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Market Interdependence; Gold Bullion, S&P500, Mining Company ADR's and Underlying Security Markets

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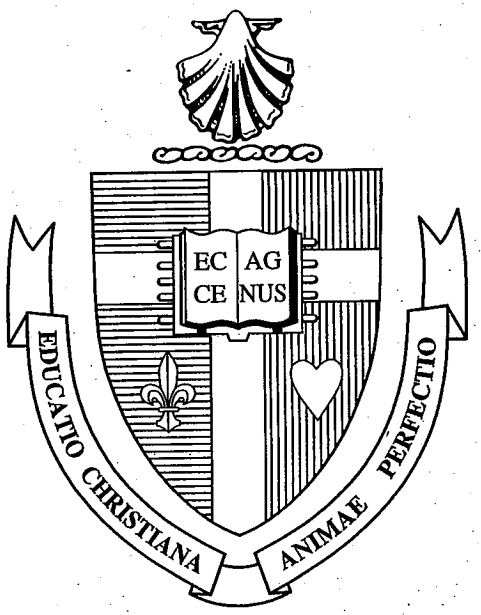

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ABSTRACT

The internationalization of equity markets appears to be associated with a level of interdependence and transmission of stock price movements across nati markets. This study examines the responses of international and ADR securities common stimulus. The study analyzes the interdependence of a commodity inde the equity price behavior of companies engaged in the production of such comm which are cross-listed in U.S. equity markets through ADRs and in underlying ec markets. The results suggest that the ADR markets are more efficient than the ur shares in reflecting information originated in commodity markets.

I. INTRODUCTION

The internationalization of equity markets appears to be associated with a higher level of interdependence and transmission of stock price movements across national markets. This trend has been more pronounced since the 1987 U.S. stock market crash. This event provided much of the motivation to study the transmission of stock market movements, i.e. the spillover effects across equity markets. This area of research continues to evolve as markets experience increased volatility, however most studies focus on identifying spillover effects across developed equity markets. Only a few studies examine the transmission of stock market movements between developed and emerging equity markets e.g., Liu and Pan (1997); Soydemir (2000).

This study examines market interdependence through a comparative analysis of two major gold firms that trade on international markets and on the New York Stock Exchange through American Depositary Receipts (ADRs). The firms examined are the Ashanti Goldfields Company Limited whose primary headquarters is in Ghana, and the Compañia de Minas Buenaventura with primary headquarters in Peru. Their shares trade on a common exchange in the New York Stock Exchange, with regional listings on multiple exchanges including Australia, Ghana, London, Toronto, Zimbabwe and Lima.

Specifically, this study measures the spillover effects into three markets – New York (Ashanti and Buenaventura ADRs), Australia (Ashanti's underlying shares) and Lima (Buenaventura's underlying shares) in response to developments impacting the gold market and the U.S. equity market. The analysis covers the May 1996 through January 2001 period. During this period the price of gold declined from an average of $387.85 to $263.80 per troy ounce. The gold bullion market has been significantly impacted by announced liquidation of Central Bank gold reserves, currency crises, the Bre-X scandal and political events. This study examines the domestic and ADR prices of two gold companies to determine the impact of events in the industry and in different geo-political environments to determine implications for asset pricing.

Ashanti Goldfields

Ashanti Goldfields Company Limited is among the top 15 gold mining companies in the world. Ashanti began underground gold mining at the Obuasi site in Ghana in 1907. The site has the richest goldfield in the world. The company has transitioned itself from a single-mine to a multimine company with international operations.

The Ghanaian government has been gradually privatizing its ownership stake in the Ashanti Goldfields Company. Recognizing the limitations of the local exchange's ability to absorb the shares of Ashanti, the government initially floated shares on the London Stock Exchange. The company's ordinary shares are traded on the following international stock exchanges: Australia (AHA); Ghana (AGC); London (AGLS); New York (ASL); Toronto (AHD.U); and Zimbabwe.[1]

[1]The Company's shares are traded on the London, New York and Toronto stock exchanges by way of sponsored American Depositary Receipts (ADRs) and Global Depositary Receipts (GDRs). The securities are also traded as ordinary shares on the Australian, Ghanaian and London stock exchanges. On the Zimbabwe Stock Exchange, the Company's securities are traded by way of sponsored Zimbabwe Depositary Receipts (ZDRs) and are also traded as ordinary shares.

On February 21, 1996, Ashanti became the first African security to be liste New York Stock Exchange. The simultaneous listing of Ashanti on the Ghana S Exchange and on other international exchanges has given its stock an internati dimension and stature. Since the Ghanaian Stock Exchange only trades on Mor Wednesday and Friday, in order to examine the daily impact of shocks in the g U.S. equity markets, the analysis of the underlying share returns will use data g in the Australian securities market as they offer daily trading and are also the b ADRs.

Compañia de Minas Buenaventura

Compañia de Minas Buenaventura S.A.A. (Buenaventura) is Peru's largest precious metals mining company and a major holder of mining rights in Peru. are listed on the New York Stock Exchange and the Lima Stock Exchange (NY Lima Stock Exchange: BUE.LM). As of December 31, 1998 60.31% of the firm's were held by national shareholders and 39.69% were held by foreign shareho "B" Shares of the Peruvian Company Minas were listed on the New York Stock in May of 1996.

The company mines, explores and markets polymetallic ores with import contents of gold and silver; in addition the Company keeps interests in other r companies such as Minera Yanacocha S.A. The company's main subsidiaries ar in mining copper, zinc, lead, gold and silver ores, transmitting electric energy t sites; and developing projects and geological studies and engineering works.[2]

A Comparison of Firms' Characteristics and Performance

As previously noted, this study examines the issue of market interdepenc through two gold firms that are listed on a common ADR market, yet have un shares that trade on different securities markets. Comparative data for the firm reported in Table 1. Buenaventura is a more diversified mining firm with subst production in silver, zinc and lead, and although smaller than Ashanti in terms production its February 28, 2001 market capitalization was four times that of A reflecting lower production costs. Despite differences in firm characteristics, bo exchange listings represent excellent proxies for examining the transmission o effects due to market events from a domestic exchange to an international ma

[2]http://cbs.marketwatch.com/tools/quotes/profile.asp?symb=BUENAVENTURA (2001 Ma

TABLE 1: SECURITIES DATA

	Ashanti	Buenaventura
NYSE ADR Listing	February 1996	May 1996
Exchange Listing	Australia, Ghana, London, Toronto, Zimbabwe	Lima
2000 Gold Production	1,737,264 oz.	915,166 oz.*
1999 Gold Production	1,561,536 oz.	777,314 oz.*
Institutional Owners	19.5%	20.7%
Revenue 2000 Million $	$582	$136
Net Income 2000 Million $	($141)	$89
Market Capitalization Million $	264	1,065
Debt/Equity	149%	6%
Beta	-0.72	0.07
Underlying Exchange	Australia	Peru

*Includes BVN's equity oz. in Yanacocha's mines

In contrast to Ashanti's internationally diversified portfolio of mining properties, BVN's operations are concentrated in Peru. Both firms engage in hedging strategies that sell gold production forward. Ashanti's more aggressive hedging strategy for its gold production is reflected in the higher debt/equity ratio and significantly higher (and negative) Beta. In addition, Ashanti confronted a significant liquidity crisis in its hedge book in October 1999 that resulted in an agreement with counterparties to exempt the firm from margin calls in return for the issuance of warrants. In contrast, BVN operates a less aggressive hedging strategy. Over the five-year period to November 2001, Buenaventura shares outperformed the Gold and Silver Metal Index, whereas Ashanti shares clearly underperformed the reference Index.

Gold Market Environment

During the third quarter 1999, up to September 26, the price of gold remained at a level of around U.S. $255-260 per ounce. The price of gold was generally considered to be depressed during this period by concerns about actual and potential sales of gold by official holders, including the Bank of England, the International Monetary Fund and the Swiss government. The market changed significantly as a result of the announcement on September 26 by 15 European Central Banks ("ECB") of an agreed program of actions to limit official gold sales and gold lending over the next five years. This announcement triggered a rapid rise in the price of gold. Altogether, the gold price rose by almost U.S. $90 per ounce in the space of two weeks (including U.S. $75 per ounce in the space of four trading days), touching a high point of U.S. $338- 340 per ounce on October 6.

These price movements occasioned increases in implied short-term volatility from the previous levels of about eight percent to levels of about 40 percent. Severe shortages of gold liquidity also led to high gold lease rates. During most of October 1999, the gold price traded in a range of U.S $300-320 per ounce, with volatilities and lease rates remaining high. Towards the end of October, the gold price decreased to a range of about U.S. $290-300 per ounce, while short-term volatilities fell to about 25 percent, and six-month gold lease rates to about 2.5% per annum.

Spillover Effects Across Equity Markets

Eun and Shim (1989) investigate the international transmission mechanism market movements among nine developed markets prior to the October 1987 st market crash (specifically, the 1980-1985 period). Using a vector autoregression model, the authors find a substantial amount of multi-lateral interaction among stock markets with innovations in the U.S. market being transmitted rapidly to c markets in a clearly recognizable fashion, while no single foreign market can si explain the U.S. market movements.

Karolyi and Stulz (1996) investigate U.S.-Japan stock return co-movements u for the 1988-1992 period. They find that U.S. macroeconomic news announcem shocks to the yen/dollar foreign exchange rate, Treasury bill returns and industi have no measurable influence on U.S. and Japanese return correlations. Howev shocks to broad-based market indexes positively impact both the magnitude an persistence of the return correlations.

Liu and Pan (1997) study the U.S. and Japanese linkages with four emergi markets. Investigating the mean return and volatility spillover effects from the U Japanese markets to Hong Kong, Singapore, Taiwan and Thailand for the 1984-: period, they finding that the U.S. market is more influential than the Japanese ir transmitting returns and volatilities to the Asian markets. The spillover effects in substantially after the October 1987 stock market crash.

Soydemir (2000) investigates the transmission patterns of stock market mo between developed and emerging economies. He considers four Latin American (Argentina, Brazil, Chile and Mexico) and identifies differences in the pattern of transmission of stock market movements associated with differences in trade lin findings suggest that the transmission of stock market movements may be assoc underlying economic fundamentals.

To the best of our knowledge no study has previously analyzed simultane transmission of market movements from a commodity market and U.S. equity m into the securities issued by companies producing such commodities. Therefore, study contributes to the existing literature by studying the markets for gold, the underlying share markets simultaneously to analyze the transmission of price mc from the gold and U.S. equity markets into these securities.

II. RESEARCH METHODOLOGY

To investigate the dynamic interactions among the markets, five-variable ve autoregression (VAR) models are fitted. The first VAR model considers the follow markets: Gold Bullion (G-Bullion), Ashanti ADR (ASH-ADR), Buenaventura ADR ADR), Ashanti's underlying shares listed in Australia (ASH-UND) and Buenaventi underlying shares listed in Peru (BNV-UND). The second VAR model considers t S&P500 equity market index (SP500), and the ADRs and underlying shares listed first VAR model.

A VAR model is a dynamic simultaneous equation system with uniform set lagged dependent variables as regressors. A VAR representation of a system of e is particularly useful when trying to understand empirical regularities embedded series data since structural equations are difficult to specify correctly (Sims, 1980 first VAR model is represented by the following system of equations:

$$GBullion_t = \alpha_{1t} + \sum_{j=1}^{k} \tau_{1j} GBullion_{t-j} + \sum_{j=1}^{k} \beta_{1j} ASHADR_{t-j} + \sum_{j=1}^{k} \vartheta_{1j} BNVADR_{t-j} + \sum_{j=1}^{k} \eta_{1j} ASHUND_{t-j} + \sum_{j=1}^{k} \gamma_{1j} BNVUND_{t-j} + u_{1t} \quad (1_a)$$

$$ASHADR_t = \alpha_{2t} + \sum_{j=1}^{k} \tau_{2j} GBullion_{t-j} + \sum_{j=1}^{k} \beta_{2j} ASHADR_{t-j} + \sum_{j=1}^{k} \vartheta_{2j} BNVADR_{t-j} + \sum_{j=1}^{k} \eta_{2j} ASHUND_{t-j} + \sum_{j=1}^{k} \gamma_{2j} BNVUND_{t-j} + u_{2t} \quad (1_b)$$

$$BNVADR_t = \alpha_{3t} + \sum_{j=1}^{k} \tau_{3j} GBullion_{t-j} + \sum_{j=1}^{k} \beta_{3j} ASHADR_{t-j} + \sum_{j=1}^{k} \vartheta_{3j} BNVADR_{t-j} + \sum_{j=1}^{k} \eta_{3j} ASHUND_{t-j} + \sum_{j=1}^{k} \gamma_{3j} BNVUND_{t-j} + u_{3t} \quad (1_c)$$

$$ASHUND_t = \alpha_{4t} + \sum_{j=1}^{k} \tau_{4j} GBullion_{t-j} + \sum_{j=1}^{k} \beta_{4j} ASHADR_{t-j} + \sum_{j=1}^{k} \vartheta_{4j} BNVADR_{t-j} + \sum_{j=1}^{k} \eta_{4j} ASHUND_{t-j} + \sum_{j=1}^{k} \gamma_{4j} BNVUND_{t-j} + u_{4t} \quad (1_d)$$

$$BNVUND_t = \alpha_{5t} + \sum_{j=1}^{k} \tau_{5j} GBullion_{t-j} + \sum_{j=1}^{k} \beta_{5j} ASHADR_{t-j} + \sum_{j=1}^{k} \vartheta_{5j} BNVADR_{t-j} + \sum_{j=1}^{k} \eta_{5j} ASHUND_{t-j} + \sum_{j=1}^{k} \gamma_{5j} BNVUND_{t-j} + u_{5t} \quad (1_e)$$

where $GBullion_t$, $ASHADR_t$, $BNVADR_t$, $ASHUND_t$ and $BNVUND_t$ represent the gold market, Ashanti ADR, Buenaventura ADR, Ashanti's Australian shares and the Buenaventura's Peruvian shares, respectively (VAR models are estimated using gold bullion and U.S. S&P500 index separately); the α and υ coefficients represent the intercept and the random error terms, respectively; τ_{1j}, β_{2j}, ϑ_{3j}, η_{4j}, and γ_{5j} are coefficients of the lagged values of dependent and independent variables; and lastly, k represents the lag-length.

Lag-length tests were conducted to determine the optimal lag structure. The lag-length tests based on the Akaike Information Criterion (AIC) indicated that the use of 8 lags was sufficient to maximize the absence of autocorrelation in the residuals. The ordering of variables was modified to determine whether VAR results are sensitive to the order in which the variables are entered. The results of the estimations using different orderings suggest that the results are not sensitive to the ordering employed.

Prior to estimating the VAR models, the time series properties of portfolios of the series are explored to identify whether those series have a constant mean and variance. To accomplish this, each price series is pre-tested for stationarity using an Augmented Dickey-Fuller (ADF) test. The results reveal that the series are not stationary in the form of logarithmic levels, but stationary in the form of logarithmic first differences. Because the series are integrated of order one, the Johansen's (1988) multivariate cointegration test is performed to see whether there is cointegration among the series in the VAR model. The cointegration tests reveal no long-run relationships among the series and therefore VAR models estimated in logarithmic first differences are not misspecified.[3]

From the VAR model one can obtain the Impulse Response Functions (IRFs) and the decomposition of the forecast error variance (VDCs). IRFs trace the response of one market over time to a one-time shock or innovation artificially introduced in any other market in the VAR model, including itself. Innovations may be defined as a one-standard-deviation increase in returns in a market. Therefore, it is possible to measure how rapidly information is transmitted across different markets. The IRFs are derived from the moving

[3]The results from the unit root and cointegration tests are not reported but available from the authors upon request.

information is transmitted across different markets. The IRFs are derived from average representation of the autoregressive system. The Monte Carlo techniqu employed to estimate confidence bands for statistical inference, as impulse res highly non-linear functions of the estimated parameters.[4]

On the other hand, a variance decomposition (VDCs) analysis measures contribution of each innovation in the VAR to the k-step ahead forecast error the markets in the system. It provides a measure of how important one marke generating fluctuations in its own and other markets. The innovations are seria uncorrelated by construction, but they may be contemporaneously correlated. an innovation in one market may also operate through the contemporaneous of innovations of different markets. Thus, innovations are transformed to make contemporaneously uncorrelated. The VDCs analysis is performed for the five-VAR models using Choleski decomposition.

III. Empirical Results

To examine the level of market interdependence we utilize daily prices c Ashanti ADR (ASH-ADR), its underlying Australian share prices in U.S. dollars (UND), the Buenaventura ADR (BNV-ADR), its underlying Peruvian share price dollars (BNV-UND), the Gold Bullion prices (G-Bullion) and the U.S. S&P500 e market index (SP500). Data on these markets is obtained from DataStream. Tab reports the summary of the correlation matrix for these series for the 1996-200

Table 2: Correlation Coefficients

	G-Bullion	SP500	ASH-ADR	BNV-ADR	ASH-UND
G-Bullion	1.000				
SP500	0.015	1.000			
ASH-ADR	0.194	-0.106	1.000		
BNV-ADR	0.290	0.070	0.112	1.000	
ASH-UND	0.103	0.006	0.137	0.077	1.000
BNV-UND	0.259	0.059	0.153	0.587	0.084

As reported in Table 2, BNV has a higher level of correlation with gold b prices than Ashanti. Ashanti's ADR moves in the opposite direction of the SP50 underlying shares have the lowest correlation with the SP500 index, whereas B low positive level of correlation with the SP500 Index returns. These correlatio coefficients clearly indicate the importance these securities play in portfolio diversification. An interesting observation is the low level of correlation betwee New York and Australian listings. As expected, Buenaventura's ADR and dome returns are highly correlated.

[4]Five hundred draws were unemployed in the Monte Carlo procedures to generate the c bands of the IRFs. When the upper and lower bounds of the impulse response function same sign, the response becomes statistically significant at the five percent significance l

Spillovers From Gold Bullion Market

The Impulse Response Functions (IRFs) test the response of the Ashanti and Buenaventura ADRs and their underlying shares to innovations in the gold bullion market (G-Bullion). The results indicate that the Buenaventura ADR (BNV-ADR) responds faster than the Ashanti ADR (ASH-ADR) or its underlying shares (ASH-UND) to developments in the gold market. Indeed, the IRFs show that the responses are statistically significant and transmitted within one day for the BNV-ADR while it takes two days for the ASH-ADR to respond. Thereafter, these responses become statistically insignificant; however, in the case of the ASH-ADR there is a market correction after three days. In particular, there is a negative effect that is statistically significant within days three and five after the shock.

Even though we might argue that there should be a one-day lag effect between the gold bullion market and the Ashanti's underlying shares market because of different time zones, that argument does not hold true for Ashanti's ADRs, which are traded in New York. In this case, we should observe an almost immediate impact because these two markets are centered in New York; however, this is not the case. Therefore, these results suggest that there is a higher level of market efficiency in markets for Buenaventura than in markets for Ashanti.

The forecast error variance of returns on Ashanti and Buenaventura ADRs and their underlying shares can be allocated to sources by using the orthogonalized innovations. Table 3 provides the decomposition of 1-day, 3-day, 5-day and 10-day ahead forecast error variance into fractions that are accounted for by innovations in the gold bullion (G-Bullion), Ashanti ADR (ASH-ADR), Buenaventura ADR (BNV-ADR), Ashanti's underlying shares (ASH-UND), and Buenaventura's underlying shares (BNV-UND).

TABLE 3: VARIANCE DECOMPOSITION WITH GOLD BULLION INCLUSION

Market	Period	S.E.	G-Bullion	ASH-ADR	BNV-ADR	ASH-UND	BNV-UND
ASH-ADR	1	0.03876	3.9	96.1	0.0	0.0	0.0
	3	0.04006	6.0	91.7	1.8	0.4	0.1
	5	0.04049	7.1	90.3	2.0	0.4	0.2
	10	0.04127	8.2	87.1	2.6	1.3	0.8
BNV-ADR	1	0.02748	8.1	0.2	91.7	0.0	0.0
	3	0.02780	8.9	0.2	90.2	0.0	0.7
	5	0.02785	9.0	0.2	89.9	0.1	0.8
	10	0.02826	9.0	0.3	88.3	0.8	1.6
ASH-UND	1	0.04853	1.0	1.7	0.1	97.2	0.0
	3	0.04920	1.5	2.4	0.2	95.8	0.1
	5	0.04937	1.7	2.6	0.1	95.5	0.1
	10	0.04983	1.8	3.0	0.5	93.8	0.9
BNV-UND	1	0.02492	6.9	0.8	33.8	0.0	58.5
	3	0.02693	6.3	0.7	38.1	0.2	54.7
	5	0.02707	6.5	0.9	37.7	0.4	54.5
	10	0.02760	6.5	0.9	37.2	1.0	54.4

In general, the results indicate that the forecast error variance in each market is r explained by developments in its own market. Developments in the gold market Bullion) have a greater explanatory effect on the forecast error variance of the Buenaventura ADR (BNV-ADR) and its underlying shares (BNV-UND) than is the the Ashanti ADR (ASH-ADR) and its underlying shares (ASH-UND). While develo in the gold bullion market explain between three and eight percent of the foreca variance in the ASH-ADR market, it explains approximately nine percent in the c BNV-ADR. Moreover, in the case of underlying shares, developments in the gold market explain less than two percent of the forecast error variance in ASH-UND explains approximately seven percent of the forecast error variance in BNV-UND to the IRFs findings, the results of the forecast error variance decomposition sugg developments in the gold market have a greater effect on Buenaventura than on

Spillovers From U.S. Equity Markets

The Impulse Response Functions testing the response of the Ashanti and Buenaventura ADRs and their underlying shares to innovations in the U.S. S&P50 market index show that the response is not statistically significant in the case of t Ashanti ADR (ASH-ADR) and its underlying shares (ASH-UND).[5] Thus, Ashanti rel not appear to be sensitive to equity market movements originating in the U.S. Hc the response is statistically significant and fully transmitted in one day in the case Buenaventura ADR (BNV-ADR) and its underlying shares (BNV-UND). Therefore, movements in the U.S. equity market do not affect the Ashanti markets but they a the Buenaventura markets. These findings imply a higher level of integration betv U.S. and Peruvian equity markets than is the case for the U.S. and Australian equ markets.

Table 4 provides the decomposition of 1-day, 3-day, 5-day and 10-day ahea forecasts error variance into fractions that are accounted for by innovations in the S&P500 index (SP500), Ashanti ADR (ASH-ADR), Buenaventura ADR (BNV-ADR), Ashanti's underlying shares (ASH-UND), and Buenaventura's underlying shares (E UND). In general, the results also indicate that the forecast error variance in each is mostly explained by developments in its own market.

Overall, the impact of innovations in the U.S. S&P500 on the forecast error v of the securities under analysis is very limited. The forecast error variance of the Buenaventura ADR (BNV-ADR) and its underlying shares (BNV-UND) is more hig explained by developments in the U.S. S&P500 index (SP500) than is the case for Ashanti ADR (ASH-ADR) and its underlying shares (ASH-UND).

[5] Complete results and IRFs graphs are available from the authors upon request.

TABLE 4: VARIANCE DECOMPOSITION WITH S&P500 INDEX INCLUSION

Market	Period	S.E.	SP500	ASH-ADR	BNV-ADR	ASH-UND	BNV-UND
ASH-ADR	1	0.03917	0.0	100	0.0	0.0	0.0
	3	0.04028	0.2	97.1	2.3	0.3	0.1
	5	0.04061	0.3	96.1	2.9	0.4	0.3
	10	0.04128	0.6	93.5	3.8	1.3	0.8
BNV-ADR	1	0.02756	0.6	0.9	98.5	0.0	0.0
	3	0.02783	0.7	1.1	97.4	0.0	0.8
	5	0.02785	0.7	1.1	97.3	0.1	0.8
	10	0.02826	1.1	1.2	95.5	0.7	1.5
ASH-UND	1	0.04857	0.0	2.1	0.3	97.6	0.0
	3	0.04920	0.3	2.9	0.4	96.4	0.0
	5	0.04937	0.5	3.1	0.4	95.9	0.1
	10	0.04984	0.7	3.5	0.7	94.2	0.9
BNV-UND	1	0.02486	0.7	1.6	38.4	0.1	59.2
	3	0.02693	0.6	1.4	42.4	0.3	55.3
	5	0.02707	0.8	1.5	42.3	0.4	55.0
	10	0.02760	1.1	1.6	41.5	1.0	54.8

Spillovers Between ADR and Underlying Shares Markets

The Impulse Response Functions testing the response of spillover effects in both directions between ADR and the corresponding underlying share markets indicate the presence of spillover effects from ADR markets into corresponding underlying share markets. Indeed, the IRFs show that innovations in ADR markets affect underlying share markets and that responses are statistically significant and transmitted within one and two days for the ASH-UND and BNV-UND, respectively. The opposite; however, does not hold true, innovations in underlying share markets do not affect ADR markets.[6]

The linkages between ADR and underlying equity markets might also be observed through an analysis of the forecast error variance decomposition. In Table 3, we observe that innovations in the underlying shares markets do not affect the forecast error variance of the respective ADRs; however, developments in the ADRs market affect the forecast error variance of underlying shares and this holds particularly true in the case of Buenaventura. Indeed, note that approximately 33 to 38 percent of the forecast error variance of the BNV-UND is explained by developments in the BNV-ADR market. In Table 4, we also observe that developments in ADR markets affect the forecast error variance of the underlying shares while the opposite does not hold true. Indeed, approximately 38 to 42 percent of the forecast error variance of the BNV-UND is also explained by developments the BNV-ADR market. These findings are consistent with the previously reported levels of correlation between the ASH-ADR and ASH-UND markets and BNV-ADR and BNV-UND markets, as reported in Table 1.

[6]These IRFs were obtained from the VAR model that incllluded the Gold Bullion market. A similar pattern of responses appeared when the VAr model included the U.S. S&P500 index.

IV. SUMMARY AND CONCLUSIONS

Examining the responses of international and ADR securities to a common provides valuable insights into the design and development of markets. Having understanding of the pricing of securities across several markets provides invest valuable information that can be used in risk management. The analysis present indicates that Ashanti and Buenaventura both provide significant portfolio diver opportunities as reflected in their low correlation coefficients.

The study reflects the first analysis of interdependence of a commodity inc the equity price behavior of companies engaged in the production of such com which are cross-listed in U.S. equity markets through ADRs and in underlying e markets. The results suggest that the ADR markets are more efficient than the u shares in reflecting information originated in commodity markets. Moreover, Buenaventura's shares respond faster to innovations in the gold market than Ash shares. Further analysis of each firm's hedging strategies may explain a greater independence of Ashanti's shares from the gold bullion market. This analysis pr insights into the portfolio diversification offered by these securities.

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