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2001
GFMS

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World Silver Survey 2001

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

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This is the seventh annual survey of the world silver market to be produced for The Silver Institute by Gold Fields Mineral Services (GFMS), the London-based analysts of global precious metals markets. The information contained here is based in part on the analysis of the GFMS database of international trade statistics, company report data and other public-domain information. But more importantly, it is also based on a series of interviews with the industry's main players, carried out every year by the GFMS team of analysts and consultants, which provide the essential data to allow the compilation of reliable estimates for world supply and demand.

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

Gold Fields Mineral Services Ltd, London **May, 2001**

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

Terminology:
"-" = not available or not applicable
0.0 = zero or less than 0.05
"dollar" refers to the US dollar unless otherwise stated.

Prices:
Unless otherwise stated US dollar prices are for the London Silver Market fixing.

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

1. Summary and Outlook

Apart from a brief flurry at the beginning of the year, the silver price moved steadily lower during 2000 to average $4.951, over 5% below the previous year's level. And the decline has continued in the first part of 2001, with the price drifting down to below $4.50.

What is immediately clear from the data shown in Table 1 is that, in 2000 at least, silver's problem was not a lack of demand. Fabrication increased by more than 5% to absorb a record 920.9 Moz (28,642 t). A small decline in photographic offtake was swamped by strong growth in jewelry and silverware demand (led by Thailand and Italy) and a stunning 11% rise in industrial applications, where silver use in electronics was booming during most of 2000. However, the very strength of demand last year has undoubtedly added to silver's malaise this year. In particular, the industrial sector is suffering from a combination of high inventories and reduced final demand - the latter particularly acute in the United States where the economy has entered a period of, at the very least, slower GDP growth.

It has been a different story when it comes to the supply side. In 2000, the pressure on the silver price was supply-driven. Firstly, in spite of the weaker silver price, mine production registered a 7% rise. The simplest explanation for this is that primary producers account for only one-quarter of world output. The balance of production is very insensitive to price. Nevertheless, as is described in Chapter 4, the growth in mine supply last year owed much to special factors which should not be repeated in 2001.

Growth in supply from above-ground stocks has arguably been a more important source of the silver price weakness over the past year. Scrap supply rose by some 3% in 2000 in spite of the low price. This indicates how, even under conditions of low and stable prices, scrap can increase, driven as it is by growth in the stock of fabricated products. It should also be remembered that in many currencies other than the US dollar silver prices actually were higher in 2000.

The major factor though on the supply side that has influenced silver prices is the sale of bullion stocks by private and official sector holders. And, even though official sales were down a little last year, the most significant story in terms of bullion stocks in the 1999-2000 period has been the emergence of China as a large net seller. GFMS estimate that last year Chinese government sales were just under 58 Moz (1,800 t). This supply-side development and its effect on the price have in turn had a tremendous, negative impact

Table 1
World Silver Supply and Demand
(Million ounces)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Supply										
Mine Production	512.8	487.6	470.0	452.0	479.7	487.7	525.3	547.9	552.6	589.4
Net Official Sector Sales	-	-	6.0	17.6	25.3	18.9	-	39.3	92.9	74.7
Old Silver Scrap	141.9	148.3	148.5	151.9	162.9	158.4	169.3	193.7	174.9	180.3
Producer Hedging	19.0	1.3	26.7	-	9.2	-	69.1	5.5	-	-
Implied Net Disinvestment	41.2	92.6	119.3	143.2	90.7	147.1	81.0	47.0	66.8	102.0
Total Supply	**714.9**	**729.8**	**770.6**	**764.7**	**767.9**	**812.2**	**844.7**	**833.4**	**887.2**	**946.3**
Demand										
Fabrication										
Industrial Applications	266.8	259.3	269.8	281.4	295.3	297.3	320.4	316.2	340.6	378.0
Photography	206.0	200.4	200.0	202.5	210.9	212.9	220.2	231.6	233.4	230.6
Jewelry & Silverware	194.5	211.8	259.3	227.9	236.9	263.9	274.9	259.5	273.5	281.7
Coins & Medals	31.3	33.5	41.5	43.8	24.7	23.3	28.5	26.1	26.8	30.5
Total Fabrication	698.6	704.9	770.6	755.6	767.9	797.4	844.0	833.4	874.3	920.9
Net Official Sector Purchases	16.3	24.9	-	-	-	-	0.7	-	-	-
Producer Hedging	-	-	-	9.1	-	14.8	-	-	12.9	25.4
Total Demand	**714.9**	**729.8**	**770.6**	**764.7**	**767.9**	**812.2**	**844.7**	**833.4**	**887.2**	**946.3**
Silver Price (London US$/oz)	4.057	3.946	4.313	5.285	5.197	5.199	4.897	5.544	5.220	4.951

on investor sentiment. As a result, some of those (but still not it would seem Mr Buffett) who had built up long positions in anticipation of higher silver prices have exited the market. This is reflected in the higher number for implied disinvestment last year of 102 Moz (3,167 t).

This year, there is a possibility that some of the supply side pressure on the market could ease. For instance, it is conceivable that Chinese sales will diminish further, particularly with the price at its lowest level since July 1997. Also, we doubt growth in mine production will be repeated on last year's scale. On the other hand, there is still uncertainty over the fate of Mr Buffett's silver hoard. But perhaps as important as these diverse supply side issues is the question mark that must be placed against the strength of demand in 2001, especially should world GDP growth move to a lower level. In this context, the value of the US dollar could become an important factor, above all in terms of the Indian market where a revaluation-assisted decline in the rupee price could significantly boost local silver demand.

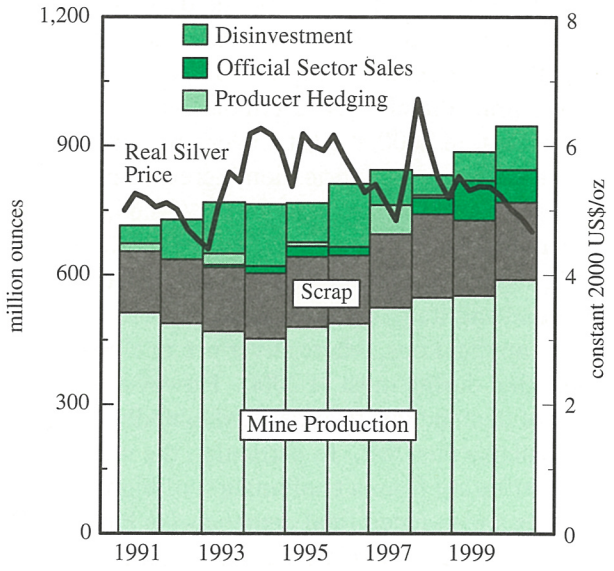
Supply

- Total supply in 2000 was 7% higher year-on-year at 946.3 Moz (29,433 t).
- Mine production increased strongly, by almost 7%, due to a recovery in Mexico and another surge in Australian production.
- Official sector sales declined almost 20% to 74.7 Moz (2,323 t) as flows from China subsided somewhat.
- Scrap was marginally higher due primarily to increased secondary flows in the United States.
- Disinvestment increased 53% year-on-year to 102 Moz (3,167 t).

The substantial increase in global silver supply was the result of strong growth in the mining sector and an increase in disinvestment in a market where the price was disappointing for most of the year. Total supply reached a new record level, as did silver **mine production** which last year contributed just over 62% of all silver that entered the market (almost 10% less than 10 years ago).

Much of the increase in silver mine output can be attributed to the fact that the Mexican silver industry

Figure 1
World Silver Supply

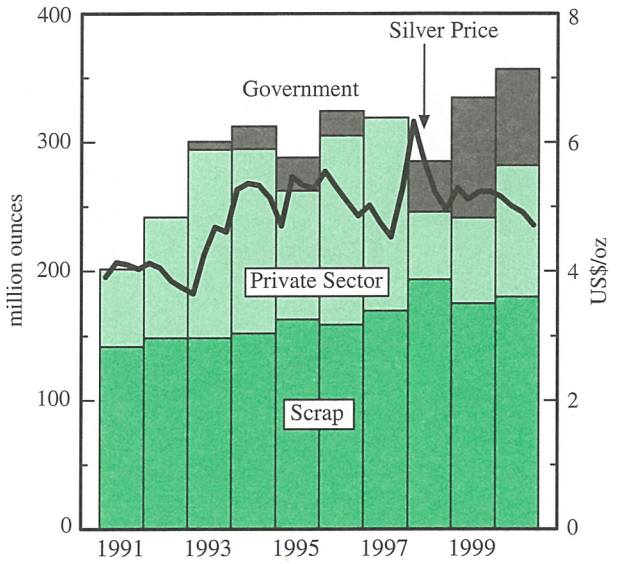


reverted to "normal" after an exceptional year in 1999. Restrictions imposed on Peñoles' processing facility at Torreón were lifted and full capacity operations resumed by around mid-year which saw many of their small miner clients resume deliveries of material for processing, leading to a recovery in output. In addition, Australian silver output leapt another 20% (having increased by 17% and 33% respectively in the previous two years) on the back of increased production at the giant Cannington silver-lead-zinc mine. BHP's Cannington was the biggest single silver-producing mine last year and Industrias Peñoles retained its position as top producer.

Around one-quarter of global output was mined at primary silver mines (on the basis of highest revenue earner, Cannington has been re-classified as a primary mine), with its share of the total contracting somewhat due partly to the depletion of reserves at the Chimberos deposit in Chile and the earlier closure of a number of primary mines in North America. Gold mines once again increased their output of silver and their share of the total went up to 15% (from 13% in 1999) as a result. A number of silver mines are nearing the end of their reserves and, with the deferral of some projects due to the weak price environment, no large increase in production is expected this year.

"Secondary" supply in the form of **scrap** showed a more modest increase. Total volumes rose 3% to 180.3 Moz (5,609 t). Most of the rise was generated in the

Figure 2
Mobilization of Above-ground Stocks



United States where recycling has grown of photographic waste, catalysts and electronic materials. However, a larger share of the actual treatment of this scrap has taken place elsewhere, in part due to the closure of the Handy & Harman facility and the disruption to secondary metal flows this has caused.

The **official sector** supplied 74.7 Moz (2,323 t) of silver last year, down markedly from the previous year but still well above the average level of net disposals over the past 10 years of 23.3 Moz (724 t). As in 1999, most of last year's sales came from China though net disposals from this country were substantially lower than the previous year at 58 Moz (1,800 t) versus a revised total of 68 Moz (2,100 t) in 1999. The United States was the only other significant seller of silver last year. Low lease rates testified to the fact that liquidity was in plentiful supply, partly as a result, it seems, of additional Chinese silver being made available to the market (though, as set out in Chapter 4, reduced demand for borrowed silver to support producer hedging no doubt also contributed to the low level of lease rates).

Given the performance of the silver price last year, the very large increase in **implied net disinvestment** was hardly surprising. Disinvestment reached 102 Moz (3,167 t).

The majority of last year's sales would seem to have come from positions established in late 1997 and early 1998, although the balance of evidence suggests that the stocks famously held by Warren Buffett were not among these. The poor price performance last year and the generally negative short term outlook for silver probably contributed to the incentive to liquidate stocks. This supply pressure was exacerbated by funds on Comex building up short positions, partly as a hedge against existing long positions and, to a lesser extent, to take advantage of an expected price decline.

Demand

- World silver fabrication continued to grow strongly last year, rising over 5% to a record 920.9 Moz (28,642 t).
- Regionally, fabrication growth was strongest in East Asia and the Indian Sub-Continent while, sectorally, it was strongest in electrical and electronics uses.
- Photographic demand slipped a modest 1% to 230.6 Moz (7,173 t).
- Demand from coins and medals increased by almost 14%.
- Net producer hedge positions declined by 23%, creating an estimated 25.4 Moz (791 t) of demand.

The growth in fabrication demand for silver accelerated in 2000, up from 4.9% in 1999 to 5.3%. This lifted the total to a record 920.9 Moz (28,642 t). Underlying this sterling performance was the fact that world GDP growth was at its highest level for over a decade (see Figure 4). Buoyant consumer spending and business investment resulted in much higher raw material demand as output rose for a huge variety of products incorporating silver.

Overall **industrial applications** remained the prime driver of the rise in total demand for silver with its growth accelerating from a (revised) 8% in 1999 to 11% for 2000. This raised the demand from industrial applications to 378.0 Moz (11,757 t). Much of the rise was within the electrical and electronics sector which increased by 12.2% to 166.6 Moz (5,182 t). This sector's growth was most pronounced in East Asia with Taiwan, for example, registering a phenomenal jump in offtake of 60%. Much of the increase was in electronics, especially in computer industry products such as CD-Rs or semiconductors and in cell phones where the much feared substitution of palladium-silver alloys, primarily, for nickel has so far proved less

Figure 3
World Silver Demand

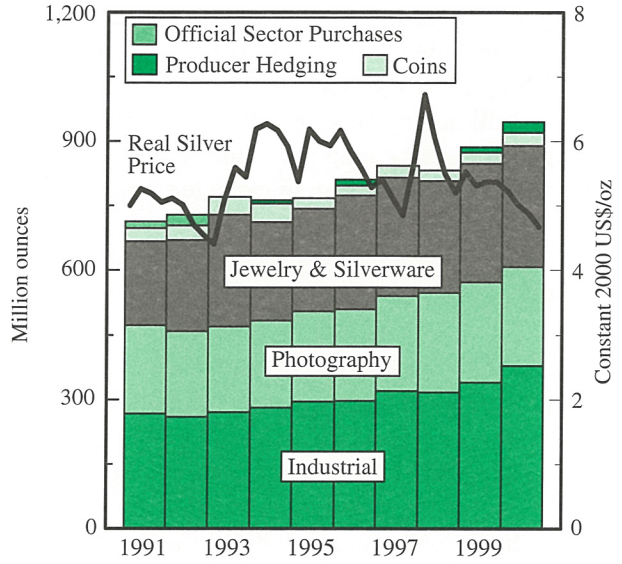
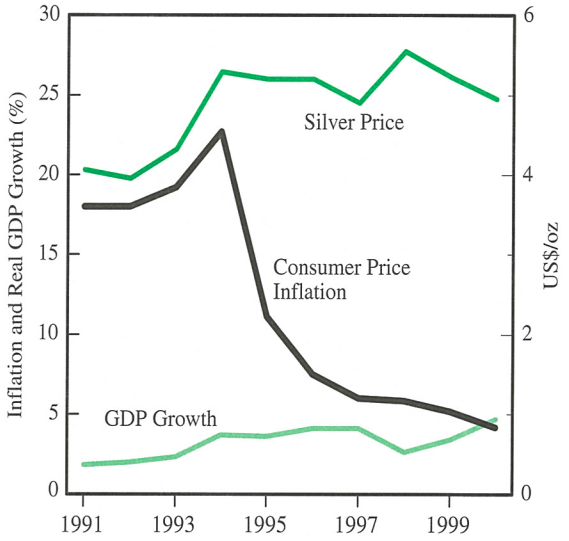


Figure 4
Silver Price and World Economic Indicators



harmful than once expected. Demand from brazing alloys and solders also rose a useful 3.7% to 38.2 Moz (1,189 t), in part as a result of the construction industry enjoying a good year.

As regards total silver demand, cell phones can be a double-edged sword - they may boost industrial demand but in many countries they provide competition to **jewelry** for disposable income. Fortunately, silver has benefited from the continued popularity within the overall jewelry market of the "white look", especially among younger consumers. It was this that helped the jewelry and silverware category record respectable growth of 3% in fabrication to 281.7 Moz (8,762 t). A good proportion of the increase in production was recorded in countries such as Italy and Thailand which saw strong demand for exports, particularly to the United States where the largest rise in silver jewelry consumption occurred.

Disaggregated figures for **silverware** are less easy to establish but it seems highly probable that demand from this sub-category declined with two of its key markets, the United States and Italy, both registering falls. The decline was focused on falling expenditure on traditional items such as cutlery though it is estimated there was some growth in what might be more accurately termed giftware.

Photographic demand was the sole area to register a fall, slipping a modest 1.2% to 230.6 Moz (7,173 t). Though the rise of digital photography has been seen to have a more complex, two-sided impact on silver demand, this ultimately was the chief factor behind this decline (see focus box on page 57). Other factors include a lower silver loading per film. Declines were, however, not universal - Japan registered a 7% rise in photographic demand for silver to 64.1 Moz (1,995 t).

The near 14% rise in the comparatively volatile **coins and medals** category was primarily due to higher fabrication in the United States and Germany where higher proof and commemorative sales lifted their combined share of the world total from 60% in 1999 to 68% in 2000.

Producers were largely absent from the forward market last year, allowing their **hedge** books to run down or closing out positions prematurely. As a result, total outstanding hedge positions declined, for a second consecutive year, by a significant 23% in 2000. This created an estimated 25.4 Moz (791 t) of demand in the physical market. A "health warning" must be issued with all statistics on silver hedging as the availability of published data is poor but a substantial decline seems probable and is certainly supported by the dramatic fall in leasing rates, particularly the longer tenures. These falls went against earlier expectations as, at the beginning of last year, it was thought that the financing of a handful of new mining projects might bring about an increase in hedging but several of these projects were subsequently postponed.

Current expectations for 2001 are that hedging will remain subdued as there are few apparent projects in such a position as to require hedging.

2. Silver Prices

- In spite of record levels of fabrication demand the price was kept under pressure during 2000 by private disinvestment, higher mine production and official sector sales.
- The average dollar price fell by 5.1% to $4.951, accompanied by a sharp decline in volatilities. By contrast, the trading range did manage to increase marginally year-on-year.

Silver remained under pressure for most of 2000, declining from $5.3025 on 4th January to $4.5750 by year-end. This generated an average price of $4.9510, down 5.1% on 1999's $5.2200. After February 2000's price spike, silver fell persistently, with very little being given away on the upside. Volatilities declined sharply year-on-year, down from 23.2% to 14.1%, a level far below those recorded in previous years (and well off 1998's 37.4%). However, the trading range rose a fraction, up from 17.4% in 1999 to 17.7%.

The behavior of prices expressed in other currencies last year was of interest, mainly in demonstrating, in stark contrast to gold, the relative weakness (globally) of the link between local silver prices and physical demand. For example, the euro-denominated price rose by almost 10% year-on-year yet demand in Europe actually increased. By contrast, flat year-on-year prices in India were accompanied by a healthy 7.7% rise in demand, whilst falling prices in Mexico were accompanied by

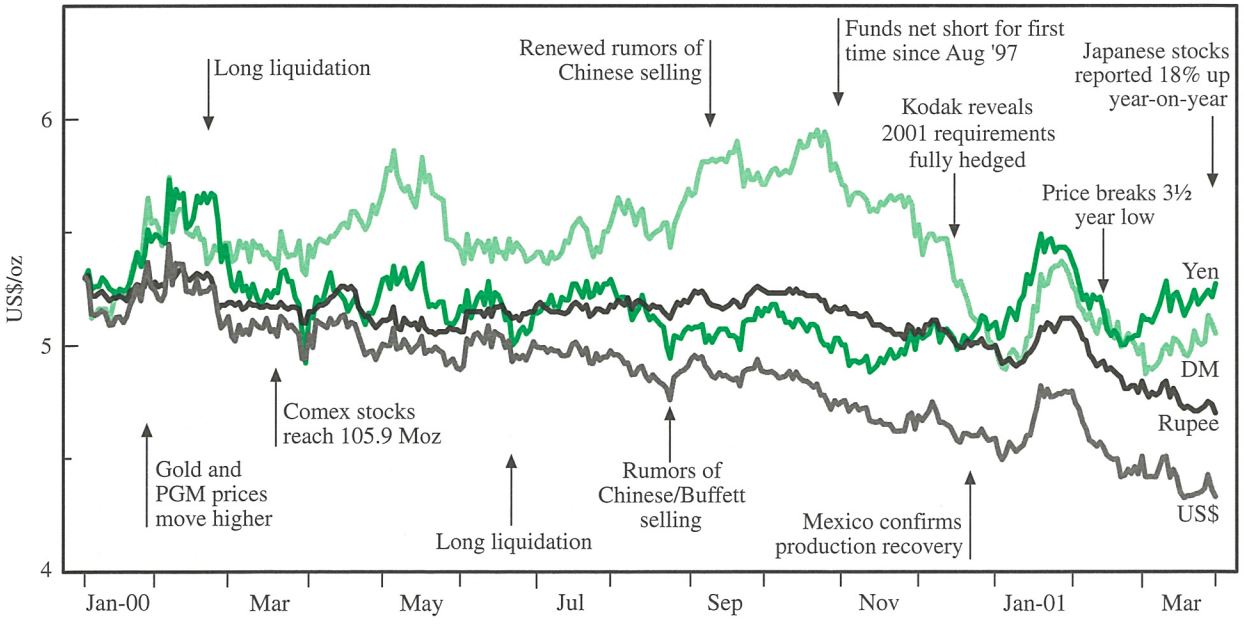
US$ Silver Price

	1970	1980	1990	2000
Annual Average	1.766	20.984	4.832	4.951
Maximum	1.928	49.450	5.356	5.448
Minimum	1.568	10.890	3.950	4.570
Range:Average	20.4%	183.8%	29.1%	17.7%

The Silver Price in Other Currencies

	US$/oz	Euro/kg	Rupee/kg	Yen/10g
Annual Average	4.951	172.6	7,997	171.6
Maximum	5.448	185.8	8,335	189.9
Minimum	4.570	156.7	7,720	161.5
Range:Average	17.7%	16.8%	7.7%	16.5%

Figure 5
London Silver Market: Spot Price
US$/oz; other currencies reindexed to 4th January 2000



a sharp reduction in demand, suggesting that other forces are often at work (GDP growth being one of the most important).

After a brief period of volatility associated with the February 2000 spike, leasing rates fell steadily throughout the year, reflecting both ample liquidity being made available from increased lending (see Chapter 5 for more on this) as well as lower demand from producer hedging (in fact, hedging appeared on the demand side of the equation for the second year in a row - Chapter 4 discusses this in more detail). The 6-month rate, for example, having fluctuated quite widely either side of 4% for the first two months of the year, eased progressively from around 3% at the beginning of March to around 1% by end-December. A second pronounced feature was the flattening of the yield curve. At the beginning of 2000, the 12-month was trading at around 1.5% above the 6-month which in turn was trading around 1.0% above the 3-month. However, by end December both these differentials had fallen to under 0.5%.

Market Analysis

It is probably fair to say that the February price spike, which took silver to its annual high of $5.4475 on the 7th, was the statistical highlight of the year. From then on the market was somewhat dull, characterized by a steadily falling price and a notable lack of investor interest. The problems facing silver last year were, ironically, neatly captured by the price rally in February, which, with the benefit of hindsight,

Figure 6
London Spot Price and 3-month Contango

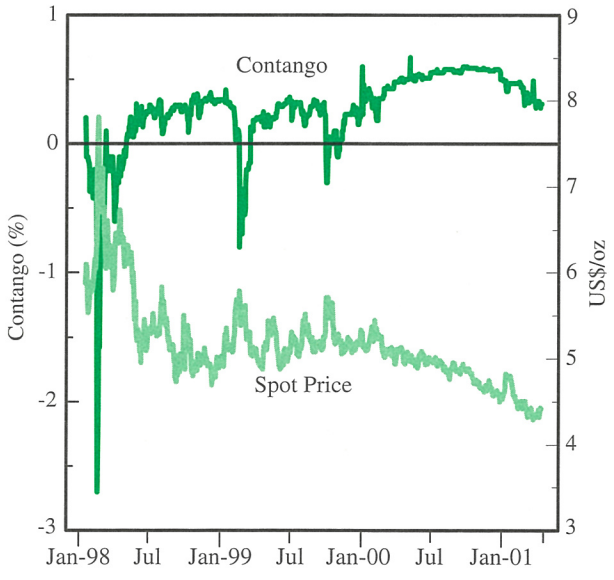
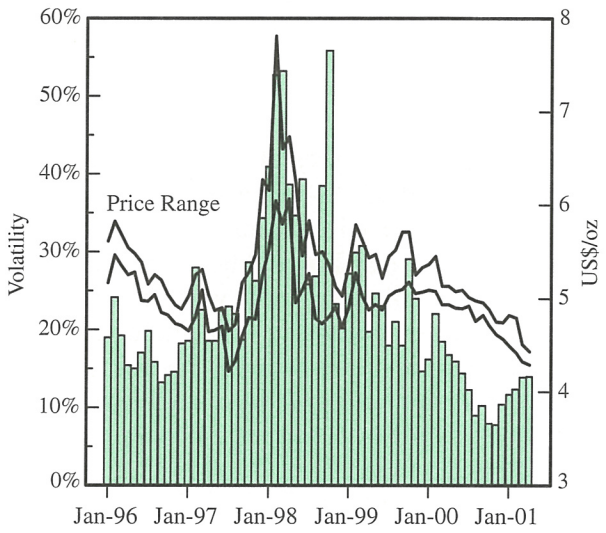


Figure 7
Daily Silver Price Volatility
Based on London fixings (30-day rolling average)



was not really the result of silver-specific factors, but rather developments in the gold market.

Although early February had seen substantial borrowing in the forward market, this appears to have been mainly attributable to the sharp run up in gold leasing rates and prices precipitated by comments from a number of large hedgers including Placer Dome and Normandy. It was surely no coincidence that the silver price peaked on the same day as gold.

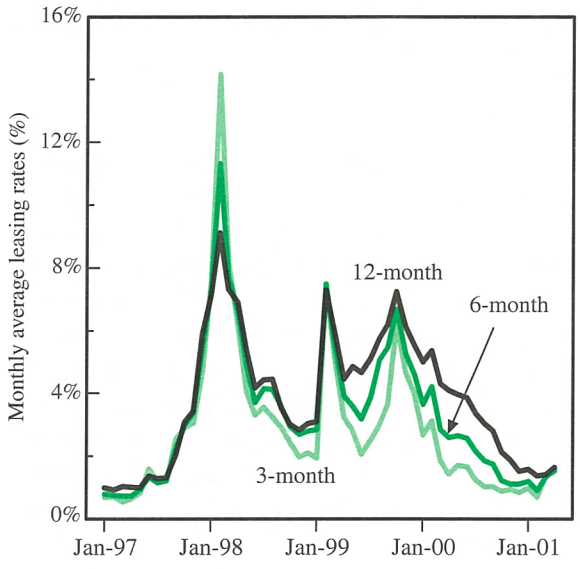
One indication that silver was really only riding on gold's coat tails was to be seen in the relative magnitude of the rallies in both metals. For instance, silver's peak was only 5% higher than the average price for the first half of January whereas gold's peak was 11% higher.

Although the fundamentals were not responsible for sparking silver's rally, higher prices did invoke an elastic response in the demand and supply variables which ultimately held back its progress. One of the key constraining factors at that time was the surge in silver flowing out of China into the global market, usually via Hong Kong. In particular, at prices over

Volatility (US$ price)
Based on London fixings (30-day rolling average)

1996	1997	1998	1999	2000
17.1%	23.5%	37.4%	23.2%	14.1%
Q1-00	**Q2-00**	**Q3-00**	**Q4-00**	**Q1-01**
18.7%	15.6%	10.5%	11.6%	16.9%

Figure 8
Silver Leasing Rates



$5, and especially above $5.25, metal flooded out of the mainland into the international market.

From that time on, silver was under sustained pressure, more from the indifference shown by the investor community than from harshly negative fundamentals. Certainly, sentiment was not assisted by unconfirmed rumors at the end of the first quarter that Warren Buffett had started to sell a portion of his large silver position. Furthermore, data from the Comex indicate that investors were liquidating long positions and building up some short ones towards the end of February and in March, no doubt motivated in part by these rumors. It is notable that funds' net long futures positions on the exchange fell from the year's high in February of over 44,000 contracts to just under 17,500 contracts at the end of the third week in March, their heaviest period of selling in the whole year. But it was not only news from the investment world that contributed to the less optimistic view of silver's short-term price prospects. In late February, Mexico's Peñoles announced that authorization had been granted for refining at its Torreón facility to be brought back up to full capacity.

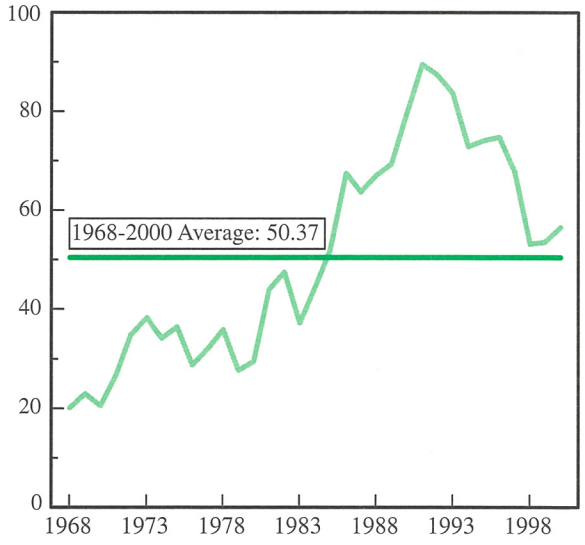
It is perhaps testament to the strength of physical demand for silver at the time that prices did not weaken further in this period.

Prices softened throughout the second and third quarters, largely because of continued Chinese selling and ongoing disinvestment (including fund long liquidation). Although the actual volume of silver coming out of China at this time was constrained by low prices, the potential supply of metal from this source at higher prices continued to cap the market, in large part because of its impact on sentiment and investor behavior.

Fund selling during this period was steady and persistent but hardly overwhelming. Their net long on the Comex had declined to 1,212 contracts by late August (basis net non-commercial futures data), down from 14,341 contracts at the beginning of April, a substantial but not massive move. During the third quarter, speculation mounted that further sales might have taken place out of physical stocks held by Warren Buffett. Although this cannot be ruled out, it is perhaps more likely that other longs were liquidating physical holdings. By August, leasing rates had fallen quite sharply from the beginning of the year. It seems probable that lower rates, especially at the short end (3-month rates fell below 1% on 9th August), were the stimulus for some of the short selling that emerged at this time.

There is little doubt that the price would have been pushed substantially lower if it had not been for the continued strength of industrial demand. In fact, into the fourth quarter there were even examples of "accelerated demand" as large users covered all or some of their 2001 requirements (Kodak being the most prominent example). However, although this assisted the price, it was not enough to sustain it at higher levels, and silver posted its low for the year, of $4.5700, on 19th December.

Figure 9
The Gold/Silver Price Ratio



Price Elasticities of Scrap and Bullion Stocks

Last year in this focus box we looked at some of the major factors that have influenced scrap supply and fabrication demand over the past decade. This year we examine the price elasticity of scrap and stocks.

Scrap

The analysis of the statistical link between global scrap volumes and the London fix was conducted by running a series of simple regressions (in the levels and logs). The regression results revealed that the price elasticity of scrap is actually quite low, at only 0.44. (This means that, for every one unit increase or decrease in the price, scrap will only increase or decrease by 0.44 times). In terms of the "strength" of the relationship, the R-squared for the regression in logs was relatively weak, "explaining" 44% of the variation in scrap.

Two tentative conclusions can be drawn from this rather simple exercise. Firstly, it suggests that other forces are important in determining scrap generation. Secondly, it points to the fact that silver will come back into the supply chain as scrap relatively independently of the price.

This result was hardly surprising considering that scrap supply is dominated by Japan, the United States and Europe (who account for 70% of the total) where non-price factors, most obviously environmental legislation and recovery technology, are important determinants of recovery rates.

Although global scrap is inelastic, this is not the case for all countries. Indian scrap price elasticity of 2.2 suggests that this market is likely to a major "swing" factor on rallies in the price.

Bullion Stocks

The sensitivity of silver bullion stocks to changes in the price is important since the "looseness" with which they are held can have profound price implications. Unlike scrap, it is not immediately self-evident whether a rise in prices would trigger a rise or a fall in stocks (i.e. whether people would hoard supplies in anticipation of further price increases or divest stocks to take advantage of "good" price levels). In fact, our analysis showed a positive relationship globally - stocks rose in response to firming prices which points, not surprisingly, to higher prices and investment being related. However, the relationship on a global basis was quite weak, explaining only 18% of the change (basis the regression run in logs) although the elasticity came in at a high 1.75.

As with scrap, local situations can differ substantially. Comex stocks, for example, showed a very weak relationship with prices. This was not entirely surprising given that stock changes have often been driven as much by arbitrage between London and New York as by absolute price levels. In light of this, it was no surprise that European dealers' stocks showed a similarly weak link to prices. By contrast, government and Japanese trade stocks showed a much stronger relationship but the link was negative, i.e. stocks rose as the price fell.

Figure 10
Price Elasticity of Silver Scrap

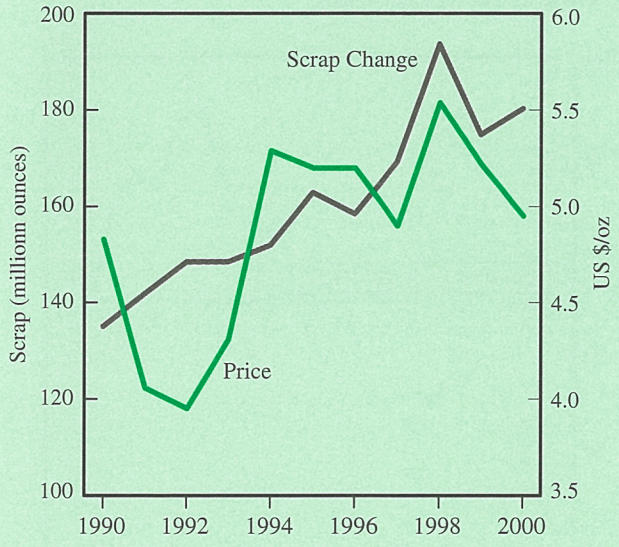
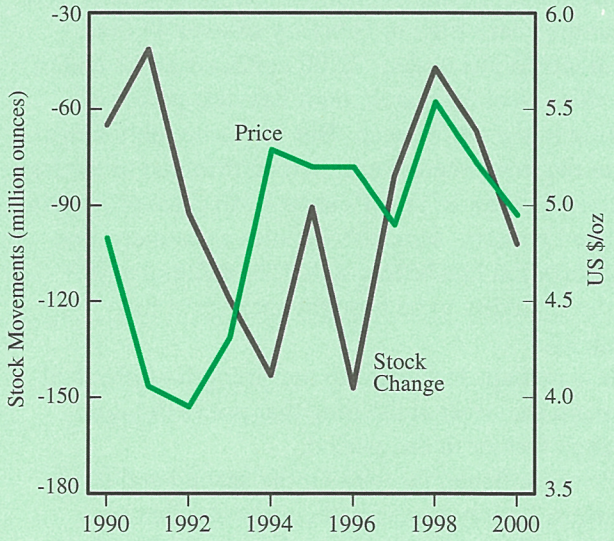


Figure 11
Price Elasticity of Silver Bullion Stocks



3. Investment

- Net implied disinvestment increased by 53% in 2000 to 102.0 Moz (3,167 t).
- Large-scale sales took place out of physical silver stocks that had been established in late 1997/early 1998.
- Funds' net long position on Comex substantially reduced during the course of the year.

Overview

Implied disinvestment increased by 53% last year to reach 102 Moz (3,167 t). It should be recalled that this number is a residual derived from the sum of all the other components of silver supply and demand. Nevertheless, the fact that the market saw an increased level of disinvestment last year is supported by other measurable data. For example, the reduction in private sector bullion stocks referred to in Chapter 5 was broadly in line with such an outcome (though much of the decline in stocks came from the non-identified category). In addition, as is explained in the relevant section below, the dramatic fall in funds' net long futures position on Comex (equivalent to a nominal 150 Moz) is powerful evidence of net disinvestment.

It is noteworthy that the net disinvestment last year occurred during a period of lower-trending silver prices. Clearly the investor sales which took place were mostly "stop loss" ones as the opportunities to sell rallies were few and far between. The liquidation of stocks that took place inevitably raises the question of whether Mr Buffett was among the sellers last year. Our conclusion is that on balance this is unlikely. Even though disinvestment rose in 2000, the level of sales does not seem to have been great enough to accommodate all or even a large part of Berkshire Hathaway's 129.7 Moz (4,034 t) silver hoard. On the other hand, it is true that gross disinvestment last year would have comfortably exceeded the net 102 Moz quoted above. This is because, at the least, there would have been some buying related to fabricators hedging their future needs (e.g. Kodak which announced in December that it had covered all its 2001 silver requirements). It is perfectly possible that such "accelerated demand" (most of which occurred in the fourth quarter) could have been good for 50 Moz of additional silver purchases. But even if we assume that gross disinvestment may have reached 150 Moz or more, this still does not necessarily mean that Mr Buffett's silver was involved. This conclusion would seem to be justified on the basis of our data on European Dealers' Stocks (see Chapter 5) and also by strong anecdotal evidence from various sources that as of early 2001 the bulk if not all of Berkshire Hathaway's position was still intact.

If the disinvestment last year was not from Mr Buffett, where did it come from? (The assumption of course being that our starting point for implied disinvestment is correct - if not, higher scrap supply would be by far the most probable source of the extra silver needed for the market to be in balance). In last year's *World Silver Survey,* we commented that at the end of 1998 other large investors were holding 50 to 80 Moz (1,560 to 2,490 t), with only a small portion of this having been sold by the end of 1999. It is very probable that these positions were mostly liquidated in 2000. In part, the declining silver price may have forced the hand of some of these longs. But, in addition, the general swing in market sentiment towards a far more bearish view of silver's short term prospects must have influenced the decisions to sell. Sentiment had already been hit by the emergence of China as a major factor on the supply side. Towards the end of 2000 and perhaps even more so this year, the potential for weaker demand to hit the price has also had a major influence on investors' expectations. Up to a point, this has prompted some selling by funds. However, such sales seem to have mostly been as a hedge against or to close out entirely existing long

Silver Price and Investment Indicators

	1999 Average	2000 Average	Change y-o-y
Silver Price	5.220	4.951	-5%
Contango (3-mth annualized)	1.54%	5.02%	n/a
US$ Libor (3-mth annualized)	5.41%	6.54%	n/a
S&P 500 Index	1,327	1,427	7%
CRB Index	195	220	13%
XAU Index	66	55	-18%
World Inflation	5.2%	4.2%	n/a
World GDP	3.4%	4.7%	n/a

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

	LBM No. of Transfers	Turnover Moz	Comex Turnover Moz	LBM/ Comex Ratio
Jan-00	329	149	68	2.2:1
Feb	344	173	106	1.6:1
Mar	288	134	50	2.7:1
Apr	277	107	84	1.3:1
May	264	121	49	2.5:1
Jun	250	97	93	1.0:1
Jul	217	93	46	2.0:1
Aug	226	101	81	1.2:1
Sep	224	117	37	3.2:1
Oct	205	82	34	2.4:1
Nov	200	98	76	1.3:1
Dec	251	116	28	4.1:1
Jan-01	229	105	42	2.5:1
Feb	300	120	79	1.5:1
Mar	260	131	35	3.7:1

World's 10 Largest Commodity Trading Advisors, 2000*

	CTA Assets (US$ billion)
Campbell & Co	2.3
Dunn Capital Management	1.4
John W Henry & Co	1.3
First Quadrant	1.3
Quantitive Financial	1.2
Graham Capital Management	0.7
Sunrise Capital	0.6
Allied Irish Capital Management	0.6
Analytic Investment Management	0.6
Barep Asset Management	0.5

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

World's 10 Largest Hedge Funds, 2000*

	Fund Equity (US$ billion)
Maverick Capital	6.2
Soros Fund Management	5.6
Zweig-Dimenna Associates	4.9
Kingdon Capital Mangement	3.7
Marshall Wace Asset Management	3.0
Perry Corp	2.5
Orbis Investment Management	2.1
American Express Asset Management Group	2.0
Tiger Management	2.0
Carlson Capital	1.9

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

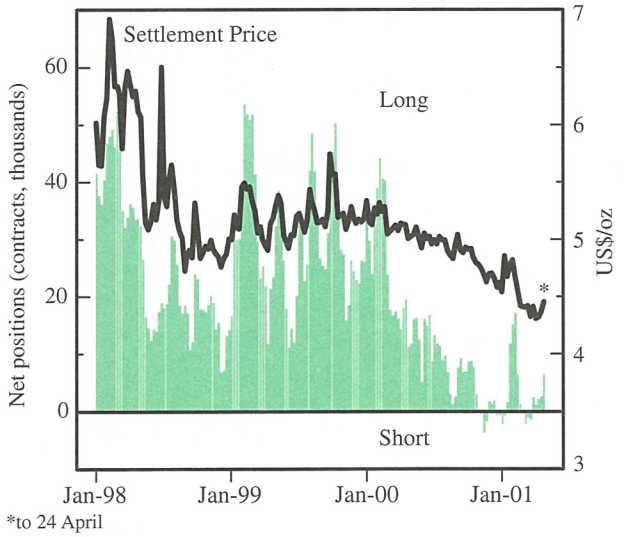
positions rather than the creation of a large outright net short position. For example, although funds' net long position on Comex has collapsed, to date there has been no build up of a large net short one, in spite of the attractive contango available on silver. This is in stark contrast with gold, where the Comex and Over-The-Counter markets have both occasionally experienced aggressive short selling by funds.

Comex

The lack of investor interest in silver last year was well illustrated by 2000's Comex statistics. In that year, average open interest fell over 4% year-on-year to 78,087 contracts while average daily turnover was down a massive 25% at 12,518 contracts.

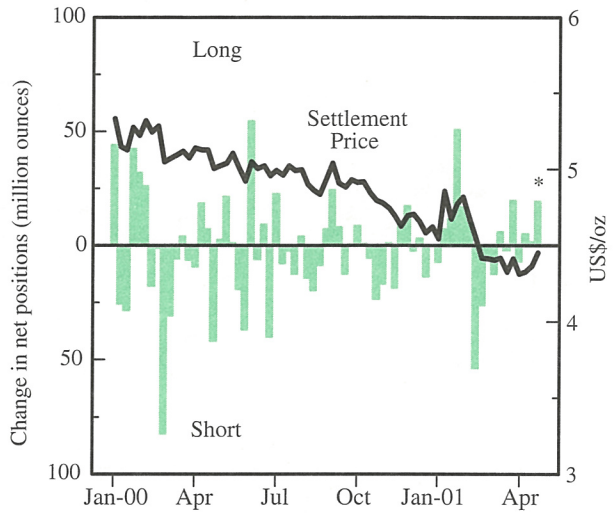
As was mentioned in Chapter 2, one of the key factors behind the steady decline in prices was persistent selling by the funds. Their position was seen to fall from a net long of over 40,000 contracts in February 2000 to a small short before the year was out (taking CFTC data on non-commercial net open interest as the best available proxy for this position). This overall gradual slide, however, masks a key development within the fund position, namely the differing behavior of shorts and longs. The fund long, in fact, held roughly constant from March onwards at a little over 30,000 contracts. Funds' (gross) short positions, however, rose progressively from under

Figure 12
Comex: Non-commercial Net Open Interest
Weekly Net Positions and Settlement Price



*to 24 April

Figure 13
Comex: Non-commercial Net Open Interest
Changes in Weekly Net Positions



*to 24 April

2,000 contracts in mid-February to over 30,000 contracts by year end and it was thus the action of the short position holders that brought about the decline in the net position. The roughly 30,000 contract decline in funds' net long position during the course of 2000 was nominally equivalent to 150 Moz (4,665 t). Even though the physical market impact would have been far smaller, there is little doubt that this heavy disinvestment was a key component of the overall figure of implied net disinvestment of 102 Moz discussed earlier in this Chapter.

Net "Fund" Positions on Comex
(period averages for non-commercial net open interest and settlement price)

		Contracts	Price
1996		9,948	5.18
1997		12,075	4.88
1998		25,513	5.50
1999		30,153	5.22
2000	Q1	29,033	5.18
	Q2	13,989	5.04
	Q3	7,645	4.94
	Q4	1,982	4.72
2001	Q1	3,718	4.54

OTC Market

It is most unlikely funds behaved very differently in the Over-The-Counter (OTC) market than they did in Comex futures. Indeed, our information is that there was some liquidation of long positions and short selling via forwards and options. However, the scale of such speculative activity, particularly on the outright short side, was reported to be modest. This conclusion is supported by the behavior of leasing rates during 2000. The steady decline in borrowing costs throughout the year would not have occurred had there been large scale shorting of silver by funds through the OTC market.

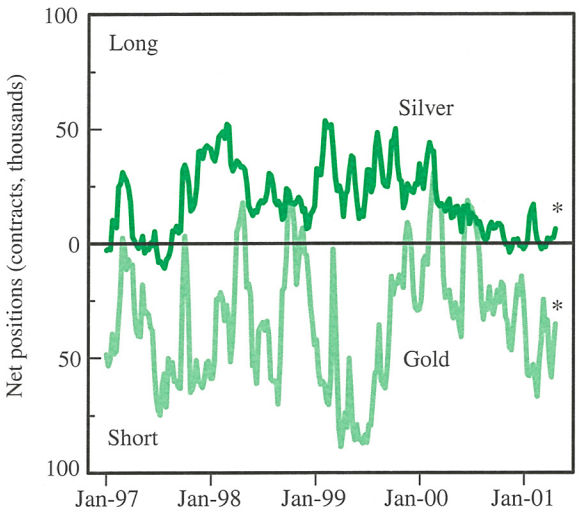
The reality is that fund interest in silver has slumped. In part this is due to the exit of some formerly important players such as Tiger Management (the hedge fund having been closed down) and John W. Henry & Company (who in February 2000 announced their decision to exit the market). The smaller trading range and reduced volatility of the silver price (compared to past years) have also turned speculators against the metal. And, underlying the reduced fund commitment has been a radical change in sentiment regarding silver's short-term price prospects. Following the exciting rally in 1998, silver has failed to meet expectations. This is important because the majority of funds are far more comfortable taking long rather than short positions. As a result, remaining fund interest in the metal has increasingly tended to be of the shorter-term, trend following variety.

Physical Investment

This section covers the buying/selling of physical bullion products by private investors. The larger quantity of metal bought and sold by funds and major individual players like Mr Buffett is discussed above.

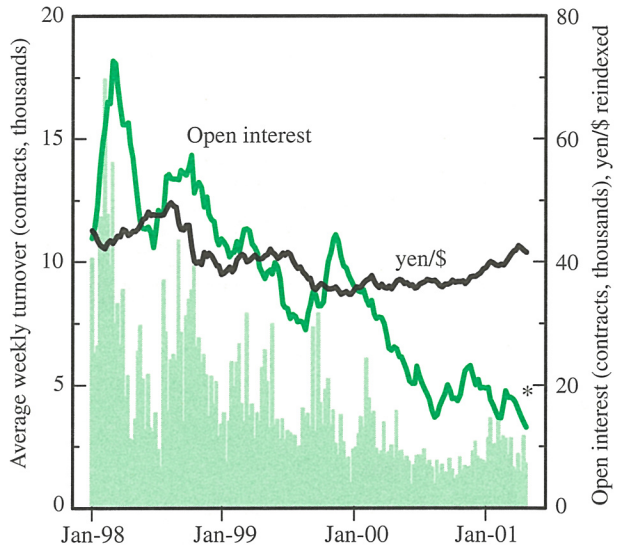
Physical investment in silver was once again negative last year. Indeed, not since the early 1980s have sales of bullion products to the public exceeded purchases from them. Back then, investors, mainly in the United States, absorbed significant quantities of 100 ounce bars (over 350 Moz of which were produced) and coin bags (typically containing 715 oz). Since that time, the market has largely seen one-way traffic, with 100 ounce bars and coin bags coming back into the market, in particular on price spikes. A lot of this silver bullion has ended up in jewelry; many manufacturers in the United States and Mexico are happy to acquire lower cost raw material, the coin bags

Figure 14
Comex: Non-commercial Net Open Interest
Weekly Net Positions



*to 24 April

Figure 15
Tocom Futures Turnover and Open Interest



*to 26 April

in particular having traded at a discount to the spot silver price in the professional market.

Physical disinvestment leapt in 1998 on the rally in silver and then was much less of a factor the following year as the price had dropped back. According to dealers, the amount of 100 ounce bars and coin bags sold back last year was lower still. This clearly owed quite a lot to the uninteresting silver price level. Unquestionably had prices been higher, so would the supply of such material. But having said that, there is also no doubt that privately-held stocks of bullion are now a good deal lower after nearly two decades of sustained net disinvestment.

Tocom

Both turnover and open interest on the Tocom silver contract fell fairly relentlessly throughout 2000, mirroring the declines seen on the other precious metals contracts. Average turnover for the year, at just over 2,200 contracts per day (equivalent to around 4.2 Moz or 130 t) was sharply off the highs seen in 1998, but in line with levels observed in 1999.

The year began with open interest above the 36,000 contract level, and the relative constancy of the yen silver price in January ensured that trading remained subdued and open interest hardly moved. The sharp uptick in the yen price in February, which at one point was close to 8% higher than the lows in January, witnessed a marked rise in turnover as longs liquidated their positions, causing open interest to fall.

Thereafter turnover and open interest continued to fall in spite of some relatively sharp movements in the yen against the dollar. Towards year end, as local currency silver prices pushed towards the 170 yen per gram level (on the back of a weaker yen against the dollar), turnover picked up slightly, touching the high for the second half (2,721 contracts) on the week ending 4th December.

4. Mine Supply

- World silver mine production increased strongly last year, rising almost 7% to a new record level of 589.4 Moz (18,334 t).
- Primary silver mines contributed 25% of the total, at 145.9 Moz (4,538 t). Primary silver output was down marginally year-on-year, but gold by-product increased strongly.
- Weighted average cash production costs increased by a marginal 1 cent to $3.19/oz.
- Lack of activity in the forward market saw outstanding positions decline by over 25 Moz (791 t).

Top 20 Silver Producing Countries in 2000

Ranking 2000	Ranking 1999		Output (Moz) 1999	Output (Moz) 2000
1	1	Mexico	75.2	88.2
2	2	Peru	71.7	78.4
3	4	Australia	55.3	66.2
4	3	United States	62.7	63.3
5	5	CIS	46.2	51.3
6	7	China	44.2	48.2
7	8	Canada	37.5	37.7
8	6	Chile	44.8	37.6
9	9	Poland	35.8	36.7
10	10	Bolivia	13.6	14.1
11	11	Indonesia	9.8	9.9
12	12	Sweden	8.9	9.5
13	13	Morocco	8.9	9.3
14	14	South Africa	4.9	4.6
15	17	Spain	3.1	3.8
16	15	Turkey	3.5	3.5
17	18	Japan	3.0	3.3
18	16	Argentina	3.3	3.2
19	19	Papua New Guinea	1.9	2.4
20	20	India	1.9	1.8

Top 20 Silver Producing Companies in 2000

Ranking 2000	Ranking 1999	Company Name	Country	Output (Moz) 1999	Output (Moz) 2000
1	1	Industrias Peñoles	Mexico	42.1	44.7
2	2	KGHM Polska Miedz	Poland	35.1	36.0
3	3	BHP Minerals	Australia	25.4	32.5
4	4	Grupo Mexico	Mexico	20.1	23.2
5	6	Homestake Mining	USA	13.1	14.7
6	5	Rio Tinto plc	UK	16.0	14.4
7	7	Cominco Ltd.	Canada	12.0	13.3
8	8	MIM Holdings Ltd.	Australia	11.9	12.7
9	15	Echo Bay Mines Ltd.	USA	8.4	12.3
10	12	Coeur d'Alene Mines Corporation	USA	9.6	11.7
11	10	Cia. de Minas Buenaventura	Peru	11.6	10.2
12	14	Boliden AB	Sweden	8.5	9.9
13	9	Noranda Inc.	Canada	11.7	9.7
14	18	Codelco	Chile	7.3	9.3
15	26	Volcan Cia. Minera SA	Peru	4.8	8.5
16	16	Hecla Mining Company	USA	7.6	8.0
17	19	Société Métallurgique d'Imiter	Morocco	7.3	7.9
18	27	Comsur	Bolivia	4.8	7.5
19	11	Placer Dome Inc.	Canada	10.8	6.3
20	21	Pasminco Ltd.	Australia	6.2	6.0

Silver Mine Production

- A 17% increase in Mexico's output strengthened its position as the top silver producing country.
- Australian output surged, pushing the country to third position among top producers, ahead of the United States.
- Mexico's Industrias Peñoles was once again the biggest silver producer in the world.

Having barely changed in 1999, world silver mine production leapt almost 7% last year, the second biggest jump in output recorded this decade (mine production increased 8% in 1997). Global production reached a new record level of 589.4 Moz (18,334 t), bringing the total growth since the beginning of the 1990s to 15%.

Several countries reported increased production but the biggest absolute rise was seen in Mexico, the world's largest silver producing country. Mexico's output surged by 17% or 13 Moz (406 t), widening the gap between it and Peru, as production levels reverted to "normal" after an unusual year in 1999 (see the discussion on page 19). Peru, equally, saw output increase strongly; but an even bigger rise was recorded in Australia (up 20% year-on-year) which has overtaken the United States as the third largest producer in the world. Australia's Cannington silver-lead-zinc mine generated most of the growth. On the other hand, declines in output in Chile (due partly to the depletion of Chimberos) and Argentina saw these countries slip further down the list of top producers. Remarkably, though, the group of Top 20 producing countries was identical to 1999, with only a few small shifts in the ranking within the group.

Mexico's Industrias Peñoles confirmed its position as leading producer, with a 6% increase in output. In fact, there were no changes among the top four producers. Grupo Mexico's acquisition of Asarco's silver assets saw attributable output rise over 15% year-on-year, but BHP stayed firmly in third position and indeed narrowed the gap with KGHM as output from prized

Table 2
World Silver Mine Production
Million ounces

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Poland	28.9	25.7	29.4	27.6	31.6	30.6	33.8	36.0	35.8	36.7
Sweden	8.2	9.1	8.9	8.1	8.0	7.7	8.5	8.6	8.9	9.5
Spain	7.5	7.5	5.9	5.7	4.0	3.3	2.1	1.5	3.1	3.8
Romania	1.6	1.5	1.5	1.4	1.4	1.4	1.4	1.2	1.4	1.2
Greece	2.3	2.0	1.9	1.4	1.4	0.5	1.2	1.4	1.3	1.0
Ireland	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.3	0.5	0.8
Finland	1.0	0.9	0.9	0.8	0.9	1.1	1.0	1.0	1.0	0.8
Portugal	1.4	1.2	1.2	1.0	1.2	1.1	1.1	1.0	0.9	0.7
Bulgaria	1.9	2.7	3.1	1.8	1.4	1.1	1.0	0.8	0.7	0.6
Serbia	3.0	2.6	0.8	0.9	1.0	1.1	1.2	1.1	0.5	0.4
Czech & Slovak Republics	0.9	0.6	0.5	0.4	0.3	0.2	0.3	0.3	0.3	0.2
Italy	0.5	0.4	0.2	0.5	0.5	0.3	0.1	0.1	0.1	0.0
France	0.9	0.4	0.4	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Norway	0.3	0.4	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0
Other	0.3	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Europe	58.8	55.4	55.3	50.5	52.6	49.2	52.3	53.5	54.3	55.7
North America										
Mexico	73.4	67.4	71.2	71.2	72.6	81.3	86.9	91.6	75.2	88.2
United States	59.4	58.0	52.9	47.6	50.2	50.5	70.1	66.2	62.7	63.3
Canada	40.6	37.6	28.3	23.8	40.0	39.9	39.0	36.4	37.5	37.7
Total North America	173.4	163.0	152.4	142.6	162.8	171.7	195.9	194.2	175.3	189.3
Central & South America										
Peru	67.1	53.6	53.7	56.0	61.4	63.3	66.8	65.1	71.7	78.4
Chile	21.8	33.0	31.2	31.6	33.5	36.8	35.1	43.1	44.8	37.6
Bolivia	12.1	10.2	10.7	11.3	13.8	12.3	12.4	13.1	13.6	14.1
Argentina	2.3	1.5	1.4	1.2	1.2	1.0	1.1	2.2	3.3	3.2
Honduras	1.4	1.1	0.8	0.9	1.0	1.2	1.5	1.5	1.6	1.8
Brazil	1.0	0.7	0.7	0.6	0.5	0.4	0.3	0.3	0.3	0.3
Dominican Republic	0.7	0.4	0.5	0.3	0.7	0.5	0.4	0.2	0.1	0.0
Other	0.4	0.5	0.5	1.3	0.3	0.3	0.3	0.3	0.3	0.3
Total Central & South America	106.6	101.0	99.5	103.1	112.2	115.8	117.8	125.8	135.7	135.5
Asia										
Indonesia	2.5	3.2	2.9	3.1	7.7	7.7	8.5	10.0	9.8	9.9
Turkey	1.3	2.5	2.3	2.1	2.1	2.9	2.9	2.8	3.5	3.5
Japan	5.5	5.5	4.4	4.3	3.2	2.9	2.8	3.0	3.0	3.3
Papua New Guinea	4.0	3.1	3.1	2.5	2.1	1.9	1.6	1.9	1.9	2.4
India	1.1	0.8	1.6	1.6	1.2	1.1	1.6	1.7	1.9	1.8
Philippines	1.1	0.9	1.1	1.0	1.1	0.8	0.6	0.6	0.6	0.7
Saudi Arabia	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.3	0.3
Thailand	0.5	0.2	0.1	0.1	0.2	0.2	0.1	0.1	0.2	0.2
Malaysia	0.4	0.5	0.5	0.4	0.4	0.3	0.3	0.2	0.1	0.0
Other	2.0	2.4	2.0	2.5	2.6	2.5	2.6	2.8	2.8	2.9
Total Asia	18.9	19.6	18.4	18.3	21.1	20.9	21.5	23.6	24.1	25.0
Africa										
Morocco	6.6	4.9	7.6	8.3	6.6	6.4	8.4	9.8	8.9	9.3
South Africa	5.5	5.9	6.3	6.2	5.7	5.5	5.2	5.1	4.9	4.6
Namibia	3.0	2.9	2.3	2.0	2.1	1.4	1.2	0.4	0.0	0.5
Zambia	0.5	0.6	0.6	0.4	0.3	0.3	0.2	0.2	0.2	0.2
Zimbabwe	0.6	0.5	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.1
Dem. Republic of the Congo	1.9	1.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.4	0.4	0.3	0.3	0.3	0.4	0.3	0.3	0.4	0.3
Total Africa	18.4	16.0	17.9	17.5	15.4	14.2	15.7	16.1	14.5	15.0
Oceania										
Australia	37.9	39.2	37.0	33.6	29.6	32.5	35.6	47.2	55.3	66.2
New Zealand	0.4	0.7	0.8	0.8	1.0	1.0	1.0	0.8	0.9	1.2
Fiji	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Total Oceania	38.3	39.9	37.9	34.4	30.6	33.5	36.7	48.1	56.2	67.4
Western World Total	414.5	394.9	381.3	366.4	394.7	405.4	439.9	461.4	460.2	488.0

Table 2
World Silver Mine Production
Million ounces

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Other Countries										
Soviet Union/CIS	64.7	58.9	54.3	49.3	47.6	43.6	40.2	40.9	46.2	51.3
China	31.4	31.4	31.7	33.8	34.7	36.5	43.0	43.4	44.2	48.2
Mongolia	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.1	1.1	1.1
North Korea	1.6	1.7	1.8	1.7	1.7	1.3	1.2	1.0	0.9	0.8
Total Other Countries	98.4	92.7	88.7	85.6	85.0	82.3	85.4	86.4	92.4	101.5
World Total	**512.8**	**487.6**	**470.0**	**452.0**	**479.7**	**487.7**	**525.3**	**547.9**	**552.6**	**589.4**

silver producer Cannington surged 24%. Excellent results at Echo Bay moved this producer up six positions in the global ranking; and Latin American producers Codelco, Volcan and Comsur all reported substantial increases in their output. On the other hand, lower output from Noranda and Placer Dome saw these producers slip back a few notches.

Last year, primary silver mines were responsible for 25% of global silver output, down slightly from a year ago (the re-classification of Cannington as a primary mine has resulted in significant adjustments to our primary and by-product numbers, discussed in some detail on page 23). A very substantial increase was recorded in silver from gold operations, with mines in the Americas generating most of the growth. The share of lead-zinc and copper mines of total output were unchanged at 35% and 24%, respectively.

North America

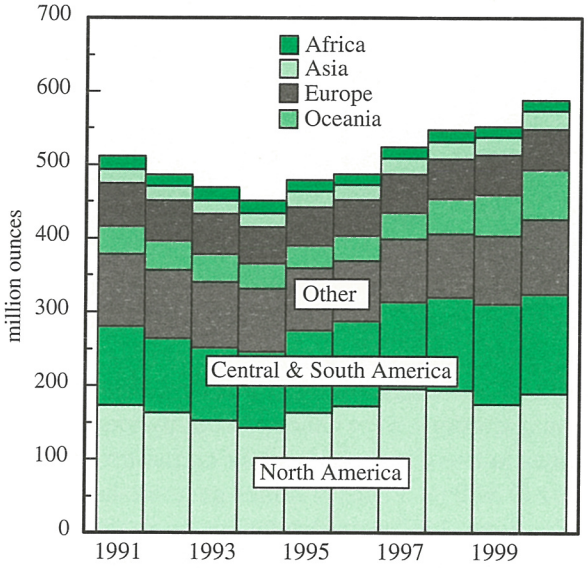
Combined output from Mexico, the United States and Canada increased by 8% last year to 189.3 Moz (5,888 t), roughly one-third of the world's total. Most of the gain was due to higher output from the world's biggest producer, **Mexico**. The 17% increase recorded in Mexico's output to 88.2 Moz (2,744 t) must be seen against the background of an unusual year in 1999 when (as reported in last year's *Survey*) output was restricted at the country's major refinery and smelter, the Met-Mex processing facility at Torreón. Restrictions were lifted on the plant in February 2000, when operators Peñoles satisfied authorities that lead emissions had been reduced to acceptable levels, following investment in equipment to filter smoke and gas. Last year's total output, however, was still lower than 1998 levels, in part because it took at least two months from the lifting of restrictions for the plant to ramp up to full capacity. But resumption of normal operations at Torreón was not the only reason for the increase. At Peñoles' Tizapa mine, output rose 29% to 6.8 Moz (212 t), while production at Mina Proaño increased by 2.7 Moz (84 t) to 23.9 Moz (744 t). The results at Proaño were largely due to expansions completed at the mine last year which raised ore throughput by roughly 30%.

In the **United States,** losses at primary, copper and lead-zinc operations were cancelled out by increases at gold mines to leave last year's silver output up 1% at 63.3 Moz (1,970 t). Primary mines generate half of the country's silver. Last year, production from that source declined 6% - gains made at Lucky Friday, Rochester and Galena were not sufficient to negate declines from Sunshine and Greens Creek. Continuing losses at the Sunshine mine, coupled with the closure of the local smelter, resulted in these operations being placed on care and maintenance in February.

US by-product silver increased 9% last year to 31.9 Moz (991 t). Declines in silver from copper operations (Mission complex was down 7%) and lead-zinc mines (output at Red Dog declined 10%) were negated by significant production gains from the McCoy/Cove gold mine. Output at the mine increased 46%, due to higher grades, to 12.3 Moz (383 t) - an additional 3.9 Moz (121 t) year-on-year.

In **Canada**, silver production was reported at 37.7 Moz (1,174 t), an increase of less than 1%. There are currently no primary silver mines in the country, with all silver being generated as a by-product from gold, copper, lead-zinc and smaller amounts from nickel operations. Silver produced at gold mines increased its share of the country total from 40% in 1999 to 46%, largely due to a 12% rise recorded in output from Homestake's Eskay Creek mine; in 2000, the mine produced 14.7 Moz (457 t). Additional support was given by Agnico-Eagle's La Ronde mine, where following a major expansion, output was more than four times higher year-on-year, at 1.1 Moz (35 t). Silver from copper mines returned to normal levels, following a full year's output at Cominco's Highland Valley copper mine (declines reported in 1999 were due to a four months' suspension of operations, during negotiations to secure its survival through granting of power, tax and labor concessions).

Figure 16
World Silver Mine Production



Central and South America

Silver output in the Americas (North, Central and South) now stands at 324.8 Moz (10,103 t), 55% of the world total (see Figure 16). Last year Central and South America's share fell by just under 2% to reach 135.5 Moz (4,215 t), representing roughly 23% of global production. It is interesting to note that while only moderate growth was recorded in output, there were significant changes in the source of silver supply last year. A 42% decline in output was reported from primary mines, while silver as a by-product from both gold and lead-zinc operations increased significantly. The change was, in part, the result of the completion of mining at the high grade Chimberos silver deposit in **Chile**, which in 1999 produced 16.4 Moz (510 t) of silver. With the closure of Chimberos, the operators remobilized equipment and personnel to the adjacent La Coipa gold mine, with the result that silver output at that mine more than doubled year-on-year (though it now falls in the by-product from gold category). Further gains were recorded at Meridian's new El Peñon gold mine, which contributed 4 Moz (125 t) in 2000. However, these gains were not sufficient to negate losses from Chimberos and overall silver output for the country declined 16% to 37.6 Moz (1,170 t).

Peru experienced a 9% increase in silver production to 78.4 Moz (2,438 t), supported by growth in primary, gold, copper and lead-zinc operations. The strongest growth was from copper mines; output at Grupo Mexico's Toquepala and Cuajone mines increased 22% year-on-year (Grupo Mexico own a 54% stake in these operations, following the acquisition of Asarco in November 1999). Newmont/Buenaventura's giant Yanacocha contributed to the increase from gold operations; output at the mine was 86% higher year-on-year at 1.5 Moz (48 t).

Turning to the primary operations, production at Pan American Silver's Quiruvilca was the highest in the mine's 76 year operating history at 3.6 Moz (112 t). Additional output came from the country's biggest silver mine, Uchucchacua, where expansions completed in 1999 by owners Buenaventura and improved recoveries contributed to a 19% rise in production to 8.5 Moz (263 t). Declines, however, were recorded at Orcopampa, where mining has moved into a rich gold, but low grade silver, zone of mineralization.

Lead-zinc mines generated 55% of the country's silver, with a contribution of 43.4 Moz (1,349 t), a year-on-year increase of 8%. A number of operations reported production gains, including El Brocal, Andaychagua and the biggest silver-from-lead-zinc producer in 2000, Yauliyacu, where output was up 21% at 4.3 Moz (134 t).

Bolivian silver production increased 3% to 14.1 Moz (437 t). A 12% decline in output from the Kori Kollo gold mine was not sufficient to cancel out the increase achieved at the operations of the country's largest producer, Comsur. At the Bolivar mine, higher grades saw production more than double to 4.5 Moz (141 t). The fact that the increase in Comsur's output was not fully translated into more significant growth in the country's total, can partly be explained by temporary problems at one of the lead smelters, which was closed during October.

Production last year from **Argentina** decreased 3% to 3.2 Moz (99 t). Lower output from both of the country's large silver producers, Cerro Vanguardia (gold) and Bajo de la Alumbrera (copper), contributed to the decline.

Europe

The European continent supplied 9% of global output in 2000 (see Figure 16). **Poland**, by far the largest producer in Europe, contributed 36.7 Moz (1,140 t) or roughly 65% of the continent's total. A moderate increase of 2% recorded in that country was primarily due to the implementation of new mining technology that boosted copper production at KGHM Polska Miedz's mines; KGHM generated 98% of Poland's total silver output as by-product of their extensive copper mining. **Sweden** recorded a

somewhat stronger gain, with a 7% rise in output to 9.5 Moz (294 t). A good year at Rio Tinto's (formally North's) polymetallic Zinkgruvan mine (which has been in continuous production for 140 years), and new procedures introduced at Boliden's operations, contributed to the improvements in production seen in the country. Boliden's Spanish subsidiary, Boliden Apirsa, also reported an increase in output. Production at their Los Frailes polymetallic mine in **Spain** roughly doubled year-on-year to 1.6 Moz (50 t). Additional output was also recorded from Minas de Rio Tinto's operations, where the company supplemented production from their Poderosa gold-silver mine with ore from a smaller high grade deposit, to give a combined output of roughly 1.6 Moz (50 t). This left Spain with full year production of 3.8 Moz (117 t), a 23% increase year-on-year.

CIS

In the countries constituting the Commonwealth of Independent States (CIS), silver mine production expanded by an impressive 11% last year, to 51.3 Moz (1,596 t). This was the second consecutive increase in the region's output, following on a 13% rise in 1999; but prior to that, silver output had been on a persistently declining trend for the entire rest of the decade.

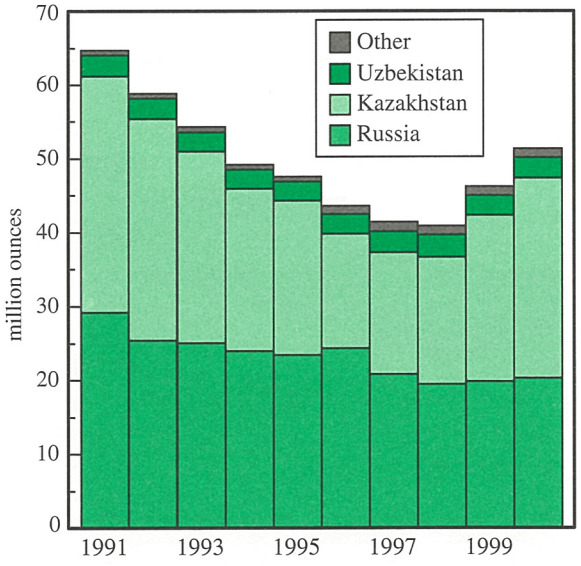
What caused this change in direction? Indications are that most of the growth was generated in **Kazakhstan**. This country used to be the biggest silver producer in the former Soviet Union but production fell dramatically during the mid-1990s to an estimated low point in 1996 of 15.5 Moz (482 t). But the trend changed the next year and four consecutive increases left output in 2000 up 75% from that point. Kazakhstan is once again the number one producer in the region (see Figure 17).

All of Kazakhstan's silver is generated at base metals operations. Both of the country's giant base metals operators have benefited in recent years from substantial foreign investment, which has borne plentiful fruit. At the Kazakhmys Corporation, which is 42% owned by South Korea's Samsung and produces 95% of the country's copper, investment in development of new mining and processing capacity has seen copper output increase by an average 15% per year for the last four years; and silver by-product has soared in the process. Kaztsink, equally, has been expanding aggressively; this lead-zinc operation is majority owned by Swiss trading house Glencore, and has reported a large jump in the silver extracted from concentrates produced at its Kazakh operations. (Kaztsink also toll process large volumes of imported concentrates; silver in such materials would generally not be included in the Kazakh mine production statistics, though precise classification is not always possible). The combined effect of these developments has been a 21% increase in Kazakhstan's silver output last year.

Silver production in **Russia** continued to languish whilst the large primary deposit, Dukat, lay dormant. Production at Dukat was suspended in 1997 and finally ceased when the previous owners went bankrupt in 1999. In the months that followed, a protracted legal battle was fought over the ownership of the mining license and certain of the operation's assets. The dispute was finally resolved late last year, when a joint venture was set up between earlier owners of the license, Serebro-Dukat (majority owned by Canadian miners Pan American Silver), and Dukat Mining Company (DMC), owned by local operators MNPO Polimetall. The joint venture is known as Serebro Magadana and is 80% owned by DMC. The Russian Ministry of Natural Resources announced early this year that Dukat is expected to re-commence mining in 2002. The Russian partner undertook to finance the development costs.

In the meantime, 65% of Russia's silver continues to be generated at lead-zinc operations, with smaller contributions from copper and gold mining. Output was estimated to have increased by a modest 2% last year on the back of higher base metals and gold production (see Figure 17).

Figure 17
CIS Silver Mine Production



In **Uzbekistan,** silver output was estimated to have grown modestly to around 2.7 Moz (54 t), though this number cannot be verified conclusively as actual production figures are never published. Most of Uzbekistan's silver comes from copper mining, with a small quantity also generated at the gold tailings extraction operation owned by Newmont-Zarafshan.

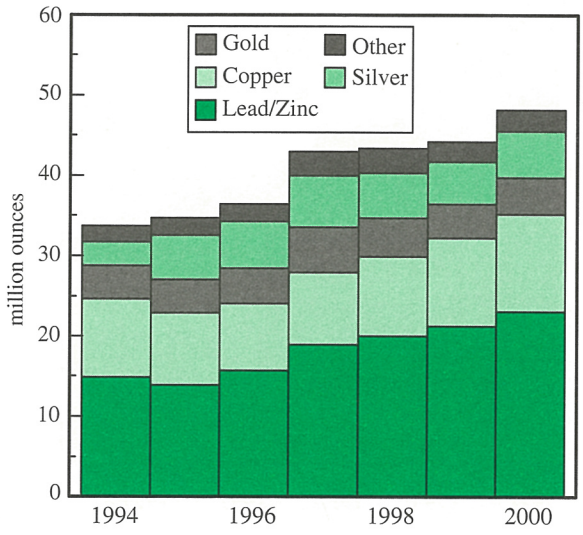
China

Silver production in China was up significantly in 2000 reaching 48.2 Moz (1,500 t). Almost half of this was derived from lead-zinc mining, but significant quantities were also generated from copper, gold and primary silver mining (see Figure 18). At the time of writing it was unclear what the main reasons have been for such tremendous growth. One possibility is that since liberalization, more silver production is finding its way into the official statistics. Furthermore, it is possible that some scrap is being counted as mine production, although why this problem would have been more severe in 2000 is unclear.

Oceania

Australia's silver output increased 20% year-on-year to 66.2 Moz (2,060 t). The growth in production can be almost completely accounted for by gains at Cannington and new output from the Century mine. BHP's Cannington, formerly classified as a zinc mine, has been re-classified in this year's *Survey* as a silver mine (see page 24); with the result that primary mines now generate 49% of silver output in the country.

Figure 18
Chinese Silver Mine Production
By source metal



Cannington, the largest silver mine in the world, last year produced 32.5 Moz (1,009 t), an extra 6.2 Moz (194 t) over 1999. Additional gains were made at Pasminco's new Century zinc mine, which became operational in March last year and contributed approximately 3 Moz (93 t). BHP announced that they intended to increase capacity at the Cannington processing plant by 20%, although no timetable for the expansions was given. **New Zealand** similarly recorded impressive production gains, primarily as a result of higher silver grades at the Martha Hill gold mine (which generated 90% of the country's silver). Output at Martha Hill stood at roughly 1.1 Moz (33 t).

Asia

Asia produces 4% of the world's silver; last year output increased 4% to 25 Moz (778 t). In **Indonesia,** the biggest producer in the region, output was more or less flat at 9.9 Moz (308 t). Over 50% of silver produced in the country was generated from gold-copper mines. Despite operational difficulties at the largest of these, Grasberg, production levels were maintained at roughly 5 Moz (156 t), in part due to higher silver grades. Additional silver was also sourced from the new Batu Hijau copper-gold mine. The rest of the country's silver was generated from gold mines; last year output from this sector declined 6%. The 0.14 Moz (4 t) generated from the first full year of operations at Gosowong was not sufficient to cancel out losses at Rawas (which closed last year) and at Kelian and Minahasa (where production was disrupted by industrial and community action).

There was little change in **Turkey's** silver output, which increased less than 1% last year to 3.5 Moz (109 t). The country's largest silver mine (the primary 100th Anniversary mine) reported output 5% higher at 3 Moz (92 t). However, silver generated by copper and lead-zinc operations (16% of the country's total) declined significantly. In **Japan,** silver production recorded a significant 10% year-on-year growth, due to higher by-product output from a number of lead-zinc mines; while in **India,** a 7% decline was the result of lower copper mine output.

In **Papua New Guinea,** a surge in production was largely due to a record year at the OK Tedi copper-gold mine, which produced 1.4 Moz (45 t) of silver, or over 60% of the country's total of 2.4 Moz (73 t). Additional gains were also made at gold mines Porgera and Misima, the latter reporting a 22% increase in silver output. In the **Philippines,** silver production recovered significantly from the previous year, which

saw a number of mine closures. Output was 32% higher year-on-year at 0.7 Moz (23 t), largely the result of gains at Lepanto's Victoria mine. New mining methods and the rehabilitation of existing mining developments saw output at the mine more than double to 0.35 Moz (11 t).

Africa

Morocco generated almost two-thirds of the continent's silver last year. Total output for the country increased 4% and stood at 9.3 Moz (289 t). Much of the increase was generated at the Imiter primary silver mine, operated by Société Métallurgique d'Imiter (SMI), a subsidiary of the ONA Group; production at the mine increased 9% year-on-year to 7.9 Moz (246 t), leaving Imiter in fifth position among primary mines.

South Africa, the second most important silver producer in the continent, saw production decline 7% last year to 4.6 Moz (142 t). Approximately half of the country's silver is a by-product of lead-zinc mining, while gold mines and copper mines account for around 29% and 20% respectively. In **Namibia**, the declining trend recorded in silver output over the last four years was reversed, following the take-over and revival of the Tsumeb Copper operations by Ongopolo Mining & Smelting. Having produced no silver in 1999, Namibia reported 0.5 Moz (17 t) last year.

Outlook

Last year's *Survey* highlighted three projects in various stages of development which were expected to have a significant impact on the future silver market. Barrick's Pascua-Lama (Argentina-Chile border), Apex Silver Mines' San Cristobal (Bolivia) and Serebro Magadana's Dukat (Russia) were expected to add roughly 78 Moz (2,420 t) of silver per year to world silver production - equivalent to around 13% of current global output. However, the situation has changed dramatically within the past 12 months. Development of Pascua-Lama is on hold, pending improvements in the gold and silver prices. Project funding for San Cristobal cannot be advanced until a problem with the provision of electricity to the project is resolved; the construction start-up date has thus been pushed back. And in Russia, the redevelopment of the Dukat silver field was on hold for most of last year while the legal struggle for ownership of the project was being settled. The license is now held by Serebro Magadana (Magadan Silver) in which a subsidiary of MNPO Polimetall owns 80% of the equity and former owners of the mining license, Pan American Silver, 20%. Recent reports suggest that the mine will still be developed, though only in 2002 (and even this seems optimistic).

Some smaller new mines, however, did come on stream during 2000. The new batch of silver producers included Rey de Plata (zinc-silver) in Mexico, El Peñon (gold-silver) in Chile and George Fisher (zinc-lead-silver) in Australia. In addition, this year has already witnessed the start-up of two primary silver mines, both in South America: Pan American Silver's Huaron (Peru) and Yamana Resources' Martha mine (Argentina). And additional output from Antamina (copper-zinc) and Francisco I Madero (zinc-lead), both of which are anticipated to start production mid-year, is expected to bring the total "new" output for 2001 to around 16 Moz (504 t). This could be boosted further by expansions completed last year at Peñoles' Mina Proaño, La Cienega and Sabinas operations in Mexico.

On the other hand, there were also a number of closures last year (Sunshine, Julcani and Andacaba); delays in development decisions (Amayapampa, Cerro San Pedro and Lucky Friday) and long-time major producers approaching ore depletion (McCoy/Cove). This could negate much of the output gains from "new" silver. Based on the above, it would seem highly unlikely that this year will see another large surge in silver production, although a small increase is possible.

By-product Analysis

In reading the analysis in the first sections of this chapter, which focuses on developments in global silver mine production, one cannot fail to notice the frequent references to the mining of other metals such as copper, gold, lead and zinc. This is, of course, because three-quarters of mined silver is not generated at silver mines, but instead is a by-product of mining of another metal. Silver in its natural state is typically associated geologically with other precious metals and/or base metals. Generally speaking, the economics affecting the primary metal(s) being mined at an operation will determine levels of output and this could result in fluctuations in silver production which may be completely unrelated to developments in the silver market itself. The implication is that silver mine production will be much less sensitive to developments in the silver market than most of the other components of supply and demand.

For this reason, any analysis of the silver mining sector would be not be complete without some

consideration of developments in the markets for copper, gold, lead and zinc. What follows is intended to give a brief overview of major developments and how they may affect future silver production from these sources.

Last year, 75% of mined silver was a by-product of other metals mining; only 145.9 Moz (4,538 t) came from primary silver mines. The following table gives the breakdown of silver output by source metal.

Silver Output by Source Metal
Million ounces

	1999 Output	% of total	2000 Output	% of total	Change y-o-y
Primary	148.2	27%	145.9	25%	-1.6%
Lead/Zinc	193.3	35%	205.7	35%	6.4%
Copper	130.9	24%	140.2	24%	7.1%
Gold	73.2	13%	91.0	15%	24.3%
Other	7.0	1%	6.6	1%	-5.7%

It is worth clarifying the basis on which this classification is done. As a general rule, mines are classified based on the dominant source of revenue. Thus, "primary silver mine" does not imply that only silver is mined at an operation; rather, it indicates that silver generates most of the revenue. Where revenue is split fairly equally between different metals, say silver and zinc, movements in metals prices can result in swings in the primary revenue earner, so that it may be silver one year and zinc the next. Excessive re-classification based on price swings which may be temporary in nature could unnecessarily distort data and complicate analysis, and efforts are made to avoid this. It is usually clear when a mine commences production which metal will generate most of the revenue over its life, and the classification is made on this basis.

Occasionally, however, re-classification is required. This was the case last year with the Cannington mine in Australia. Originally classified as a lead-zinc mine, it became clear during the course of the past two years that silver would generate most of Cannington's revenue, and that a re-classification to a primary silver mine was justified. This explains the noticeable increase in the volumes of primary silver compared to figures published in last year's *World Silver Survey*, and the decline in the lead-zinc component.

The contribution of primary silver mines to total output contracted somewhat to just under 25%, and total primary silver output fell by 2%, the second consecutive annual decline. The decline was recorded despite a 24% increase in Cannington's output last year, to a massive 32.5 Moz (1,009 t). Primary silver production in Mexico also expanded substantially (up 23% to 42.2 Moz (1,311 t)), largely as a result of strong performances at Peñoles's Proaño and Tizapa divisions. But in the United States, the third largest primary silver producing region, growth at Coeur d'Alene's Rochester and Galena mines and Hecla's Lucky Friday operation was cancelled out by the declines at the Sunshine mine, as well as Hecla/ Kennecott's Greens Creek operation. And in Latin America, primary production collapsed to less than two-thirds of 1999 levels as the Chimberos deposit in Chile was mined out and operators Mantos de Oro switched their focus back to mining gold at La Coipa.

This switch back to gold mining at La Coipa contributed to the 24% surge globally in silver-from-gold. La Coipa has always had high silver grades, and last year generated over 11 Moz (344 t) of silver. The table above shows how silver production from gold mines increased to 15% of total silver output, up from 13% in 1999. Gold by-product from Chile more than doubled, as the output from La Coipa was enhanced by 4 Moz (125 t) of silver from Meridian's new gold mine, El Peñon. As a region, Latin America saw its silver as gold by-product surge by 62% last year. Canadian and US gold mines also increased their silver output (up 13% and 27% respectively), with Agnico Eagle's LaRonde and Echo Bay's McCoy/Cove mines being particularly prominent. Homestake's Eskay Creek also increased silver production substantially.

This robust increase in silver from gold mines belies the fact that there was virtually no growth in global gold mine production last year. Gold output increased by less than half a percent, to 82.7 Moz (2,573 t) as prices remained depressed for most of the year. The market continued to be under pressure: total fabrication demand fell marginally and investment swung from a positive 5.5 Moz (170 t) in 1999 to a negative 9.4 Moz (291 t) in 2000. This year there are fears that a global economic slowdown could impact negatively on gold demand, which does not bode well for prices. While gold prices remain depressed, there is not much scope for new gold projects to be brought onstream; the potential for silver from this source is therefore also muted. The deferral of Barrick's Pascua-Lama project due to poor metals prices is one prominent case where future silver production was removed (albeit perhaps only temporarily) from the production pipeline -

Pascua was expected to generate an average of 36 Moz (1,120 t) of silver per year as gold by-product.

Average Prices of Source Metals

	1996	1997	1998	1999	2000	Change y-o-y
Lead ($/t)	774	624	528	503	454	-10%
Zinc ($/t)	1,025	1,313	1,023	1,077	1,128	5%
Copper ($/t)	2,290	2,276	1,653	1,575	1,814	15%
Gold ($/oz)	388	331	294	279	279	0%

Sources: LME, GFMS

Most of the world's silver is still generated at lead-zinc mines. Silver by-product from this source increased by just over 6% last year, thus maintaining its 35% share of total output. Growth in the category was recorded in every region of the world, except for Africa, with countries in Latin America once again accounting for the majority (almost 30%) of silver from this source. In Peru, where there are 13 lead-zinc mines that produce more than 1 Moz (31 t) of silver a year, impressive increases were reported at several operations, including Yauliyacu, El Brocal and Andaychagua. Mexico's lead-zinc by-product also increased strongly (up over 11%) as mines such as Naica, La Cienega and San Martin upped production and Sabinas more than doubled its output. And in Australia, lead-zinc by-product jumped almost 15%, due to the commencement of production at the Century zinc mine and strong results from the Rosebery and McArthur River mines.

This result was recorded against the background of a 9% increase in worldwide zinc mine output (according to ILZSG, the International Lead and Zinc Study Group) and a 1% decline in lead production.

World Mine Production of Source Metals

Thousand tonnes

	1996	1997	1998	1999	2000	Change y-o-y
Lead	3,008	3,026	2,988	2,981	2,938	-1%
Zinc	7,296	7,336	7,566	7,739	8,418	9%
Copper	11,103	11,483	12,288	12,716	13,227	4%
Gold (t)	2,361	2,479	2,538	2,567	2,573	0%

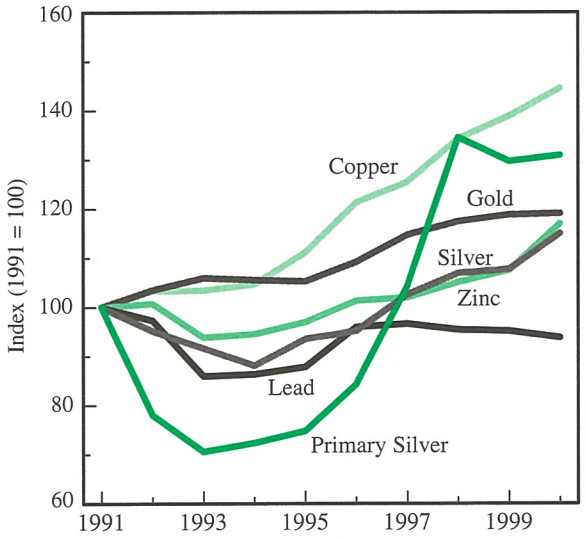
Sources: ILZSG, WBMS, GFMS

Having performed well in 2000, zinc prices are expected to ease in 2001 due to increased supply of new metal and an expected surplus in the market for a second consecutive year. The market has been identified as being particularly exposed to the effects of an economic slowdown due the metals's particular end-uses. The lead market, equally, is expected to be under continued pressure from excess supply, and growing demand is generally expected to be insufficient to absorb high stocks and rising supply levels.

Last year also witnessed an increase in silver generated as a by-product of copper mining (up 7% to 140 Moz (4,361 t)). Copper mines are the source of just under one quarter of all silver. Many of the large silver-containing copper mines are located in Europe and Central Asia, with Poland and Kazakhstan contributing the lion's share of this type of silver. It was the latter which recorded explosive growth in its silver by-product. Kazakhmys, the country's mammoth copper producer, reported a 33% surge in silver output on the back of a strong increase in copper production. Kazakhmys has benefited enormously from substantial capital investment over the past number of years by 42%-owners and operators Samsung, and indications are that production could increase even further.

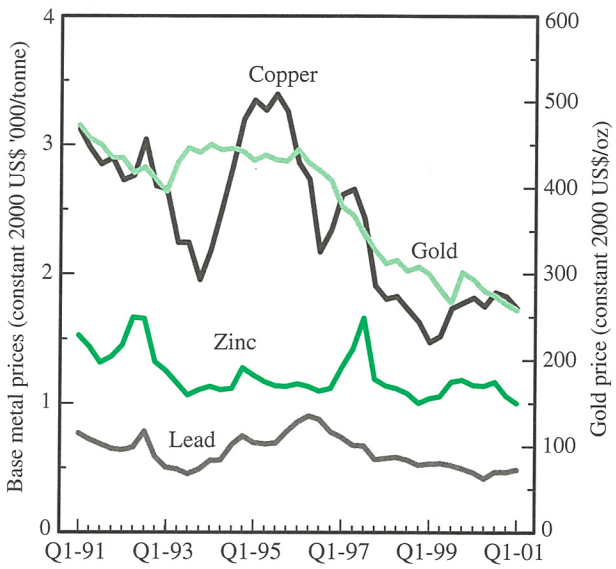
Copper prices strengthened by 15% last year (see table above) and expectations are for a further increase in 2001, as observers anticipate a deficit of refined metal, despite modestly higher mine production and a possible slowdown in consumption. It has become apparent in recent years that higher copper output does not necessarily translate into increased silver output (see Figure 19) as some of the cheap new processing technology does not favor extraction of silver.

Figure 19
Mine Production of Source Metals



Sources: GFMS / ILZSG / WBMS

Figure 20
Source Metal Prices (real terms)



Production Costs

- Weighted average production costs were $3.19/oz, up less than one cent year-on-year.
- Only one primary silver producer reported cash costs which were higher than the average spot price of $4.95.
- Weighted average total production costs were $4.23/oz.

Data from eleven operations were used to calculate the weighted average cash cost for this year's *Survey*. In total, the sample group produced 94.5 Moz (2,939 t) of silver, or 16% of global output. The small sample size can largely be explained by the fact that only 25% of silver in 2000 was generated from primary mines.

Silver Mine Production Costs

		1998	1999	2000
Cash costs:	highest	$5.34	$5.09	$5.02
	lowest	$1.90	$1.99	$2.20
	weighted average	$3.03	$3.18	$3.19
Average spot price		$5.54	$5.22	$4.95
% output with costs > spot price		0.0%	0.0%	5.0%
Sample size (million ounces)		81.3	87.7	94.5

Last year was particularly tough for primary silver operators, as the average spot price declined 5% and cash costs increased moderately, with the result that cash margins declined by 14% (margins had declined by 20% 1999). The lowest reported cash costs in 2000 (and the only mines producing at less than $3/oz) were Greens Creek silver-gold-lead-zinc mine in Alaska (owned by Rio Tinto subsidiary Kennecott Minerals 70.3% and Hecla Mining 29.7%) and Mina Proaño silver mine in Mexico (Peñoles 100%). Impressive cost reductions of roughly 15% were made at Pan American Silver's Quiruvilca mine, where improved work methods and modernization resulted in increased mill throughput and a record silver output. Similar improvements at Buenaventura's Uchucchaccua mine were due to higher silver recoveries at the plant.

The highest costs were recorded by Hecla's Lucky Friday mine, with both cash costs and total production costs higher than the average spot price. The high costs were in part due to lower revenues from lead production (an important by-product at Lucky Friday). Hecla is expected to make a decision on the mine's future within the next few months, as a large capital investment project to develop the next level of ore is coming due.

Last year, total production costs were also monitored, albeit for a slightly smaller sample size of 82 Moz (2,555 t); a total of nine mines.

Weighted average total production costs (including depreciation, amortization and reclamation costs) for the sample size in 2000 was $4.23/oz, and 21% of sampled production was produced at total costs that exceeded the average spot price.

Producer Hedging

- Net outstanding producer hedge positions declined for the second consecutive year, falling by 25.4 Moz (791 t).
- Forward sales positions declined by 16.5 Moz (514 t); options positions also contracted substantially.
- Lack of hedging activity appeared to contribute to exceptionally low and declining lease rates.

Last year's *World Silver Survey* highlighted the possibility of increased producer hedging during 2000 associated with financing of a few large-scale new mining projects. As was discussed in the Outlook section on page 23, several of these projects which could potentially have required hedging were deferred during the course of the year, and the expected hedging did not materialize. On the contrary, producers were largely absent from the forward market last year, allowing their hedge books to run down or, in a number of cases, closing out positions prematurely. As a result, total outstanding hedge positions declined by a

significant 23% last year, creating an estimated 25.4 Moz (791 t) of demand in the physical market (see Figure 21).

A note of caution is warranted about these numbers: unlike gold, the silver market has not benefited from greater transparency and a more regular information flow about producer hedging activity, and reliable, comprehensive statistics are virtually impossible to come by. Part of the reason for this is that a substantial part of silver hedging is generated by producers of other metals, who tend not to place much emphasis on disclosure of their activities as they relate to (often relatively unimportant) by-products. This is particularly true for the large base metals producers. Also, some of the biggest silver producing companies operate from countries where financial disclosure requirements are different to those in, say, the United States or Australia; there is often no obligation to disclose details of hedging activities (producers in Peru, Mexico, Poland and Kazakhstan, for example, would fall into this category). As a result, the hedging statistics presented here are to be taken as indicative of trends in this somewhat obscure sector of the market, rather than at absolute face value.

The available published data suggest that forward sales and options positions both declined substantially during the year. Support for this observation was provided in the form of anecdotal evidence, with several producers confirming that they found prices too unattractive last year to lock in. In addition, silver lease rates declined throughout the year, a further suggestion that there was not much demand for borrowed silver to support producer hedging. During the previous year, lease rates were volatile and relatively high on average. Three-month rates, for example, averaged 3.87% during 1999; but during the course of last year, they declined by over 80%, and the average for 2000 was an exceptionally low 1.52%. Medium-term rates also fell sharply: the 12-month rate averaged 3.45% in 2000, down 38% year-on-year.

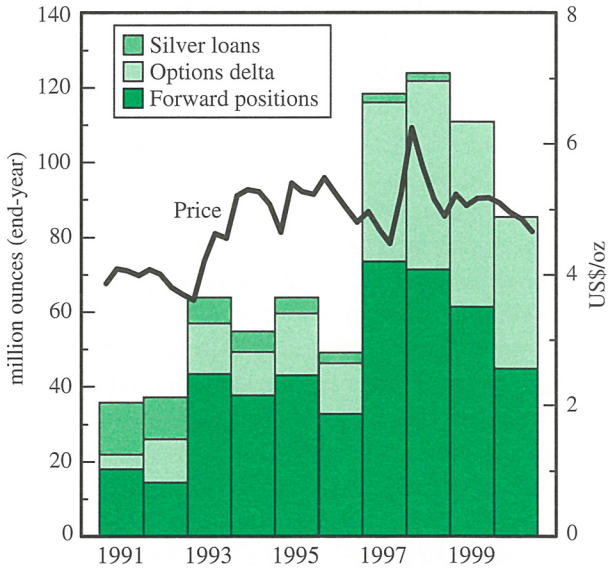
Much of the decline in hedged positions was purely the result of deliveries into positions established at higher prices, without replacing them. In some cases, producers allowed their positions to run down in line with a change in their future silver production profile. For example, Placer Dome have allowed their silver hedge position to decline as they require less hedging now that Chimberos has been mined out. (The company also declared a temporary "moratorium" on gold hedging last year, which may further have discouraged them from putting on new silver positions). Echo Bay's silver hedge position has also contracted markedly since the end of 1999 (their silver reserves at the end of last year had declined to 10.9 Moz (339 t)).

Some of the large silver hedging deals completed in the last two years were of a more "one-off" nature, such as the transactions announced by Boliden, MIM and Pasminco - these all appeared to be declining gradually over the course of time. There were also some active close-outs of positions, such as Homestake's buying back in March of the 3.6 Moz (112 t) of hedged silver on their books.

This is not to say that there was no hedging done at all last year. Barrick, for one, built its silver book up quite aggressively in the second and third quarters, but by the fourth quarter, after the deferral of the Pascua project had been announced, the silver book had shrunk back to 20 Moz (622 t) - though this was still up substantially from the end of 1999.

But all indications are that there will not be much activity in the hedging arena this year. This is primarily because there are few projects - both new mines and expansions - in the financing stage which could generate significant amounts of hedging. An additional factor is the fact that one or two players who used to hedge some of their silver will no longer feature in this area: BHP, which used to do a very modest amount of silver hedging, have stated publicly that they would no longer engage in any commodity hedging; and North Limited has been taken over by Rio Tinto, who have long held a policy of not hedging at all.

Figure 21
Silver Producer Hedging: Outstanding Positions



5. Supply from Above-ground Stocks

- Supply from above-ground stocks remained at a high level in 2000 and contributed to the fall in the silver price.
- Net sales of bullion stocks rose marginally as higher private disinvestment offset lower government sales.
- Scrap supply increased slightly in spite of the lower US dollar silver price.

Summary

Supply from above-ground stocks increased by 9.9 Moz (308 t) in 2000 to reach 331.6 Moz (10,314 t). The table below shows the contribution made from each of the components of this total.

Supply from Above-ground Stocks

	1999	2000
Implied Disinvestment	66.8	102.0
Producer Hedging	-12.9	-25.4
Net Government Sales	92.9	74.7
Sub-total Bullion	146.8	151.3
Scrap	174.9	180.3
Total	321.7	331.6

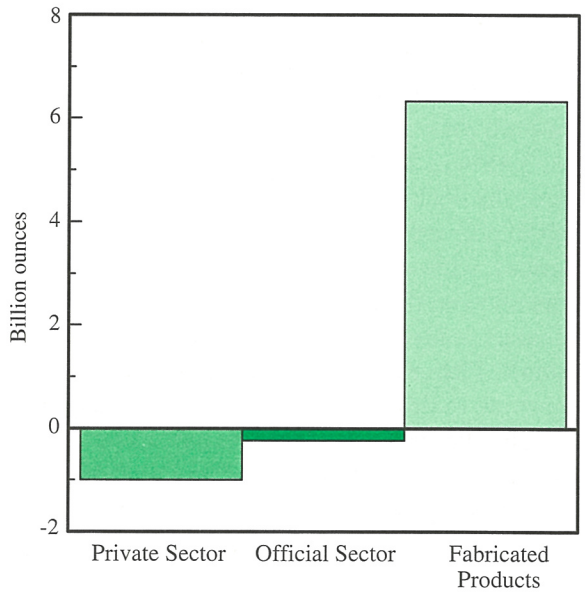
The sub-total for supply from bullion stocks - 151.3 Moz last year - is the sum of implied disinvestment, producer hedging and net government sales. This suggests that the aggregate level of sales out of bullion stocks rose by only 3% in 2000. However, even though the overall level of supply was little changed, its composition did vary, with a reduced amount of net government sales more than compensated for by a higher quantity of bullion mobilized from private stocks. Global scrap supply also increased in 2000, again by just over 3% according to our estimates.

The relatively modest increase in supply from above-ground stocks during the course of 2000 probably helps to explain why the average silver price fell by only 5% last year, compared to the substantial decline seen in the first few months of 2001. In this regard, it may be significant that the amount of metal which entered the market from above-ground stocks represented some 35% of total silver supply in 2000, a figure that was marginally lower year-on-year and spot on its ten-year average. Conversely, the lower price in the first third of 2001 may owe something to a higher level of supply from, especially bullion stocks (although as explained elsewhere in this *World Silver Survey*, weaker demand probably played a larger part).

Figure 22 shows the changes in above-ground stocks over the past decade. Ten years of sustained net disinvestment (plus a smaller rise in the producer hedge book) has reduced private sector bullion stocks by one billion ounces (more than 31,000 tonnes). There has been a much smaller fall in government holdings over the same period, amounting to 232.9 Moz (7,244 t). It is worth noting, however, that 89% of this decline has occurred in the last three years. Meanwhile, the stock of fabricated products has grown by over six billion ounces (197,000 t). Last year alone the stock of fabricated products would have increased by up to 740.6 Moz (23,035 t), netting scrap supply off the figures for fabrication demand. (Note that these estimates for the increase in the stock of fabricated products do not make any allowance for "lost" silver through abrasion, products going into landfill or drains etc).

Measuring the change in the main components of above-ground stocks is one thing, it is quite another to determine the absolute level of such stocks. For one thing, the historical supply/demand and stocks data are simply not good enough to generate accurate estimates for the main components (in stark contrast with the more thoroughly analyzed gold market). Arguably the only consistent data set (and it too has its weak spots) is for historical mine production. Cumulative mine production totalled approximately 39,600 Moz (1.23 million tonnes) at the end of 2000. However, from this number it is necessary to subtract the quantity of silver

Figure 22
Changes in Above-ground Stocks, 1991-2000



that has been irrecoverably lost over the millennia. Although there is little doubt that a huge amount of metal has been lost, even small adjustments to one's assumptions regarding the exact percentage have enormous implications for the implied level of above-ground stocks. (This is because just 1% of historical mine production is equivalent to no less than 396 Moz). Yet the difficulties in making such a "top-down" analysis are small compared to the immense challenge of making a comprehensive "bottom-up" one. The main reason for this is that bullion stocks and, even more so, stocks of fabricated products are very widely dispersed and scarcely reported. Due to this fact, GFMS has sought to measure those stocks, which are arguably closest to the market and that can be measured with some degree of accuracy, namely what we term Identifiable Bullion Stocks. These are analyzed in the sections that follow.

Identifiable Bullion Stocks

Identifiable Bullion Stocks is a subset of total bullion stocks that can be reasonably well measured on a regular basis. Its most difficult to measure component is government stocks. There is very little public domain data available on official holdings of silver (again unlike official sector gold reserves). GFMS' estimates, which are made on a country-by-country basis, are therefore mainly based on our own analysis of privately obtained data on flows in and out of government stocks. There are two other important components of our Identifiable Bullion Stocks total,

Figure 23
Identifiable Bullion Stocks

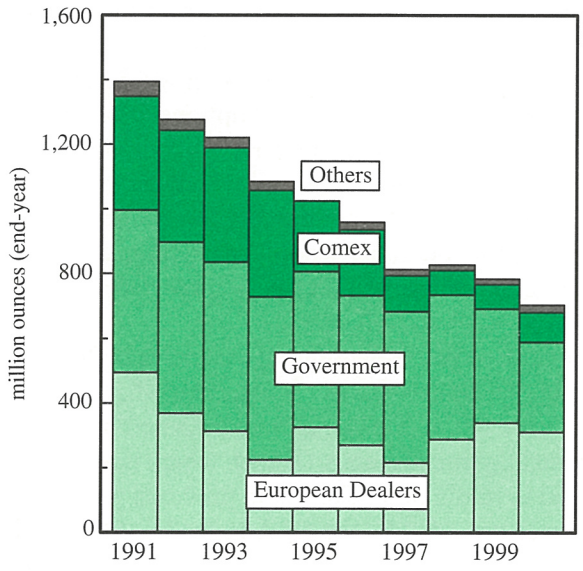
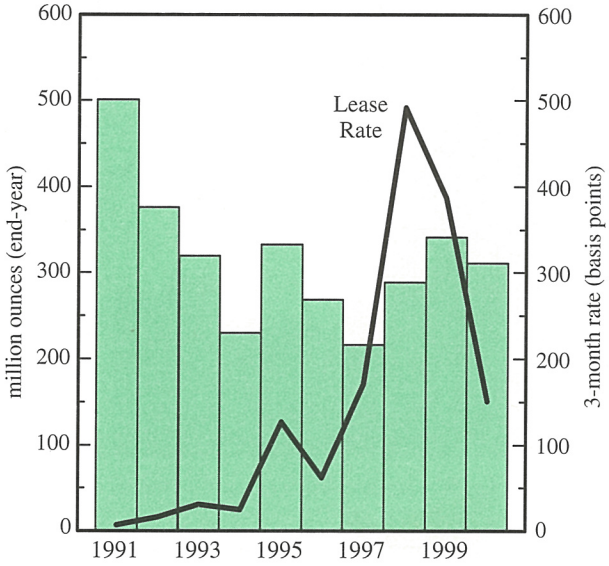


Figure 24
Bullion Stocks in Dealers' Vaults in Europe

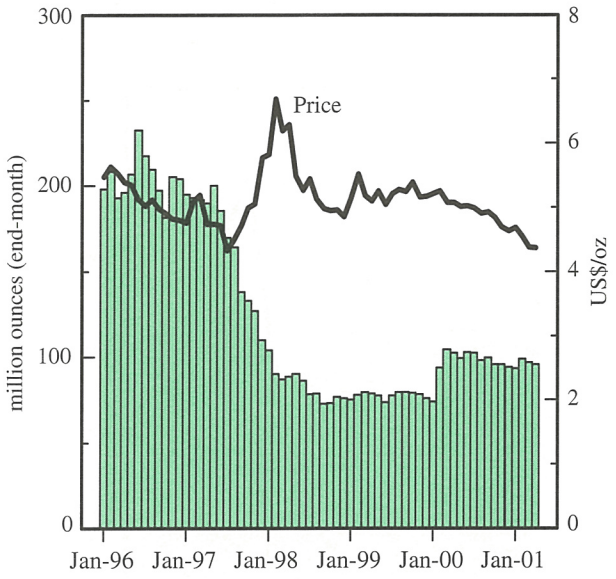


Comex inventories (which are regularly reported by the exchange) and European Dealers' Stocks (data on which are obtained via a private survey conducted by GFMS). Overall Identifiable Bullion Stocks stood at 705 Moz (21,928 t) at the end of 2000. This represented a decline of 81 Moz (2,519 t) from our revised end-1999 total. Given that the absolute decline in bullion stocks amounted to 151 Moz (4,696 t) in 2000 (see table on page 28), the implication is that 70 Moz (2,177 t) of this must have come from bullion inventories that are outside our Identifiable Bullion Stocks universe. Using the same methodology to look at changes in stocks over the last ten years generates the perhaps surprising result that the reduction in the Identifiable Bullion Stock accounted for only 60% of the 1,232.4 Moz (38,331 t) decline in total world bullion stocks over the period. The difficulty with such extrapolations, however, is that they do not take into account declines in stocks that were associated with new lending (as opposed to sales) of silver or, for that matter, the simple relocation of inventories outside of

Identifiable Bullion Stocks

	end-1999	end-2000
European Dealers	341	311
Comex	76	94
Government	352	278
Others	17	22
Total	786	705

Figure 25
Comex Warehouse Stocks



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

our measurable universe. Thus, it is quite probable that the percentage mentioned above exaggerates the contribution to supply from Identifiable Bullion Stocks (given our supposition that the growth in lending over the period for non-producer hedging purposes would mainly have come from the Identifiable category).

European Dealers' Stocks

GFMS' survey of European Dealers' Stocks shows that these declined by some 30 Moz (933 t) last year to end 2000 at around 311 Moz (9,664 t). Taking into account some new positions being built up (stocks increased in the second quarter before resuming their descent in the fourth quarter), the decline in those stocks that were held at the end of 1999 was probably greater than implied by the 30 Moz decline quoted above. Nevertheless, the scale of the reduction in European Dealers' Stocks last year hardly supports the notion, for example, that Warren Buffett liquidated a large part (if not all) of his 129.7 Moz (4,034 t) holding - assuming of course that this was/is held in European Dealers' vaults. A more plausible explanation is, firstly, that especially in the first quarter some silver was simply relocated (see the section on Comex stocks). In addition, holders of stocks (possibly but not necessarily including Mr Buffett) sold or lent a sizeable quantity of silver last year that up until then had been held on their behalf by European dealers. The reduction in silver leasing rates last year could indicate that fresh lending was at least an equally valid explanation for the reduction in such inventories as were outright sales.

Comex Silver Stocks (end period)
(Million ounces)

	Q1	Q2	Q3	Q4
1999	80	74	79	76
2000	104	103	100	94
2001	97			

Comex Stocks

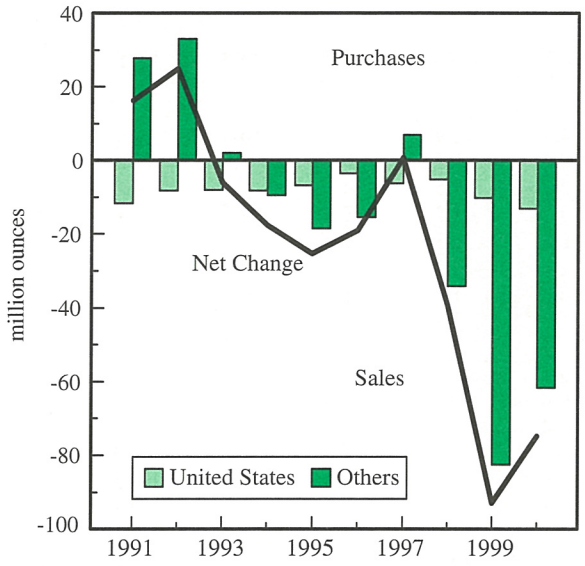
Comex inventories ended last year at just under 94 Moz (2,924 t). At the end of March 2000, however, they had peaked at over 104 Moz (3,235 t). Given that exchange stocks totalled only 76 Moz (2,364 t) at the end of December 1999, this was a quite remarkable increase. The underlying reason for the rise in exchange stocks was the relative lack of available metal in the US market, something that was intimately related to the closure of the Handy & Harman refinery in Attleboro. This led to prices on the Comex rising to a sufficiently attractive premium over the London fix to merit the shipping of a large quantity of bullion across the Atlantic and into Comex depositories. Most of this occurred during February and March, when the rise in Comex stocks was close to the same quantity as the level of US bullion imports from the United Kingdom.

Government Stocks

Net sales out of government stocks came to 74.7 Moz (2,323 t) in 2000. By far the largest contribution to this total came from China. We estimate that official sales from China amounted to 58 Moz (1,800 t), down from a revised total of 68 Moz (2,100 t) in 1999. A further quantity of stocks was exported but not sold outright. The reason for this probably was the low level of silver prices. This conclusion would seem to be supported by rumors that call options had been written by the Chinese against part of their silver holdings. In addition, there was evidence that some official stocks were being lent into the market, something that probably would have played a part in the reduction of leasing rates during the course of 2000.

The bulk of the remaining official sales in 2000 were made by the United States. Most, if not all, of this silver came out of the stockpile maintained by the Defense Logistics Agency (DLA), which has now been reduced to minimal levels. As in previous years, this silver was provided by the DLA to the US Mint for the

Figure 26
Changes in Government Stocks



minting of silver coins. Unfortunately, the information released by the government agencies involved is somewhat equivocal. Nevertheless, indications are that 13 Moz (404 t) was used by the Mint in 2000 and that all of this silver came from government stocks.

Regarding the outstanding level of official bullion holdings, we estimate that these totalled at least 278 Moz (8,647 t) at the end of 2000. This is, however, a conservative estimate. It does not, for instance, take into account the possibility that certain governments may be holding large quantities of formerly circulating coins. Particularly in Europe, this could become a factor in the next few years as the introduction of the euro may prompt some countries to recycle their redundant coin holdings.

We have also not taken at face value news from India that government stocks could be far greater than previously estimated. Unconfirmed reports from the country are that official holdings amount to no less than 160 Moz (5,000 t) and that the authorities are looking to sell around half of this silver. At this stage, there is no evidence to substantiate either of these claims, although it is possible that a large quantity of metal could have been amassed in the past, chiefly from confiscated silver during the long period when most bullion entered India unofficially.

Other Stocks

Other identifiable bullion stocks not covered in the sections above, consist of those inventories registered on the Tokyo Commodities Exchange (Tocom), the Chicago Board of Trade (CBOT) and Japanese trade stocks, which are reported to the Ministry of International Trade and Industry. (These stocks collectively make up the "others" category in Figure 23). The level of these other identifiable stocks came to 22 Moz (682 t) at the end of 2000, representing a not insignificant rise year-on-year. Nearly all the increase came from growth in Japanese trade stocks.

Silver Borrowing

Silver leasing rates declined steadily during 2000. As a result, for the year as a whole, 3-month rates averaged 1.5% compared to 3.9% in 1999. The lower level of leasing rates was partly caused by a reduction in borrowing. As the graph shows, even though fabrication related demand probably rose last year, this was more than offset by a reduced call on the market from producer hedging (see Chapter 4). It is possible that the closure of the Handy & Harman facility also contributed to the lower demand for borrowed metal. It is probable, however, that the decline in leasing rates owed more to supply-side developments. Our understanding is that extra liquidity was injected into the market from at least three sources last year. Firstly, some formerly allocated metal held by one or more private investors was lent into the market. This may have included a portion of Mr Buffett's holding. Secondly, part of the silver exported by China was not sold or stockpiled but was lent out. And, thirdly, the "accelerated demand" (i.e. the hedging of future raw material needs) seen from manufacturers (chief among which was Kodak) in the fourth quarter resulted in a large amount of fresh liquidity being provided to the market.

Figure 27
Silver Borrowing

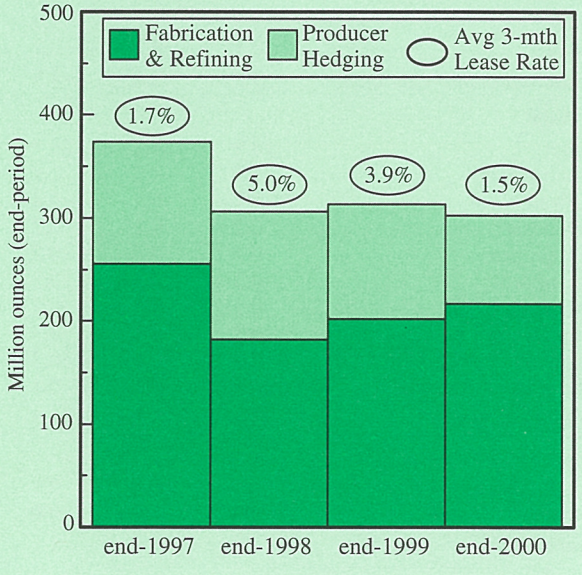


Table 3

Supply of Silver from the Recycling of Old Scrap

Million ounces

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Germany	16.1	16.1	15.8	15.4	14.8	15.4	16.1	16.4	16.1	16.7
UK & Ireland	7.2	7.2	7.3	7.9	7.4	7.6	8.4	10.8	11.5	12.5
France	3.8	5.3	4.0	4.2	4.7	4.5	4.3	4.1	4.0	3.5
Italy	2.7	2.7	2.7	2.8	3.2	3.5	3.4	4.7	3.4	3.4
Austria	1.9	1.9	1.9	1.9	2.0	1.8	1.8	1.8	1.7	1.6
Netherlands	1.1	1.2	1.1	1.3	1.1	1.3	1.3	1.3	1.3	1.4
Norway	0.8	0.8	0.8	0.8	0.8	1.0	1.0	0.8	0.9	1.1
Sweden	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Belgium	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Czech & Slovak Republics	0.8	1.0	0.8	0.7	0.7	0.9	0.8	0.7	0.6	0.6
Denmark	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Portugal	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5
Spain	0.4	0.3	0.3	0.3	0.4	0.5	0.5	0.4	0.4	0.4
Switzerland	0.7	0.7	1.5	0.6	1.6	1.7	0.8	0.4	0.3	0.3
Romania	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other	1.4	1.5	1.5	1.5	1.5	1.5	1.6	1.5	1.5	1.4
Total Europe	39.8	41.5	40.6	40.3	41.1	42.5	42.7	45.9	44.6	45.9
North America										
United States	42.7	42.3	43.2	45.2	46.0	48.4	51.8	55.7	57.4	62.4
Mexico	2.3	2.3	2.3	2.3	4.8	2.4	4.3	10.6	2.4	2.1
Canada	1.3	1.3	1.3	1.3	1.7	1.8	1.6	1.9	1.6	1.4
Total North America	46.3	45.9	46.7	48.7	52.5	52.6	57.7	68.3	61.4	65.9
Central & South America										
Brazil	1.9	1.9	1.9	1.9	1.9	1.9	1.6	1.6	1.8	1.5
Argentina	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Chile	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4
Other	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.9	0.9	0.8
Total Central & South America	3.9	3.9	3.8	3.8	3.8	3.8	3.4	3.7	3.7	3.4
Middle East										
Turkey	1.9	1.9	2.0	2.3	2.3	1.9	1.6	1.7	1.4	1.3
Saudi Arabia & Yemen	0.1	0.6	0.8	1.9	3.0	1.3	3.2	2.1	1.1	0.7
Egypt	1.0	0.6	1.0	0.9	0.8	0.7	0.3	0.2	0.2	0.2
Other	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.3
Total Middle East	3.1	3.4	4.2	5.4	6.5	4.3	5.5	4.3	3.0	2.5
Indian Sub-Continent										
India	9.6	7.2	4.5	4.5	9.6	6.4	9.6	11.9	6.7	6.4
Other	0.1	0.2	0.2	0.2	0.3	0.2	0.3	0.5	0.4	0.4
Total Indian Sub-Continent	9.8	7.4	4.7	4.7	9.9	6.6	10.0	12.4	7.0	6.8
East Asia										
Japan	18.9	24.2	26.2	26.9	27.3	27.1	27.8	29.2	29.5	29.8
South Korea	2.3	2.6	2.9	3.0	3.3	3.4	3.6	7.8	5.3	5.3
Taiwan	1.1	0.9	0.8	0.7	0.7	0.7	0.8	0.8	0.9	0.9
Indonesia	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.5
Philippines	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.4
Singapore	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Vietnam	0.3	0.3	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4
Hong Kong	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.4	0.4
Thailand	0.3	0.3	0.3	0.3	0.3	0.4	0.8	1.0	0.4	0.3
Malaysia	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total East Asia	23.9	29.3	31.5	32.4	33.4	33.4	34.9	41.0	38.1	38.4
Africa										
South Africa	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other	0.9	1.0	0.9	0.9	1.0	1.0	0.9	1.0	1.0	1.0
Total Africa	1.0	1.1	1.1	1.0	1.2	1.1	1.1	1.1	1.1	1.1

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

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Oceania										
Australia	2.3	2.3	2.4	2.5	2.5	2.3	2.3	2.4	2.4	2.4
Total Oceania	2.3	2.3	2.4	2.5	2.5	2.3	2.3	2.4	2.4	2.4
Western World Total	130.0	134.7	135.1	138.7	150.9	146.5	157.6	179.1	161.3	166.4
Other Countries										
China	1.5	3.7	3.7	4.1	4.3	4.5	4.6	5.8	5.9	6.0
Other	10.4	10.0	9.7	9.0	7.7	7.4	7.1	8.8	7.7	7.9
Total Other Countries	11.9	13.6	13.4	13.1	12.0	11.9	11.7	14.6	13.6	13.9
World Total	**141.9**	**148.3**	**148.5**	**151.9**	**162.9**	**158.4**	**169.3**	**193.7**	**174.9**	**180.3**

Photographic Scrap Supply

The quantity of silver recycled from photography looks set to become an issue of greater importance to the market in future. In large measure this is due to the growing threat to photographic end-uses from digital technology. Here a key point to understand is that the gross numbers for annual demand considerably exaggerate silver's vulnerability. This is because the real call on the market is the amount of silver required net of scrap. In 2000, photographic scrap was the largest source of recycled silver, accounting for over 40% of the total of 180 Moz (over 5,600 t). Furthermore, it is possible that current and, in particular, historical recovery rates of silver from used photographic products could be higher than previously estimated. As suggested above, this could have important implications for the market going forward.

For analytical purposes, historical fabrication demand can be divided into three main categories: products still in use; items scrapped/recycled and those irretrievably lost. Thus, for example, of the 211 Moz (6,560 t) of silver used in photography in 1995, some of this is still in use (e.g. archived X-ray film). Another part has been scrapped and recycled (e.g. the silver recovered from fixer solutions). And, finally, some of it has been irretrievably lost (e.g. low-grade film put into landfill or solutions poured down drains). Clearly, determining how much silver is in each of these categories is extremely difficult and estimates will be subject to a wide margin of error. Nevertheless, it could be that traditional views about recovery rates have been somewhat conservative and if this were the case, then historical scrap supply from photography would have been commensurately greater.

The two most important sources of old silver scrap from photography are radiographic and consumer film. Radiography's share of overall historical photographic demand for silver has ranged from 30-40% and, while technical improvements have meant that the amount of silver used for each individual film has declined, the increase in the use of x-rays has offset this reduction. Anecdotal evidence suggests that as early as the 1930s a small cottage industry had developed, using simple recovery techniques for discarded X-ray film (incineration and smelting), and by the 1950s commercial plants on a larger scale were being established. The early development of the recycling industry and the fact silver recovery rates from the medical sector are generally high (the implied overall rate of recycling is close to 70%) both support the theory that recovery rates could be higher than previously estimated. On the other hand, some X-rays go into landfill after visual inspection has shown that there is insufficient silver on the film to make recovery economic.

Turning to consumer photography, the amount of silver irretrievably lost before the 1970s was undoubtedly high. Mainstream photography was weighted towards black and white processes where much of the silver is retained on the print and kept by the consumer (and therefore rarely recycled). The advent of the color developing process changed the balance in the recovery equation – all the silver in color film processing is taken into solution, which means, in theory at least, that 100% recovery can be achieved. Recovery rates therefore climbed steeply from the 1970s onwards, in no small measure helped by the rising silver price at the time.

More recently, there has been an important shift in the recycling industry; from precious metal recovery to waste management. Two factors have changed the industry's role: tighter environmental controls on the disposal of silver and the lower price of the metal. These factors are tending to work against one another and thus making it difficult to assess whether there will be any further improvement in silver recovery rates. Furthermore, much of the growth in demand for photographic products in recent years has come from developing countries where environmental controls are looser and local recycling industries immature. This could mean that, globally, current recovery rates are actually lower than they were a few years ago.

Scrap

Total scrap volumes rose modestly in 2000, up by 3.1% to 180.3 Moz (5,609 t).

As Table 3 shows, over 80% of silver scrap is generated in the so-called industrialized countries. This is quite a remarkable contrast with the gold market where the percentage share is reversed (i.e. only 20%). The fact that the pattern of silver scrap supply is so different than for gold reflects two things. Firstly, silver demand is skewed far more than gold towards the industrialized countries (around two-thirds compared to one-third in the case of the yellow metal). Secondly, scrap supply from silver is mostly from photographic (see the section above) and electronics sources. Jewelry (and silverware) is far less important as a source of recycled metal than it is for gold. This is important because in spite of strong growth in demand in developing countries consumption of silver in photography and electronics is still biased towards North America, Europe and Japan. By contrast' jewelry demand, especially for gold, is very much dominated by the Asian markets where recycling rates are traditionally very high.

Somewhat surprisingly, given the droughts and floods experienced in the north of the country, **Indian** scrap fell last year, albeit slightly, by 3.4% to 6.4 Moz (200 t). Readers of past *World Silver Surveys* will be familiar with the fact that the north of India is the largest silver consuming area in the country, and it was this region that was particularly badly hit by natural disasters, primarily drought, throughout 2000.

GFMS field research did not find any evidence of a rise in distress selling (at the beginning of the year when news as to the severity of the drought started to circulate, our expectation had been for scrap to increase sharply). Quite why scrap did not increase is not immediately clear, but the stability of the silver price and the fact that it fell below Rps 8,000 per kilogram on numerous occasions in the second half may have played a role.

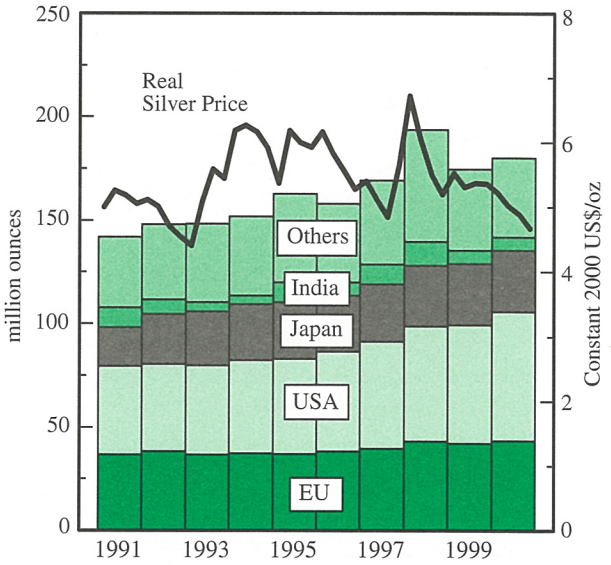
Total East Asian scrap volumes rose marginally in 2000, by a paltry 0.7% to 38.4 Moz (1,194 t). As would be expected in the context of an expanding pool of above ground stocks of finished products, tightening environmental legislation and relative price stability, **Japanese** scrap volumes rose modestly, by 1% to 29.8 Moz (927 t). **Chinese** scrap volumes are estimated to have risen by around 2.7% in 2000. A combination of larger above-ground stocks of potential metal plus the liberalization of the domestic market contributed to this increase.

The closure last year of the Handy & Harman refining facility in the **United States** led to a significant loss of capacity and, for a period of time, to a disruption in the supply chain. As a result, scrap volumes were markedly higher at a number of other operations, several of which were running at close to or full capacity. However, despite the take-up at other plants, capacity constraints were still evident at times last year, which resulted in higher volumes of scrap being treated outside of the United States.

This redistribution of scrap refining somewhat clouded the statistical picture in 2000. However, it appears that last year scrap supply was nearly 9% higher at 62.4 Moz (1,941 t). This was due to more recycling of photographic waste, a source which has grown for most of the last decade, and an increase in the volume of recycled catalysts (inextricably linked to the production of new catalysts with a time lag, in most cases, of less than two years before the material is recycled). Electronics scrap also seems to have risen.

Looking ahead, scrap volumes could potentially be affected by lower supplies from the medical sector. This would primarily be due to the impact of the Dry-View (and other similar) X-ray system. This was first introduced in the late 1990s and contains roughly two-thirds the silver of conventional materials. However, because of the legal requirements to hold X-rays for a designated period of time, it will be a number of years before these X-rays are recycled.

Figure 28
World Scrap Supply



6. Silver Bullion Trade

- Flows of silver bullion out of China continued to weigh on the market in 2000. GFMS estimate that shipments to the rest of the world once again totalled over 100 Moz (3,100 tonnes), although not all of this was sold.

Europe

Europe is a substantial importer of silver with the United Kingdom and Switzerland the leading destinations for metal entering the region. In part, this inflow reflects the important role in the market played by European refiners who take mine production from other parts of the world and convert this into deliverable bars and products, much of which is re-exported, principally to Asia. Europe's key position in the international bullion trade also stems from the fact that the bulk of the trading of physical silver is carried out in London, and to a lesser extent, Zurich. As such, most bullion stock movements begin or end in the region. For example, a large part of the silver exported from China last year came to Europe. But in addition to its role as an entrepôt, Europe needs to import silver for its own manufacturing industry. A glance at the data for 2000 clearly reveals this fact. With mine production of 55.7 Moz (1,732 t) and local scrap supply of 45.9 Moz (1,426 t) failing to cover the region's fabrication of 250.4 Moz (7,789 t) there was a shortfall of physical metal, even taking into account some locally dishoarded stocks. Imports were required to fill this deficit.

Bullion imports into the **United Kingdom** declined by 16% last year to 62.8 Moz (1,955 t). The chief cause was a large fall in the amount of silver that came in from the United States. As Figure 29 shows, in 1999, and to a much greater extent in 1997 and 1998, imports from the United States were heavy. These had been prompted by the price in London rising to a sufficiently attractive premium over New York to make physical arbitrage profitable (the rise in leasing rates over the period also indicates the "squeeze" in the London market). By contrast, in 2000 it was the premium in New York over London that led to a partial reversal of this flow and also reduced UK imports from the United States.

UK bullion exports in 2000 by contrast were up a staggering 193% to no less than 104.6 Moz (3,254 t). Most of the growth came from a higher level of shipments to the United States, India and Belgium. In the case of the United States, as described above, there was an arbitrage opportunity at times last year with prices on Comex above those available in the London market. Such exports mostly occurred in the period February through to April (the reasons are explained in the section on US bullion trade). UK exports to India were also much higher in 2000. In part, this reflected somewhat stronger demand from that country. More importantly, however, it stemmed from a lower level of Chinese supply to India, which provided scope for an increase in UK exports. Shipments from the United Kingdom to Belgium rose sharply in 2000 from their very depressed level in 1999.

Italian official bullion imports soared in 2000 (see

Figure 29
UK Bullion Imports

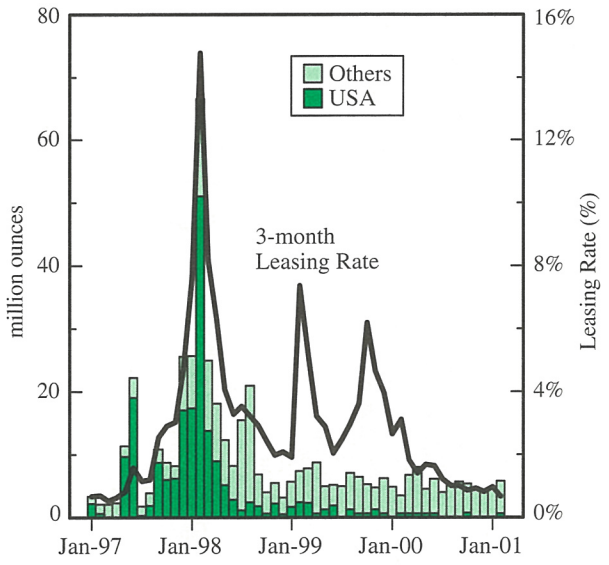


Figure 30
UK Bullion Exports

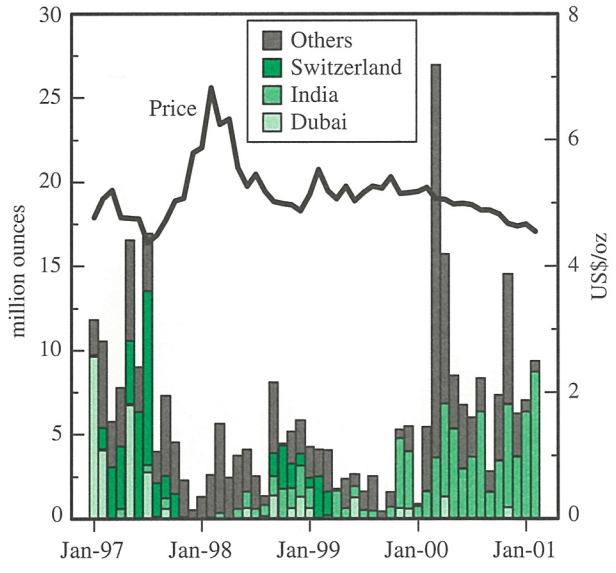


Figure 31). However, as indicated in Chapter 7, fabrication demand growth though up strongly (5.7% year-on-year) in no way accounted for the 68% rise in official imports to 64.2 Moz (1,998 t). The explanation instead is that official shipments largely increased to replace unofficial imports, which collapsed last year. The reason for the shift away from unofficial to official trade lies in the system adopted in 2000 for applying Value Added Tax (VAT) to silver. The new system had the effect of eliminating the substantial amount of unofficial silver imports that had been used in first instance as a vehicle for VAT fraud. Thus, although there continue to be some unofficial imports into Italy their volume has fallen very substantially. Returning to the theme of official imports, the graph below shows that much of the growth last year came from Switzerland.

North America

North America formerly used to have a substantial surplus of silver in its regional market. Local mine production and scrap comfortably exceeded fabrication demand. Furthermore, regional supply was added to by sales out of locally-held bullion stocks that in the early 1990s were still substantial in the United States. This picture of abundant local supply has since changed. Firstly, growth in fabrication demand has outstripped that of mine production plus scrap. The difference for North America as a whole between these elements of supply and demand came to only 34 Moz (1,058 t) in 2000 compared to more than 73 Moz in 1991. In fact, the decline in the regional surplus was probably greater than indicated by these numbers. This is because in the last few years a higher proportion of North American mine production has been directly exported to Europe for refining. Secondly, bullion inventories in the region (both private sector and government) have fallen considerably in the last decade due to disinvestment into the local market and transfers of stocks abroad, above all in the 1995-98 period. In 2000, the tighter supply situation was greatly exacerbated by the effective closure of the giant Handy & Harman refinery in Attleboro, Massachusetts. The removal of this facility from the production pipeline was only partially compensated by other North American refiners increasing their throughput. The relative lack of refined metal in the **United States** was made that much worse by the boom in fabrication demand, especially in the first half. Price data also supports this analysis, as silver prices in the United States (e.g. on Comex) generally traded at a premium to the London fix in 2000. As a result of the above developments, it is very probable that at least in the United States last year there was a local market deficit. This would seem to have been the case as US bullion imports exceeded exports by no less than 119 Moz (3,714 t). The former rose by 29% in 2000 to 131.4 Moz (4,086 t) whereas as Figure 32 indicates, the latter slumped by 41% to just 12.0 Moz (372 t).

Middle East and Indian Sub-Continent

Turkish bullion imports through the Istanbul Gold Exchange rose by an impressive 178% to nearly 3.7 Moz (113 t) in 2000. However, this comparison is

Figure 31
Italian Bullion Imports

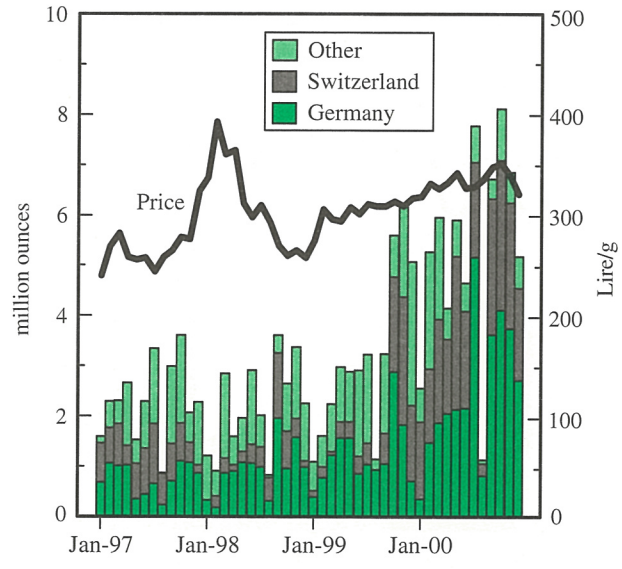


Figure 32
US Bullion Exports

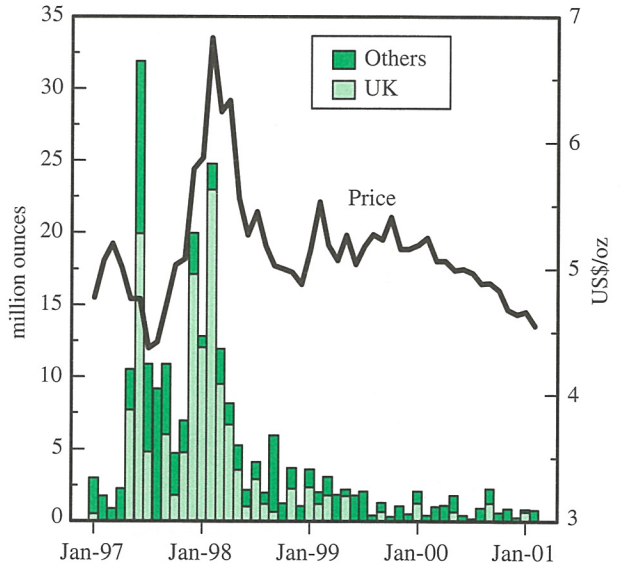
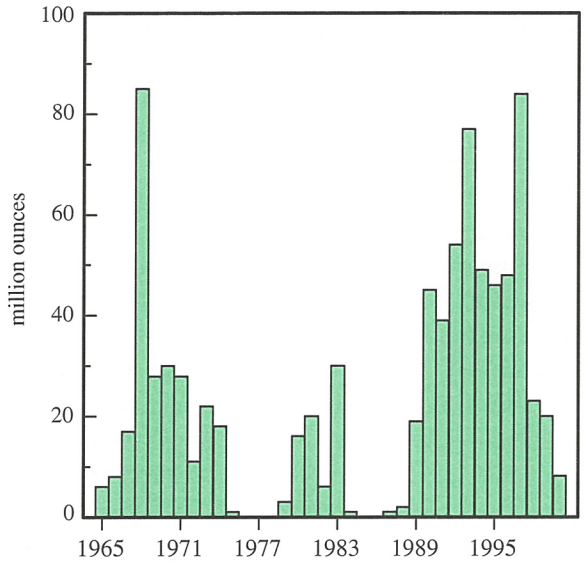


Figure 33
Dubai Bullion Imports



somewhat misleading given that imports were only first registered at the Exchange in March 1999 (having been imported directly to the market beforehand). However, on a like-for-like basis, imports were still 117% higher last year.

The **Egyptian** market is almost entirely serviced by official supplies of silver (in contrast to the domestic gold market which is supplied with predominantly unofficial bullion), both in grain and bar form. Last year, despite the widespread liquidity and economic difficulties experienced in Egypt, physical imports of silver remained broadly unchanged on the 1999 level.

The rest of the Middle East is not in itself a large consumer of silver and so therefore most of our attention has been focused on **Dubai**, a major entrepôt for the Indian market. As the table shows, Dubai's imports of silver have at times reached quite staggering levels, peaking in 1997 at over 84 Moz (2,612 t). Since

Dubai - Bullion Imports
Million ounces

1995	1996	1997	1998*	1999*	2000*
45.5	48.1	84.2	23.3	20.2	7.2

*includes GFMS estimates

then, there has been a dramatic decline in imports, mirrored by the huge surge in official shipments into India.

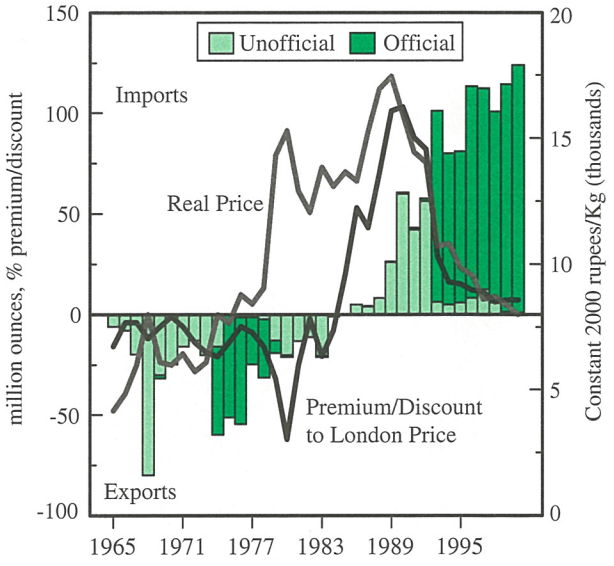
It is certainly the case that the pattern of silver bullion flows into **India** has changed dramatically in recent years. Firstly, the gradual liberalization of the import regime has seen a massive swing away from Special Import Licence (SIL) to Open General Licence (OGL) imports. Secondly, since late 1998, India has taken substantially less metal from Europe, substituting this with silver flowing out of China.

As we have noted in previous *World Silver Surveys*, the primary motivation for moving away from SIL to OGL imports was the lower cost of the latter over the former. In the mid-1990s, SILs could, on occasion, push the price of imports up considerably (SIL premia occasionally rose as high as 15-16%). The move to OGL, with a fixed duty of 500 rupees per kilogram (equivalent to around 6%), witnessed a surge in imports under this category.

The move to OGL imports not only impacted on the price of landed silver, however. It also brought about tremendous changes in the location from which the metal was sourced. Instead of metal being shipped from Dubai into India, the arrival of OGL imports saw far greater quantities being sourced directly, usually from the United Kingdom or Switzerland .

However, the sources of supply into India have not remained static since the introduction of OGL. Since late 1998, silver flows into India from Europe have slowed considerably, substituted for by supplies from China (usually via Hong Kong). Contrary to what some commentators have suggested, the flows of bullion out of China into India have been sustained and substantial, in spite of the low price. Furthermore, and as we discuss in more detail below, we believe that

Figure 34
Indian Bullion Imports and Exports



Indian Bullion Imports

Million ounces

	1996	1997	1998	1999	2000
OGL	-	0.6	93.3	108.9	121.9
NRI	1.1	0.8	0.1	0.1	0.1
SIL	102.5	96.9	1.4	1.4	0.1
Replenishment	1.8	1.5	0.3	3.0	0.9
Sub-total official	105.5	99.8	94.8	110.4	123.0
Smuggling	8.0	12.5	5.8	1.2	0.8
Total	113.5	112.4	100.6	111.6	123.8
Local premium*	23%	23%	9%	11%	12%

* percent above London price at the official exchange rate

most of these shipments are of genuine Chinese silver, not toll refined metal (i.e. silver recovered in China but from imported base metal concentrates).

The volumes of metal flowing from China/Hong Kong into India over the past two years have been nothing short of staggering. Indeed, in 1999, GFMS estimate that nearly two-thirds of India's silver requirements were met by Chinese metal. And although the volumes fell sharply in 2000, we estimate that this source accounted for just under 50% of total official imports.

One reason for the decline has been price related. As we note below, although the shipments of silver out of China have become somewhat less price sensitive, the low price that prevailed during 2000 did witness a shrinkage in available supplies out of the mainland. Not only this, but lower prices impacted directly on the profitability of those facilitating the flows, especially the middlemen in Hong Kong. For instance, at $5.50 silver it had been possible for the middleman to make anything up to 50 or 60 cents an ounce (gross), while at lower prices, these margins shrank dramatically. Yet another constraining influence in 2000 was the action taken by the Commerce Ministry instructing importing agencies not to import what they described as sub-standard Chinese silver.

The table above also shows GFMS estimates of imports under the so-called replenishment scheme as well as smuggling. Reliable data on the former has been difficult to obtain, but what information is available suggests that they are quite small. Having said this, GFMS data on silver jewelry imports into markets like the United States and Europe point to a very substantial flow from India, most of which one would expect to be fabricated under the replenishment scheme (which avoids the payment of duty which eats into working capital). Official data suggest that imports under this category in 2000 were only around 1 Moz (31 t).

Smuggling of silver has collapsed, having peaked at over 12 Moz (373 t) in 1997. In 2000, GFMS estimate that such imports fell to around 1 Moz (31 t).

East Asia

One of the most profound changes in the international silver market in recent years has been the steady and regular flow of massive amounts of metal out of **China**. There has been some confusion about these flows and it is worthwhile setting the record straight right from the start.

Figure 35

Estimated Indian Bullion Imports by Scheme

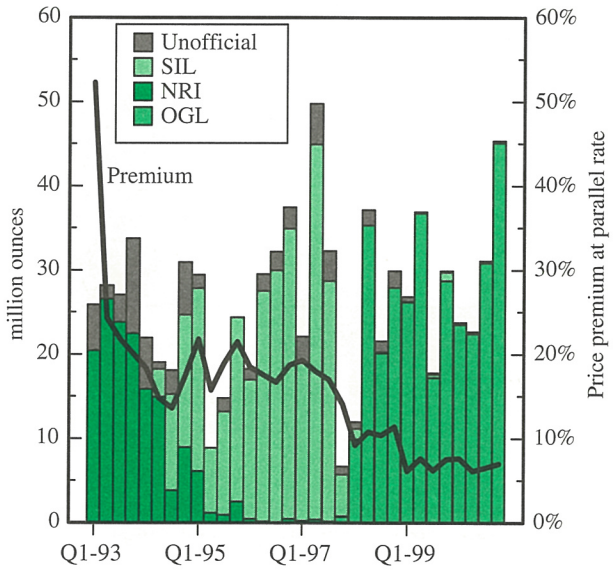
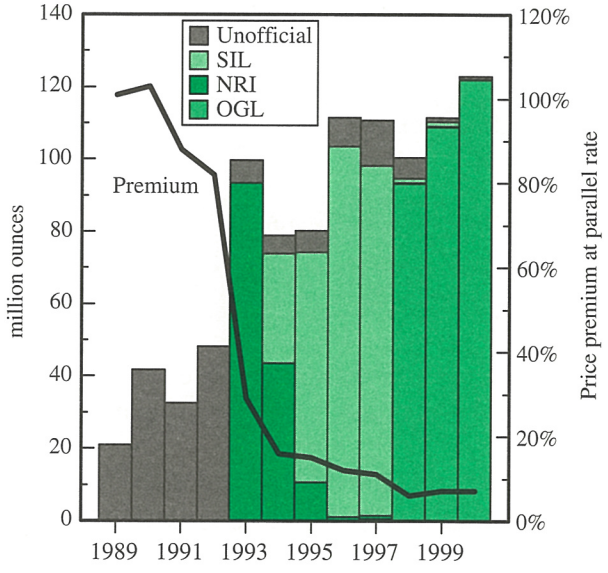


Figure 36

Estimated Indian Bullion Imports by Scheme



The People's Bank of China and various other agencies have been selling, as well as location swapping, very large volumes of silver since 1998. Shipments of Chinese metal have had a dramatic influence on the supply side (and price).

It has been suggested that most of the silver being shipped out of China is from domestic refiners processing base metal concentrates. While it is true that there is a flow of silver associated with these activities (and has been for many years we should add), the volumes are relatively modest when compared with the total that we estimate has been moved over the past two years.

To put this in context, it is useful to remember that until recently, both the silver and gold markets were tightly controlled, which meant that exporting metal, even if legitimately imported in concentrates in the first instance (and hence eligible for re-export), was quite difficult and subject to a huge amount of bureaucratic intervention. This has always been an important disincentive for foreign companies to have their concentrates toll refined in China. Not only this, but it is well known that many smelters on the mainland have very poor precious metals recovery rates meaning that it is "costly" to have high precious metal containing concentrates processed by them. Consequently, base metal producers with high gold and silver content in their concentrates will be less inclined to have it processed in China. It is our information that the amount of silver generated via this route would account for perhaps no more than 5% of the total exported (but not necessarily sold) from China last year.

Silver tends to move out of China in two distinct ways. Firstly, there are direct shipments into Europe, where the metal is re-refined and either sold or held loco-Europe. This is the more "formal" of the two methods and is done via official channels. Secondly, silver is shipped to the Asian region, usually via Hong Kong. This is the less formal route and some of the metal is "quasi-official", although most of it does come out of stocks that at one time would have *de jure* belonged to the state. It is particularly interesting to observe the disparate countries across the region who have received this metal. In addition to India, Korea, Taiwan, Singapore, Thailand, Japan and Malaysia have all taken shipments of Chinese metal via Hong Kong intermediaries.

The preferred method of shipment used to be by air, especially when the price was above $5. The efficiency of the processing in Hong Kong, especially at peak times, is quite remarkable. Metal is weighed, drilled, assayed and shipped within a very short time. In 2000, shipping by sea became far more popular, with some suggesting an average of at least 5-6 containers leaving Hong Kong per month during the year, mainly destined for India.

In an important development, China ended its 50-year monopoly on silver trading at the end of 1999. The People's Bank has relinquished control and the Shanghai Huatong Nonferrous Metal Wholesale Marketplace Co has exclusive rights to manage and regulate silver trading. To date, trading on the new exchange has been slow, hindered initially by VAT problems. What it has done, however, is to bring silver prices on the mainland into line with world prices.

Not surprisingly, the official data for **Hong Kong** do not fully capture the flows out of China. Having said this, recorded imports from the mainland into the former colony accounted for close to 60% of the total last year. A sign of the strength of unrecorded imports of Chinese material is reflected in Hong Kong's re-export figures. In 1997, re-exports stood at a paltry 1 Moz (31 t). By 2000, they had grown to a massive 20 Moz (600 t).

Singapore imports, under both the bullion and semis categories, rose strongly in 2000. The former was up the most, by around 95% year-on-year, while the latter rose by a more modest 60%. There were two main factors underpinning the strength of imports last year. Firstly, Indonesian demand rose sharply, mainly on the back of higher export led demand (see Chapter 7 for more on this). Secondly, Thai demand also rose markedly in 2000 and a significant proportion of its

Figure 37
Singapore Bullion and Semis Imports

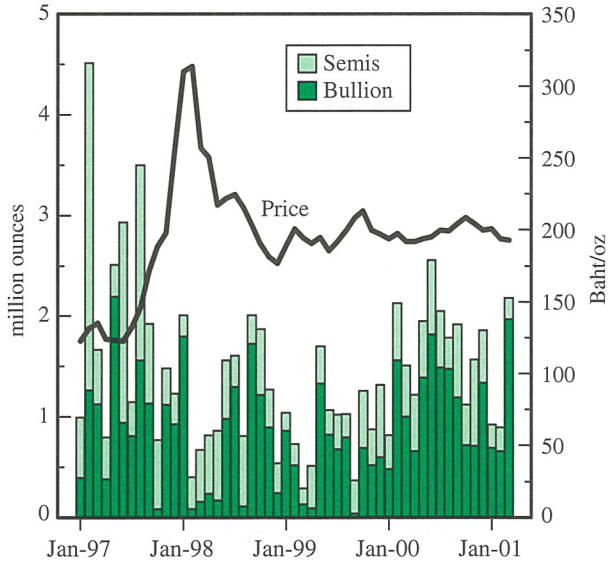
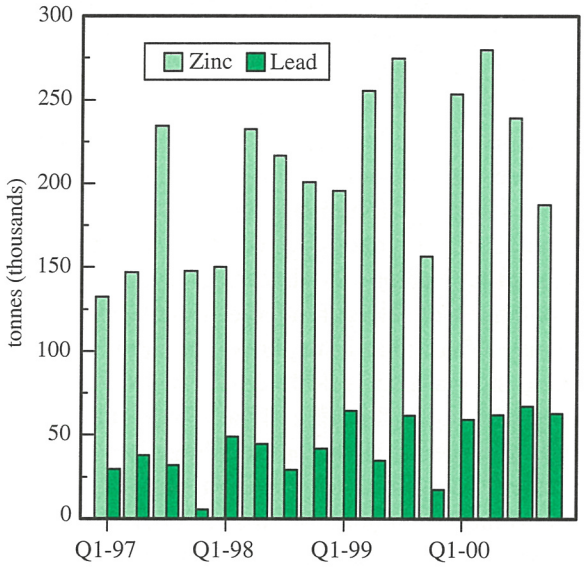


Figure 38
Korean Lead and Zinc Concentrate Imports



raw material is sourced via Singapore.

Japanese bullion imports rose sharply in 2000, an observation that is entirely consistent with the huge growth in industrial demand seen there last year. Shipments grew by close to 30% year-on-year to a total of around 46 Moz (over 1,400 t). Mexico continues to be the largest supplier to Japan, accounting for 40% of total imports, followed by Peru which accounted for just over 20%.

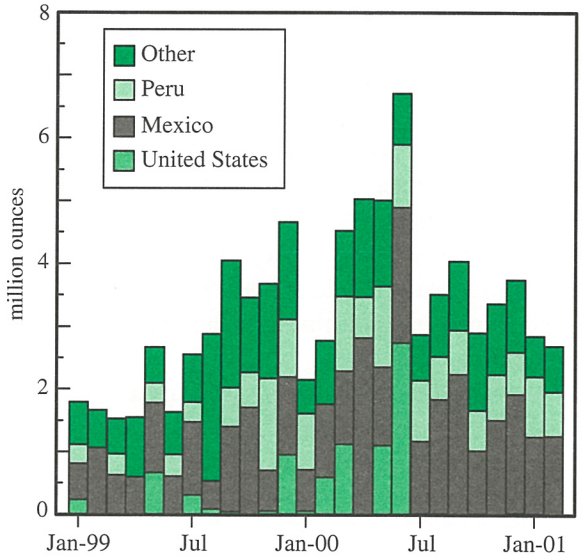
But Japanese bullion imports are only half the story when it comes to analyzing the silver supply and demand balance. An almost equal amount of silver contained in concentrates was imported last year, effectively boosting the pool of available metal loco-Japan. By contrast with bullion imports, however, silver contained in concentrates grew modestly last year, rising 1.3% to 48 Moz (close to 1,500 t).

As with Japan, it is simply not possible to construct an adequate supply and demand balance for **Korea** without including shipments of silver contained in concentrates. This was especially true in 2000. For instance, bullion imports rose by a modest 3% year-on-year to just over 5 Moz (160 t), while GFMS estimate that supply from silver contained in processed concentrates rose by over 27% (around 70% of Korea's available silver comes from these sources).

GFMS estimate that silver supplies into **Thailand** rose sharply in 2000, by around 17% year-on-year. Singapore is still the main source of supply although China/Hong Kong has grown in importance in the past two years. Thailand still continues to source substantial quantities of metal unofficially, although as a percentage of the total, this has fallen in recent years. The primary reason for this unofficial trade has been tax related. Although silver imports do not attract import duty, VAT was still being applied to silver imports outside of the bonded warehouse scheme. A very substantial quantity of fabrication in Thailand is done outside of the bonded system, meaning that these manufacturers have to pay VAT on imports which they can then reclaim once the finished product is exported. The disincentive to bring in silver officially partially revolves around the working capital implications of this system. Simply put, export orientated manufacturers have to find the additional capital to fund the 7% VAT on their stock and work in progress, a cost that many of them can ill afford, especially in the context of rising competition from the Chinese, Koreans and Indonesians. But this has not been the only problem facing the industry. VAT refunds in Thailand are notoriously slow and it is not uncommon to find businesses waiting for over a year for a refund (the average time appears to be over 6 months). This opportunity cost means that many fabricators, especially those focused on the lower end "back-packer" trade, prefer to take silver unofficially. (Of course, there is the added advantage of no income/ corporation tax audit trail either).

Indonesia's growing demand for silver for the jewelry trade is fed from several sources including locally refined metal plus imports from Singapore, Australia (usually via Singapore) and Hong Kong.

Figure 39
Japanese Bullion Imports



7. Fabrication Demand

- World silver fabrication continued to grow strongly last year, rising over 5% to a record 920.9 Moz (28,642 t).
- Growth was particularly strong in the key markets of East Asia and the Indian sub-Continent where demand rose respectively by 16% to 210.3 Moz (6,542 t) and by 7% to 140.0 Moz (4,355 t). Growth in the West was far more modest - Europe rose 1% to 250.4 Moz (7,789 t) and North America 2% to 223.8 Moz (6,962 t).
- The prime driver of growth remained industrial demand for silver whose rate of increase accelerated from a (revised) 8% in 1999 to 11% for 2000, bringing that year's world total to 378.0 Moz (11,757 t). Much of the rise was within the electrical and electronics sector, particularly in East Asia.
- The use of silver in the photographic sector fell a fraction, down just over 1% to 230.6 Moz (7,173 t) last year, as growth in Japan failed to counter declines in Europe and, to a lesser extent, the United States.
- Jewelry and silverware fabrication rose 3% in 2000 to 281.7 Moz (8,762 t). The largest producer, India, was broadly flat at 92.8 Moz (2,887 t) while strong growth was recorded in East Asia, up 13% at 43.9 Moz (1,365 t), and a modest rise was seen in Europe, up 3% at 87.5 Moz (2,723 t).
- Demand for silver in coins and medals increased by almost 14% in 2000 to 30.5 Moz (950 t).

The healthy growth in the use of silver in industrial applications means that this sector's share of total fabrication has continued to rise, reaching 41% compared to 1999's 39% and a typical 37% in the early 1990s. Jewelry and silverware nonetheless managed a respectable increase of 3%, thanks in large part to buoyant consumption in the United States boosting fabrication demand in such countries as Thailand and Italy. Coins and medals saw even faster growth and it was just the photographic sector that disappointed, seeing its silver use slip partly in response to technological changes.

Weak numbers in a smattering of European countries such as Germany and Belgium has allowed North America to continue closing in on Europe as the largest user of silver despite fabrication falls in Canada and Mexico. However, the rapid growth within East Asia (Taiwanese demand for example was up over 50%) means the latter has moved nearer to re-establishing its second place ranking.

Figure 40
World Silver Fabrication

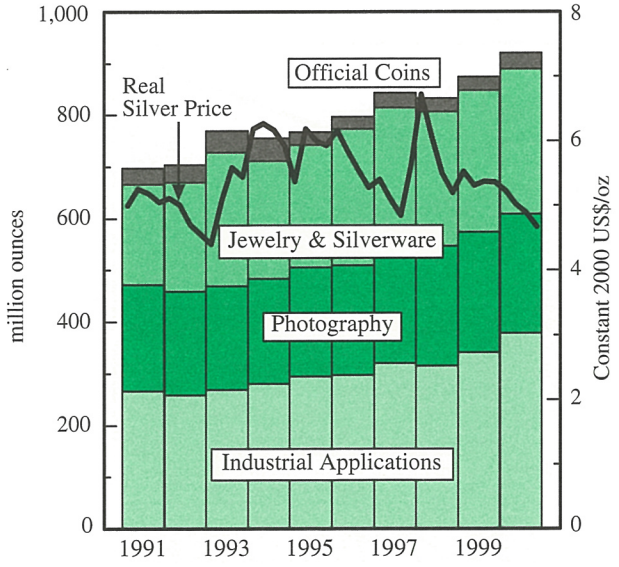


Figure 41
World Silver Fabrication

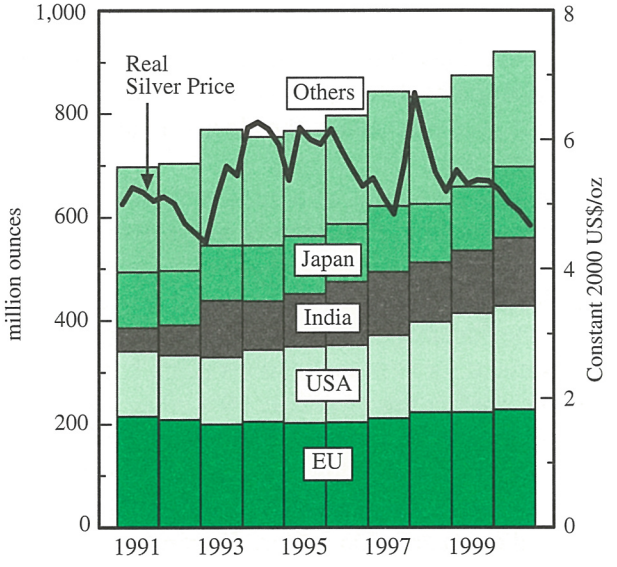
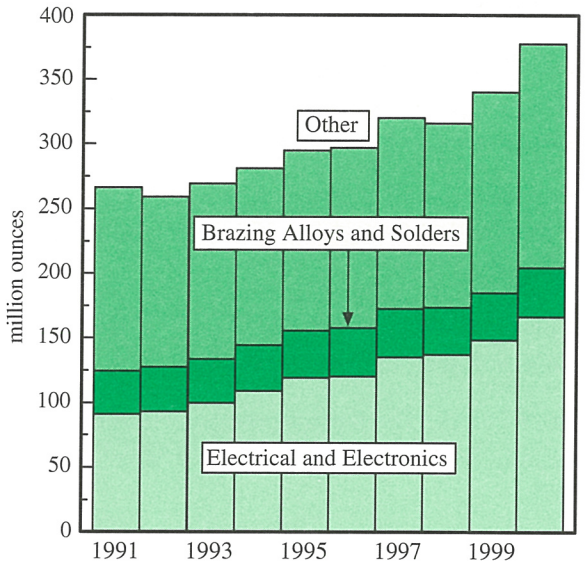


Figure 42
Main Components of Industrial Applications



Industrial Applications

- The industrial demand for silver grew by a very healthy 11% in 2000 to 378.0 Moz (11,757 t).
- Demand grew fastest in East Asia, rising 22.7% to 101.8 Moz (3,168 t). This re-established the region's lead over North America despite the latter's 6.2% gain to 100.2 Moz (3,117 t).
- Once again, it was electrical and electronics uses that spearheaded growth, rising 12.2% to 166.6 Moz (5,182 t).

Europe

The 13.4% rise in **German** industrial demand nearly took fabrication back to the 1991 level. Most of the growth last year was seen in the electrical and electronics sectors.

Electrical demand was up significantly last year, mostly due to strong, European-based growth. The single largest end-use is the use of rivets for car relays which alone saw growth in the region of 10-15% last year. In the contacts market, growth was driven by higher demand for new applications using high silver containing contact tips (typically 90% silver with the balance being made up of nickel, tin oxide or graphite).

Demand for brazing alloys increased modestly in 2000. In the domestic market, one of the major end-uses is in the construction sector. However, there is an increasing tendency to use either silver free alloys (e.g. copper containing) or low silver materials (perhaps with as little as 5% silver although the cost saving needs to be offset against the additional difficulty of brazing and melting).

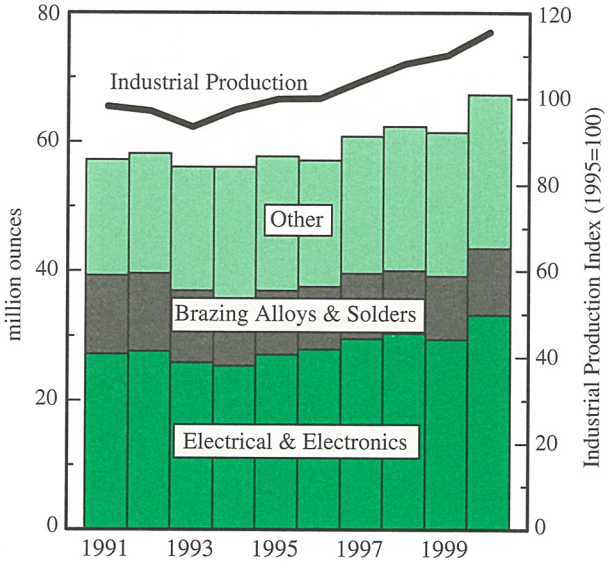
Looking further ahead, an interesting development, which could stimulate demand in future, is the potential substitution of silver for gold in the production of DVDs.

Industrial demand in the **United Kingdom** rose by over 16% to 17.6 Moz (549 t) in 2000. Electrical and electronics demand led the way with an increase of over 18% to 6.8 Moz (211 t) while brazing alloy offtake grew modestly to 2.3 Moz (72 t).

Last year witnessed strong growth in contacts demand in a variety of end-uses. For example, the use of silver from upgrading and the expansion of base stations (including not only Second but Third Generation) rose last year as a result of both higher UK and export-led demand. In addition, the production of non-photo nitrates, principally for the electronics sector, increased sharply in 2000. Elsewhere, the use of silver in fuse caps and switches increased modestly whilst demand for silver anodes in the United Kingdom was markedly higher, driven by buoyant growth in the cell phone sector.

The industrial use of silver in **France** rose by almost 6% to 12.2 Moz (380 t) in 2000. This was thanks primarily to strong growth in the electrical and

Figure 43
EU Industrial Fabrication



EU Industrial Production
Index (1995=100)

1996	1997	1998	1999	2000
100.4	104.4	108.2	110.1	115.5

Source: OECD

electronics sector which rose almost 9% to an estimated 7.3 Moz (228 t). The rise in the use of silver in contacts and the like was mainly a result of higher exports and a transfer of manufacturing capacity to France. Other areas of growth included brazing alloys which increased due to such factors as booming construction, particularly on the non-residential side.

Italy's silver usage in industrial applications is estimated to have risen a modest 3% in 2000 to 11.2 Moz (347 t). An increase for brazing alloys (up around 6% to 2.3 Moz or 72 t) explained part of the rise while there was also growth within the electrical and electronics sector (up just over 3% to 3.1 Moz or 95 t). The modest scale of the latter's rise masks the ongoing significant change in silver's use whereby a falling amount of metal used per contact or whatever as designs become more efficient is being countered by an increase in the number of uses.

North America

That industrial demand in the United States advanced last year by only 6.2% - a figure lower than those recorded in in several European countries - may at first appear surprising. However, the strength of the market notwithstanding, this was largely a timing issue.

At the end of 1999, there was general concern over a breakdown in some part of the supply chain because of "Y2K" fears. This led to a significant build up of raw material inventories in the fourth quarter. As a result, although fourth quarter demand was exceptionally strong, part of this offtake (in terms of the final consumption in silver bearing components) was postponed until the beginning of 2000 thus reducing the demand for new silver at this time. In addition, towards the end of the year, the slowdown in the wider economy led to a decline in silver demand. The downturn in demand was noticeable from November onwards and became more pronounced in the first quarter of 2001.

United States Industrial Production
Index (1995=100)

1996	1997	1998	1999	2000
104.5	111.1	117.2	122.1	129.0

Source: OECD

Turning to the main components of industrial demand, fabrication for electronics increased last year. This was, in no small measure, due to higher demand for cell phones and, to a lesser extent, for the computer industry. And, although demand for silver containing multi-layer ceramic capacitors (MLCCs) was little changed on a year earlier (due to substitution in favor of non precious metals, see below), the cell phone industry still required additional silver, namely for shielding, gaskets and printed circuit boards (PCBs).

The trend last year in silver demand for MLCCs was less clear cut. Much has been made of the move away from palladium in this market but this has implications for silver too. As discussed in some detail last year, MLCCs essentially work on the basis of an electrical field generated in the space between two oppositely charged electrodes. The key to understanding the potential impact on silver demand is that usually one of the electrodes (the "outer" electrode) is often made of silver (or an alloy thereof). The massive substitution away from palladium impacted on silver because in the main, nickel has been used as the "inner" electrode and copper as the "outer", resulting in less silver being used, all other things remaining equal. Technological as well as price factors lay behind the timing of this change. For several years, the majority of low fired

Figure 44
US Industrial Fabrication

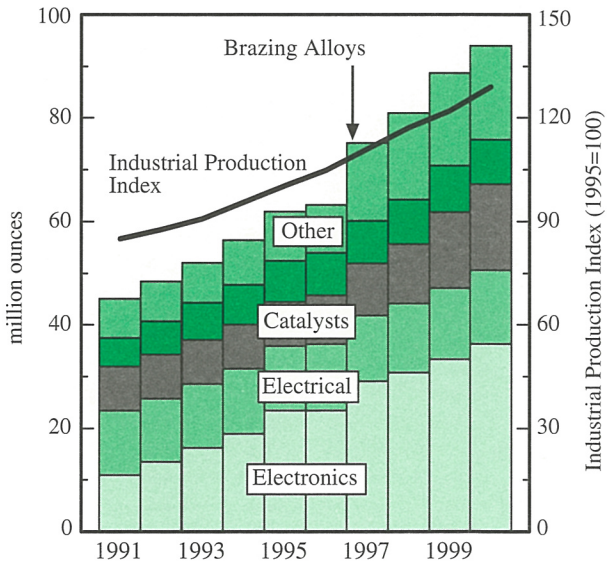


Table 4
World Silver Fabrication
(including the use of scrap)
Million ounces

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Italy	56.3	60.5	56.7	52.1	50.1	52.2	56.5	56.3	62.4	66.0
UK & Ireland	25.4	26.8	28.4	31.2	32.3	34.4	35.5	39.2	39.9	43.2
Germany	57.9	54.8	48.4	52.8	46.0	45.6	46.0	46.8	40.5	39.0
Belgium	20.2	20.2	20.7	21.1	23.4	25.3	27.2	33.8	37.5	35.3
France	28.6	30.9	30.2	28.2	31.1	27.2	28.7	28.6	26.5	28.4
Switzerland	7.6	6.7	6.2	7.1	7.3	7.8	9.6	10.7	11.1	8.7
Spain	17.4	6.6	6.1	10.7	9.9	9.3	8.7	8.8	7.5	7.0
Greece	3.4	3.5	3.7	3.9	3.8	4.2	4.5	4.1	4.1	4.3
Poland	3.9	2.1	2.3	2.6	3.1	3.0	3.4	3.6	3.7	3.9
Portugal	2.3	2.5	2.5	2.0	2.4	2.8	2.9	3.1	3.2	3.5
Norway	2.0	2.5	1.9	1.6	1.6	1.4	1.5	1.5	3.0	2.9
Netherlands	2.2	2.1	2.1	2.6	3.2	2.2	2.1	2.1	2.1	2.0
Sweden	1.9	1.6	1.6	1.5	1.4	1.5	1.7	1.4	1.4	1.3
Austria	1.7	1.6	1.5	1.5	1.6	1.5	1.3	1.4	1.2	1.1
Denmark	1.0	1.1	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0
Czech & Slovak Republics	1.5	1.0	0.7	0.6	0.8	0.7	0.8	0.9	0.8	0.8
Finland	1.5	1.3	0.9	1.0	0.9	1.0	0.9	0.7	0.7	0.6
Romania	0.6	0.5	0.5	0.4	0.3	0.4	0.4	0.5	0.4	0.4
Cyprus & Malta	0.2	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Other	0.9	1.0	1.1	0.9	0.9	0.9	0.7	0.8	0.8	0.8
Total Europe	236.6	227.7	216.6	223.0	221.5	222.8	233.8	245.5	248.0	250.4
North America										
United States	126.7	125.5	130.7	139.3	148.2	150.4	160.1	175.8	191.8	201.5
Mexico	15.1	22.9	32.0	27.6	17.5	20.8	23.7	22.2	23.5	19.4
Canada	4.7	2.3	2.8	3.1	2.7	2.7	2.8	3.4	3.5	3.0
Total North America	146.4	150.8	165.5	170.0	168.4	173.9	186.5	201.4	218.8	223.8
Central & South America										
Brazil	6.7	6.6	6.9	8.3	9.4	8.4	8.4	8.1	7.7	6.8
Argentina	4.1	4.1	4.1	4.1	3.9	3.8	3.8	3.1	2.7	2.3
Peru	1.2	0.9	0.8	0.9	1.0	1.1	1.1	1.1	1.0	1.0
Colombia	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.9	0.8
Ecuador	0.4	0.4	0.5	0.7	0.7	0.7	0.7	0.7	0.5	0.5
Chile	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4
Other	0.6	0.6	0.6	0.5	0.6	0.9	1.3	1.6	1.8	1.1
Total Central & South America	14.4	14.1	14.5	15.9	17.1	16.4	16.8	16.2	15.1	12.8
Middle East										
Turkey	4.7	5.5	5.9	5.2	6.1	6.4	6.5	6.2	5.5	6.8
Israel	2.3	2.6	2.8	3.1	3.4	3.7	4.0	3.9	3.9	3.6
Egypt	1.7	2.3	1.9	2.5	2.2	2.3	2.1	1.9	2.0	2.0
Saudi Arabia	0.3	0.4	0.4	0.3	0.4	0.4	0.6	0.5	0.6	0.6
Other	1.9	2.7	2.0	2.4	2.5	2.6	2.6	2.5	2.6	2.6
Total Middle East	10.9	13.4	13.2	13.5	14.5	15.4	15.8	14.9	14.5	15.8
Indian Sub-Continent										
India	44.8	58.1	108.8	93.9	101.3	122.2	122.9	114.7	121.5	130.9
Bangladesh & Nepal	2.0	2.6	3.9	4.5	5.1	5.8	6.4	5.1	5.7	6.0
Other	2.3	2.8	3.4	2.8	3.8	2.7	4.1	2.8	3.4	3.2
Total Indian Sub-Continent	49.1	63.5	116.0	101.2	110.2	130.7	133.5	122.6	130.6	140.0
East Asia										
Japan	108.8	104.9	107.9	108.4	112.7	112.1	127.2	112.8	122.5	138.0
Thailand	20.1	31.6	38.7	29.1	27.7	27.6	27.1	24.2	26.7	30.2
South Korea	9.3	9.0	15.6	16.4	18.6	18.5	18.6	13.8	16.7	20.6
Taiwan	3.6	4.3	4.8	5.3	5.7	6.4	6.9	6.8	6.8	10.2
Hong Kong	2.1	2.3	2.6	3.4	3.4	3.7	4.4	3.6	3.9	4.4
Indonesia	1.7	1.9	1.8	2.7	3.1	3.4	4.1	2.7	3.2	4.4

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

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Myanmar, Laos & Cambodia	1.0	1.0	1.0	1.0	1.1	1.1	1.0	0.8	0.9	0.8
Vietnam	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.6	0.7	0.7
Malaysia	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.5
Other	0.4	1.1	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4
Total East Asia	147.6	156.9	173.7	167.5	173.7	174.2	190.6	165.9	182.1	210.3
Africa										
Morocco	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.5	0.6
Tunisia	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3
South Africa	0.3	0.3	0.6	0.4	0.5	0.3	0.3	0.3	0.3	0.3
Algeria	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2
Other	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4
Total Africa	1.9	1.8	2.0	1.9	2.0	1.8	1.8	1.7	1.7	1.8
Oceania										
Australia	5.2	6.9	7.0	6.3	5.3	5.2	5.2	5.6	5.8	6.6
Total Oceania	5.2	6.9	7.0	6.3	5.3	5.2	5.2	5.6	5.8	6.6
Western World Total	612.2	635.1	708.4	699.3	712.9	740.4	784.0	773.9	816.6	861.6
Other Countries										
China	19.2	19.6	21.1	24.6	26.0	28.6	32.2	33.9	33.1	34.0
Soviet Union/CIS	67.2	50.2	40.9	31.7	29.0	28.4	27.8	25.6	24.6	25.3
North Korea	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Other Countries	86.4	69.8	62.2	56.3	55.0	57.0	60.0	59.5	57.7	59.3
World Total	**698.6**	**704.9**	**770.6**	**755.6**	**767.9**	**797.4**	**844.0**	**833.4**	**874.3**	**920.9**

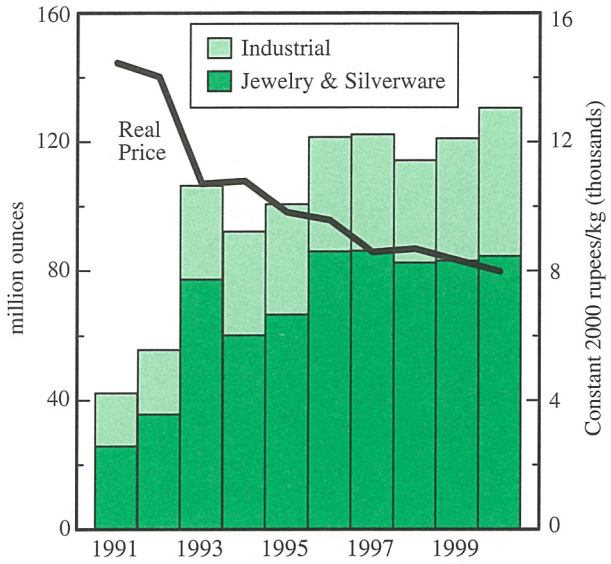
MLCCs required 25-30% palladium (with the balance made up of silver) and could not be fired any lower (with generally little incentive to do so). The sharp increase in the palladium price led to the development of ultra low fire materials, the use of which over the past year has become widespread. In other words, the product mix has moved from a 70:30 silver:palladium ratio to as high as 80:20 or 85:15 or, in some cases, even a 95% electrode.

However, the MLCC industry has also experienced a significant shift to nickel electrodes accompanied by a switch from silver to copper terminations (CuNi). As a result, despite expectations of growth in world MLCC demand this year, it is probable that the additional demand will be satisfied by higher production of CuNi products. Having said this, there appears to have been a two-tier approach to this development. Because of the required capital investment to adopt base metal MLCCs, the tendency has been for larger companies to switch from using silver palladium materials leaving smaller operations reliant on the precious metal materials.

The growth in demand for electrical components was more subdued last year due to contrasting developments in a number of the major end-use markets. For example, housing starts (typically an important source of refractory demand for circuit breakers) in the United States experienced a modest decline in 2000. Elsewhere, the use of silver in electroplating consumed in the cell phones sector saw steady growth last year. This contrasted with buoyant demand in the semiconductors industry in which silver electroplating is used extensively (partly due to a shift from palladium to gold to silver).

Demand in the automotive industry has typically followed the growth in auto sales, although the expansion of equipment, especially items that have become standard (e.g. relay demand in power windows door locks, intermittent wipers) has tended to weaken this relationship. Finally, the electrical industry has benefited indirectly from growth in cell phone use, through the increased number of base stations that have been built, and the computer industry which has created higher demand for backup infrastructure (thus, to an extent, reducing the reliance on the housing industry for electrical circuitry demand).

Figure 45
Indian Fabrication



India

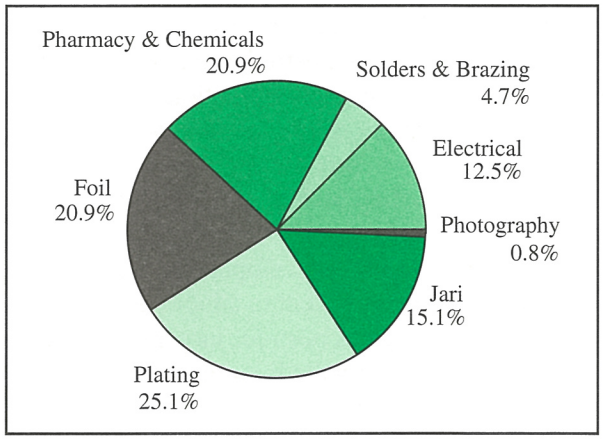
Indian consumption of silver in industrial applications rose sharply in 2000, up by over 21% to 46.0 Moz (1,430 t). The growth in offtake over the past decade has been nothing short of spectacular. In the space of 10 years, demand has risen by 177% (from a relatively paltry 16.6 Moz or 517 t in 1991).

Remarkably, this has left India as the third largest industrial user of silver in the world after the United States and Japan. In developing world terms, the only country to come close to Indian levels of offtake is China but, even here, demand is substantially lower on both a per capita and absolute basis. (Absolute offtake in China is around 48% of Indian demand). This somewhat surprising state of affairs is a direct consequence of India's industrial policy of self-reliance which goes back to the days of Gandhi. (There are of course parallels with China's history of industrialization which partially explains why offtake there is also so much higher than the average for the "developing world") .

The basic framework for Indian policy was given real substance in "The Industrial Policy Resolution of 1956". This was a very restrictive policy regime, with the growth of industry being regulated through the granting of industrial licenses and other industrial approvals, and all of the indications are that this was a major constraint on industrial development . A major change, in the form of the "Statement on Industrial Policy" of 1991, greatly changed the framework within which industry operated. It substantially dispensed with industrial licensing, introduced measures to facilitate foreign investment and technology transfers and threw open areas that hitherto had been exclusively reserved for the public sector. It is perhaps not entirely coincidental that silver offtake grew so dramatically during the 1990s after the implementation of this policy.

Turning to last year, it appears that reasonably robust economic growth (of around 6% for the financial year 1999/00) underpinned some of the growth in offtake. Having said this, the increase in economic activity in 2000 was down on the previous year's rate of 6.4%, an observation that appears somewhat at odds with the large rise in silver demand recorded last year. It has to be said that there are no patently obvious economic reasons for the huge increase in silver demand last year, especially given the decline in GDP growth (albeit a slight fall). Perhaps one partial explanation is the fact that the slowdown in GDP was largely accounted for by a sharp fall in agriculture and allied sector growth to 0.7% from 7. 1% in the previous year, a part of the economy that is not a large consumer of industrial silver. Furthermore, data from the Central Statistics Office show that the fall in overall GDP growth in the year 1999/00 came despite a hefty 9.4% risein capital formation and a 15% increase in government consumption expenditure. Perhaps most importantly of all from the perspective of industrial silver use, headline figures for the manufacturing sector showed growth of 6.8% in 2000 (up from 2.5% the year before).

Figure 46
Indian Industrial Fabrication, 2000



Turning to the individual components of demand, GFMS data show that electrical and electronics demand rose slightly (at least compared with the massive increases seen in other countries in these applications last year), by around 7% year-on-year. Solders and brazing alloys increased by around 10% whilst industrial and decorative uses appear to have grown by as much as 25%.

The biggest rise in industrial silver demand last year (both in absolute and relative terms) was seen in pharmacy and chemicals which rose by over 60%. Much of the growth came from silver nitrate production which surged last year. In addition to this, ayurvedic uses of silver rose year-on-year. Plating applications, which are the single biggest use category by weight, rose strongly as well, up 20% on the previous year to around 9.6 Moz (300 t). Similarly, use of silver in foil expanded robustly, up by around 25% (a thin layer of silver foil on certain foodstuffs like sweets is very popular in India). Jari (a gilded silver thread used in embroidery) was the only category to show a decline last year, falling by over 5%. One possible explanation for this was the weakness of the rural economy, a mainstay of demand for jari.

East Asia

The East Asian region recorded extremely strong growth in industrial demand in 2000, with total offtake rising by over 22% to 101.8 Moz (3,168 t). All of the major fabricating regions recorded large year-on-year rises, with electronics demand being one of the main drivers behind the surge in offtake. A useful proxy for the strength of the electronics industry is the Global Billings data published by the Semiconductor Industry Association (SIA). According to this source, billings rose by a massive 37% in 2000, with all four of the regions covered recording strong growth. The America's posted a 35% increase year-on-year, whilst Europe, Japan and Asia chalked up rises of 33%, 42% and 38% respectively. In terms of the final applications driving this demand for silver semis, the SIA identify the growth in communications solutions for data networking, broadband, wireless, optoelectronics and the continued high demand for personal computers as being the most important.

Japanese Manufacturing Production
Index (1995=100)

1996	1997	1998	1999	2000
102.3	106.0	98.5	99.3	105.1

Source: OECD

Japanese Non-Photographic Nitrate and Contact Production
Million ounces

	1997	1998	1999	2000
non-photo nitrates	10.5	10.5	13.7	17.1
contacts	9.5	9.1	9.5	11.5

Japanese offtake rose by close to 19%, up by over 11 Moz to 72.1 Moz (2,244 t). As was the case last year, a considerable amount of this was related to export orientated demand rather than domestic Japanese offtake. Although it is extremely difficult to make precise estimates, it is an indisputable fact that a significant proportion of Japanese silver industrial fabrication is integrated into final products or used in the manufacture of intermediary products in countries other than Japan. Here, Taiwan springs to mind. Substantial quantities of Japanese electronics semis, be they made of gold, silver and/or the PGMs, are exported to Taiwan every year for use in various electronics items, including final products like note books but more often than not in intermediary products like semiconductors.

GFMS estimate that overall electronics uses of silver in Japan rose by around 22% last year. One of the biggest growth areas was in silver nitrate production which rose by 25% on top of the 30% growth recorded in 1999. Given such phenomenal growth, it may be instructive to briefly describe what silver nitrate is and how it is used.

Silver nitrate ($AgNO_3$) is also known by the more popular names of lunar caustic, silver mononitrate and silver salt. In terms of its physical properties, it is colorless and transparent, with tabular, rhombic crystals which react to light (becoming gray or grayish-black) in the presence of organic matter (which hints at why it is used in photographic applications). In terms of its uses and occurrences, many people will know that nitrate is used in photographic film as well as in the manufacture of mirrors (silvering mirrors). Other less high-tech applications include its use in indelible inks, for dying hair, coloring porcelain and etching ivory. For the agriculturally minded, it is also used for animals as an astringent and antiseptic (although in

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

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Germany	21.1	20.0	18.6	18.0	18.5	17.2	17.8	18.4	18.3	20.8
UK & Ireland	10.8	11.1	11.4	11.7	11.9	12.2	12.5	16.3	15.2	17.6
France	11.1	12.8	11.3	11.6	12.0	11.7	13.4	11.2	11.6	12.2
Italy	9.5	9.6	10.1	10.2	10.6	11.2	11.4	10.6	10.8	11.2
Switzerland	5.7	6.0	5.6	6.5	6.6	6.9	8.6	10.0	10.4	8.0
Spain	1.9	1.8	1.8	1.7	1.8	2.0	2.9	3.1	2.7	2.7
Netherlands	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Poland	0.5	0.5	0.6	0.8	0.8	0.8	0.7	0.7	0.7	0.7
Austria	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.5	0.5	0.5
Sweden	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4
Belgium	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Czech & Slovak Republics	0.7	0.5	0.5	0.4	0.5	0.5	0.4	0.4	0.5	0.3
Other	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	2.2	1.9
Total Europe	65.3	66.5	64.1	65.0	67.0	66.6	71.9	74.6	75.3	78.3
North America										
United States	49.3	52.7	56.3	60.6	65.9	68.2	75.3	81.0	88.6	94.1
Mexico	2.6	2.6	2.6	2.8	2.5	2.6	2.9	3.2	5.1	5.5
Canada	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.5	0.5	0.5
Total North America	52.6	55.9	59.6	64.0	69.2	71.4	78.8	84.8	94.3	100.2
Central & South America										
Brazil	2.4	2.4	2.5	3.2	3.5	3.3	3.4	3.5	3.2	3.2
Argentina	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.0	0.8
Colombia	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2
Other	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total Central & South America	4.4	4.4	4.5	5.2	5.4	5.2	5.3	5.4	4.8	4.6
Middle East										
Israel	0.6	0.7	0.8	0.9	1.0	1.0	1.0	1.0	0.9	1.0
Turkey	0.7	0.9	0.9	0.8	0.9	0.9	1.0	0.9	0.8	0.9
Egypt	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Middle East	1.4	2.0	1.9	1.8	2.0	2.1	2.1	2.0	1.9	2.0
Indian Sub-Continent										
India	16.6	20.0	29.0	32.1	34.1	35.5	36.0	31.9	37.9	46.0
Other	0.4	0.5	0.6	0.5	0.6	0.5	0.7	0.5	0.6	0.5
Total Indian Sub-Continent	17.0	20.4	29.5	32.6	34.8	36.0	36.7	32.4	38.5	46.5
East Asia										
Japan	47.5	44.1	45.8	51.1	53.6	52.1	59.4	52.8	60.8	72.1
South Korea	4.0	4.0	8.4	10.0	11.9	11.9	12.3	11.2	12.2	15.7
Taiwan	3.1	3.7	4.2	4.7	5.2	5.8	6.3	6.2	6.3	9.6
Hong Kong	1.1	1.3	1.6	2.4	2.5	2.8	3.4	3.0	3.3	3.9
Indonesia	0.6	0.7	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5
Total East Asia	56.3	53.8	60.4	68.6	73.6	73.1	81.9	73.7	83.0	101.8
Africa										
Morocco	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
South Africa	0.3	0.2	0.5	0.3	0.3	0.2	0.2	0.2	0.2	0.2
Other	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total Africa	0.6	0.5	0.8	0.6	0.7	0.6	0.6	0.6	0.6	0.6
Oceania										
Australia	1.9	2.0	2.0	2.2	2.4	2.3	2.1	2.3	2.4	2.5
Total Oceania	1.9	2.0	2.0	2.2	2.4	2.3	2.1	2.3	2.4	2.5
Western World Total	199.5	205.6	223.0	240.1	255.2	257.2	279.4	275.8	300.8	336.5

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

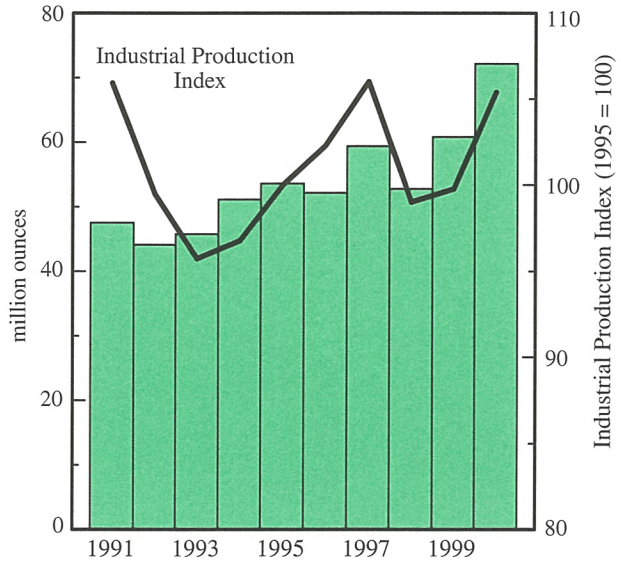
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Other Countries										
China	13.2	14.1	14.9	17.3	18.2	19.1	20.3	20.7	20.9	21.9
Soviet Union/CIS	54.1	39.5	31.9	24.0	21.9	21.1	20.6	19.6	18.8	19.6
Total Other Countries	67.3	53.6	46.8	41.3	40.1	40.1	41.0	40.4	39.8	41.5
World Total	**266.8**	**259.3**	**269.8**	**281.4**	**295.3**	**297.3**	**320.4**	**316.2**	**340.6**	**378.0**

mild forms, it is used in human medicine too).

Most importantly from the perspective of this section though is the fact that silver nitrate is often the starting material for the production of a huge range of products used in electronics which is why it grew so strongly over the past couple of years. It is also the initial material used in the manufacture of other silver chemicals such as silver chloride, silver acetate, silver sulfate and so on (some of which are used in electronics applications) and it is often used in the manufacturing of catalysts.

Contact production also rose sharply last year, up by over 22% to 36.6 Moz (1,140 t). Again, much of this growth was attributable to the strength of the electronics industry, although not all of the increase was derived from this sector. For instance, new housing starts grew by over 8%, according to OECD data, which increased demand for contacts for use in switches and other electrical equipment. Motor vehicle production also rose modestly year-on-year, by around 3%, which pulled up contact production too.

Figure 47
Japanese Industrial Fabrication



Production of silver sputtering targets also grew robustly last year. Sputtering is a technology capable of depositing thin films of silver (or gold, PGMs, silver alloys and so forth) onto diverse substrate shapes and sizes, for example onto CDs, integrated circuits and as coatings for glass. This market has expanded rapidly as the demand for thin film devices and coated products has grown and Japan is one of the leading producers of the targets that fulfil this need.

As we noted in last year's *World Silver Survey*, demand for MLCCs has underpinned a large part of the growth in industrial demand for silver in Japan. What was particularly interesting in Japan last year was that in spite of all the talk of massive and wholesale substitution taking place, the overall impact on silver (and palladium) demand was in fact quite modest. Much of this was attributable to the phenomenal growth in demand for MLCCs and the fact that manufacturers of products like cell phones (which use a large number of these devices) were happy to pay a premium just to get the capacitors. Consequently, although virtually all new MLCC capacity coming on stream in Japan uses no palladium or silver, old capacity has been kept on stream, resulting in demand for silver in this application falling only relatively modestly. In fact, there are still customers who insist on palladium/silver MLCCs, especially for use in higher-end applications (in spite of the fact that many of the technical hurdles facing the use of base metals appear to have been overcome).

Antibacterial applications of nitrates were steady

Japanese Motor Vehicle Production
Year-on-year percent change

1996	1997	1998	1999	2000
1.5	6.1	-8.4	-1.5	3.3

Source: JAMA

year-on-year, in spite of some novel new applications. For instance, one leading clothing manufacturer is evidently supplying cloth impregnated with silver to kill off unwelcome bacteria (and presumably smells as well).

Nitrate use in mirrors is estimated to have increased in 2000, albeit slightly. As already noted above, new construction starts in Japan last year were higher, a factor which contributed to the overall rise in offtake in this application.

Chinese industrial demand is estimated by GFMS to have risen modestly in 2000, by around 4.6% to 21.9 Moz (681 t). The liberalization of the Chinese market, which is discussed elsewhere in this *Survey*, has not yet had a profound impact on silver consumption. What it has done, however, is to make the statistical gathering exercise a little more complicated because the People's Bank is no longer the only official supplier of metal to the market. Having said this, they remain important suppliers to the market, although "leakage" from other sources has increased, making the business of tracking actual flows somewhat more difficult. Notwithstanding the difficulties in collecting data, the anecdotal and statistical picture does support the view that demand increased last year.

Certainly, the macroeconomic backdrop was broadly supportive of higher offtake last year, with real GDP growth of around 8%. Demand for China's exports surged by 12.9% in 2000 and exports of goods and services grew by an estimated 25.6% in 2000. Significantly, electronics exports were up by over 50%, much of this accounted for by computers.

Domestically, the picture has not been quite as rosy. In particular, the urban/rural and east/west divide has become more pronounced in recent years. Rural income growth, for instance, has lagged that in the urban areas, a factor that has held back consumption. In fact, it has been China's urbanites who have been doing the bulk of the spending that is powering GDP growth. In October, for example, when the nation took a full week off to celebrate National Day, urban retail sales leapt nearly 12% from a year earlier to 188.2 billion renminbi ($22.9 billion) while rural retail sales rose just 8.1% to 114.7 billion renminbi.

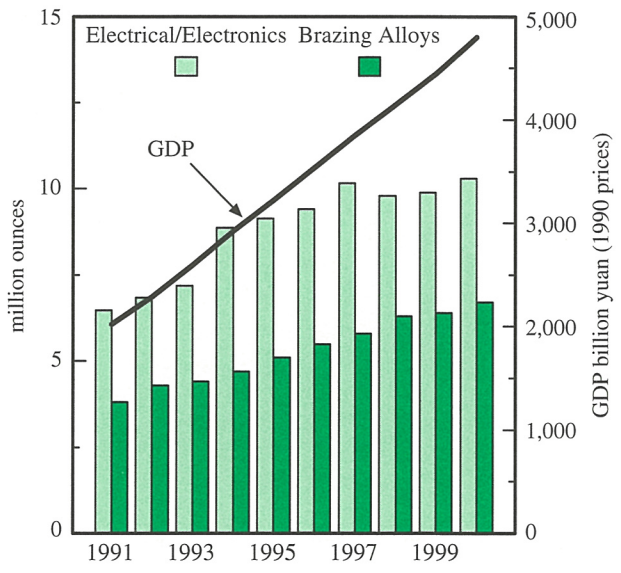
Much of this has been good for silver demand because urban expenditure tends to be focused on so called white goods and electronics items (by contrast, gold jewelry offtake has stagnated because of the weakness in rural demand). Indeed, the growth in these sectors, in particular electronics, has underpinned much of the rise in silver offtake in the past decade.

Home electrical appliances first entered China toward the end of the 1970s and demand grew steadily throughout the 1980s. Offtake really started to pick up in the late 1980s and rapid growth was witnessed in the 1990s in line with burgeoning incomes. The heady increases in output seen in the early 1990s have now been replaced by more sedate growth (for instance, year-on-year growth in the production of refrigerators was 209% ten years ago as against 0.8% in 1999).

Certainly, the industry is entering a mature period and it seems unlikely that the growth rates of the past will be maintained. There have even been suggestions within the industry that there is excess capacity and the fierce competition at the wholesale and retail end of the market would appear to support this contention. The selling prices of many household electrical appliances, such as televisions, VCDs, microwave ovens, washing machines and air conditioners have all tended to fall in recent years. Data released recently suggested that the profits of refrigerator and microwave oven fabricators have dropped by as much as 30-40% in the space of a few years.

The real engine of growth in the past two years has been in the electronics sector, in particular, computers. Last year witnessed quite phenomenal growth in this sector, aimed both at the domestic and export markets. (Computer exports racked up an unprecedented year-on-year growth of 666% in the first half of the year). Fabricators such as Legend (which has a 26% market

Figure 48
Chinese Industrial Uses of Silver



The Main Uses of Silver

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

Industrial

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

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

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

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

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

Silver, usually in the form of mesh screens but also as crystals, is used as a catalyst in numerous chemical reactions. For example, silver is used in formaldehyde catalysts for the manufacture of plastics and, to an even greater extent, in ethylene oxide catalysts for the petrochemical industry.

Silver is employed as a bactericide and algaecide in an ever increasing number of water purification systems in hospitals, remote communities and domestic households.

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

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

Photography

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

Jewelry and Silverware

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

Coins

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

share) have focused on domestic software applications to appeal to the local market and boost sales. For instance, its TianXi model, which sells only in China, comes preloaded with an internet connection that can be accessed easily by hitting a single button and one year of free internet time through a special deal with China Telecom. Furthermore, it also has Chinese voice-recognition software and a graphics pad for handwriting.

In fact, China is experiencing something of a "silicon rush" as foreigners and Chinese alike race to set up factories that make, assemble or design chips for computers, cell phones and almost every other electronic device. For instance, in August, Motorola said it would double its investment in a plant in the coastal city of Tianjin to $1.9 billion - at the time, the largest-ever foreign investment in China. In October, IBM said it would build a chip-packaging plant in Shanghai and Intel has recently announced similar plans. All of this bodes well for silver demand into the future.

Having said this, it is important to bear in mind that much of China's export industry is still heavily dependent on imported components. As we have remarked in these *Surveys* in the past, there was a time when most foreign fabricating facilities in China, especially on the industrial/electronics side, were little more than assembly plants. Although this is changing, it is still the case that many of the higher tech applications use imported semis. Quality issues have always been a stumbling block towards using locally fabricated semi's, although each year increasing numbers of foreign companies source greater volumes of semi-finished products from the local market.

However, electronics has not been the only growth area for silver in China. In the mid and late 1990s, the formaldehyde sector in China entered a stage of incredibly fast development. According to the China Chemical Reporter, there were more than 140 formaldehyde producers with a total capacity of 2.1 million t/year in 1998. By August of 2000, the number of formaldehyde producers reached 256 and the total design capacity exceeded 5 million t/year, more than doubling the capacity in 1998. The key from the perspective of this *Survey* is that most domestic producers still use silver catalysts in their processing, which has seen demand for the metal increasing sharply.

South Korean industrial demand rose sharply in 2000, rising by 29% to 15.7 Moz (489 t), the highest level ever recorded and almost 28% higher than the previous peak set in 1997.

Korean Industrial Production
Index (1995=100)

1996	1997	1998	1999	2000
108.5	113.5	106.2	131.9	154.0

Source: OECD

Not too surprisingly, the major engine of growth was electronics. The first half of the year was especially strong, with, for example, exports of electronics items rising by an astonishing 94% year-on-year. This was not to continue, however, and the industry quickly went from boom to bust, especially for the domestic semiconductor and display manufacturers. Had it not been for this reversal of fortunes, full year demand would have been substantially higher still.

The figures speak for themselves. For example, Korea's DRAM exports grew by around 32% year-on-year according to the Korea Semiconductor Industry Association. (Exports for the entire year 2000 reached a record-high of around $26 billion). Much of this growth actually took place in the first half as already mentioned, at a time when DRAMs were trading at up to $8 a piece in the spot market, mainly on the back of robust sales of personal computers (which account for somewhere in the region of 70% of demand for DRAMs).

Offtake of silver was also helped along by good growth in motor vehicle production. Data from the Korean Automobile Manufacturers Association show that production rose to 3,114,998 vehicles in 2000, up by close to 10% on 1999's 2,843,114. As we discuss in more detail elsewhere in this chapter, silver use in vehicles is tending to rise because of the increasing number of applications per car.

Domestic demand also helped push up silver use last year. Both GDP and consumer spending increased robustly through much of 2000, the former posting a year-on-year increase of over 9%. Powered by pent-up demand and increased overtime, private consumption fuelled the recovery last year, helped by rising fixed investment and export growth. One important factor behind the strong economic performance was the sharp rebound in confidence, helped by structural reforms and a reversal in the flow of funds due to a huge current account surplus and a record level of foreign direct investment (US$15.5 billion in 1999). Increases in consumer spending and a sharp rise in construction

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

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
United States	23.5	25.8	28.6	31.6	36.0	36.3	41.9	44.1	47.1	50.6
Japan	22.4	20.3	20.9	22.5	23.9	22.7	25.8	23.7	30.0	36.7
Germany	12.7	12.1	11.3	10.9	11.9	11.6	11.9	12.2	12.2	14.3
China	6.5	6.9	7.2	8.9	9.1	9.4	10.2	9.8	9.9	10.3
South Korea	0.6	0.5	4.5	5.3	6.4	6.4	6.5	6.0	6.6	8.6
Taiwan	2.2	2.7	2.9	3.3	3.6	4.2	4.7	4.8	4.8	7.7
France	5.3	6.2	5.0	5.4	6.1	6.3	7.7	6.7	6.8	7.3
United Kingdom	4.4	4.5	4.5	4.6	4.7	5.0	5.1	6.8	5.7	6.8
Switzerland	1.9	2.6	2.8	3.5	3.8	4.1	5.5	7.3	7.5	5.0
India	2.4	2.4	2.4	2.6	3.0	3.2	4.2	4.2	4.5	4.8
Hong Kong	0.8	0.9	1.2	1.8	1.9	2.2	2.7	2.5	2.9	3.5
Mexico	1.2	1.2	1.2	1.2	1.1	1.1	1.2	1.3	2.9	3.1
Italy	3.1	3.1	3.2	2.7	2.7	3.3	3.2	2.9	3.0	3.1
Brazil	1.0	1.0	1.0	1.5	1.6	1.4	1.4	1.4	1.3	1.3
Spain	0.9	0.9	1.0	0.9	0.9	0.9	0.9	1.0	1.0	1.0
Turkey	0.7	0.9	0.9	0.8	0.9	0.9	1.0	0.9	0.8	0.9
Australia	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6
Netherlands	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Austria	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Romania	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Egypt	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	**91.2**	**93.3**	**100.0**	**109.0**	**119.2**	**120.5**	**135.4**	**137.2**	**148.5**	**166.6**

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

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
United States	5.6	6.5	7.2	7.7	8.0	8.2	8.4	8.6	9.0	8.7
China	3.8	4.3	4.4	4.7	5.1	5.5	5.8	6.3	6.4	6.7
Japan	4.8	4.2	3.8	4.7	4.8	5.1	5.0	4.2	4.2	4.4
Germany	5.1	4.8	4.5	4.0	3.5	2.9	3.1	3.1	3.0	3.2
Italy	1.5	1.6	1.7	1.9	2.1	2.1	1.9	1.8	2.2	2.3
United Kingdom	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.4	2.2	2.3
India	1.5	1.5	1.5	1.6	1.9	2.1	1.6	1.5	1.6	1.8
Switzerland	2.6	2.4	1.8	1.8	1.8	1.7	1.7	1.6	1.5	1.6
Taiwan	0.5	0.6	0.7	0.8	1.0	1.1	1.1	1.0	1.0	1.2
Spain	0.6	0.5	0.4	0.3	0.3	0.6	0.9	1.0	1.1	1.1
South Korea	0.2	0.3	0.8	1.0	1.2	1.2	1.1	0.8	0.8	1.0
France	2.1	2.4	1.8	1.4	1.3	1.4	1.4	1.0	0.9	1.0
Australia	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.7	0.7	0.8
Brazil	0.5	0.5	0.6	0.8	0.9	0.9	0.8	0.8	0.7	0.7
Mexico	0.9	0.9	0.9	1.0	0.9	0.9	0.9	1.0	0.6	0.6
Canada	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.3	0.3	0.3
Netherlands	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Austria	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Israel	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	**33.3**	**34.2**	**33.9**	**35.6**	**36.9**	**37.3**	**37.4**	**36.6**	**36.8**	**38.2**

(up by over 11%) fuelled the demand for silver containing products.

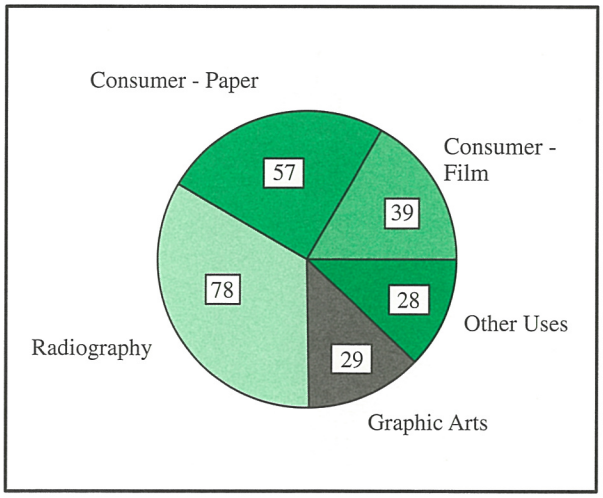
Taiwan was the real star performer in 2000, with silver offtake in industrial applications rising by over 50% year-on-year to a record level of 9.6 Moz (298 t).

As with Korea, one of the major drivers behind this spectacular growth was the electronics sector, especially the export market. New records were set virtually every month last year and total exports stood about 22% higher year-on-year. (Looking forward, one obvious danger has to be the weakening of global demand for hi-tech and electronics which account for nearly 50% of Taiwan's exports). However, the growth in silver fabrication was not only derived from the rise in exports and the tremendous strength of the electronics industry. An important explanatory factor has been the shift in Taiwan towards more local fabrication of silver semi's.

As regular readers of GFMS *Surveys* will know, imported semis are **not** counted in the fabrication data. So, for example, silver nitrate imported from Japan into Taiwan would be counted in the Japanese fabrication statistics. Until recently, the bulk of Taiwan's silver semis were sourced overseas, mainly from Switzerland, Germany the United States, Korea and Japan. This has changed quite dramatically in recent years, usually in response to new technological developments that have helped domestic fabricators to set up plants that compete directly with foreign firms.

A good example of this has been the CD-R market.

Figure 49
Photographic Uses of Silver
million ounces



Taiwan's CD-R production figure increased sharply last year, with their share of the global market rising from 69% in 1999 to 85%. (There are about 30 companies in Taiwan which have invested in the manufacture of CD-R disks but the market is largely held by Lai-Der, Chung-Huan and Ching-Tie. These three manufacturers produce approximately 60% of the CD-R disks on the world market) . Whereas initially some of these fabricators were taking sputtering targets from other countries, primarily Japan, for the manufacture of the disks, this has now changed and many local suppliers have sprung up producing sputtering targets. From the perspective of the statistics in this *Survey*, these manufacturers are sourcing raw bullion from the international market to manufacture the targets and this is correctly counted in our statistics as Taiwanese demand.

Of course, computer demand last year was particularly robust and this helped push up silver use considerably. As in the case of CD-Rs, many of the intermediary products used in the manufacture of computers are now being made in Taiwan, boosting the silver figures by more than would be justified by simply looking at the overall growth in that market.

Industrial demand for silver in **Hong Kong** rose by almost 20% year-on-year to 3.9 Moz (121 t). Higher electronics demand for plating salts across the Asian region was the main factor behind this.

Photography

- Demand fell for the first time in eight years, down 1.2% to 230.6 Moz (7,173 t).
- The fall was greatest in Europe, down 6.4% to 72.0 Moz (2,240 t), but North America also slipped, down 2.5%. In contrast, Japanese demand was up 7.0% to 64.1 Moz (1,995 t).

New information on the net amount of silver nitrate used by one of the larger American photographic product manufacturers has led us to revise downwards the data series for the **United States**. On the basis of these revised numbers, the picture last year was one of modest growth, fabrication demand rising by just over 1% year-on-year to 80.2 Moz (2,495 t). This outcome may be surprising given reports of strong US sales of consumer film and paper plus healthy offtake of radiographic and motion picture films. However, there are several explanations for why the increase in silver use was so low. Firstly, growth in demand for

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

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Belgium	19.4	19.7	20.1	20.6	22.8	24.8	26.6	33.2	36.9	34.7
UK & Ireland	12.3	13.1	13.6	15.9	16.7	18.2	19.0	19.1	21.0	21.8
France	13.4	14.3	14.7	13.7	15.9	13.2	12.7	14.5	11.9	13.1
Germany	16.6	15.8	15.4	16.1	14.8	13.8	14.5	9.9	6.7	1.7
Czech & Slovak Republics	0.5	0.2	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.3
Hungary	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Romania	0.4	0.3	0.3	0.2	0.1	0.2	0.2	0.3	0.2	0.2
Bulgaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Poland	2.3	0.5	0.5	0.5	0.5	0.3	0.2	0.0	0.0	0.0
Spain	1.4	0.6	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Total Europe	66.6	64.8	65.2	67.4	71.1	70.7	73.5	77.4	76.9	72.0
North America										
United States	54.8	53.5	54	57.2	60.8	62.7	65.7	75.2	79.3	80.2
Mexico	2.3	2.6	3.2	3.2	3.3	3.4	4.1	3.4	2.9	0.0
Canada	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total North America	59.0	56.2	57.1	60.3	64.1	66.1	69.8	78.7	82.3	80.2
Central & South America										
Brazil	2.6	2.6	2.6	3.2	4.0	3.4	3.4	3.2	3.2	2.4
Argentina	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.6	1.3
Total Central & South America	4.4	4.4	4.4	5.0	5.8	5.2	5.2	5.0	4.8	3.7
Indian Sub-Continent										
India	2.6	2.6	2.3	1.6	0.6	0.6	0.6	0.3	0.3	0.3
Other	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.4	0.4	0.4
Total Indian Sub-Continent	2.8	2.8	2.5	1.8	0.9	0.9	1.0	0.7	0.7	0.7
East Asia										
Japan	57.8	58.0	57.2	55.1	56.9	57.9	58.6	58.2	59.9	64.1
Taiwan	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Total East Asia	57.9	58.1	57.3	55.2	56.9	57.9	58.6	58.2	60.0	64.1
Oceania										
Australia	2.3	2.3	2.1	1.9	1.6	1.6	1.6	1.6	1.7	2.7
Total Oceania	2.3	2.3	2.1	1.9	1.6	1.6	1.6	1.6	1.7	2.7
Western World Total	192.8	188.5	188.7	191.6	200.4	202.5	209.7	221.7	226.3	223.5
Other Countries										
China	4.4	4.7	5.1	5.6	5.6	5.8	6.0	6.1	3.7	3.9
Soviet Union/CIS	8.8	7.2	6.3	5.2	5.0	4.7	4.5	3.8	3.4	3.2
Total Other Countries	13.2	11.9	11.4	10.8	10.5	10.4	10.5	9.9	7.1	7.1
World Total	**206.0**	**200.4**	**200.0**	**202.5**	**210.9**	**212.9**	**220.2**	**231.6**	**233.4**	**230.6**

photographic products turned out to be softer than expected due to a weaker second half performance. For instance, figures released by Kodak for consumer film roll sales indicated that after rising by 7-8% in the first half, growth slipped to a 4% rate in the third quarter and to 0% in the fourth quarter. Secondly, average silver loadings in film have generally tended to decline. Thirdly, some manufacturing of photographic products has been moved abroad (e.g. to Europe), with this offsetting the relocation to the United States of production by other companies (e.g. from Japan and Latin America).

Arguably the most important news for the silver market last year from the photographic sector was Kodak's announcement in December that it had fully hedged its 2001 silver needs. No further details were

provided and so it is not clear what hedging structures were put in place or the quantity of metal covered. For instance, did the company make use of forward purchases or derivatives or a combination of both? The scale of the counterparty buying associated with the trade would of course vary according to what instruments were used to cover Kodak's silver requirements this year. Yet although the scale of this "accelerated demand" is unclear, what is certain is that the transaction would have provided support to the embattled silver price in the fourth quarter, which is when one supposes the operation was made. Conversely, Kodak's hedging activities will tend to result in reduced support for the price in 2001 as its demand was effectively brought forward into calendar 2000.

In **Germany**, a decline in exports and domestic demand accounted for much of the 75% fall in the production of silver nitrate. In addition, the Neu Isenburg facility which Belgium's AGFA-Gevaert announced in 1999 that it would close finally ceased production last year. It is arguable that other formats have impacted on areas of traditional nitrate demand and it is perhaps telling that AGFA's latest annual report shows that the share of "new digital solutions" in Group sales has risen from less than 5% in 1996 to 22% last year. Elsewhere, silver nitrate demand in the **United Kingdom** was higher, primarily on the back of increased exports.

The importance of the definition of fabrication is highlighted when assessing silver use in photography

Worldwide Film and Paper Consumption and Photographic Fabrication Demand

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

	1996	1997	1998	1999	2000
Film**	3,005	3,404	3,332	3,440	3,490
Paper^	1,430	1,511	1,556	1,699	1,790
Fabrication*	213	220	232	233	231

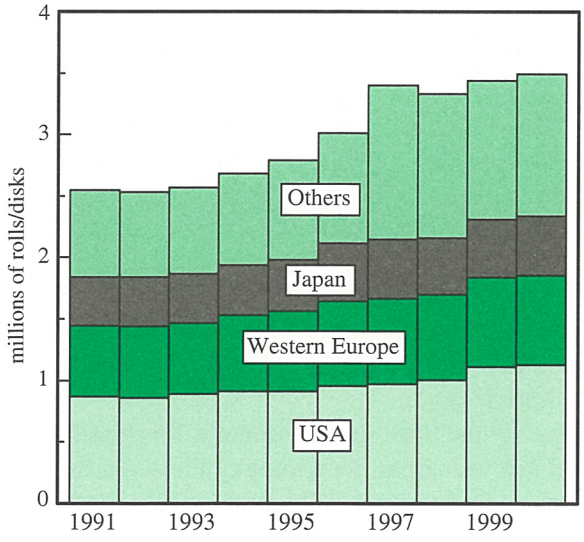
Source: Photofinishing News, GFMS

in **France**. GFMS locate fabrication in the country where the silver nitrates for photography are made. Thus while there are signs that consumption in France might have been flat or weak and imports rose (particularly in the fourth quarter), it is estimated that fabrication itself grew strongly thanks to an impressive export performance.

GFMS estimate that **Japanese** photographic demand rose quite strongly in 2000, up by around 7% to 64.1 Moz (1,995 t). We estimate that all three of the major manufacturers saw increased offtake last year, this in spite of the inroads that digital technology is making into certain sectors of the market.

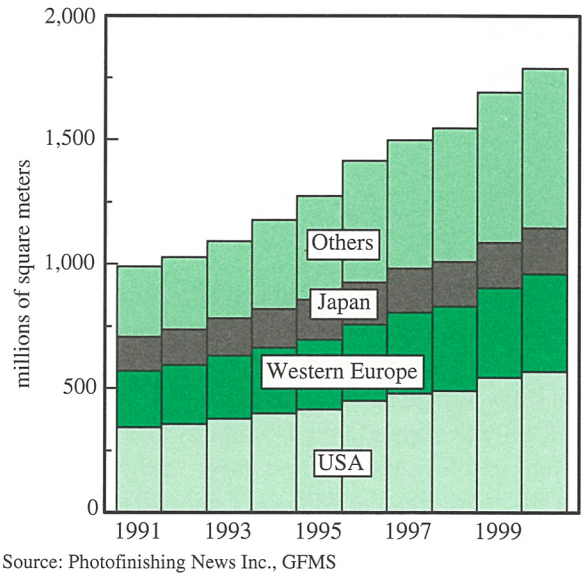
For instance, recent data show that sales of traditional silver halide cameras have fallen sharply (down from 5.0 million units in 1999 to only 4.2 million in 2000) which would seem to suggest that silver consumption should have followed a similar pattern of decline. However, this relationship is not as

Figure 50
World Consumer Film Sales



Source: Photofinishing News Inc., GFMS

Figure 51
World Color Photographic Paper Consumption



Source: Photofinishing News Inc., GFMS

Digital Technology and the Photographic Market

The decline in the amount of silver used in photograhpy last year reflected the growing share of digital technology in the overall photographic market.

By far the most significant impact to date has taken place in the graphics arts sector, which in 2000 is estimated to have experienced an absolute fall in demand.

The impact in the medical sector has perhaps been less clear cut, not least because silver halide demand has also been affected by the introduction of new materials containing less silver. This notwithstanding, the growth in digital products has broadly been limited to Europe and the United States. Furthermore, global sales of radiographic film (and the quantity of silver used) have continued to rise.

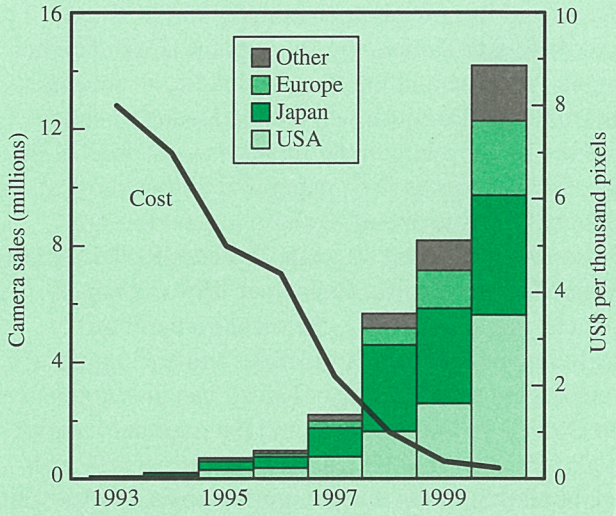
Turning to other areas of the photographic market, a number of digital films have already been produced by the motion picture industry, some of which have completely by-passed conventional film. However, in the United States, for example, the huge growth in the number of new theaters over recent years has led to overcapacity and a decline in profitability. Although this fact may encourage some theaters to try to differentiate their product, it is thought unlikely that the major chains will be in a position to make the costly transition to digital systems for some time.

The professional end of the consumer market is the other area where, at a minimum, growth in traditional silver halide technology has been restrained by the adoption of digital systems. However, the capital outlay for high-end digital equipment (including digital backs, computer, software and storage) seems to have limited the take-up in this field.

In the general consumer market, a combination of improved image quality (standard cameras moving from 350,000 pixels a few years ago up to typically 2 to 3 million pixels today) and declining prices have led to higher digital camera sales (see Figure 52). At present the impact of this on film demand seems to be very limited - the overall population of conventional cameras has also increased, albeit far more modestly in percentage terms. Eventually, however, digital technology will encroach on film sales (although as explained in the box on page 33, to a large extent the impact on the silver market will be moderated by lower scrap supply from this source). Arguably the more important issue is what will happen to photographic paper consumption as digital technology spreads. Here, in the short to medium term at least, the outlook is more positive. Commercially viable and cost-effective substitutes for silver-based paper are still some way off. Thus, for the next few years at least, the growing number of images likely to be produced via digital systems will generally be output on traditional photographic paper.

Figure 52

Digital Cameras: Sales* and Cost per Pixel



*Includes toy cameras

Source: GFMS, Lyra Research, Inc.

clear-cut as might appear at first sight because the majority of printing is still done on silver halide paper. It is revealing to note, for instance, that the big three in Japan have all brought out printing systems aimed at the digital end of the market that still require traditional paper (e.g. Fuji's "Super Digital Print"). Importantly, digital capture of images appears to encourage multiple printing which has boosted the demand for silver halide paper.

Another factor boosting silver offtake in Japan in 2000 was export demand from the Asian region for both consumer and X-ray film. In particular, it seems that the Japanese push into the China market (see below) boosted shipments to the mainland and Hong Kong. A very substantial amount of the film consumed in China is imported unofficially from Hong Kong. For instance, imported film is priced at around 10.75 yuan per roll when it arrives at customs. After adding a 17% value-added tax, production costs and the earnings of wholesalers and retailers, the minimum retail price would probably have to be at least 15 yuan per roll or 2 yuan more than the sales price in the big cities. This has been a major incentive to ship in film unofficially.

Another factor underpinning silver offtake in Japan has been the move to higher speed films. It appears as

if the average user of traditional film is no longer content with standard ASA100 film and is using higher speeds, typically in the 200 to 400 range. Importantly, high-speed film uses more silver.

Turning to the sub-sectors of demand, the data point to both consumer and X-ray uses having risen year-on-year, the latter by as much as 10%. (Japan exports large volumes of X-rays to the Asian markets where traditional imaging techniques are still widely used). As would have been expected in light of recent trends, graphics arts uses of silver fell, albeit marginally last year.

Chinese photographic demand for silver is estimated to have risen by around 5% to 3.9 Moz (120 t). As discussed at length in last year's *Survey*, the Chinese market has undergone some tremendous changes in the past three years since Kodak's entry. Investment in the mainland market has been ongoing and Kodak took another strategic step in its commitment to China with the full-capacity operation of its sensitizing facility in Xiamen and its new photochemical plant in Wuxi.

According to Kodak, the Wuxi plant in east China's Jiangsu Province and the Xiamen facility in southeast China's Fujian Province will enable Kodak to better serve the fast-growing imaging market of China with convenient access to film, paper and photochemical products. (This is one of Kodak's largest foreign investments in the last 30 years and uses Kodak's most-advanced technologies. Consumer film and paper products' processing from chemical preparation, sensitizing and coating to finishing and packaging will be conducted in the facility). Kodak has invested more than US$1.2 billion in China and the mainland market has already grown to be Kodak's second-largest after the United States. On a consumption basis, Kodak film and paper now hold a more than 40% share of the Chinese market compared to 10% in 1994, dwarfing Japan's Fuji and China's Lucky brands, the two other major players in the Chinese film market. The observant reader may be wondering why all of this investment and activity has not increased fabrication demand by more. The main reason for this is that GFMS estimate most of the semis used in producing the final photographic products were still being imported last year.

Most nitrate production for photographic applications in China is still being carried out by Lucky Film. In response to the fierce competition introduced by Kodak, Lucky has gone on the offensive, opening 780 outlets across China in 2000, bringing them to a total of 1,800 (Kodak has 6,000 outlets). An extra 1,000 are planned for 2001. Rising competition has also forced Lucky to look to expanding both its product range and quality. So although they have tended to focus on low-end products, for example ASA100 in the past, rising living standards and competition from Kodak and Fuji is forcing them to look to 200 and 400 formats. On the quality front, GFMS information is that they have been looking to source some high quality nitrate from outside of China.

Jewelry and Silverware

- World demand in jewelry and silverware rose a respectable 3% to 281.7 Moz (8,762 t).
- The increase was strongest in East Asia with demand rising 12.8% to 43.9 Moz (1,365 t) though this is still behind its pre-crisis peak.
- Europe saw a fifth year of growth, up 3% to 87.5 Moz (2,723 t) due, primarily, to buoyant demand in Italy where offtake rose 6% to 54.2 Moz (1,685 t).
- The largest market, India, also enjoyed growth but a more modest 1.6% to 84.6 Moz (2,630 t)

Europe

The **Italian** jewelry and silverware industry saw a fifth year of growth in silver use, rising nearly 6% year-on-year in 2000 to 54.2 Moz (1,685 t).

The increase would have been yet more impressive but for a continuation of the decline in silverware. This fall remains mainly attributable to the ongoing shift in social customs; silver table sets no longer

Figure 53
Official Italian Jewelry Exports

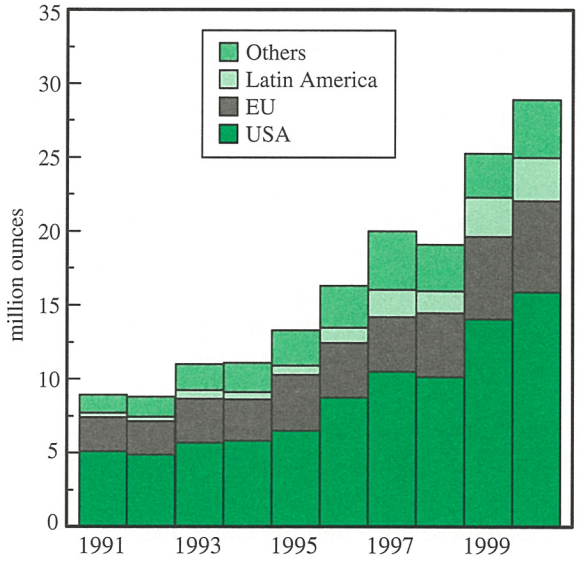


Table 7
Silver Fabrication: Jewelry and Silverware
(including the use of scrap)
Million ounces

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Italy	46.3	50.4	46.2	41.4	39.0	40.5	44.8	45.3	51.2	54.2
Germany	14.5	13.5	11.6	11.6	10.3	10.0	10.0	10.1	10.0	9.3
Greece	3.4	3.5	3.7	3.9	3.8	4.2	4.5	4.1	4.1	4.3
UK & Ireland	1.9	2.2	2.7	2.9	3.0	3.3	3.4	3.3	3.1	3.2
Spain	13.0	3.7	3.7	4.0	4.1	4.5	4.0	4.1	3.4	3.0
Poland	1.0	1.0	1.0	1.1	1.6	1.8	2.3	2.7	2.9	3.0
France	1.8	1.7	2.0	1.9	2.0	2.0	2.2	2.6	2.7	2.8
Portugal	2.2	2.2	2.1	1.5	1.7	1.9	1.9	1.9	2.1	2.1
Norway	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.5	1.6
Denmark	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9
Sweden	1.6	1.3	1.2	1.2	1.0	1.1	1.3	1.0	1.0	0.9
Finland	1.3	1.0	0.8	0.9	0.7	0.8	0.8	0.6	0.6	0.5
Cyprus & Malta	0.2	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Austria	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.3
Czech & Slovak Republics	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Other	1.2	1.1	1.1	1.0	1.0	0.9	0.9	1.0	0.9	0.9
Total Europe	90.9	84.7	79.0	74.3	71.2	74.0	79.2	79.7	85.3	87.5
North America										
United States	9.7	10.9	11.3	12.0	12.5	12.4	12.5	12.6	13.1	13.7
Mexico	8.7	9.0	9.2	8.7	11.0	14.2	16.3	15.3	15.1	13.2
Canada	1.2	0.9	0.9	1.0	1.2	1.3	1.5	1.8	1.5	1.4
Total North America	19.5	20.8	21.3	21.6	24.8	28.0	30.4	29.7	29.7	28.4
Central & South America										
Brazil	1.7	1.6	1.8	1.8	1.9	1.8	1.6	1.4	1.3	1.2
Peru	1.1	0.7	0.8	0.8	0.9	1.0	1.1	1.0	1.0	0.9
Colombia	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.6	0.6
Ecuador	0.3	0.3	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5
Argentina	1.0	1.0	1.0	1.0	0.9	0.8	0.8	0.2	0.2	0.2
Other	0.7	0.7	0.7	0.6	0.7	1.0	1.4	1.7	1.9	1.2
Total Central & South America	5.6	5.1	5.5	5.7	5.9	6.0	6.3	5.8	5.4	4.4
Middle East										
Turkey	3.9	4.6	5.0	4.3	5.1	5.5	5.5	5.2	4.7	5.9
Israel	1.7	1.8	2.0	2.1	2.3	2.6	3.0	2.8	2.9	2.6
Egypt	1.6	2.2	1.8	1.8	2.0	2.1	2.0	1.7	1.9	1.9
Saudi Arabia	0.3	0.4	0.4	0.3	0.4	0.4	0.6	0.5	0.6	0.6
Other	1.9	2.4	2.0	2.4	2.5	2.6	2.6	2.4	2.5	2.6
Total Middle East	9.5	11.4	11.2	11.0	12.4	13.3	13.6	12.8	12.6	13.7
Indian Sub-Continent										
India	25.7	35.6	77.5	60.2	66.6	86	86.3	82.5	83.2	84.6
Bangladesh & Nepal	2.0	2.6	3.9	4.5	5.1	5.8	6.4	5.1	5.7	6.0
Other	1.7	2.1	2.5	2.1	2.9	2.0	3.1	1.9	2.4	2.3
Total Indian Sub-Continent	29.3	40.3	83.9	66.8	74.6	93.8	95.8	89.5	91.4	92.8
East Asia										
Thailand	20.1	31.6	38.5	28.9	27.4	27.1	26.8	23.9	26.5	30.0
South Korea	5.3	5.0	7.2	6.4	6.8	6.6	6.3	2.6	4.5	4.9
Indonesia	1.1	1.2	1.4	2.3	2.7	2.9	3.6	2.2	2.7	3.9
Japan	3.5	2.8	2.5	2.2	2.2	2.1	1.9	1.8	1.8	1.7
Myanmar, Laos & Cambodia	1.0	1.0	1.0	1.0	1.1	1.1	1.0	0.8	0.9	0.8
Vietnam	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.6	0.7	0.7
Hong Kong	1.0	1.0	1.0	1.0	0.9	0.9	1.0	0.6	0.6	0.5
Malaysia	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.5
Taiwan	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4
Other	0.4	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.3
Total East Asia	33.3	44.0	53.2	43.4	42.8	42.6	42.5	33.6	38.9	43.9

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

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Africa										
Morocco	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3
Tunisia	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
Algeria	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Other	0.5	0.5	0.4	0.5	0.5	0.4	0.4	0.3	0.4	0.4
Total Africa	1.4	1.3	1.2	1.3	1.3	1.2	1.2	1.2	1.1	1.2
Oceania										
Australia	0.5	0.5	0.6	0.6	0.6	0.5	0.6	0.7	0.7	0.8
Total Oceania	0.5	0.5	0.6	0.6	0.6	0.5	0.6	0.7	0.7	0.8
Western World Total	190.0	208.0	256.0	224.6	233.5	259.4	269.6	252.9	265.1	272.6
Other Countries										
China	0.2	0.4	0.7	1.0	1.4	2.4	3.1	4.7	6.3	6.7
Soviet Union/CIS	4.2	3.4	2.6	2.3	2.0	2.1	2.3	1.9	2.1	2.4
Total Other Countries	4.4	3.8	3.3	3.3	3.4	4.5	5.3	6.6	8.4	9.1
World Total	**194.5**	**211.8**	**259.3**	**227.9**	**236.9**	**263.9**	**274.9**	**259.5**	**273.5**	**281.7**

automatically appearing on the wedding lists of any good, bourgeois couple heading up the aisle. This has been reinforced by the ever rising competition for disposable income from other consumer items, the most obvious examples being cell phones and foreign travel. The latter, for example, is estimated to have grown by over 2.5% in 2000. There is also some evidence of a rise in the proportion of silverware that is either plated or laminated as opposed to solid with obvious negative consequences for silver offtake.

The shift in customs might make it appear that the decline for silverware is inevitable and inexorable. However, some blame could be laid at the doors of the manufacturers themselves. For too long, too many have just been producing conservative Empire-style flatware that an Armani-clad generation are all too readily shunning. There are signs that this is beginning to change with a growing number producing high fashion items that younger consumers might show interest in. There are also calls for improved generic marketing to reposition the sector's image. This might in the future begin to turn offtake around but there is little sign of this as yet - the scale of the fall in silver use in this sector averaged around 4% a year for the second half of the 1990s yet it is possible the fall in 2000 was into double digits.

This performance stands in stark contrast to silver use in jewelry which rose even faster than silverware's fall, enabling the combined category to register the above 6% increase. Much of the growth in jewelry was export led with shipments to the most important market, the United States, up an estimated 13% while the increases for 'newer' markets for Italian jewelry such as the Middle East or East Asia were even stronger. The overall increase was not solely export based, however, with offtake within Italy showing a healthy increase as local fashion swung in its favor. In all categories, it was once again chains, often in quite heavy designs, that spearheaded growth.

Fabrication in the **United Kingdom** rose by just 2.1% last year to 3.2 Moz (100 t). The rise in jewelry fabrication may appear modest, given the level of growth in consumer demand, but it appears that imports benefited more from this trend. For example, Italian exports to the country are estimated to risen by over one fifth last year. At the same time, the UK industry did not take advantage of the more than 13% rise in US jewelry and silverware imports as shipments from the United Kingdom fell by nearly a quarter in 2000. The silverware sector appears to have been the main beneficiary of the Millennium hallmark which was introduced in 1999 although the industry's share of total offtake has remained relatively small.

Jewelry and silverware demand in **Germany** is estimated to have fallen by over 7% to 9.3 Moz (290 t). The ongoing decline in the domestic silverware market (both fabrication and consumption) has led to aggressive price promotions in the retail sector (price

German Silver Jewelry Imports
(estimated fine quantities in Moz)

	1996	1997	1998	1999	2000
Thailand	1.76	1.76	1.75	2.11	2.30
Others	2.83	3.04	3.53	5.68	7.16

reductions of up to 20-50% have become common place) in an effort to kick-start demand. The decline in jewelry demand was partly due to a shift, at the consumer level, away from the "white look" (Germany in this regard differing from most other countries).

Greek demand rose by 7% last year despite the economic problems which beset the country (including a sharp collapse in the stock market which contributed to lower gold jewelry offtake). The silver market has benefited from both higher domestic and export sales. In the home market, demand has picked up, notably from the younger generation with its preference for "white look" pieces. On the export side, it is worth noting that shipments to the United States increased sharply last year.

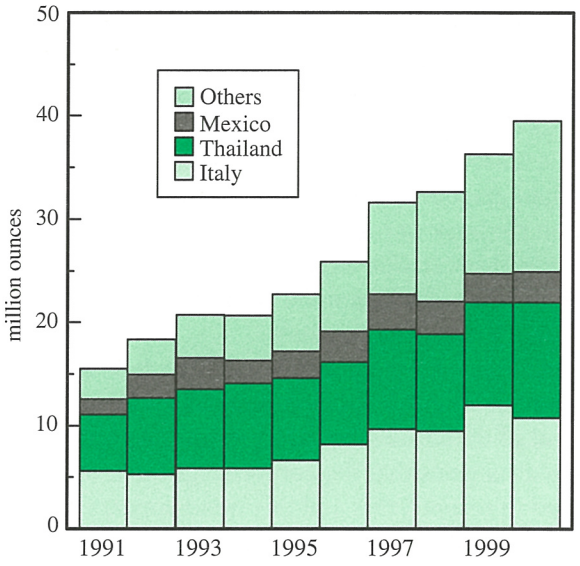
Fabrication within **France** is estimated to have risen as the "white look" gains in popularity. However, much of the benefit of this change in taste has accrued to imports, keeping the scale of the rise to a modest 2.4% which brings fabrication up to 2.8 Moz (86 t).

North America

Fabrication in the **United States** of jewelry and silverware was nearly 5% higher at 13.7 Moz (427 t). Most of the growth was due to higher demand in the jewelry and giftware markets which have benefited from the rise in retail consumption. In the jewelry sector, demand has improved for both chains and higher value-added pieces, in particular jewelry with semi-precious stones. This development is also confirmed by trade data which suggests that US imports from Thailand and China, both of which tend to specialize in these products, were sharply higher last year.

Overall, US jewelry consumption increased by almost 9% in 2000 to an estimated 48 Moz (1,500 t). The bulk of this growth was accounted for by higher imports, which rose by 4.7 Moz (145 t), easily outstripping the modest rise in jewelry fabrication. It should come as no surprise therefore that imports share of total consumption increased to over 80% last year.

Figure 54
US Silver Jewelry Imports



In the giftware industry, demand, in particular for baby gifts, e.g. for christening spoons, remained buoyant last year.

Fabrication in the silverware industry, which had been broadly unchanged for a number of years, declined in 2000. This category includes silver plated cutlery (as well as solid pieces), demand for which has suffered due to the ongoing shift to stainless steel.

Mexican jewelry and silverware fabrication suffered a large reversal in 2000, raw material demand declining by nearly 13% to 13.2 Moz (410 t). Around 80% of production consists of jewelry and this sector has been under pressure from low-cost Asian competition, above all in the key US market. The competitiveness of Mexican exports was not helped last year by an appreciation of the peso in real terms against the dollar. Another factor contributing to lower output has been some manufacturers switching back to the production of gold jewelry which has sold well in line with the stronger local economy.

Middle East

The silverware and jewelry sectors in **Turkey** experienced contrasting fortunes last year.

Until the fourth quarter, the level of silverware fabrication was little changed compared to a year earlier. The November banking crisis, and its impact

on domestic consumption, led to a downturn in the silverware market (year-end sales account for a significant share of annual turnover). By contrast, jewelry demand last year was significantly higher. Not only did fabrication of silver articles pick-up, on the back of both higher tourist and local demand, but the use of silver in gold jewelry was markedly higher. For obvious reasons, this was concentrated in the 10 and 14 carat markets, both of which made tremendous gains in 2000 on the back of higher exports. In addition, both jewelry and silverware exports were significantly higher in 2000. For example, shipments destined for the United States rose markedly.

Despite the economic difficulties which beset the **Egyptian** economy last year, there was little change in the level of domestic silver fabrication. Anecdotal evidence suggests that the corporate gift market has declined in recent years and this trend appears to have continued in 2000. However, it appears that two other developments worked to the benefit of the silver market. Firstly, the economic crisis, which involved a liquidity crunch, led to a substitution of gold for silver articles in the domestic market. Secondly, the high level of tourism which appeared to be of little benefit to the gold market (due to the tourists' perceived "low quality") provided for additional demand in the jewelry and silverware markets.

After staging a modest recovery in 1999, jewelry and silverware demand fell back in **Israel** last year. The 10% decline took domestic offtake to its lowest level since 1996. In addition, exports to the United States continued to fall in 2000. From its peak in 1997, the volume of official exports is estimated to have fallen by over 55% and last year alone shipments fell by 13%.

Indian Subcontinent

Indian jewelry and silverware offtake is estimated to have risen by around 1.6% in 2000 to 84.6 Moz (2,630 t), up from (a revised) 83.2 Moz (2,589 t). Last year, India accounted for a staggering 30% of the world's jewelry and silverware production and a not inconsequential 9% of total fabrication demand. As we have long maintained at GFMS, India will remain one of the most important swing factors in the global silver market because of its price elasticity.

At first sight, it seems somewhat surprising that demand increased. Early on in the year, the data pointed very clearly to the market being down, and sharply at that. Imports into the main entrepôts such as Ahmedabad were significantly lower year-on-year and the general economic circumstances seemed to be broadly supportive of the notion that demand should probably have fallen.

The first point to make in this context is that 2000 was a fairly poor year economically speaking. Real GDP growth was around 6%, down on the previous year's 6.4%. Perhaps more importantly, private consumption expenditure only grew by 4.1%, down from the 7.2% recorded in the previous year. Perhaps an even more compelling argument in favor of a decline was the lackluster performance of the agricultural sector which has now suffered two years of relatively poor harvests. Rural demand accounts for a significant proportion of silver demand so any weakening within this sector would be expected to impact adversely on total Indian offtake.

All India Monsoon Rainfall
(rainfall % on normal)

1996	1997	1998	1999	2000
103	102	106	96	92

(source: National Informatics Centre)

Indian agricultural output is of central importance to silver offtake and this is generally dictated by the monsoon, in particular the southwest one which runs from June to September each year. Although statistically normal last year (defined by a 10% variation around the long term average), the southwest monsoon left a third of districts (142) with deficient to scanty precipitation according to data published by the NIC. In fact, last year's monsoon was the worst since 1991 (when around 91% of normal precipitation was recorded) and the states of Gujarat, Madhya Pradesh and Rajasthan were particularly badly affected.

Production problems were further compounded by very weak post-monsoon rains (which typically fall between October and December). These were down by 25% on the average and, ominously, there are predictions that the country may face severe water shortages in the summer months of 2001. The fall in absolute levels of agricultural production was also associated with slower income growth in this sector.

According to the official data, agricultural incomes grew by only 0.7% in 1999/00 and by 0.9% in 2000/01. Considering that agriculture accounts for 25% of Indian GDP, one might have expected demand to have suffered. The impact of agriculture on silver demand

is put in stark relief when one looks at the preceding years. For example, in the financial year 1996/97 when agricultural GDP grew by 9.6%, silver demand surged by over 20 Moz to record highs.

So why did demand increase, albeit quite slightly, in 2000? There are a number of possible explanations but the strongest influence last year appears to have been the price.

The silver price averaged Rps 8,001 per kilogram, down on 1999's average (albeit by a paltry 0.3%) in spite of the weakness of the rupee against the dollar (which fell from 43.55 in January to 46.75 in December, a decline of over 7%). Possibly of greater importance, however, was the relative lack of volatility in the price last year. Silver traded in a very narrow Rps 8,445 to 7,710 per kilogram range, a factor which appears to have encouraged buying. (In India, buying usually stops if the price moves strongly in either direction. On the way up, purchasers are reluctant to buy for obvious reasons. On the way down, there is usually a "wait and see" attitude). On top of this, silver spent quite a lot of time below the psychologically important Rps 8,000 level. The consensus is that if the rupee had been stable against the dollar (i.e. rupee silver prices would have fallen by more) demand would have been significantly higher.

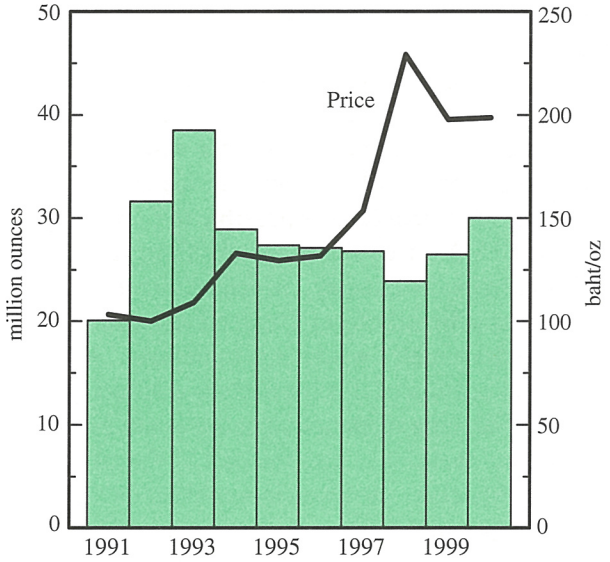
In terms of the items of jewelry being consumed, there were no significant changes year-on-year. The bulk of offtake is accounted for by payal (leg chains), Mangal Sutra and kandola (very heavy waist belts). Mangal (auspicious) Sutra are the chains worn by women to show that they are married and the "Mangala Suthra Dharana" is the tying of the thread containing the marks of the Vishnu or Shiva around the neck of the bride by the groom. (Any interested readers who are about to get married should take a look at http://www.vedicfuture.com/mangal.asp to find an auspicious day to buy their very own Mangal Sutra).

East Asia

Thailand accounts for close to 70% of total East Asian jewelry and silverware fabrication demand. Last year, offtake rose strongly, by over 13% to 30 Moz (934 t), the highest level recorded in the past six years but still substantially below the peak of 1993 when over 38 Moz was fabricated.

The sharp rise in offtake was somewhat surprising, not least of all because of the trend in recent years for Thai fabricators to move more upmarket into higher value added pieces of jewelry. As we have chronicled

Figure 55
Thai Jewelry and Silverware Fabrication



over the past few years, rising competition from places like China and Korea has seen Thai manufacturers moving heavily into gemset jewelry. Bangkok is arguably the key global market place for colored stones (both synthetic and natural) and fabricators have taken advantage of this expertise to move upmarket.

Some of the more popular stones include garnet, hermatile, amethyst, bloodstone, tourmaline, white zirconia, emerald, jade, pearl, moonstone, ruby, sapphire, opal, topaz and yellow and blue zirconia. Bangkok's competitive edge comes from the large pool of skilled workers who are capable of setting stones in a variety of jewelry items (which is why so much of the world's gold, platinum and silver gemset jewelry is fabricated there).

In the face of an increasingly competitive global market place, many Thai fabricators have shifted their business towards supplying only gemset items, although some have carried on supplying plain silver items but with much greater value added. As a consequence, the trend has been for fine silver offtake in Thailand to decline (even though the dollar value of sales has increased, the amount of silver per dollar per piece has fallen), something that has been captured in our statistics over the past few years.

2000 appears to have witnessed something of a reversal of these trends. GFMS information is that there was considerable growth in the so-called "backpacker" or "cash-and-carry" trade last year. This

is in effect the unofficial side of the silver jewelry business. However, it is not only on the fabrication side that things are unofficial. Most of the export trade (and imports on the other side) are done unofficially too.

For instance, a significant proportion of the European market for silver jewelry is fed through informal channels, typically in street markets and via other less formal retail channels. In the United Kingdom, for example, it is possible to purchase un-hallmarked VAT-free silver jewelry from street markets across the country. Much of this jewelry is imported unofficially from Thailand and handcarried back into the country where it is to be sold. A substantial portion of this business is conducted out of the Khao San area of Bangkok and it is not entirely coincidental that this is also the part of the city towards which backpackers gravitate in search of cheap accommodation.

Another reason for the pick up in offtake last year seems to have been due to the relative normalization of the country's financial affairs after the crises of 1997 and 1998. Although baht weakness and financing issues remain important constraints on the development of the business, these pressures have become somewhat less onerous recently. Readers of previous *Surveys* will be familiar with the problems brought about by the sharp devaluation of the baht in 1997. Working capital difficulties forced many fabricators to cut back on output at a time when they were in many senses best placed to increase it.

In terms of formal exports, the United States is by far and away the largest market for Thai silver. Indeed, Thailand overtook Italy as the largest supplier of silver jewelry to the US market in 2000, accounting for close to 11.3 Moz (350 t) in fine silver terms. The other large market for Thai silver jewelry is Europe. These two markets alone probably account for over 90% of Thai exports, both officially and unofficially.

Chinese silver jewelry fabrication continues to go from strength to strength. GFMS estimate that demand in 2000 rose by close to 7% year-on-year to 6.7 Moz (208 t). The growth in offtake in the past decade has been quite phenomenal, rising by close to 400%. Very little of this is consumed domestically and an overwhelming proportion is exported, primarily to the United States and Germany. In fact, according the GFMS estimates, US imports in 2000 accounted for over 70% of China's production.

Korean demand also rose year-on-year, up by a modest 8.6% to 4.9 Moz (152 t). Strong domestic and export demand underpinned this increase. (In the case of the latter, exports to the United States rose by more than 100%). **Indonesian** fabrication demand rose very sharply in 2000, up by over 40% to 3.9 Moz (120 t). Not surprisingly, the export market accounted for most of this growth, with shipments to the United States rising by close to 50% year-on-year.

Coins and Medals

- World coin demand rose by nearly 14% to 30.5 Moz (950 t) in 2000, its highest level since 1994.
- Sharply higher demand in Germany and the United States accounted for much of the increase last year.

The near 14% rise in world coins and medals demand last year was primarily due to higher fabrication in just two countries, namely the United States and Germany, which together accounted for almost 68% of world demand last year (compared to 60% in 1999).

The 2.7 Moz (85 t) rise in fabrication in the **United States** may at first appear surprising, given that Eagle bullion coin sales increased by just over 1% or barely 0.1 Moz (4 t). Before going into the reasons for the rise in overall demand, it is worth noting that Eagle sales were still a remarkable 114% higher than in 1998. One explanation for the high level of demand was that retail interest in painted coins remained buoyant and once again may have accounted for at least half of total Eagle sales last year.

It appears that higher sales of silver proof sets accounted for much of the increase in US coin fabrication last year. Consumer demand for the proof sets was sparked by the inclusion, for the first time, of six new coins - the next five quarters in the 50 State Quarters program as well as a new Golden Dollar (produced in base metals). Although the set was only released in the holiday catalogue (published in the fourth quarter) the level of demand for the 2000 dated sets was exceptionally strong, even taking into account that sales at this time of year are normally buoyant.

Finally, commemorative sales were also higher in 2000. Two such coins were issued last year. These featured the "Library of Congress" Commemorative Silver Dollar and the "Leif Ericson Millennium"

Commemorative. In addition, the "Yellowstone National Park" silver dollar, which was released in 1999, continued to be sold last year.

During 2000, the US Mint's silver requirements were still satisfied by the Defense Logistics Agency (DLA) (as has been the case since 1986). However, it appears that the DLA's stocks will soon be exhausted. As a result, it is expected that silver required for future coin programs will be sourced elsewhere (which in itself will require a change in legislation).

Canadian demand fell back to close to the 1998 level although fabrication was boosted in 1999 due to the one-off issue of double-dated bullion coins.

Turning to Europe, coin production in **Germany** was nearly one-third higher last year by virtue of an additional commemorative program (in 1999, three issues of circulating coins had been produced). Once again, the coins were minted in 925 silver (the quality of silver used having been increased from 625 in 1998). Each issue comprised 3 million brilliant uncirculated coins and 800,000 proof coins.

Production of the Peseta 2000 circulating coin in **Spain** continued to fall last year. The 1.3 Moz (42 t) produced in 2000 represented the lowest level of output since the coin was first issued in 1994.

Elsewhere a number of coins and medals were issued to mark the new Millennium including a commemorative medal released by the **Vatican** (included in the statistics for Italy).

Austrian demand fell over 20% to just 0.2 Moz (8 t). In contrast to the country's gold program, the commemorative issues dominated the fabrication of silver coins.

It is also worth noting that 2001 marks the end of the Schilling as a face value for the Philharmoniker bullion coin. As of 2002, this will be denominated in euros but it remains to be seen what form the coin programs of other countries will take once the euro is introduced.

Australian coin fabrication fell by over 30% to 0.7 Moz (20 t). Over 90% of demand is accounted by the Kookaburra bullion coin program.

Chinese demand fell by one-third to 1.5 Moz (47 t), its lowest level since 1996. Coin sales declined in both the domestic and export markets. However, sales of the Panda coin increased by over 17% to 0.2 Moz (5 t) last year. As a percentage of total Chinese coin sales, the share occupied by the Panda coin has risen from just over 6% in 1999 to nearly 11% last year.

Figure 56
World Coin Fabrication

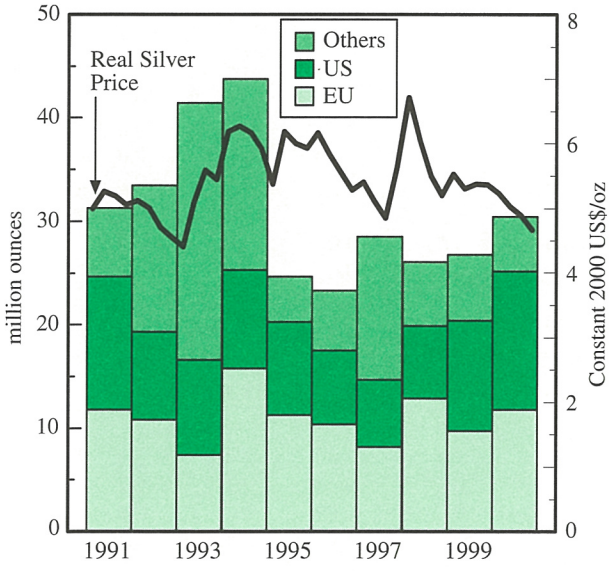


Figure 57
US Silver Eagle Coin Sales

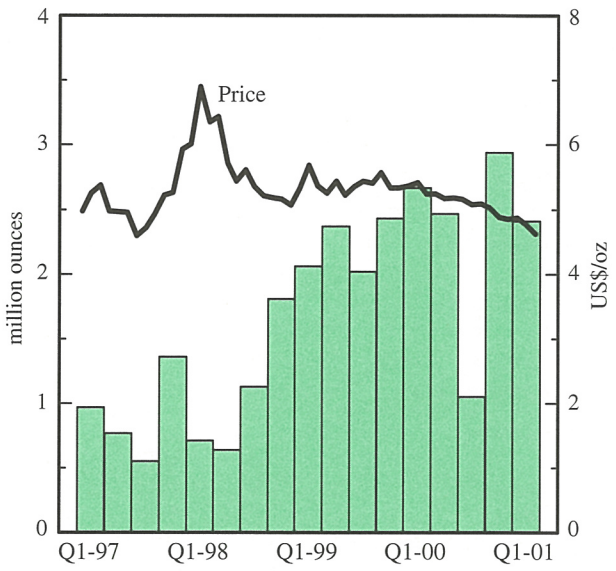


Table 8
Silver Fabrication: Coins and Medals
(including the use of scrap)
Million ounces

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Germany	5.7	5.6	2.8	7.1	2.4	4.6	3.7	8.4	5.4	7.2
Spain	1.1	0.4	0.3	4.8	4.0	2.8	1.8	1.7	1.5	1.3
Portugal	0.0	0.1	0.3	0.4	0.5	0.8	0.8	1.0	0.9	1.2
Italy	0.6	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.6
UK & Ireland	0.4	0.5	0.7	0.8	0.7	0.6	0.6	0.6	0.6	0.6
Switzerland	1.6	0.4	0.3	0.3	0.4	0.6	0.6	0.3	0.4	0.4
France	2.3	2.1	2.1	1.0	1.1	0.3	0.3	0.3	0.3	0.3
Austria	0.6	0.5	0.5	0.5	0.6	0.4	0.3	0.3	0.3	0.2
Poland	0.2	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.2
Belgium	0.3	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1
Netherlands	0.1	0.0	0.0	0.6	1.1	0.2	0.1	0.1	0.1	0.1
Czech & Slovak Republics	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.1
Finland	0.2	0.2	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.1
Norway	0.5	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Romania	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cyprus & Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denmark	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Other	0.1	0.2	0.4	0.1	0.2	0.3	0.1	0.2	0.2	0.2
Total Europe	13.8	11.7	8.3	16.3	12.3	11.5	9.2	13.7	10.5	12.6
North America										
United States	12.9	8.5	9.2	9.5	9.0	7.1	6.5	7.0	10.7	13.4
Canada	0.9	0.8	1.2	1.5	0.7	0.7	0.7	1.1	1.4	1.0
Mexico	1.6	8.7	17.1	13.0	0.6	0.5	0.4	0.2	0.4	0.7
Total North America	15.4	17.9	27.5	24.0	10.3	8.3	7.6	8.3	12.5	15.1
Central & South America										
Other	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Central & South America	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Middle East										
Israel	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Turkey	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Egypt	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0
Total Middle East	0.0	0.1	0.0	0.7	0.1	0.1	0.1	0.1	0.1	0.1
East Asia										
Thailand	0.0	0.1	0.2	0.2	0.3	0.5	0.3	0.2	0.1	0.2
Singapore	0.0	0.9	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1
Japan	0.0	0.0	2.4	0.0	0.0	0.0	7.2	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Total East Asia	0.1	1.0	2.7	0.3	0.4	0.6	7.5	0.3	0.2	0.5
Africa										
South Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oceania										
Australia	0.5	2.1	2.3	1.6	0.7	0.8	0.8	1.0	0.9	0.7
Total Oceania	0.5	2.1	2.3	1.6	0.7	0.8	0.8	1.0	0.9	0.7
Western World Total	29.9	33.0	40.8	42.9	23.8	21.3	25.3	23.5	24.3	28.9
Other Countries										
China	1.4	0.4	0.4	0.7	0.8	1.4	2.8	2.4	2.3	1.5
Soviet Union/CIS	0.0	0.1	0.1	0.2	0.1	0.6	0.4	0.2	0.2	0.1
North Korea	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Other Countries	1.4	0.5	0.7	0.9	0.9	2.0	3.2	2.6	2.5	1.6
World Total	**31.3**	**33.5**	**41.5**	**43.8**	**24.7**	**23.3**	**28.5**	**26.1**	**26.8**	**30.5**

Appendix I

Table 1
World Silver Supply and Demand
(tonnes)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Supply										
Mine Production	15,950	15,165	14,619	14,058	14,920	15,170	16,339	17,040	17,188	18,334
Net Official Sector Sales	-	-	187	548	788	589	-	1,224	2,889	2,323
Old Silver Scrap	4,415	4,613	4,620	4,724	5,066	4,926	5,267	6,025	5,439	5,609
Producer Hedging	591	40	832	-	287	-	2,150	171	-	-
Implied Net Disinvestment	1,279	2,882	3,711	4,453	2,822	4,578	2,517	1,461	2,079	3,167
Total Supply	22,235	22,700	23,969	23,784	23,883	25,263	26,273	25,921	27,595	29,433
Demand										
Fabrication										
Industrial Applications	8,299	8,064	8,391	8,752	9,185	9,247	9,965	9,834	10,593	11,757
Photography	6,408	6,232	6,222	6,297	6,561	6,622	6,849	7,203	7,260	7,173
Jewelry & Silverware	6,048	6,588	8,064	7,088	7,368	8,208	8,551	8,072	8,507	8,762
Coins & Medals	974	1,041	1,291	1,363	769	725	886	811	835	950
Total Fabrication	21,730	21,925	23,969	23,500	23,883	24,802	26,251	25,921	27,194	28,642
Net Official Sector Purchases	505	775	-	-	-	-	22	-	-	-
Producer Hedging	-	-	-	284	-	461	-	-	401	791
Total Demand	22,235	22,700	23,969	23,784	23,883	25,263	26,273	25,921	27,595	29,433
Silver Price (London US$/oz)	4.057	3.946	4.313	5.285	5.197	5.199	4.897	5.544	5.220	4.951

Figure 58
World Silver Supply

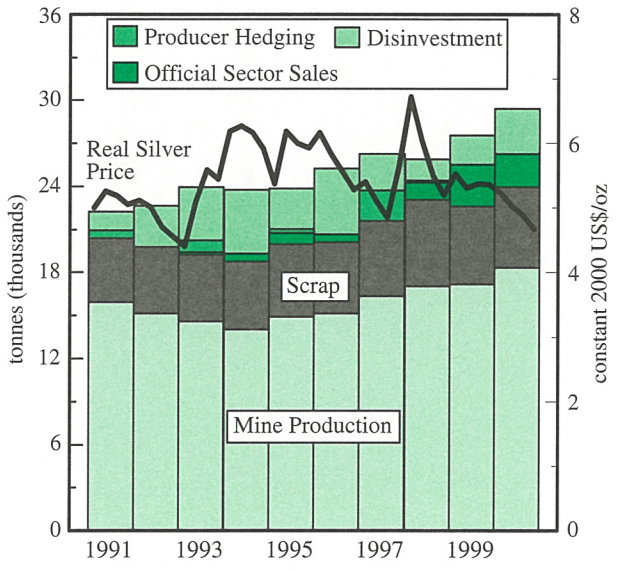


Figure 59
World Silver Demand

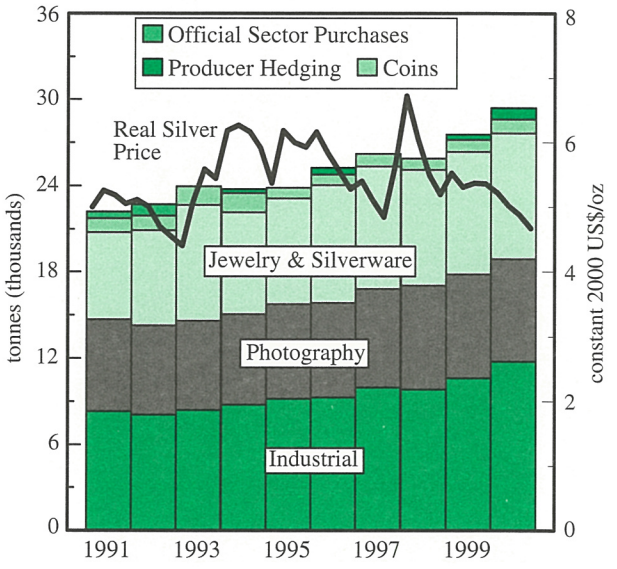


Table 2
World Silver Mine Production
Tonnes

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Poland	899	798	915	859	984	953	1,050	1,119	1,115	1,140
Sweden	254	282	278	252	250	241	265	268	275	294
Spain	233	233	183	176	124	103	66	47	95	117
Romania	50	48	45	42	44	44	43	39	43	39
Greece	70	61	59	45	45	16	36	45	40	31
Ireland	11	13	13	17	14	15	13	11	15	25
Finland	30	27	29	26	27	34	32	30	31	24
Portugal	43	38	36	32	39	34	34	32	27	21
Bulgaria	59	84	96	56	44	35	31	25	21	18
Serbia	92	80	25	28	31	34	38	34	17	13
Czech & Slovak Republics	28	20	16	12	10	7	8	8	8	7
Italy	14	12	5	14	14	9	4	4	2	1
France	28	13	12	3	4	3	2	1	1	1
Norway	10	11	7	7	5	4	4	4	0	0
Other	8	2	2	2	2	0	0	0	0	0
Total Europe	1,829	1,722	1,721	1,571	1,636	1,530	1,626	1,665	1,689	1,732
North America										
Mexico	2,284	2,096	2,215	2,215	2,258	2,529	2,701	2,848	2,338	2,744
United States	1,848	1,804	1,645	1,480	1,560	1,570	2,180	2,060	1,950	1,970
Canada	1,262	1,169	879	740	1,245	1,243	1,213	1,131	1,166	1,174
Total North America	5,394	5,069	4,739	4,435	5,063	5,341	6,094	6,039	5,454	5,888
Central & South America										
Peru	2,087	1,668	1,671	1,742	1,908	1,968	2,077	2,025	2,231	2,438
Chile	677	1,025	970	983	1,042	1,144	1,091	1,342	1,392	1,170
Bolivia	376	317	333	351	429	383	386	407	424	437
Argentina	70	46	43	38	37	31	34	69	103	99
Honduras	43	35	24	27	30	38	45	45	48	55
Brazil	30	21	21	18	15	14	9	8	8	8
Dominican Republic	22	13	17	9	21	17	12	7	3	0
Other	11	15	15	39	10	9	10	9	9	9
Total Central & South America	3,316	3,140	3,094	3,207	3,491	3,603	3,664	3,914	4,220	4,215
Asia										
Indonesia	78	100	90	97	238	239	263	311	305	308
Turkey	40	78	72	67	65	90	90	87	108	109
Japan	171	172	137	134	100	89	87	95	94	104
Papua New Guinea	124	95	96	77	66	60	49	58	59	73
India	34	26	51	50	38	36	50	52	60	56
Philippines	35	29	33	31	33	25	20	19	18	23
Saudi Arabia	14	15	16	16	17	16	16	14	11	9
Thailand	17	5	3	4	7	8	3	4	5	5
Malaysia	13	15	14	13	11	10	10	7	3	0
Other	61	76	61	79	80	77	81	88	86	90
Total Asia	587	611	573	568	655	649	670	735	749	778
Africa										
Morocco	206	152	237	258	204	200	260	306	278	289
South Africa	171	182	195	192	178	171	163	157	152	142
Namibia	92	89	72	62	66	42	39	14	0	17
Zambia	14	18	18	11	8	9	7	8	5	5
Zimbabwe	19	17	12	11	11	10	10	6	5	5
Dem. Republic of the Congo	59	30	11	1	1	1	1	1	1	1
Other	12	11	10	11	11	11	10	11	11	9
Total Africa	573	499	555	545	479	443	489	502	453	467

Table 2
World Silver Mine Production
Tonnes

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Oceania										
Australia	1,180	1,218	1,152	1,045	920	1,010	1,106	1,469	1,720	2,060
New Zealand	11	23	26	24	30	31	33	26	27	36
Fiji	0	1	1	1	2	2	2	2	2	2
Total Oceania	1,191	1,242	1,179	1,070	952	1,043	1,140	1,496	1,749	2,098
Western World Total	12,891	12,283	11,861	11,396	12,276	12,610	13,684	14,351	14,314	15,178
Other Countries										
Soviet Union/CIS	2,013	1,831	1,690	1,532	1,482	1,356	1,249	1,274	1,437	1,596
China	975	975	986	1,050	1,080	1,134	1,339	1,350	1,375	1,500
Mongolia	21	23	26	27	28	29	31	33	33	34
North Korea	50	53	56	53	53	40	36	32	29	26
Total Other Countries	3,059	2,882	2,758	2,662	2,643	2,560	2,655	2,689	2,874	3,156
World Total	**15,950**	**15,165**	**14,619**	**14,058**	**14,920**	**15,170**	**16,339**	**17,040**	**17,188**	**18,334**

Figure 60
World Silver Mine Production

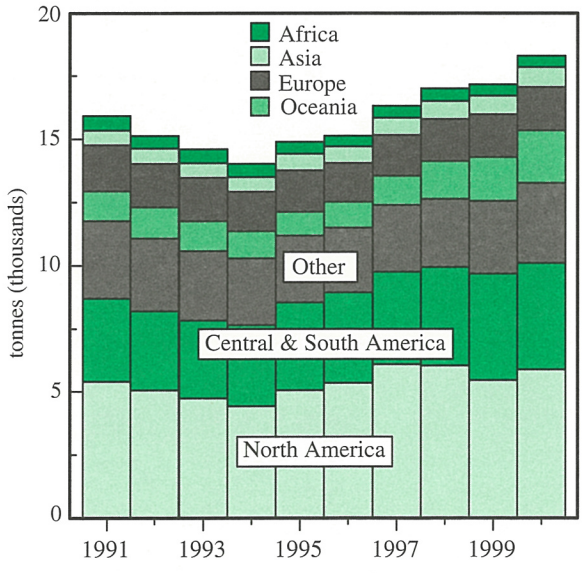


Figure 61
Silver Producer Hedging: Outstanding Positions

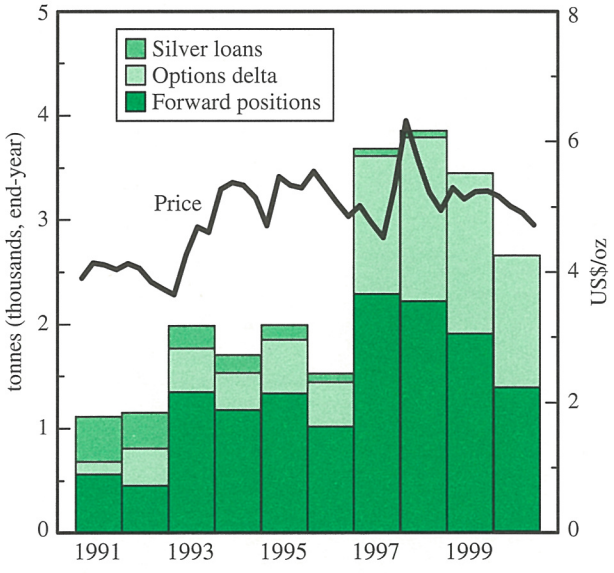


Table 3

Supply of Silver from the Recycling of Old Scrap

Tonnes

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Germany	500	500	490	480	460	480	500	510	500	520
UK & Ireland	225	225	228	245	231	236	261	337	358	388
France	118	166	124	130	145	140	133	127	124	110
Italy	85	85	85	87	100	110	105	145	105	105
Austria	60	60	60	60	63	55	56	57	52	50
Netherlands	35	36	35	39	35	39	40	40	40	45
Norway	24	24	24	24	24	30	30	25	29	33
Sweden	34	34	34	34	34	34	35	34	34	33
Belgium	20	20	20	20	20	20	20	20	20	20
Czech & Slovak Republics	26	30	24	22	23	28	25	22	19	19
Denmark	20	20	20	20	19	19	19	19	19	18
Portugal	12	12	12	12	12	13	14	14	14	14
Spain	11	10	10	10	12	14	14	13	12	13
Switzerland	21	21	48	19	51	52	24	14	10	10
Romania	3	3	3	3	3	3	3	3	3	3
Other	44	46	47	48	46	48	49	48	48	45
Total Europe	1,238	1,292	1,264	1,253	1,278	1,321	1,328	1,428	1,387	1,426
North America										
United States	1,329	1,317	1,343	1,405	1,432	1,505	1,612	1,733	1,785	1,941
Mexico	70	70	70	70	150	75	134	330	75	65
Canada	41	41	41	41	52	55	50	60	50	45
Total North America	1,440	1,428	1,454	1,516	1,634	1,635	1,796	2,123	1,910	2,051
Central & South America										
Brazil	60	60	60	60	60	60	50	50	55	48
Argentina	20	20	20	20	20	20	20	20	20	20
Chile	14	14	14	14	14	14	14	17	13	12
Other	26	26	25	23	23	23	23	29	27	25
Total Central & South America	120	120	119	117	117	117	107	116	115	105
Middle East										
Turkey	58	60	63	70	72	60	50	53	43	40
Saudi Arabia	2	19	25	58	94	40	101	64	35	22
Egypt	31	20	32	28	25	22	10	5	5	6
Other	6	6	11	11	11	11	11	12	11	10
Total Middle East	97	105	131	167	202	133	172	134	94	78
Indian Sub-Continent										
India	300	225	140	140	300	200	300	370	207	200
Other	4	5	7	6	9	5	10	15	11	13
Total Indian Sub-Continent	304	230	147	146	309	205	310	385	218	213
East Asia										
Japan	589	752	816	836	850	842	865	908	917	927
South Korea	73	81	90	92	102	107	111	244	164	164
Taiwan	33	28	24	22	22	22	24	26	28	28
Indonesia	5	7	7	9	10	11	11	12	13	15
Philippines	4	5	5	5	10	12	13	13	13	13
Singapore	9	9	9	12	12	11	11	12	12	12
Vietnam	8	8	7	10	11	11	12	12	12	11
Hong Kong	8	8	8	8	9	9	11	15	11	11
Thailand	10	10	10	10	10	11	25	30	12	10
Malaysia	3	3	3	3	3	3	3	4	3	3
Total East Asia	742	911	979	1,007	1,039	1,039	1,086	1,276	1,185	1,194
Africa										
South Africa	4	3	4	4	4	4	4	4	4	4
Other	28	30	29	27	33	31	29	30	30	30
Total Africa	32	33	33	31	37	35	33	34	33	34

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

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Oceania										
Australia	71	71	75	78	78	73	71	74	75	76
Total Oceania	71	71	75	78	78	73	71	74	75	76
Western World Total	4,044	4,189	4,202	4,315	4,693	4,557	4,903	5,570	5,017	5,177
Other Countries										
China	46	114	115	128	135	139	143	180	182	187
Other	325	310	303	281	238	230	220	275	240	245
Total Other Countries	371	424	418	409	373	369	363	455	422	432
World Total	**4,415**	**4,613**	**4,620**	**4,724**	**5,066**	**4,926**	**5,267**	**6,025**	**5,439**	**5,609**

Figure 62
World Scrap Supply

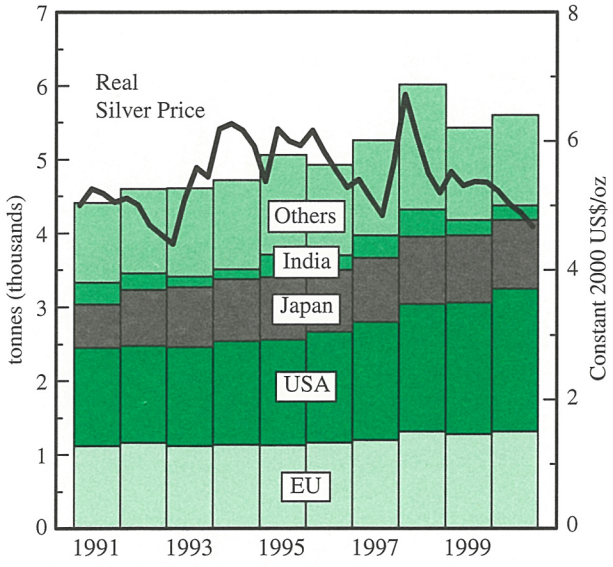


Figure 63
World Scrap Supply, 2000

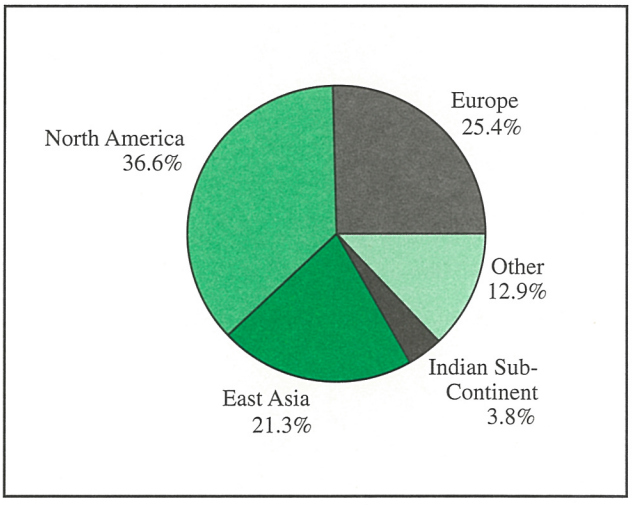


Table 4
World Silver Fabrication
(including the use of scrap)
Tonnes

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Italy	1,752	1,882	1,765	1,619	1,557	1,624	1,757	1,752	1,940	2,052
UK & Ireland	790	835	882	971	1,005	1,071	1,104	1,219	1,241	1,344
Germany	1,800	1,706	1,507	1,642	1,431	1,419	1,431	1,455	1,259	1213
Belgium	628	629	642	655	728	788	847	1,052	1,167	1,098
France	891	962	938	876	968	845	891	890	824	884
Switzerland	237	208	194	221	229	243	298	332	344	271
Spain	542	206	191	333	309	288	271	275	234	218
Greece	105	110	115	120	118	130	140	126	126	135
Poland	120	64	70	79	96	94	104	111	117	120
Portugal	72	78	77	64	76	88	89	96	100	107
Norway	63	78	60	51	50	45	46	47	94	89
Netherlands	68	66	65	81	98	67	65	65	64	63
Sweden	60	51	49	47	43	46	52	43	42	41
Austria	53	50	48	46	51	46	42	42	38	33
Denmark	30	33	30	30	33	31	35	32	31	32
Czech & Slovak Republics	47	31	21	18	24	23	24	28	24	25
Finland	46	40	28	31	27	30	29	21	21	17
Romania	19	16	14	13	9	13	11	16	13	13
Cyprus & Malta	7	8	8	11	12	13	12	11	12	12
Other	29	32	34	27	28	28	23	24	23	25
Total Europe	7,359	7,083	6,737	6,935	6,890	6,929	7,272	7,636	7,714	7,789
North America										
United States	3,941	3,905	4,065	4,331	4,610	4,679	4,978	5,469	5,965	6,268
Mexico	468	712	994	859	544	646	736	690	732	602
Canada	145	73	88	96	83	83	87	106	109	92
Total North America	4,555	4,689	5,147	5,287	5,236	5,408	5,801	6,265	6,806	6,962
Central & South America										
Brazil	208	206	215	257	291	262	260	253	238	210
Argentina	126	126	126	126	122	118	118	97	84	70
Peru	37	29	26	28	31	34	35	34	32	30
Colombia	33	34	33	33	33	33	33	33	27	24
Ecuador	12	12	17	21	21	21	21	21	17	17
Chile	15	15	15	15	15	15	15	15	14	13
Other	18	17	18	15	19	27	41	50	56	34
Total Central & South America	449	438	451	495	532	510	523	503	468	398
Middle East										
Turkey	145	170	185	161	189	198	203	191	173	213
Israel	73	80	88	95	105	116	125	120	120	112
Egypt	54	72	59	78	67	70	65	58	63	64
Saudi Arabia	9	12	14	10	12	12	20	16	18	20
Other	60	83	64	76	79	82	81	77	80	82
Total Middle East	339	417	409	420	452	479	493	462	452	490
Indian Sub-Continent										
India	1,395	1,808	3,383	2,920	3,152	3,801	3,824	3,567	3,779	4,070
Bangladesh & Nepal	62	82	120	140	160	180	200	160	178	187
Other	70	86	105	88	117	84	127	87	105	98
Total Indian Sub-Continent	1,527	1,976	3,608	3,148	3,429	4,065	4,151	3,814	4,062	4,355
East Asia										
Japan	3,383	3,263	3,356	3,373	3,504	3,487	3,955	3,508	3,809	4,293
Thailand	625	984	1,205	905	862	859	843	751	829	939
South Korea	290	280	484	510	579	575	579	429	519	641
Taiwan	111	134	149	164	179	198	214	210	210	317
Hong Kong	65	71	81	106	107	117	138	112	120	138
Indonesia	53	60	57	83	97	104	126	84	99	136

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

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Myanmar, Laos & Cambodia	31	31	31	31	33	34	30	25	28	26
Vietnam	9	9	12	16	20	21	22	19	22	22
Malaysia	11	12	14	11	12	12	13	12	15	17
Other	13	36	12	11	11	11	10	11	12	13
Total East Asia	4,590	4,879	5,402	5,210	5,404	5,418	5,928	5,161	5,664	6,542
Africa										
Morocco	15	15	14	14	17	18	20	18	17	18
Tunisia	6	6	7	8	8	9	10	10	10	10
South Africa	10	9	18	12	14	9	8	8	8	8
Algeria	11	10	9	9	9	8	7	6	6	6
Other	18	17	16	16	15	13	12	11	12	12
Total Africa	60	57	64	59	63	57	56	53	53	54
Oceania										
Australia	163	214	217	196	166	162	161	176	180	207
Total Oceania	*163*	*214*	*217*	*196*	*166*	*162*	*161*	*176*	*180*	*207*
Western World Total	19,042	19,754	22,034	21,750	22,173	23,028	24,385	24,071	25,398	26,798
Other Countries										
China	596	609	657	765	809	890	1,003	1,055	1,030	1056
Soviet Union/CIS	2,090	1,562	1,271	985	901	884	864	795	766	788
North Korea	2	0	7	0	0	0	0	0	0	0
Total Other Countries	2,688	2,171	1,935	1,751	1,710	1,774	1,866	1,850	1,796	1844
World Total	**21,730**	**21,925**	**23,969**	**23,500**	**23,883**	**24,802**	**26,251**	**25,921**	**27,194**	**28,642**

Figure 64
World Silver Fabrication

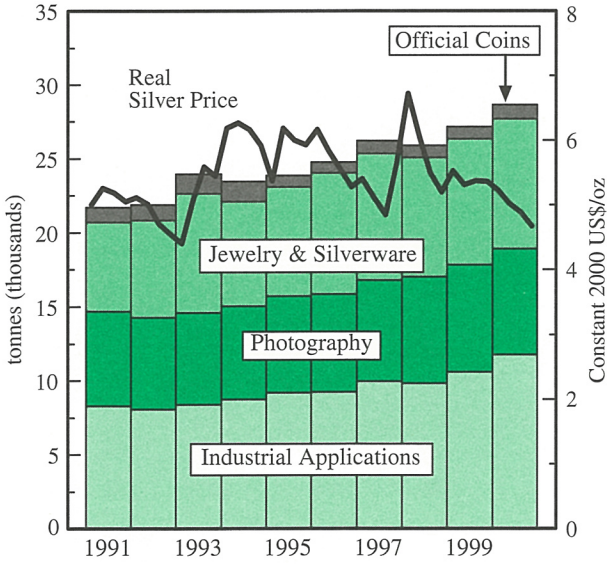


Figure 65
World Fabrication, 2000

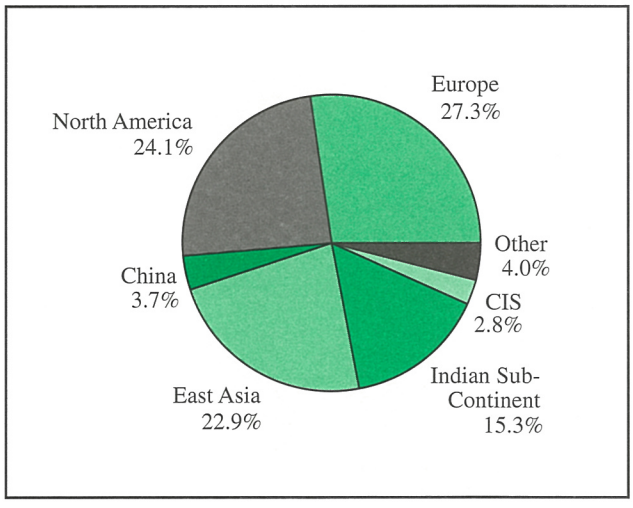


Table 5

Silver Fabrication: Industrial Applications

(including the use of scrap)

Tonnes

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Germany	656	622	580	560	575	535	555	571	571	647
UK & Ireland	335	344	354	363	371	381	388	506	472	549
France	346	399	352	360	374	363	417	347	360	380
Italy	294	300	315	316	329	348	354	331	337	347
Switzerland	177	188	174	203	206	215	269	311	322	249
Spain	59	57	57	54	55	61	91	95	83	83
Netherlands	54	54	54	54	54	54	52	52	52	52
Poland	14	15	19	24	26	24	23	23	23	23
Austria	19	19	19	19	22	19	18	17	17	17
Sweden	10	10	10	10	10	10	11	11	11	11
Belgium	10	10	10	10	10	10	10	10	10	10
Czech & Slovak Republics	21	17	16	13	16	17	13	13	16	8
Other	36	35	35	36	36	34	35	35	68	60
Total Europe	2,031	2,070	1,995	2,022	2,084	2,071	2,235	2,322	2,342	2,436
North America										
United States	1,533	1,638	1,751	1,886	2,050	2,120	2,343	2,520	2,757	2,928
Mexico	80	80	80	86	79	81	89	100	160	172
Canada	22	22	23	20	23	20	20	17	17	17
Total North America	1,635	1,740	1,854	1,992	2,152	2,221	2,452	2,637	2,934	3,117
Central & South America										
Brazil	75	75	78	100	108	102	105	108	98	98
Argentina	40	40	40	40	38	36	36	36	30	25
Colombia	9	9	9	9	9	9	9	9	7	6
Other	14	14	14	14	14	14	14	14	14	14
Total Central & South America	138	138	141	163	169	161	164	167	149	143
Middle East										
Israel	18	21	26	28	30	33	31	31	30	30
Turkey	23	27	29	26	29	28	31	28	24	28
Egypt	3	4	3	3	3	4	3	4	4	4
Other	0	9	0	0	0	0	1	1	1	1
Total Middle East	44	61	58	57	63	64	66	63	58	63
Indian Sub-Continent										
India	517	621	901	999	1,062	1,105	1,120	992	1,180	1,430
Other	12	15	18	15	20	14	22	15	18	16
Total Indian Sub-Continent	529	636	919	1,014	1,082	1,119	1,142	1,007	1,198	1,446
East Asia										
Japan	1,477	1,371	1,425	1,591	1,667	1,622	1,848	1,643	1,890	2,244
South Korea	125	125	260	311	369	370	382	349	379	489
Taiwan	96	115	131	146	163	181	197	193	196	298
Hong Kong	35	41	51	76	79	88	107	93	101	121
Indonesia	18	22	12	11	12	13	15	16	16	16
Total East Asia	1,751	1,674	1,879	2,135	2,289	2,273	2,549	2,294	2,582	3,168
Africa										
Morocco	2	2	2	2	5	7	7	7	7	8
South Africa	9	7	16	10	10	5	5	5	5	5
Other	7	7	7	7	7	7	5	5	5	5
Total Africa	18	16	25	19	22	19	17	17	17	18
Oceania										
Australia	60	61	63	67	76	70	66	72	76	77
Total Oceania	60	61	63	67	76	70	66	72	76	77
Western World Total	6,205	6,395	6,935	7,468	7,937	7,999	8,691	8,579	9,356	10,467

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

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Other Countries										
China	410	439	464	538	567	593	632	645	651	681
Soviet Union/CIS	1,684	1,230	992	746	682	655	642	610	586	609
Total Other Countries	2,094	1,669	1,456	1,284	1,249	1,248	1,274	1,255	1,237	1,290
World Total	**8,299**	**8,064**	**8,391**	**8,752**	**9,185**	**9,247**	**9,965**	**9,834**	**10,593**	**11,757**

Figure 66
Main Components of Industrial Usage

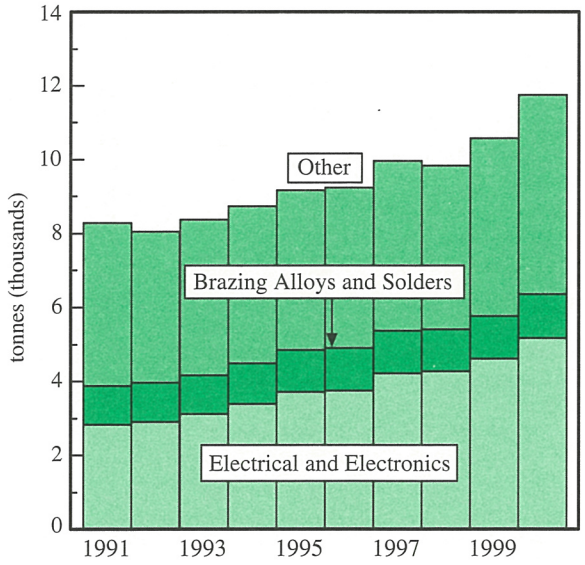


Figure 67
World Industrial Fabrication, 2000

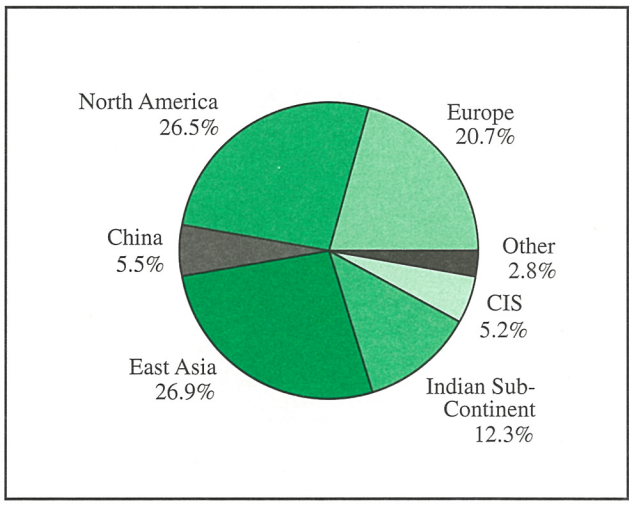


Table 5a
Silver Fabrication: Electrical and Electronics
(including the use of scrap)
Tonnes

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
United States	731	802	890	983	1,120	1,129	1,303	1,373	1,464	1,573
Japan	697	631	650	701	743	706	804	738	933	1,140
Germany	396	375	350	340	370	360	370	380	380	445
China	202	213	223	276	284	293	316	305	308	320
South Korea	19	16	140	164	200	199	201	188	206	268
Taiwan	70	85	89	102	113	130	146	148	150	240
France	165	193	155	168	190	195	238	207	210	228
United Kingdom	138	139	141	143	145	155	160	210	179	211
Switzerland	60	80	86	108	117	127	172	228	232	155
India	76	76	76	80	92	100	130	130	140	150
Hong Kong	26	27	37	57	59	68	85	77	90	110
Mexico	36	36	36	38	34	34	36	40	90	97
Italy	95	96	100	85	85	103	100	90	92	95
Brazil	31	31	32	46	49	45	45	45	40	40
Spain	28	28	30	28	28	28	29	30	30	30
Turkey	23	27	29	26	29	28	31	28	24	28
Australia	13	13	14	14	17	16	15	17	18	19
Netherlands	20	20	20	20	20	20	18	18	18	18
Austria	7	7	7	7	7	7	7	7	7	7
Romania	3	3	3	3	3	3	3	4	4	4
Egypt	3	4	3	3	3	4	3	4	4	4
Total	**2,838**	**2,902**	**3,112**	**3,391**	**3,709**	**3,749**	**4,212**	**4,266**	**4,618**	**5,182**

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

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
United States	174	202	224	239	249	255	260	269	280	272
China	119	132	138	146	159	170	179	196	198	208
Japan	148	130	119	147	150	160	155	130	131	137
Germany	158	150	140	125	110	90	95	97	94	101
Italy	46	50	54	58	66	65	59	56	68	72
United Kingdom	70	70	71	72	72	72	72	75	68	72
India	45	45	45	50	60	65	50	47	50	55
Switzerland	80	75	55	56	56	52	52	49	48	50
Taiwan	16	20	23	25	32	35	34	31	32	37
Spain	18	15	11	9	9	18	29	32	33	33
South Korea	6	9	25	30	38	36	35	25	26	31
France	65	74	55	45	40	42	43	32	29	30
Australia	18	18	19	20	23	21	20	22	23	24
Brazil	17	17	18	26	27	27	25	25	23	23
Mexico	28	28	28	31	27	27	28	30	20	20
Canada	13	13	13	13	16	13	13	10	10	10
Netherlands	8	8	8	8	8	8	8	8	8	8
Austria	5	5	5	4	4	3	3	3	3	3
Israel	1	1	2	2	2	3	3	3	3	3
Total	**1,036**	**1,063**	**1,053**	**1,106**	**1,149**	**1,161**	**1,163**	**1,140**	**1,146**	**1,189**

Table 6

Silver Fabrication: Photographic Use

(including the use of scrap)

Tonnes

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Belgium	602	614	626	640	708	770	828	1,034	1,149	1,080
UK & Ireland	383	406	422	495	519	566	592	593	652	678
France	417	445	458	425	495	411	395	452	370	407
Germany	515	490	480	500	460	430	450	307	208	52
Czech & Slovak Republics	15	5	0	0	0	0	3	8	1	9
Hungary	11	10	8	8	8	7	7	6	6	7
Romania	12	10	8	6	2	6	5	8	6	6
Bulgaria	1	1	1	1	1	1	1	0	0	0
Poland	70	15	15	15	15	9	7	0	0	0
Spain	45	20	11	6	3	0	0	0	0	0
Total Europe	2,071	2,016	2,029	2,096	2,210	2,200	2,287	2,408	2,392	2,240
North America										
United States	1,704	1,665	1,678	1,778	1,891	1,950	2,043	2,339	2,467	2,495
Mexico	70	82	98	98	104	107	127	107	91	0
Canada	60	0	0	0	0	0	0	0	0	0
Total North America	1,834	1,747	1,776	1,876	1,995	2,057	2,170	2,446	2,558	2,495
Central & South America										
Brazil	80	80	82	100	123	105	105	100	100	76
Argentina	56	56	56	56	56	56	56	56	49	40
Total Central & South America	136	136	138	156	179	161	161	156	149	116
Indian Sub-Continent										
India	80	80	70	50	20	20	20	10	10	10
Other	6	6	8	7	8	9	10	12	12	12
Total Indian Sub-Continent	86	86	78	57	28	29	30	22	22	22
East Asia										
Japan	1,796	1,805	1,779	1,713	1,770	1,800	1,822	1,810	1,864	1,995
Taiwan	3	3	3	3	1	1	1	1	1	0
Total East Asia	1,799	1,808	1,782	1,716	1,771	1,801	1,823	1,811	1,865	1,995
Oceania										
Australia	70	70	65	60	50	49	51	51	52	85
Total Oceania	70	70	65	60	50	49	51	51	52	85
Western World Total	5,996	5,862	5,868	5,960	6,233	6,297	6,522	6,894	7,039	6,953
Other Countries										
China	138	146	159	174	174	180	187	190	114	120
Soviet Union/CIS	274	224	195	163	154	145	140	119	107	100
Total Other Countries	412	370	354	337	328	325	327	309	221	220
World Total	**6,408**	**6,232**	**6,222**	**6,297**	**6,561**	**6,622**	**6,849**	**7,203**	**7,260**	**7,173**

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

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Italy	1,440	1,568	1,436	1,288	1,212	1,260	1,392	1,410	1,592	1,685
Germany	451	420	360	360	320	310	310	315	312	290
Greece	105	110	115	120	118	130	140	126	126	135
UK & Ireland	59	69	85	89	92	104	105	102	98	100
Spain	403	115	115	125	127	140	124	126	105	93
Poland	30	31	32	35	49	57	71	83	89	92
France	55	53	63	60	63	62	69	81	84	86
Portugal	67	69	64	47	54	58	59	60	66	66
Norway	36	36	37	37	37	33	33	35	47	51
Denmark	27	27	27	27	27	28	32	29	28	29
Sweden	49	40	36	37	32	35	40	31	30	29
Finland	40	32	26	27	23	26	26	18	18	14
Cyprus & Malta	7	8	8	11	12	13	12	11	12	12
Austria	15	15	15	12	12	13	13	15	11	8
Czech & Slovak Republics	7	6	5	5	5	5	6	5	5	5
Other	36	35	33	31	32	28	29	32	29	28
Total Europe	2,827	2,634	2,457	2,311	2,215	2,302	2,462	2,480	2,652	2,723
North America										
United States	302	339	351	373	389	387	389	391	407	427
Mexico	270	280	285	270	343	442	508	477	470	410
Canada	36	27	27	30	38	41	47	55	48	45
Total North America	608	646	663	673	770	870	944	923	925	882
Central & South America										
Brazil	53	50	55	57	60	55	50	45	40	36
Peru	35	23	24	26	29	32	33	32	30	28
Colombia	24	24	24	24	24	24	24	24	20	18
Ecuador	10	10	15	19	19	19	19	19	15	15
Argentina	30	30	30	30	28	26	26	5	5	5
Other	21	21	22	20	23	31	45	54	59	36
Total Central & South America	173	158	170	176	183	187	197	179	169	138
Middle East										
Turkey	122	143	156	134	160	170	171	163	147	184
Israel	54	57	61	66	72	82	92	88	89	80
Egypt	51	68	56	55	64	67	62	54	58	60
Saudi Arabia	9	12	14	10	12	12	20	16	18	20
Other	60	74	63	75	79	82	80	76	79	81
Total Middle East	295	354	350	341	386	412	425	397	391	425
Indian Sub-Continent										
India	798	1,107	2,412	1,871	2,070	2,676	2,684	2,565	2,589	2,630
Bangladesh & Nepal	62	82	120	140	160	180	200	160	178	187
Other	52	65	79	66	89	61	95	60	75	70
Total Indian Sub-Continent	912	1,254	2,611	2,077	2,319	2,917	2,979	2,785	2,842	2,887
East Asia										
Thailand	624	982	1,199	899	852	844	834	744	825	934
South Korea	165	155	224	199	210	205	197	80	140	152
Indonesia	35	38	45	72	85	92	111	68	83	120
Japan	109	87	77	69	67	65	60	55	55	54
Myanmar, Laos & Cambodia	31	31	31	31	33	34	30	25	28	26
Vietnam	9	9	12	16	20	21	22	19	22	22
Hong Kong	30	30	30	30	28	29	31	19	19	17
Malaysia	11	12	14	11	12	12	13	12	15	17
Taiwan	12	16	15	15	15	16	16	16	13	13
Other	11	8	8	7	8	9	9	9	9	10
Total East Asia	1,037	1,368	1,655	1,349	1,330	1,326	1,322	1,047	1,209	1,365

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

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Africa										
Morocco	13	13	12	12	12	11	13	11	10	10
Tunisia	5	5	6	7	7	8	9	9	9	9
Algeria	9	8	7	7	7	7	6	5	5	5
Other	15	14	13	14	15	12	11	11	11	12
Total Africa	42	40	38	40	41	38	39	36	35	36
Oceania										
Australia	17	17	18	19	19	17	18	22	23	24
Total Oceania	17	17	18	19	19	17	18	22	23	24
Western World Total	5,911	6,471	7,962	6,986	7,263	8,069	8,385	7,867	8,246	8,479
Other Countries										
China	6	13	21	32	45	75	96	145	195	208
Soviet Union/CIS	132	105	82	70	61	65	70	60	66	75
Total Other Countries	138	118	103	102	106	140	166	205	261	283
World Total	**6,048**	**6,588**	**8,064**	**7,088**	**7,368**	**8,208**	**8,551**	**8,072**	**8,507**	**8,762**

Figure 68
World Jewelry Fabrication

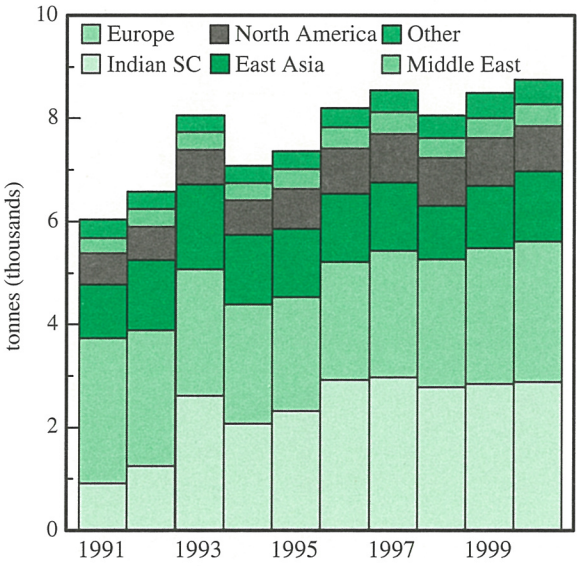


Figure 69
World Jewelry Fabrication, 2000

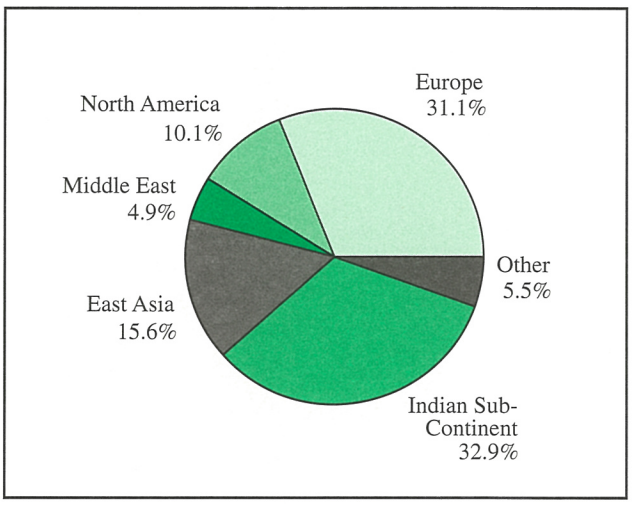


Table 8

Silver Fabrication: Coins and Medals

(including the use of scrap)

Tonnes

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Europe										
Germany	178	174	87	222	76	144	116	262	168	224
Spain	35	14	8	148	124	87	56	54	46	42
Portugal	0	4	8	12	17	25	25	31	29	36
Italy	18	14	14	15	16	16	11	11	11	20
UK & Ireland	13	16	21	24	23	20	19	19	19	17
Switzerland	50	11	10	9	13	18	20	9	12	12
France	73	65	65	31	36	9	10	10	10	11
Austria	19	16	14	15	17	14	11	10	10	8
Poland	6	3	4	5	6	4	3	5	5	5
Belgium	11	0	1	0	5	3	4	3	3	3
Netherlands	2	0	1	18	35	5	3	3	3	3
Czech & Slovak Republics	4	3	0	0	3	1	2	2	2	3
Finland	5	7	1	3	3	3	2	2	2	2
Norway	15	29	10	1	1	0	0	0	1	2
Romania	0	0	0	0	0	1	0	1	1	1
Cyprus & Malta	0	0	0	0	0	0	0	0	0	0
Denmark	0	3	0	0	3	0	0	0	0	0
Other	3	7	13	4	6	9	5	7	6	6
Total Europe	430	364	257	507	382	357	288	427	328	392
North America										
United States	402	263	285	295	280	222	203	219	333	418
Canada	27	24	38	46	22	22	20	34	44	30
Mexico	48	270	531	405	18	16	12	6	11	20
Total North America	478	557	854	746	320	259	235	259	388	468
Central & South America										
Other	2	6	2	0	1	1	1	1	1	1
Total Central & South America	2	6	2	0	1	1	1	1	1	1
Middle East										
Israel	1	2	1	1	3	2	2	2	2	2
Turkey	0	0	0	0	0	0	1	0	2	1
Egypt	0	1	0	20	0	0	0	0	0	0
Total Middle East	1	3	1	21	3	2	2	2	4	3
East Asia										
Thailand	1	2	6	6	10	15	9	7	4	5
Singapore	2	28	4	4	3	3	1	2	3	3
Japan	0	0	75	0	0	0	225	0	0	0
Other	0	0	0	0	0	0	0	0	0	6
Total East Asia	3	30	85	11	13	17	234	10	7	14
Africa										
South Africa	0	1	0	0	1	1	0	0	0	0
Total Africa	0	1	0	0	1	1	0	0	0	0
Oceania										
Australia	16	66	71	50	21	26	26	31	29	20
Total Oceania	16	66	71	50	21	26	26	31	29	20
Western World Total	930	1,026	1,270	1,335	740	663	787	730	757	899
Other Countries										
China	43	12	13	21	24	43	88	75	71	47
Soviet Union/CIS	0	3	2	6	4	19	12	6	7	4
North Korea	2	0	7	0	0	0	0	0	0	0
Total Other Countries	44	15	22	27	28	62	99	81	78	51
World Total	**974**	**1,041**	**1,291**	**1,363**	**769**	**725**	**886**	**811**	**835**	**950**

Appendix II

Silver Prices, 1980-2000
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
1980	20.984	2,783	429.67	1,530	4,098	578	1,226	0.48
1981	10.487	2,650	228.83	744	2,296	383	762	0.26
1982	7.922	2,675	182.20	634	1,862	344	618	0.45
1983	11.430	3,435	262.89	873	2,851	558	938	1.37
1984	8.145	3,514	192.53	622	2,111	460	745	1.37
1985	6.132	3,880	166.53	470	1,715	376	580	1.58
1986	5.465	4,105	143.71	296	1,549	262	382	3.34
1987	7.016	5,124	180.46	326	1,855	292	405	9.67
1988	6.532	6,231	165.23	269	1,536	273	369	14.85
1989	5.500	6,803	141.34	244	1,187	243	332	13.54
1990	4.832	6,779	123.62	225	1,099	186	251	13.59
1991	4.057	6,993	103.51	176	956	162	216	12.24
1992	3.946	7,580	100.24	161	991	156	198	12.21
1993	4.313	6,163	109.15	154	1,110	214	229	13.44
1994	5.285	6,846	132.92	174	1,365	274	276	17.84
1995	5.197	6,864	129.49	157	1,289	272	239	33.36
1996	5.199	7,291	131.79	182	1,345	258	252	39.51
1997	4.897	7,009	153.60	191	1,498	268	273	38.78
1998	5.544	8,016	229.30	233	2,498	309	314	50.65
1999	5.220	8,021	197.54	191	1,995	305	309	49.90
2000	4.951	8,001	198.61	171	1,800	335	338	46.82

* 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 2000 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
1980	43.863	15,304	1028.19	2,036	12,340	2,114	1,992	371.33
1981	19.860	12,888	485.97	943	5,702	1,175	1,164	172.97
1982	14.137	12,053	367.67	783	4,311	906	897	171.88
1983	19.763	13,842	511.31	1,057	6,381	1,281	1,319	273.83
1984	13.503	13,074	371.30	737	4,619	953	1,023	163.57
1985	9.818	13,676	313.45	546	3,664	714	779	119.49
1986	8.584	13,304	265.65	342	3,229	469	514	135.38
1987	10.634	15,268	325.59	376	3,742	500	544	169.62
1988	9.514	16,970	287.04	308	2,893	445	489	121.54
1989	7.640	17,452	233.02	273	2,114	371	428	92.29
1990	6.368	15,961	192.38	244	1,803	268	315	73.19
1991	5.130	14,456	152.43	185	1,433	219	262	53.75
1992	4.844	14,019	141.71	166	1,399	201	231	46.42
1993	5.142	10,717	149.00	157	1,495	264	257	46.54
1994	6.140	10,802	172.27	176	1,731	325	300	57.77
1995	5.872	9,826	159.39	160	1,565	307	256	80.04
1996	5.709	9,579	153.34	184	1,556	280	265	70.54
1997	5.254	8,592	169.17	190	1,660	285	283	57.38
1998	5.856	8,693	233.58	231	2,577	322	322	64.64
1999	5.397	8,350	200.60	190	2,040	313	315	54.64
2000	4.951	8,001	198.61	171	1,800	335	338	46.82

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

Appendix III

Silver Prices, in US dollars per ounce

1. London and US Prices

	London Silver Market - Spot			Comex Spot Settlement		
	High	Low	Average	High	Low	Average
1975	5.2110	3.9280	4.4256	5.2500	3.9200	4.4193
1976	5.0840	3.8300	4.3532	5.1370	3.8340	4.3506
1977	4.9750	4.3130	4.6333	4.9760	4.2850	4.6235
1978	6.2640	4.8180	5.4218	6.3170	4.8110	5.4068
1979	32.2000	5.9350	11.0679	34.4500	5.9230	11.1135
1980	49.4500	10.8900	20.9837	48.7000	10.8000	20.6568
1981	16.3030	8.0300	10.4869	16.2900	7.9850	10.5014
1982	11.1100	4.9010	7.9219	11.2100	4.9800	7.9311
1983	14.6680	8.3700	11.4301	14.7150	8.4000	11.4340
1984	10.1100	6.2200	8.1446	10.0640	6.2950	8.1585
1985	6.7500	5.4500	6.1319	6.8350	5.5250	6.1459
1986	6.3100	4.8530	5.4645	6.2850	4.8540	5.4653
1987	10.9250	5.3600	7.0156	9.6600	5.3790	7.0198
1988	7.8215	6.0500	6.5324	7.8270	5.9980	6.5335
1989	6.2100	5.0450	5.4999	6.1940	5.0300	5.4931
1990	5.3560	3.9500	4.8316	5.3320	3.9370	4.8174
1991	4.5710	3.5475	4.0566	4.5450	3.5080	4.0355
1992	4.3350	3.6475	3.9464	4.3180	3.6400	3.9334
1993	5.4200	3.5600	4.3130	5.4430	3.5230	4.3026
1994	5.7475	4.6400	5.2851	5.7810	4.5730	5.2808
1995	6.0375	4.4160	5.1971	6.1020	4.3750	5.1850
1996	5.8275	4.7100	5.1995	5.8190	4.6760	5.1783
1997	6.2675	4.2235	4.8972	6.3070	4.1550	4.8716
1998	7.8100	4.6900	5.5442	7.2600	4.6180	5.4894
1999	5.7900	4.8800	5.2198	5.7600	4.8720	5.2184
2000	5.4475	4.5700	4.9514	5.5470	4.5630	4.9691

2. US Prices in 2000

	Comex Spot Settlement		
	High	Low	Average
January	5.4130	5.1000	5.2090
February	5.5470	5.0360	5.2569
March	5.1300	4.9560	5.0696
April	5.1620	4.9420	5.0757
May	5.1230	4.9200	5.0107
June	5.0960	4.9480	5.0209
July	5.0330	4.9260	4.9883
August	4.9960	4.7900	4.9010
September	5.0470	4.8300	4.9285
October	4.9230	4.7310	4.8451
November	4.7980	4.6150	4.6970
December	4.7540	4.5630	4.6314

3. Leasing Rates in 2000

	Monthly Averages		
	3-month	6-month	12-month
January	2.66%	3.63%	5.01%
February	3.11%	4.19%	5.37%
March	1.83%	2.82%	4.30%
April	1.41%	2.58%	4.10%
May	1.68%	2.64%	3.97%
June	1.64%	2.55%	3.87%
July	1.22%	2.14%	3.36%
August	1.00%	1.83%	3.03%
September	1.01%	1.73%	2.80%
October	0.87%	1.20%	2.14%
November	0.93%	1.09%	1.88%
December	0.81%	1.09%	1.52%

Appendix IV

Leading Primary Silver Mines

Rank	Mine	Country	Operator	1999 Moz	2000 Moz
1	Cannington	Australia	BHP Minerals	26.2	32.5
2	Proaño*	Mexico	Industrias Peñoles SA de CV	21.2	23.9
3	Greens Creek	United States	Kennecott Minerals/Hecla Mining Company	10.3	9.3
4	Uchucchacua	Peru	Compañia de Minas Buenaventura SA	7.1	8.5
5	Imiter	Morocco	Société Métallurgique d'Imiter	7.3	7.9
6	Tizapa	Mexico	Industrias Peñoles SA de CV	5.3	6.8
7	Rochester	United States	Coeur d'Alene Mines Corporation	6.2	6.7
8	Arcata	Peru	Minas de Arcata SA	6.2	5.1
9	Lucky Friday	United States	Hecla Mining Company	4.4	5.0
10	Quiruvilca	Peru	Pan American Silver Corporation	3.3	4.1
11	Galena	United States	Coeur d'Alene Mines Corporation	3.7	4.0
12	Sunshine	United States	Sunshine Mining and Refining Company	5.2	3.9
13	San Martin	Mexico	First Silver Reserves Inc	2.3	2.3
14	La Encantada	Mexico	Industrias Peñoles SA de CV	2.5	2.1
15	Caylloma	Peru	Hochschild Group	1.2	1.9

*part of the Fresnillo Group, which includes Naica and El Monte

Silver Mine Production by Source Metal

Million ounces

	1997	1998	1999	2000
Primary				
Mexico	43.2	45.6	34.2	42.2
Australia	3.5	19.8	26.2	32.5
United States	36.2	36.6	33.5	31.5
Other	39.3	54.1	54.3	39.7
Total	122.2	156.1	148.2	145.9
Gold				
Chile	18.3	10.2	9.6	20.2
Canada	13.3	12.0	15.2	17.2
United States	17.1	13.6	13.5	17.2
Other	31.2	31.9	34.9	36.4
Total	79.9	67.7	73.2	91.0
Copper				
Poland	33.1	35.3	35.1	36.0
CIS	18.7	19.8	20.8	25.3
Chile	16.6	16.7	18.0	17.2
Other	59.1	59.8	57.0	61.7
Total	127.5	131.6	130.9	140.2
Lead/Zinc				
Peru	38.4	36.1	40.0	43.4
Mexico	31.1	32.9	29.3	32.4
Australia	31.1	26.5	28.1	32.2
Other	87.4	89.0	95.9	97.7
Total	188.0	184.5	193.3	205.7
Other	7.7	8.0	7.0	6.6
Total	525.3	547.9	552.6	589.4

Silver Mine Production by Main Region and Source Metal

Million ounces

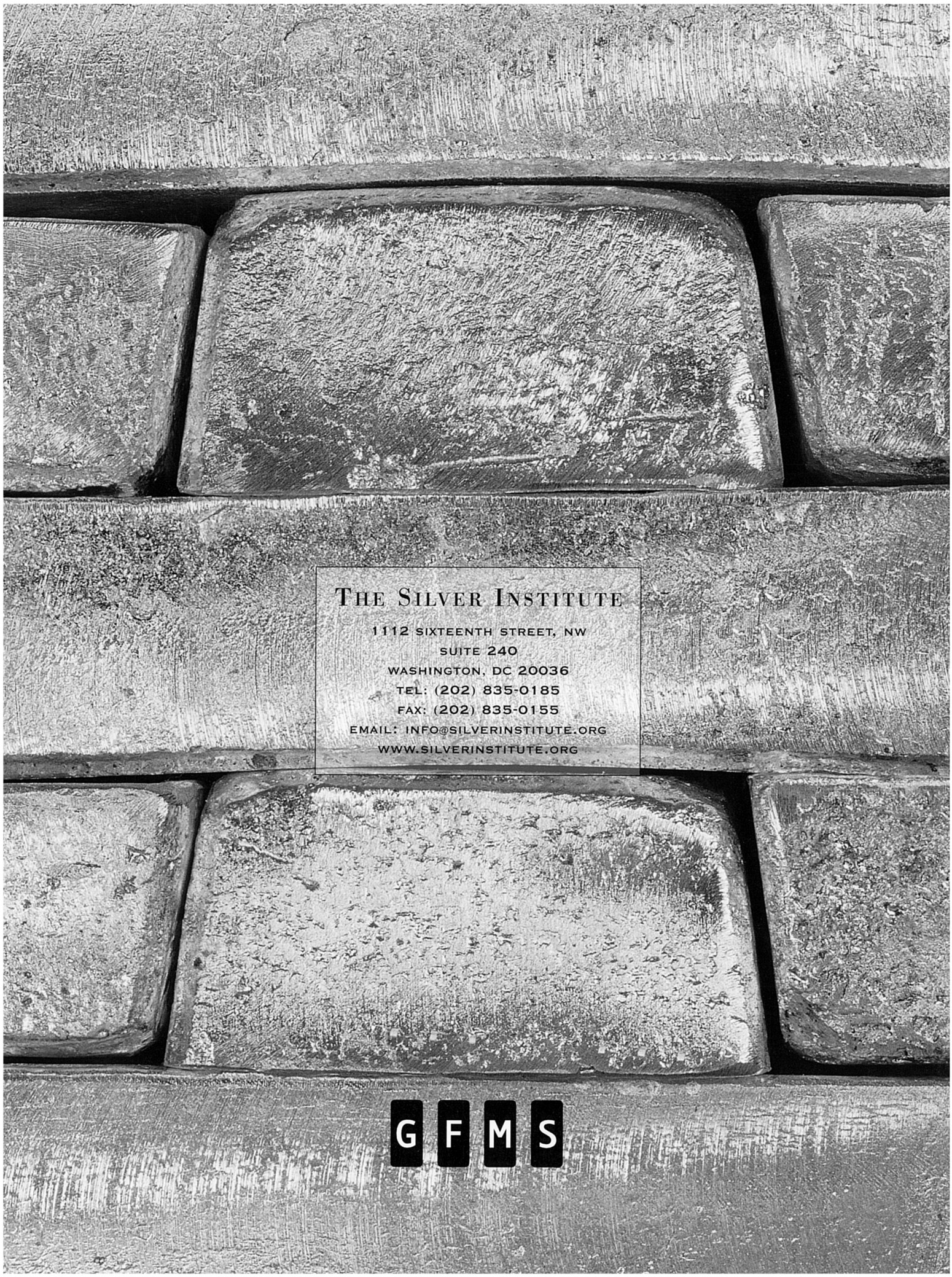
	1997	1998	1999	2000
North America				
Primary	79.4	82.1	67.7	73.6
Lead/Zinc	48.5	48.8	45.7	45.9
Copper	26.5	26.3	22.7	23.8
Gold	39.7	35.0	37.4	44.2
Other	1.9	1.9	1.9	1.8
Total	195.9	194.2	175.3	189.3
Central & South America				
Primary	21.1	37.4	37.8	22.1
Lead/Zinc	52.5	50.9	55.6	59.8
Copper	22.9	23.0	24.3	24.7
Gold	21.1	14.5	17.8	28.8
Other	0.1	0.1	0.1	0.1
Total	117.8	125.8	135.7	135.5
Europe				
Lead/Zinc	10.8	10.5	11.0	12.4
Copper	39.9	40.5	39.8	40.5
Gold	0.3	1.0	2.2	1.8
Other	1.2	1.5	1.3	1.0
Total	52.3	53.5	54.3	55.7
Rest of World				
Primary	21.7	36.6	42.7	50.2
Lead/Zinc	76.2	74.3	81.0	87.6
Copper	38.2	41.8	44.1	51.2
Gold	18.8	17.2	15.8	16.2
Other	4.5	4.5	3.7	3.7
Total	159.3	174.4	187.3	208.9
Total	525.3	547.9	552.6	589.4

Appendix V

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

	Comex				LBMA Clearing Turnover[3]		
	No. of Contracts						
	Futures		Options				
	Turnover[1]	Open Interest[2]	Turnover[1]	Open Interest[2]	Ounces transferred (millions)	Value (US$bn)	Number of transfers
Jan-98	352,688	105,152	84,147	116,984	330.4	1.9	630
Feb	550,800	101,987	132,311	117,511	347.8	2.4	690
Mar	368,127	85,986	74,310	119,826	272.1	1.7	581
Apr	360,130	76,882	64,626	89,894	230.7	1.5	520
May	310,130	91,571	76,681	106,995	266.5	1.5	583
Jun	393,971	79,898	56,802	79,783	217.9	1.1	484
Jul	278,774	81,144	67,854	89,839	233.5	1.3	474
Aug	367,257	80,983	52,059	75,667	223.4	1.2	441
Sep	283,475	71,779	66,718	89,108	232.2	1.2	466
Oct	280,066	74,722	62,102	95,772	249.4	1.2	443
Nov	319,216	74,758	43,630	57,240	169.1	0.8	341
Dec	229,982	75,353	36,813	60,858	202.2	1.0	389
Jan-99	315,165	80,995	54,145	72,202	214.2	1.1	420
Feb	550,271	98,954	71,617	64,476	277.3	1.5	514
Mar	355,559	78,260	72,105	77,834	188.8	1.0	448
Apr	424,822	75,328	53,915	67,547	198.2	1.0	423
May	274,002	75,735	52,214	70,271	189.0	1.0	454
Jun	373,662	76,274	46,312	52,076	161.3	0.8	400
Jul	288,480	82,457	42,827	54,589	191.3	1.0	387
Aug	422,653	73,844	70,670	55,928	196.1	1.0	413
Sep	328,907	91,223	73,260	73,130	176.3	0.9	371
Oct	318,256	79,505	86,082	88,505	182.4	1.0	407
Nov	344,289	71,574	56,365	57,902	125.9	0.6	322
Dec	161,434	76,387	46,373	64,209	119.9	0.6	300
Jan-00	258,053	82,294	73,327	73,417	149.2	0.8	329
Feb	425,910	74,070	66,153	51,380	172.7	0.9	344
Mar	231,336	82,388	56,731	63,045	134.0	0.7	288
Apr	318,752	74,593	44,260	52,488	106.9	0.5	277
May	216,938	82,650	44,846	62,840	121.0	0.6	264
Jun	407,455	73,297	49,899	52,412	97.0	0.5	250
Jul	175,235	78,813	34,800	54,252	93.3	0.5	217
Aug	370,739	77,857	50,962	55,582	100.5	0.5	226
Sep	146,007	71,994	32,341	59,574	117.0	0.6	224
Oct	149,252	84,841	38,243	64,576	82.2	0.4	205
Nov	303,673	74,830	46,208	53,946	97.6	0.5	200
Dec	113,667	72,121	41,315	62,417	116.4	0.5	251

1 Monthly total; 2 Month-end; 3 Daily average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