

The Option-Listing Effect and Depositary Receipts: Is it Different from that of Domestic Stocks?

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In recent decades, the introduction of options on a stock has usually led to negative abnormal returns on and around the days the options began trading. This paper explores that effect with respect to American Depositary Receipts (ADRs) and finds a similar result; however, the impact is lower when compared to a matching sample of domestic stocks. This is congruous with the previous research, which finds that the trading of stocks that are listed in more than one country is more efficient compared to the trading of stocks that are not, and the higher level of efficiency lowers the level of abnormal returns associated with an event like option listing.

JEL classification: G14; G15

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1. Introduction

The effect of the introduction of options on the performance of the underlying shares has received a great deal of attention. We believe that this effect has yet to be adequately explored in the case where the underlying assets are American Depositary Receipts (ADRs) on a foreign security. We find that the negative returns associated with the introduction of options observed with stocks that only trade in the US and Canada also occur with ADRs; however, the returns are less negative, which may be because the trading of ADRs is more efficient, relative to the stocks that only trade in one country.

We analyze a sample of ADRs that had options initially listed on them over the period 2000 to 2007. Although the number of newly optioned ADRs is small relative to the number of total stocks optioned, examining ADRs is important for at least two reasons. First, markets are becoming more globalized. Given the dramatic increase in cross-listings, distinguishing the behavior of ADRs from other stocks is important. Second, examining certain markets or types of assets in isolation can help provide additional insights into the causes of the abnormal behavior of stock returns observed at the introduction of options.

As Faff and Hillier (2005, p. 1360) note, “Empirical research examining the impact of new option listing has not yet reached a consensus on its effect on prices”. One point of continued interest is why researchers have found the effect of option listing on prices and returns to have been positive before 1981, see Branch and Finnerty (1981) and Conrad (1989), and negative in the subsequent periods, see Figlewski and Webb (1993) and Sorescu (2000). By looking at the effects of option listing both in unique data sets and from different perspectives, researchers can gain insights to explain such contrary results. Our study of the optioned ADRs is a part of the growing literature examining the effect of option listing on a specific subgroup of assets.

Our primary goal is to analyze the “option-listing effect”, which is the behavior of cumulative abnormal returns (CARs) before, on, and after the option listing date. We compare the option-listing effect of ADRs to that of a matching sample of stocks that only trade in the US and Canada, henceforth, “domestic stocks”. Using a sample of ADR returns over the period 2000 to 2007, our event study finds a significant negative effect and negative CARs on many days just before and after the listing of options, that is, the option-listing effect is negative. This is consistent with most of the research on this topic that uses the post 1981 data. Compared to a matching sample of domestic stocks, however, the option-listing effect is not as large in absolute value terms. A visual inspection

of CARs clearly indicates the lower negative effect on ADRs. Using two specifications to control for other effects, we find that an econometric estimate of the average difference of the effect on ADRs versus domestic stocks is positive and robust over various time periods around the option-listing date. Although it is true that the difference is not significant, we feel that the overall evidence does indicate that there is a lower negative impact on the ADRs compared to the other stocks, even after controlling for other factors. We posit that the lower option listing effect on ADRs is from a higher level of efficiency compared to the domestic stocks. The reason for the higher level of efficiency may be because of the higher visibility of stocks that trade in more than one country. Another reason may be a self-selection effect. The firms that selected to have ADRs tended to have had certain properties and had to achieve certain standards in order to achieve that goal. These properties and the results of the efforts to get cross-listed lead to more efficient trading and higher valuations, even when compared to stocks in the country where the ADR trades.¹

Some evidence suggests that the level of efficiency plays a role in determining the effect on a stock's price and return when there is a development or announcement concerning that stock. Chern, Tandon, Yu, and Webb (2008) report that the positive effects of stock split announcements is less for stocks that have options trading on them when compared to those that do not. They conclude that their results are consistent with a hypothesis that the existence of options on a stock increases the efficiency of the market for that stock. This *ex ante* level of enhanced efficiency would then lessen the relative efficiency increase at the announcement of the stock split. Our finding that the negative abnormal returns around the option listing date are lower for ADRs than domestic stocks suggests that the trading of cross-listed stocks is more efficient. We present further support for the distinct properties of cross-listed stocks using a regression analysis that finds, after controlling for other factors, cross-listed stocks have a higher Tobin's Q than the matching sample of domestic stocks.

We include a summary of theories concerning the behavior and value of ADRs in the review of the literature in the next section. That literature review also summarizes the findings and conclusions of previous authors concerning the option-listing effect. Next, we describe the data and its sources. The fourth section describes our approach for measuring the option-listing effect, which follows the standard event study methodology. The fifth section provides descriptive statistics and analysis of the CARs in the window around the option-listing date. Our analysis includes a cross-sectional regression, which finds that the difference in the CARs between ADRs and a matching sample of domestic stocks is robust in the models that control for other factors. The sixth section offers concluding remarks.

2. Review of the Literature

The two topics of this paper require a review of two areas of research. The first area is the research into the effect of the introduction of option trading on the underlying stock. The second area is the research into the reasons a company may choose to cross-list its stock, which creates DRs, and also into the properties of the market for DRs compared to other stocks.

2.1 The Option-Listing Effect

Trading of calls and puts began on The Chicago Board Options Exchange and other exchanges in the 1970s. The interest in the effect of options on stocks began early. Black and Scholes (1973) viewed options as redundant securities, but Ross (1977), suggested that options might affect the underlying stock prices by expanding the opportunity set available to investors. Since then, interest in the effect of the introduction of options on stocks has continued. Three general lines of research attempt to explain the effects: a sampling bias, an implicit relaxation of short-sale constraints effect, and an increase in efficiency effect. One point of common interest in most of the literature on the

¹ The distinct behavior of foreign stocks that select to have DRs compared to the returns of stocks without DRs in their respective home countries has been documented by previous studies such as Lang, Lins, and Miller (2003); Bailey, Karolyi, and Salva (2006); Durnev and Kim (2005); and Karolyi (2006). Our study adds to the literature by making a comparison of ADRs to American stocks.

effect of option listing is why the introduction of options on stocks appears to have had a positive effect on returns up until 1981 and a negative effect after 1981.

The sampling bias theory posits that it is not the options themselves that have an effect on prices and returns. According to the theory, companies with certain characteristics begin to have options written on them, and those endogenous characteristics explain the abnormal returns, see Mayhew and Mihov (2004a, 2004b). The characteristics that led to option listing before 1981 are different from the characteristics that have led to option listing in the years after 1981. Lundstrum and Walker (2006) apply the Mayhew and Mihov methodology to stocks at the introduction of Long-Term Equity Anticipation Securities (LEAPS). Their results suggest that endogenous factors associated with the types of stocks selected for option trading, e.g., high volatility, explain some of the abnormal returns observed at the introduction of LEAPS.

Another explanation is the theory that the introduction of options essentially relaxes short-selling constraints, which would explain the negative abnormal returns associated with option listing that have been observed since 1981. Diamond and Verrecchia (1987) show that when option listings eliminate binding short-sale constraints, the underlying stock prices adjust more quickly to adverse information. According to the theory, options allow pessimistic investors to act more readily upon negative information; therefore, the introduction of options will have a negative impact on stock prices, see Danielson and Sorescu (2001).

One obvious problem with the relaxation of short-selling constraints theory is that it is incongruous with the observed patterns prior to 1981; however, Sorescu (2000) and Danielson and Sorescu (2001) suggest that changes in the market in the early 1980s can explain why the introduction of option trading began having negative effects after 1981. The theory in this case posits that there are two separate effects: an increase in efficiency and a relaxation of short-selling constraints. The increase in efficiency had a positive effect, but the ability of that effect to increase prices declined as markets became more efficient from two changes in the early 1980s. One important change was the introduction of index options in 1982, which may have made the market more complete. In a more complete market, the positive effects of option introduction for individual stocks would be lower, and the short-selling effect would then dominate. The other important change was an increase in regulations concerning options, e.g., more stringent margin restrictions for option dealers and an increased scrutiny of sales practices, which increased efficiency and lowered the additional efficiency from the introduction of option trading.

It is generally thought that the introduction of options increased the efficiency of the market for the underlying stock. For the years 1974 to 1980, Conrad (1989) uses the term the “additional information hypothesis” in his explanation as to why stocks increased in value following the introduction of options during that period. According to the hypothesis, the introduction of option trading increases interest in the stock and its price. Other researchers have found that the introduction of options increases interest in the stock. Damodaran and Lim (1991) find that after options begin trading on a stock, the number of analysts following the stock and the number of articles mentioning the stock in *The Wall Street Journal* increase. The increase in attention the stock gets after the introduction of option trading would explain why Damodaran and Lim (1991) and Jennings and Starks (1986) find that the prices of optioned stocks adjust more quickly to new information than stocks without options trading on them, and this is consistent with the Diamond and Verrecchia (1987) study that focuses on negative information.

One way to gain insights into the underlying effects is to examine the behavior of stock prices in special cases. As already mentioned, Lundstrum and Walker (2006) look at the effect of the introduction of LEAPS. Other examples are Sahlstrom (2001) who examines the effect of option listing in Finland; Chern, Tandon, Yu, and Webb (2008) who compare the behavior of optioned stocks and non-optioned stocks at the announcement of stock splits; and Tandon, Yu, and Webb (2008) who examine the effect of option listing on stocks that also have secondary offerings.

Sahlstrom (2001) essentially examines the effect of option listings on stocks in a market that is not as liquid as American markets. For the time period of the study, compared to American markets,

the Finnish stock market was relatively volatile and thinly traded. Also, a short-selling system did not exist. The study finds that the volatility and bid-ask spread of a stock tend to decline after the listing of options on that stock, which supports the theory that the introduction of options increases efficiency.

Chern, Tandon, Yu, and Webb (2008) find that the abnormal returns associated with stock splits are lower in magnitude for stocks that have options trading on them than stocks that do not have options trading on them. They employ a traditional event study that controls for market returns, capitalization, book-to-market ratio, and trading volume. The results are significant for stocks on the NYSE and Amex, but the results are not as strong in the case of NASDAQ stocks. Overall, however, the results suggest that the markets for stocks with options are more efficient, and this diminishes the impact of the stock split announcement.

Tandon, Yu, and Webb (2008) examine the stocks of firms that have a secondary stock offering at a point when options do not trade on their stocks and then have another secondary stock offering at a point when options are trading on the stock. They find that the magnitude of the abnormal returns associated with the offering after the options have begun trading, is smaller. In summary, when a secondary offering occurs, the effect on the stock is negative, and the effect is greater when options do not trade on the stock compared to when options trade on the stock. The authors conclude that option trading increases the efficiency of the market for the stocks.

Our work in this study contributes to this growing line of research that examines the effect of option listing on stocks with a unique set of properties. The issue here is to compare the behavior of ADRs to stocks that only trade in America. To understand the issue, it is important to review the properties of DRs.

2.2 Depositary Receipts

There is a long and extensive literature on why firms seek cross-listings in other markets and the effect of cross-listing on the firm, competing firms, and overall markets. Exploring all the theories and lines of research are beyond the scope of this study. A comprehensive review can be found in Karolyi (2006). Although each competing theory has some support, many researchers provide results that suggest that the trading of cross-listed stocks is more efficient when compared to stocks that trade in only one country.

The traditional explanation for why firms choose to list in other countries is to lower the cost of capital as the shares become more accessible to global investors, see Karolyi (2006). Many studies report positive abnormal returns associated with the event of cross-listing, see Miller (1999) and Foerster and Karolyi (1999). It may also lower the cost of acquiring the shares of another company in that market. A model developed by Kumar and Ramchand (2005) demonstrates that possibility. The results of Burns (2004) and Tolmunen and Torstila (2005) offer some support for it.

Another line of research addresses issues concerning management, dominant shareholders, and public investors. One reason that firms might choose to cross-list is for the benefit of the stockholders by having the stock listed on an exchange that lowers the agency problem. According to the "bonding hypothesis", foreign firms that list in the US come under the Securities and Exchange Commission (SEC) reporting regulations, and the investors have legal recourse under the US judicial system. According to the hypothesis, managers will improve their performance if the stock becomes listed on a foreign exchange, with tighter regulatory oversight, see Coffee (1999, 2002), Stulz (1999), and Reese and Weisbach (2002).

Just as several possible causes for the option-listing effect exist, several possible explanations for the effects associated with cross-listing also exist. A foreign stock listed as a DR may have increased liquidity and price discovery. Lang, Lins and Miller (2003, 2004) and Bailey, Karolyi and Salva (2006) find that more analysts follow foreign stocks once they are listed in the US, and their forecasts become more accurate. Lang, Lins and Miller (2003) and Grammig, Melvin, and Schlag (2005) find improved price discovery from listing in the US.

The hypothesized increased trading efficiency, improved management performance and improved corporate governance associated with cross-listing should lead to ADRs having a higher

relative value when compared to stocks in their respective home markets that are not cross-listed. Durnev and Kim (2005) and Klapper and Love (2004) find Tobin's Q is higher for firms with a higher quality of governance and better disclosure practices. Lang, Lins, and Miller (2003) find that firms that have more analyst coverage and higher forecast accuracy have a higher relative value. Although recent articles such as Gozzi, Levine and Schmukler (2008), King and Segal (2008), and Sarkissian and Schill (2009) find that some of the increase in value from cross-listing is transitory, most studies find that the value of firms increase after they cross-list their stocks.

Our study adds to this research by comparing the option-listing effect of ADRs relative to stocks that trade only in America and examining the evidence for support of a hypothesis that the market for ADRs is more efficient. Chern, Tandon, Yu, and Webb (2008) find that when options trade on a stock, secondary offerings and stock splits have less of an effect. It is likely, therefore, that if a stock trades in several exchanges, it would already have more attention from investors and analysts, and may have other properties that would lessen the option-listing effect.

3. Sample and Data Description

Our study uses option listing data, returns data, price data, and volume data from the years 2000 to 2007. The option-listing data determines the sample period for the returns of each ADR and stock as well as the corresponding market index values. All the data except the option-listing data and values of Tobin's Q comes from the Center for Research in Security Prices (CRSP) data set. CRSP supplies the data for daily returns for each DR and stock as well as the value-weighted index used in our market model, which is used in the calculation of abnormal returns and betas. CRSP also supplies the price and volume data needed for creating a matching sample of domestic stocks. Tobin's Q is computed from a merged file of CRSP and Compustat data.

The source of the options-listing data is the Options Clearing Corporation.² It provides data from the Chicago Board Options Exchange (CBOE), American Stock Exchange (AMEX), Boston Option Exchange (BOX), Philadelphia Stock Exchange (PHLX), the International Securities and Exchange (ISE), and the Pacific Exchange (PCX). Table 1 summarizes the number of total option listings and the number of DRs listed each year from 2000 – 2007.

As Table 1 indicates, 113 ADRs began having options trading on them during the period 2000 to 2007. The criterion for the event study is the availability of data for 100 trading days prior to the listing of the option. This requirement reduces the size of the ADR sample to 76. The sample does not include ADRs that had new options added to existing option listings, and the same is true of our matching sample of domestic stocks.

Composing the matching sample of domestic stock requires special care. First, it requires matching the industry specifications. Second, comparing the ADR sample to all domestic stocks that had options listed on them would not be appropriate. This is because most large US companies had their initial options listings prior to 2000, see Chern, Tandon, Yu, and Webb (2008). Given this observation by Chern et al., we chose to compose our matching sample based upon capitalization rather than other possible characteristics, because it is a very straightforward measure that previous research has found significant for explaining the variation in returns across firms.³ CRSP readily provides the necessary information for matching the capitalization of the two groups. The capitalization measure is the average number of outstanding shares during the year multiplied times the closing price for the calendar year. The CRSP data symbols for the number of shares and price are CSHTR and PRCC_C, respectively.

To compose the sample of domestic stocks for each year and each ADR, we chose a domestic

² www.optionsclearing.com

³ Another possible measure for selecting a matching sample of American stocks is the book-to-market ratio, but we feel capitalization is superior for several reasons. First, accounting conventions can affect book value, and this is even more of a concern when comparing companies from different countries. Second, event studies have found that the abnormal returns associated with an event such as stock splits are negatively correlated with both capitalization and the book-to-market ratio; therefore, the two variables seem to capture similar effects, see Ikenberry, Rankine, and Stice (1996). Finally, using a ratio such as the book-to-market ratio could lead to the inclusion of domestic firms that have very different sizes from the foreign firms.

company that had a new option listing that year, was in the same industry, and was closest in capitalization to the respective ADR. In two cases, the domestic stock that matched the ADR most closely had two option listings in the given year; therefore, the sample of domestic stocks consists of 76 stocks and 78 option-listing events.

Table 1
Optioned Domestic Stocks and ADRs.

Year	Number of option listings	Number of optioned ADRs	Percentage of new option listings that are ADRs
2000	657	7	1.07%
2001	1,659	14	0.84%
2002	1,381	17	1.23%
2003	1,120	10	0.89%
2004	2,574	16	0.62%
2005	1,826	13	0.71%
2006	2,619	27	1.03%
2007	2,859	9	0.32%
Total	14,698	113	0.77%

Notes: Source: Options Clearing Corporation, 2008.

4. Event Study Methodology

The main goal of our empirical analysis is to measure the effect of option listings on the returns of ADRs, relative to domestic stocks. We employ the standard event-study techniques that the researchers have applied to announcements and other events in the market. For good examples of this methodology see Brown and Warner (1980, 1985) and Fama (1991). We offer a summary of our approach here.

We apply the event-study approach to both ADRs and a control group of domestic stocks. For each stock and ADR, we assign the date of the option listing as 0. Negative whole numbers indicate the days before the date of option listing, and positive values indicate the days after the date of option listing. For example, -1 represents the day before the listing date, and +2 represents two days after the listing date. For each ADR “ i ” and stock “ j ”, we estimate the standard market model over the 80 observations consisting of days -100 to -21:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad \text{and} \quad R_{jt} = \alpha_j + \beta_j R_{mt} + \varepsilon_{jt}$$

Where R_{it} represents the daily returns of ADR “ i ” on day “ t ”, R_{jt} represents the daily returns of stock “ j ” on day “ t ”, and R_{mt} represents the daily returns of a US market index on day “ t ”. In this case we use the CRSP value weighted index returns for the market index. It should be noted that $-100 < t < -21$, but the actual corresponding calendar dates will vary from asset to asset.

We estimate the model for each ADR and domestic stock, and this gives one set of coefficient estimates for each ADR denoted a_i and b_i and each stock denoted a_j and b_j . Over the observations consisting of days -20 to +20, we compute the abnormal returns:

$$AR_{it} = R_{it} - [a_i + b_i R_{mt}] \quad \text{for ADRs} \quad \text{and} \quad AR_{jt} = R_{jt} - [a_j + b_j R_{mt}] \quad \text{for domestic stocks.}$$

For each value of t , denoted T , between -20 and +20, we compute the average of all the abnormal returns in each group and then test

$$H_0: \text{given } T \text{ and for all } i, \text{ the population mean of } AR_{iT} \text{ equals zero,}$$

and

$$H_0: \text{given } T \text{ and for all } j, \text{ the population mean of } AR_{jT} \text{ equals zero}$$

Also, for each value of T , we compute a cumulative average for all values of $t < T$ for each of the two samples. Each cumulative average for ADRs is the sample mean of R_{it} given $t < T$. Each

cumulative average for stocks is the sample mean of R_{jt} given $t < T$. This provides an important descriptive measure in each case that lowers the effect of stochastic elements caused by the aggregation of returns of a variety of assets from different points in time.

We also perform a test of proportions on each group. For each T , we test if the proportion of positive values is significantly different from 50 percent:

H_0 : given T and for all i , the proportion of values where $AR_{iT} > 0$ equals 0.50

and

H_0 : given T and for all j , the proportion of values where $AR_{jT} > 0$ equals 0.50.

Such an approach means there are potentially $41 \times 2 = 82$ tests for each group and 41 cumulative averages; however, we condensed the results of the starting values, -20 to -10, and ending values 10 to 20, in each case. The following section presents and summarizes the results.

5. Empirical Results

This section provides results concerning the option-listing effect from three perspectives. First, we compare the pre-listing and post-listing date summary statistics of both the ADRs and domestic stocks. Second, we compare the option-listing effect of ADRs to that of domestic stocks. Third, we perform a cross-sectional regression analysis to measure the difference in the option-listing effect between ADRs and domestic stocks while controlling for other factors such as beta and volatility. Although the option-listing effect is negative for both ADRs and domestic stocks, the results indicate that ADRs tend to have a superior relative performance in the 41-day window around the option listing date. We further explore how ADRs compare to domestic stocks by using a regression of Tobin's Q on the market characteristics of the firms, including a dummy variable indicating whether the stock is an ADR or a domestic stock, and we find that the coefficient on the ADR dummy variable is positive and significant.

5.1 Summary Measures

Although our primary focus is on returns, Table 2 provides summary statistics for several other variables such as daily prices, market capitalizations, and daily trading volumes, as well as the returns. The statistics indicate how well we composed our matching sample of domestic stocks. Furthermore, the statistics give insights into how the initiation of option trading can affect measures other than returns, which can provide the motivation for future research.

The preliminary comparison of the optioned ADRs and optioned stocks shows that, for both groups, the average daily closing stock price is higher over the 20 days prior to the option listing than it is after the option listing. The average of the daily returns for ADRs is higher, that is, less negative than that of the optioned domestic stocks during the 20 days prior to the option listing. In fact, the median return of the ADRs is actually positive prior to the option listing, and the median return of the domestic stocks is negative.

Trading volume is higher for the ADRs, which may be the result of a higher level of visibility. Trading volume declines for both groups after the listing of options, which could be the result of less noise trading and/or the possibility that some investors began substituting the trading of options for the trading of stocks.

5.2 Event-Study Analysis

Table 3 offers results that allow for detailed comparisons of the abnormal returns of ADRs and domestic stocks in the 41-day window around the option-listing date. The statistics in the table are cross-sectional measures that correspond to the indicated day relative to its proximity to the day of option listing. For example, the average abnormal return for the sample of ADRs on the 20th day prior to the option listing date is -0.27 percent. As another example, the average of CARs is -2.69 percent for the sample of domestic stocks for the 20 days to 10 days before the option listing date, which is denoted as [-20,-10]. The corresponding measure for ADRs for [-20,-10] is less negative, with

a value of -1.33 percent. Making such comparisons gives an indication of a difference in the option-listing effect between ADRs and that of the domestic stocks.

Table 2
Descriptive statistics for optioned ADRs and matching sample of optioned stocks.

	Optioned ADRs		Optioned stocks	
	Days [-20; -1] relative to the option listing N=76	Days [+1; +20] relative to the option listing N=76	Days [-20; -1] relative to the option listing N=78	Days [+1; +20] relative to the option listing N=78
Panel A. Closing Daily Price (\$)				
Mean	32.20	31.61	27.95	27.38
Median	23.48	23.34	25.33	23.70
Minimum	3.72	3.75	5.26	4.79
Maximum	101.32	97.93	83.92	76.05
Panel B. Market capitalization (\$ millions)				
Mean	1,729.96	1,754.86	1,748.85	1,791.79
Median	989.97	1,007.65	759.93	724.35
Minimum	18.19	19.49	143.74	139.53
Maximum	17,048.89	18,660.84	16,828.16	17,114.54
Panel C. Trading volume				
Mean	916,153.73	802,617.40	732,533.63	538,886.20
Median	570,649.00	499,581.82	304,205.00	306,190.00
Minimum	32,725.00	21,700.00	34,249.20	37,508.50
Maximum	4,774,234.45	4,937,205.00	14,604,670.00	3,949,616.00
Panel D. Holding-period return (%)				
Mean	-0.0056	0.0040	-0.0523	0.0697
Median	0.0651	0.0215	-0.0811	0.0821
Maximum	-3.0600	-0.7075	-2.0576	1.9198
Minimum	2.7041	0.8763	2.9698	-3.0667

Notes: Closing daily price is the price of the common shares averaged across firms. Market capitalization is computed as the number of shares outstanding times the closing stock price. Trading volume is the number of shares sold daily, averaged across firms. Holding-period return is the daily return on common shares averaged across firms.

It is true that the ADRs and domestic stocks have both positive and negative averages on individual days before and after the reference period of "0", which corresponds to the day of the listing of the options. The results for a specific day may contradict our expectation, and ironically, this is true for the average abnormal return on the option listing day, which is negative for ADRs (-0.02%) and positive (0.13%) for stocks. There can always be anomalies, and this is especially true here, where the data points for each statistic can come from different time periods within the overall sample period of 2000 to 2007. Events on any given calendar day can have large effects opposite in sign and of greater magnitude than the option-listing effect. For any given day T , several observations in either the ADR or domestic sample could have been affected by market events that happened to occur on their respective day T , but there were no large market movements in the other group on their respective day T .

Furthermore, the signs of the averages for $t = 0$ may also be an adjustment after an overreaction with respect to the domestic stocks and an underreaction with respect to the ADRs. In the case of domestic stocks, there were several large negative average values in the days [-4,-1], and the average of the four averages is -0.375. Traders may have tended to oversell on the days leading up to the listing and then did some buying on the days of the listing. Just the opposite may be true for ADRs where the average of the averages for the days [-4,-1] is -0.078, which led to selling pressure on the option-listing dates.

Table 3
Excess returns Around the Option Listing Date

Day	ADR Average Abnormal Return, %	Percent of ADRs with Positive Returns, %	Cumulative Abnormal Return, %	Domestic Stock Average Abnormal Return, %	Percent of Domestic Stocks with Positive Returns	Cumulative Abnormal Return, %	Cumulative Abnormal Return Difference, %	t-ratio Difference in Averages: ADR minus stock
-20	-0.27	43.42	-0.27	-0.42*	39.74*	-0.42	0.15	0.2902
-15	-1.26*	38.15*	-0.86	0.10	44.87	-0.29	-0.57	-2.6315***
-10	-0.22*	39.47 *	-1.33	-0.98***	35.89*	-2.69	1.36	1.4705*
-9	-0.08	44.74	-1.41	0.06	33.45	-2.63	1.22	-0.2709
-8	-0.25	43.42	-1.66	-0.32*	37.18*	-2.95	1.29	0.1354
-7	-0.59 *	38.16*	-2.25	-0.03	47.44	-3.58	1.33	-1.0835
-6	0.65**	52.63	-1.60	-0.63	44.87	-4.21	2.61	2.4767***
-5	-0.61**	46.05	-2.21	0.64	64.10**	-3.57	1.36	-2.4186***
-4	-0.10	40.79	-2.31	-0.81***	33.33**	-4.38	2.07	1.3738*
-3	0.45	50.00	-1.86	-0.50*	38.46*	-4.88	3.02	1.8382**
-2	-0.26	40.79	-2.12	0.27	53.85	-4.61	2.49	-1.0255
-1	-0.40**	35.53**	-2.52	-0.46*	42.31	-5.07	2.55	0.1161
0	-0.02*	56.58*	-2.54	0.13	52.56	-4.94	2.40	-0.2902
+1	-0.26	43.42	-2.80	-0.33	38.46*	-5.27	2.47	0.1354
+2	-0.11	46.05	-2.91	0.01	46.15	-5.26	2.35	-0.2322
+3	-0.40*	43.42	-3.31	0.19	44.87	-5.07	1.76	-1.1416
+4	-0.33	42.11	-3.64	0.00	50.00	-5.07	1.43	-0.6385
+5	-0.18	44.74	-3.82	-0.43	41.03	-5.50	1.68	0.4837
+6	-0.32	44.74	-4.14	0.32	42.31	-5.18	1.04	-1.2383
+7	-0.11	46.05	-4.25	-0.12	51.28	-5.30	1.05	0.0193
+8	0.18	46.05	-4.07	-0.66*	44.87	-5.96	1.89	1.6253*
+9	-0.16	47.37	-4.23	-0.74**	41.03	-6.70	2.47	1.1222
+10	-0.37**	35.53**	-4.60	-0.16	50.00	-6.86	2.26	-0.4063
+15	0.16	48.68	-4.99	0.02	50.00	-7.79	2.80	0.2709
+20	0.02	44.74	-5.70	-0.36	46.15	-8.23	2.53	0.6966

Notes: Abnormal returns are based on the market model, using the CRSP Value-Weighted index return as the market return. The symbol * denotes statistical significance at the ten percent level; ** denotes statistical significance at the five percent level, *** denotes statistical significance at the one percent level. All results are based on one-tailed tests.

The patterns of the averages over the longer period [-10,-1] add additional insights. With respect to the ADRs, for [-10, -1] in Table 3, two of the days have negative averages that are significant at the five percent level, two days have negative averages that are significant at the ten percent level, and one day has a positive and significant average. With respect to the domestic stocks, for [-10, -1] in Table 3, two of the days have negative averages that are significant at the one percent level, three days have negative averages that are significant at the ten percent level, and none of the averages are positive or significant. For [-10,-1] in Table 3, only three of the proportions for ADRs are significantly less than 50 percent, and four of the proportions for domestic stocks are significantly less than 50 percent.

The last column tests the difference between the averages on individual days. There are seven days where the averages are significantly different at the ten, five, or one percent level. On only two of those days are the average returns of the domestic stocks greater than those of the ADR, that is, the value of the ADRs' average excess return minus that of the domestic stocks is negative. Although the t-ratio for the listing day ($t = 0$) has the sign opposite to our hypothesis, of the 25 listed days, it has the sixth lowest absolute value. Table 4 provides the statistics for comparisons over groups of days. In a one-to-one comparison of each of the 30 statistics, the vast majority indicate that the ADRs have a relatively superior performance.

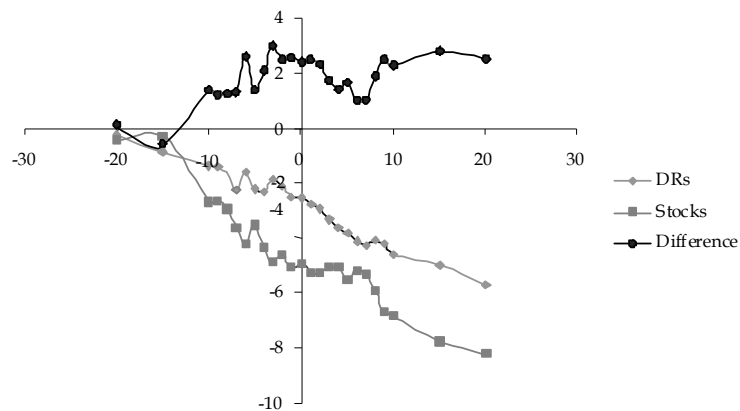
Table 4
Statistics for excess returns during three periods (-20,-2), (-1,0), and (+1,+20) around the options listing date

Days	N	Mean Cumulative Abnormal Return	Precision Weighted CAAR	Ratio of Positive to Negative CARs	Patell Z	Generalized Sign Z
Panel 1. Optioned ADRs (n=76)						
(-20,-2)	76	-3.09%	-2.03%	32:44	-1.718**	-0.912
(-1,0)	76	-0.42%	-0.22%	29:47	-0.579	-1.601*
(+1,+20)	76	-3.17%	-3.00%	31:45	-2.475***	-1.142
Panel 2. Optioned stocks (n=78)						
(-20,-2)	78	-4.01%	-3.95%	26:52**	-3.723***	-2.546***
(-1,0)	78	-0.32%	-0.35%	32:46	-1.024	-1.186
(+1,+20)	78	-3.28%	-2.12%	29:49*	-1.948	-1.866**

Notes: CAAR refers to cumulative average abnormal return. The symbols*, **, and *** denote statistical significance at the ten, five, and one percent levels, respectively, using a one-tail test. The level of significance for the "Ratio of Positive to Negative CARs" pertains to the results of a generalized sign test.

The relative effect of option listing on daily returns is most apparent when comparing the cumulative average returns, or CARs, for the two sets of data. The CARs are negative for both sets of data for all the indicated days. As indicated in Table 3, the CARs for ADRs does dip below that of the domestic stocks at $t = -15$, but that difference is relatively small compared to the CARs starting with $t = -10$. The cumulative return is clearly more negative for day -10 and for the rest of the series after that: $[-9,+20]$. Figure 1 provides a visual presentation of the CARs of both series and the differences. The difference of the CARs for ADRs minus that of domestic stocks is about two percent at $t = 0$ and stays fairly constant over $[1,20]$.

Figure 1
Cumulative abnormal returns (CARs) in the event window for ADRs and domestic stocks.



Notes: Difference is computed as the cumulative abnormal return on ADRs minus the cumulative abnormal return on domestic stocks.

5.3 Cross-sectional Analysis

Having provided evidence of a difference between the option-listing effect of ADRs and domestic stocks, we measure that difference using regression analysis. The goal is to see if a measurable effect exists when other factors are in the equation. In the following discussion, the "DR effect" refers to the difference in the option-listing effect between the ADRs and the matching sample of domestic stocks, as measured by an estimated coefficient in each multiple regression. In estimating the DR effect, we compose our models following the examples from previous research,

for example, Chern, Tandon, Yu and Webb (2008). We regress the combined sample of CARs for ADRs and domestic stocks on a set of cross-sectional independent variables, which include a dummy variable that indicates if the CAR is that of an ADR or domestic stock. The coefficient on that dummy variable is the estimated value of the *DR* effect.

We begin with a sparsely specified model to measure the *DR* effect without other market factors. It includes the *DR* dummy variable and also a dummy variable to account for possible differences associated with the year of the option listing:

$$CAR_k(t_1, t_2) = \alpha_0 + \beta_1 DR + \beta_2 Year + \varepsilon_i$$

The null hypothesis is that $\beta_1 = 0$ and the alternative, based upon previous research is $\beta_1 > 0$. $CAR_k(t_1, t_2)$ represents the cumulative abnormal return of asset k over the specified period relative to the option listing, for example, $CAR_k(-20, -2)$ represents the cumulative abnormal return for asset k from 20 days before to 2 days before the option listing date, or $[-20, -2]$. In this case " k " can refer to either a DR or domestic stock. We perform regressions using the following three dependent variables: $CAR_k(-20, -2)$, $CAR_k(-1, 0)$, and $CAR_k(1, 20)$. We feel that these three choices most directly and succinctly addressed the issue of the option-listing effect and *DR* effect before, on, and after the option-listing date.

The sample includes both the 76 ADRs and the matching sample of 78 domestic stocks. The dummy variable is equal to one for the ADRs and zero for domestic stocks, and β_1 is the *DR* effect. The variable "Year" equals one for the years 2000 to 2002 and zero for years 2003 to 2007. The specification for Year attempts to capture the possible differences associated with the years before and after the 2002 recession.

In Table 5, the coefficient on *DR* is positive in the regressions of all three dependent variables. It is true that the t-ratios are not significant; however, if the *DR* effect was zero for all three dependent variables, the probability of all three coefficients being positive would be one-eighth, or 12.5%. Furthermore, the slope coefficients on *DR* are of similar magnitude for $CAR_k(-20, -2)$ and $CAR_k(1, 20)$. It should seem reasonable that the estimated *DR* effect is larger for $CAR_k(-20, -2)$ and $CAR_k(1, 20)$ than it is for $CAR_k(-1, 0)$ given the relative difference in the number of days. We observe the same result in the richer specification and that the coefficients are similar in value across the specifications.

Table 5
The DR effect with only a listing-date control variable

Dep. Var.	$CAR_k(-20, -2)$		$CAR_k(-1, 0)$		$CAR_k(1, 20)$	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Intercept	-0.04277	-1.95	-0.00125	-0.27	-0.03630	0.0204
DR	0.02381	1.04	0.00101	0.16	0.01810	0.4086
Year	-0.01846	-0.83	-0.00459	-0.64	0.01286	0.6212
R ²	0.0094		0.0034		0.0068	

Notes: T-ratios are calculated using Newey-West standard errors.

The richer specification that measures the *DR* effect in the presence of other factors is

$$CAR_k(t_1, t_2) = \alpha_0 + \beta_1 DR + \beta_2 Year + \beta_3 Beta + \beta_4 Log(Volume) + \varepsilon_i$$

The independent variables in our model are representative of the variables used in Chern et. al. The variable *Beta* is the slope from the OLS regression of asset k on a value-weighted CRSP market index for the period of 100 days to 21 days prior to listing, or $[-100, 21]$. $Log(Volume)$ is the

logarithm of the average trading volume of asset k over the period $[-100, -21]$. StDev represents the standard deviation of the returns over the period $[-100, -21]$. Table 6 provides statistics of these variables and Tobin's Q , which we use in a subsequent analysis.

Table 6
Descriptive statistics of explanatory variables and Tobin's Q

	Mean	Median	Max	Min
Panel A. Optioned ADRs				
Tobin's Q	44.3883	11.1479	659.911	0.7277
Beta	1.2392	1.2352	2.7464	-0.4367
Log(Volume)	5.6227	5.6634	6.6500	0.1535
StDev	0.0335	0.0289	0.1092	0.0127
Panel B. Optioned stocks				
Tobin's Q	8.9429	2.39601	64.816	0.1297
Beta	1.0099	0.8502	3.6921	-0.1195
Log(Volume)	5.4566	5.3742	6.5529	4.7022
StDev	0.0293	0.0267	0.0963	0.0079

The results from the richer econometric specification are shown in Table 7. Only DR and Beta have coefficients with the same sign in all three regressions. Comparing the results of Table 5 and Table 7, we observe that the estimated coefficients on DR are similar in magnitude for each of the dependent variables, in their respective specifications. In each set of specifications, the coefficient on DR is the highest for $CAR_k(-20, -2)$. The equations for $CAR_k(1, 20)$ have the second highest coefficient on DR , and that coefficient is much lower in the results for $CAR_k(-1, 0)$. We posit that the robustness of the coefficient on DR is an indication of the presence of a non-negligible DR effect.

Table 7
The DR effect in a fully specified model

Dep. Var.	$CAR_k(-20, -2)$		$CAR_k(-1, 0)$		$CAR_k(1, 20)$	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Intercept	-0.06704	-0.74	0.04738	2.17	-0.11588	-1.16
DR	0.01586	0.71	0.00162	0.26	0.01496	0.67
Year	-0.01022	-0.36	-0.00489	-0.64	0.02512	0.79
Beta	0.02482	0.94	0.00537	0.84	0.01536	0.83
Log(Volume)	-0.00416	-0.29	-0.00948	-2.68	0.01367	0.76
StDev	0.66240	0.85	-0.07569	-0.40	-0.49473	-0.78
R^2	0.0312		0.0353		0.0183	

Notes: T-ratios are calculated using the Newey-West standard errors.

Exploring the reasons as to why Beta has a positive coefficient in each case and why the others have different signs is outside the focus of this paper, and will be a subject for future research. The main point is that the constancy of the sign and robustness of the coefficients on DR in the different specifications is evidence that the DR effect is positive and a factor to consider when analyzing or forecasting the returns of assets before, on, and after the date of option listing.

The results have implications for practitioners such as a trader who routinely short sells ADRs and domestic stocks that are about to have options listed on them. Our results suggest that the

profits for such a strategy will be lower for ADRs than for domestic stocks. Furthermore, the reasons proposed for the positive DR effect, such as higher liquidity and visibility, will tend to increase a firm's value. Therefore, we can expect that ADRs will have a higher relative market value than similar domestic stocks.

Table 8
Regression of Tobin's Q on a cross-section of variables including DR

Dep. Var.	Tobin's Q		Tobin's Q	
	Coefficient	t-ratio	Coefficient	t-ratio
Intercept	-74.25590	-1.32	-97.30130	-0.90
DR	34.48757	2.65	33.83295	2.57
Year			21.57040	0.81
Beta	1.410871	0.15	5.90068	0.86
Log(Volume)	14.95868	1.45	18.24167	0.95
StDev			-198.11700	-0.84
R ²	0.0745		0.0891	

T-ratios are calculated using Newey-West standard errors. Because the book value of debt was not available for some firms, N=136.

Table 8 provides the results of a regression of Tobin's Q on a set of independent variables, which includes the DR dummy variable. In the two specifications, the coefficient on the *DR* dummy variable is positive and significant. In fact, the t-ratio on the coefficient for *DR* is the largest in both specifications. This is evidence that cross-listing does provide benefits that increase the market value of the firm. Given the results in Table 8, those benefits may include greater market efficiency, which lessens the magnitude of abnormal returns from developments such as the introduction of option-trading on the stock.

6. Conclusion

This paper investigates how the listing of options affects the returns of ADRs relative to domestic stocks. It contributes to the growing literature that examines the effect of option listings both on assets in general and on the specific subgroups of assets, for example, the stocks in a particular market or sharing a certain characteristic. As has been the case for most studies using post 1981 data, our sample for the period 2000 to 2007 shows that the initiation of option trading generally leads to negative returns for both our sample of ADRs and the control group of domestic stocks. Our analysis finds that the negative impact on ADR returns is lower than that for a matching sample of domestic stocks. The analysis also provides measures of the *DR* effect and provides evidence that ADRs apparently have properties that give them relatively higher market valuations, which may explain the difference the *DR* effect around the option-listing date.

One of the more popular explanations for the negative returns and the decline in the price of stocks that have options listed on them is that the listing of the options makes the market for those stocks more efficient and lowers the risk premium. If this is the case, then the reason for the less negative returns for ADRs is probably the result of the market for those assets already being relatively more efficient. One possible explanation is that cross-listing gives the stocks more exposure, which leads to a higher level of efficiency and less of a decline in the risk premium and price, in the days around the option listing date. Another possible explanation is a self-selection effect. Those firms that elect to cross-list and achieve that goal have certain properties that make the market for their shares more efficient. Our finding that Tobin's Q is higher for ADRs compared to the control group of domestic stocks supports these explanations.

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