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The impact of forward sales on the price of gold

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SYNOPSIS
The individual supplies of and demands for gold that make up the total supply/demand structure in any year, together with their individual price elasticities, are used to determine the effect of forward sales on the gold price.

SAMEVATTING
Die vraag en aanbod van goud wat die totale vraag/aanbod markstruktuur daar stel in enige gegewe jaar, tesame met die prys beweeglikheid, word gebruik om die effek van vooruitverkoping van goud op die goudprys te bepaal.

INTRODUCTION

Forward sales consist of gold borrowed from the banks. The interest rate charged by the banks is the gold leasing rate[1], which is very low. The borrowed gold is immediately sold on the spot market, and the proceeds are invested at the US dollar Libor rate (London interbank offered rate), which is much higher than the gold leasing rate. The difference between these two rates is the gold contango, which over the past three years has varied between 3 and 8 per cent.

The contango has been very attractive to gold mines, but the borrowed gold represents an additional supply to the market, which lowers the price. This loss, which is not readily apparent, has been overlooked in most cases or disregarded as being of little consequence, which is quite incorrect. It will be shown that every extra ton of gold sold per annum reduces the price by about $0,2/oz, and the consequences have been disastrous.

CALCULATIONS

The data needed to make the necessary calculations are given in Table I and refer to 1990. The tonnages recorded in the table are derived from data published in *Gold 1991*[1], mainly in the summary table on page 49. The price elasticities are determined in the next section of this paper.

TABLE I
Data for the calculations

Supply	Tons	Unlagged price elasticity	Demand	Tons	Unlagged price elasticity
Mine production	1734	0,0	Industrial	259	0,0
Communist sales	380	–1,0	Official	40	–1,0
Secondary	441	1,4	Investment	515	–1,0
Gold loans	5	0,0	Jewellery	1986	–0,6
Forward sales	240	1,0			
Total supply	2800		Total demand	2800	

The tonnages shown in the table above apply to 1990 when the average gold price was $383,59/oz. We need to be able to calculate the supply or demand at other prices. For example, the supply of secondary gold in 1990 was 441 tons when the price was $383,59/oz. The supply when the price rises to $400/oz will be 441 $(400/383,59)^{1,4}$ or, more simply, $441Q^{1,4}$ tons where Q is the price expressed in units of $383,59/oz. All other supplies and demands can be expressed in this manner.

Because the total supply equals the total demand, it follows that the total supply minus the total demand equals zero. Thus,

$$1734Q^{\circ} + 5Q^{\circ} - 259Q^{\circ} + 240Q + 441Q^{1,4} - 1986Q^{-0,6} - 515Q^{-1} - 40Q^{-1} + 380Q^{-1} = 0,$$

where Q is the price expressed in units of $383,59/oz, the average price in 1990.

As Q° equals unity and collecting terms with the same elasticity, the above expression reduces to

$$1480 + 240Q + 441Q^{1,4} - 1986Q^{-0,6} - 175Q^{-1} = 0. \quad [1]$$

This is the factual model including 240 tons of forward selling, and $Q = 1$ because the model balances with that value.

If there had been no forward selling, the $240Q$ tons in equation [1] would have been zero, and the model without forward selling is thus

$$1480 + 441Q^{1,4} - 1986Q^{-0,6} - 175Q^{-1} = 0. \quad [2]$$

To obtain a balance, Q is found by trial and error with the aid of a programmable calculator to equal 1,12839. This means a price increase of 0,12839 x 383,59 = $49,25/oz.

It follows that the gold price depressor per ounce for every ton sold, whether forward or spot, and called D, is

$49,25/240 = $0,205/oz.

Thus, model [2] with no forward sales should earn $49,25/oz more than model [1] with forward selling, that is, $432,89/oz.

In both cases, non-Communist mines produce 1734 tons. Therefore, with no forward selling, earnings would have been higher by

$49,25 \times 1734 \times 32\,151/10^6 = \$2746$ million (Note: 1 ton = 32 151 troy oz).

With forward selling, a contango is earned that would have amounted to about 6,65 per cent of the gold price on 240 tons of gold. This is

$240 \times 32\,151 \times 0,0665 \times 383,59/10^6 = \$195$ million.

The monetary gain by not selling forward during 1990 is the difference between $2746 million and $195 million, or $2551 million, for the non-Communist mines. In other words, forward selling does not pay. The gold contango is

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poor compensation for the price of gold having been seriously depressed by forward sales.

The generalized case is analysed below.

In any year, let

G = tons of gold sold forward by all non-Communist mines
T = tons of gold sold spot by all non-Communist mines
P = the average spot price, $/oz
N = the proportion of the price earned as a contango
= (average US $ Libor (3 month) rate in per cent minus the average gold leasing rate in per cent[1]) divided by 100
D = the gold price depressor in $/oz for every ton of gold sold forward.

Then, in any year for all non-Communist mines, the earnings from the gold contango will be

32 151 *GNP* dollars.

The depression of the gold price will be $\$GD$.

The loss of revenue through the depression of the gold price will be

32 151 *GDT* dollars.

The overall loss of revenue from selling forward will be

32 151 $G\,(DT - NP)$ dollars. [3]

In 1990, G = 240 tons, D = $0,205/oz, T = 1734 tons, N = 0,065, and P = $383,59/oz.

Substitution of these values in equation [3] gives the loss of revenue as $2,551 billion in 1990. Because DT will always exceed NP in practice, the quantity in brackets will always be positive so that there will always be a loss of revenue unless it is reduced to zero by G being reduced to zero.

It should now be clear that forward selling is counter-productive and should be stopped at once. Furthermore, it should be reversed where practicable by the repayment of gold borrowed from banks. This will entail the selling of Libor loans held by mines and the purchase of gold on the spot market to repay the banks. The gold will thereby be removed from the world gold market, where it depresses the price, and will be returned to the World Central banking system, where it has no effect on the price.

The extent to which the views expressed in this paper will be accepted, and the speed with which this will happen, are of course unknown. If readily accepted, forward sales will diminish, and many loans will be repaid so that the price of gold will rise fairly rapidly to a level perhaps in excess of $400/oz. Complete acceptance, including the repayment of all loans, might raise the price to about $500/oz if the present borrowings are as high as, say, 500 tons. Data for 1990 show total borrowings of 530 tons, which may be an over-estimate but, since then, the borrowings for 1991 have to be added, so that 600 tons is a plausible figure.

Complete rejection of the views expressed here would mean that the price of gold will continue to stagnate or fall slightly.

The likely immediate outcome of this paper is acceptance by a few more mines and continued rejection by the rest, which means that it will take some time to achieve general acceptance.

ACCURACY

The accuracy of the foregoing calculation depends on the data shown in Table I, which consist of tonnages and price elasticities. The latter are exact or close estimates, so that the accuracy depends mainly on the tonnage figures. Inspection of equations [1] and [2] shows that the supply from forward sales of 240 tons is the most critical figure. However, this figure can be changed only if there is an equal and opposite change in the total demand.

DETERMINATION OF UNLAGGED PRICE ELASTICITIES

The nine unlagged price elasticities shown in Table I have to be derived. Seven of these have values of zero, –1, +1, or values very close to those numbers, and are best determined by deduction. The price elasticities of gold used in jewellery and from any secondary supply are determined by regression techniques.

Because of the demise of the USSR, the model for that area applies only up to 1990. Thereafter, the model should be modified to suit changing conditions until stability is achieved and a new model derived.

Non-Communist Mine Supply and Gold Loans

The usual way of financing the new mine production of gold is to raise the money on the capital market, and some years later the past expenditure results in increased gold production. Thus, the supply of gold lags the expenditure by several years.

Another way of raising the finance is through gold loans. In that case, gold is borrowed from the banks and sold on the spot market to provide the necessary capital. Again, there is a lag of several years before the gold is produced. There is thus a lagged price elasticity in both cases, and the current price of gold has no effect on the current production. This means that the observed non-Communist mine supply remains unaltered, just as it would if there were, in fact, only an unlagged price elasticity of zero. For this reason, this value is shown in Table I since it gives the correct answer, though it might be argued that it should be more properly shown as a blank or a dash.

Forward Sales

Forward sales and mine supply both have a price elasticity of supply of +1,0. However, in the case of mine supply, it is lagged by several years but, in the case of forward sales, there is no lag so that the price elasticity of +1,0 is applicable.

The Price Elasticity of Demand for Gold

This varies from a very small negative number such as –0,01 when 1 per cent of the value of the articles concerned is due to gold, to –1,0 when the value is due entirely to the gold content. Hence, industrial use including dental demand has a very low negative price elasticity, which can for practical purposes be taken as zero.

On the other hand, investment and official demand have a price elasticity of almost –1,0, and can for practical purposes be taken as such.

Communist Supply of Gold to the West

It is not possible to derive a complete model for this supply, which depends on unquantifiable factors. However, it is possible to derive the likely unlagged price elasticity.

It seems that the Communist countries decide on a suitable monetary target for their annual gold sales, taking into account, among other factors, the likely price and the amount of gold available. The amount of gold sold is the sum of these target sums in US dollars, J, divided by the average price for the year in US dollars, P.

Hence, sales in ounces = JP^{-1}.

Thus the price elasticity is –1,0.

Jewellery

This is the most important of all demands. Developing countries usually have a high negative price elasticity, and developed countries a lower negative price elasticity. However, any attempts to derive separate models for each would be unsatisfactory, since it is impossible to split the total demand accurately because of smuggling, and because published data give only the amount of jewellery manufactured in each country, which is not the same as that bought.

For these reasons, a single model for the whole world has been derived. This means that a world price has to be used in the regression. India buys nearly as much jewellery as the USA, so that, in this context, the rupee is as important as the dollar. Consequently, a demand-weighted mean world price is used, which will now be described.

The national deflated price (NDP) of gold in any year for any country is the dollar price converted to the national price and deflated by dividing by the national cost price index (CPI). The NDP for 1980 is taken as the standard for each country; so, all the NDPs for all years are divided by their NDP for 1980, which provides the normalized national deflated prices (NNDP) every year for each country. This is thus 1,0 for all countries in 1980.

The demand-weighted NNDP is accepted as the world price. These prices are to be found in Tables II and III.

Although the exact purchases of jewellery by each country are not known, it has been possible to correct the worst errors because details of exports of jewellery from Italy, the world's largest manufacturer, are available, as are imports by the USA. The Chamber of Mines has also from time to time published details of actual purchases by the largest jewellery-buying countries.

Other errors are not serious because the variance of the NNDP each year is relatively small. This is because changes in these prices due to changes in exchange rates tend to be offset by changes in the cost price index, which have the opposite effect.

Table II gives the data for deriving the model for jewellery demand, which includes the price elasticity of jewellery. The results of the regression are shown together with the decision to accept the price elasticity of jewellery as –0,6.

The model for the world's demand for jewellery in 1981 to 1988 inclusive is

Demand = $840\,P^{-0,582}\;Y^{2,046}$ tons $R^2 = 0,945$
Standard errors (0,24) (0,31).

This is a reasonable result. A previous regression using jewellery-demand data from the CPM Group[3] gave a price elasticity of –0,614, which was also reasonable. It was decided to use a price elasticity of –0,6.

Secondary Supply of Gold

There is a constant flow of gold from secondary sources, consisting of broken, worn-out, and outmoded jewellery and of industrial scrap, mainly electronic. A simple model in which supply is a function of price and of the index of growth was tried. This gave a fit with a value of $R^2 = 0,9$, which is not really good enough. It appeared that some other factor was missing; so, the price lagged by a year, as well as the unlagged price, was tried. The model obtained was

Supply = $615\,P_t^{1,448}\;P_{t-1}^{-0,372}\;Y_t^{1,182}$ tons $R^2 = 0,951$
Standard errors (0,15) (0,14) (0,44).

As this is a satisfactory result, the unlagged price elasticity of 1,448, or 1,4 to the first decimal place, was accepted.

This model can be written as

Supply = $615\,P_t^{1,076}\,(P_t/P_{t-1})^{0,372}\,Y_t^{1,182}$ tons.

TABLE II
Data for the model for jewellery demand

	Unit	Source	1981	1982	1983	1984	1985	1986	1987	1988
World jewellery demand	Tons	Ref. 1	798	940	847	1 098	1 179	1 154	1 197	1 515
Index of world income/100, Y		Ref. 2	0,898	0,900	0,920	0,965	1,000	1,030	1,067	1,113
Price, P	World units	See text	0,746	0,608	0,686	0,591	0,542	0,563	0,645	0,599

TABLE III
Data for the model for secondary supply

	Unit	Source	1976	1977	1978	1979	1980	1981
Secondary gold supply, S	Tons	CPM Group[3]		140	177	339	659	327
Index of world income/100, Y	–	IMF[2]		0,801	0,835	0,865	0,884	0,898

	Unit	Source	1982	1983	1984	1985	1986	1987
Secondary gold supply, S	Tons	CPM Group[3]	345	364	324	280	404	398
Index of world income/100, Y	–	IMF[2]	0,900	0,920	0,965	1,000	1,030	1,067
Price, P	World units	See text	0,608	0,686	0,591	0,542	0,563	0,645

This model shows that sellers prefer to sell in a rising market and withhold gold in a falling market. This preference is probably due to the fact that low-grade scrap is not worth treating when the price of gold is low, and becomes profitable when the price rises. This results in the accumulation of low-grade scrap when the price of gold is low and the depletion of these stockpiles when the price is high.

The model for the secondary supply using CPM Group data[3] for 1977 to 1987 (Table III) is as follows:

$$\text{Supply} = 615 P_t^{1,448}\ P_{t-1}^{-0,372}\ Y^{1,182} \text{ tons}\quad R^2 = 0,951$$

Standard errors (0,15) (0,14) (0,44).

REFERENCES

1. Gold Fields Mineral Services Limited, London. *Gold 1991.*
2. *International financial statistics* published monthly and annually by the International Monetary Fund, Washington D.C.
3. CPM Group, 71 Broadway Suite 305, New York, NY 10006.

New Institute of Materials

At an Extraordinary General Meeting held on 10th October, 1991, at the London headquarters of The Institute of Metals, members of the Institute approved the Council to take office on 1st January, 1992, subject to an Order of the Privy Council, on the formation of The Institute of Materials.

The composition of the new Council, which provides for balanced representation of metal, ceramic, and polymer interests within the new Institute of Materials, was put to the Metals' membership following discussions between the Councils of The Institute of Metals, The Institute of Ceramics and The Plastics and Rubber Institute and the names that were put forward have the unanimous support of all three Councils.

The structure of the new Council, which will hold office until May 1993, also has the full support of the Engineering Council. President-designate of The Institute of Materials is Sir John Collyear.

Last year the members of The Institute of Metals voted overwhelmingly for the formation of The Institute of Materials, which was seen as vital in providing the human and financial resources necessary for the effective development and application of engineering materials.

The President of The Institute of Metals, Dr Les Mercer, in a statement to his fellow members, said that the Institute was delighted that The Institute of Ceramics and The Plastics and Rubber Institute were holding further votes. Sir Geoffrey Allen (President, The Plastics and Rubber Institute) and Mr John Troth (President, The Institute of Ceramics) were confident the majority of their members were in favour of joining The Institute of Materials in order to meet the many exciting challenges and opportunities presented across the whole spectrum of materials science and technology, as well as continuing and enhancing the service to individuals whose interests are with more traditional materials.

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Mineral Processing Symposium

The Universities of Stellenbosch and Cape Town, under the auspices of the Western Cape Branch of the SAIMM, hold annual meetings to discuss research topics in minerals processing. In 1989 this meeting was in the form of an International Column Flotation Colloquium. In 1990 the Symposium was extended to two days.

For this, the 11th meeting, the Symposium will be held over two days, and speakers from other research groups and industry are invited to take part in this national meeting. Papers on materials engineering and chemical engineering are also invited.

The Symposium will be held in Gordon's Bay on the 6th and 7th August, 1992. Registration will take place on 5th August, and a banquet will be held on 6th August, 1992.

The object of this Symposium, the 11th Annual Minerals Processing Symposium, is to

- discuss current research areas and findings
- keep abreast of recent developments in the industry
- elicit debate on relevant topics
- serve as a forum for informal contact
- encourage young researchers.

All interested persons are invited to participate in this event. Papers and posters may be presented. Only abstracts of the papers will be distributed, and presenters are welcome to publish their findings elsewhere. The dates for submissions are as follows:

30th April, 1992 Title with extended abstract (500words)
31st May, 1992 Notice of acceptance of paper or poster.

Further information is available from

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