ON THE PRICING OF DUAL CLASS STOCKS: EVIDENCE FROM BERKSHIRE HATHAWAY

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ABSTRACT

This study focuses on determining whether short-term market inefficiencies exist that can be periodically exploited by investors. Berkshire Hathaway's dual class stock with differential voting rights and one- way conversion option provides a unique opportunity to investigate this issue while controlling for other exogenous variables that could bias the findings. Given the investor attention directed toward Berkshire Hathaway, and the company's famous CEO Warren Buffett, this company's stock should always trade in an efficient market. The results suggest that Berkshire Hathaway class B shares tend to have significantly higher opening prices and Berkshire Hathaway class A shares tend to have higher closing prices, although both A and B shares have similar average daily returns. Price dynamics may create unique arbitrage opportunities for investors. However, the higher overnight returns for B shares may be offset by higher volatility embedded in the B shares.

JEL: G11; G12; G14

KEYWORDS: Dual class stock, market efficiency, asset pricing, volatility

INTRODUCTION

Berkshire Hathaway's dual classes of common stock with differential voting rights and one-way convertibility provide a unique opportunity to study market efficiency in the short run. Both class A and class B shares are based on the same corporate fundamentals but class A shares are convertible to 30 shares of class B stock. However 30 class B shares can never be converted to one share of class A stock. Holding everything else constant, class B shares should trade for exactly $1/30^{th}$ of class A's stock price.

In addition to the conversion differences class B shares carry lower voting rights with each class B share voting at only $1/200^{th}$ of its class A counterpart. In other words an investor holding 30 shares of class B stock only possesses 15 percent of the voting power of one class A share even while owning the same fraction of the company. Since several studies including Megginson (1990) and DeAngelo and DeAngelo (1985) maintain that shares of stock with superior voting rights sell at a premium the expectation is that class B shares should always trade at a slight discount to class A shares. The inferior voting rights should keep class B shares trading at a lower price than its fractional class A value but arbitrage will also keep the prices closely in line. If class B shares increase too high relative to class A then class A shareholders will convert and sell class B pushing the price back to equilibrium with class A. In addition, both classes of stock should share the same risk characteristics. Given sufficient adjustment time we fully expect these price and risk relationships to hold. However, what about in the short run? Are there opportunities for profit that exist for alert day-traders? In this study we investigate whether Berkshire Hathaway class A and class B stock maintains the expected price and risk relationship in the very short run.

The purpose of this paper is to further investigate short-run market efficiency issues. Given the ubiquitous nature of short-term traders it would be useful to see if temporal market inefficiencies do indeed exist that short-term traders can arbitrage for profit. Jordan and Diltz (2003) in their study of 324 day traders find that opportunities for short-term trading profits do exist. Their findings indicate that 36 percent of day

traders make some money and approximately 20 percent of day traders were marginally profitable. However there is no evidence to indicate whether the profits were due to momentum strategies as Jordan and Diltz's (2003) findings suggest or actual short-term market inefficiencies. Using Berkshire Hathaway's dual class stock in this study enables us to focus solely on the issue of whether short-term market inefficiencies do indeed periodically exist even for a widely followed company.

The remainder of the paper is organized in the following manner. In section two we provide a brief discussion of the relevant literature. Section three provides information on data collection, methodology, and a presentation of the various models used in this study. In section four we discuss the empirical results and in section five we provide some concluding remarks with suggestions for future research.

LITERATURE REVIEW

Several studies use a single firm as an opportunity to evaluate certain issues and simultaneously control for other exogenous variables. Perhaps the most famous series of studies involves Citizens Utilities Company. Citizens Utilities offered two classes of common stock that differed based on dividend payout. Class A shares received stock dividends while Class B shares received cash dividends. This unique arrangement provides a controlled laboratory for finance researchers to study dividend relevance issues and the impact of taxes on dividend policy. The Citizens Utilities Company was the sole data source for several studies investigating this issue further including Long (1978), Poterba (1986), Sterk and Vandenberg (1990), and Hubbard and Michaely (1997).

Another single-firm study used Berkshire Hathaway returns due to the fact that the company's Chief Executive Officer, Warren Buffet, is considered to be an investment genius by many people in the investing community. Christopherson and Gregoriou (2004) look at a number of macroeconomic factors and other market variables in an attempt to develop a model forecasting Berkshire Hathaway's returns and provide additional detail on the various investment metrics utilized by Buffet. For the purposes of this study the widespread investor focus on Berkshire Hathaway stock should contribute to greater price efficiency of the company. If short-term price inefficiencies do exist for Berkshire Hathaway these inefficiencies should be even greater, or occur with greater frequency, for companies with thinner market followings.

The dual class stock literature provides a unique opportunity to evaluate a number of financial and managerial issues. Several of these studies look at voting issues related to differential voting rights often assigned to different classes of a company's stock. Jensen and Meckling's (1976) agency theory paper suggests that the separation of ownership and control will result in management consuming excess perquisites unless some monitoring mechanism prevents them from doing so. The vote assigned to common stock is one such mechanism. As such, voting rights have value to shareholders because it affords them the opportunity to control the board and thereby exert pressure on management to behave in a manner consistent with shareholder wealth maximization.

According to Swisher (2006) the dual class structure is often adopted to allow managers and/or original owners to raise equity and simultaneously maintain control through retention of superior voting shares. Swisher's study specifically evaluates stock returns of companies with dual classes of common stock and determines that contrary to Dann and DeAngelo (1988) the stock of firms with dual class offerings does not trade at a discount. The study postulates that management with voting control may have greater freedom to make long-term decisions instead of succumbing to investor pressure for less optimal short term decisions.

Smith and Amoako-Adu (1995) studied dual class shares listed on the Toronto Stock Exchange to determine whether shares with superior voting rights traded at a premium to their paired inferior voting

right shares. Their findings indicate that investors do assign a slight premium to voting rights. DeAngelo and DeAngelo (1985) and Megginson (1990) provide consistent results of voting power commanding a premium. Hauser and Lauterbach (2004) approached the value of voting rights from a different perspective. Their study uses data from dual class reunifications where firms recapitalized their dual class stocks into one class of common equity. Shareholders with superior voting rights were compensated in most cases with additional shares of the new equity. The size of the "share compensation" was directly related to family controlled firms and inversely related to institutional holdings. However, the higher the vote concentration lost during the reunification, the higher the additional share compensation.

Ang and Megginson (1989) compiled results from five U.S. studies on dual class premiums and reported that the average premium paid to superior voting rights shareholders was 5.4 percent. The five studies included DeAngelo and DeAngelo (1985), Jarrel and Poulsen (1988), Lease, McConnell, and Mikkelson (1983 & 1984), and Partch (1987). Nenova (2003) conducts a cross-country study using 661 dual class firms from 18 different countries. Nenova (2003) determines that legal differences, takeover regulations, and other country specific issues explain only about two-thirds of the price differential between dual class shares. While the average price differential varies substantially depending on the country it does appear to exist in the 18 countries included in this study.

One study by Robinson, Rumsey, and White (1996) focuses on dual class equity and concludes that voting rights do help explain price differentials but investors also require a "significant time period to assess and incorporate into prices the information contained in series of complex events." Foerster and Porter's (1993) study provides some support for this finding in their result that the premium assigned to superior voting shares is not constant over time. Since the literature consistently supports the value associated with common stock voting rights we would expect Berkshire Hathaway class A shares with superior voting rights to trade at a slight premium over class B shares. However, given the adjustment period identified in Robinson, Rumsey, and White (1996) and the temporal fluctuations identified by Foerster and Porter (1993) this expected premium may not persist at all times.

A study by Froot and Dabora (1999) that focuses on trade location finds that the level of market activity can impact price. Their study evaluated the price behavior of three 'Siamese twin' companies that trade in different markets. Since the fundamentals are identical one would expect the asset prices to be identical. However, even after controlling for exchange rate differentials, differences in dividend income, and taxes they find that price differentials continue to exist between 'twin' firms traded in different markets. One noticeable difference in these firms was level of market activity from one location to another. Firms with more active markets resulted in higher prices. The authors conclude that some market segmentation does exist but are unable to pinpoint the primary cause. These results might suggest that Berkshire Hathaway Class A and Class B shares might exhibit some price differentials during trading hours with lower volume and prices might converge during higher volume trading periods.

Volatility issues surrounding overnight trades are also of interest. Do investors perceive one class of Berkshire Hathaway stock to have greater risk than the other class? Since risk should be associated with the expectation of cash flows one would expect both Class A and Class B shares to exhibit similar volatility. However research does support volatility differences in overnight trades versus daytime trades of the same stock. Amihud and Mendelson (1987) look at the 30 stocks in the Dow Jones Industrial Average and find greater return volatility in open-to-open trades versus close-to-close trades. Another study by George and Hwang (1995) finds similar results in the Japanese market. Oddly, this return volatility is not exhibited in companies with lower trading volume. Zhang et al (2007) conducts a similar study using Chinese stocks and finds volatility differences exist for the same stock when looking at open-to-open returns versus close-to-close returns. Kim and Kim (2007) evaluate return and volatility issues in different markets using dual-listed stocks. Daytime and overnight returns are evaluated for 114 different

stocks. Their findings indicate that price and volatility spillover is stronger when the stock listed on the overseas market opens trading on the overnight U.S. ADR market.

Ulibarri (1998) finds that after hours price changes and changes in volume are due to the release of new information after the markets closed. Consistent with Ulibarri (1998) much of the volatility difference in each of these studies could be attributed to the release of new information after trading in the home market has ended for the day. In any case, the authors are aware of no study to date that evaluates overnight volatility differences between dual classes of common stock issued by the same company.

Since Berkshire Hathaway is a U.S. listed company we would expect minimal overnight differences in both returns and volatility unless relevant new information is released. However, we would expect no differences to exist in the reaction to new information of Class A stock and Class B stock in either returns or volatility. In other words both classes of Berkshire Hathaway stock should respond in the same manner to the release of new information so price swings and volatility reaction should be consistent in the overnight markets. For these reasons Berkshire Hathaway's dual class stocks with large investor followings provide a unique opportunity to evaluate market efficiency in terms of both price and volatility.

DATA AND METHODOLOGY

The daily stock prices for Berkshire Hathaway class A and B shares and S&P 500 Stock Index are used in this study. The data are downloaded from Yahoo.com and cover a period of May 9, 1996 through June 30, 2008. When the data are converted into some return ratios, one observation is lost. In addition, trading information for class A shares is missing on six trading days: February, 23, 2000, June 2 and 9, 2000, August 28 and 29, 2000, and February 1, 2002. Therefore, the actual sample used in analysis includes 3,049 observations.

The sample ends ahead of the current economic recession, in order to avoid the possible skewness caused by extreme volatility in stock prices. Both the daily stock prices for Berkshire Hathaway class A and B shares and S&P 500 Stock Index show excessive volatility over the period of July1, 2008 to December 31, 2009. The tremendous volatility altered normal relationships we plan to analyze in this paper. Therefore, we exclude this period in our analysis. In addition to the volatility problem, the class B shares experienced a 50:1 split on January 21, 2010. Even though the split itself cannot change any relationships, it did occur in a volatile time. This is another reason why we did not include any data after June 30, 2008. We use following three return ratios and a volatility ratio to assess risk and return characteristics of A and B shares:

(1). Daily returns, (close price - previous close price)/previous close price, is a measure of total returns between two trading days. It catches information released during a 24-hour period, the previous closure of the stock market to the current closure, in addition to holidays and weekends. In order to differentiate sensitivities of stock prices to day time and overnight information, the daily return ratio is broken into two sub-ratios for day time and overnight returns, respectively.

(2). Daytime returns are measured as (close price – open price)/open price. All information, mainly domestic, released during trading time should be reflected in this ratio.

(3). Overnight returns reflect information available after market closure, mostly from overseas. The ratio is calculated by (open price - previous close price)/previous close price.

(4). Volatility ratio, log (high price)-log (low price), measures the maximum swing in stock prices during a trading day.

All variables are measured in percentage change or growth form and proven to be I(1) by Augmented Dickey-Fuller unit root test (results are available upon request).

For each ratio class A and B shares represent two independent random samples and a test for equality of population means without the assumption of equal variances suggested by Newbold (1995) is conducted. The approximate t-test of equal means is calculated as the following:

$$t_A = \frac{\overline{x}_1 - \overline{x}_2}{\sqrt{\hat{\sigma}_1^2/n_1 + \hat{\sigma}_2^2/n_2}}, \quad (1)$$

where, t_A represents the t-statistic, $\overline{x}$ and $\hat{\sigma}^2$ indicate means and variances for class A and B shares.

In order to examine differences in stock market sensitivities of stock returns of class A and B shares, we estimated the following two-equation system:

$$Y_A = \alpha_A + \beta_A M + \varepsilon_A$$
$$Y_B = \alpha_B + \beta_B M + \varepsilon_B$$
$$Test: \beta_A = \beta_B \quad , \quad (2)$$

where $Y_A \; and \; Y_B$ are daily, daytime or overnight stock returns for class A and B shares, respectively. $\beta_A \; and \; \beta_B$ are class A and B stocks' regression coefficients of stock market, M, represented by percentage changes in S&P 500 Stock Index. The coefficients of stock market measure sensitivities of class A and B shares to the stock market. The result of the t-test can tell if the null hypothesis of equal stock market coefficients for class A and B shares should be accepted or rejected.

We also use the t-test to examine if investors need to pay a premium for more voting rights and one-way conversion privilege attached to the class A shares. The null hypothesis is that the premium equals zero. We calculate and test two types of premiums as follows:

1- Daytime premium = (close price of A – 30*close price of B)/30*close price of B.
2- Open premium = (open price of A-30*open price of B)/30*open price of B.

RESULTS

Compared to class B shares, class A shares have advantages in voting and conversion rights which may be acquired by paying a one-time premium as suggested by our results (Table 1). The premiums paid by class A shareholders for extra voting rights and conversion privilege are significantly different from zero. The result is in line with previous findings that investors have to pay a premium for additional stock voting rights, for example, Smith and Amoako-Adu (1995), Hauser and Lauterbach (2004) and Swisher (2006). Since both class A and B shares are issued by the same company, returns and price volatility in both class A and B shares should not deviate far from each other. Therefore, we hypothesize that class A and B shares share similar return and risk characteristics. The traditional daily return ratio supports our hypothesis. The ratio has a mean of 0.051% for both class A and B shares, and its standard deviations are also close for class A and B shares, 1.444% vs. 1.414% (Table 1). Nevertheless, inconsistency is revealed in intraday changes. Overnight returns for class B shares have a mean of 0.064%, in contrast to 0.027% for class A shares. The difference is significant at the five percent level. However, daytime returns tell a different story. Although the average daytime return rate for class A shares is higher, 0.024%, compared

with a -0.012% for class B shares, results of the equality test suggest that there are no significant differences in daytime returns and their variances (Table 1). The results suggest that class B shares tend to have higher opening prices and class A shares tend to have higher closing prices. The stock price behavior may reflect an intraday adjustment due to the stock conversion. As Buffett (2003) points out when the price of class B shares rises above $1/30^{th}$ of the price of class A shares, investors may buy class A shares and immediately convert them into class B shares to realize arbitrage profits. The increase in the demand for class A shares bids up the class A prices and the conversion of class A to class B shares pushes down the class B prices. The process continues until the arbitrage opportunity disappears. However, if the process is overdone, it may make the class B prices more attractive and thus lead to the higher opening prices for class B shares and eventually another potential arbitrage opportunity.

The higher overnight returns for class B shares may be a reason for investors to buy class B shares at discounted prices (compared to the premium prices for class A shares). However, this benefit may be offset by greater risks involved in the class B shares. The class B shares display much higher volatility than class A shares. The volatility ratio for the class B shares is 1.65 and 1.395 for the class A shares. The difference is significant at the one percent level. Results in Table 1 indicate that the class B share prices are more volatile with much larger trading volumes during the entire trading period, but the average return rate over the entire trading day is almost at or slightly below zero.

Table 1: Summary Statistics (in percent, except for VolumeA and VolumeB): May 10, 1996 through June 30, 2008

Variable	*Mean*	*Std. Deviation*	*Minimum*	*Maximum*
DayA	0.024	1.293	-6.627	8.989
DayB	-0.012	1.309	-6.182	10.462
NiteA	0.027	0.631	-7.647	7.500
NiteB	0.064	0.651	-9.591	8.643
DailyA	0.051	1.444	-7.401	10.227
DailyB	0.051	1.414	-6.771	11.753
VolatilA	1.396	1.197	0.000	10.446
VolatilB	1.642	1.187	0.000	11.248
VolumeA	35849	29589	0	332000
VolumeB	1090600	952380	300	17867000

Equality Tests for A Shares vs. B Shares		
	T-test of equal means	F-test of equal variances
DayA vs. DayB	1.091 (0.275)	1.025 (0.493)
NiteA vs. NiteB	-2.257 (0.024)**	1.064 (0.089)*
DailyA vs. DailyB	0.003 (0.998)	1.043 (0.241)
VolatilA vs. VolatilB	-8.057 (0.000)***	1.018 (0.622)
VolumeA vs. VolumeB	-61.12 (0.000)***	1036.0 (0.000)***

Test of hypothesis: Mean = 0
Mean of Daypre = 0.515, Std. Deviatoin of Daypre = 1.111, t-statistic = 24.154(0.000)***
Mean of Openpre = 0.446, Std. Deviation of Openpre = 1.083, t-statistic = 22.741(0.000)***

*DayA and DayB are day time returns, (close price-open price)/open price, for A and B shares, respectively. NiteA and NiteB are overnight returns, (open -previous close)/previous close, for A and B shares, respectively. DailyA and DailyB are daily returns, (close -previous close)/previous close, for A and B shares, respectively. VolatilA and VolatilB are daily volatilities, log (high price)-log (low price), for A and B shares, respectively. VolumeA and VolumeB are trade volumes for A shares and B shares, respectively. Daypre=(closeA –30*closeB)/30*closeB; Openpre=(openA-30*openB)/30*openB. P-values are in parentheses. *, **, *** indicate significance at the ten, five, and one percent levels, respectively. Although the null hypothesis of equal variances between VolumeA and VolumeB is rejected, the t-statistic and its p-value remain the same as reported in the table. Number of observations is 3049. The following trading dates are deleted, due to lack of trading information for A shares: 2/23/2000, 6/2/2000, 6/9/2000, 8/28/2000, 8/29/2000, and 2/1/2002.*

Table 2 reports sensitivities of class A and B shares to the stock market. We estimate the market model for the three return ratios and volatility ratio. There are no significant differences detected in sensitivities of class A and B shares to the stock market, in terms of daily returns. For daytime returns, class B shares display higher stock market sensitivity than class A shares do, although the difference is marginally

significant at the ten percent level. The similar stock market sensitivities of daily and daytime returns for class A and B shares may explain why daily and daytime returns for the class A and B shares are statistically equal (Table1). However, in the case of overnight returns, the constant term for class B shares is 0.001 with a t-value of 5.60, in contrast to that for class A shares of 0.000 with a t-value of 2.48. The larger constant term in the market model suggests that class B shares are more sensitive to the overnight information which may not be reflected in the domestic market portfolio. The result is in line with the Kim and Kim's (2007) finding that stock price and volatility spillover is stronger when the stock listed on the overseas market opens trading on the overnight U.S. ADR market. Moreover, fluctuations in the prices of class B shares demonstrate a significant higher sensitivity to the stock market volatility than class A shares do. The result is not surprising, given the fact that the average volatility ratio for class B shares is significantly higher than that for class A shares (Table 1). In addition, the average daily returns for class A and B shares are virtually same. There is no meaningful financial motivation to convert class A shares into class B shares, unless the arbitrage opportunity mentioned above can bring returns large enough to compensate higher volatility embedded in the class B shares.

Table 2: Sensitivities of A and B Shares to the Stock Market (Independent Variable: S&P 500 Stock Index)

Dependent variable	**Constant**	**Coefficient of DaySP**	**R^2 (%)**
DayA	0.000	0.260	5.09
	(0.72)	(12.79)***	
DayB	-0.000	0.276	5.60
	(-0.88)	(13.45) ***	
T-test of equal coefficients of DaySP: -1.752	P-value: 0.080*		
Dependent variable	Constant	Coefficient of NiteSP	R^2 (%)
NiteA	0.000	1.149	0.08
	(2.48)**	(4.96)***	
NiteB	0.001	1.480	1.25
	(5.60)***	(6.22)***	
T-test of equal coefficients of NiteSP: -2.074	P-value: 0.038**		
Dependent variable	Constant	Coefficient of DailySP	R^2 (%)
DailyA	0.000	0.385	9.01
	(1.61)	(17.37)***	
DailyB	0.000	0.387	9.51
	(1.64)*	(17.89)***	
T-test of equal coefficients of DailySP: -0.251	P-value: 0.802		
Dependent variable	Constant	Coefficient of VolatilSP	R^2 (%)
VolatilA	0.006	0.546	14.34
	(16.08)***	(22.59)***	
VolatilB	0.008	0.594	17.28
	(21.18)***	(25.23)***	
T-test of equal coefficients of VolatilSP: -4.435	P-value: 0.000***		

*DayA and DayB are day time returns, (close price-open price)/open price, for A and B shares, respectively. NiteA and NiteB are overnight returns, (open -previous close)/previous close, for A and B shares, respectively. DailyA and DailyB are daily returns, (close -previous close)/previous close, for A and B shares, respectively. VolatilA and VolatilB are daily volatilities, log (high price)-log (low price), for A and B shares, respectively. Variables with names ended with SP are based on S&P 500 Stock Indexes. t-values are in parentheses. *, **, *** indicate significance at the ten, five, and one percent levels, respectively. Number of observations is 3049. The following trading dates are deleted, due to lack of trading information for A shares: 2/23/2000, 6/2/2000, 6/9/2000, 8/28/2000, 8/29/2000, and 2/1/2002.*

CONCLUDING COMMENTS

This paper investigates intraday changes in Berkshire Hathaway's dual class common stocks with differential voting rights and one-way convertibility. The sample used in this study contains 3049 observations over a period of May 9, 1996 through June 30, 2008. We conduct a t-test on the null hypothesis that average premium for obtaining class A shares with additional voting rights and one-way

conversion privilege is zero. Our results suggest that investors do pay significant premiums to obtain extra voting rights and one-way conversion privilege embedded in the class A shares. The result is consistent with many previous studies.

We create four series to examine return and risk characteristics of class A and B shares: daily returns, daytime returns, overnight returns, and volatility ratio. While we find that the overall return and risk are priced in an efficient manner for both class A and B shares as evidenced by almost identical daily returns and their variations of the two classes of stocks, our results on intraday prices detect market inefficiencies over short intervals. The results indicate that class B shares tend to have significantly higher opening prices and class A shares tend to have higher closing prices, although both class A and B shares have similar average daily returns. Price dynamics may create arbitrage opportunities for investors.

Investors may buy class A shares at the opening of the stock market when the price of class B shares rises above $1/30^{th}$ of the price of class A shares. It means acquiring class A shares at relatively low prices. Then the investors can immediately convert acquired class A shares into class B shares to realize arbitrage profits. The increase in the demand for class A shares in morning may bid up the A prices and the conversion of class A to class B shares push down the B prices in the rest of the trading day. The process continues until the arbitrage opportunity disappears. Nonetheless, if the process is overdone, the A prices exceed 30 times of the B prices near the market closure, it may make the B prices more attractive. The strong demand for class B shares may lead to the higher opening prices for class B shares. It may indicate another potential arbitrage opportunity. The intraday inefficiencies in the stock market cannot guarantee feasible arbitrage opportunities which require significant misprices to offset trading costs and tax liabilities.

In addition, the higher overnight returns for class B shares may be counteracted by higher volatility embedded in the class B shares. Results of our two-equation (the market model) system indicate that class B shares are more sensitive to the stock market volatility, compared with class A shares. The above findings are solely derived from a single company. Therefore, the intraday trading strategy discussed in this study is only relevant to Berkshire Hathaway dual listed stocks. Nevertheless, the method of analyzing intraday pricing efficiency may be applied to other companies with dual listings or cross-exchange listings to identify potential patterns of mispricing.

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BIOGRAPHY

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