacturers struggling to keep pace with surging consumer demand for air conditioners. The momentum of demand then remained for the rest of the year. The Japanese love of electronic gadgetry has also sustained the large local manufacture of silver oxide batteries at 3.2 Moz (100 t). Solutions for electro-plating were also maintained at 3.6 Moz (112 t), of which around 70% is for the electronics industry and the balance for decorative plating. Silver use in dental alloy increased by over 10% to 1.6 Moz (50 t) due to a growing market share for the alloy Kinpara 12, which contains 48% of silver and 12% gold by weight and is available on health insurance.

Figure 25

Japanese Silver Fabrication



Industrial fabrication fell marginally in **Germany** to 18.0 Moz (560 t), compared to 18.6 Moz (579 t) the previous year. The main use is in electronics, taking just over 10.5 Moz (327 t). The sector is dominated by the production of contacts and contact materials. Although demand in contacts was slightly less, manufacturers report that over the long term, silver use is moving ahead by 2-3% per year, with subtle fluctuations year-on-year, according to the economic growth cycle.

Brazing alloys and *solders*, by contrast, continue a steady decline, down another 7% to 4.2 Moz (131 t). Demand has suffered from the recession and a strong DM inhibiting competitive exports.

Other specialist uses, ranging from decorative plating to dental amalgams and mirrors recorded a 5.5% improvement to 3.0 Moz (93 t).

Overall industrial and decorative demand in **France** rose 12% to 11.8 Moz (367 t), back up to 1992 levels. The main sectors, *contacts* and *fuses*, turned in the best performance, rising over 30% to 6.4 Moz (198 t), good evidence that France is moving out of the 1993 recession. Export performance to Germany, Italy and the United Kingdom continued to be strong. Exports of electrical devices, notably contacts, now account for almost half French fabrication. *Brazing alloys* fell by 8% to 1.8 Moz (56 t), continuing their downward trend in both the domestic and export markets due to less unit silver use and the replacement of silver brazing alloys by other composite materials. Use in *batteries* was stable at 0.26 Moz (8 t). *Mirror* fabrication was steady at 0.16 Moz (5 t), and other specialist uses accounted for 0.22 Moz (7 t). *Plating salts*, mainly for decorative use in silverware and domestic jewelry, are also exported widely and amounted to 2.4 Moz (75 t) of fabrication. Exports to such markets as the United Kingdom, Singapore and Hong Kong, have almost doubled since 1992, and now account for over 80% of the plating salts fabrication in France.

Total industrial fabrication in **Switzerland** rose 16% to 6.7 Moz (208 t) due to growing export orders,

particularly in the electronics/electrical sector. By comparison brazing alloys and solders were steady at 1.8 Moz (56 t), but remained depressed at 30% below the 1991 level.

The industrial and decorative demand in the **United Kingdom** has been relatively flat during the 1990s, although registering a small improvement in 1994 to 10.5 Moz (325 t). *Electronic* and *electrical* applications form the main sector, using 4.6 Moz (143 t). The main increase in demand was for switches and contacts for the automotive industry (although growth in the UK was not so strong as elsewhere in Europe). The move from silver-cadium to silver-tin-oxide alloys is well underway. *Brazing alloys* and solders were slightly down at 2.3 Moz (72 t). Copper phosphate systems, particularly copper-phosphate-tin, were increasingly favored as filler metals in copper joints at the expense of silver-based alloys. *Electroplating* took 1.4 Moz (44 t), with the solutions used partly in electronics and partly for decorative applications. Consumption is improving because new regulations stipulate that in various electronic equipment plating must be thicker, while in the automobile sector there is a trend away from self-color copper and brass contacts towards high quality silver plated ones. *Water purification* demand rose by 55% to 0.8 Moz (25 t), helped by rapidly growing domestic and export orders for household and industrial filters.

Industrial fabrication in **Italy** rose 2% to 11.4 Moz (355 t). Manufacture is confined primarily to contacts for the electrical industry and brazing alloys. Contacts showed continued steady growth in 1994, up nearly 5% to 3.5 Moz (109 t), with a further 0.3 Moz (9 t) of silver used in the plating of contacts. New labor-saving technology has cut working costs on the production of brazing alloys, making them more competitive, so that exports have tripled since 1988. Total output was 2.2 Moz (68 t) in 1994. Use in mirrors is steady at 0.26 Moz (8 t), but the application of nitrates for making pastes for flat glass for the automotive industry has grown steadily to 0.5 Moz (16 t). Electroplating of silverware and jewelry has risen over the last two years, often as a replacement for sterling silver, to reach 2.7 Moz (84 t).

Overall, industrial and decorative use of silver in **Spain** has declined to 1.7 Moz (51 t), due to fewer units being produced and some substitution. In *electronics* solid rivets have been replaced by bi-metallic ones made of brass, with just the contact point in silver. In *brazing alloys* silver use declined by more than 30% in alloys for domestic use in refrigerators.

Although **India** has 30.5 Moz (947 t) of industrial silver manufacture, the principal consumer is the *jari* industry. Jari is the golden thread which is woven into silk or cotton cloth typically, but by no means exclusively, to embellish saris worn on special occasions such as weddings. Two forms of jari are produced in India. Real jari is based on silk thread, wound with a silver alloy wire and electro-plated with gold. Because of its ability to retain its lustre and, when necessary to be repolished, real jari is preferred for the manufacture of high-quality garments. The silver content depends on the alloy used and ranges from a low of 20% to a maximum of just under 70%. The other form is known as imitation jari and uses copper alloy wire instead of silver, which after silver plating is colored gold using a varnish. Although produced in larger quantities than real jari, its low silver content makes the imitation form a relatively small consumer of silver. The statistics for jari shown below cover both real and imitation jari.

Silver Use in Jari (Moz of silver)

1989	1990	1991	1992	1993	1994
2.9	3.4	6.7	8.7	9.6	9.6

The rapid growth in the consumption of real jari in India since 1990 reflects two quite separate phenomena. The first is the abandonment of gold control in 1990 which allowed manufacturers access to unlimited amounts of gold (in contrast to the previous arrangement whereby jari manufacturers were allowed a gold quota of only around 0.05 Moz (1.5 t)). The liberalization led to a rapid expansion in the capacity of real jari manufacturers, to an extent, at the expense of the imitation variety. The other factor behind the growth of real jari was the improvement in prosperity which has accompanied the economic reforms of the last several years, an important consideration given the price ratio of 7:1 between the two forms. The flat trend over the past two years is attributable to the impact on consumer spending of a lower pace of economic growth over this period.

Hong Kong is an important manufacturer of lead frames for semi-conductors, but much of the potassium silver cyanide (PSC) required is imported, and counted as fabrication in the country of origin. However, local production of PSC has grown rapidly in recent years and now amounts to 1.9 Moz (59 t), although close to two-thirds of this is used for decorative plating, often over the border in China. The selective plating in electronics with this local PSC is 0.7 Moz (22 t). A small quantity of silver nitrate, about 0.3 Moz (9 t), is also made locally for silver oxide batteries and mirrors, but again has to compete with imports.

China's rapidly growing economy and rising levels of individual wealth has prompted surging consumer demand for electrical appliances. This is most noticeable in the manufacture of *contacts*, most of which is now effected within China. The silver offtake for contacts alone is estimated to have risen by 20% in 1994 to reach 10.6 Moz (330 t). *Brazing alloy* production has also soared to 6.0 Moz (187 t) as the extreme ranges of temperature across the country have encouraged many Chinese businesses and households to place the purchase of air conditioners and refrigerators high on their list of priorities. Other industrial uses in *batteries, catalysts, cathodes, electro-plating* and *mirrors* also rose by 10% to around 5.6 Moz (175 t). Decorative plating is at 1.4 Moz (44 t). This brings total industrial use to 22.5 Moz (700 t) in 1994, up from 20.1 Moz (625 t) the previous year.

South Korea is now a significant industrial user of silver. The prime application is in *contacts*. There are five main contact manufacturers, whose combined requirement rose by 15% in 1994 to 4.5 Moz (140 t). This improvement was driven in part by good demand from the local automotive industry, but also by exports to Asian neighbors. Indeed, as South Korea becomes more competitive against Japan (because of the yen's strength), the export of contacts now exceeds demand in the local market, according to some manufacturers. The other major use of silver comes from the selective *plating* of lead frames, a growing industry in South Korea as its semi-conductor sector expands, especially in the manufacture of DRAMS (memory chips) of which it is now the world's largest producer. This plating is using 0.8 Moz (25 t), an increase of 30% in 1994. Silver powder for varied uses in *conductive coatings* and *batteries* accounted for a further 0.8 Moz (25 t), taking overall use in *electrical* to 6.1 Moz (190 t). *Brazing alloys* also had an excellent year, up 30% to 1.8 Moz (56 t), helped (as in Japan) by an unusually hot summer stimulating consumer demand for air conditioners and refrigerators.

The *electrical* and *electronics* industry is the main consumer of silver in **Taiwan**, accounting for 3.2 Moz (100 t) in 1994, an increase of 13%. The prime use is PSC for the plating of lead frames in semi-conductors, of which Taiwan is the world's largest manufacturer. Locally made PSC for electronics amounts to 2.1 Moz (65 t), but the industry supplements its needs with imports. The second main application is contact points, including those made by a large manufacturer of computer monitors. Contact manufacture rose 20% last year to 1.1 Moz (34 t). Taiwan also has three significant manufacturers of brazing alloys whose output rose 10% to 0.9 Moz (28 t). There is also modest use of silver in decorative plating, mirrors and chemicals, amounting to 0.7 Moz (22 t).

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 special reducing agents called developers. The resulting negative image is then converted to the positive by repeating the process under specific conditions. Approximately 5,000 color photographs can be taken using one ounce of silver.

Photographic products include: commercial or amateur film; graphic art materials and professional film for use in advertising, publishing, fashion etc.; sensitized photographic papers; x-rays or radiographic film for use in medical, dental and industrial applications; and motion picture film (the cinema, incidentally, celebrates its centenary in 1995).

Photographic film manufacturers demand very high quality silver (999.9 fineness) and are becoming increasingly selective in their choice of new metal from specific countries and refineries. Their data on silver loadings in the numerous film types remain tightly guarded due to the limited number of players in this competitive market. The recycling of photographic waste has also become a highly organized industry, particularly in countries such as Japan and the United States in which significant recovery rates of both silver and plastic are being achieved.

For many years, photography was the largest user of silver and it remains of great importance, although overtaken by industrial demand. In 1994, the photographic industry in the Western World required 206.7 Moz (6,429 t), an improvement of 3%. With estimates for China and the CIS included for the first time in this Survey, the world total is 219.3 Moz (6,821 t). However 56% of this demand is represented by just two countries, the United States and Japan; if Belgium, the United Kingdom, Germany and France are included, this rises to 88%. In those countries (and elsewhere) the industry is dominated by the three principal manufacturing groups, Eastman Kodak, Agfa and Fuji. Local manufacture is often limited to X-ray film (as in India). Even in an important industrial country like Italy, film has been made since 1989 with silver nitrate imported from France and Germany - and for that reason the fabrication is counted in those countries not Italy. The potential for future growth in China and eventually in the CIS (where photographic use has fallen in the 1990s) is considerable, as it is, too, in Asia/Pacific countries like Indonesia as popular color film is more widely purchased.

Photography remains easily the biggest user of silver in the **United States**, just outstripping all other fabrication combined. Last year fabrication rose by almost 6% to 67.8 Moz (2,109 t). Commercial film has now overtaken radiography as the largest sector, but between them they still command nearly a 70% share. Offtake in the smaller graphic arts sector has continued to fall, and it, too, now requires less silver than the generalized "others" category which includes motion picture film.

In commercial photography, over 80% of film sales consists of 35 mm color negative films. Growth in the last couple of years has been especially rapid in single-use cameras although their market share/ penetration is still much lower than in Japan (suggesting room for further growth). In 1994, close to 19 billion pictures were taken by "amateurs" in the US, 98% in color. The share of black and white continues to fall, but this has been due, in recent years, to an increase in the color sector with the decline in the number of black and white pictures taken having levelled out since the mid-1980s. So far, digital technology has barely touched the commercial sector. Expense, weight, cost, image quality and lack of "ease of use" has meant that even in the professional area of commercial photography, digital cameras have, so far, had little success. The threat to silver use from an ongoing decline in coating weights also seems to have receded somewhat. This is because there has already been a sharp fall in the amount of silver used for sensitizing as greater efficiency in the use of raw materials has been sought,

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

	1985	1986	1987	1988	1989	1990	1991	1992	1993	**1994**
Europe										
Belgium	16.00	17.20	17.40	18.80	18.80	19.29	19.48	19.87	20.58	**21.70**
UK & Ireland	8.30	8.10	10.40	12.30	13.00	12.44	12.99	13.60	14.76	**18.39**
Germany	10.60	10.40	10.50	12.10	12.50	16.08	16.56	15.75	15.43	**16.40**
France	7.60	7.70	8.40	11.20	10.80	10.90	10.90	14.47	14.89	**13.99**
Poland	-	-	-	-	-	2.89	2.25	1.61	0.96	**0.48**
Romania	-	-	-	-	-	0.48	0.39	0.32	0.26	**0.23**
Spain	-	-	-	-	-	1.61	1.45	0.64	0.35	**0.19**
Hungary	-	-	-	-	-	0.39	0.35	0.32	0.26	**0.19**
Netherlands	-	-	-	-	-	0.03	0.03	0.03	0.03	**0.03**
Czech Republic	-	-	-	-	-	0.64	0.48	0.16	0.00	**0.00**
Italy	3.20	4.20	3.50	1.90	1.60	0.00	0.00	0.00	0.00	**0.00**
Other	2.40	3.50	2.40	0.70	0.40	-	-	-	-	**-**
Total Europe	48.10	51.10	52.60	57.00	57.10	64.75	64.87	66.76	67.52	**71.60**
North America										
United States	57.90	55.40	60.20	62.50	65.20	67.00	65.01	63.50	64.01	**67.81**
Mexico	4.50	4.30	3.90	4.00	4.00	2.25	2.25	3.22	3.86	**3.86**
Canada	-	-	-	-	-	2.89	1.93	0.00	0.00	**0.00**
Total North America	62.40	59.70	64.10	66.50	69.20	72.14	69.19	66.72	67.87	**71.67**
Central & South America										
Brazil	-	-	-	-	-	2.57	2.57	2.57	2.64	**3.22**
Argentina	-	-	-	-	-	0.80	0.80	0.80	0.80	**0.80**
Total Central & S. America	-	-	-	-	-	3.37	3.37	3.37	3.44	**4.02**
India	-	-	4.10	4.80	4.80	5.63	2.57	2.57	2.25	**1.61**
Far East										
Japan	42.20	47.00	51.30	56.80	54.80	56.50	57.80	58.02	57.20	**55.07**
Taiwan	-	-	-	-	-	0.10	0.10	0.10	0.10	**0.60**
Indonesia	-	-	-	-	-	0.10	0.13	0.16	0.16	**0.19**
Total Far East	42.20	47.00	51.30	56.80	54.80	56.70	58.03	58.28	57.46	**55.86**
Australia	-	-	-	-	-	2.25	2.25	2.25	2.09	**1.93**
Western World Total	152.70	157.80	172.10	185.10	185.90	204.84	200.28	199.95	200.63	**206.68**
Other Countries										
China	-	-	-	-	-	4.34	4.43	4.68	5.10	**5.60**
Soviet Union/CIS	-	-	-	-	-	10.00	9.00	8.00	7.20	**7.00**
Total Other Countries	-	-	-	-	-	14.34	13.43	12.68	12.30	**12.60**
World Total	-	-	-	-	-	219.18	213.71	212.63	212.93	**219.28**

initially in response to the spike in the silver price at the start of the 1980s and, latterly, due to tougher competition in the market putting pressure on costs generally. Coating weights have halved from 0.03 oz/ft^2 (10 g/m^2) to 0.014 oz/ft^2 (4.5 g/m^2). Both Kodak and Fuji have come up with new processes for coating color paper which require less silver. Nevertheless, volume growth has been sufficient to result in modestly rising consumption. Additionally, the amount of photographic paper being produced for the commercial sector is growing quite rapidly because of rising demand by consumers for larger prints and multiple copies. But one potential economy is the so-called "T-grain" technology, which involves altering the shape of the silver nitrate grain to that of a "T" (in fact, more like a downward pointing triangle). The

"T-shape" captures more light, thereby allowing for a lower silver usage. On the other hand, some products are actually using more silver these days. In part, this is because quality of product has become an important determinant of market share and lowering the silver content does tend to compromise this objective. Average coating weights for films, therefore, are holding up. Furthermore, at the prevailing price level, silver accounts for only 9% of the costs of commercial papers and films. Pressure for substitution or economization has therefore lessened.

Radiography is dominated by medical X-rays (around 90% share) due to their higher volume and the fact that they are double-coated (unlike industrial X-rays). Silver accounts for 50% of the variable cost and 25% of the total cost of medical X-ray film. There is still, therefore, an incentive to economize and pursue alternative, silverless technologies. However, despite the advances in digital imaging, it is felt that hard copies in the form of X-rays will still be required, if only for legal reasons, because it is too easy to alter "digital evidence" (a factor which by contrast will encourage the use of digital technology in the commercial sector).

Graphic arts demand is under more immediate threat from digital imaging. Already, a sharply declining trend in silver requirements has been established. Better computer software is also facilitating the manipulation of images which can be more easily/rapidly stored and retrieved (and more cheaply) on the latest generation of PCs. However, there is still significant capital expenditure involved in moving over to digital technologies and this is slowing, somewhat, the process of substitution. Nevertheless, over the past two years alone there has been a greater than 10% decline (cumulatively) in silver requirements for graphic arts.

The most important component of the "others" category is motion picture films (of which there are three types: camera, intermediate, print) which account for nearly 40% (with microfilms and aerial films also significant). Silver use for movies has increased strongly in the past two years through a change in the strategy of the distributors, with shorter releases or runs of individual films which are, however, distributed more widely. Blanket distribution has required the making of far more prints of each film to achieve the necessary coverage.

In **Japan** the photographic industry is dominated by a handful of major manufacturers producing a complete range of products from X-ray film to pre-loaded single-use cameras. The manufacturing process is generally highly integrated right through from the in-house production of silver nitrate to film manufacture and processing. While the domestic Japanese market remains the major consumer of these products, substantial volumes are also exported, mainly to North America and, increasingly, to the rapidly growing Asian economies. However, the future trend appears to be one oriented to offshore growth rather than domestic expansion on the part of the major producers, several of whom already have plants operating in Europe and North America, with others planned. While the domestic photo market will recover in line with the economy, the yen's appreciation may see a greater share of the domestic market going to importers, whose presence was already being felt more keenly in 1994.

Published figures as well as unpublished data indicate that overall silver use by Japan's photographic industry contracted slightly in 1994 to 55.1 Moz (1,714 t). While it is possible that the figures underestimate the absolute size of the market (due mainly to underestimation of scrap recovery levels) traders, refiners and producers reported unanimously that silver use in the photographic industry was at best flat and probably fell slightly. There were several reasons for this, not least being the yen's appreciation which served to encourage imports and placed downward pressure on prices. A significant development was the tie-up between a major European manufacturer and one of Japan's largest supermarket chains to market cut-price film, although imported brands still represent only a fraction of the market.

For Japanese producers, the performance in the various market sectors varied widely and, while volumes of film produced (normally expressed in square metres) grew in some areas, goals to reduce the silver loading in film and papers are, to some extent, still being met. The manufacturing of X-ray film increased by nearly 6%, although part of this went to build inventory and feed a strong rise in exports. The largest sector of the market, color roll film, also grew by almost 9%, aided by a 14.5% growth in exports, offset by a small drop in domestic sales. In the color roll film sector, one of the most successful recent developments has been the single-

use camera, known in Japan as the "lens camera". However, in 1994 production of these units declined as manufacturers and the retail trade sought to reduce high inventory levels. These cameras now account for an estimated 20% of all color roll film sales, offering not only convenience to the consumer but to the manufacturers, greater opportunity to recycle silver. Production of black and white film, both for still and movie film, declined. The weakest performance, though, came in the manufacture of photographic paper due in part to a problem over exports of photographic paper to the US market. Production of both color and black and white paper declined, offset to some extent by increased imports.

After the downward trend in photographic use in **Germany** in the early 1990s, a good improvement of 9% was reported for the three main manufacturers of film. This growth was due, in part, to improved paper exports to the United States as a result of anti-dumping duties levied on Japan, thus making German material more competitive. The fabrication level is also helped by increasing exports of silver nitrate for use in film in other countries, notably Italy. The resulting rise in photographic use, including this exported nitrate, takes German fabrication to 16.4 Moz (510 t), up from 15.4 Moz (479 t) the previous year.

In **Belgium** photographic use rose just over 5% to 21.7 Moz (675 t). The main application in Belgium itself is X-ray and other specialized film, but considerable quantities of silver nitrate are also fabricated for export within Europe.

The **United Kingdom** has shown a steady rise in silver required for photography during the 1990s, mainly because of improved exports of silver nitrate. Silver use has risen from 12.4 Moz (387 t) in 1990 to 18.4 Moz (572 t) in 1994. While the prime use is in color film, there is a significant niche in black and white film.

Virtually half of all silver fabrication in **France** is in silver nitrate for the photographic industry in France itself (which accounts for 50% of demand) and in neighboring European countries. There was a fall of 6% to 14.0 Moz (435 t) in 1994 due to loss of export orders for Italy.

Although commercial and X-ray film is made in **Italy**, since 1989 all silver nitrate required by the manufacturers has been imported from France and Germany and is counted in the fabrication numbers for those countries. Similarly, in **Canada** for several years now all silver nitrate required for sensitizing film has been imported and is counted in the source countries.

After a number of years of static demand, photographic use in **Brazil** improved by 22% to reach 3.2 Moz (100 t). In **Mexico** fabrication has been steady at 3.9 Moz (120 t) for the last two years.

The photographic industry has long viewed **China** as a great potential market for the future. That forecast is slowly becoming reality. There are now at least six film manufacturing plants, in such cities as Beijing and Guangzhou, to which the official allocation of silver was increased in 1994 to 5.6 Moz (175 t).

Direct fabrication for photography in **India** continued a steady decline, down another 28%, to 1.6 Moz (50 t) as photographic companies increasingly re-package "jumbo" rolls of imported film under their own label. Only a modest quantity of X-ray film is actually made locally.

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 utilise the metal's reflecting power and to enhance the play of light on silver's already bright surface. Pure silver (999 fineness) does not tarnish, but in order to make it durable enough for jewelry, it is often alloyed with small quantities of copper. It is also widely used in combination with base metals in gold alloys.

Silver is also used in the form of solders in the manufacture of jewelry. These typically have a silver content of 80-99% silver.

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". The former includes bowls, chalices, tea pots, jugs and coffee pots, and is manufactured both by machine and handcraft, whilst the latter refers to knives, forks and spoons, produced from sheet or strip metal, generally by machine. Sterling silver is harder than pure silver and is capable of attaining far wider properties through heat-treatment.

Fabrication of silver in jewelry and silverware declined by 15% in the Western World in 1994 to 206.2 Moz (6,414 t); with the CIS included, this total rises to 208.3 Moz (6,470 t). No estimate was made for China, although there is some informal production, but not apparently supplied by formal allocations from the government. The decline occurred in all three of the main manufacturing countries, India, Thailand and Italy, which between them account for 61% of the fabrication (see Table 7). While the rise in the silver price had some effect on output, more important local considerations in each country accounted for the change. Notably, in India, high levels of trade inventory had been built up in 1993 after the liberalization of imports and these had to be worked off, while in Italy the local political and economic crisis has had considerable effect. Thailand was influenced by lower export orders and competition from Indonesia. In fact, these may prove to be short-term setbacks and output could improve again in 1995.

In general, the most noticeable feature is that silverware in many countries is more vulnerable than jewelry, partly because of social trends away from heavy sterling silver flatware and hollow-ware and sometimes tax restrictions on their uses as corporate gifts. Jewelry is the more buoyant sector, because it is popular with young people. In South Korea, for instance, tax is inhibiting corporate silverware purchases, while jewelry demand rose because a popular hero in a local soap opera on television gave his girl-friend silver jewelry.

India is well established as the major user of silver in a wide range of ornaments and silverware, although fabrication fell by 25% to 59.0 Moz (1,835 t), compared with 78.8 Moz (2,451 t) the previous year. Indeed, it still accounted for nearly 30% of world fabrication in this sector. Silver jewelry and tableware have been closely interwoven with social customs in India for generations. Silver ornaments are offered as gifts to girls and women throughout their lives from birth, to birthdays, to marriage. Silver tableware is widely used in the home among Hindu (though much less so in Muslim) families. The liberalization of imports and other controls on silver from February 1993 (gold was liberalized the previous year) has transformed the retail trade. Thousands of new shops have opened selling both gold and silver, so that much fabrication, especially in 1993, represented the build-up of stocks for these new retailers. Each shop may well open with a stock of 5 kg (160 oz) of gold and 50 kg (1,600 oz) of silver; with an estimated 200,000 new shops the scale of inventory building is clear. This is the principal explanation for the decline in fabrication in 1994, as the rush to manufacture stock for these new shops was over, and they had to settle down and start selling. Thus 1994 was a transition year, working off some of the trade inventory. In 1995 and 1996, a much clearer picture of the regular annual demand will emerge.

Many of these retailers are also quite new to the business and their fortunes may be mixed. But, large or small, every retailer has both a gold and silver section. In a medium-sized establishment, gold will occupy the ground floor, silver the floor above.

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

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Europe										
Italy	14.30	22.60	28.20	28.60	33.90	37.70	42.50	48.23	43.40	**36.65**
Germany	6.40	8.50	11.20	12.70	12.70	13.21	14.50	13.50	11.57	**10.61**
Greece	-	-	-	-	-	3.22	3.38	3.54	3.70	**3.86**
Spain	-	-	-	-	-	3.80	4.00	3.50	3.37	**3.06**
UK & Ireland	1.80	1.70	2.00	2.00	2.20	1.96	1.83	2.15	2.64	**2.76**
Portugal	-	-	-	-	-	1.99	1.96	2.03	1.83	**1.32**
France	2.80	2.80	2.30	2.50	2.70	2.80	2.50	1.32	1.45	**1.32**
Poland	-	-	-	-	-	1.35	0.96	0.93	1.13	**1.19**
Denmark	-	-	-	-	-	0.87	0.87	0.87	0.87	**0.87**
Finland	-	-	-	-	-	1.16	1.22	1.00	0.84	**0.84**
Norway	-	-	-	-	-	0.64	0.64	0.68	0.71	**0.71**
Sweden	-	-	-	-	-	0.48	0.48	0.48	0.48	**0.55**
Switzerland	-	-	-	-	-	0.64	0.58	0.58	0.45	**0.42**
Austria	0.20	0.20	0.20	0.20	0.20	0.48	0.48	0.48	0.48	**0.39**
Cyprus & Malta	-	-	-	-	-	0.23	0.23	0.26	0.26	**0.35**
Netherlands	0.50	0.50	0.50	0.50	0.50	0.39	0.42	0.39	0.35	**0.29**
Czech Republic	-	-	-	-	-	0.26	0.26	0.23	0.19	**0.19**
Other	7.10	11.00	8.90	10.80	11.60	0.40	0.40	0.40	0.37	**0.37**
Total Europe	33.10	47.30	53.30	57.30	63.80	71.57	77.20	80.56	74.08	**65.66**
North America										
United States	9.30	8.50	8.00	6.40	5.80	9.81	9.71	10.90	11.29	**11.99**
Mexico	2.30	2.20	2.00	2.10	2.10	8.04	8.68	9.00	9.16	**8.68**
Canada	-	-	-	-	-	0.61	0.61	0.45	0.29	**0.29**
Total North America	11.60	10.70	10.00	8.50	7.90	18.46	19.00	20.35	20.74	**20.96**
Central & South America										
Brazil	-	-	-	-	-	1.80	1.70	1.61	1.77	**2.31**
Argentina	-	-	-	-	-	0.96	0.96	0.96	0.96	**0.96**
Peru	-	-	-	-	2.40	1.29	0.96	0.64	0.64	**0.71**
Ecuador	-	-	-	-	-	0.32	0.32	0.32	0.48	**0.61**
Other	-	-	-	-	-	0.96	0.96	0.96	0.96	**0.96**
Total Central & S. America	-	-	-	-	2.40	5.33	4.90	4.49	4.81	**5.55**
Middle East										
Turkey	-	-	-	-	-	4.12	3.91	4.58	4.97	**4.95**
Israel	-	-	-	-	-	-	-	-	1.77	**1.93**
Egypt	-	-	-	-	-	1.50	1.64	2.19	1.80	**1.78**
Saudi Arabia	-	-	-	-	-	0.21	0.28	0.36	0.37	**0.34**
Other	-	-	-	-	-	0.49	0.49	0.49	0.49	**0.49**
Total Middle East	-	-	-	-	-	6.32	6.32	7.62	9.39	**9.48**
India	-	-	6.30	6.40	10.90	23.03	22.31	36.13	78.80	**59.00**

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

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Far East										
Thailand	-	5.30	6.60	7.40	10.10	24.10	20.05	31.57	38.54	**29.12**
South Korea	-	-	-	-	4.30	4.50	5.30	5.00	7.20	**6.40**
Indonesia	-	-	-	-	-	1.07	1.13	1.22	1.45	**2.30**
Japan	1.40	1.70	2.20	3.00	3.50	3.80	3.50	2.80	2.49	**2.22**
Myanmar, Laos & Cambodia	-	-	-	-	-	1.00	1.00	1.00	1.00	**1.00**
Hong Kong	0.90	0.90	0.90	0.80	0.90	0.90	0.96	0.96	0.96	**0.96**
Vietnam	-	-	-	-	-	0.30	0.30	0.30	0.40	**0.50**
Taiwan	-	-	-	-	-	0.40	0.40	0.50	0.48	**0.48**
Malaysia	-	-	-	-	-	0.30	0.35	0.39	0.45	**0.35**
Philippines	-	-	-	-	-	0.23	0.24	0.26	0.27	**0.29**
Singapore	-	-	-	-	-	0.20	0.20	0.10	0.10	**0.00**
Other	2.50	3.00	9.30	9.60	14.30	-	-	-	-	**-**
Total Far East	4.80	10.90	19.00	20.80	33.10	36.79	33.43	44.09	53.34	**43.61**
Africa										
Morocco	-	-	-	-	-	0.41	0.40	0.39	0.35	**0.35**
Algeria	-	-	-	-	-	0.32	0.29	0.26	0.23	**0.23**
Libya	-	-	-	-	-	0.32	0.29	0.26	0.23	**0.23**
Tunisia	-	-	-	-	-	0.16	0.16	0.16	0.16	**0.16**
South Africa	-	-	-	-	-	0.05	0.04	0.04	0.03	**0.06**
Other	-	-	-	-	-	0.16	0.16	0.16	0.16	**0.16**
Total Africa	-	-	-	-	-	1.41	1.34	1.26	1.16	**1.19**
Australia	-	-	-	-	-	0.54	0.54	0.54	0.57	**0.60**
Western World Total	49.50	68.90	88.60	93.00	118.10	163.47	165.04	195.05	242.90	**206.15**
Soviet Union/CIS	-	-	-	-	-	4.60	3.50	2.70	1.80	**2.10**
World Total	-	-	-	-	-	168.07	168.54	197.75	244.70	**208.25**

While the gold displays are mainly of wedding "sets" of necklace, armband, ring, nosepin, bangle and earrings, the silver section offers an immense selection of coins, medallions, and small ingots (like the one shown on the cover of this Survey), which serve as house-warming presents for newlyweds or for guests at the wedding. Household articles, ranging from a pair of silver lamps to vases large and small, dishes, goblets and plates, without which no middle-class Indian couple could entertain their peer group. Also on display are articles of special cultural and religious significance: solid silver crowns for embellishing the images of the pantheon of Indian deities found in homes and places of worship and ornaments of personal adornment, which are traditionally produced in silver rather than gold. No Hindu girl would wear a *payal* (ankle chain) made of anything but silver. Since even the youngest children are given these to wear, by the time a young woman reaches maturity, she may have amassed a collection of *payals* of varying weights, designs and even functions. In the southern state of Tamil Nadhu, for instance, there has long been a tradition of heavy *payals* often with tinkling bells for dancing, which will also be worn with a silver waist-chain. Cultural tradition is important, too, in the tribal belt of northern India, where increasing prosperity is enabling people to switch from ornaments in copper to silver.

Although jewelry and silverware industries showed

good growth in **Italy** during the late 1980s and early 1990s, fabrication has declined in the last two years. In 1994 the total was 36.6 Moz (1,140 t) compared with 48.2 Moz (1,550 t) in 1992. Previously the strongest growth had been in silverware as the relatively low silver price made cutlery and tableware accessible to broad sections of society. New technologies were developed and new equipment installed in the factories of the Veneto region, Alessandria, Milan and Palermo (Sicily). By 1992, silverware production was 39.5 Moz (1,229 t). Since then, it has fallen by 33% to 26.5 Moz (824 t) in 1994.

The decline began in the second half of 1993, when Italy's domestic, political and economic crisis undermined local demand. The biggest decline has been in the traditional heavy cutlery and tableware articles. In an increasingly uncertain economic climate, with the value of the lira falling fast, families simply have not invested in silverware. Although manufacturers have sought to diversify into export markets - Italian silverware is doing well in the United States and Germany - this diversification has not been able to compensate for the weak domestic market.

However, the demand has grown for gift items, such as picture frames, icons, boxes and light tableware, produced particularly around Florence. The articles now account for 60% of production, compared with 20% in the early 1990s. Their manufacture requires a very fine laminate, which has become the speciality of Italian semi-fabricators.

Silver jewelry fabrication, located mainly in Arezzo and Vicenza, has risen to over 10 Moz (311 t). The domestic market is small, because Italians prefer gold, but business has grown through good orders for silver chain from the United States and the Far East.

During the 1990s, the silver jewelry manufacturing industry in **Thailand** has grown rapidly to become one of the largest in the world. High levels of exports have been established to the United States, Japan and Europe. A sharp contraction of the industry took place, however, during 1994. Fabrication fell by close to 24% to around 29 Moz (905 t), compared with 38.5 Moz (1,199 t) the previous year. The reason was not so much the higher price of silver, but poor demand in Europe and increasing competition from lower cost Asian centers, such as Indonesia. The exceptionally fast growth of the industry in recent years has also led to some manufacturers reportedly over-expanding with heavy investment in expensive equipment, in anticipation that export orders would continue to rise. A number of leading Bangkok manufacturers interviewed all confirmed that their volumes were variously down between 5% and 30%.

This contraction has affected the entire structure of the trade, which is dominated by a few companies (several of whom have the capacity to use individually well over 1 Moz (31 t) annually), although a substantial part of their production is sub-contracted out (mainly the casting and polishing) to hundreds of smaller workshops. These workshops suffered most in last year's setback.

Production levels aside, the most important change in the Thai silver market in 1994 was the reduction of import tariffs. From October, the duty on silver bars fell from 15% to 5% and on silver grain from 35% to 5%. These duties may be cut further this year. This has led already to more direct imports of silver from Australia, whereas in the past most silver supplies have come unofficially from Singapore or, to a lesser extent, from Hong Kong, China and Myanmar (Burma). The liberalization of imports will make it easier to monitor Thai fabrication levels more accurately (as has happened in India). The difficulty in judging the fabrication based on apparent exports is that, although most of the jewelry is of solid pieces of 925 fine (22.2 carat), they may be set with diamonds, semi-precious stones or marcasite. Some local trade estimates suggest that only 40% is plain silver jewelry; the rest is set with some kind of stone, which has a significant influence on the reported weight and value of exports. Silverware, by contrast, accounts for a small proportion of output, perhaps 5% or less according to Bangkok traders.

Both silverware and silver jewelry fabrication have shown a steadily rising trend in the **United States** in the 1990s, having overcome the setbacks of the exceptional silver price of 1980. Last year, total fabrication was 12.0 Moz (373 t), up 6%. Silverware, usually 925 fine, whose production is still concentrated in the north-eastern states, required 6.2 Moz (193 t). Cutlery (flatware) accounts for 80% of this fabrication and does not face too much competition from imports. By contrast, hollow-ware, whose production process is more labor-intensive, has to match imports from Italy and Thailand. Silver

jewelry manufacture was up 7% to 5.8 Moz (180 t). Although the jewelry industry has been located historically in New England, there is also considerable fabrication of native American style jewelry in Arizona and New Mexico. The lightweight jewelry and trinkets appeal particularly to tourists visiting those states. In general, silver jewelry enjoys a vogue with young people, which has stimulated a 40% improvement in US fabrication in the 1990s, quite apart from imports.

Jewelry and silverware fabrication in **Germany** have shown a steady and significant decline in the 1990s, falling to 10.6 Moz (330 t), compared with 14.5 Moz (451 t) in 1991. Strong competition from manufacturing centers such as Thailand, where labor costs are lower, has been the problem. Indeed, the fall in German fabrication exactly matches the rise in Thailand.

In jewelry, fabrication by companies employing more than 20 workers (which must declare their turnover), fell by 7% in 1993 and a further 17% in the first nine months of 1994. Imports of silver jewelry (over 40% from Thailand) amounted to close to 3.0 Moz (93 t), actually exceeding the domestic production, estimated at 2.6 Moz (81 t).

Silverware has suffered an even sharper decline. Although fabrication grew strongly prior to 1991, it has since collapsed. The value of cutlery produced fell 46% between 1991 and 1993, declining another 15% in the first half of 1994. Tableware initially reacted less; down 19% from 1991 to 1993, but then slipped 20% in 1994. Total fabrication is now estimated at 8.0 Moz (249 t).

Although fabrication in silverware and jewelry in the **United Kingdom** remains well below the levels of the 1970s, there has been steady growth in recent years to reach 2.8 Moz (86 t) in 1994. The improvement has come primarily through more use of silver in such accessories as key-rings, money clips, pill boxes and even curiosities such as hollow gavels. Silver jewelry is also selling well among teenagers and younger women. In contrast, tableware producers still face a stagnant market. However, over the past ten years hallmarking data reveals that the average weight of articles submitted has risen by 70%, reflecting the lower silver price. Hallmarking is still required on all silverware or jewelry articles above 7.7 g (0.24 oz).

Manufacture of silver jewelry in **France** is relatively stable at 1.3 Moz (40 t) according to the official Assay Office. Virtually no solid silverware is made in France.

Spain achieved high levels of silverware output in the early 1990s, when the silver price was under $4.00, the peseta was relatively strong against the dollar and banks were promoting silverware, offering attractive credit terms. However, during the last two years, fabrication has fallen off sharply due to local economic weakness and the challenge of imports from Italy. Domestic output is 2.1 Moz (65 t). Jewelry manufacture, helped by sales to tourists and exports, has been maintained at 0.96 Moz (30 t).

Silverware and jewelry fabrication in **Greece** has experienced good growth over the last few years to reach 3.9 Moz (120 t). Silverware accounts for 70% of the output, because Greek people are fond of it in their homes. Low prices have also encouraged gifts of silverware at the expense of other items such as crystal. There are 15 medium-sized manufacturers and many small workshops, usually making articles of 800 fine. Exports are increasing, notably to the United States. Silver jewelry is popular with tourists, who account for 50% of all purchases, because they like Greek styles and the relatively low costs. Jewelry exports are now going to the former Yugoslavia and Eastern Europe.

Silverware and silver jewelry manufacture is a significant industry in **Turkey**, accounting for 5.0 Moz (155 t) annually, more than 80% of all silver fabrication. The silverware, often beautifully hand-beaten and varying between 900 and 950 fine, is made in small ateliers, of which there are more than one hundred in Istanbul's Grand Bazaar and others in the bazaars of Ismir and Ankara. The reputation of Turkish silverware secures good exports to Europe and North America, as well as to the Middle East, particularly the Gulf States. Although the local economic crisis in 1994 made business difficult, silverware manufacture was maintained at 3.5 Moz (108 t). The silver jewelry made in Turkey is primarily for tourists and for export to Dubai (which has a large Indian population). Output was stable at 1.5 Moz (47 t).

Demand for silver in silverware and jewelry has been increasing steadily in **Israel** in recent years, to reach 1.9 Moz (59 t) by 1994. Silverware, which

accounts for 80% of the fabrication, has been rising because of the success of Judaica silverware and the increasing use of electro-forming techniques for candlesticks and bowls. Jewelry manufacture, using the same techniques, is also growing.

Egypt has for many years been a significant manufacturer of jewelry and silverware, with 2,000 silver workshops, albeit most of them very small. Fabrication has been sustained at 1.8 Moz (56 t) for the last two years, down from a 1992 total of 2.2 Moz (68 t) because of poor tourist trade due to terrorist attacks. A special export order for silverware also boosted the latter year. All silverware and jewelry is stamped by the government Assay Office to confirm purity; for the local market silverware is normally 800 or 900 fine, while exports are 925 or 950 fine. Jewelry represents the largest part of the market, with pendants of ancient Pharaohs being popular with tourists.

Silver jewelry, rather than silverware, predominates in **Saudi Arabia**, where strict adherence to Islamic law prohibits the use of precious metals in eating utensils. But use in jewelry, which until recently has been primarily as a component of alloys for carat gold jewelry, is now increasing. One leading manufacturer in the capital, Riyadh, has been switching his production from gold to silver jewelry since 1992 and has plans for further expansion in 1995. This action has come partly as a response to stiff competition in gold jewelry, for which Saudi Arabia has many new factories. Already, Saudi Arabia fabrication is 0.3 Moz (9 t).

Elsewhere in the Middle East, the demand for silverware and jewelry is limited, although in **Lebanon** there are signs of fabrication reviving after the devastating civil war. In the 1970s, Lebanon was a significant distribution and manufacturing centre, handling up to 3 Moz (93 t) annually, but fabrication now amounts to no more than 0.1 Moz (3 t). **Syria** continues to make small quantities of ornate silver jewelry, often set with semi-precious stones. In the **Gulf States** there are an increasing number of shops in the souks specialising in silver, but most of the items are imported from Italy, Turkey or India. The Kuwait Assay Office stamped 17,103 oz (532 kg) of silver items in 1994, mainly imported; 1,639 oz (51 kg) went through the Assay Office in Bahrain. In the **United Arab Emirates** and **Oman**, there are several small workshops making silver ornaments, mostly with craftsmen of Indian origin. But even there, the silver shops in the souks sell mainly imported jewelry. Dubai wholesalers, for instance, send silver to Turkey for manufacture. Thus, actual fabrication in the Gulf States is no more than 0.2 Moz (6 t).

South Korea's jewelry fabrication increased 15% to 2.6 Moz (81 t), spurred by an episode of a popular soap opera on television, in which the leading man presented silver jewelry to his girlfriend. His gift prompted a wave of similar tokens of love by teenagers across the country, enhancing an existing vogue among the younger generation for rings and chains. The underlying demand for silver is also benefiting from increased carat gold jewelry sales, in which silver is used as an alloying element.

By contrast, silverware fabrication was down at least 10% to 3.8 Moz (118 t). Silverware sales in South Korea are dominated by solid silver spoons, which are traditionally given at births, weddings or as Lunar New Year or Thanksgiving Day presents. Indeed, silver spoon-making is a major industry, with over 400 workshops, usually small, family-run operations. Spoons with 80% silver content are most popular, but they are available up to 999.9 fine. Every household has a few sets of spoons. However, the custom among families is waning and the trend has been towards spoons as corporate gifts. Last year, government tax regulations began to inhibit such gifts, leading to the fall in fabrication.

In **China**, the manufacture of silverware and silver jewelry is still limited, because of a shortage of official supplies from the People's Bank of China, which allocates most silver to photographic and industrial applications. Only an allotment of 1.5 Moz (47 t) is made for decorative plating, which would cover some electroplating of silverware. Otherwise fabricators, for the moment, have to look to local scrap for metal or are sent silver by Hong Kong companies for fabrication and re-export (as already happens extensively in gold). But the number of silver fabricators working with Hong Kong metal is still very limited. Overall, silverware and jewelry could account for up to 2 Moz (62 t). In our analysis, however, this is included under Industrial and Decorative uses as shown in Table 5.

In **Hong Kong** itself, capacity for making silverware and silver jewelry has declined over the last

20 years. There are scarcely one hundred specialist silver workshops left, and operations are moving increasingly to China. What remains is mainly the fabrication of high quality, hand-made jewelry and a limited amount of solid silverware totalling, in all, no more than 1 Moz (31 t) annually.

Taiwan's silver jewelry industry is made up of many small, family-owned workshops, which produce both solid and plate jewelry. However, they are facing increased competition from Thailand, both on the home front and in export markets, so that output is stable at a modest 0.5 Moz (16 t). Silverware is rarely seen except in the most expensive stores.

Elsewhere in South-East Asia, the most substantial market for silver jewelry is **Myanmar** (Burma). The country has several silver mines, whose precise output is not known, but there are sales of silver by the government from time to time. Some of this is exported to Hong Kong, Singapore and Thailand, but a proportion remains for domestic fabrication. Hand-made silver ornaments are particularly popular with the hill tribes of northern Myanmar, and some orders are reportedly placed by Thai manufacturers, who then export the jewelry to world markets as "Thai". Output could be approaching 1 Moz (31 t).

Cambodia and **Vietnam** are also reviving silver jewelry manufacture, as their economies strengthen. They are importing silver from Singapore and are also getting some from former Eastern Bloc countries. One manufacturer in Vietnam is making, in exchange, lightweight earrings and rings for Russia. Production in both countries is approaching 0.5 Moz (15 t) .

Indonesia has long had a thriving silver jewelry output by craftsmen on the island of Bali, whose ornaments are largely directed at tourists. But more formal production is now increasing, especially in Surabaya in eastern Java where factories (already equipped for gold jewelry manufacture) are starting to export silver articles and chain. Low labor costs enable Indonesia to compete with Thailand. While fabrication is still a modest 2.5 Moz (78 t), growth could become quite rapid.

Although **Malaysia** is a major manufacturer of gold jewelry, it uses little silver and much of what is on display in shops is from Italy. Local output is no more than 0.35 Moz (11 t).

Manufacture of silverware and jewelry is limited in **Japan** and, in a difficult year for the local economy, fell by just over 10% to 2.2 Moz (68 t). Silverware is the largest sector, with jewelry sales being concentrated very much among young people, especially teenagers. Moreover, the strength of the yen has made it difficult for Japanese manufacturers to compete, so that jewelry, in particular, is imported from Thailand and the United States, actually exceeding domestic fabrication.

Mexico has a substantial silverware and jewelry industry, regularly requiring between 8-9 Moz (250-280 t). Last year, fabrication was marginally down at 8.7 Moz (270 t), partly because of the economic situation, but also because lower tariffs on imported jewelry since late 1993 have resulted in more articles from Thailand being sold. The principal center for manufacture is the city of Taxco in the state of Guerrero, in which there are 2,000 workshops or *talleres*. Taxco alone needs up to 0.6 Moz (20 t) per month in busy periods. Tourists are the prime buyers of silverware and jewelry and industry sources estimate that they account for 95% of purchases.

The silverware and jewelry industry in **Brazil** made a good recovery in 1994 after several difficult years, with demand up to 2.3 Moz (72 t). The growth was aided by good orders for silver jewelry exports. There are still more than 3,000 companies in jewelry and silverware, and the trade association hopes their future is now more secure.

Official 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 to California, Australia and, later, South Africa, the silver standard increasingly gave way to the gold. Silver was gradually phased out of regular coinage, although it is still used in the German 10 DM coin, France's 100 francs, and Mexico's 10, 20 and 50 peso coins.

The principal use in the last twenty years has been in commemorative coins, notably for the Olympic Games and World Cup Soccer, and bullion coins. The most successful bullion coins are the American Eagle silver dollar, the Australian Kookaburra, the Canadian Maple Leaf and the Mexican Libertad.

Fabrication of coins and medals in the Western World rose by almost 9% to 42.4 Moz (1,319 t), the highest level since the mid-1960s when the United States ceased to use silver regularly in its coinage. With coin minted in China included, the world total is 42.9 Moz (1,335 t). While Mexico and the United States continue to be the largest users, accounting for virtually half of all coins, it is worth observing that the number of countries minting special issues or commemorative coins is growing. Most notably, Spain has joined Germany and France in issuing a legal tender silver coin of 2,000 pesetas, which alone required 4.7 Moz (146 t). While the silver bullion coins had mixed fortunes, with Australian Kookaburra and US Eagle sales falling, Canada's Maple Leaf enjoyed strong sales as rising prices early in 1994 brought back investors. The fabrication of coins is counted in the country in which they are minted. Thus mints in the United Kingdom and Singapore, for example, regularly make coins for other nations, which is one reason that they show significant numbers. Where possible the actual amount of silver required to make the coins is shown, but in some countries only sales figures are available. Moreover, although coins may be fabricated, the full minting may not always be issued or fully subscribed.

Mexico has lived up to its role as the world's foremost silver producer, by also being the main producer of silver coin in the last two years. In 1994 Mexico's Casa de Moneda used just over 13 Moz (404 t) of silver, down from 17.1 Moz (532 t) the previous year. The principal coins are the 10, 20 and 50 pesos issued for circulation - but often hoarded. They took 12.3 Moz (383 t) in 1994. The other main coin produced is the Libertad (often known as Onza) showing the Winged Goddess of Victory in a range of five sizes from 1/20th of an ounce to 1 ounce in 999 fine silver. The Libertad coins required 0.5 Moz (15.6 t). Other popular coins include the Aztec, commemorating the Mayan god Chaac Mool, also in 999 fine silver, in ¼, ½ and 1 ounce sizes, which consumed 0.07 Moz (2.2 t), and the 10 pesos, commemorating the Mayan Pyramid of the Castle, using 0.1 Moz (3.1 t).

Overall fabrication of coins in the **United States** rose to 8.2 Moz (225.2 t) although sales of the one ounce silver Eagle bullion coin fell by 12% to 5.54 Moz (172.3 t). However, almost half these sales occurred in December alone, after reports in coin magazines that the Eagle was heading for the lowest ever mintage (there were no sales at all in September) and that the premium on the year's issue would soar. Even with the December rush, the Eagle sales were the lowest since 1986. However, total minting was up, because the US Mint also issued almost 2.7 Moz (84 t) of commemorative coins, honoring the World Cup (soccer), Thomas Jefferson, US Veterans, and the US Capitol.

Canada's one ounce Maple Leaf bullion coin produced by the Royal Canadian Mint turned in an excellent performance, with sales at just over 1.1 Moz (34 t), the best since 1990. This compares with 0.9 Moz (28 t), and 0.35 Moz (11 t) in the previous two years. Sales were helped by the rising silver price in the early months of the year, which tempted small investors back. By contrast, the minting of commemorative coins at the Royal Canadian Mint declined to 0.34 Moz (10.6 t). Even so, the overall Canadian production at 1.48 Moz (46 t) was the highest since 1990.

The actual issue of new 10 DM silver coins (silver content 625 fine) in **Germany** in 1994 was 6.96 Moz (216.5 t), up from 2.62 Moz (81.5 t) the previous year. However, there were three issues during the year, the

Table 8

Silver Fabrication in Official Coins

(including the use of scrap)

Million ounces

	1985	1986	1987	1988	1989	1990	1991	1992	1993	**1994**
Europe										
Germany	-	-	3.20	3.20	3.20	2.44	5.51	5.38	2.62	**6.96**
Spain	-	-	-	-	-	0.40	1.25	0.45	0.25	**4.69**
UK & Ireland	0.40	0.80	1.30	1.60	1.60	1.07	0.65	1.28	1.75	**1.95**
Netherlands	-	-	1.20	-	-	0.67	0.06	0.00	0.03	**1.11**
France	2.20	2.20	2.20	2.20	2.20	2.19	1.97	2.06	0.96	**0.96**
Austria	4.90	1.20	0.60	0.60	0.40	0.46	0.62	0.52	0.45	**0.47**
Switzerland	-	-	-	-	-	0.19	1.54	0.39	0.35	**0.42**
Portugal	-	-	-	-	-	0.11	0.01	0.12	0.25	**0.38**
Poland	-	-	-	-	-	0.71	0.22	0.10	0.13	**0.18**
Finland	-	-	-	-	-	0.16	0.17	0.21	0.02	**0.09**
Andorra	-	-	-	-	-	0.04	0.00	0.03	0.00	**0.04**
Bulgaria	-	-	-	-	-	0.00	0.00	0.07	0.16	**0.02**
Italy	0.50	0.20	0.20	0.20	0.20	0.15	0.06	0.01	0.14	**0.02**
Norway	-	-	-	-	-	0.00	0.47	0.94	0.32	**0.00**
Hungary	-	-	-	-	-	0.06	0.06	0.10	0.18	**0.00**
Sweden	-	-	-	-	-	0.04	0.04	0.04	0.08	**0.00**
Belgium	-	-	-	-	-	0.45	0.35	0.00	0.05	**0.00**
Other	-	-	-	-	-	0.22	0.11	0.19	0.03	**0.00**
Total Europe	8.00	4.40	8.70	7.80	7.60	9.36	13.08	11.89	7.77	**17.28**
North America										
Mexico	3.50	2.00	2.30	2.00	1.70	1.23	1.55	8.68	17.08	**13.02**
United States	0.40	10.30	12.20	7.90	6.80	9.11	10.46	8.14	7.92	**8.21**
Canada	0.30	1.30	1.20	1.10	3.30	1.93	0.88	0.76	1.22	**1.48**
Total North America	4.20	13.60	15.70	11.00	11.80	12.27	12.89	17.57	26.21	**22.71**
Central & South America	-	-	-	-	-	0.10	0.07	0.19	0.05	**0.01**
Middle East										
Egypt	-	-	-	-	-	0.01	0.00	0.02	0.01	**0.63**
Israel	-	-	-	-	-	0.01	0.02	0.05	0.00	**0.04**
Total Middle East	-	-	-	-	-	0.02	0.01	0.06	0.00	**0.66**
Far East										
Singapore	-	-	-	-	-	0.09	0.05	0.89	0.13	**0.14**
Japan	-	6.40	-	-	-	8.92	0.00	0.00	2.41	**0.00**
Thailand	-	-	-	-	-	0.02	0.04	0.07	0.02	**0.00**
Malaysia	-	-	-	-	-	0.02	0.00	0.00	0.00	**0.00**
South Korea	-	-	-	-	-	0.00	0.05	0.00	0.22	**0.00**
Total Far East	-	6.40	-	-	-	9.03	0.14	0.95	2.77	**0.13**
South Africa	-	-	-	-	-	0.01	0.01	0.03	0.01	**0.01**
Australia	-	-	-	-	-	0.41	0.52	2.13	2.27	**1.54**
Other Western World	1.30	2.50	3.50	4.10	5.20	-	-	0.00	0.00	**0.00**
Western World Total	13.50	26.90	27.90	22.90	24.60	31.21	26.74	32.85	39.09	**42.36**
Other Countries										
China	-	-	-	-	-	0.40	1.37	0.40	0.40	**0.57**
Soviet Union/CIS	-	-	-	-	-	0.00	0.00	0.08	0.00	**0.00**
Total Other Countries	-	-	-	-	-	0.40	1.37	0.48	0.40	**0.57**
World Total	-	-	-	-	-	31.61	28.10	33.33	39.49	**42.93**

first of which was of a coin dated 1993 amounting to 2.3 Moz (71.5 t), with two further issues dated 1994, while the previous year there had been only one issue (at 2.48 Moz). Thus the apparent increase (and use of silver) has more to do with the timing of the issue. Normally Germany uses close to 5 Moz (155 t) annually in the coin and, taken together, the years 1993/94 fit that pattern.

Spain embarked on a major new legal tender silver coin program with the first issue of a 2,000 pesetas coin, calling for 4.7 Moz (146 t) silver. A similar issue is planned for 1995. The concept of a legal tender coin has been adopted from Spain's European Union partners, Germany and France, with their 10 DM and 100 FF silver coins. Much of the silver required was imported directly from Mexico, already in the form of blanks.

The long-running 100 franc silver coin program in **France** is being wound down; after being cut by over 50% between 1992 and 1993, it was maintained at 0.96 Moz (29.9 t), but production may stop completely in 1995.

Silver use in coins minted at the Royal Mint and the Pobjoy Mint in the **United Kingdom** rose by 11.6% to 1.9 Moz (59 t). As usual, coins made to order for other countries accounted for most of the silver required. The main issue, amounting to 0.97 Moz (30.2 t), was a series of coins for Gibraltar, which are denominated in ECU (European Currency Units) and commemorate various European acheivements. The regular series of Isle of Man silver coins consumed 0.38 Moz (11.9 t), while coins were also minted for Bosnia Herzegovina, Eritrea, Fiji and Liberia.

Silver coin minting in the **Netherlands** increased notably to 1.1 Moz (34.6 t) because of two special issues. One commemorated the European Union treaty signed in the Dutch city of Maastricht, the other celebrated fifty years of the Benelux (Belgium, Netherlands, Luxembourg) alliance and their parliaments. The latter issue called for two million coins of 15 grams (0.48 oz) at 720 fine silver content.

In **Austria** minting was maintained close to the customary level at 0.47 Moz (14.6 t), mainly comprising 100 and 500 schilling coins.

As a significant producer of silver, **Poland** has a regular coin program which used 0.18 Moz (5.5 t). A series of ten commemorative coins was minted, honoring Polish heroes and historical or cultural events. The most important coin issued for 1994 was a 100,000 zlotych coin, at 900 fine, commemorating the 50th anniversary of the Warsaw Uprising in 1944. These coins are purchased mainly by the Polish Numismatic Society, to which most collectors belong, but were also exported to the United States.

In **Egypt** the Treasures of Ancient Egypt collection used 0.63 Moz (19.6 t). These coins, with a face value of five Egyptian pounds are in 999 fine silver and weigh 22.5 grams (0.72 oz). They honor Pharaohs, ancient temples, sacred gods and animals.

Coin fabrication in **Australia** fell from 2.3 Moz (70.6 t) in 1993 to 1.54 Moz (48 t), because of lower sales of the Kookaburra bullion coin series. The sales of these coins amounted to 0.86 Moz (26.8 t), with other special collections from the Perth Mint accounting for a further 0.36 Moz (11.3 t). The Royal Australian Mint produced 0.32 Moz (9.9 t) of commemorative coins, with the series of A$5 The Explorers II and Kangaroo in Mid-Flight accounting for 80% of sales.

However, in **China** the output by China Gold Coin Inc. rose from 0.4 Moz (12 t) in 1993 to 0.57 Moz (18 t), chiefly due to improved sales of the Giant Panda coins. Minting of the smaller 5 yuan Panda coin increased from 15,563 pieces in 1993 to 268,750 pieces, accounting for much of the higher consumption. Besides the Panda range, which accounted for 55% of the silver, China Gold Coin also made no less than 54 other special coins and medals, usually issuing between 500 and 6,000 of each. Themes ranged from the Winter Olympics and the Asian Games to famous Chinese personalities and Chinese inventions. Although these coins are principally designed for export, up to 20% of sales now take place within China.

Japan did not follow the special issue of 2.4 Moz (75 t) of silver coins in 1993 to commemorate the wedding of the Crown Prince with any new silver issue in 1994. Similarly, **South Korea**, which had struck 0.2 Moz (6 t) of coin in 1993 for the Taejon Expo, did not follow this up in 1994.

6. Investment: Futures and Options

The word "investment" can be something of a misnomer in today's silver market, whose character has been changed so dramatically by the derivatives revolution. Physical investment in silver, except in coins, is largely a thing of the past; instead the preferred vehicles are futures, options or warrants. Certainly the renewed interest in silver over the last two years is best seen in the improved volume on the exchanges. But the investor - or the hedge fund - using the exchanges or the over-the-counter (OTC) options market has a different perception and time-frame from the traditional physical buyer who acquired so much silver in the 1970s and early 1980s. Today's investor seeks quick performance; failing that, the money moves elsewhere. This money, operating through derivatives, has become the major force in silver.

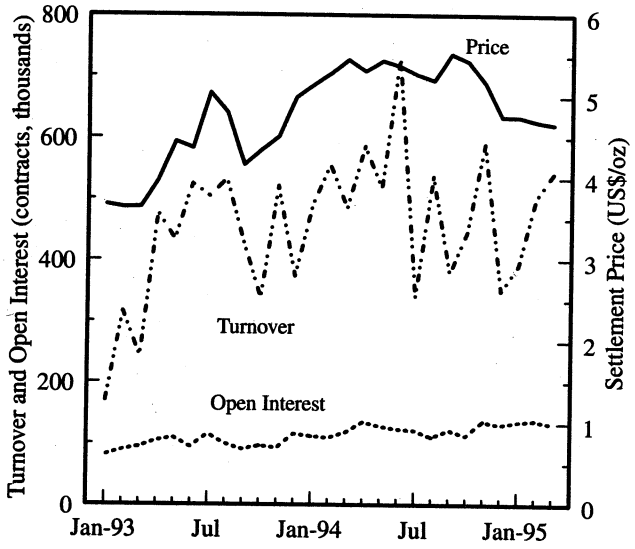
The physical buyer does still play a part, but primarily as a seller of long held metal, rather than as a new purchaser. Research in the United States and Canada suggests that up to 90% of physical investor transactions through banks and dealers now consist of sales. In Canada alone, it is estimated that at least 20 Moz (622 t) has been sold back to the banks in physical metal or from metal accounts and certificates in the six years 1988-94. In the United States quantities are more substantial, but harder to determine. However, they probably amounted to at least 10 Moz (311 t) in 1993, and up to 20 Moz (622 t) last year. Many individual private holdings of physical silver, sometimes amounting to several million ounces and held in bank vaults, have been sold out in recent years. This is distinct from the long positions liquidated in the market by hedge funds in the second half of 1994.

The affinity for silver in the United States, while not unique, does have its roots in the long rearguard action in the last decades of the 19th century to maintain a joint gold and silver standard (reflected in silver being used in coin long after the silver standard was given up) and to the ban on gold-holding from 1933 until 1975. Silver became the accustomed investment metal in those years. But today a new generation, with no such memories, usually prefers "paper" silver. Outside North America, there is relatively little physical investment in silver, except in countries such as Mexico where people hoard the 10, 20 and 50 peso coins. There is also a small amount of kilobar hoarding in Japan. In India, of course, silver is seen as a basic form of saving, but primarily in jewelry, silverware or medallions, rather than bars.

Figure 26

Comex Silver Futures

January 1993 to March 1995, monthly



Futures Exchanges

Trading on Comex (which merged with Nymex in August 1994) reflected the revived interest in silver, as hedge funds made a concerted effort to get the price up. Futures turnover in 1994 was the highest for a decade at 5,994,345 contracts, up 23% on 1993 and almost double the turnover in 1992. Indeed, it was the third best year ever for the Comex silver contract. The volume rose steadily in the first half of 1994 to reach 729,414 contracts in June, the second best month ever (exceeded only in April 1987). This activity was matched by falling Comex stocks, but they bottomed out by May and recovered during the remainder of the year, while trading volumes declined. In December, volume on Comex was half that of June and momentarily it seemed that the life had gone out of the market. The large speculative positions originally opened up in late 1993 had been unwound, with significant liquidation in mid-October. Silver had lost its momentum, and the gold/silver ratio, which had narrowed in May 1994 to 67:1 was widening again towards 80:1. Traders suggested that silver was "dead" and ratio trading was ended. The lull was short. First the price slipped to $4.42 in early

1. Futures Turnover

Contract (oz)	Number of Contracts: Comex 5,000	Tocom*	CBoT 1,000	CBoT 5,000	MidAmerica 1,000	Total Silver Equivalent (million ounces): Comex+ Tocom	Others	Total
1985	4,821,206	1,838,448	1,034,830	0	47,163	24,697	1,082	25,779
1986	3,849,687	706,455	511,239	0	9,981	19,476	521	19,997
1987	5,055,652	1,471,815	509,965	12,092	9,578	25,751	580	26,331
1988	4,664,655	2,302,428	481,566	4,165	12,063	24,064	514	24,578
1989	4,376,611	643,891	254,713	2,397	13,562	22,325	280	22,606
1990	3,913,609	504,332	178,801	2,256	11,005	20,055	201	20,256
1991	4,154,704	1,057,598	114,268	640	13,106	21,794	131	21,925
1992	3,016,339	231,864	52,658	472	8,888	15,305	64	15,369
1993	4,855,924	661,452	89,141	1,022	10,986	24,918	105	25,023
1994	5,994,345	1,042,185	88,663	10,278	17,170	30,977	157	31,135

* 10 kg contracts up to June 1989, thereafter 30 kilogram contracts

2. Options Turnover

Contract (oz)	Number of Contracts: Comex 5,000	Comex 5 day 5,000	CBoT 1,000	Toronto 100	Total Silver Equivalent (million ounces): Comex	Others	Total
1985	531,315	0	10,819	75,850	2,657	18	2,675
1986	579,427	0	3,081	23,132	2,897	5	2,903
1987	918,064	0	10,009	34,664	4,590	13	4,604
1988	872,106	0	8,303	7,188	4,361	9	4,370
1989	752,645	0	8,346	5,325	3,763	9	3,772
1990	747,499	0	1,398	965	3,737	1	3,739
1991	1,019,093	798	2,804	1,276	5,099	3	5,102
1992	676,543	9,606	20,105	331	3,431	20	3,451
1993	1,094,702	1,262	12,423	4,583	5,480	13	5,493
1994	1,316,650	368	5,952	8,300	6,585	7	6,592

March 1995, low enough to tempt the hedge funds and speculators back in. Indeed, they had precisely the new springboard they needed. Silver bounced. Comex volume picked up to 541,807 contracts for the month. As the price continued upward in April to $5.92, volume was well-maintained, especially on 17th and 18th April, when turnover in two days was 102,535 contracts.

The vitality of Comex in 1994 was matched on other exchanges, albeit with their smaller volumes. The Chicago Board of Trade's 5,000 ounce contract achieved the highest turnover since 1987, and the MidAmerica Exchange's 1,000 ounce contract had its best year since 1985. While in Japan, Tocom's turnover topped one million contracts, the best since 1991.

Back on Comex, options had their best-ever year with turnover of more than 1.3 million on the 5,000 ounce contract. The volume on the exchange, of course, is only a reflection of the much larger over-the-counter (OTC) market, for which there are no turnover figures. Yet it is this OTC market that carries the most substantial options books. And it is the delta hedging potential from those books which can influence, and even exaggerate, price moves. The strong rally in April 1995 was related very much to options. While the main users of options strategies in the past have been producers or hedge funds, greater use of options is now being made by large industrial users to protect themselves from an unforeseen increase in the price. Such consumers are also buying more forward silver to lock in low prices - an

indication that they feel the days of a bear market in silver are over.

Warrants

Meanwhile, the investor has shown considerable interest over the last two years in warrants, either of silver alone or in a basket with gold and other metals. Although the warrant is essentially a securitized option (and is often slightly more expensive) it has the advantage of having a quantifiable value, often by being listed on an exchange, and for that reason is preferred by private and institutional investors, especially in Europe, who may be forbidden to use derivatives. When silver began its price recovery in 1993, an immense selection of silver warrants was issued. The majority of these were calls, but a few were puts. At the beginning of 1994, no less than 19 different silver warrants (16 calls, 3 puts) were outstanding, with maturity dates in 1994 and 1995, for a total issue of over 700 Moz (21,773 t). The question is, how many of these warrants were subscribed? By no means all were fully taken up; indeed, it is unlikely that even half the warrants were purchased. The good price performance in the early months of 1994 led to several further issues, both of straight silver and silver in diversified baskets with base metals and oil. But they had missed the tide and, in the second half of the year, with interest in silver waning, the few issues were not well subscribed. By the end of the year, there were less than a dozen outstanding warrant issues.

For the market, the unknown factor is the amount of delta hedging needed to cover the subscribed warrants and its likely impact on the price (just as with OTC options). In practice, the issuers may cover themselves through options or futures, thus making little impact on the spot market, or they may not hedge at all. Even so, the potential impact of warrants should not be ignored, especially if the revival of the silver price in April 1995 leads to further offerings.

Silver Leasing Rates

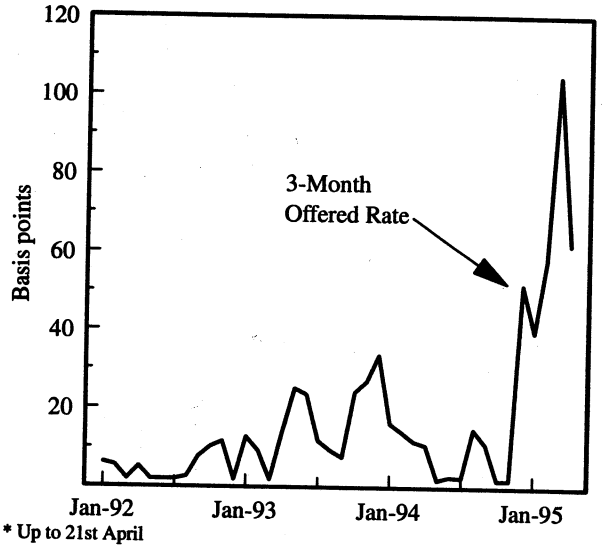
In recent years the silver leasing rate has not merited a great deal of attention. The existence of substantial loco-London stocks and only limited hedging demand from silver producers and consumers has enabled bullion banks comfortably to meet their needs for liquidity. But as Figure 27 shows, this changed dramatically in December when a shortage of physical metal led to a spike in rates, with the average for the month exceeding 50 basis points. During the first two months of 1995 leasing rates remained at high levels before shooting up above 100 basis points in March. On 31st March, rates suddenly fell sharply and averaged just over 60 basis points for the first three weeks of April.

Not surprisingly, the dramatic change in the structure of leasing rates over the past four to five months has reflected several important developments in the silver market. Firstly, on the supply side, the available loco-London stocks have been run down to low levels. For remaining holders of silver, the realization that the market was tightening may have encouraged them, initially, to refrain from leasing their metal in the belief that this would force rates up further. Secondly, the unwinding of long positions and an increase in short sales by speculators had a major impact on rates during the December, 1994 to March, 1995 period. When this was followed by another significant turn-around in speculative positions from short to long at the end of March and in early April, rates suddenly fell sharply from earlier peak levels. Finally, a more limited contribution to the higher level of leasing rates since December has resulted from the increase in demand for borrowed silver to fund consignment stocks in end-user markets.

Figure 27

Silver Leasing Rate

Monthly averages, January 1992 - April 1995*



* Up to 21st April

Appendix I
Silver Prices in 1994, in US dollars per ounce

1. London Prices

	London Silver Market - Spot			London Silver Market - 3-Months		
	High	Low	Average	High	Low	Average
January	5.344	4.912	**5.143**	5.382	4.947	**5.180**
February	5.455	5.120	**5.247**	5.495	5.157	**5.290**
March	5.748	5.180	**5.435**	5.799	5.225	**5.483**
April	5.645	5.094	**5.308**	5.697	5.146	**5.359**
May	5.730	5.068	**5.425**	5.791	5.123	**5.485**
June	5.605	5.251	**5.388**	5.665	5.312	**5.447**
July	5.408	5.163	**5.283**	5.470	5.225	**5.343**
August	5.382	5.050	**5.195**	5.443	5.108	**5.254**
September	5.710	5.385	**5.524**	5.781	5.450	**5.590**
October	5.655	5.308	**5.455**	5.731	5.381	**5.529**
November	5.320	5.075	**5.192**	5.392	5.147	**5.266**
December	4.932	4.640	**4.782**	5.004	4.706	**4.849**
Year	5.748	4.640	**5.285**	5.799	4.706	**5.344**

	London Silver Market - 6-Months			London Silver Market - 12-Months		
	High	Low	Average	High	Low	Average
January	5.426	4.990	**5.222**	5.523	5.076	**5.315**
February	5.539	5.199	**5.335**	5.638	5.292	**5.438**
March	5.859	5.278	**5.539**	5.998	5.401	**5.666**
April	5.760	5.202	**5.418**	5.891	5.342	**5.560**
May	5.862	5.184	**5.551**	6.021	5.325	**5.709**
June	5.728	5.375	**5.508**	5.898	5.539	**5.676**
July	5.536	5.291	**5.411**	5.704	5.445	**5.570**
August	5.513	5.174	**5.321**	5.677	5.327	**5.480**
September	5.855	5.518	**5.661**	6.034	5.691	**5.833**
October	5.810	5.454	**5.605**	5.999	5.630	**5.785**
November	5.470	5.230	**5.343**	5.655	5.422	**5.530**
December	5.086	4.781	**4.928**	5.275	4.960	**5.111**
Year	5.862	4.781	**5.408**	6.034	4.960	**5.561**

2. US Prices

	Comex Spot Settlement			Handy & Harman		
	High	Low	Average	High	Low	Average
January	5.326	4.967	**5.139**	5.310	4.950	**5.131**
February	5.465	5.172	**5.281**	5.360	5.175	**5.272**
March	5.781	5.176	**5.453**	5.755	5.190	**5.451**
April	5.578	5.097	**5.309**	5.585	5.075	**5.309**
May	5.761	5.107	**5.439**	5.700	5.130	**5.436**
June	5.591	5.243	**5.376**	5.600	5.235	**5.393**
July	5.405	5.128	**5.272**	5.400	5.160	**5.287**
August	5.443	5.061	**5.199**	5.400	5.065	**5.195**
September	5.712	5.376	**5.528**	5.680	5.400	**5.529**
October	5.647	5.242	**5.434**	5.640	5.270	**5.441**
November	5.316	4.896	**5.168**	5.285	5.035	**5.196**
December	4.907	4.573	**4.754**	4.910	4.625	**4.768**
Year	5.781	4.573	**5.281**	5.755	4.625	**5.286**

Appendix II
Silver Prices, 1975-94, in US dollars per ounce

1. London Prices

	London Silver Market - Spot			London Silver Market Averages		
	High	Low	Average	3-Month	6-Month	12-Month
1975	5.211	3.928	4.426	4.500	4.585	4.767
1976	5.084	3.830	4.353	4.407	4.472	4.618
1977	4.975	4.313	4.633	4.696	4.776	4.935
1978	6.264	4.818	5.422	5.519	5.627	5.856
1979	32.200	5.935	11.068	11.331	11.540	11.939
1980	49.450	10.890	20.984	21.491	21.972	22.867
1981	16.303	8.030	10.487	10.911	11.346	12.174
1982	11.110	4.901	7.922	8.159	8.406	8.923
1983	14.668	8.370	11.430	11.694	11.970	12.537
1984	10.110	6.220	8.145	8.356	8.588	9.081
1985	6.750	5.450	6.132	6.252	6.382	6.668
1986	6.310	4.853	5.465	5.551	5.642	5.825
1987	10.925	5.360	7.016	7.141	7.267	7.533
1988	7.822	6.050	6.532	6.661	6.795	7.076
1989	6.210	5.045	5.500	5.627	5.755	6.015
1990	5.356	3.950	4.832	4.931	5.031	5.249
1991	4.571	3.548	4.057	4.112	4.172	4.302
1992	4.335	3.648	3.946	3.982	4.020	4.107
1993	5.420	3.560	4.313	4.345	4.380	4.459
1994	5.748	4.640	5.285	5.344	5.408	5.561

2. US Prices

	Comex Spot Settlement			Handy & Harman		
	High	Low	Average	High	Low	Average
1975	5.250	3.920	4.419	5.225	3.910	4.419
1976	5.137	3.834	4.351	5.100	3.815	4.353
1977	4.976	4.285	4.623	4.960	4.300	4.623
1978	6.317	4.811	5.407	6.296	4.829	5.401
1979	34.450	5.923	11.113	28.000	5.961	11.094
1980	48.700	10.800	20.657	48.000	10.800	20.632
1981	16.290	7.985	10.501	16.450	7.950	10.512
1982	11.210	4.980	7.931	11.210	4.885	7.947
1983	14.715	8.400	11.434	14.745	8.340	11.441
1984	10.064	6.295	8.158	10.035	6.260	8.141
1985	6.835	5.525	6.146	6.735	5.570	6.145
1986	6.285	4.854	5.465	6.195	4.870	5.468
1987	9.660	5.379	7.020	10.200	5.360	7.019
1988	7.827	5.998	6.534	7.990	6.010	6.537
1989	6.194	5.030	5.493	6.170	5.015	5.494
1990	5.332	3.937	4.817	5.390	3.930	4.818
1991	4.545	3.508	4.036	4.530	3.580	4.041
1992	4.318	3.640	3.933	4.315	3.630	3.937
1993	5.443	3.523	4.303	5.370	3.545	4.302
1994	5.781	4.573	5.281	5.755	4.625	5.287

Appendix III
Silver Prices 1975-1994
The Effects of Exchange Rates and Inflation

1. Actual Prices * (money of the day)

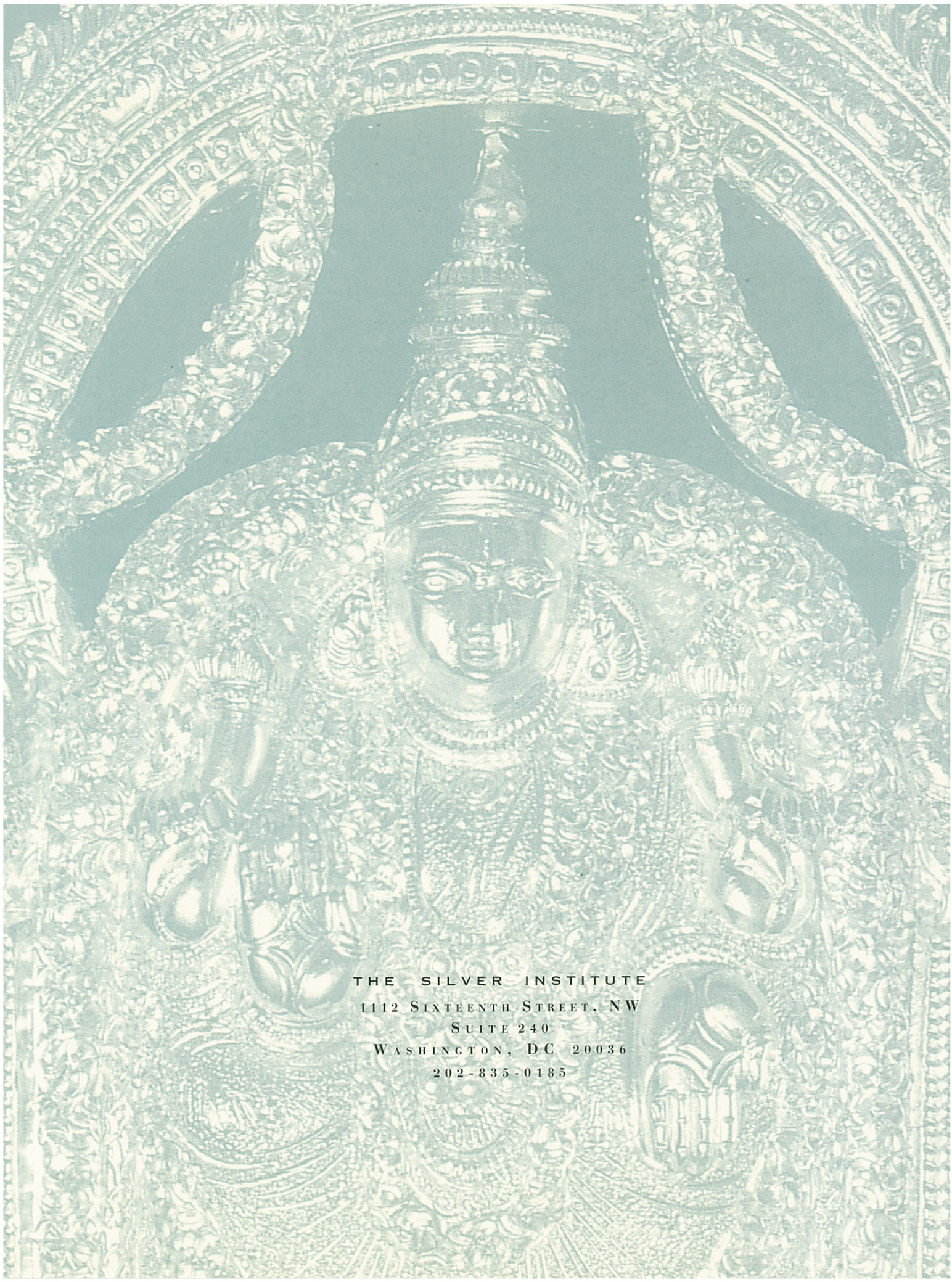
	London US$/oz	India * Rupee/kg	Thailand Baht/oz	Japan Yen/10g	Korea Won/10g	Italy Lire/g	Germany DM/kg	Mexico Peso/oz
1975	4.426	1,160	90.19	422	689	93	350	0.06
1976	4.353	1,217	88.81	415	677	116	352	0.07
1977	4.633	1,120	94.52	400	721	131	346	0.10
1978	5.422	1,393	110.26	367	844	148	350	0.12
1979	11.068	1,896	225.99	780	1,722	296	652	0.25
1980	20.984	2,783	429.67	1,530	4,098	578	1,226	0.48
1981	10.487	2,650	228.83	744	2,296	383	762	0.26
1982	7.922	2,675	182.20	634	1,862	344	618	0.45
1983	11.430	3,435	262.89	873	2,851	558	938	1.37
1984	8.145	3,514	192.53	622	2,111	460	745	1.37
1985	6.132	3,880	166.53	470	1,715	376	580	1.58
1986	5.465	4,105	143.71	296	1,549	262	382	3.34
1987	7.016	5,124	180.46	326	1,855	292	405	9.67
1988	6.532	6,231	165.23	269	1,536	273	369	14.85
1989	5.500	6,803	141.34	244	1,187	243	332	13.54
1990	4.832	6,779	123.62	225	1,099	186	251	13.59
1991	4.057	6,993	103.51	176	956	162	216	12.24
1992	3.946	7,580	100.24	161	991	156	198	12.21
1993	4.313	6,163	109.15	154	1,110	214	229	13.44
1994	5.285	6,846	132.92	174	1,365	274	276	17.84

* 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 1994 money)

	London US$/oz	India Rupee/kg	Thailand Baht/oz	Japan Yen/10g	Korea Won/10g	Italy Lire/g	Germany DM/kg	Mexico Peso/oz
1975	12.190	4,940	266.87	764	3,622	619	637	30.72
1976	11.344	5,607	252.19	686	3,114	665	615	37.23
1977	11.329	4,763	249.52	611	2,985	634	582	43.61
1978	12.322	5,782	269.78	538	3,052	636	574	51.49
1979	22.609	7,408	503.12	1,103	5,264	1,108	1,027	84.08
1980	37.757	9,756	799.09	2,007	9,732	1,784	1,831	114.86
1981	17.095	8,216	377.69	930	4,497	991	1,070	53.51
1982	12.169	7,684	285.75	772	3,400	765	825	53.17
1983	17.012	8,825	397.38	1,043	5,033	1,081	1,213	84.70
1984	11.623	8,334	288.57	727	3,643	804	940	50.60
1985	8.451	8,719	243.61	538	2,890	603	716	36.96
1986	7.389	8,482	206.46	337	2,546	396	472	41.88
1987	9.154	9,733	253.04	371	2,951	422	500	52.47
1988	8.190	10,818	223.08	304	2,281	376	450	37.60
1989	6.577	11,125	181.10	269	1,667	313	394	28.55
1990	5.481	10,175	149.52	241	1,422	226	290	22.64
1991	4.416	9,215	118.46	182	1,130	185	241	16.63
1992	4.170	8,937	110.13	164	1,103	170	213	14.36
1993	4.427	6,832	115.80	155	1,179	223	236	14.40
1994	5.285	6,846	132.92	174	1,365	274	276	17.84

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



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