The Behavior of Prices, Trades and Spreads for Canadian IPO's

Lawrence Kryzanowski
Concordia University, Canada

Skander Lazrak
Brock University, Canada

Ian Rakita
Concordia University, Canada

Microstructure effects for 359 TSX listed IPO's in the period 1984–2002 are examined. Based on first day returns, earning positive mean returns is very difficult even when most IPO's are purchased at the offer price. Mean daily trade volume for the first five days of IPO trading is large relative to the means for the first thirty days and for longer periods. The dollar volume of sells is always significantly larger than that of buys suggesting that institutional investors are active on the sell side in the aftermarket. Liquidity as measured by quoted depth is initially large and decays rapidly over time. Gross returns are often low or negative, and average round-trip trade costs increase from 1.5% to 2.9% and 1.8% to 3.7% for more and less patient traders, respectively, over the first nine months of trading for an average IPO. Early amortized spreads are relatively large due to large initial share turnover (JEL: G10, G15).

Keywords: initial public offerings; microstructure; spreads; decimalization.

I. Introduction

The importance of frictions in capital markets has been acknowledged at least as far back as 1968 when Demsetz published his seminal article

*Financial support from the Concordia FRDP (Faculty Research and Development Program), Ned Goodman Chair in Investment Finance, SSQRC_CIRPÉE, SSQRC, IFM2 and SSHRC (Social Sciences and Humanities Research Council of Canada) are gratefully acknowledged. We appreciate comments and suggestions from participants at presentations at the Multinational Finance Conference (Paphos 2002), Northern Finance Association Conference (Calgary 1999) and Financial Management Association Conference (Orlando 1999), and the research assistance provided by Gang Li.

(*Multinational Finance Journal*, 2005, vol. 9, no. 3/4, pp. 215–236)

DOI: 10.17578/9-3/4-4

that included a model of market maker activity wherein he demonstrated that the bid-ask spread could be interpreted as a cost of immediacy. Thereafter, the literature in this area has grown dramatically. While Demsetz (1968) concentrated on order processing costs, other papers examined components of the bid-ask spread that also included asymmetric information and inventory holding costs.[1]

Market microstructure research has also been strongly driven by order flow characteristics and related security market rules and regulations. The determination of equilibrium prices and how they vary over time are critically affected by rules regarding minimum tick sizes as well as by other trade features such as share volume and trade frequency. Therefore, the move to decimalization has been an important determinant of liquidity and trade cost and has received significant attention by researchers. For the 1996 move to decimalization on the Toronto Stock Exchange (TSX), Chung et al. (1996), Ahn et al. (1996, 1998), Bacidore (1997), Porter and Weaver (1997), and others, find significant reductions in quoted and effective spreads for TSX-listed stocks post-decimalization.[2] Bessembinder (2003) analyzes the 2001 move to decimalization on the NYSE and Nasdaq and notes that quoted spreads decline significantly on each market and that liquidity supply is not adversely affected.

The literature on initial public offerings (IPO's) is extensive and concentrates to a large degree on underpricing and its associated determinants. In contrast, substantially less published work exists on the market microstructure of new equity offerings.[3] Given this deficiency

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1. See, for example, Choi, Salandro and Shastri (1988), Glosten and Harris (1988), George, Kaul and Nimalendran (1991), Stoll (1989), and Huang and Stoll (1997).

2. Beaulieu, Ebrahim and Morgan (2003) examine the 1991 move to decimalization for Toronto Stock Exchange 35 Index Participation Units, and find that price discovery is influenced by tick size.

3. Some notable exceptions include Hegde and Miller (1989) who find that bid-ask spreads for IPO's are on average about 25 percent less than those for seasoned stocks and that this difference persists for eight weeks post IPO; Glascock, Hughes and Varshney (1998) who conclude that bid-ask spreads for REIT IPO's are significantly larger than for common stocks and funds; Ellis, Michaely and O'Hara (2000) who establish the fact that lead underwriters are the dominant IPO market-makers and that they act to stabilize prices for poorly performing new issues; Aggarwal and Conroy (2000) who determine that the price discovery process is influenced by the time of day when IPO trading begins; and Nandha and Sawyer (2002) who find that in the Indian IPO market the relationship between ex-ante uncertainty and information asymmetry proxies and the level of underpricing varies between par (a fixed price of 10 rupees) and premium (priced above par) new issues.

in the literature, the primary objective of this paper is to examine specific microstructure characteristics of a sample of Canadian common stock IPO's over a relatively long period of time (1984–2002). To this end, we examine trade and quote behavior and returns over various initial time intervals stretching out to 180 trading days post IPO. Additionally, we examine the impact that the 1996 move to decimalization on the Toronto Stock Exchange (TSX) had on trade costs, depth, number of trades, volume and returns.

This research is of particular interest to both private and institutional investors who need to better understand the costs and risks that they are likely to bear as participants in the IPO aftermarket. It also is of importance to underwriters who typically act as market makers for new issues and to market regulators who are charged with the responsibility of ensuring that the new issue process and trading in the aftermarket is fair to all participants.

The remainder of this paper is organized as follows. In the next section the sample and data set are described. In section three, returns are briefly considered. We report on the results of our investigation into short run trade activity, as measured primarily by share volume in section four. In section five, we examine two dimensions of trade liquidity, as measured by quoted depth and spreads, where various relative and absolute measures are used to capture the latter. In section six, amortized spreads are examined. Concluding remarks are offered in section seven.

II. Sample and Description of the Data

For the period 1984–92, Canadian IPO's are identified using the TSX Annual New Listings Report and cross matching each new listing (since it need not be an IPO) with a prospectus that identifies the issue as being an IPO. For the period 1993–2002, the Record of New Issues published by the Financial Post is employed. This database lists new Canadian issues of all types (classes of debt, equity and preferred shares). Debt, unit offerings and preferred shares are filtered out as are issues with offer prices below $2.

Next, trade-by-trade data are extracted from the Equity History database compiled by the TSX. This database contains the time stamp, bid, ask, transaction price, depth, and volume for all TSX trades and quotes. In the next sections of this paper, we specifically examine the

TABLE 1. IPO's By Year

Year	IPO's in Sample	Year	IPO's in Sample
1984	4	1994	35
1985	3	1995	13
1986	53	1996	39
1987	28	1997	32
1988	1	1998	9
1989	6	1999	15
1990	4	2000	30
1991	4	2001	4
1992	11	2002	6
1993	62	Total	359

trade and quote data for periods up to (trading) days 5, 30, 90 and 180 post IPO. Thus, this study examines microstructure effects that extend approximately 9 calendar months after the start of secondary market trading.

The final sample contains 359 new issues.[4] Table 1 gives a year-by-year account of the number of IPO's included in the sample. It is interesting to note the relatively large number of issues in 1986 and in 1987 (i.e., up to the world-wide market crash) and the limited number of issues for the five subsequent years. The years 2001 and 2002 show restricted activity following the bursting of the telecom and tech bubbles.

Concerning quotes, we only include those that fall between 9:30 am and 4:00 pm and for which the bid is less than ask, are both positive, and for which the spread is less than 30 percent of the mid-spread. Pre-open and halt quotes are ignored. To be included, trades must occur between 9:30 am and 4:00 pm, have positive transaction prices for a positive number of traded shares and have trade-by-trade returns less

4. The final sample consists of 370 IPO's. Since we have access to the Equity History database from the middle of 1984, four IPO's were dropped from the sample since they were issued in the first few months of 1984. Seven other IPO's were sold on a "when issued" basis. These IPO's have different risk characteristics and trade several days prior to the start of regular share trading on the TSX. According to a document issued by Market Regulation Services Incorporated - Canada's independent securities trading regulator, trades on a when issued basis will be cancelled if the Exchange determines that the security underlying the trade will not be issued. To maintain sample homogeneity, these issues were also dropped although we conducted our analysis both with and without these issues and they had no discernible influence on the final results.

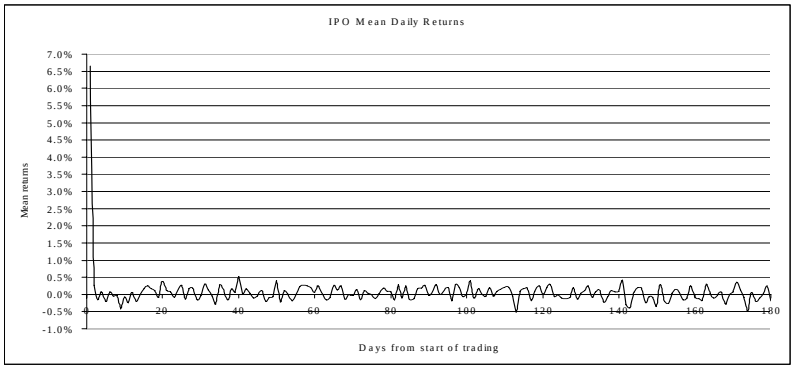

FIGURE 1.—Mean Daily Returns Over 180 Days Post IPO for 359 New TSX Issues in the Period 1984–2002.

than or equal to 50 percent. Trades also are excluded if they have special conditions attached related to settlement, delayed delivery or cancellation.[5] We assume that the associated quote is posted at least 5 seconds before a trade. Finally, the Lee and Ready (1991) algorithm is used to sign each trade.

III. Returns

Although an analysis of returns is not the primary focus of this study, a few comments are worth mentioning since they add to the growing world wide evidence aimed at highlighting the underpricing of IPO's. Of the 359 new issues in the sample, 50.1 percent (180 of 359 issues) are underpriced. This is consistent with the percentage of underpriced IPO's (49.1%) reported in an earlier study by Chung, Kryzanowski and Rakita (2000).

The fact that IPO returns are significantly positive at the start of secondary market trading has been well documented in numerous international studies.[6] For the present sample, day-one mean (median) returns are 6.65 (0.2) percent. Since initial median returns are indistinguishable from zero the typical investor will probably not earn

5. The raw sample consists of 2,947,583 quote lines and 2,285,698 trade lines. The filters eliminate 1.16% and 0.90% respectively of the quotes and trade lines.

6. See Jay Ritter's website link at http://bear.cba.ufl.edu/ritter/Int.pdf.

TABLE 2. Distribution of First Day TSX IPO Returns

First Day Returns	Number of Sample IPO's Represented	Percentage of Sample IPO's Represented	First Day Mean Return
< 178%	All 359	100.00%	6.65%
< 100%	356	99.16%	5.40%
< 50%	348	96.94%	4.05%
< 40%	341	94.99%	3.21%
< 30%	330	91.92%	2.18%
< 20%	314	87.47%	1.06%
< 10%	278	77.44%	–0.64%

a short term profit. The initial mean return found here is among the smallest of any country where a formal study has been conducted.[7] Figure 1 shows the daily evolution of mean returns. After relatively large first day positive returns, daily unadjusted mean returns appear to bounce around randomly within a narrow band (–0.5% to +0.5%) through to the end of the sample period.

Table 2 gives a more detailed breakdown of the distribution of first day mean returns for the IPO sample and serves to highlight how difficult it is to earn positive first day returns for Canadian IPO's even when purchases are made at the offer price. Consider an uninformed investor who naively adopts a policy of investing in every available IPO listed on the TSX. Assume that the universe of possible IPO's available for investment is the sample selected in this study. As is usually the case, hot IPO's will be oversubscribed and the investor will receive a small allocation or more likely no allocation of shares for these IPO's. According to table 2, if the investor misses out on investing in all issues with first day returns above 100 percent (these are the IPO's with the three largest first day returns in the sample having a mean first day return of 155.8%) but still invests in the remaining 99.16 percent of the sample, the first day return before trade costs would drop from 6.65 percent to 5.40 percent. Missing out on IPO's with first day returns above 20 percent (these are the top forty-five new issues in terms of first

7. Only two of 38 countries listed on Jay Ritter's website have similar low initial mean returns. The country with the lowest recorded initial mean return is Denmark at 5.4% for 117 new issues in the period 1984–1998. Austria had the same first day mean return of 6.3% for the period 1984–2002 (83 IPO's) as did the aggregate group of three Canadian studies (500 IPO's) listed.

day returns) but investing in the remaining 87.47 percent of the sample would produce a first day mean return of only 1.06 percent. Finally missing out on IPO's with first day returns above 10 percent (the top 81 issues) but investing in more than three-quarters of the remaining sample would actually produce a negative first day mean return of 0.64 percent before trade costs. The inescapable conclusion is that being able to buy the majority of TSX listed IPO's at the offer price does not guarantee a positive first day mean return and may in fact result in an average loss.

Even the relatively low short term return encountered here is strongly influenced by the price run up in the post-decimalization period, which embodies the tech and telecom bubbles of the later 1990s. The pre-decimalization (prior to April 15, 1996) mean return for 234 IPO's (65.2 percent of the sample) was 4.1 percent whereas the post-decimalization mean return for 125 IPO's (34.8 percent of the sample) was 11.4 percent. The pre (post)-decimalization median initial return was 0 percent (1.7 percent).

IV. Dollar Volume

Transactions and volume are known to convey information to market participants. The onset of secondary market trading in a new stock marks the beginning of the price discovery process wherein opposing forces of supply and demand are influenced by a stream of information ultimately resulting in a price that is suppose to reflect the value of the stock. Conventional belief is that the start of trading for most IPO's is typically marked by unusually high trading frequency and share volume. This exaggerated trading frequency and share volume decays steadily over time and generally reaches a stable long-term level pending the release of new and significant information that normally causes a short-term jump in these two market activity measures.

Comments focusing on dollar volume and differences compared to trading frequency are reported when they exist. Specifically, the dollar volume of trades for the sample of 359 IPO's for periods of 5, 30, 90 and 180 trading days post issue are examined. In calendar time, this corresponds to from one week up to about nine months after the start of secondary market trading. Dollar share volume for each IPO trade in the first 180 days of post-IPO trading is obtained by finding the product of the number of shares traded and its associated transaction price. The

TABLE 3. IPO Volume Statistics and Statistical Tests of Dollar Volume for IPO Buys Versus Sells

	Dollar Volume				Dollar Volume of Buys			
Statistic	5	30	90	180	5	30	90	180
For Full Period:								
Mean	2,370,474	979,259	674,964	670,729	1,027,831	444,584	302,803	312,462
Median	418,063	207,047	150,606	126,023	161,260	81,676	65,662	57,857
Std. Dev.	7,692,286	3,040,841	2,519,753	3,000,716	3,609,911	1,437,632	1,128,564	1,425,117
For Pre-decimalization Period								
Mean	1,077,649	448,740	304,357	250,086	416,607	184,616	130,745	109,417
Median	263,847	150,756	117,976	104,840	95,914	59,251	52,132	44,604
Std. Dev.	3,155,056	1,029,389	679,716	561,379	1,208,934	439,988	307,873	259,250
For Post-decimalization Period								
Mean	4,790,642	1,972,390	1,368,739	1,458,173	2,172,042	931,243	624,897	692,562
Median	989,157	405,747	249,305	188,768	433,056	183,388	110,074	88,172
Std. Dev.	11,961,188	4,814,528	4,088,777	4,944,201	5,731,671	2,288,442	1,827,188	2,348,158

(Continued)

TABLE 3. (Continued)

Statistic	Dollar Volume of Sells 5	30	90	180	Dollar Volume Ratios 5	30	90	180
For Full Period								
Mean	1,342,643	534,675	372,160	358,267	0.8949[b]	0.8558[c]	0.8649[c]	0.8610[c]
Median	239,253	111,962	81,404	72,420	0.6896[c]	0.7571[c]	0.7886[c]	0.8104[c]
Std. Dev.	4,204,450	1,640,767	1,415,674	1,586,741	0.8298	0.5606	0.4748	0.4495
For Pre-decimalization Period								
Mean	661,042	264,124	173,613	140,669	0.8581[c]	0.8043[c]	0.8210[c]	0.8039[c]
Median	160,723	89,963	68,387	60,285	0.6626[c]	0.7374[c]	0.7739[c]	0.7824[c]
Std. Dev	2,047,903	612,234	377,826	305,391	0.8002	0.5590	0.4625	0.3919
For Post-decimalization Period								
Mean	2,618,600	1,041,147	743,841	765,611	0.9636	0.9479	0.9426	0.9622
Median	564,874	203,896	121,216	101,852	0.7469[c]	0.8086[b]	0.8879[c]	0.8851[b]
Std. Dev.	6,374,792	2,582,899	2,303,093	2,614,787	0.8813	0.5537	0.4879	0.5232

Note: a, b and c indicate significance at the 0.10, 0.05 and 0.01 levels. This table reports various cross-sectional statistics for the average dollar volume of trades undifferentiated and differentiated as buys or sells for the sample of 359 IPO's for the first 5, 30, 90 and 180 days of trading post-IPO for the entire period and for the periods before and after the introduction of decimalization by the Toronto Stock Exchange (TSX) on April 15, 1996. Buys and sells are inferred using the algorithm of Lee and Ready (1991). The dollar volume of each trade is obtained by multiplying the number of shares traded by the trade price. Dollar trade volumes are first aggregated on a daily basis for each IPO, and then the time-series average is calculated for each IPO for each of the four post-IPO periods. The table also reports three summary statistics for the cross-sectional distributions of the time-series averages for the ratios of the dollar volume of buys to the dollar volume of sells for the IPO sample. Following the classification of each trade as a buy or sell for each IPO, the ratio of the dollar volume of buys and sells are then aggregated on a daily basis and the time-series average is calculated for each of the four post-IPO trading periods (the first 5, 30, 90 and 180 days). Finally, cross-sectional statistics are computed for the ratios for each period and the appropriate statistical test is conducted. The null hypothesis that the cross-sectional mean (median) is equal to one against an appropriate alternative is tested using a *t*– (Wilcoxon) test.

daily values then are averaged for each IPO over the number of days in each of the four post-IPO trading periods. Sample statistics are then calculated cross-sectionally and appear in table 3. Initially, for each IPO, the time-series mean of the dollar volume of daily trades (un)differentiated by trade direction is determined for each stock for each of the four periods. Differentiating by trade direction involves classifying each trade as a buy or sell according to the Lee and Ready (1991) algorithm.

As expected, the dollar volume of trades per day for the first five days of trading in the life of an IPO is large relative to the means for the first thirty days and for longer periods. The distribution of the dollar volume of trades, dollar volume of buys and dollar volume of sells is skewed with the mean not only exceeding the median in every case but also exceeding the 75th percentile (not shown) in the majority of cases. There is rarely much of a further decline in the mean or median after day ninety. Volatility, as measured by the standard deviation of the cross-section of company means, declines rapidly after day five and exhibits some stability and even limited growth after day ninety.

The post-decimalization period is distinguished by a dramatic increase in the dollar volume of trades, dollar volume of buys and dollar volume of sells compared to respective pre-decimalization levels for each of the four post-IPO trading periods. The mean dollar volume of trades for the five-day post-IPO period in the post-decimalization period (4.79 million) is more than four times the corresponding mean in the pre-decimalization period (1.08 million). This increased trade activity remains relatively stable for all four post-IPO periods, and is due at least in part to the dot-com boom at the end of the millennium. The median dollar volume of trades for the 180-day post-IPO period is only 188,768 (coupled with a median number of daily trades of only 14.87), which suggests that many of the IPO's are thinly traded. The dollar volume of daily buys never exceeds the corresponding dollar volume of daily sells, and this is true in both pre- and post-decimalization periods.

The rightmost four columns under the heading "Dollar Volume Ratios" in table 3 contain cross-sectional statistical tests of ratios of dollar volume of buys to dollar volume of sells. While qualitatively similar results for dollar volume ratios and trade frequency ratios (not shown) are obtained, there is one notable exception. While the mean (median) number of buys is larger (and predominantly statistically significant) compared to the mean (median) number of sells for each post-IPO period following the onset of decimalization, such is not the

TABLE 4. Statistical Tests For IPO Volume Ratios

	Dollar Volume					Dollar Volume of Buys					Dollar Volume of Sells				
	5/30	5/90	5/180	30/180	90/180	5/30	5/90	5/180	30/180	90/180	5/30	5/90	5/180	30/180	90/180
Full Period															
Mean	2.16[c]	3.40[c]	4.23[c]	1.82[c]	1.20[c]	2.06[c]	3.22[c]	4.03[c]	1.79[c]	1.20[c]	2.19[c]	3.51[c]	4.40[c]	1.86[c]	1.21[c]
Median	2.12[c]	3.04[c]	3.61[c]	1.77[c]	1.24[c]	2.00[c]	2.74[c]	3.16[c]	1.66[c]	1.25[c]	2.19[c]	3.11[c]	3.77[c]	1.81[c]	1.25[c]
Std. Dev.	0.94	2.12	3.16	0.84	0.31	1.06	2.38	3.52	0.97	0.35	1.05	2.32	3.40	0.88	0.33
Pre-decimalization															
Mean	1.93[c]	2.82[c]	3.51[c]	1.70[c]	1.21[c]	1.85[c]	2.69[c]	3.36[c]	1.66[c]	1.20[c]	1.95[c]	2.91[c]	3.66[c]	1.74[c]	1.21[c]
Median	1.85[c]	2.50[c]	2.79[c]	1.67[c]	1.25[c]	1.82[c]	2.20[c]	2.48[c]	1.53[c]	1.24[c]	1.88[c]	2.62[c]	2.72[c]	1.71[c]	1.24[c]
Std. Dev.	0.86	1.82	2.68	0.77	0.30	0.97	2.05	3.03	0.93	0.34	0.98	1.97	2.97	0.82	0.32
Post-decimalization															
Mean	2.59[c]	4.47[c]	5.58[c]	2.05[c]	1.20[c]	2.45[c]	4.21[c]	5.29[c]	2.05[c]	1.21[c]	2.64[c]	4.63[c]	5.79[c]	2.09[c]	1.21[c]
Median	2.60[c]	4.32[c]	4.98[c]	1.99[c]	1.23[c]	2.40[c]	3.74[c]	4.08[c]	1.97[c]	1.28[c]	2.69[c]	4.55[c]	4.91[c]	2.09[c]	1.26[c]
Std. Dev.	0.94	2.24	3.53	0.90	0.33	1.12	2.63	3.99	1.00	0.37	1.05	2.50	3.71	0.94	0.34

Note: a, b and c indicate significance at the 0.10, 0.05 and 0.01 levels, respectively, using a *t*–test for the mean ratios and using a Wilcoxon test for the median ratios. This table reports three summary statistics (mean, median and standard deviation) for the cross-sectional distributions of the ratios for the time-series average dollar volumes of trades undifferentiated and differentiated as buys or sells for the sample of 359 IPO's for various pairings of the first 5, 30, 90 and 180 days of trading post-IPO for the entire period and for the periods before and after the introduction of decimalization by the Toronto Stock Exchange (TSX) on April 15, 1996. Buys and sells are inferred using the algorithm of Lee and Ready (1991). For each IPO, the dollar volumes of trades are first aggregated on a daily basis, then the time-series average is calculated for each of the four post-IPO trading periods, and finally the ratio of the time-series averages for various pairs of the four post-IPO trading periods are computed. Thus, "5/30" indicates a comparison involving the first five-to-30 days of trading post-IPO for the respective dollar volume of trade metric. The null hypothesis that the cross-sectional mean (median) is equal to one against an appropriate alternative is tested using a *t*– (Wilcoxon) test.

case for dollar volume of buys versus dollar volume of sells. The dollar volume of sells is always larger than that of buys for each post-IPO period with the ratio of buys to sells being generally significantly different from one at the 5% level or better. This suggests that institutional investors are active on the sell side. While this observation is compelling, its verification is left for future research.[8]

A series of statistical tests for the ratios for each of the three dollar volume variables (undifferentiated and differentiated as buys and sells) for various pairs of post-IPO periods are conducted next by first dividing, for example, the five-day mean dollar volume of trades by its 30-day counterpart for each IPO. A cross sectional mean (median) for each ratio for each trade activity metric is then calculated and a parametric *t*-test (a nonparametric Wilcoxon test) of the null hypothesis that the mean (median) is equal to one against an appropriate alternative is performed. The comparisons are, in turn, for the first five days compared to the first 30, 90 and 180 days, and for the first 30 days compared to the first 180 days, and for the first 90 days compared to the first 180 days. Results appear in table 4.

Both statistical tests indicate that the ratios comparing the first five trading days post-IPO are significantly different from one at the 0.01 level for all three trade activity metrics. Furthermore, the magnitudes of these ratios for each metric increase monotonically as the first five trading days are compared in succession to its counterpart for the first 30, 90 and 180 trading days post-IPO. The ratios for the first 30-to-180 trading days are significantly different from one for each trade activity metric, and are generally less than two for the full period as well as for the pre- and post-decimalization periods. Similar comments can be made when considering the ratios for the first 90-to-180 trading days for each of the three trade activity metrics. Mean and median levels for each metric are only about 20% larger for the first 90 versus the first 180 trading days post-IPO.[9]

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8. Two outliers were removed from the analysis for the five-day ratio of the dollar volume of buys to the dollar volume of sells. One company (MNT Limited) had over $252,000 of buyer initiated trades in the five-day period versus less than $3,000 of seller initiated trades and produced a ratio that was close to 86. Another company (Majestic Electronic) had a ratio that was in excess of 8. These two extreme values had little effect on the nonparametric test but when included, they inflated the standard deviation dramatically (4.59 for the full period and 5.65 for the pre-decimalization period) thereby producing an insignificant *t*-statistic.

9. All ratios are strongly significant for both tests due in large part to the relatively

V. Quoted Depth and the Bid-Ask Spread

Liquidity is an important aspect of any well functioning market. This is true in particular for new stocks where the efficiency of the price discovery process may be hampered by restrictions encountered by investors seeking to acquire or sell their shares. As documented previously, the dollar volume of shares traded and the number of trades are exceptionally large during the early days of secondary market trading. It is not surprising therefore to observe that the number of shares made available for trading by suppliers of liquidity is initially large and declines significantly over time. As is shown in table 5, mean depth for the first five days (90,840) is accompanied by similarly large mean depths pre- and post-decimalization (105,073 and 64,197, respectively). These levels decrease monotonically as the post-IPO window is extended to day180. The decline in depth post-decimalization is inconsistent with the argument advanced by Harris (1994) for changes in tick sizes (i.e., price discreteness) who suggests that ceteris paribus when the price of liquidity (i.e., the spread) is reduced, the quantity supplied will fall.[10] The decline in depth post-decimalization may also imply that institutional investors bear higher trading costs for Canadian IPO's as large orders are fractured when met by inadequate supply at a given price.

There are several potentially important conclusions that can be extracted from an examination of the four spread measures appearing in table 5. Consistent with the large initial trading volume, dollar quoted spreads are smallest for the period ending at day 5 according to both metrics (mean and median) for the full period (0.176 and 0.150). This is also true pre- and post-decimalization. This measure jumps noticeably for the mean (0.273) and median (0.234) for the full period for the first 180 days as well as during the pre- (0.248 and 0.224) and post-decimalization (0.319 and 0.277) periods. The increase is steady over the 30, 90 and 180 days periods. The post-decimalization dollar

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small degree of variability that exists in each of the sets of ratios for each pairing of post-IPO time periods. From the full sample of 359 IPO's, twenty stocks were issued in 1995 and 1996 and overlapped the April 15, 1996 change to decimalization. As a robustness check, all ratios are re-computed with these twenty stocks excluded. Although the ratios change marginally, all ratios remain statistically significant at the 0.01 level.

10. Goldstein and Kavajecz (2000) observe a decrease in depth when most NYSE stocks moved to a 1/16th minimum price increment in June 1997.

TABLE 5. IPO Depth and Spread Statistics

	Quoted Depth				Dollar Quoted Spread				Proportional Quoted Spread			
Statistic	5	30	90	180	5	30	90	180	5	30	90	180
For Full Period												
Mean	90840	53669	37695	32506	0.1755	0.2104	0.2473	0.2726	0.0206	0.0243	0.0290	0.0327
Median	43513	31123	25234	22182	0.1498	0.1818	0.2099	0.2344	0.0177	0.0215	0.0254	0.0280
Std. Dev.	157424	81547	51269	43121	0.1475	0.2039	0.1893	0.1821	0.0147	0.0155	0.0187	0.0224
For Pre-decimalization Period												
Mean	105073	58150	39495	32945	0.1726	0.1941	0.2241	0.2479	0.0218	0.0247	0.0279	0.0304
Median	40847	30572	25116	22152	0.1555	0.1831	0.2047	0.2239	0.0197	0.0229	0.0254	0.0281
Std. Dev.	185018	93293	57458	47535	0.0813	0.0947	0.1142	0.1539	0.0126	0.0139	0.0150	0.0160
For Post-decimalization Period												
Mean	64197	45279	34327	31684	0.1807	0.2410	0.2907	0.3189	0.0183	0.0235	0.0312	0.0371
Median	45635	31439	25407	22883	0.1197	0.1688	0.2323	0.2774	0.0145	0.0182	0.0260	0.0273
Std. Dev.	78287	52302	36981	33487	0.2245	0.3191	0.2758	0.2193	0.0179	0.0182	0.0241	0.0306

(Continued)

TABLE 5. (Continued)

	Dollar Effective Spread				Proportional Effective Spread			
Statistic	5	30	90	180	5	30	90	180
For Full Period								
Mean	0.1430	0.1691	0.1932	0.2095	0.0165	0.0187	0.0224	0.0248
Median	0.1254	0.1408	0.1598	0.1776	0.0145	0.0159	0.0193	0.0215
Std. Dev.	0.1221	0.2164	0.1767	0.1382	0.0130	0.0116	0.0144	0.0161
For Pre-decimalization Period								
Mean	0.1377	0.1487	0.1684	0.1830	0.0175	0.0188	0.0214	0.0228
Median	0.1274	0.1385	0.1545	0.1677	0.0155	0.0164	0.0186	0.0209
Std. Dev.	0.0665	0.0737	0.0798	0.0874	0.0140	0.0106	0.0126	0.0117
For Post-decimalization Period								
Mean	0.1529	0.2076	0.2399	0.2594	0.0147	0.0188	0.0244	0.0288
Median	0.1043	0.1438	0.1881	0.2238	0.0121	0.0157	0.0207	0.0223
Std. Dev.	0.1861	0.3505	0.2737	0.1923	0.0108	0.0133	0.0171	0.0216

Note: This table reports various cross-sectional statistics for average depth and various spread measures for the sample of 359 IPO's for the first 5, 30, 90 and 180 days of trading post-IPO for the entire period and for the periods before and after the introduction of decimalization by the Toronto Stock Exchange (TSX) on April 15, 1996. Quoted Depths are first aggregated on a daily basis for each IPO, and then the time-series average is calculated for each IPO for each of the four post-IPO periods. A similar approach is taken for each of the spread measures. The Depth variable is calculated from the formula: Quoted Depth=[(*bid * bid size+ ask * ask size*)/2]. The Dollar Quoted Spread is simply the difference between the ask and the bid. The Proportional Quoted Spread is equal to the Dollar Quoted Spread divided by the mid spread. The Dollar Effective Spread is the absolute value of the difference between the transaction price and the mid spread. Finally, the Proportional Effective Spread is the Dollar Effective Spread divided by the mid spread.

quoted spread is generally larger than the similar pre-decimalization value. This apparently anomalous finding can be explained by noting that this measure does not adjust for price and the post-decimalization period is influenced in particular by significant price inflation during the telecom/tech boom. The proportional quoted spread does adjust for price and a monotonic increase at each point in time for the full period as well as for the pre- and post-decimalization periods is accompanied by larger pre-decimalization values for the post-IPO periods ending at day 5 and day 30 in particular.

The dollar effective spread and the proportional effective spread also are shown in table 5. Consistent monotonic increases in both spread variables can also be observed for periods out to day 180. It is interesting to note that for the proportional effective spread, pre- and post-decimalization values are similar for the post-IPO period ending at day 5 and are in fact identical for the period ending at day 30. What is even more relevant for investors is the observation that secondary market trading over the first nine calendar months generates material round-trip trade costs before accounting for brokerage commissions. To illustrate, an investor who used a similar mix of executed market and limit orders for the IPO's in the post-decimalization period paid, on average, round trip trade costs of 1.47%, 1.88%, 2.44% and 2.88% over the first 5, 30, 90 and 180 days, respectively, of post-IPO trading for an average IPO. Similarly, a less patient investor who always traded against the posted quotes (i.e., used market orders) in the post-decimalization period paid, on average, round trip trade costs of 1.83%, 2.35%, 3.12% and 3.71% over the first 5, 30, 90 and 180 days, respectively, of post-IPO trading for an average IPO.[11] Thus, the relatively high cost of trading before accounting for brokerage commissions for Canadian IPO's coupled with generally low or negative returns for investors who do not purchase shares in the primary market, suggest that the majority of new issues will be poor performers in the short run.[12]

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11. The trade costs, on average, for a typical IPO (i.e., based on the medians) in the post-decimalization period for each of the post-IPO periods for both trader situations are lower than those reported in the text for an average IPO (i.e., based on the means) due to the right skewness (mean greater than the median) that exists in all of the trade cost distributions for the post-decimalization period.

12. Similar to the analysis done for dollar volume (and number of trades), tests of significance of depth and the four spread variables for the first 5 days compared to the first 90 and 180 days, for the first 30 days compared to the first 180 days, and for the first 90 days

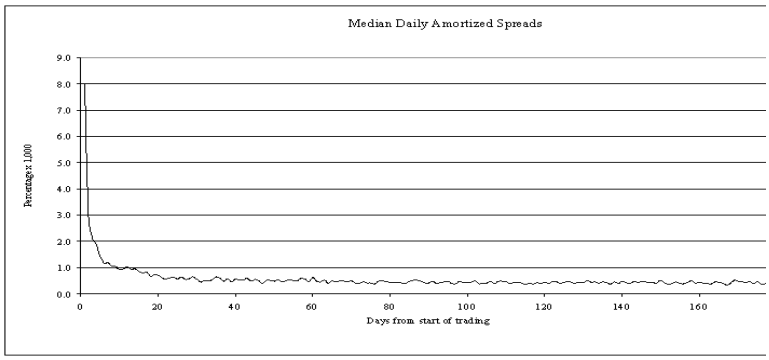

FIGURE 2. — Median Daily Percentage Amortized Spreads Over the 180 Event Days Post IPO For 359 TSX IPO's Issued During 1984–2002.

VI. The Amortized Spread

The amortized spread is investigated next. Most empirical studies that consider the importance of the bid-ask spread in asset pricing ignore the impact of amortizing the cost of the spread over investors' holding periods. Chalmers and Kadlec (1998) find that the amortized spread is quite small in a study of AMEX and NYSE stocks over the period 1983-1992. The amortized spread at the end of day T is summed over all daily trades (τ) and is defined as:

$$AS_T = \frac{\sum_{t=1}^{\tau} |P_t - M_t| V_t}{P_T \ SO_T} \tag{1}$$

where $|P_t - M_t|$ is the absolute value of the effective spread (i.e., the absolute value of the transaction price less the prevailing mid-spread), V_t is the volume of shares associated with each trade, and $P_T \ SO_T$ represents the firm's market value of equity at the end of day T. Table 6 contains summary statistics for the amortized spread for the full sample at different points of time as well as for the samples of pre- and

compared to the first 180 days also were conducted. Since these were all significant at less than 1%, the discussion and the associated tables have been suppressed to save space.

TABLE 6. IPO Amortized Spread Statistics and Statistical Tests

	Amortized Spread (%) × 10^3				Amortized Spread Comparisons (%) × 10^3				
Statistic	5	30	90	180	5/30	5/90	5/180	30/180	90/180
For Full Period									
Mean	6.5077	2.7996	2.2064	2.0880	0.3702[c]	0.4301[c]	0.4418[c]	0.0712[c]	0.0118[a]
Median	4.2151	2.1894	1.8040	1.6174	0.1864[c]	0.2160[c]	0.2293[c]	0.0481[c]	0.0172[a]
Std. Dev.	7.9697	2.4171	1.9076	1.9162	0.6099	0.7073	0.7262	0.1904	0.1209
For Pre-decimalization Period									
Mean	6.0198	2.8199	2.2556	2.0019	0.3190[c]	0.3764[c]	0.4016[c]	0.0818[c]	0.0254[c]
Median	3.8934	2.2157	1.8690	1.6870	0.1544[c]	0.1945[c]	0.2018[c]	0.0498[c]	0.0190[c]
Std. Dev.	7.5368	2.4175	1.8149	1.4844	0.5716	0.6646	0.6862	0.1717	0.0872
For Post-decimalization Period									
Mean	7.4173	2.7617	2.1143	2.2492	0.4656[c]	0.5303[c]	0.5168[c]	0.0512[c]	–0.0135
Median	4.6986	2.1823	1.5861	1.6015	0.6675[c]	0.2922[c]	0.2706[c]	0.0432[c]	0.0118[b]
Std. Dev.	8.6779	2.4256	2.0745	2.5339	0.6675	0.7734	0.7930	0.2205	0.1641

Note: a, b and c indicate significance at the 0.10, 0.05 and 0.01 level respectively, using a *t*–test for the mean differences and using a Wilcoxon test for the median differences. This table reports various cross-sectional statistics for the average amortized spread for the sample of 359 IPO's for the first 5, 30, 90 and 180 days of trading post-IPO for the entire period and for the same periods before and after the introduction of decimalization by the Toronto Stock Exchange (TSX) on April 15, 1996. Under the four columns headed by "Amortized Spread", amortized spreads are first aggregated on a daily basis for each IPO, and then the time-series average is calculated for each IPO for each of the four post-IPO periods. Finally, the cross-sectional means, medians and standard deviations of these cross-sectional averages are calculated and then scaled by multiplying each result by 10^3. Under the five columns headed by "Amortized Spread Comparisons", summary statistics (scaled by a factor of 10^3) for the differences between the cross-sectional averages for various pairs of the four post-IPO trading periods are reported. Thus, "5/30" indicates a comparison involving the first five-to-30 days of trading post-IPO for the respective amortized spread statistic. The null hypothesis that the cross-sectional mean (median) is equal to zero is tested using a *t*– (Wilcoxon) test.

post-decimalization new issues. Tests of significance for comparisons of amortized spreads over four post-IPO periods are also shown.

The mean (median) amortized spread in the initial 5 days of IPO trading is relatively large at a scaled (by 1,000) percent value of 6.5077 (4.2151). This is due in large part to the substantially higher level of share turnover on the first day of secondary market trading. Figure 2 makes this last observation even more apparent as the median day-one amortized spread for the full sample is large at 8 percent (scaled) and then declines rapidly and remains fairly stable at less than 0.5 percent (scaled) after day 30. Post-decimalization day one amortized spreads are relatively large at a scaled 12.81 percent compared to pre-decimalization day-one amortized spreads (scaled to 6.46 percent). After day one there is virtually no difference between median daily pre- and post-decimalization amortized spreads.[13]

After day 5 mean (median) amortized spreads decline noticeably out to day 30 and then level off. A similar pattern is obtained for the pre- and post-decimalization issues although the post-decimalization mean (median) is higher in the initial 5-day period.

Statistical tests for comparisons between mean amortized spreads at various post-IPO points in time appear in table 6. Apart from three specific comparisons, all remaining comparisons indicate significant differences according to both parametric and nonparametric tests at less than the 0.01 level. The median difference between the mean 90-day amortized spread and the mean 180-day amortized spread is significant at the 0.10 level. The post-decimalization mean difference between the mean 90-day amortized spread and the mean 180-day amortized spread is not significant at all while the median for the same post-decimalization comparison is significant at the 0.05 level.

VII. Concluding Remarks

Through the examination of 359 TSX listed IPO's over the period 1984-2002 several important findings emerge. First, an investigation of first day returns indicates how difficult it is to earn positive mean returns even when an IPO is purchased at the offer price. While the purchase of every IPO produces an average initial day return (pre-trade

13. The median daily pre- and post-decimalization amortized spreads have been omitted from figure 2 for this reason.

costs) of 6.65 percent, the purchase of a typical IPO only produces a corresponding return of 0.2 percent. Subsequent average daily returns are not statistically different from zero. Furthermore, missing out on the best initial performing IPO's but investing in more than three-quarters of the remaining sample can produce negative first day returns even when trade costs are ignored.

Second, the mean dollar volume of trades per day for the first five days of IPO trading is large relative to the means for the first thirty days and for longer periods. The distribution of the dollar volume of trades, dollar volume of buys and dollar volume of sells is right skewed and levels off after day ninety. A similar decay is observed for dollar volume volatility over the same initial time period.

Third, following the move to decimalization in April of 1996 by the TSX, there is a dramatic increase in the dollar volume of trades, dollar volume of buys and dollar volume of sells compared to respective pre-decimalization levels for each of the four post-IPO trading periods examined herein. Even though trade activity increases post-decimalization it appears that many of the IPO's are still thinly traded.

Qualitatively similar results for number of trades are obtained with one apparent exception. While the mean (median) number of buys is larger (and generally significant) compared to the mean (median) number of sells for each post-IPO period following the onset of decimalization, such is not the case for a comparison between the dollar volume of buys and the dollar volume of sells. The dollar volume of sells is always larger than that of buys for each post-IPO period with the ratio of buys to sells being generally significantly different from one. In turn, this suggests that institutional investors may be active on the sell side. This observation will be explored in greater detail in subsequent research.

Fourth, a series of parametric and nonparametric tests are conducted for the ratios for each of three dollar volume variables for the first five days compared to the first 30, 90 and 180 days, and for the first 30 days compared to the first 180 days, and for the first 90 days compared to the first 180 days. Both statistical tests indicate that the ratios comparing the first five trading days post-IPO are significantly different from one for three trade activity metrics. Furthermore, the magnitudes of these ratios for each metric increase monotonically as the first five trading days are compared in succession to counterparts for the first 30, 90 and 180 trading days post-IPO.

Fifth, liquidity is examined via depth and spread measures. Depth is initially large and declines significantly over time. The observed decline in depth post-decimalization suggests that institutional investors are likely to bear higher trading costs for Canadian IPO's as large orders are split up due to inadequate supply at a given price. Dollar quoted spreads are smallest at day 5 both pre- and post-decimalization with post-decimalization values exceeding those during the pre-decimalization period due at least in part to significant price inflation during the telecom/tech boom. On the other hand, proportional quoted spreads increase monotonically at each point in time for the full period as well as for the pre- and post-decimalization periods.

Secondary market trading in IPO's over the first nine calendar months can generate substantial round-trip trade costs before brokerage commissions that can, for example, be in excess of 3.7 percent for the least patient traders for an average IPO. The relatively high costs of trading together with the material probability of low or negative gross returns make it difficult for investors transacting in secondary markets to earn short-run profits in Canadian IPO's.

Sixth, an examination of the amortized spread in the first 5 days of IPO trading for the full sample and for pre- and post-decimalization periods suggest that high initial turnover is the cause of unusually high initial amortized spreads. These elevated levels quickly decline and stabilize after day 30. Furthermore virtually no difference exists between median daily pre- and post-decimalization amortized spreads after day one.

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