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Demand Curves for Stocks *Do* Slope Down: New Evidence from an Index Weights Adjustment

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ABSTRACT

Weights in the Toronto Stock Exchange 300 index are determined by the market values of the included stocks' public floats. In November 1996, the exchange implemented a previously announced revision of its definition of the public float. This revision, which increased the floats and the index weights of 31 stocks, conveyed no information and had no effect on the legal duties of shareholders. Affected stocks experienced statistically significant excess returns of 2.3 percent during the event week, and no price reversal occurred as trading volume returned to normal levels. These findings support downward sloping demand curves for stocks.

An obvious event with which to examine the slope of demand curves for stocks is one that changes supply. In the absence of new information, a shift in supply should not affect stock prices if demand curves for stocks are flat. Scholes (1972), using a sample of secondary equity distributions, asks whether stocks are "unique works of art" or merely abstract claims to residual cash flows with many close substitutes, as is assumed in much of finance theory. Scholes finds that the negative price impact of secondary offerings depends on the seller's identity—implying the revelation of unfavorable information—and rules out a pure supply effect. Mikkelson and Partch (1985), also using a sample of registered and unregistered secondary offerings, find weak evidence of downward sloping demand curves, but are unable to cleanly distinguish this explanation from the alternative explanation based on unfavorable information.

A different class of events—additions to widely followed stock market indexes—ostensibly provides a setting where information effects should not be present. Shleifer (1986) documents a permanent price increase for stocks

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added to the S&P 500 index and argues that if S&P index membership is associated with increased demand for the stock, the price increase is, prima facie, consistent with downward-sloping demand curves. However, several studies have identified alternative sources of the price increase accompanying index inclusion, chiefly, favorable information, enhanced liquidity, and price pressure.[1] Put simply, the existing literature does not provide unequivocal evidence on the slope of demand curves for stocks because an event that is unambiguously free of information has not been identified.

In this paper, we examine the slopes of demand curves for common stocks using a unique event at the Toronto Stock Exchange. In November 1996, the Toronto Stock Exchange (TSE) redefined the public float (the number of shares outstanding less blockholdings) for listed firms to include all ownership stakes of less than 20 percent, up from 15 percent previously. This decision, which brought the TSE's definition of the public float in line with the definition used by its regulator, the Ontario Securities Commission (OSC), increased the float for 31 stocks in the TSE 300 index. Since weights in the TSE 300 index are determined by the market values of the included stocks' public floats, these float changes translated into economically significant increases in the index weights assigned to these 31 stocks. As a result, index funds that mimic the TSE index had to purchase additional shares in order to rebalance their portfolios. In short, this event was associated with an increase in demand for the affected stocks. Furthermore, it was free from information effects, and allows us to isolate price pressure effects.

The redefinition of the float was devoid of information for four reasons. First, the event was fully anticipated, having been announced three months earlier (on August 6, 1996). Second, the ownership data used to compute index weights were publicly available. Third, the new TSE definition of the float matched the definition already used by the OSC for corporate law purposes, so its adoption by the TSE had no legal or regulatory effects. Fourth, the event did not involve the addition of new stocks to the index, so a certification effect is ruled out.

We find statistically and economically significant excess returns of 2.34 percent for the 31 stocks in the week the revised weights became effective. These stocks experience unusually high trading volume, consistent with index fund rebalancing. In cross-sectional tests, both returns and trading volume are positively associated with measures of the shift in demand associated with the redefinition.

The float redefinition does not affect bid-ask spreads for the 31 affected stocks and causes no excess returns for nonindex stocks whose floats changed, confirming the absence of transactions cost or information effects. The excess returns for the 31 stocks are not reversed during the following seven weeks, even though trading volume reverts to normal levels within two weeks. The fact that the price increase outlives abnormal volume is inconsistent

[1] See, most notably, Harris and Gurel (1986), Jain (1987), Dhillon and Johnson (1991), Beneish and Whaley (1996), and Lynch and Mendenhall (1997).

with short-term price pressure effects. Over longer intervals, due to increasing standard errors, statistical tests cannot reject a complete price reversal (long-lived price pressure effects). However, the point estimate of the cumulative excess return 15 weeks after the event is virtually identical to its event week value. Furthermore, estimates from regressions of post-event period cumulative abnormal returns on event week abnormal returns do not support a complete reversal as far out as nine weeks following the event. Overall, we interpret the evidence as supporting downward sloping demand curves for stocks.

The rest of this paper is organized as follows. Section I describes the hypotheses, Section II describes the event and our data, Section III contains our findings, and Section IV concludes.

I. Hypotheses and Prior Evidence

The price effects of equity offerings and index inclusions have been used as evidence on the slope of demand curves for stocks. However, the price revisions associated with these events are also consistent with information and temporary price pressure effects. These three competing hypotheses are briefly described below.[2]

A. Downward Sloping Demand Curves

In the earliest study of the price elasticity of demand for stocks, Scholes (1972) examines the price impact of secondary equity distributions and finds it to be mainly a function of the seller's identity, with the largest absolute price impact associated with equity sales by insiders. He concludes that information effects are responsible for price revisions around secondary distributions and that stocks have very high price elasticities. Mikkelson and Partch (1985) reexamine secondary equity distributions and find that the price impact is larger in absolute value for larger offerings. Although this evidence is consistent with downward sloping demand curves, Mikkelson and Partch find that variables they expect to be positively related to the elasticity of demand for stocks are not significant in explaining the price impact of secondary offerings. They surmise that the larger price impact for larger offerings is not an artifact of downward sloping demand curves but is more likely due to the revelation of adverse information. Other events, such as block sales of equity or primary offerings, suffer from the same

[2] A fourth hypothesis is based on transaction costs. In Amihud and Mendelson (1986), expected future trading costs are capitalized into asset prices. If activities such as mechanical index arbitrage lead to higher volume and lower spreads, this hypothesis could explain the price increase for stocks that get added to major indexes. Such effects are unlikely to be important in our context since we do not examine index additions. Nevertheless, it is possible that the redefinition of the public float made index weights more stable and the TSE 300 index easier to track, thereby increasing its popularity. However, our evidence shows that bid-ask spreads did not narrow and that there was only a temporary increase in trading volume following the redefinition. We therefore conclude that transactions cost effects are not driving our results.

problem. These events provide new information about the firm's value, and hence affect prices regardless of the slope of the demand curve for its shares.[3]

Shleifer (1986) adopts a different approach and examines the price impact of adding stocks to a widely followed index. If the stocks added to the index do not have perfect substitutes (i.e., their demand curves slope down), a rightward shift in demand for these stocks (driven by index funds) will result in higher prices. Consistent with this hypothesis, Shleifer finds a permanent abnormal price increase of 2.79 percent accompanying additions to the S&P 500 Index over the 1976 to 1983 period.

B. Information

Standard and Poor's states that adding a stock to the S&P 500 is not an information event: "Judgments as to the investment appeal of the stocks do not enter into the selection process" (Standard and Poor's (1996), p. 1). However, the same document states, in the next paragraph, that the objectives are "to keep the Index representative and updated, but always within the context of the basic principal [*sic*] of stability of composition, and every effort is made to avoid excessive turnover." This statement raises the possibility that, when a stock is added to the S&P 500, favorable information about the expected longevity (and, therefore, the financial health) of the company is being revealed by an agency that specializes in rating companies. Furthermore, the list of stocks being considered for inclusion is kept secret until the change is announced, so the market is not necessarily aware that a stock is a candidate for inclusion. Hence, it is possible that additions are viewed as good news.

Evidence supportive of the information hypothesis is provided by Dhillon and Johnson (1991), who find that prices of the included firms' bonds (which are not tracked by index funds) increase on the announcement date. Also, Jain (1987) documents positive abnormal returns when stocks are added to supplementary indices that are distinct from the S&P 500 Index and, therefore, not tracked by index funds. Importantly, he reports that these abnormal returns are statistically indistinguishable from, and of similar magnitude to, the abnormal returns for stocks added to the S&P 500 Index.

Overall, the findings of Dhillon and Johnson (1991) and Jain (1987) are consistent with a certification role for S&P and with index inclusion conveying favorable news about the included company's prospects. Therefore, the evidence from index inclusions cannot be said to unambiguously support downward sloping demand curves.

[3] Bagwell's (1992) analysis of Dutch auction stock repurchases provides evidence consistent with upward sloping supply curves for stocks. However, an alternative explanation for her findings is that the repurchase announcement conveys information about the firm's value that is interpreted differently by investors submitting closed bids.

C. Price Pressure

Harris and Gurel (1986) argue that suppliers of liquidity can demand higher prices during the temporary surge in demand from index funds at the time of the inclusion. Once index funds have achieved their desired portfolio positions and abnormal demand has subsided, prices should return to normal levels. This theory is cleanly testable; it implies that the positive returns over the rebalancing period should be offset by subsequent negative returns of approximately equal magnitude.

Harris and Gurel, using a sample of index inclusions from 1978 through 1983, find that the announcement date abnormal return of 3.13 percent is accompanied by a cumulative abnormal return of −2.49 percent over the next 29 trading days. Thus, Harris and Gurel are unable to reject complete reversal of the event period abnormal returns. However, Shleifer (1986), Jain (1987), and Dhillon and Johnson (1991) find no evidence of a return reversal following index inclusion. Additionally, Dhillon and Johnson find that the prices of call options written on the included stocks increase on the announcement date. These increases do not appear to be caused by increased volatility, as put prices do not increase. If the stock price increase is viewed as temporary, call prices should be unaffected since option values are determined by the distribution of future stock prices. This evidence suggests that the increase in stock prices associated with index addition is regarded as permanent. In contrast, Beneish and Whaley (1996) and Lynch and Mendenhall (1997) find partial reversals in the event windows they study.

Previous empirical studies of the slope of demand curves for common stocks have not been able to conclusively disentangle effects related to downward sloping demand curves, information, and price pressure. Thus, the issue of whether demand curves for stocks slope down remains unresolved.

II. The Event and Data

The redefinition of the public float for Toronto Stock Exchange firms provides a natural context in which to study the slopes of demand curves.

A. The Redefinition of the Public Float

The TSE 300 index is a value-weighted index with the weights of the constituent stocks proportional to the market values of their public floats.[4] The redefinition of the public float by the TSE was announced August 6, 1996 and became effective November 15, 1996. This redefinition was a mechanical and bureaucratic decision. Prior to November 15, 1996, the public float of a company was defined by the TSE as the sum of all ownership stakes less than 15 percent. The redefinition changed this threshold to 20 per-

[4] The TSE 300 Index is the most widely followed index in Canada, and contains most of the largest firms in Canada. More than half of the TSE 300 firms are cross-listed on a major U.S. market, and these firms are comparable in size to the top tier Nasdaq and American Stock Exchange firms.

cent, bringing it into line with the OSC definition of controlling stakes. Acquiring equity positions in excess of 20 percent triggers OSC takeover regulations as well as other burdensome compliance rules and filings. However, passing the 15 percent threshold has no such effects, and investors allow their stakes to rise or fall past this point in routine trading. These actions had the undesirable effect of causing frequent changes to the public float as defined by the TSE and hence to the TSE 300 index weights. The float redefinition made the index weights more stable, making it easier for index funds to track the TSE 300 index.

B. Sample and Data

We use the TSE 300 Composite Index Summary files to obtain ownership data for each firm in the TSE 300 Index. The TSE uses these files to construct the public floats, and therefore the weights, for TSE 300 Index stocks. According to TSE rules, the smallest ownership stake, as a percentage of all outstanding shares, was 15 percent in October, prior to the redefinition. At the November redefinition, the smallest ownership stake is set at 20 percent. Therefore, all stakes between 15 percent and 20 percent become part of the public float, and all firms affected by the redefinition have a float increase of 15 percent or more. We identify 31 such stocks. For 28 of these stocks, the ownership stake falls to zero as a result of the redefinition.

We verify that the float increases for these firms result from the redefinition, not from insiders' block sales or from equity issues. Specifically, we examine insider trading records and equity issuance announcements in the OSC Monthly Bulletins. These bulletins provide records of all trades by insiders, a group that includes any shareholder owning more than 10 percent of the outstanding shares. None of the 31 firms has insider sales or issued equity. Thus, the float increases for these firms are driven by the redefinition. Finally, we examine *The Globe and Mail* CD-ROM index to check for confounding events in October and November 1996. No confounding events are found for the 31 firms.

Table I provides summary statistics on the changes in floats and weights for the 31 affected stocks, and shows that both changes are large. We hypothesize that the weight increases for these stocks trigger buying by index funds in order to rebalance their portfolios and track the revised TSE 300 index.[5] We label the sample of 31 stocks that are directly affected by the redefinition the *test sample*.

In the tests conducted in this paper, it is desirable to control for marketwide influences unrelated to the redefinition. A natural benchmark for such effects is the set of TSE 300 stocks whose floats are not affected by the

[5] We are assuming that the increased trading activity surrounding the redefinition is driven by rebalancing trades initiated by index funds. The assumption is supported by anecdotal evidence from the financial press. For example, the *Financial Post* of November 15, 1996 quotes a stock analyst discussing the effect of the redefinition on Barrick Gold Corp., one of the affected stocks: "Index funds which try to match the weighting of the index are going to have to scramble to buy . . . more Barrick shares."

Table I

Float and TSE 300 Index Weight Changes Surrounding the Toronto Stock Exchange's Redefinition of the Public Float

Float is the number of shares in noncontrolling hands. The pre-redefinition float is measured on October 31, 1996 and includes all shares held in stakes under 15 percent. The post-redefinition float is measured on November 15, 1996 and includes shares held in stakes under 20 percent. Days traded is calculated as the ratio of the float change to mean daily trading volume during August through October 1996, multiplied by the fraction of the value of TSE 300 firms held in indexed portfolios. Weight is the TSE 300 weight on October 31 and November 15, 1996. The test group consists of 31 firms whose public floats are affected by the TSE redefinition of controlling blocks. The comparison group consists of 261 firms whose floats are not affected by the redefinition. p-values for changes in variables from pre-redefinition to post-redefinition are in parentheses.

	Mean	First Quartile	Median	Third Quartile
Panel A: Test Sample (N = 31)				
Firm size (market value, $million)	1,269	298	516	762
Pre-redefinition float	46,423,173	18,087,592	25,195,360	41,433,837
Post-redefinition float	58,213,858	23,557,245	30,485,764	52,047,501
ΔFloat	11,790,685	4,223,550	7,983,199	10,207,321
	(0.000)		(0.000)	
ΔFloat/Outstanding shares	0.1933	0.1572	0.1751	0.1939
	(0.000)		(0.000)	
Days traded	6.98	3.09	6.00	9.24
Pre-redefinition weight, $\times 10^{-2}$	0.2539	0.0600	0.1000	0.1800
Post-redefinition weight, $\times 10^{-2}$	0.3135	0.0700	0.1300	0.3000
ΔWeight/Pre-redefinition weight	0.2872	0.1818	0.2333	0.3333
	(0.000)		(0.000)	
Panel B: Comparison Group (N = 261)				
Firm size (market value, $million)	1,774	348	659	1,668
Pre-redefinition float	59,737,049	18,854,120	37,332,909	73,113,192
Post-redefinition float	60,214,364	19,318,997	37,582,905	77,131,960
ΔFloat	477,315	0	9,100	98,437
	(0.000)		(0.000)	
ΔFloat/Outstanding shares	0.0002	0.0000	0.0000	0.0000
	(0.000)		(0.000)	
Days traded	0.34	0	0.01	0.10
Pre-redefinition weight, $\times 10^{-2}$	0.3505	0.0700	0.1400	0.3100
Post-redefinition weight, $\times 10^{-2}$	0.3422	0.0700	0.1400	0.2900
ΔWeight/Pre-redefinition weight	−0.0291	−0.0714	0.0000	0.0000
	(0.000)		(0.000)	

redefinition. Since weights in the TSE 300 index must sum to one, firms not in the test sample collectively experience a decline in their index weights as a result of the redefinition. This should trigger selling by index funds and, potentially, price decreases. As shown in Table I, however, the decline in weights for these firms, and, therefore, its effect on fund rebalancing, is small relative to that for test sample firms.

We find 267 such stocks in the TSE 300 index with data spanning the event period (we omit one firm because it was replaced in the index in early November and a second firm because of missing data). Six of these 267 stocks have an increase in float greater than one percent at the time of the redefinition (ranging from one percent to 12 percent). Using information from the OSC Monthly Bulletins and *The Globe and Mail* index, we find that three of the six firms issue equity during this period, we find insider sales records for two others, and we are unable to account for the increase in the float for one firm. All six firms are excluded from further analysis because of potentially confounding effects. The remaining 261 stocks form our *comparison sample*.

We obtain bid and ask quotes, transaction prices, and trading volumes from the Quotes and Trades files of the monthly intraday TSE transaction records. Information on monthly public floats and index weights for all stocks in the TSE 300 index for September through December 1996 is obtained directly from the TSE.

C. Descriptive Statistics on Float and Weight Changes

Table I provides summary statistics on the float and weight changes for the test and comparison sample stocks. In the test sample, the redefinition raises the mean public float by 19.3 percent. The median public float also rises, by 17.5 percent. By contrast, the comparison group's mean (median) public float increases by only 0.02 percent (0.0 percent). The substantial float increases for test sample stocks translate into large increases in the TSE weights. The mean (median) weight for stocks in the test sample rises from 0.25 percent (0.10 percent) of the index's value to 0.31 percent (0.13 percent) of its value. The mean index weight for the comparison group falls from 0.35 percent to 0.34 percent, the median is unchanged at 0.14 percent. Note that comparison group firms are somewhat larger than firms in the test sample. This is not surprising since smaller firms tend to be characterized by more concentrated ownership.

As an alternative measure of the importance of the float change, we calculate the number of days of trading required to completely absorb the increased float resulting from the redefinition. For the median test sample stock, the change in float is equivalent to 150 days of normal trading (based on mean daily volume from August 1996 through October 1996). The actual trading required of index funds should equal the change in float times the size of index fund assets relative to the total value of the TSE 300. Figures available from *The Globe and Mail*, *The Financial Post*, and *Statistics Canada* show that, in 1996, one percent of the value of the TSE 300 was in index funds and an additional three percent was in pension funds indexed to the TSE 300. The value of assets indexed to the TSE 300 is, therefore, approximately four percent of the total value of the index in 1996, and the rebalancing required of index funds is equivalent to six trading days (four percent of 150 days).

Table I provides compelling evidence that both the floats and the weights increase in an economically significant sense for the test sample, requiring index funds to buy additional shares in order to track the redefined TSE 300 index. The increased demand by index funds, coupled with readily available data for examining price pressure effects and a total absence of information effects, make this an ideal event for testing the downward sloping demand curves hypothesis.

III. Results

A. *Excess Returns Around the Redefinition*

Table II summarizes the distribution of weekly returns for the test and comparison samples surrounding the public float redefinition. Additionally, Table II presents, for the test sample, both excess returns, defined as the difference between the return for each test sample stock and the mean return for the comparison sample, and beta-adjusted abnormal returns. We choose the week ending November 15 (a Friday) as the event week and designate it *week zero*. Aggregating to the weekly level is reasonable since index funds might balance tracking error concerns against the costs of buying into a market with higher prices by adjusting their portfolios a few days before the date the revised weights become effective (November 15).[6]

The desire of index funds to trade in a specific window could create incentives for arbitrageurs to buy prior to the event week and sell after prices have risen. It is important to note that such attempts at arbitrage would be risky. OSC Act §107(2) states that insiders must report changes in ownership within 10 days following the month in which any changes take place. Thus, the first trading day on which market participants know with certainty the ownership stakes and the index weights following the redefinition is November 11, the Monday of the event week.

The mean return in week zero is 4.31 percent for test sample stocks and 1.97 percent for comparison sample stocks. The mean excess return of 2.34 percent is highly significant (p-value < 0.01).[7] Outliers are not driving this

[6] Informal discussions with index fund managers at Alberta Treasury support this view. We recognize the possibility that some index funds might have chosen to trade after the November 15 redefinition, and have repeated our analysis using a two-week event window (Monday, November 11 through Friday, November 22). Excess and abnormal returns are similar, both in magnitude and in significance, when we use this enlarged window.

[7] Since the event period for all firms is the same, the weekly returns for the firms in the test and comparison samples are not independent. To address this issue, we obtain weekly returns for every stock in the test and comparison samples from January 1, 1996 through October 31, 1996 (the period preceding the event window). For each week, we then compute the mean return for each sample, as well as the difference between the mean returns for the test and comparison samples (i.e., the mean excess return for the test sample). This provides us with empirical distributions of the mean weekly return and the mean excess return. We assess significance by comparing the mean returns and the mean excess return for each week in the event period to critical values from the respective empirical distributions. The 95 percent cutoff for the mean return for the test (comparison) sample is 2.236 percent (2.021 percent), and the 95 percent cutoff for the excess return is 1.662 percent. Hence, the positive mean return and excess return for the test sample in week zero are significant at better than the 5 percent level of significance. Likewise, the mean return for the comparison sample in week zero is marginally significant. For no week other than week zero is the mean excess return for the test sample significantly different from zero.

Table II

Weekly Returns for TSE 300 Stocks Surrounding the Toronto Stock Exchange's Redefinition of Public Float

The test group consists of 31 firms whose public floats are directly affected by the TSE redefinition of controlling blocks. The comparison group consists of 261 firms whose floats are not affected by the ruling. p-values from two-sample difference in means tests and two-sample difference in median tests are provided in parentheses. The TSE redefinition became effective Friday, November 15, 1996. The week ending November 15 is designated as week 0.

Week	Period	Test Group Return	Comparison Group Return	Difference between Test and Comparison Group Return	Beta-Adjusted Abnormal Return for Test Group
		Panel A: Means			
Week −1	4/11/96 through 8/11/96	0.0114	0.0174	−0.0060	−0.0062
				(0.67)	(.66)
Week 0	11/11/96 through 15/11/96	0.0431	0.0197	**0.0234**	**0.0207**
				(0.01)	**(0.01)**
Week +1	18/11/96 through 22/11/96	0.0106	0.0104	0.0002	0.0001
				(0.98)	(0.99)
Week +2	25/11/96 through 29/11/96	0.0079	0.0066	0.0013	−0.0004
				(0.89)	(0.96)
Week +3	2/12/96 through 6/12/96	−0.0309	−0.0273	−0.0036	−0.0003
				(0.75)	(0.98)
Week +4	9/12/96 through 13/12/96	−0.0126	−0.0180	0.0054	0.0047
				(0.39)	(0.48)
Week +5	16/12/96 through 20/12/96	0.0224	0.0153	0.0071	0.0042
				(0.44)	(0.66)
Week +6	23/12/96 through 27/12/96	0.0219	0.0193	0.0026	−0.0014
				(0.81)	(0.90)
		Panel B: Medians			
Week −1	4/11/96 through 8/11/96	0.0124	0.0169	−0.0045	−0.0001
				(0.67)	(0.77)
Week 0	11/11/96 through 15/11/96	0.0387	0.0140	**0.0247**	**0.0190**
				(0.00)	**(0.02)**
Week +1	18/11/96 through 22/11/96	0.0108	0.0034	0.0074	0.0006
				(0.92)	(0.74)
Week +2	25/11/96 through 29/11/96	0.0085	0.0018	0.0067	−0.0002
				(0.73)	(0.85)
Week +3	2/12/96 through 6/12/96	−0.0252	−0.0268	0.0016	−0.0002
				(0.72)	(0.96)
Week +4	9/12/96 through 13/12/96	−0.0074	−0.0140	0.0066	0.0128
				(0.59)	(0.26)
Week +5	16/12/96 through 20/12/96	0.0176	0.0091	0.0085	0.0001
				(0.49)	(0.85)
Week +6	23/12/96 through 27/12/96	0.0147	0.0138	0.0009	−0.0046
				(0.84)	(0.94)

finding, since a similar pattern exists in the medians. Specifically, the test sample's median return is 3.87 percent versus 1.40 percent for the comparison sample, and the difference is highly significant in a Wilcoxon two-sample median test (p-value < 0.01). By contrast, returns for the two samples over the six weeks following the event week are indistinguishable in statistical or economic terms. Weekly returns for the two samples in the three months preceding the redefinition are also similar and not reported. The similarity in pre-event returns indicates that the positive event week excess returns for test sample firms are not caused by differences in risk factor loadings for the test and comparison samples.

We also estimate beta-adjusted abnormal returns. As shown in Table II, the mean abnormal return for the event week is +2.07 percent (p-value = 0.01) for test sample firms. Abnormal returns for the test sample in other weeks surrounding the event are not statistically significant. (To conserve space we do not report the mean or median abnormal return for comparison sample stocks. In no week is either the mean or the median significantly different from zero for this group.)

We conclude from Table II that the prices of stocks in the test sample rise in the week in which their weights in the TSE 300 index increase. These findings are consistent with downward sloping demand curves for stocks, but also with the information and price-pressure hypotheses. In the following sections, we conduct additional tests to examine which hypotheses are favored by the evidence.

B. Rejecting the Information Hypothesis

The redefinition of the public float should be information-free for the following four reasons. First, the decision to redefine the float was communicated (by fax) to TSE members and to institutional investors subscribing to the TSE Index Fund Support service on August 6, 1996 (i.e., three months earlier). Although the change was not reported until November 15 in *The Globe and Mail* and *The Financial Post*, the two major business newspapers in Canada, the important players knew of it well in advance. Second, the list of blockholdings greater than 10 percent is published monthly by the OSC. Thus, the redefinition is not associated with new information about blockholdings. Third, blockholders' legal duties are determined by the OSC and by federal and provincial laws. Changing the TSE's definition of the public float in no way alters these duties. Finally, there is no possibility of certification effects since none of the stocks in the test or comparison samples in November 1996 represent additions to the index.

We empirically confirm the absence of information by examining returns and volume for test sample stocks around the August 6 announcement date. There is no evidence of abnormal returns or volume on the day of, or during the week containing, the announcement. Additionally, we create a second comparison sample consisting of 52 companies whose public floats are affected by the TSE redefinition, but which are not in the TSE 300 index in November 1996. The stocks of many of these firms are infrequently traded, and we are able to obtain weekly returns for only 38 stocks. We call this sample of 38 stocks the *nonindex comparison sample*. If the redefinition conveys information, event-week returns for the nonindex comparison sample should be larger than those for the comparison sample. However, if the source of the large event-week returns for the test sample is the buying activity of index funds, returns for the nonindex comparison sample should be significantly lower than those for the test sample. We find that the mean and median week zero returns for the nonindex comparison sample (1.73 percent and 1.30 percent respectively) are not significantly different from zero or from the mean and median returns for the comparison sample. They are, however, significantly lower than the week zero mean and median returns for the test sample (p-value < 0.01 in each case).

These findings confirm that the TSE's redefinition of the public float conveys no information, and they weigh against the information hypothesis as an explanation for the excess returns in Table II.[8]

C. Rejecting the Short-Term Price Pressure Hypothesis

The short-term price pressure hypothesis implies that, even if long-run demand curves for the affected stocks are perfectly elastic, short-term providers of liquidity would require a temporary price premium to accommodate the excess demand by index funds during the event week. Consequently, the price pressure hypothesis predicts a price reversal once index funds have rebalanced their portfolios and abnormal demand has subsided. Accordingly, we examine trading volume in the six weeks following the event, noting when it returns to normal.

Table III displays excess weekly turnover (the ratio of weekly volume to the number of shares outstanding) for the test and comparison samples in week -1 through week $+6$. Excess turnover for each firm is calculated by scaling weekly turnover by median turnover in week -5 through week -2. For the test sample, median excess turnover in the event week is 1.0 (twice normal), compared to 0.395 for the comparison sample. The difference between excess turnover for the test and comparison samples is significant at the 5 percent level in a Wilcoxon two-sample median test.[9] Excess turnover for the test sample remains above that for the comparison sample in week $+1$ and week $+2$, although neither these differences nor the differences in

[8] We also examine the bid-ask spread in the event period. To the extent that the bid-ask spread widens during periods of information release (to compensate for additional adverse selection costs borne by market makers) there should be no change in the bid-ask spread if the November 15 event is information-free. We find that in the event week, relative bid-ask spreads do not change significantly from prior levels for the test or comparison samples. Mean relative spreads in subsequent weeks are also similar to pre-event week values. Thus, the revision in weights is not associated with permanent, or even temporary, changes in the bid-ask spread. This finding is also inconsistent with liquidity improvements being the source of the event week price increases for test sample firms.

[9] As with excess returns, we obtain the empirical distribution of the difference between median excess turnover for the test and comparison samples using weekly data from January 1, 1996 through October 31, 1996. We find that median excess turnover is significantly higher for the test sample than the comparison sample in week 0 (at the 1 percent level) and week $+1$ (at the 5 percent level).

Table III

Excess Turnover for TSE 300 Companies Surrounding the Toronto Stock Exchange's Redefinition of the Public Float

Turnover is calculated as the ratio of weekly trading volume to the number of shares outstanding. Excess turnover is the ratio of turnover in any week to the stock's normal weekly turnover (median weekly turnover in week −5 through week −2) less one. The test group consists of 31 firms whose floats are affected by the TSE redefinition of controlling blocks. The comparison group consists of 261 firms whose floats are not affected by the redefinition. The TSE redefinition became effective Friday, November 15, 1996. The week ending November 15 is designated week 0.

Week	Period	Median of Test Group	Median of Comparison Group	Difference between Test and Comparison Sample Medians
Week −1	4/11/96 through 8/11/96	+0.499	+0.376	+0.123
Week 0	11/11/96 through 15/11/96	+1.000	+0.395	+0.605*
Week +1	18/11/96 through 22/11/96	+0.699	+0.396	+0.303
Week +2	25/11/96 through 29/11/96	+0.307	+0.057	+0.250
Week +3	2/12/96 through 6/12/96	+0.110	+0.281	−0.171
Week +4	9/12/96 through 13/12/96	+0.050	+0.149	−0.099
Week +5	16/12/96 through 20/12/96	+0.443	+0.355	+0.088
Week +6	23/12/96 through 27/12/96	−0.287	−0.434	+0.147

* denotes significance at the 5-percent level based on the Wilcoxon two-sample test of difference in medians.

week +3 through week +6 are statistically significant. We note that excess turnover in week +6 is negative for both test and comparison firms, most likely due to light end-of-year trading.

Two additional features of the results in Table III deserve comment. First, excess turnover for the test sample is high in week −1 through week +1. This is consistent with fund managers spreading their trades over an extended period in order to reduce the price impact of their trades. Second, excess turnover for the comparison sample is also high for week −1 through week +1. A likely explanation is index fund rebalancing to reflect the reduced weights assigned to comparison firms in the TSE 300 index. The relative magnitudes of the weight changes for the test and comparison samples would explain why excess turnover is lower for the comparison sample.

Since excess turnover subsides by the end of week +1, price reversals should be evident by that time, or shortly thereafter. In other words, the positive excess returns for test sample stocks in week zero should be matched by cumulative negative excess returns during, or soon after, week +1. Table II shows weekly average excess and abnormal returns for the test sample for the six weeks subsequent to the redefinition (November 18 through December 27, 1996). It is evident that the excess and abnormal returns after week zero are never statistically below zero. In other words, there is no evidence of price reversals, in the form of negative excess or abnormal returns, in the six weeks after the redefinition.

This evidence notwithstanding, we examine return reversals beyond the six weeks reported in Table II. Specifically, we extend the post-event window for cumulative excess returns through February 28, 1997 (week +15) and conduct three tests. The first is a posterior odds ratio test, similar to that in Harris and Gurel (1986), comparing the sample likelihoods under the hypotheses of complete reversal and no reversal. The results favor the hypothesis of no reversal through week +9.

The second test directly examines the significance of cumulative excess returns from the event week through week +15. Under the hypothesis of complete reversal, cumulative excess returns should eventually be insignificantly different from zero. We find that the mean cumulative excess return is significantly positive until the week ending January 3, 1997 (week +7). Thereafter, the large standard error reduces the power of the test, and longer period cumulative excess returns are not inconsistent with full reversal. However, the mean cumulative excess return at the end of week +15 (February 28, 1997) is two percent, almost identical to its week zero value. In other words, based on the point estimate of the cumulative excess return, we do not find evidence of a decline in prices after the event week. Using beta-adjusted returns yields identical conclusions.

Third, we test a more powerful prediction of the price pressure hypothesis—namely, that the event week price increase for each stock in the test sample is completely reversed over subsequent weeks. In other words, for every stock j in the test sample, $CAR_{1-T,j} = -AR_{0,j}$, where $AR_{0,j}$ is the week zero abnormal return for stock j and $CAR_{1-T,j}$ is the cumulative abnormal return between week one and week T. In a cross-sectional regression of cumulative abnormal returns on week zero abnormal returns, the price pressure hypothesis predicts that the intercept is zero and the slope is -1. Table IV displays coefficients from such regressions of cumulative abnormal returns over varying post-event intervals on event week abnormal returns. We use beta-adjusted abnormal returns in these regressions. Our conclusions are unaltered when we use excess returns for the test sample stocks. In interpreting the results of this test, note that the independent variable in the regressions, the week zero abnormal return, reflects not only the price impact of the redefinition but also other firm-specific news in that week. As a result, the regressions are subject to an errors-in-variables problem that biases the slope coefficient toward zero.

We reject complete reversal until week +9, after which the coefficient estimate is not significantly different from -1 at the 5 percent level of significance. As above, our inability to reject the hypothesis of complete reversal stems from diminishing power as the cumulating interval is widened. For instance, the standard error of the slope coefficient in week +9 is three times that in week +2 (to conserve space, standard errors are not reported). The point estimates of the coefficient are +0.0130 and -0.1008 as far out as week +13 and week +15, very different from -1 in economic terms.

Table IV

Regression Estimates in a Test of Return Reversals for Test Sample Firms

For varying post-event windows, the following cross-sectional regression is estimated for 31 firms whose public floats are affected by the TSE's redefinition (the test group).

$$CAR_{1-T,j} = \alpha + \theta AR_{0,j} + \epsilon_{t-T,j}.$$

The dependent variable, $CAR_{1-T,j}$, is the cumulative abnormal stock return beginning in week +1 through week $+T$ inclusive. The independent variable, $AR_{0,j}$, is the abnormal return in week 0. The TSE redefinition became effective Friday, November 15, 1996. The week ending November 15 is designated week 0. The coefficient on $AR_{0,j}$ equals −1 under the price pressure prediction of complete reversals. The coefficient on $AR_{0,j}$ equals zero under the hypothesis of no reversals.

Dependent Variable	α	θ	p-value: $\theta = -1$	p-value: $\theta = 0$	R^2
$CAR_{1-1,j}$	−0.0032	0.1621	0.00*	0.47	0.018
$CAR_{1-2,j}$	−0.0042	0.1910	0.00*	0.47	0.018
$CAR_{1-3,j}$	0.0046	−0.2588	0.01*	0.33	0.033
$CAR_{1-4,j}$	0.0148	−0.5394	0.01*	0.03*	0.144
$CAR_{1-5,j}$	0.0167	−0.4373	0.01*	0.13	0.076
$CAR_{1-6,j}$	0.0152	−0.4277	0.05*	0.33	0.033
$CAR_{1-7,j}$	0.0129	−0.2970	0.03*	0.48	0.017
$CAR_{1-9,j}$	0.0015	0.1593	0.05*	0.84	0.002
$CAR_{1-11,j}$	−0.0002	0.1283	0.08	0.87	0.001
$CAR_{1-13,j}$	−0.0010	0.0130	0.15	0.98	0.000
$CAR_{1-15,j}$	0.0007	−0.1008	0.21	0.91	0.001

* denotes significance at the 5 percent level.

In Table IV, we also examine the possibility of a partial reversal of the event week abnormal return by testing whether the coefficient on $AR_{0,j}$ is equal to zero. We find that the coefficient on $AR_{0,j}$ is significantly different from zero only in week +4, consistent with a partial reversal in that week. The coefficient is not significantly different from zero in any of the other weeks that we examine, suggesting the absence of any price reversal. Note that, at longer horizons, the low power of the test favors the null of no reversal.[10]

Taken together, the results in this section are inconsistent with short-lived price pressure effects. We interpret our results as supporting the hypothesis that demand curves slope down.

[10] If the hypothesis of interest is that the coefficient on $AR_{0,j}$ lies between −1 and zero, a one-tailed test is more appropriate. In this case, the p-values in Table IV indicate that the abnormal return in week +5 is also weakly consistent with a partial reversal.

D. Regression-Based Tests

The univariate results presented above provide easily interpretable evidence on the magnitude of the price revisions and the additional trading activity associated with the redefinition. In this section we conduct multivariate regression-based tests. There are two advantages. First, we are able to pool data for the test and comparison sample stocks. Thus, we can directly relate the price revisions and trading activity associated with the redefinition to measures of the change in demand. Second, we are able to estimate these relations while controlling for other factors that could affect returns and turnover.

We estimate the following cross-sectional regression equations relating week zero abnormal returns and excess turnover to proxies for the shift in demand and other influences:

$$\begin{aligned} \textit{abnormal return}_j = b_0 + b_1 \Delta \textit{demand}_j + b_2 \delta_{run-up,j} \\ + b_3 \ln(\textit{Market Value}_j) + \epsilon_j \end{aligned} \tag{1}$$

$$\begin{aligned} \textit{excess turnover}_j = c_0 + c_1 |\Delta \textit{demand}_j| + c_2 \delta_{run-up,j} \\ + c_3 \ln(\textit{Market Value}_j) + \eta_j, \end{aligned} \tag{2}$$

where *abnormal return*$_j$ and *excess turnover*$_j$ are the week zero abnormal return and excess turnover, $\Delta \textit{demand}_j$ is a proxy for the change in demand, $\delta_{run-up,j}$ is a proxy for the elasticity of supply, and $\ln(\textit{Market Value}_j)$ is the natural logarithm of market value, all for stock j (the proxies are described below). The correlation between the errors from OLS estimation of equation (1) and equation (2) ranges between 0.11 and 0.16, depending on the specification employed, and is significantly above zero. This nonzero residual correlation allows us to enhance efficiency in the estimation procedure by using the *seemingly unrelated regressions* (SUR) technique.

The variables of primary interest in equations (1) and (2) are proxies for the demand shift resulting from the redefinition. We use three variables to measure the shift in demand. ΔFloat_j is the change in stock j's public float. ΔWeight_j is the change in stock j's weight in the TSE 300 index induced by the redefinition of its float. ΔFloat_j and ΔWeight_j are expressed as percentage deviations from the pre-redefinition float and weight respectively. The third measure of the change in demand is Days traded$_j$, the number of days of normal trading required to absorb the float change for stock j. It is constructed as the float change for stock j divided by its mean daily trading volume over the three-month period from August 1996 through October 1996. Days traded measures the intensity of trading necessary to revise index portfolios. It attempts to capture the fact that a given change in the float will have different effects for stocks with different levels of normal trading volume. We use the absolute value of each demand shift proxy in the turnover equation because a positive or negative shift in demand induces trading by index funds (buying in the case of weight increases and selling in the case of weight reductions). A positive coefficient on the three variables in the return and turnover regressions is consistent with both downward sloping demand curves and price pressure.

The price change and trading resulting from the redefinition depend not only on shifts in demand but also on the elasticity of supply. To control for the elasticity of supply, we use $\delta_{run-up,j}$, which is based on the run-up in the price of stock j over the previous 10 months.[11] Specifically, $\delta_{run-up,j}$ is an indicator variable set to one if the stock j's return from January 1, 1996 to October 31, 1996 exceeds 50 percent, and zero otherwise. The rationale for using this proxy is that, for tax reasons, shareholders are reluctant to sell stocks with large accumulated capital gains. In other words, supply is less elastic for stocks with large price run-ups. Hence, the coefficient on $\delta_{run-up,j}$ is predicted to be positive in the return regression and negative in the turnover regression. It seems logical to separate large and small capital gains by using a dichotomous variable. However, similar results are obtained when we employ a continuous capital gains measure, defined in terms of the accumulated return.[12] Finally, we include $\ln(\textit{Market Value}_j)$ to control for cross-sectional variation in the dependent variables due to firm size. Market value is computed at the end of October 1996.

The results of the regression tests are provided in Table V. The coefficients on ΔFloat and ΔWeight are positive and significant at better than the 1 percent level of significance in the regressions for both abnormal returns and excess turnover. The coefficient on Days traded is significantly positive in the regression for excess turnover, but not in the regression for abnormal returns. The coefficient on δ_{run-up} is significantly above zero in the abnormal return regression and significantly negative in the turnover regression. The coefficient on $\ln(\textit{Market Value})$ is insignificantly different from zero in the return regression, but it is significantly negative in the turnover regression.[13]

[11] We are grateful to an anonymous referee for suggesting this line of thought and the measures of the elasticity of supply.

[12] Our results are somewhat sensitive to how we define "large" capital gains, being significant at conventional levels only for capital gains of 30 percent or higher. In an alternative specification, we use separate indicator variables for accumulated capital gains and capital losses. We expected a negative coefficient on the capital loss variable, but find a significantly positive coefficient. The coefficient on the capital gains indicator variable, as well as its significance, are unaltered. We believe that the symmetry between capital gains and losses may be distorted by investor reluctance to sell stocks that decline in price, as in Odean (1998). As an alternative measure of the elasticity of supply, we use the coefficients from firm-by-firm regressions of absolute returns on the natural logarithm of volume. The coefficient on this variable is significantly positive in the abnormal return regression, but is insignificantly different from zero in the excess turnover regression.

[13] Note that the residuals from regressions (1) and (2) are unlikely to be independent across stocks, even though the dependent variables are abnormal return and excess turnover. This causes the estimated standard errors to understate the true standard errors. Unfortunately, we are unable to correct the standard errors for such dependence because sufficient observations on the independent variables are not available (we have four observations per stock on the float and two observations on the weight).

Table V

Seemingly Unrelated Regression Estimates

The regressions below are estimated as a system using the seemingly unrelated regressions estimation procedure. The dependent variables in the two models are the week 0 abnormal return and the week 0 excess turnover for 292 stocks in the TSE 300 index. The TSE redefinition became effective Friday, November 15, 1996. The week ending November 15 is designated week 0. ΔFloat and ΔWeight measure the percentage change in floats and index weights. Days traded is the ratio of the float change to mean daily trading volume. Absolute values of ΔFloat, ΔWeight, and Days traded are used in Model 2 (dependent variable: Excess Turnover). *CapDum* is an indicator variable that equals one if the stock price increases by more than 50 percent during January 1, 1996 through October 31, 1996, and zero otherwise. Ln(MV) is the natural log of the firm's market value. *p*-values are given in parentheses. Estimated cross-equation error correlations are significantly different from zero in all regressions.

	Reg. #1	Reg. #2	Reg. #3	Reg. #4	Reg. #5	Reg. #6
Model 1 Dependent Variable: Abnormal Return						
Intercept	−0.0034	−0.0007	−0.0003	−0.0194	−0.0156	−0.0142
	(0.28)	(0.81)	(0.93)	(0.26)	(0.34)	(0.41)
ΔFloat	0.1048*			0.0955*		
	(0.00)			(0.00)		
ΔWeight		0.1114*			0.1078*	
		(0.00)			(0.00)	
Days traded			0.0005			0.0005
			(0.53)			(0.51)
CapDum				0.0136	0.0144*	0.0182*
				(0.07)	(0.04)	(0.02)
Ln(MV)				0.0021	0.0018	0.0015
				(0.43)	(0.46)	(0.56)
Model 2 Dependent Variable: Excess Turnover						
Intercept	0.7592*	0.7134*	0.7737*	1.6661*	1.5780*	1.6573*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
|ΔFloat|	1.1455			1.2434*		
	(0.06)			(0.04)		
|ΔWeight|		1.0420*			0.9942*	
		(0.02)			(0.02)	
|Days traded|			0.0388*			0.0352*
			(0.01)			(0.02)
CapDum				−0.3169*	−0.2976*	−0.2629
				(0.03)	(0.03)	(0.06)
Ln(MV)				−0.1281*	−0.1210*	−0.1254*
				(0.01)	(0.01)	(0.01)
System weighted R^2	0.022	0.067	0.012	0.055	0.098	0.047

* denotes significance at the 5 percent level.

The coefficients on δ_{run-up} are consistent with the supply elasticity interpretation. Ceteris paribus, a larger run-up leads to higher abnormal returns and to lower excess turnover. In other words, shareholders are reluctant to sell stocks with large accumulated capital gains, and this reluctance translates into a steeper supply curve for these stocks. The positive coefficients on the proxies for the shift in demand in the return and turnover regressions mean that larger shifts in demand are associated with both larger price revisions and greater trading. This is consistent with the hypothesis that demand curves for stocks slope down. Ceteris paribus, larger shifts in demand require larger price changes and more trading to restore equilibrium. Since Tables II through IV do not support a short-term price pressure-based explanation, we conclude that the price increases associated with the TSE's redefinition of the public float imply downward sloping demand curves for the affected stocks.

We can derive rough estimates of the elasticity of excess demand from these regression coefficients. For example, if we assume that index trading activity is proportional to the change in float, the coefficient on the float change variable in regression (4) implies an elasticity of 10.5 (0.0955^{-1}). This is substantially lower than that estimated by Scholes (1972).

IV. Conclusion

On November 15, 1996, the Toronto Stock Exchange redefined the public float of TSE stocks to include all common shares held in stakes of less than 20 percent, up from 15 percent under the old definition. This redefinition resulted in a significant increase in the floats and, therefore, in the index weights for 31 stocks in the TSE 300 index. In the week the weight change became effective, these 31 stocks experienced a mean price increase of 4.31 percent, while the prices of other stocks in the TSE 300 index (whose weights were not directly affected by the redefinition) rose by only 1.97 percent. In other words, stocks with a significant increase in their index weights experienced statistically significant event week excess returns of 2.34 percent. The 31 stocks experienced unusually high trading volume, consistent with index fund rebalancing. In cross-sectional tests, both returns and trading volume are positively associated with measures of the shift in demand arising from the redefinition.

The redefinition of the public float was a bureaucratic change designed to bring the TSE's definition of controlling stakes into line with that of its regulator, the Ontario Securities Commission, and was devoid of information content. Excess turnover subsided within two weeks. Yet the cumulative excess return remained significantly above zero for at least seven weeks. Also, the point estimate of the cumulative excess return 15 weeks after the event was virtually identical to its event week value. Finally, a regression-based test of reversals does not support reversals for at least nine weeks after the redefinition. These results are inconsistent with short-lived price pressure effects. Overall, we interpret the evidence as supporting the hypothesis that demand curves for stocks slope down.

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