Edison
investment
research

Gold – a return to the 1970s
But the old benchmarks no longer apply

"In the absence of the gold standard, there is no way to protect savings from confiscation through inflation… Deficit spending is simply a scheme for the 'hidden' confiscation of wealth. Gold stands in the way of this insidious process. It stands as protector of property rights."

Alan Greenspan, Gold & Economic Freedom, 1968

April 2009

ANALYST

Charles Gibson   020 3077 5724

cgibson@edisoninvestmentresearch.co.uk

Gold poised for second leg of bull run

While these are extraordinary times for the world economy, they are not without precedent, with structural trade deficits, burgeoning budget deficits and bank failures all equally prominent in the 1970s. During the 1970s, gold rose from US$35/oz to its only recently surpassed record of US$850/oz in 1980 – a 24-fold uplift in value. While we do not expect quite such dramatic appreciation in the current era, a repeat of the same cycle would see gold rise to a price of US$1,567/oz in the near term.

27 UK-listed gold companies cheap; two stand out

Against the background of a potential bull run, the universe of London-focused gold companies becomes attractive from an investment perspective. Rather than use the traditional benchmark of US$35 per resource ounce to determine value, however, this report outlines a new methodology to determine individual valuations for 'inferred', 'indicated' and 'measured' ounces. Using this new methodology reveals that 27 out of 41 companies may be regarded as cheap in relation to their resources. Screening further to identify both high average grades and historic profitability highlights three companies – Avocet Mining, Highland Gold and Pan African Resources – as attractive investment targets.

Operational consequences

In addition to identifying value, the separate valuation of 'inferred', 'indicated' and 'measured' resources has operational consequences for the companies concerned. In particular, we conclude that full exploration programmes add value for only 11 out of the 41 companies considered, but are potentially value-destroying for a further 11.

COMPANIES IN THIS REPORT

Allied Gold	Medoro Resources
Ariana Resources	Medusa Mining
Avocet Mining	Metals Exploration
Centamin Egypt	Moto Goldmines
Central Rand Gold	Norseman Gold
Chaarat Gold	Orsu
China Goldmines	Oxus Gold
Cluff Gold	Pan African Resources
Condor Resources	Patagonia Gold
Conroy	Peninsular Gold
European Goldfields	Peter Hambro
Frontier Mining	Randgold Resources
Galantas Gold	Serabi Mining
Glencar Mining	Shanta Gold
Greatland Gold	Stratex International
Greystar Resources	Tianshan Goldfields
Hambledon Mining	Trans-Siberian Gold
Highland Gold	Uruguay Minerals
Kirkland Lake	Vatukoula Gold
Kryso Resources	Wits Gold
Leyshon Resources	

Investment summary: All ounces are not the same

Background: The gold market

Gold is in a bull market for the first time in a generation. Should it repeat the same cycle now that it went through in the 1970s, it will average over US$1,000/oz over the next 21 years, with a short-term peak in excess of US$1,567/oz. With this in mind, we have identified 27 companies that we believe offer investors the opportunity to acquire assets cheaply. These are shown in Exhibit 1.

Exhibit 1: Cheap gold companies as identified by Edison (according to methodology set out below)

Note: Rangold Resources and Avocet considered prior to their bids for Moto Goldmines and Wega, respectively.

Company	'Top' resource category	Implied value of ounces in 'top' category (US$)	EV per total resource oz (US$)	Average grade (g/tonne)	Historic P/E ratio (x)
Greatland Gold	Inferred	-10.00	-10.00	Unk.	-ve
Condor Resources	Inferred	-2.12	-2.12	1.8	-ve
Serabi Mining	Indicated	-105.00	-11.60	11.0	-ve
Chaarat Gold	Indicated	4.35	3.41	4.4	-ve
Central Rand Gold	Indicated	5.29	3.78	8.3	-ve
Wits Gold	Indicated	7.14	4.54	5.8	-ve
Conroy Diam&Gld	Indicated	8.02	4.09	1.3	-ve
Orsu	Indicated	8.49	6.56	0.8	-ve
Stratex International	Measured	-64.12	2.93	1.3	-ve
Shanta Gold	Measured	-38.18	-6.73	2.2	-ve
Tianshan Goldfields	Measured	-12.51	3.57	0.9	-ve
Leyshon Resources	Measured	0.09	4.36	1.2	-ve
Kryso Resources	Measured	0.49	2.53	2.5	-ve
Greystar Resources	Measured	6.44	8.24	1.1	-ve
Medoro Resources	Measured	8.47	10.11	2.2	-ve
Vatukoula Gold	Measured	6.98	6.45	9.5	-ve
European Goldfields	Measured	26.26	20.59	1.5	-ve
Cluff Gold	Measured	29.71	15.62	2.1	-ve
Ariana Resources Plc	Measured	30.41	11.64	1.8	-ve
Uruguay Mineral	Measured	69.47	15.04	1.2	-ve
Pan African Resources	Measured	46.12	18.85	5.5	8.00
Highland Gold	Measured	46.62	9.55	6.4	12.67
Oxus Gold	Measured	57.77	14.05	2.4	-ve
Metals Exploration	Measured	76.17	13.96	2.0	-ve
Avocet Mining	Measured	75.11	29.31	1.6	9.6
Norseman Gold Plc	Measured	154.95	26.37	4.0	-ve
Peninsular Gold Ltd	Measured	173.47	106.94	1.0	-ve

Source: Edison Investment Research

Of these, we would highlight Avocet, Highland Gold and Pan African Resources in particular as attractive investment propositions, given that they combine cheap in-situ resources with both historic profitability and relatively high grades.
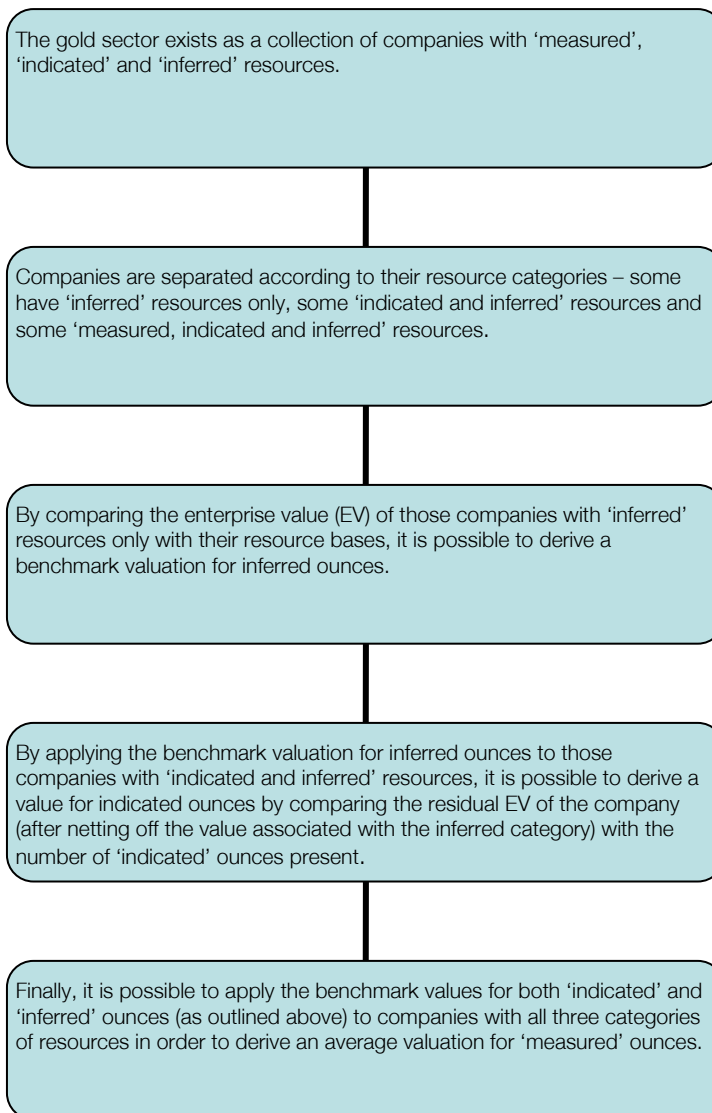
Description of methodology

One of the most common analytical techniques in the gold industry is the valuation of a company relative to its resource base. Historically, this technique has supported a valuation of US$35 per total resource ounce on the basis that this has been the *a posteriori* average cost of discovering ounces of gold in the ground. Remarkably, average valuations in the gold industry continue to conform to this benchmark. At the same time, it has become increasingly accepted within the investment community that not all ounces of gold in the ground are the same.

Under JORC-style reporting standards, resources are sub-divided into three categories, according to the level of confidence and knowledge in their geology. In ascending order, these categories are 'inferred', 'indicated' and 'measured'. One of the most obvious ways in which ounces are different

is their categorisation, yet the US$35/oz benchmark still persists. Rather than accepting the benchmark, this report sets out the methodology by which in-ground ounces may be distinguished from one another and derives valuations for each of the three categories separately. As well as offering new valuation benchmarks for the industry, the conclusions highlight a number of operational issues for London-focused gold companies, including the identification of those companies that have little scope to add value to shareholders through the continuation of their exploration activities. A description of the methodology used is shown in Exhibit 2.

Exhibit 2: Schematic depiction of methodology used

The gold sector exists as a collection of companies with 'measured', 'indicated' and 'inferred' resources.

Companies are separated according to their resource categories – some have 'inferred' resources only, some 'indicated and inferred' resources and some 'measured, indicated and inferred' resources.

By comparing the enterprise value (EV) of those companies with 'inferred' resources only with their resource bases, it is possible to derive a benchmark valuation for inferred ounces.

By applying the benchmark valuation for inferred ounces to those companies with 'indicated and inferred' resources, it is possible to derive a value for indicated ounces by comparing the residual EV of the company (after netting off the value associated with the inferred category) with the number of 'indicated' ounces present.

Finally, it is possible to apply the benchmark values for both 'indicated' and 'inferred' ounces (as outlined above) to companies with all three categories of resources in order to derive an average valuation for 'measured' ounces.

Source: Edison Investment Research

Summary observations and conclusions

Compared to the oft-quoted benchmark valuation of US$35 per resource ounce, in fact resource portfolios are composed of 'inferred' resources that are, on average, valued at US$1.05/oz each, 'indicated' resources that are valued at US$12.05 each and 'measured' ounces, which are valued at US$187.73 each. Within that, the valuation for 'measured' ounces may be further sub-divided into an 'above average' peer group, dominated by mature, well-established producers, which command a mean valuation of US$591.78 per 'measured' resource oz and a 'below average' peer group, which commands a mean valuation of US$35.85 per 'measured' resource ounce.

Consequences

Two particular consequences follow from this analysis – one empirical and the other operational. The empirical consequence is that, by creating a new benchmark (or benchmarks), a whole new series of companies is identified as cheap. Using the US$35 per resource ounce benchmark divides the industry approximately into two, with 'high quality' companies commanding premium valuations and 'lower quality' ones commanding discounts. However, using the three-way benchmark of US$1.05 per 'inferred' ounce, US$12.05 per 'indicated' ounce and US$187.73 per 'measured' ounce demonstrates that some companies at the upper end of the curve may nevertheless be cheap, while others, at the lower end of the curve, may be expensive. In this case, we identified 27 cheap companies, which we further screened for historic profitability and the average grade of their ore bodies. This process highlighted three companies – Avocet, Highland Gold and Pan African Resources – as viable investment targets.

The second, operational consequence concerns the sort of exploration work that companies should be undertaking in the light of their valuations. Since we know the valuations of their 'inferred' ounces compared to their 'indicated' and 'measured' ounces, we can see the extent to which their exploration activities are likely to add or destroy value to their shareholders. In this case, we conclude that maintaining a full exploration programme enhances shareholder value for only 11 out of 41 companies profiled. By contrast, a limited exploration programme to upgrade resources to the 'measured' category will enhance value for seven companies and may enhance value for a further 12. The valuations of the remainder (see page 13) suggest that they should discontinue all exploration activity (unless it can be undertaken extremely cheaply) and either develop, sell, farm out or mothball their projects.

Sensitivities

Our analysis of the gold market in particular is dependent upon a number of key macro-economic variables, including real US interest rates and the oil price. In particular, we assume the continuation of an environment of very low and/or negative real US interest rates and a relatively well-supported oil price. While we believe that gold prices above US$800/oz would still be justified by a return to more normal economic conditions, a rapid increase in real dollar rates of interest in particular would mean that there is unlikely to be a short-term speculative spike in the price of gold.

Similarly, a long-term oil price of US$75/bbl would support a gold price of US$835/oz. In the event that the oil price remains at current levels (or falls) for a sustained period of time, it is likely to undermine gold both relative to our assumed scenario and its current price.

The gold industry and resource definition

Fundamentally, the business of the gold industry involves the location of a geological asset and its subsequent conversion into a usable product. Unlike many industries, these two processes are quite distinct to the point at which some companies specialise solely in either one activity or the other, but not both. The problem of evaluating gold in the earth's crust is significant. Most in-ground gold will never be mined and, under most circumstances, never could be mined. Thus it is incumbent upon any mining exploration company to instead identify and delineate a resource that at least has the potential to be economically viable. There are no universally accepted mineral reporting standards, but JORC-style reporting standards are now used in most major mining countries and have been adopted by most companies and financial institutions. According to the JORC code, a resource is defined as:

"A concentration or occurrence of material of intrinsic economic interest in or on the Earth's crust in such form, quality and quantity that there are reasonable prospects for eventual economic extraction."

In quantitative terms, the estimate of the size of the resource "represents a realistic inventory that, under assumed and justifiable technical and economic conditions, might in whole or in part, become economically extractable." This is distinct from an ore reserve, which is, "an estimate of the tonnage and grade that is expected to be delivered to the mill or treatment plant." Thus the estimation of a reserve includes non-geological factors, such as mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors (together called the 'modifying factors'). Resources may be converted into reserves upon due consideration of these modifying factors.

After an initial period, during which a number of techniques are used (eg from flying aeromagnetic surveys to trenching and sampling), an estimate is typically achieved via a drilling campaign. This yields data about gold grades at specific locations within a mineral deposit that are then put through a complex statistical process to interpolate the likely size of the potential ore body from the core samples logged.

Depending on the pattern and the density of the drilling, the ore body will be described according to three resource categories, reflecting increasing geological knowledge and confidence. In ascending order, these three categories are 'inferred', 'indicated' and 'measured' resources.

The definition of 'inferred' resources

Inferred resources are that part of a mineral resource for which tonnage, grade and mineral content can be estimated with a low level of confidence on account of inadequate geological knowledge, limited sampling data, data of uncertain or poor quality and/or uncertain geological and/or grade continuity. For these purposes, 'low confidence' means usually not sufficient to allow the application of technical and economic parameters to be used for detailed planning. Instead the resource is inferred from geological evidence and assumed but not verified geological and/or grade continuity. It is typically based on information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes, which may be limited or of uncertain quality or reliability. As a result, inferred resources may not be converted directly into reserves.

The definition of 'indicated' resources

Indicated resources are "that part of a mineral resource that can be estimated with a reasonable level of confidence." That is to say, with sufficient confidence to allow the application of technical and economic parameters and to enable an evaluation of economic viability. In this case, the locations of the samples are "too widely or inappropriately spaced to confirm geological and/or grade continuity but are spaced closely enough for continuity to be assumed."

The definition of 'measured' resources

Finally, measured resources are "that part of a mineral resource that can be estimated with a high level of confidence." That is to say, with sufficient confidence "to allow the application of technical and economic parameters and to enable an evaluation of economic viability that has a greater degree of certainty than an evaluation based on an indicated mineral resource." In the case of measured resources, the locations of the samples are "spaced closely enough to confirm geological and grade continuity."

Exploration cost and value

Historically, each ounce of gold resource has cost an average of US$35 to discover, leading to the oft-repeated valuation benchmark of US$35/oz. However, this assumes that there is no difference between a measured ounce, an indicated ounce and an inferred ounce and that a 1Moz measured resource should have the same value as a 1Moz indicated resource or a 1Moz inferred resource. Given the wide difference in geological knowledge and confidence between the three resource categories, this is clearly simplistic. For example, only measured and indicated resources are eligible to be upgraded to the proven and probable reserve categories (leading to the other common habit of valuing ounces purely on a 'measured and indicated' basis). Clearly, however, inferred ounces should have some value attached to them. In addition, it is a moot point whether cost and value, in this instance, are synonymous.

It is possible, however, to use an alternative technique to determine the value of a measured resource ounce as distinct from an indicated or an inferred one, as set out below.

A note on codes

There are a number of different codes relating to the reporting of resources in operation around the world. Although JORC-compliant reporting is increasingly becoming the standard for the industry, we would not go so far as to say that it is necessarily the best in all circumstances. For the purposes of this analysis, the other major code under which companies report resources is the Russian code, which classifies resources as B, C1, C2, P1, P2 and P3. In broad terms, the A and B categories equate to measured resources under the JORC code, while C1 and C2 equate to indicated and a portion of inferred resources. The remainder of inferred resources are made up by a portion of P1 resources. This is represented schematically in Exhibit 3.

Exhibit 3: Comparison of JORC and Russian standard classification strategies

JORC Code	Measured	Indicated	Inferred	Unclassified
Russian standard classification categories	A+B	C1 C2		P1 P2+P3

Source: Wardell Armstrong International, Peter Hambro Mining

The remainder of P1 resources plus P2 and P3 are sub-inferred resources as far as the JORC code is concerned and do not merit a JORC classification. That does not mean that they do not exist, only that there is not yet sufficient geological knowledge to categorise them at a higher level. With more work, it is entirely possible that these resources will eventually be upgraded. Nevertheless, in order to impose relative consistency with respect to the analysis that follows, only JORC-compliant resources have been attributed to companies reporting them, with any resources reported under different codes being ignored. In addition, all non-gold resources have also been ignored.

Valuing each resource category independently

While most mineral deposits have supported enough exploration historically to host all three categories of resources, a notable few have only two categories (indicated and inferred) and a very few have just one (inferred).

By using those companies that have only inferred ounces to derive an average value for them, it is then possible to use the resulting valuation to determine an average value for indicated ounces. This achieved, it is then possible to use the average values derived for the inferred and indicated resource categories in order to derive an average value for measured ounces.

Summary results and discussion

For the purposes of the discussion that follows our universe of companies is 41 gold stocks. A summary of these 41 according to the type of resource category reported is given in Exhibit 4.

Exhibit 4: Gold sector summary valuation according to resource category

Note: Totals may not add up owing to rounding. Prices as at 15 April 2009.

Resource category	No. of co's	%	Market cap (US$m)	%	Net debt/ (cash) (US$m)	%	EV (US$m)	%	Total oz (m)	%	Mkt cap/ oz (US$)	EV/oz (US$)
Inferred only	3	7	20	0	(17)	3	3	0	2.8	1	7.14	1.05
Indicated & inferred	11	27	781	10	(80)	13	702	10	94.5	44	8.27	7.42
Measured, indicated & inferred	27	66	7,053	90	(512)	84	6,541	90	118.4	55	59.57	55.24
Totals/average	41		7,854		(609)		7,245		215.7		36.41	33.59

Source: Edison Investment Research, Bloomberg, Company sources

A number of features are immediately apparent from this summary:

1) On aggregate the gold sector has net cash on its balance sheet; not only that but also all three sub-sectors (broken down by resource category type) have net cash on their balance sheets.

2) The 'inferred ounces only' category has the most cash on its balance sheet (on aggregate) relative to its size.

3) The 'indicated and inferred ounce' sub-sector contains almost as many ounces on aggregate as the 'measured, indicated and inferred ounce' sub-sector, yet both the

former's aggregate market capitalisation and its aggregate enterprise value is only around 11% of the latter's.

4) There is a wide variation in the average value of ounces, depending on the sub-sector.

5) Notwithstanding point 4 (above), the sector as a whole complies surprisingly closely with the oft-quoted overall benchmark valuation of US$35/oz.

The value of 'inferred' ounces

From the above analysis, it can be seen that, on average, each inferred ounce has a value of US$1.05/oz. Within this there are a number of important features. The first is that this value is an average of two negative valuations (for Condor Resources and Greatland Gold) and one positive one (for China Goldmines). As a result, the unweighted average value per inferred resource ounce is actually negative. Clearly this is nonsensical within the context of an asset and requires an alternative interpretation. Several are possible; however, our favoured interpretation is that the market is discounting the expenditure of the cash on the balance of the three companies concerned with no further increase in resources. Whereas our lower limit valuation of inferred ounces must by zero, this provides an upper limit valuation of US$7.20/oz – being the weighted market capitalisation of the sub-sector per ounce. It is worth noting at this stage, however, that whatever the number adopted, since the possible range of values is relatively narrow (ie between only zero and US$7.20 per ounce), it makes little difference for the purposes of the valuation of indicated ounces (see below).

The value of an 'indicated' ounce

Having derived a standardised value for an inferred ounce, it is now possible to derive an average value for an indicated ounce. This is achieved by studying the sub-sector of companies that have delineated only indicated and inferred resource ounces. The standardised value of the inferred ounce portfolio is then subtracted from the companies' aggregate enterprise value to give a value for the indicated ounce portfolio. This is then divided by the aggregate number of indicated ounces to give an average value for each indicated resource ounce. In the case of our sub-sector of 10 companies, this value is US$12.05 per indicated ounce on a weighted basis.

Unlike the inferred ounce sub-sector, however, in which the range between the maximum and minimum possible values is relatively small, in the case of the 'inferred and indicated' sub-sector, the range of implied values is high – being between minus US$108.87 per indicated resource ounce for Serabi and US$378.00 for Medusa. However, all but three of the companies have implied valuations between US$5.19 per indicated ounce and US$29.06/oz. Given that the average of this sample (excluding obvious outliers, viz Medusa, Frontier and Serabi) is US$13.37, we are confident that our overall average value per indicated resource ounce of US$12.05 is reasonable. Of note is the fact that were the value of an inferred ounce to be increased to US$7.20, then the value of an indicated ounce would decrease to US$7.45 (NB the effect on the value of a measured ounce would be a negligible 0.2%). Given the differences in geological knowledge and confidence between indicated and inferred resources, having such a potentially small valuation differential between inferred resources at US$7.20/oz and indicated resources at US$7.45/oz is an additional reason why we accepted the US$1.05/oz weighted valuation of inferred ounces, despite the inclusion within that number of two negative data points. The range of implied valuations for

indicated ounces is depicted in Exhibit 5 below, compared to both the sub-sector's weighted average value of US$12.05/oz and its un-weighted average of US$45.97/oz.

Exhibit 5: Implied value per 'indicated' resource ounce (US$)

Note: Moto Goldmines is considered prior to the offer from Randgold Resources.
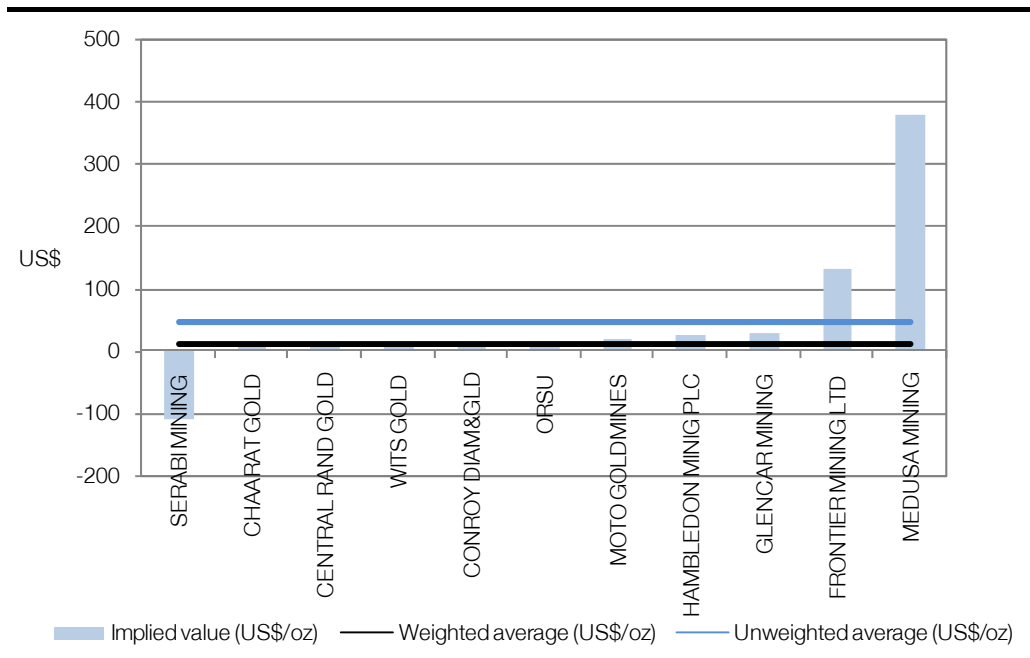
Source: Edison Investment Research

In the case of Serabi, the extreme negative valuation ascribed to its indicated ounces probably reflects market reaction to news of the ongoing problems at its Palito mine in Brazil. Nevertheless, from a purely empirical perspective, Serabi – along with Conroy, Wits Gold, Central Rand Gold, Orsu and Chaarat – must be regarded as offering investors the possibility of acquiring assets in the form of gold ounces in the ground cheaply.

The value of a 'measured' ounce

Finally, having determined the value of inferred and indicated resource ounces within reasonable limits, it is possible to apply the same methodology to determine the value of measured ounces.

Of the 41 companies within our universe of gold stocks, 27 fall into the sub-sector of having measured, indicated and inferred ounces. In this case, the range of results for the implied value of measured ounces is much wider than it is for either indicated or inferred resources, being between minus US$70.19 and US$1,611.55 per ounce, with a weighted average value of US$187.73/oz and an unweighted average value of US$194.49/oz, as shown in Exhibit 6, below.

Exhibit 6: Implied value per 'measured' resource ounce (US$)

Note: Randgold Resources is considered exclusive of its bid for Moto Goldmines; Avocet is considered prior to its offer for Wega Mining.
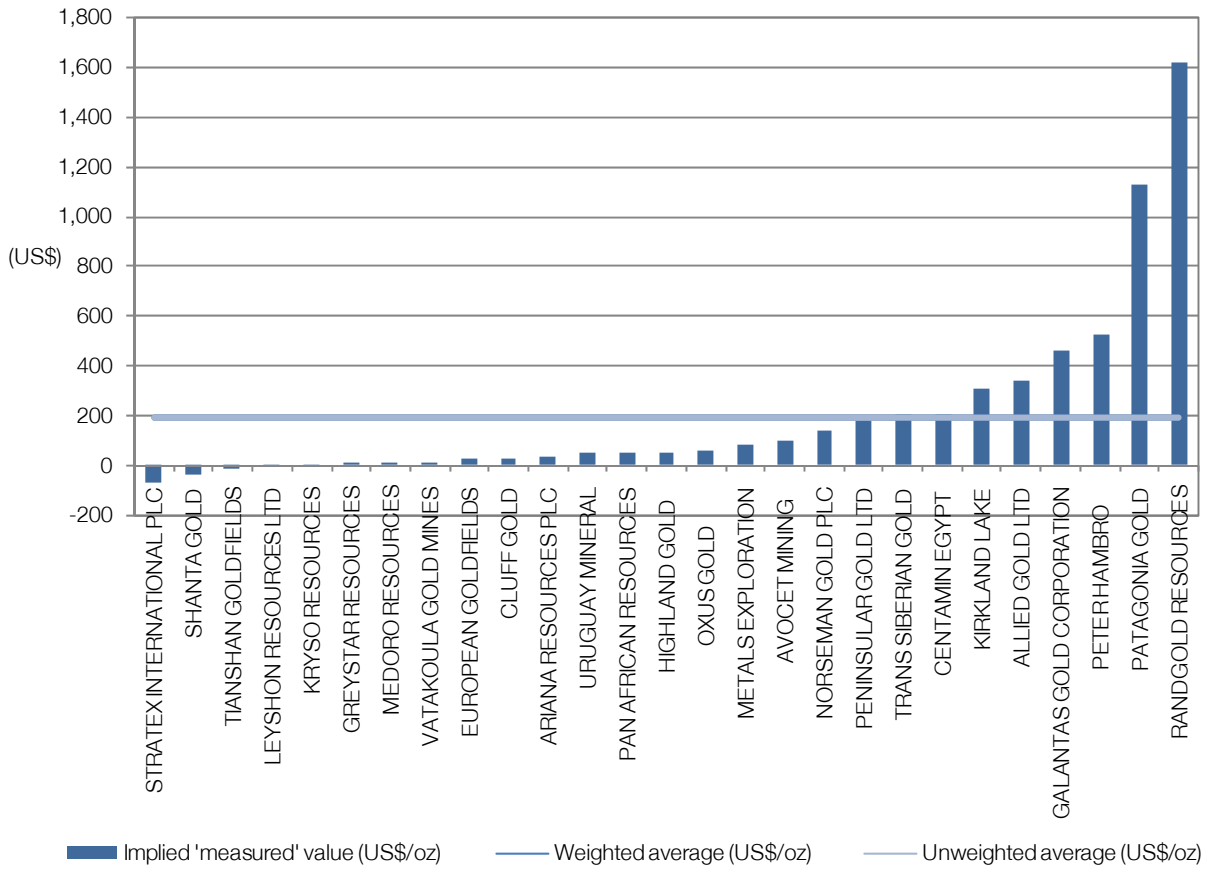
Source: Edison Investment Research

In the case of those companies occupying the upper end of the implied range of values, clearly it is nonsensical for a resource ounce in the ground to be valued at more than a refined ounce of gold in the marketplace. In the case of Randgold Resources and Patagonia Gold, therefore, the market must be either attributing a higher value to indicated and inferred ounces than the rest of the sub-sector, or discounting the future discovery of more resource ounces and/or the upgrading of those already identified. Albeit their valuations are not as elevated as those for Randgold Resources and Patagonia Gold, in our opinion the same is also likely to be true of Peter Hambro Mining and Kirkland Lake. Interestingly, excluding these top eight (including Galantas Gold, Allied Gold, Trans-Siberian Gold and Centamin), the (unweighted) average implied value for each measured resource ounce for the remaining 19 companies (with below average implied values for their measured ounces) is again US$35.85/oz.

Summary

A valuation determined solely by the implied value of different categories of resource ounce is not necessarily a perfect investment indicator for the sector for the purposes of predicting future share price performance in that it is unable to distinguish those companies that are likely to succeed in bringing their resources to account from those that are not. Nevertheless, it is able to identify unquestionably cheap assets. Two other factors, we believe, are also important in determining attractive potential investments in the sector. They are the average grades of the deposits held by the companies in question (as an indicator of potential future profitability) and whether or not they have positive historic earnings (as an indicator of their already having successfully turned ounces in the ground to account). Exhibit 7 shows these two measurements in addition to the companies' EVs per total resource ounce and the resource category by which they have been valued.

Exhibit 7: Gold companies ranked according to EV per total resource ounce (US$)

Note: Rangold Resources and Avocet considered prior to their bids for Moto Goldmines and Wega, respectively. Companies identified as cheap are in bold.

Company	'Top' resource category	Implied value of ounces in 'top' category	EV per total resource oz	Average grade (g/tonne)	Historic P/E ratio (x)
Greatland Gold	Inferred	-10.00	-10.00	Unknown	-ve
Condor Res.	Inferred	-2.12	-2.12	1.8	-ve
China Goldmines	Inferred	3.33	3.33	11.2	-ve
Serabi Mining	Indicated	-105.00	-11.60	11.0	-ve
Chaarat Gold	Indicated	4.35	3.41	4.4	-ve
Central Rand Gold	Indicated	5.29	3.78	8.3	-ve
Wits Gold	Indicated	7.14	4.54	5.8	-ve
Conroy Diam&Gld	Indicated	8.02	4.09	1.3	-ve
Orsu	Indicated	8.49	6.56	0.8	-ve
Moto Goldmines	Indicated	18.90	10.08	3.2	-ve
Hambledon Mining Plc	Indicated	22.12	9.32	2.7	-ve
Glencar Mining	Indicated	27.60	10.08	1.6	-ve
Frontier Mining Ltd	Indicated	128.16	42.42	0.7	-ve
Medusa Mining	Indicated	389.01	155.23	13.3	-ve
Stratex Int'l	Measured	-64.12	2.93	1.3	-ve
Shanta Gold	Measured	-38.18	-6.73	2.2	-ve
Tianshan Goldfields	Measured	-12.51	3.57	0.9	-ve
Leyshon Resources	Measured	0.09	4.36	1.2	-ve
Kryso Resources	Measured	0.49	2.53	2.5	-ve
Greystar Resources	Measured	6.44	8.24	1.1	-ve
Medoro Resources	Measured	8.47	10.11	2.2	-ve
Vatakoula Gold	Measured	6.98	6.45	9.5	-ve
European Goldfields	Measured	26.26	20.59	1.5	-ve
Cluff Gold	Measured	29.71	15.62	2.1	-ve
Ariana Resources Plc	Measured	30.41	11.64	1.8	-ve
Uruguay Mineral	Measured	69.47	15.04	1.2	-ve
Pan African Res.	Measured	46.12	18.85	5.5	8.0
Highland Gold	Measured	46.62	9.55	6.4	12.7
Oxus Gold	Measured	57.77	14.05	2.4	-ve
Metals Exploration	Measured	76.17	13.96	2.0	-ve
Avocet Mining	Measured	75.11	29.31	1.6	9.6
Norseman Gold Plc	Measured	154.95	26.37	4.0	-ve
Peninsular Gold Ltd	Measured	173.47	106.94	1.0	-ve
Trans Siberian Gold	Measured	272.90	49.63	12.6	-ve
Centamin Egypt	Measured	200.83	60.03	1.6	-ve
Kirkland Lake	Measured	300.68	91.82	15.6	-ve
Allied Gold Ltd	Measured	329.85	58.16	1.2	-ve
Galantas Gold Corp.	Measured	356.70	17.78	7.0	-ve
Peter Hambro	Measured	553.39	116.86	1.1	19.8
Patagonia Gold	Measured	1,191.23	267.70	0.9	-ve
Randgold Resources	Measured	1,604.83	200.29	3.3	118.9

Source: Edison Investment Research

The inclusion of the requirement for companies to have a positive historic P/E ratio in particular is sobering in that, of the companies considered above, only five fulfil this criterion.

A word of caution – proportionate interpretation required

As with all empirical analyses, a degree of context is important in interpreting the results. This is perhaps best achieved by looking at a hypothetical example. Suppose, for example, that a company has an EV of US$13m and 1,000,001 resource ounces, of which 1,000,000 are in the indicated category and just one is in the measured category. According to our methodology, the 1,000,000 indicated ounces have a value of US$12.05m, leaving the remaining measured ounce with an implied value of US$950,000. While logically correct as a method of identifying over-valuation, it could be argued that the extent of this overvaluation has been over-stated in that an alternative interpretation would be that each resource ounce has a value of US$13.00. While this is still an over-valuation relative to our indicated benchmark of US$12.05/oz, it appears much less so. Hence it is worth noting that under certain circumstances (ie especially when there is a small proportion of higher category ounces relative to low category ones) the degree of over-valuation of those resource ounces can appear exaggerated. Of our eight companies with the highest value measured ounces, this caveat is particularly applicable to Galantas Gold.

Conclusion

In general it is very apparent that large, profitable operating companies command significantly higher ratings relative to their resource bases than the cash-consuming explorers. This is to be expected. The consequences, however, are significant, in both valuation and operational terms. From a valuation perspective, of the companies covered in this report, 27 may be considered cheap in terms of their portfolio of assets, adjusted for the categorisation of those assets. Of these, two have only inferred resources, six have 'indicated and inferred' resources and 19 have 'measured, indicated & inferred' resources. Of those 27, however, only three – Avocet, Highland Gold and Pan African Resources – have a positive historic P/E ratio. Highland Gold and Pan African Resources also have the ninth and the 11th highest grades of the companies profiled (ie both in the top third), respectively.

Operational consequences

Rather than looking at all ounces as homogenous and fungible, there are clearly large differences in the valuations of 'measured', indicated and inferred ounces. According to our calculations, as set out above, whereas an inferred ounce in the ground has a value of US$1.05, an indicated one has a value of US$12.05 and a measured one a value of US$187.73. Even stripping out the top eight companies with the highest value measured ounces (on the grounds that the market is valuing them differently), the average value of measured ounces is still a relatively high US$35.85 on an un-weighted basis. From this, it can be seen that if the cost of discovering a resource ounce is US$35, then the raising of funds by explorers in order to discover either indicated or inferred resource ounces is, in the current environment, a value destroying proposition. Similarly, upgrading resources from the inferred to the indicated category is almost certainly a value destroying exercise, unless it can be achieved at a cost of less than US$11 per ounce upgraded or unless an additional 23 inferred ounces can be delineated in the process. Given that for every four exploration drill holes configured in a square on a 200m x 200m grid, it takes a further five holes to reduce the grid to a 100m by 100m spacing, the possibility of upgrading an inferred ounce that was discovered at a

cost of US$35 to an indicated one at a cost of US$11 is small. In fact, in general terms, only upgrading inferred and indicated ounces to measured ounces has the potential to be value enhancing and, even then, not for all companies. In the meantime, upgrading from inferred to indicated resources is only a value enhancing proposition in two instances.

Companies for which it is worth conducting a full exploration programme both in order to discover new ounces and to upgrade existing ones can be recognised by the fact that they have both an EV per total ounce above US$35 and a difference between the valuation of their measured and indicated ounces (or indicated and inferred ounces) in excess of US$35. Companies for which it is only worth upgrading indicated to measured ounces, but not discovering new ounces can be recognised by the fact that they too have a greater than US$35 difference in valuation between measuredand indicated ounces (or indicated and inferred ounces in two instances), but have an EV per total resource ounce below US$35. The 18 companies that fit these criteria are shown in Exhibit 8.

Exhibit 8: Companies whose valuations justify continuing exploration work

Note: * Denotes companies with 'indicated and inferred' ounces only.

Companies for which it is worth conducting full exploration programme	Companies for which it is only worth upgrading indicated and/or inferred ounces to measured ounces
Centamin Egypt	Pan African Resources
Peninsular Gold	Metals Exploration
Kirkland Lake	Uruguay Minerals
Allied Gold	Oxus Gold
Avocet	Norseman Gold
Peter Hambro Mining	Galantas Gold
Patagonia Gold	Highland Gold
Randgold Resources	
Trans-Siberian Gold	
Frontier Mining*	
Medusa Mining*	

Source: Edison Investment Research

In addition, there are 12 companies – Glencar, Hambledon, Moto, Orsu, Conroy, Wits Gold, Central Rand Gold, Chaarat, Serabi, China Goldmines, Condor Resources and Greatland Gold – for which it may be worth upgrading resources to the measured category. However, this remains uncertain, given that they currently lack any measured category resources, as a result of which it is impossible to quantify the degree to which such an exercise may or may not be value enhancing. The remaining companies (Shanta, Tianshan, Stratex, Kryso, Medoro, Leyshon, Greystar, Vatukoula, Ariana, Cluff and European Goldfields), for which it is apparently neither worth upgrading existing resources nor discovering new ones, have six options:

1. To cease exploration activity and mothball operations until a more propitious environment presents itself.
2. To cease exploration activity and develop their assets as they stand in order to bring their ounces to account profitably.
3. To sell (or part sell) their assets.
4. To sell the company.
5. To demonstrate that they are able to add value by discovering new ounces cheaply.
6. To demonstrate that they are able to add value by upgrading existing ounces cheaply.

Assuming that future share price movements reflect the extent to which value is either added or destroyed at these companies, the degree to which they are successfully able to achieve any one or all of the above imperatives will determine the extent to which their future share prices will either appreciate or depreciate.

The gold market

A store of value since the beginning of recorded history, gold nevertheless exhibits a distinctly split personality.

During the 1970s it was orthodoxy within the fund management industry that all you had to do in order to guarantee outperformance was ensure that you had one or two South African gold mining stocks in your portfolio. Yet for an entire generation of fund managers who followed in the 1980s and 1990s, gold was about as popular as a rattlesnake in a lucky dip. Indeed, by the end of the 1990s, entire swathes of the fund management industry had cut gold not just out of their portfolios, but out of their thinking as well. Just as everyone was preparing to write gold off as a decayed relic from a bygone era, however, so the twin issues of global trade disequilibrium and excessive financial leverage once again propelled it to the forefront of investors' minds. Now, having risen from around US$250/oz in 2001 to around US$900/oz today, the question for investors is how much further can it rise and when to book a profit.

"Study the past if you would divine the future" – Confucius

While a store of value since the beginning of recorded time, gold's role in the modern era can be traced back to the adoption of the gold standard by the recently created Bank of England in the early 18th century. Traditionally on a silver standard, in 1717 Sir Isaac Newton (in his role as master of the mint) recommended the adoption of a mint ratio between gold guineas and silver shillings at a ratio that made gold relatively cheap. As a result, silver disappeared from the coinage to the point at which Britain was required to overstrike foreign coins in order to ensure sufficient supplies. After a period of non-convertibility during the Napoleonic Wars, Britain passed the Great Recoinage law of 1816, re-creating the sovereign (which had been discontinued in 1604) and adopting the new standard of 113 grains of gold per £1 (or £4.4s.11½d per troy ounce). In 1833, Bank of England notes were made legal tender, and, in 1844 (suitably backed by gold) the legal standard.

The US similarly adopted bimetallism in 1792, but at such a ratio that gold did not come in to the US mint and the US monetary system therefore functioned as if it were on a monometallic silver standard until 1834, when the ratio was revised. Like Britain before it, the US suspended convertibility during the Civil War, but when it resumed once again with the Coinage Act of 1873 (sometimes referred to as 'the crime of '73'), it effectively returned to a gold standard.

Thereafter, the adoption of the gold standard by the rest of the world was concluded rapidly.

Exhibit 9: Dates of adoption of gold standard by different countries/currency unions

1717	United Kingdom at £1 to 113 grains of fine gold.
1818	Netherlands at 1 guilder to 0.6g gold.
1834	United States *de facto* at $20.67 to 1 troy oz gold.
1854	Portugal at 1,000 reis to 1.6g gold.
1871	Germany at 2,790 goldmarks to 1kg gold.
1871	Japan at 1 yen to 1.5g gold.
1873	Latin Monetary Union (Belgium, Italy, Switzerland, France) at 31 francs to 9.0g gold
1875	Scandinavian monetary union (Denmark, Norway and Sweden) at Kr2,480 to 1kg gold.
1876	France internally.
1876	Spain at 31 pesetas to 9.0g gold.
1878	Finland at 31 marks to 9.0g gold.
1879	Austria.
1881	Argentina at 1 peso to 1.5g gold.
1893	Russia at 31 roubles to 24.0g gold.
1897	Japan at 1 yen devalued to 0.8g gold.
1898	India.
1900	United States *de jure*.

Source: Edison Investment Research

It is from this time – the late 19th century until the eve of the First World War – that the so-called international gold standard pertained.

Like so much else, the international gold standard ultimately fell victim to the 1914-1918 conflict. Initially, formal convertibility was suspended. But after the expansion of the money supply that accompanied the war, it was impossible for Britain to simply re-adopt the standard at the old rate once the Armistice had been signed without a long and protracted period of deflation. Government policies to this end were duly imposed before Winston Churchill, as Chancellor of the Exchequer, returned sterling to gold at the pre-War rate in 1925. At a stroke, this rendered much of Britain's manufacturing and export industries uncompetitive on world markets and the UK began to run a series of balance of payments deficits, in particular with the US, which could only be sustained by keeping UK interest rates higher than those in the US, further deflating the UK economy. Thus, while the 1920s roared in America, they stalled in Britain, which was beset with industrial unrest and the general strike. When the booming stock market in America began to attract capital out of Britain as well, the then governor of the Bank of England, Montagu Norman, decided the only option to defend Britain's currency was to raise interest rates further. In late September 1929, the Bank of England aggressively raised interest rates to cut off the supply of speculative capital being exported to America. The resulting fall in prices in turn caused over-geared US investors to withdraw their non-core funds from abroad, thereby undermining Germany and Austria's ability to meet war reparations' payments. Nineteen months later, Kreditanstalt failed in Vienna, followed by the rest of the German banks later that year. As investors worried about British banks' exposure to Central Europe in turn, London (which had hitherto been inviolable) suddenly experienced a speculative attack all of its own. On 20 September 1931, amid sensational headlines, the British government announced that 'for the time being' it would suspend gold convertibility.

As news of Britain's effective default sank in, investors turned to the US as the guarantor of their gold holdings and precipitated an immediate run on the US banks as they sought to exchange dollars for gold – thereby forcing the Federal Reserve to raise interest rates in an attempt to protect its reserves. Thereafter, events followed a predictable pattern. Already under pressure, property prices and the mortgage banks collapsed (over 500 commercial banks failed in October 1931

alone) and, amid the disintegration of the gold standard, was born the Great Depression. When Roosevelt took office on 4 March 1933, one of his earliest acts was to issue Executive Order 6102 on 5 April 1933 'forbidding the Hoarding of Gold Coin, Gold Bullion, and Gold Certificates.' On pain of a US$10,000 fine or up to 10 years in prison, all persons were required to deliver on or before 1 May 1933 all gold coin, gold bullion and gold certificates owned by them to the Federal Reserve at the then official price of US$20.67/oz. Less than a year later, the Gold Reserve Act of January 30 1934 was passed and one day later the price of gold was fixed at US$35/oz (booking an almost US$3bn profit for the Treasury). While not a gold standard in the earlier sense, this price of US$35/oz was nevertheless destined to pertain for another 37 years as a pseudo-gold standard until the collapse of Bretton Woods in August 1971. In the meantime, restrictions on the private ownership of gold in the US were not lifted until 31 December 1974 under President Gerald Ford.

Exhibit 10: The gold price, nominal and real (US$/oz), 1913-2008

Note: Prices are annual averages.
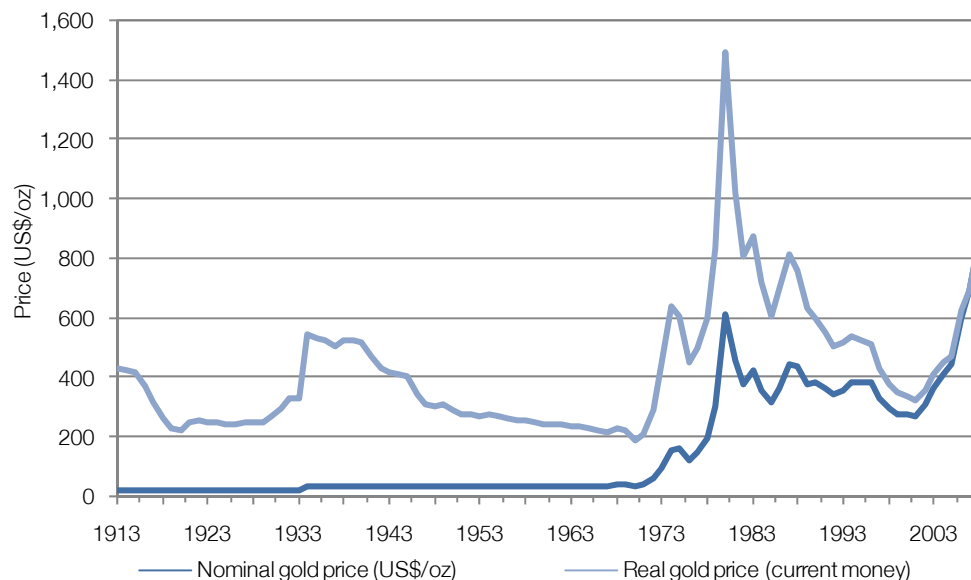
Source: Edison Investment Research, South African Chamber of Mines, US Department of Labor

Analysis and parallels

From 1913 to the present it can be seen that the price of gold in constant 2008 dollars has traded between US$200/oz and US$600/oz in cycles lasting up to 40 years (Exhibit 10). As such, the current price of around US$900/oz may be regarded as historically high. However, two other features of the market are also apparent:

- Prior to the end of fixed convertibility in 1971, gold performed best during periods of falling prices, whereas after 1971 it performed best during periods of rising prices.
- There has been increased volatility in the price since 1971.

If gold is to be analysed as a store of extrinsic value, then it is instructive to compare its actual price against the value that it should have had, assuming that it maintained its purchasing power relative to US inflation (as defined by the consumer price index, or CPI). This is shown in Exhibit 11, relative to both the first and last dates on which it was 'fixed' at US$35/oz.

Exhibit 11: US$35/oz gold price indexed with US CPI from January 1934 and August 1971
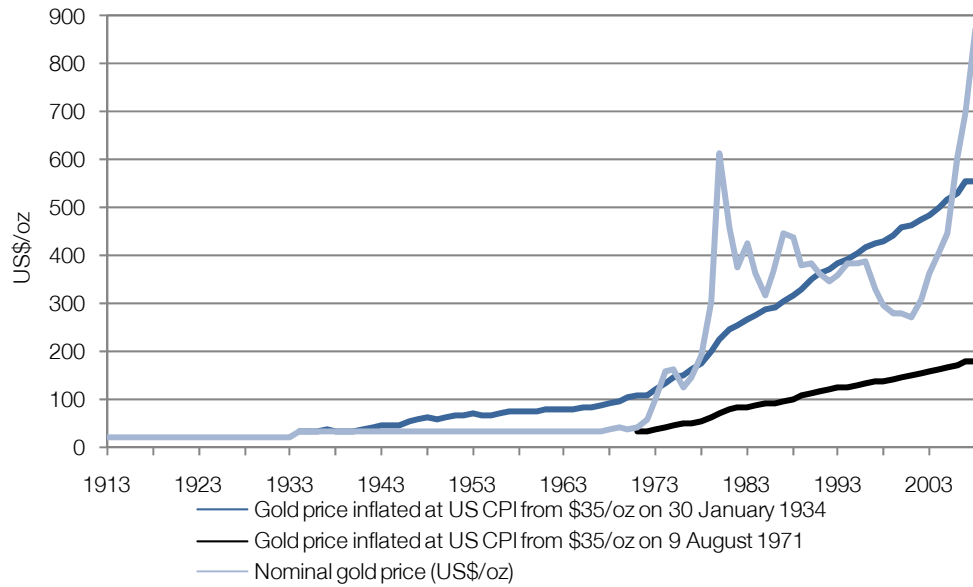
Source: Edison Investment Research, South African Chamber of Mines, US Department of Labor

From this graph, two things are immediately apparent.

- Gold has never again been as cheap in real terms as in 1971 (suggesting that this was a period of unnatural depression in the price).

- Since the end of formal convertibility the onset of the era of fiat money and inflation, gold has rarely traded at its 'correct' price of US$35/oz in 1934 dollar terms, but has instead oscillated about it in distinctive cycles.

It is beyond the scope of this document to explain the possible psychological causes of the recurrence of such cycles over 30 year periods except perhaps to observe that such an interval obviously represents approximately one generation in length. Nevertheless, the similarities between the periods 1971-1980 and 2001-present are striking. In both cases, the world's reserve currency, the US dollar, was suffering from the problem of twin deficits. Whereas the US had run a continuous balance of payments surplus since the second world war, in 1968 that surplus dropped by over 90% and then again by a further two-thirds in 1969. Although it recovered in 1970, in only two years since then (in 1973 and 1975) has the US again returned a balance of payments surplus. Similarly, while the federal government had recorded budget surpluses in eight of the 14 years between 1947 and 1960, in only five years since then (1969 and the period 1998-2001) has it done so again and it is currently forecasting a deficit of some 12.26% of GDP in 2009. In both eras there were oil 'shocks' and a belief that the US currency was unsustainable at levels then pertaining. France under General de Gaulle, for example, had a policy of redeeming all US dollars earned on its current account surplus for gold until at least 1970. In addition, there was also a severe equity slump in 1973-1974 and evidence of financial stress including a secondary banking crisis, with major corporations (eg Burmah Oil in the UK) failing.

Accepting the similarity of the situation during the 1970s to the present, we can depict the gold price cycle empirically by calculating the extent of over- or under-valuation of the gold price relative to its 'correct' US$35/oz in 1934 price (indexed for inflation), as shown in Exhibit 12.

Exhibit 12: Gold price US$ per oz/Gold price indexed at US CPI since US$35/oz in January 1934
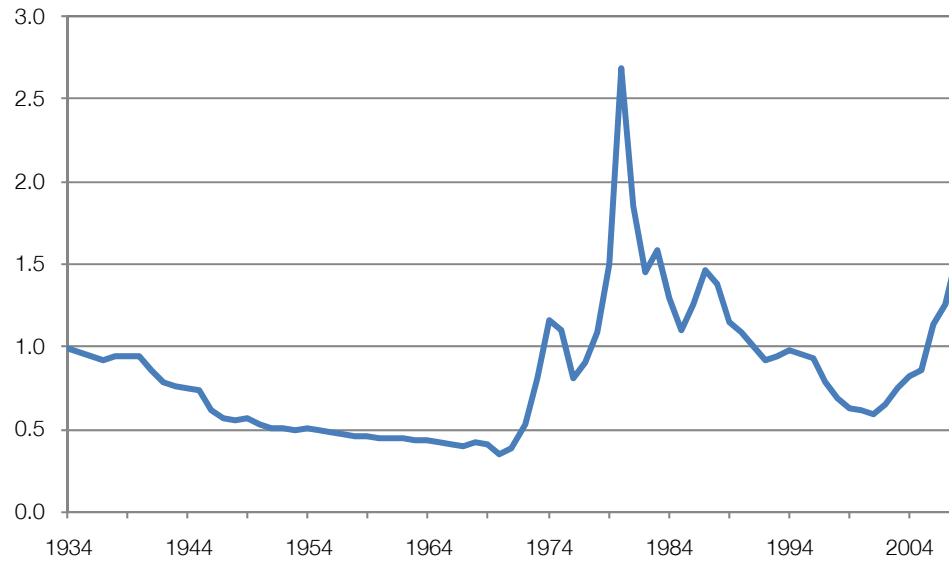
Source: Edison Investment Research

This graphically demonstrates the undervaluation of gold in 1970 and its subsequent over-valuation in 1980. In 1970, the discount of the actual price to the theoretically 'correct' indexed price was 66%, while in 1980 it was at a 169% premium.

What is also apparent is that, while not exceeding it, the discount of the actual to the 'correct' price of 42% at the nadir of the last gold bear market in 2001 was of the same order of magnitude as the earlier discount in 1970. On this basis, it would not be unreasonable to suppose that the extent of the premium in the current phase will be similar in magnitude to that experienced in 1980.

Plus ça change…

As is the case today, the crisis of the 1970s proceeded in two distinct phases. In the first, financial markets were sucked into a debt-deflation spiral coinciding with the first oil 'shock' and culminated in the stock market crash of 1973-1974.

After a good year in 1972, during which it rose 15%, in the 694 days between 11 January 1973 and 6 December 1974, the Dow Jones Industrials average lost 45% of its value, while the US economy slowed from 7.2% real GDP growth in 1972 to a 2.1% contraction in 1974.

While there was already inflation in the system as a result of the first oil shock, the subsequent use of excessively stimulative monetary policy to counteract the resulting recession then created a runaway wage-price spiral and a second peak in inflation later in the decade (see Exhibit 13).

Exhibit 13: US consumer price index, percent change year-on-year, 1965-2008
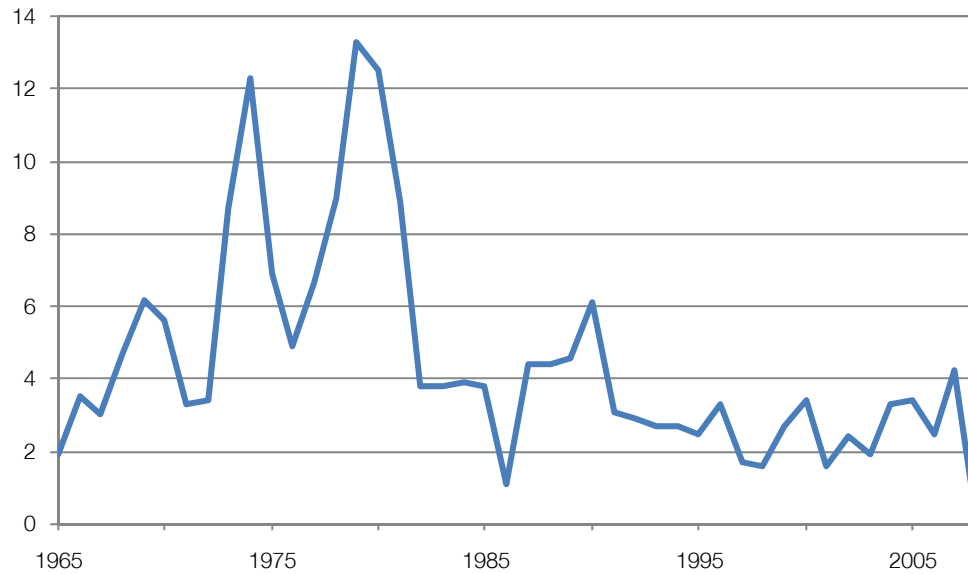
Source: US Department of Labor

In the current time, we have witnessed the superimposition of a similar oil shock upon a similarly stressed financial system to create a debt-deflation spiral to which the Federal Reserve has reacted by imposing a similarly stimulative monetary policy, expanding its balance sheet by an amount greater than 10% of US GDP.

While we believe we are currently undergoing a debt-deflation spiral analogous to the 1973-1974 experience, we also believe that the full consequences of the Fed's easing of monetary policy and the adoption of unconventional policy measures to combat recession have yet to be fully felt. As and when they are, we expect economies to suffer and a renewed inflationary peak analogous to that in 1977-1981.

… Plus c'est la même chose

While it is difficult to estimate the exact effect of such a reflation on the gold price, some idea may be gleaned by projecting a continuation of the cycle of gold relative to its 'correct' price of US$35/oz in 1934 adjusted for inflation. In order to create this projection, we have estimated that future US CPI will be 4.7% (being the average experienced in the US throughout the period of paper money from 1972 to the present), onto which has been superimposed the same cycle of discounts and premia in the future as were experienced in the period 1980-2001. This is shown in Exhibit 14.

Exhibit 14: Effect of repetition of the 1980-2001 gold price cycle in 2009-2030

Note: Prices are annual averages.
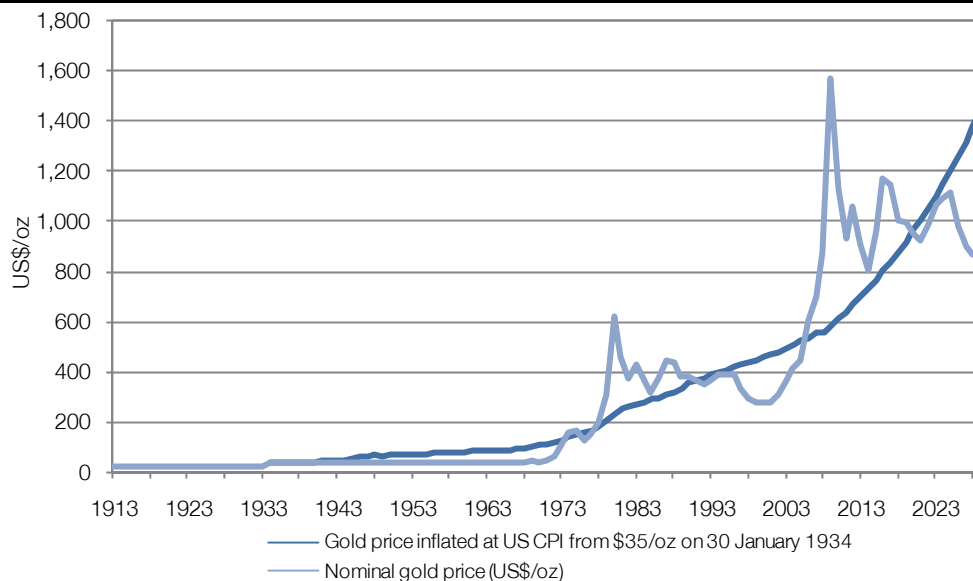
Source: Edison Investment Research, South African Chamber of Mines, US Department of Labor

This shows that, after hitting an annual average price of US$1,567/oz in the next two years, the price will then moderate as positive real interest rates are once again re-imposed on the economy (analogous to the sound money policies of Paul Volcker in the early 1980s). Significantly, a repetition of this pattern under these circumstances would also mean that the gold price is destined never again to fall below US$800/oz (on an annual average basis) and that it would average US$1,012/oz over the 21-year period to 2030.

Gold and interest rates – a special relationship

A special and often overlooked relationship exists between the price of gold and real US interest rates.

The structure of the gold market is such that in periods of 'normal' economic activity (eg 1950-1970 and 1980-2001), the natural supply of gold is less than the demand for gold. The balance is made up by a combination of sales from the official sector (ie central banks) and hedging, as shown in a typical year in Exhibit 15.

Exhibit 15: Western world gold supply, 1995 (%)

Option hedging 3%
Forward gold sales 14%
Western world mine production 56%
Old gold scrap 17%
Net official sales 7%
Net Communist/CIS sales 4%
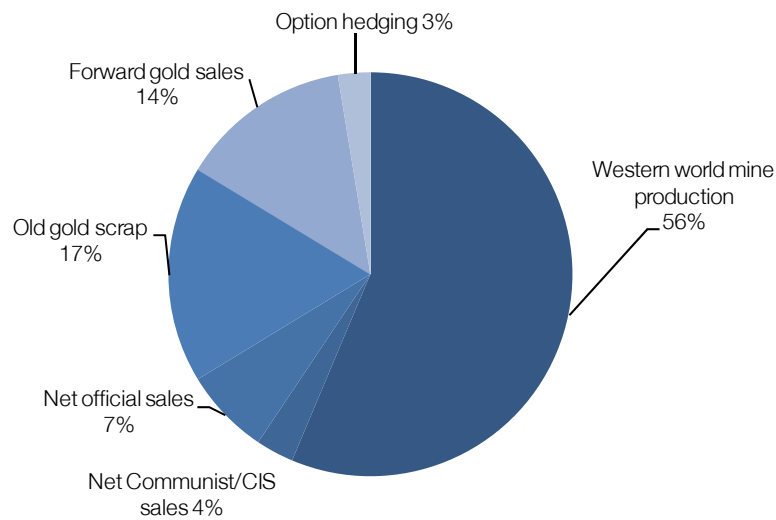
Source: GFMS

The mechanism by which producer hedging appears as supply reflects the relationship between producers, bullion banks and central banks. In particular, while not always available for sale, the approximately 30,000 tonnes (t) of gold residing in the vaults of central banks is often instead available for lease in order that central banks may earn some sort of income return on their asset. At the same time, producers are ordinarily in a position in which they are looking to sell future production of gold forward. The reasons for this are twofold. Firstly, new producers are often required to sell forward a portion of their future production in order to guarantee revenues as a condition of receiving financing for their projects. Secondly, since the gold market is usually in contango (that is to say, the forward price of gold is higher than the spot price), they get a higher price for doing so than they would if they simply sold into the spot market instead. The nexus of these two commercial interests are the bullion banks.

When a bullion bank buys gold forward, it will typically seek to offset its position by leasing gold from a central bank and selling it on the spot market. This procedure has two consequences. First, the bullion bank is protected against future volatility in the gold price. Second, it generates a cash position, which the bullion bank typically puts on deposit at the dollar LIBOR rate of interest. When the forward contract is due for settlement, the producer delivers its gold to the bullion bank in return for payment and the bullion bank then delivers the metal back to the central bank. However, the whole process is dependent upon the real return from the bullion bank's cash position more than covering the cost of leasing the gold from the central bank plus the contango (ie the premium of the forward price over the spot price). This may be expressed as follows:

$$\text{Real LIBOR} \geq \text{Contango} + \text{Lease rate}$$

When real interest rates become negative, this dynamic breaks down.

Since lease rates are invariably positive, real negative interest rates can only be balanced by a negative contango (ie a forward price lower than the spot price – or backwardation). Under these circumstances, all the producers that are able look instead to sell their gold onto the spot market

rather than the forward one and the accelerated supply of gold from central banks dries up, leaving the physical market undersupplied. This undersupply is then exacerbated by the fact that producers are still required to deliver metal into their existing hedge positions and thence via the bullion banks back to the central banks. Hence, during times of negative real interest rates, not only is there a lack of accelerated supply reaching the market from the central banks, but there is also accelerated demand into the central banks – all at a time when the physical market is already structurally undersupplied. The net effect of negative real rates is thus to convert accelerated supply into accelerated demand. With mines unable to respond rapidly to supply shortfall, this only increases the upward pressure on spot prices. The disappearance of this accelerated supply into the market is demonstrated in Exhibit 16 for 2002.

Exhibit 16: World gold supply, 2002
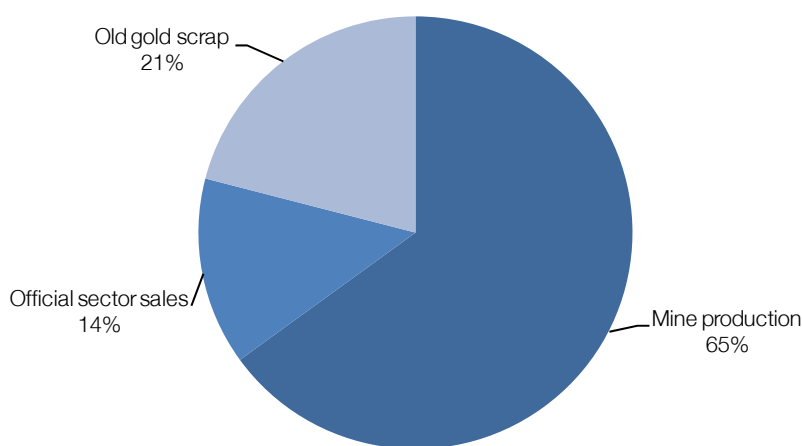
Source: GFMS

Compared to Exhibit 15, the effect of the aftermath of the 9/11 terrorist attacks on the United States and the Federal Reserve's subsequent easing of monetary policy resulting in negative real interest rates can be clearly seen, with no contribution to supply from financial transactions whatsoever in 2002. Instead, the accelerated supply of 1995 relating to hedging transactions was converted into accelerated demand, as shown in Exhibit 17.

Exhibit 17: World gold demand, 2002
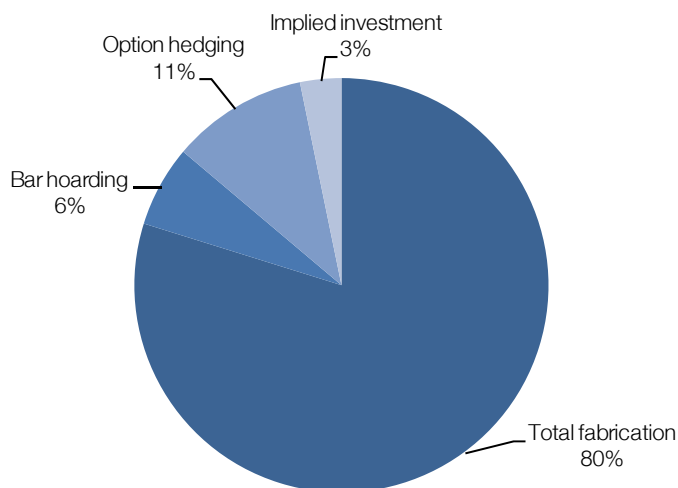
Source: GFMS

Across the entire period, the effect of negative real interest rates was therefore to convert an environment of permanent accelerated supply prior to 2001 of up to 500 tonnes per year into one of accelerated demand of approximately the same magnitude in just two years, as shown in Exhibit 18.

Exhibit 18: Net effect of all financial transactions on gold market supply/(demand), 1995-2002
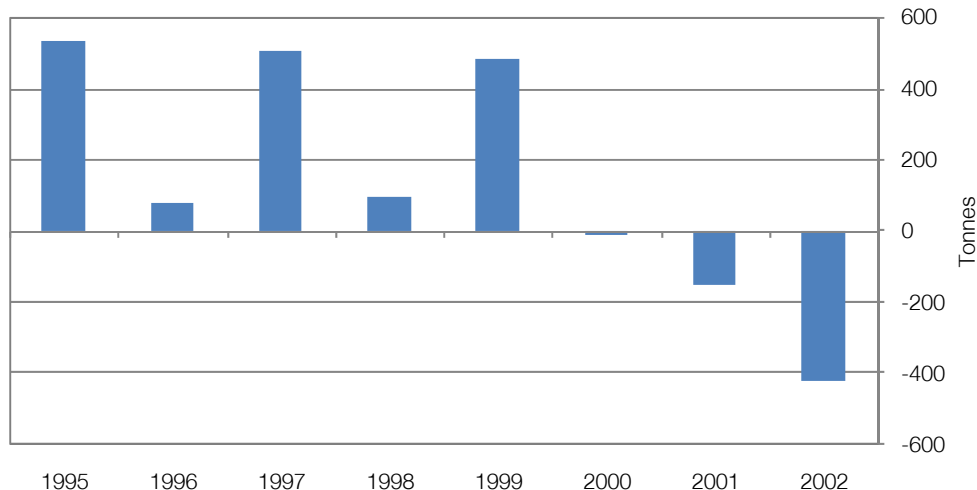
Source: GFMS

At a time when total supply was of the order of 4,000 tonnes of gold per annum, such a change represented an approximate 20% swing away from supply towards demand. Thus it is no coincidence that both the period 1970-1980 and the period 2001-present witnessed sharp reductions in real interest rates being coincident with a rapidly rising gold price. Moreover, the market is such that upward pressure is likely to continue to persist as long as US real interest rates are expected to remain either negative or at very low levels.

Gold and oil – a causal relationship

In addition to its close relationship with interest rates, the gold price also has a close relationship with oil. Indeed, since the first moves to demonetise gold in 1968, the correlation between the two, as measured by the Pearson Product Moment Coefficient, has been 0.84 (on a scale between -1 for a perfect negative correlation and +1 for a perfect positive correlation). Given the amount of data in the analysis, this is said to be statistically significant at the 5% level. That is to say, there is less than a 5% possibility that this correlation occurred by chance. The obvious rationalisation for this correlation is that oil-related costs can make up 40% of a gold mining operation's cost base. If the two prices do not move in tandem, therefore, it exposes gold miners to the possibility of excessive profits or losses over extended periods of time. Either way, the free market reaction to such unnaturally large profits (or losses) is likely to be an alteration of the supply-demand balance of either product such that the two ultimately come back into alignment. Nevertheless, it also allows us to predict the future price of gold within the context of our expected future, long-term oil price. The results of such an analysis are shown in Exhibit 19.

Exhibit 19: Price of gold (US$/oz) derived from future expected long-term price of oil (US$/bbl)

Expected, long-term oil price (US$/bbl)	50	75	100	125	150
Implied gold price (US$/oz)	589	835	1,081	1,327	1,572

Source: Edison Investment Research