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Gold mining companies and the price of gold ☆

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ABSTRACT

This paper studies the exposure of Australian gold mining firms to changes in the gold price. We use a theoretical framework to formulate testable hypotheses regarding the gold exposure of gold mining firms. The empirical analysis based on all gold mining firms in the S&P/ASX All Ordinaries Gold Index for the period from January 1980 to December 2010 finds that the average gold beta is around one but varies significantly through time. The relatively low average gold beta is attributed to the hedging and diversification of gold mining firms. We further find an asymmetric effect in gold betas, i.e. the gold exposure increases with positive gold price changes and decreases with negative gold price changes consistent with gold mining companies exercising real options on gold.

1. Introduction

Investors who want exposure to the price of gold can buy gold bars, gold coins, shares of exchange-traded funds on gold or invest in gold mining firms. Theoretically, the latter provides a leveraged investment into gold since a share in a gold mining firm does not only give access to one unit of gold but a share in the total future production of the gold miner. If a gold mining firm further uses managerial flexibility to expand in times of rising gold prices and to contract (including the temporary closure of mines) in times of falling gold prices, gold mining shares may be a superior alternative to physical gold investments. In other words, since gold mining firms hold real options on gold with the exercise price being their marginal production costs, they can provide an asymmetric exposure to gold yielding higher returns.

This study aims to analyze the performance of gold mining firms relative to the price of gold and provide information about the value of the real options held by the firms, the hedging activities and the managerial flexibility of the firms. We focus on firms that are part of the Australian gold mining company index listed on the Australian stock exchange. Since Australia is the second largest gold producing country[1] an analysis of Australian gold mining firms can provide interesting results on its own and if compared to the literature that focussed on other countries.

The strong positive trend in the price of gold between 2004 and 2010 provides an additional motivation and feature that is particularly interesting for the question whether gold mining firms actively use their real options on gold and thus provide an asymmetric exposure to gold price changes. The 2004–2010 period is also characterized by the introduction and increased popularity of exchange-traded funds on gold. Since shares in exchange-traded funds are financial claims on gold and thus an alternative to both direct physical investments and equity investments an analysis of this period can provide information on how the introduction and presence of ETFs on gold have affected the exposure of gold mining firms to the price of gold.

This study is related to earlier work that analyzes the stock price exposure of gold mining firms to gold (see Blose & Shieh, 1995; Faff & Chan, 1998; Faff & Hillier, 2004; Tufano, 1996; Tufano, 1998; Twite, 2002). While many studies focus on North American gold mining firms (e.g. Tufano, 1996, 1998), this research follows Faff and Chan (1998) and Twite (2002) and studies Australian gold mining firms but extends the existing literature as follows: First, we use a theoretical framework to formulate hypotheses about the gold exposure of gold mining firms. Second, by using the longest sample period among all existing studies the data comprise significant bear and bull market regimes and are thus well-suited for an analysis of asymmetric gold betas and real optionality. Relatively short sample periods may not be composed of different gold market conditions or regimes and thus provide biased estimates of the importance of real optionality.[2] Third, we analyze the exposure of gold mining firms assuming constant, asymmetric and time-varying exposure.

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[1] Australia produced the second largest amount of gold (in tonnes) in 2011 and 2012. China is the largest producer and the US is the third largest producer (see Thomson Reuters GFMS Gold Survey, 2013).

[2] The relatively stable gold price in the 1990s is an example of a period that is not composed of different gold market conditions or regimes.

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Table 1
Descriptive statistics—weekly returns.

	Mean	Std. dev.	Skewness	Kurtosis	Min	Max	JB stat	*p*-value	Box–Ljung	*p*-value	Nobs
ALLIANCE RESOURCES	−0.0013	0.1282	0.1253	5.1340***	−0.4626	0.5108	162.56	0.00	13.86	0.02	845
ALLIED GOLD MINING CDI.	0.0039	0.0962	0.1677	5.0046***	−0.3552	0.4140	63.34	0.00	6.04	0.30	368
AMPELLA MINING	0.0172	0.1395	−0.0868	4.4963***	−0.4700	0.4700	16.64	0.00	8.24	0.14	176
ANGLOGOLD ASHANTI CDI.	0.0002	0.0534	−0.0061	4.8731***	−0.2453	0.2280	84.79	0.00	14.72	0.01	580
AZUMAH RESOURCES	0.0039	0.1106	−0.2086	3.6000*	−0.3365	0.2877	5.76	0.06	3.34	0.65	259
BEADELL RESOURCES	0.0041	0.1679	−0.2566	9.4786***	−0.8873	0.6190	299.17	0.00	10.12	0.07	170
CGA MINING	0.0020	0.1334	−0.0034	11.7517***	−0.6931	0.7621	3657.31	0.00	36.91	0.00	1146
CHALICE GOLD MINES	0.0042	0.0999	0.1889	4.1931***	−0.3254	0.4055	16.18	0.00	21.20	0.00	248
ELDORADO GOLD CDI.	0.0048	0.0494	0.1275	2.9235	−0.0940	0.1392	0.16	0.92	7.54	0.18	55
EVOLUTION MINING	0.0014	0.1145	1.2638***	8.7278***	−0.3567	0.6168	712.08	0.00	32.20	0.00	436
FOCUS MINERALS	−0.0023	0.1328	0.3388**	5.4762***	−0.4055	0.6931	147.46	0.00	30.26	0.00	537
GOLD ONE INTERNATIONAL	−0.0069	0.1326	0.6571***	12.5044***	−0.5894	0.9555	1975.48	0.00	21.32	0.00	515
GOLDEN WEST RESOURCES	0.0036	0.1197	1.0554***	7.0746***	−0.3102	0.6221	274.63	0.00	3.11	0.68	313
GREENLAND MRLS.& ENERGY	0.0062	0.1769	5.1138***	53.2323***	−0.3629	1.8608	25,840.87	0.00	1.50	0.91	236
IMX RESOURCES	0.0029	0.0895	0.3808***	7.0617***	−0.5543	0.4733	556.45	0.00	3.99	0.55	782
INTREPID MINES	0.0011	0.1060	−0.1779	7.7300***	−0.5390	0.4590	537.17	0.00	8.45	0.13	573
KENTOR GOLD	−0.0026	0.1391	0.0310	6.6343***	−0.6931	0.5596	165.70	0.00	9.48	0.09	301
KINGSGATE CONSOLIDATED	0.0047	0.0858	0.4582***	8.2799***	−0.3651	0.5581	935.70	0.00	4.54	0.47	782
KINGSROSE MINING	0.0088	0.1221	−0.2456	5.3020***	−0.4055	0.4055	36.71	0.00	2.97	0.71	159
MARENGO MINING	0.0021	0.1134	0.2511	7.0500***	−0.6286	0.4626	257.46	0.00	10.65	0.06	371
MEDUSA MINING	0.0086**	0.0734	0.1080	4.2545***	−0.2433	0.3102	24.71	0.00	2.84	0.73	366
MORNING STAR GOLD NL	0.0001	0.1449	−0.8026***	18.3363***	−1.4271	0.8473	7737.73	0.00	29.94	0.00	781
NEWCREST MINING	0.0016	0.0608	−0.0465	5.7747***	−0.3804	0.2771	377.02	0.00	8.02	0.16	1174
NOBLE MINERAL RESOURCES	0.0038	0.1544	1.8588***	14.8859***	−0.5306	0.8575	840.09	0.00	4.86	0.43	130
NORTON GOLD FIELDS	0.0004	0.1209	0.3266	3.8655**	−0.3677	0.4796	13.47	0.00	10.21	0.07	275
OCEANAGOLD CDI.	−0.0004	0.1185	−0.3269	5.3697***	−0.4463	0.3950	46.33	0.00	8.71	0.12	184
PENINSULA ENERGY	0.0000	0.1730	0.0644	7.6622***	−0.6931	0.6931	783.99	0.00	48.04	0.00	865
PERSEUS MINING	0.0093*	0.0978	0.2678	5.5293***	−0.3637	0.4329	91.07	0.00	7.77	0.17	327
RAMELIUS RESOURCES	0.0052	0.1174	2.9273***	27.1985***	−0.2787	1.1550	10,434.01	0.00	5.23	0.39	404
RED 5	0.0003	0.1171	0.2544*	4.5949***	−0.4055	0.4463	86.53	0.00	15.72	0.01	741
REGIS RESOURCES	0.0006	0.1383	−0.8380***	27.6650***	−1.3863	1.0986	28,801.43	0.00	3.02	0.70	1131
RESOLUTE MINING	0.0002	0.0776	0.1178	6.1162***	−0.4418	0.3512	466.33	0.00	3.66	0.60	1146
SARACEN MINERAL HDG.	0.0042	0.1621	3.8515***	63.0453***	−1.0986	2.3026	11,9410.69	0.00	6.20	0.29	782
SIHAYO GOLD	−0.0007	0.1380	0.3205**	5.7380***	−0.6931	0.6931	257.65	0.00	24.52	0.00	782
SILVER LAKE RESOURCES	0.0110	0.1032	0.5582*	3.9940**	−0.2624	0.3677	15.17	0.00	5.08	0.41	163
SOUTH BOULDER MINES	0.0059	0.1460	1.1724***	9.9199***	−0.5108	1.0116	834.12	0.00	5.90	0.32	375
ST BARBARA	0.0000	0.1043	0.3469***	8.4638***	−0.6931	0.6931	2043.80	0.00	14.90	0.01	1617
TALISMAN MINING	0.0057	0.1485	0.6947***	5.9674***	−0.4700	0.7282	118.54	0.00	3.25	0.66	265
TANAMI GOLD	−0.0012	0.1076	0.6678***	8.2678***	−0.5108	0.7563	1406.54	0.00	15.12	0.01	1143
TROY RESOURCES	0.0038	0.0816	0.1066	5.9118***	−0.4329	0.3909	277.73	0.00	14.38	0.01	782
Stock market	0.0015**	0.0248	−1.8608***	29.1070***	−0.3503	0.1193	46,854.22	0.00	17.67	0.00	1617
Gold (USD)	0.0006	0.0254	0.3990***	9.4933***	−0.1238	0.2133	2883.60	0.00	10.36	0.07	1617
Gold (AUD)	0.0007	0.0253	0.6309***	9.4289***	−0.1578	0.1565	2891.96	0.00	4.08	0.54	1617

The JB (Jarque–Bera) statistics and the corresponding *p*-values indicate that the returns are not normally distributed.
The LB (Ljung–Box) statistics and the corresponding *p*-values indicate that the majority of returns do not exhibit significant serial correlation.
*, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Our estimates provide evidence for average gold betas around one. These estimates are lower than reported in Blose and Shieh (1995) and Tufano (1998) which report gold betas around 1.5 for North American gold mining companies but consistent with the findings of Coleman (2010) and Twite (2002) which report similar gold betas for Australian gold mining companies. The different gold betas estimated in this study are a result of the significantly longer sample period. Since Blose and Shieh (1995) and Tufano (1998) only use a ten-year (1981–1990) and four-year (1990–1994) sample period for their analysis, respectively, it is not surprising that the gold betas are different. A sub-sample analysis of the Blose and Shieh (1995) and Tufano (1998) sample periods yields similar gold betas. Potential economic reasons for the lower gold beta are hedging and diversification. These reasons can be clearly distinguished from the asymmetric effect of gold betas which support the hypothesis that gold mining firms exercise the real options derived from the mining activities. Finally, the significant and relatively large exposure of gold mining firms to the Australian stock market illustrates that gold mining firms offer both exposure to the equity market and the gold market.

The remainder of this paper is divided into four sections. Section one contains a description of the sample, section two discusses theoretical predictions regarding the exposure of gold mining firms to the price of gold and formulates testable hypotheses, and section three presents the estimation results and discusses its implications. Finally, section four summarizes the main findings and provides concluding remarks.

2. Sample description

This section presents the sample of gold mining firms, gold prices, exchange rates and stock index data. The core of the sample consists of 41 gold mining firms that are the constituents of the ASX All Ordinaries Gold Equity Index obtained at a daily frequency from January 1, 1980 until December 31, 2010.[3] Table 1 displays all gold mining firms and descriptive statistics of the weekly share price returns of each firm. The descriptive statistics are based on 30 years of weekly data between 1980 and 2010. The number of observations varies across firms and ranges between 55 and 1617 observations. Firms with only a small number of observations are firms that became publicly listed companies only recently, e.g. Beadell Resources (in 2007), Eldorado Gold CDI (in 2009), Nobel Mineral Resources (in 2008) and Silver Lake Resources (in 2007).

[3] The firms were the constituents of the index as of December 31, 2010. The data were obtained from Thomson Reuters Datastream. Two firms were eliminated since the number of observations was too low.