

**Information Spillover, Profit Opportunities, and Return
Deviations Analysis: The Case of Cross-Listed BHP Billiton**

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Abstract

This paper examines (1) whether a cross-listed company spillover effect starts from an earlier time zone market to a later time zone market, whether investors can find profit opportunities from cross-listed share trading, and (2) whether the magnitude of cross-listed share performance deviations can be sufficiently explained by market fundamental factors. BHP Billiton, the world's largest mining company, is listed on both Australian and UK stock exchanges and has become a perfect example to be examined for the above two hypotheses. We analyze BHP and BLT daily share price returns from 2001 to 2011 and most available Australian and UK market fundamental factors in the same period. With regression analysis, we find evidence that a spillover effect may start from the earlier time zone. Our findings partly support that investors can get arbitrage profit from cross-listed shares when they hold a medium-term position; in the short term, there is no strong evidence to show BHP and BLT prices will converge. Furthermore, we haven't found any evidence that any individual market fundamental factor can sufficiently explain the magnitude of cross-listed share performance deviations.

Key words: spillover; BHP Billiton; arbitrage; cross listing

JEL classification: G11; G14; G15

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1. Introduction

Cross listing of shares is when a company lists its equity shares on one or more foreign stock exchanges in addition to its domestic exchange. Cross listing research has become significant because of the dramatically increasing number of cross-listed shares in the world (Lee, 2013). The traditional point of view believes that cross-listed shares may become more accessible to global investors; others believe cross-listing could lead to an increase in the liquidity of the share and a decrease in the cost of capital (Roosenboom and Van Dijk, 2009). Cross-listing may also be driven by product and labour market considerations to facilitate foreign acquisitions (Khana, et al., 2003).

From an efficient market point of view, even if a company is listed on two different exchanges, the identical securities should have the same share price; otherwise, investors would get arbitrage or profit opportunities without any risk (Lei, 2008). Because of different listings, one listing sometimes has a strong influence on the other one. This is called spillover effects among markets.

BHP Billiton is an Australian multinational mining and petroleum company headquartered in Melbourne, Australia, and with a major management office in London, UK. BHP Billiton was created on 29 June 2001 through the merger of the Australian Broken Hill Proprietary Company Limited (BHP) and the Anglo-Dutch Billiton Plc. The result is a dual-listed company. The Australia-registered BHP Billiton Limited, which is the majority partner, has a primary listing on the Australian Securities Exchange and is the largest company in Australia measured by market capitalisation. The UK-registered BHP Billiton Plc has a primary listing on the London Stock Exchange and is a constituent of the Financial Times Stock Exchange (FTSE) 100 Index. It had a market capitalisation of approximately £39.6 billion as of 23 December 2011, the ninth largest of any company listed on the London Stock Exchange.

The headquarters of BHP Billiton Limited, and the global headquarters of the combined BHP Billiton Group, are located in Melbourne, Australia. BHP Billiton Plc is located in London, UK. Both companies have identical Boards of Directors and are run by a single management team. Shareholders in each company have equivalent economic and voting rights in both companies. On 29 June 2001, each Australian BHP shareholder received 1.0651 new BHP shares for every existing BHP share held; so that the BHP dual-listed share issue ratio was 1:1.

As the world's largest mining company, measured by 2011 revenues and as of February 2011 was the world's third largest company measured by market capitalisation, BHP can be a perfect example for cross-listing share studies. The purpose of this study is (1) to examine the same-day spillover effect and trading arbitrage profit opportunities between BHP Australian (BHP) and BHP UK (BLT) and (2) to test the relationships between share (BHP/BLT) quarterly return and its domestic market (Australian/UK) indicators' quarterly movements; furthermore, to

investigate whether the magnitude of BHP and BLT returns’ deviations has been significantly influenced by any market indicators’ movement deviations.

The paper is organized as follows. Section 2 presents a literature review and develops hypotheses. Section 3 discusses the data and provides details of employed methodology. Section 4 presents the empirical results, and Section 5 concludes.

2. Literature Review and Hypotheses Development

From the study of Australian-American cross-listed shares, Alaganar and Bhar (2002) find unidirectional information flow from the US to the Australian market. Hamao et al. (1990) find cross-listed share price spillovers from New York to Tokyo, London to Tokyo, and New York to London. They find volatility spillovers from large to small markets, but not vice versa. Dual-listed shares should have a common information base, because the underlying economic unit is the same. If active cross market hedging with lower transaction costs exists, there is spillover of information flow between the two markets (Alaganar and Bhar, 2002).

Many researchers such as Park and Tavakkol (1994), Miller and Morey (1996) and Karolyi (1998) believe that American Depositary Receipts (ADRs) and their underlying shares are expected to be perfect substitutes and no arbitrage opportunities should prevail (Koum kwa and Susmel, 2007). However, Hong and Susmel (2003) and Barberis and Thaler (2003) point out that investors may find arbitrage strategies from theoretical prices parity to make significant profits. Furthermore, De Jong et al. (2004) find substantial variation over a long period for which an arbitrageur has to maintain a position before price convergence; in some cases, arbitrageurs have to wait for almost 9 years. Lee (2013) believes that dual-listed shares increase the need for an arbitrage platform.

As a dual-listed stock, BHP and BLT should have a strong relationship between the prices on the two markets. Australia and London have different time zones, with BHP Australian trading opening time more than 8 hours ahead of BLT London trading opening time. See Exhibit 1 below, which provides both Australia and UK Stock Exchanges opening and closing times.

Exhibit 1. Market Hours Difference for Australia and UK

Australian Securities Exchange (ASX)	London Stock Exchange (LSE)
Open: 9:50am AEST / 23:50 UTC	Open: 8:00am GMT / 08:00 UTC
Close: 4:12pm AEST / 06:12 UTC	Close: 4:30pm GMT / 16:30 UTC

Source: Copeland and Copeland, 1998.

However, we haven’t found any literature indicating spillover effect on dual-listed shares flowing from an early time zone to a later time zone. We hypothesise that information spillover possibly flows from the earlier time zone (Australia) market to the later time zone (London) market because investors could judge BLT

price movement from the BHP closing price. As such investors may find profit opportunities from the different markets hours.

Copeland and Copeland (1998) find the exchange rate is significant as an explanatory factor of country rate of return. Investors seek high risk-adjusted returns in foreign equity markets (Karolyi, 1998). International markets demand a premium valuation of cross-listing companies (Banconi and Tan, 2010). Hauser et al. (1998) believe market trading volume will strongly influence the share price; in other words, the market will be more efficient with high trading volume (You et al., 2012). Miller (1999) finds a significant positive stock price reaction in the home market. Froot and Dabora (1999) find existence of mispricing in dual-listed companies over a long time. However, they believe fundamental factors (currency risk, governance structures, legal contracts, liquidity, and taxation) are not sufficient to explain the magnitude of the price deviations.

Because BHP and BLT share a single Board of Directors and a single management team, and because shareholders in each company have equivalent economic and voting rights in both companies, the two companies have the same individual business risk and different market risk. The second hypothesis is because BHP and BLT have the same company risk, the magnitude of their returns' deviations must be driven by risks in the different markets (Australia and London). As such, we will examine the relationships between the magnitude of BHP and BLT returns' deviations and the magnitude of Australian and UK market indicators movements' deviations in order to find which market factors drive BHP and BLT returns' deviations.

3. Data and Methodology

We choose daily BHP Billiton historical Australian and UK share prices in local currency from 29 June 2001 (the date of the merger forming BHP Billiton) to 30 June 2011 at BHP website (www.bhpbilliton.com.au). BHP provides both Australian and UK BHP and BLT *open, high, low, close* price; there is no ask, bid, or trading volume available. The theoretical price ratio is equal to 1:1 in Australia and UK. We also choose the FTSE100 as the UK share market index benchmark while Australian Security Exchange (ASX 200) is used as the Australian share market index benchmark.

Daily exchange rates between AUD and GBP are obtained from DataStream, which provides the FX rate at 4 pm Australian time. Because of the different time zones, the Australian market opens 8.5 hours ahead of the UK market. When we determine the same-day price, we choose the Australian closing price and the UK opening price, which may help us to test the time influence between Australian and UK markets. BLT had reverse split its share as 100 for 1 on 1 June 2009; to simplify the comparison of BHP and BLT share prices, however we still treat the BLT price as an un-split price between June 2009 and June 2011. Public holidays and weekends have been deleted from our data selection. We only select those trading

days that are available for both countries. To avoid exchange rate interfering with our examination, we keep all data in domestic currencies.

First, to examine the same-day spillover effect of returns of BHP and BLT, we use vector autoregression (VAR), which is a good model to examine the spillover effect with a simultaneous equation system, free of prior restriction on the structure of relationships (Eun and Shim, 1989; Hansda and Ray, 2003).

To calculate the daily return of BHP and BLT, we use:

$$\text{Return [BHP (t)]} = (\text{BHP closing price (t)} - \text{BHP closing price (t-1)}) / \text{BHP closing price (t-1)}. \quad (1)$$

$$\text{Return [BLT (t)]} = (\text{BLT closing price (t)} - \text{BLT opening price (t-1)}) / \text{BLT opening price (t-1)}. \quad (2)$$

To examine the price spillover effect, the model we employed is:

$$\text{BHP (t)} = a_1 \text{BHP(t-1)} + b_1 \text{BLT(t-1)} + c_1. \quad (3)$$

$$\text{BLT (t)} = a_2 \text{BHP(t-1)} + b_2 \text{BLT(t-1)} + c_1. \quad (4)$$

where a and b are regression coefficients of predictor variables and c is a “noise” term reflecting other factors that influence share return.

Second, we would like to examine the relationships between the magnitude of BHP and BLT returns’ deviations and the magnitude of Australian and UK market indicators movements’ deviations. We collected Australian and UK economic indicator data from those countries’ national statistics, central banks, and Trading Economics (www.tradingeconomics.com).

Because some economic data are only available on a quarterly basis, to make the comparison and examination consistent, we decide to examine the BHP/BLT quarterly return with economic data quarterly movement.

We selected all available economic data, including currency (AUD/USD, GBP/USD), stock index (S&P/ASX200, FSTE 100), GDP growth rate, unemployment rate, inflation rate, consumer price index (CPI), Official Cash Rate (OCR), national current account, imports, exports, government debt, business confidence, consumer confidence, and 10-year government bonds for both countries from June 2001 to June 2011. All the above data cover market influences such as GDP, labour, price, money, trade, government, business, and consumer responses, which we believe are present in both Australian and UK markets.

In the first step, we will examine the relationship between BHP or BLT share performance and its own domestic economic indicators’ performance. In other words, we would like to find whether there are any domestic economic factors that can strongly influence BHP/BLT performance.

To calculate the quarterly return of BHP and BLT, We use:

$$\text{Return [BHP (t)]} = (\text{AU closing price (t)} - \text{AU closing price (t-1)}) / \text{AU closing price (t-1)}. \quad (5)$$

$$\text{Return [BLT (t)]} = (\text{UK closing price (t)} - \text{UK opening price (t-1)}) / \text{UK opening price (t-1)}. \quad (6)$$

Similar to (5) and (6), the following formulas are used to calculate the movement of each economic indicator:

$$\text{Return [currency]} = (\text{Exchange rate (t)} - \text{Exchange rate (t-1)}) / \text{Exchange rate (t-1)}. \quad (7)$$

$$\text{OCR movement} = (\text{OCR (t)} - \text{OCR (t-1)}) / \text{OCR (t-1)}. \quad (8)$$

$$\text{Import movement} = (\text{Import (t)} - \text{Import (t-1)}) / \text{Import (t-1)}. \quad (9)$$

$$\text{Export movement} = (\text{Export (t)} - \text{Export (t-1)}) / \text{Export (t-1)}. \quad (10)$$

$$\text{GDP movement} = (\text{GDP (t)} - \text{GDP (t-1)}) / \text{GDP (t-1)}. \quad (11)$$

$$\text{Business Confidence movement} = (\text{Business Confidence (t)} - \text{Business Confidence (t-1)}) / \text{Business Confidence (t-1)}. \quad (12)$$

$$\text{Consumer Confidence movement} = (\text{Consumer Confidence (t)} - \text{Consumer Confidence (t-1)}) / \text{Consumer Confidence (t-1)}. \quad (13)$$

$$\text{Index return} = (\text{Index (t)} - \text{Index (t-1)}) / \text{Index (t-1)}. \quad (14)$$

$$\text{10-year Government bond return} = (\text{10 year Govt bond yield (t)} - \text{10 year Govt bond yield (t-1)}) / \text{10 year Govt bond yield (t-1)}. \quad (15)$$

Note that (5) and (6) are different from (1) and (2); here t and $t-1$ are on a quarterly basis, not a daily basis. The examination period is from Q3 in 2001 to Q2 2011. The Australian index is S&P/ASX200 and the UK index chosen is the FTSE100.

Some economic data provide negative information, such as unemployment rate, government current account, the inflation rate, the CPI, and government debt. For those indicators, a decrease in movement results in a better position, so we design further formulas to compensate for the negative information:

$$\text{Unemployment rate movement} = (\text{Unemployment rate (t-1)} - \text{Unemployment rate (t)}) / \text{Unemployment rate (t-1)}. \quad (16)$$

$$\text{CPI movement} = (\text{CPI (t-1)} - \text{CPI (t)}) / \text{CPI (t-1)}. \quad (17)$$

$$\text{Current account movement} = (\text{Current account (t-1)} - \text{Current account (t)}) / \text{Current account (t-1)}. \quad (18)$$

$$\text{Inflation rate movement} = (\text{Inflation rate (t - 1)} - \text{Inflation rate (t)}) / \text{Inflation rate (t - 1)}. \quad (19)$$

$$\text{Government debt movement} = (\text{Government debt (t - 1)} - \text{Government debt (t)}) / \text{Government debt (t - 1)}. \quad (20)$$

Considering (5) to (20), we examine the relationships between BHP or BLT share performance and its own domestic economic indicators' performance using:

$$\begin{aligned} \text{SR} = & \alpha + \beta_1 \text{Currency} + \beta_2 \text{OCR} + \beta_3 \text{Import} + \beta_4 \text{Export} + \beta_5 \text{GDP} \\ & + \beta_6 \text{Business Confidence} + \beta_7 \text{Consumer Confidence} \\ & + \beta_8 \text{10-year bond} + \beta_9 \text{Index} + \beta_{10} \text{Unemployment} + \beta_{11} \text{CPI} \\ & + \beta_{12} \text{Inflation} + \beta_{13} \text{Current Account} + \beta_{14} \text{Government Debt} + \varepsilon. \end{aligned} \quad (21)$$

where:

- SR = share return.
- Currency = currency quarterly return.
- Import = import quarterly increase/decrease.
- Export = Export quarterly increase/decrease.
- GDP = GDP quarterly increase/decrease.
- Business Confidence = Business confidence index quarterly increase/decrease.
- Consumer Confidence = consumer confidence index quarterly increase/decrease.
- 10-year bond = 10-year Government Bond yield quarterly return.
- Index = ASX200 or FSTE100 quarterly return.
- Unemployment = Unemployment rate quarterly increase/decrease.
- CPI = CPI quarterly increase/decrease.
- Inflation = inflation quarterly increase/decrease.
- Current Account = Government current account quarterly increase/decrease.
- Government Debt = Government debt quarterly increase/decrease.
- α = a constant amount.
- β = regression coefficients of independent variables 1 to 14.
- ε = the "noise" term reflecting other factors that influence share return.

We randomly choose Q4 2004 as an example to show BHP and BLT quarterly return performance with other economic data movement. From Q3 2004 to Q4 2004, BHP has had a quarterly return of 14.15% while the Australian dollar had a return of 2.84% against US dollar, the ASX 200 index achieved a 2.63% quarterly return, and the 10-year Australian government bond had a negative 2.22% return. Within the same period, some economic data showed positive movement—unemployment rate 1.82%, imports 3.21%, CPI 0.74%, consumer confidence 6.15%, GDP growth rate 0.8%, and business confidence 13.5%—and others had negative movement—government current account -8.79%, inflation rate -8.7%, government debt -3.39%

and exports -0.79% . BLT and UK economic data movement are also shown in Table 1.

Table 1. Q4 2004 BHP/BLT Quarterly Performance and Other Economic Data Quarterly Movement Examples (Domestic Currency)

Q4 2004	Australia	UK	Difference
Share Return	14.15%	21.88%	7.73%
Currency Return	2.84%	-1.05%	-3.89%
Unemployment Rate	1.82%	2.08%	0.26%
Current Account	-8.79%	51.38%	60.17%
OCR	0.00%	0.00%	0.00%
Imports	3.21%	69.00%	65.79%
Inflation	-8.70%	-54.55%	-45.85%
Government Debt	-3.39%	-1.44%	1.95%
CPI	0.74%	0.51%	-0.23%
Consumer Confidence	6.15%	-7.00%	-13.15%
GDP Growth Rate	0.80%	0.00%	-0.80%
Business Confidence	13.50%	7.00%	-6.50%
Index	2.63%	8.18%	5.55%
10-yr Government Bond Return	-2.22%	-5.81%	-3.59%
Exports	-0.79%	4.34%	5.13%

In step two, we further examine the gap between the BHP and BLT return rate with the gaps of all above economic factors between Australian and UK markets. We look forward to investigating whether the difference between BHP and BLT returns has been strongly influenced by any other market factors. In other words, we want to find whether market fundamental factors can be sufficient to explain the magnitude of the BHP and BLT share performance deviations. We designed the regression model:

$$\begin{aligned}
 \text{DSR} = & \alpha + k_1\text{DCurrency} + k_2\text{DOCR} + k_3\text{DImport} + k_4\text{DExport} \\
 & + k_5\text{DGDP} + k_6\text{DBusiness Confidence} \\
 & + k_7\text{DConsumer Confidence} + k_8\text{D10 - year bond} + k_9\text{DIndex} \quad (22) \\
 & + k_{10}\text{DUnemployment} + k_{11}\text{DCPI} + k_{12}\text{DInflation} \\
 & + k_{13}\text{DCurrent Account} + k_{14}\text{DGovernment Debt} + \varepsilon.
 \end{aligned}$$

where:

- DSR = Difference of BHP and BLT return.
- DCurrency = Difference of Australian and UK currency quarterly return.

- DImport = Difference of Australian and UK import quarterly increase/decrease.
- DExport = Difference of Australian and UK Export quarterly increase/decrease.
- DGDP = Difference of Australian and UK GDP quarterly increase/decrease.
- DBusiness Confidence = Difference of Australian and UK Business confidence index quarterly increase/decrease rate.
- DConsumer Confidence = Difference of Australian and UK consumer confidence index quarterly increase/decrease rate.
- D10-year bond = Difference of Australian and UK 10-year Government Bond yield quarterly return.
- DIndex = Difference of ASX200 and FSTE100 quarterly return.
- DUnemployment = Difference of Australian and UK Unemployment rate quarterly increase/decrease.
- DCPI = Difference of Australian and UK CPI quarterly increase/decrease.
- DInflation = Difference of Australian and UK inflation quarterly increase/decrease.
- Current Account = Difference of Australian and UK Government current account quarterly increase/decrease.
- DGovernment Debt = Difference of Australian and UK Government debt quarterly increase/decrease.
- α = a constant amount.
- k = regression coefficients of independent variables 1 to 14.
- ε = the “noise” term reflecting other factors that influence the difference of BHP and BLT return.

Data are quarterly from Q3 2001 to Q2 2011. In Table 1, the third column shows the magnitude of the deviations of Australian and UK market economic factors.

4. Empirical Results and Discussions

4.1 BHP and BLT Spillover Effect and Profit Opportunities

With regression analysis, we find BHP has significant influence on the BLT share price, which means the BHP closing price will generally lead BLT opening price movements. Conversely, we do not find any significant influence from BLT to BHP.

$$\text{BHP}(t) = -0.093^* \text{BHP}(t-1) + 0.048^* \text{BLT}(t-1) + 0.00083.$$

$$\text{BLT}(t) = 0.34^* \text{BHP}(t-1) + (-0.34)^* \text{BLT}(t-1) + 0.00086.$$

The result indicates that a strong one-way influence from the Australian to London stock exchange exists at the level of mean return. Our finding supports our first hypothesis that price spillover occurs from an earlier time zone market

(Australia) to the later time zone market (London) market. Trading Economics (2013) shows that the Australian Stock Exchange has up-to-date market capitalization of USD 1386 billion with average annual trading value of USD 800 billion, while the UK has capitalization of USD 3396 billion with average annual trading value of USD 1890 billion. So it is clear that the UK share market is much bigger than the Australian market. From the perspective of Alaganar and Bhar (2002) and Hamao et al. (1990), spillover effects should flow from UK to Australia. However, our findings are different with BHP Billiton share price and information spillovers occurring from the small and earlier-opening market (Australia) to the large and late-opening market (UK).

To test this result, we examine the BHP and BLT same-day price movement and find that, when the BHP price increases (decreases), the same-day BLT price generally follows. From Table 2 below—a randomly chosen period—BLT price movement followed BHP price movement on 38 out of 40 days.

Table 2. BHP and BLT Prices between 13/07/2001 and 23/08/2001

	BHP Closing Price (AUD)	BLT Opening Price (GBP)
13/07/2001	10.54	3.33
16/07/2001	10.63	3.36
17/07/2001	10.57	3.31
18/07/2001	10.48	3.29
19/07/2001	10.17	3.24
20/07/2001	10.23	3.22
23/07/2001	9.96	3.12
24/07/2001	9.61	3.04
25/07/2001	9.2	2.89
26/07/2001	9.37	2.91
27/07/2001	9.49	2.94
30/07/2001	9.54	2.98
31/07/2001	9.70	3.03
1/08/2001	10.04	3.09
2/08/2001	9.88	3.08
3/08/2001	9.99	3.14
7/08/2001	9.99	3.16
8/08/2001	9.67	3.10
9/08/2001	9.46	3.02
10/08/2001	9.36	2.99
13/08/2001	9.30	3.05
14/08/2001	9.18	2.99
15/08/2001	9.43	3.05
16/08/2001	9.17	2.99
17/08/2001	9.24	3.02
20/08/2001	9.13	2.98
21/08/2001	9.18	3.01
22/08/2001	9.02	2.94
23/08/2001	9.14	3.01

We also believe investors may get a profit opportunity when they understand the price movement relationship between dual-listed BHP and BLT. In an efficient market, companies with identical risk should be traded at the same price (Rosenthal and Young, 1990), which means arbitrage opportunities exist before price convergence. To examine this, we provide two figures below to find how long an arbitrageur has to maintain a position before price convergence.

Figure 1 one shows BHP and BLT share price movement based on their local currencies: AUD and GBP.

Figure 1. BHP and BLT Prices Movement from 28/06/2001 to 28/06/2011

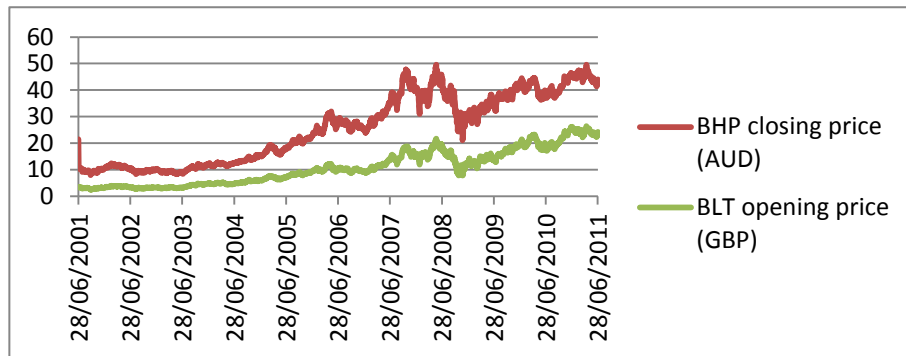
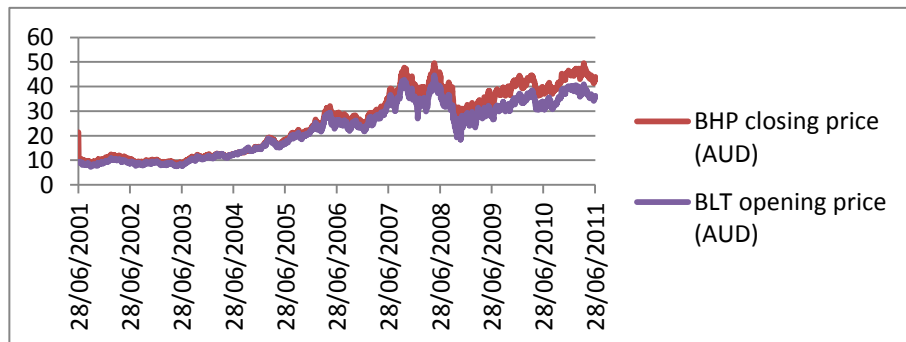


Figure 2 shows BHP and BLT price movements based on AUD.

Figure 2. BHP and BLT Price Movements from 28/06/2001 to 28/06/2011



From the beginning of the merger on 28 June 2001, BLT was traded at a 12% discount of BHP (calculation with daily AUD and GBP exchange rates); the gap gradually narrowed until 17 August 2004, when BHP and BLT achieved price convergence. After that, BLT was trading at a premium to BHP for about a two month period until 26 October 2004, then BHP traded at a premium again and up to

now and it is clear that the price gap has become wider. These findings partly support De Jong et al. (2004) that investors may get arbitrage opportunity from dual-listed companies. However, if an arbitrageur held a position from the beginning of the BHP merger, he/she only needed to wait approximately 3 years; from October 2004 until now we have yet to see price convergence again between BHP and BLT. When we only focus on the term after 2004, it is hard to believe BHP and BLT can converge in the near future.

4.2 BHP/BLT Quarterly Return with Other Market Data Movements

To further explore the relationship between BHP or BLT share performance and its own domestic economic indicators' performance, we present evidence on whether or not BHP/BLT return performance can be explained by their domestic economic fundamental factors. Tables 3 and 4 provide the results of model (21).

Table 3. BHP Return with Other Australian Economic Data Movements (Quarterly Basis)

Variables	Coefficient	Standard Error of Coefficient	Standardized Coefficient (beta)	t	P-value
	-7.549	6.227		-1.212	.237
x1	.326	.448	.173	.728	.474
x2	-.908	.707	-.330	-1.285	.211
x3	.045	.091	.140	.491	.628
x4	.198	.423	.140	.468	.644
x5	-.307	.950	-.096	-.324	.749
x6	.036	.132	.064	.269	.790
x7	-1.032	1.040	-.207	-.992	.331
x8	11.701	6.151	.378	1.902	.069
x9	.046	.320	.029	.143	.888
x10	1.417	5.232	.052	.271	.789
x11	.181	.447	.117	.405	.689
x12	.505	.375	.302	1.347	.191
x13	.044	.236	.036	.186	.854
x14	-.252	.487	-.134	-.518	.609
Analysis of Variance					
	Sum of Squares	DF	Mean Square	F Ratio	P-value
Regression	3081.770	14	220.126	1.335	.258
Residual	3956.240	24	164.843		
Sum	7038.010	38			

In both Tables 3 and 4, none of the domestic fundamental data are significant in explaining BHP or BLT share performance. In other words, BHP (or BLT) share return doesn't have a strong correlation with other domestic economic market

factors. Therefore, domestic economic data movement cannot predict BHP (or BLT) share price movement in this model framework.

Table 4. BLT Return with Other UK Economic Data Movements (Quarterly Basis)

Variables	Coefficient	Standard Error of Coefficient	Standardized Regression Coefficient (beta)	t	P-value
	1.166	8.466		.138	.892
x1	.483	.608	.184	.794	.435
x2	1.566	1.276	.343	1.228	.231
x3	.003	.011	.049	.284	.779
x4	.470	.314	.452	1.495	.148
x5	2.532	1.393	.688	1.817	.082
x6	-.031	.072	-.078	-.433	.669
x7	-.062	.116	-.113	-.537	.596
x8	-4.814	7.258	-.163	-.663	.514
x9	-.429	.395	-.282	-1.088	.287
x10	-.851	7.115	-.042	-.120	.906
x11	-.423	.219	-.563	-1.933	.065
x12	.078	.517	.035	.151	.881
x13	-.212	.352	-.126	-.604	.551
x14	-.550	.995	-.192	-.553	.586
Analysis of Variance					
	Sum of Squares	DF	Mean Square	F Ratio	P-value
Regression	4269.205	14	304.943	1.358	.247
Residual	5390.720	24	224.613		
Sum	9659.925	38			

Next we investigate whether the premium/discount between BHP and BLT can be explained by the differences between Australian and UK economic data movements. Table 5 shows insignificant coefficients between the magnitude of BHP and BLT share performance deviations and other variables we select. From our studies, it is difficult to use any economic fundamental factors to explain the magnitude of share performance deviations.

As one single cross-listed company, the difference between BHP and BLT share performance should be driven by different market risks when they have the same company risk. However, we do not find any economic market factor helps to explain the magnitude of the cross-listed share price deviations. This finding is similar to Froot and Dabora (1999); however, it doesn't support Copeland and Copeland (1998) that the exchange rate is significant as an economic factor to explain cross-listed share price return. When Copeland and Copeland (1998) chose a single currency to examine share performance, the exchange rate was already there.

In this study, we choose BHP and BLT domestic currencies to avoid currency effects. This may be one reason our findings are different from Copeland and Copeland (1998).

Table 5. BHP and BLT Return and Other Australian and UK Economic Factors Deviations (Quarterly Basis)

Variables	Coefficient	Standard Error of Coefficient	Standardized Regression Coefficient (beta)	t	P-value
	.013	.019		.663	.514
X1	.012	.261	.010	.045	.964
X2	.074	.298	.052	.250	.805
X3	.000	.005	-.019	-.084	.934
X4	-.083	.154	-.148	-.535	.597
X5	-.146	.300	-.140	-.487	.631
X6	-.035	.036	-.197	-.986	.334
X7	-.003	.041	-.016	-.075	.941
X8	2.138	2.520	.199	.849	.404
X9	-.097	.095	-.230	-1.015	.320
X10	.715	1.847	.089	.387	.702
X11	.032	.080	.102	.399	.693
X12	-.030	.152	-.050	-.200	.843
X13	.030	.171	.040	.177	.861
X14	.235	.221	.337	1.064	.298

Analysis of Variance					
	Sum of Squares	DF	Mean Square	F Ratio	P-value
Regression	.030	14	.002	.554	.874
Residual	.092	24	.004		
Sum	.122	38			

5. Conclusion

BHP Billiton is listed on both the Australian and UK market; however, BLT has been discounted relative to BHP for a long time. We find there is a one-way spillover effect from the Australian market (earlier time zone) to the UK market (later time zone). This finding does not support some studies that believe a cross-listing spillover effect usually is from a large market to a small market (Copeland and Copeland, 1998; Alaganar and Bhar, 2002; Hamao et al., 1990). Our finding partly supports that investors can get arbitrage profit from cross-listed shares when they hold medium-term positions (Hong and Susmel, 2003; Rosenthal and Van Jiji, 2004); since 2004, there has been no evidence to suggest that BHP and BLT prices will converge in the near future.

Furthermore, we investigate the relationship between BHP/BLT share performance and other domestic economic factor movements on a quarterly basis. There is, however, no significant evidence of influence between share returns and other variables in the models we considered. To further examine our second

hypothesis—that the magnitude of BHP and BLT performance deviations are driven by their respective market risks—we use regression to examine the magnitude of BHP and BLT performances deviations and the magnitude of Australian and UK market fundamental factors deviations. However, there is no evidence that any market factor significantly influenced the deviation of BHP and BLT performance. One explanation is that the magnitude of performance of a cross-listing company is not driven by any individual market factor but rather by general market risks.

We believe this study has academic contributions to future or relevant cross-listing studies. We find spillover effect can also happen from an earlier time zone market to a later time zone market, and we could not identify a market factor with long-term significant influence on individual share performance. This study may also be valuable for practicing professionals and investors as it is difficult to predict cross-listing share price deviation based on individual market risk.

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