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The Magnetic Attraction of Price Limits

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ABSTRACT

This paper utilizes a natural experiment on the Egyptian Stock Exchange, where a tight symmetric 5 percent limit was imposed from 1997-2002, to test for the 'magnet effect' of price limits and provides evidence that it exists and is economically significant. I employ a logit model of the probability of reaching a limit with pooled time series data from individual firms across two sub-periods: a period with price limits versus one without. The result of this comparison shows that the conditional probability of reaching a limit rose after imposing the limits, substantiating the evidence on the presence of a magnet effect in markets with tight price limits.

JEL Classifications: *C23, C25, G15*

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I. INTRODUCTION

In this article, I test for the presence of a magnet effect on the Egyptian Stock Exchange (EGX). The EGX provides an excellent laboratory to test for the 'magnet effect' in stock markets with price limits for two main reasons: it had a tight symmetric 5 percent price limit from 1997-2002 and reaching this limit resulted in a complete trading halt for the day. I find clear and robust evidence that share prices of stocks listed on the EGX were drawn towards their price limits as predicted by the magnet effect hypothesis. This finding contradicts the evidence presented by Abad & Pascual (2007), the only other paper to have benefited from having the aforementioned market characteristics for studying the magnet effect of price limits.

The main contribution of this paper is that it also benefits greatly from a natural experiment in an emerging equity market since it compares two sub-periods: one with price limits versus another without. This is empirically crucial in order to be able to attribute the magnet effect to the price limit, without having to resort to complicated estimation methods. To this author's knowledge this is the first paper in the price limit literature that isolates this effect.

Starting in the early nineties, price limits became commonplace in stock markets around the world (Table 1). The main explicit motivation for exchanges to impose a price limit was to reduce volatility (Kim & Sweeney, 2002; Hsieh & Yang, 2009) and stabilize stock markets (Taiwan Stock Exchange, 2006). The desired reduction in volatility could come from the direct constraint that they impose on price changes, giving "frenzied traders time to cool off" (Kim and Rhee 1997, 885), hence, leading to less panic-driven trading. However, recently Kim and Park (2010) argue for yet another implicit reason; they claim that regulators could use price limits to counter stock price manipulation by large investors and find empirical support for their hypothesis.

Table 1
Stock market and price limits.

Country	Limit	Country	Limit	Country	Limit
Argentina	±10%	Hong Kong	none	Peru	±15%
Australia	none	India	±8%	Philippines	±30%
Austria	±5%	Ireland	none	Portugal	±10%
Belgium	±5-10%	Israel	none	Singapore	none
Brazil	none	Italy	±10-20%	South Africa	none
Chile	none	Japan	±10-60%	Spain	none
Columbia	none	Kenya	±10%	Sweden	±7.50%
Denmark	none	Korea	±15%	Switzerland	±15%
Ecuador	±15%	Malaysia	±30%	Taiwan	±40-50%
Egypt	±5%	Mexico	±10%	Thailand	±15%
Finland	±15%	Netherlands	none	Turkey	none
France	±10-20%	New Zealand	none	UK	none
Germany	none	Norway	none	United States	±10%
Greece	none	Pakistan	±7.50%	Venezuela	none

Source: Kim and Park (2010)

Previous studies have offered inconclusive evidence on the magnet effect of price limits. Formally it was Subramanyam (1994) who elaborated the formal theoretical case for the magnet effect of price limits in a model based on Kyle (1985), opening up a line of empirical scrutiny. In support of the magnet effect, one can cite Cho et al. (2003) and Hsieh et al (2009) on the Taiwan Stock Exchange (TWSE), Chan et al (2005) on the Kuala Lampur Stock Exchange, Du et al. (2009) on the Korean Stock Exchange and possibly Goldstein and Kavajecz (2004) on the NYSE.

Cho et al (2003) estimate the return process for high-frequency returns to shares on the TWSE under a tight, 7 percent, price constraint. Notably, the authors find an asymmetry between upper and lower price limits. They find strong evidence that stock prices accelerate toward upper limits, but little evidence that prices accelerate toward lower limits. Further evidence on TWSE can be found in Hsieh et al (2009), who use transaction data for firms listed on TWSE and provide the first evidence of when magnet effects start to emerge. Using logit regressions, they show that the magnet effect initiates when the price falls within nine ticks of the upper price limits and approximately four ticks of the lower price limits. Chan et al (2005) also use transaction data and not only find evidence of the magnet effect on the KLSE, but also explicitly test how the magnet effect occurs through order imbalance[1.] They test the hypothesis that "the order imbalance remains unchanged after limit-hits" and find that "the order imbalance prior to the limit-hit suggests a magnet effect (where suboptimal trades are being made in anticipation of a limit-hit) and the subsequent order imbalance reversal after the limit-hit lends further support that a magnet effect did take place during the pre-hit period". Du et al. (2009)'s also find evidence consistent with the magnet effect in returns, trading volume, and volatility, among other measures. Goldstein and Kavajecz (2004) provide evidence that trading on the NYSE accelerated just before a trading halt in October 1997. However, this evidence is quite weak since they also provide an opposing one and the evidence applies to just one episode.

In contrast to these works, Kuserk et al.'s (1989) analysis of Treasury bond and commodity futures, as well as Berkman and Steenbeek's (1998) analysis of futures trading do not support the existence of a magnet effect. The latter paper exploits the fact that the Nikkei 225 futures contract is traded on the Osaka Stock Exchange, a market with strict price constraints, and also on the Singapore International Monetary Exchange, which has no price constraints. If price constraints exert a magnet effect, then when the price approaches the lower limit, Nikkei futures traded in Osaka should have a relatively low price compared to Nikkei futures traded in Singapore (and vice versa). Thus the results of this analysis do not provide evidence of a magnet effect. The lack of evidence of a magnet effect in futures will not obviously generalize to stock markets because futures contracts typically have close substitutes, while individual stocks do not. The only study that does not find support of the magnet effect in stock markets is that of Abad & Pascual (2007), who study the Spanish stock exchange (SSE) and find that price limits do not cause traders to advance their trades. However, this can be attributed to the specific trading halt mechanism dealing with the price limit hit, which results in 5 minute call auction and then resuming of the trading. Thus, the magnet effect can be unobservable in a market mechanism where investors know that they may trade after limit hits and trading halts, creating little incentive for them to advance their trades.

Using logit regressions, in which the probability of reaching a limit during a given close-to-close period depends on the overnight (close-to-open) return and other factors, I find clear and substantive evidence of a magnet effect of price limits on EGX.

The remaining sections of the paper are organized as follows: Section II provides an overview of the Institutional Background. Section III describes the data and methodology. Section IV presents the results and finally, section V concludes.

II. INSTITUTIONAL BACKGROUND

The EGX is one of the oldest stock markets in the world, since it dates to the era of the British colonial rule. Indeed, during the early 20th century, it was one of the world's most active stock markets. However, Nasser, one of the former Presidents of Egypt, closed the market in the 1950s. This persisted until its reopening in 1992. Later in 1997, the authorities imposed price limits with hopes of curbing volatility. These limits were eventually relaxed in 2002.[2]

The EGX is an order-driven market that does not utilize designated market makers. Investors issue orders that are posted on a large screen. During regular trading hours, which span the interval Sunday through Thursday from 10:30 a.m. to 2:30 p.m., orders are matched to determine equilibrium prices. In addition, there is a three-hour pre-opening session at the end of which bids and offers are matched to determine the opening price.

The total market capitalization on the EGX was approximately £.E. 121 billion (or roughly \$20 billion) in October 2002[3]. As in most emerging market stock exchanges, a relatively small set of companies dominate market and trading value. The 100 most heavily traded firms, out of the 1,151 listed in 2002[4], account for 34 percent of the total market capitalization, 85 percent of trading by volume, and 96 percent of trading by value.

From February 1997 till December 2002 the EGX had a tight symmetric 5 percent price limit on all firms in the stock market, which is as tight as any limit imposed anywhere at that period. Reaching of the price limit triggered trading halts and were applicable across firms. Specifically, once the price of a security moved by 5 percent relative to the closing price of the previous day, all trading halted until the end of the trading day. This led to the postponement of pending orders to the opening call market of the following day.

III. DATA AND METHODOLOGY

The tight price limit on EGX meant that limits were reached relatively frequently for the firms studied here. Taken in aggregate, limits were hit on 8 percent of the trading days during the period of enforcing limits. I focus on the intraday behavior of returns. Among all the various market properties one could examine – returns, trading volume, etc. – returns are uniquely important because moderating return volatility is the limits' intended purpose. Intraday data are, in turn, critical for the analysis of the magnet effect since each day's close determines the limit prices of the next day.

A. Data

Following a number of other microstructure papers, I study very closely the price action of a limited subset of the market. The data comprise open and close prices for five major EGX companies from January 3, 1994 to December 31, 2001. Prices are adjusted for stock splits, capital distributions, and dividends. I chose these firms because, unlike other firms, their available price data cover time periods both before and after imposing the price limits[5]. Fortunately, the five firms are all actively traded. All together, they account for 12 percent of total trading value during the decade 1992 to 2001. This is comparable to the roughly 10 percent share of NYSE trading accounted for by the Dow

Table 2
Descriptive statistics on firm returns

		No-Limits		Limits	
		Mean	Std. Dev.	Mean	Std. Dev.
APSW					
Returns:	Overnight	0.0009	0.0238	-0.0078	0.0182
	Intraday	-0.0017	0.0259	-0.0054	0.0422
Volatility		0.0034	0.0248	0.0252	0.0477
Returns ≥ +5%		23	3.0	28	2.3
Returns ≤ -5%		14	1.8	46	3.8
COMI					
Returns:	Overnight	-0.0006	0.0277	-0.0094	0.0258
	Intraday	-0.0002	0.0239	-0.0090	0.0149
Volatility		0.0229	0.0209	0.0248	0.0165
Returns ≥ +5%		46	6.0	15	1.2
Returns ≤ -5%		46	6.0	20	1.7
EPICO					
Returns:	Overnight	0.0166	0.0587	-0.0098	0.0271
	Intraday	-0.0012	0.0483	0.0187	0.0318
Volatility		0.0191	0.0406	0.0301	0.0212
Returns ≥ +5%		60	7.8	108	9.0
Returns ≤ -5%		42	5.5	92	7.7
NSGB					
Returns:	Overnight	0.0011	0.0186	-0.0121	0.0193
	Intraday	0.0007	0.0217	-0.0162	0.0207
Volatility		0.0118	0.0159	0.0188	0.0181
Returns ≥ +5%		48	6.3	25	2.1
Returns ≤ -5%		31	4.0	36	3.0
SUCE					
Returns:	Overnight	-0.0006	0.0155	-0.0009	0.0172
	Intraday	-0.0002	0.0190	0.0037	0.0211
Volatility		0.0197	0.0166	0.0244	0.0174
Returns ≥ +5%		44	5.7	14	1.2
Returns ≤ -5%		29	3.8	19	1.6

Note: This table describes five major firms on the EGX. Overnight returns are log price changes between the close on day *t*-1 and the open on day *t*. Intraday returns are log price changes between the open on day *t* and the close on day *t*. Volatility is measured as a twenty-day trailing average of the proportionate difference between high and low prices. The No-Limit period is January 3, 1994 through February 1, 1997. The Limit period is March 2, 1997 through December 31, 2001.

Jones companies studied in Handa and Schwartz (1996), and likely exceeds the share accounted for by the five stocks examined in Andersen (1996). The companies are Arab Polavara Spinning and Weaving (APSW), Commercial International Bank (COMI), Egyptian Pharmaceuticals (EPICO), National Societe General Bank (NSGB), and Suez Cement (SUCE).

Table 2 provides descriptive statistics for returns, volatility, and the frequency with which prices moved 5 percent (or more for the no-limit period)[6]. In the no-limit period, there is a total of 3,840 firm-day observations. Prices rose 5 percent or more on 5.8 percent or 221 of those occasions, whereas prices fell five percent or more on 4.0 percent or 152 occasions. In the limit period, there are 6,005 firm-day observations. Prices hit the upper limit on 3.2 percent or 190 occasions; and hit the lower limit on 3.5 percent or 213 occasions[7].

The limit-hit events are not highly correlated across firms, as shown in Figures 1A and 1B, which plot the number of hits per day for upper and lower bounds. Among upper limit hits, over 70 percent of individual hits were isolated events; the corresponding figure for lower limit hits is 78 percent.

B. Methodology

Following Cho et al. (2003) and Berkman and Steenbeek (1998), I focus on the implications of the magnet effect for price dynamics[8]. Since I sampled data only twice daily, returns would be censored on days when limits are hit. In such case, the GARCH approach of Cho et al. (2003), which used five-minute returns, becomes statistically unreliable.

Figure 1A

Number of firms whose price rose by 4.85% or more on a given day

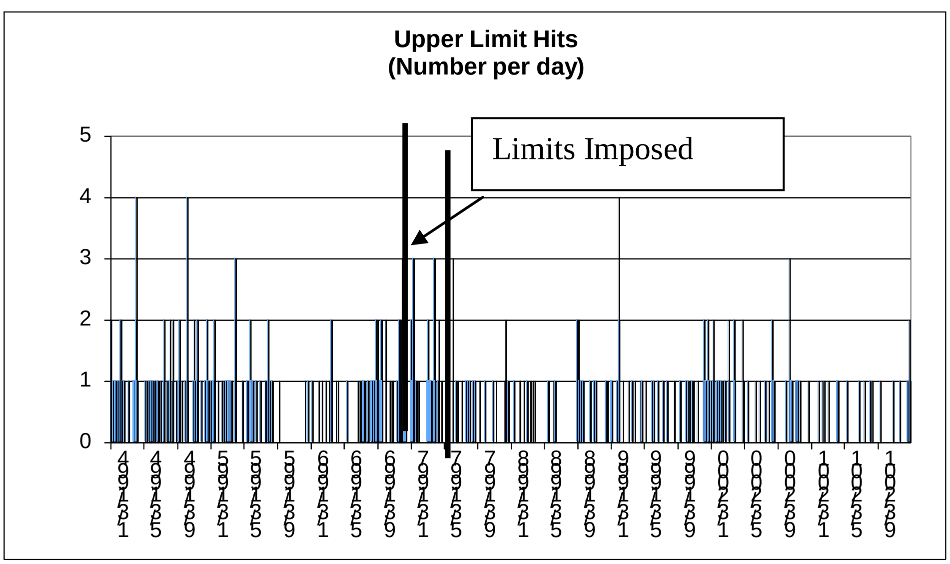
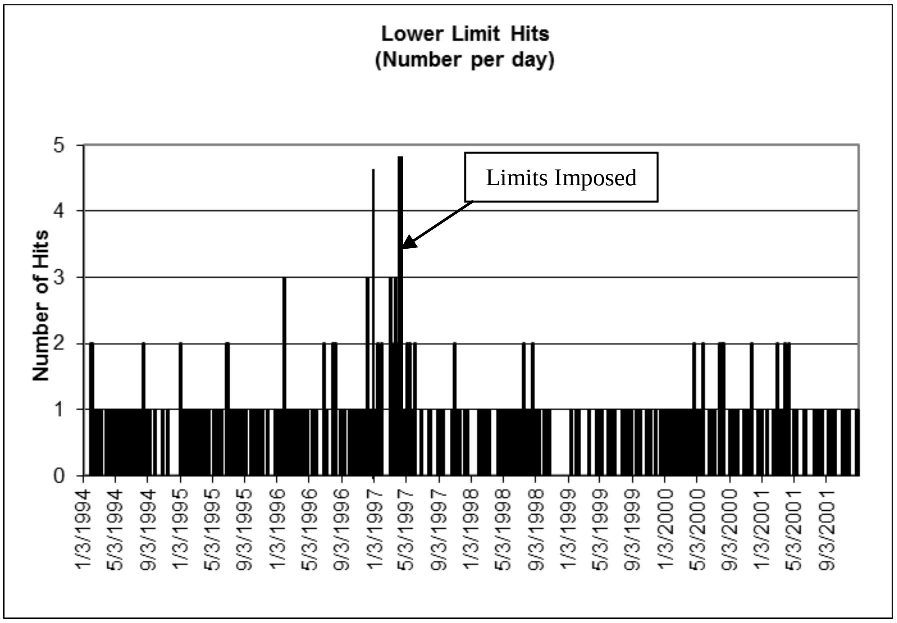


Figure 1B
Number of firms whose price fell by 4.85% or more on a given day



Instead, I build a new analytical approach based on the following from the evidence and the evidence of Hsieh et al (2009) and the key observation from Subramanyam that (1994, p. 245)); "if the price is close to the breaker limit, the breaker can actually increase ex ante price variability and the probability of hitting the circuit breaker bounds." This directs attention to the conditional probability of hitting a price limit and its dependence on the distance between the current price and price limit.

In the formal treatment of the magnet effect (Subrahmanyam 1994), an individual discretionary trader must choose whether to split his trades across periods one and two or to trade exclusively in period one. Splitting his trades has the advantage of reducing transactions costs, as mentioned by Chowdry and Nanda (1991). Concentrating his trades in the first period could also be advantageous. Nonetheless, if there is a significant probability that the limit is to be hit, this will prevent him from trading at all in period two. In this case, he will be accelerating his trades, meaning that he only trades in period one, if and only if the period-one price is within a certain distance of the limit. An exogenous and fixed cost of failing to trade determines this critical period-one price. This suggests a knife-edge property, whereby trading accelerates all at once if the price reaches a given level. In reality, the acceleration should be gradual, in part because the costs of failing to trade – and thus the key trigger prices – will vary across individuals.

The key implication drawn from Subrahmanyam (1994) is that under a formal price limit and upon observing a given overnight return some traders will accelerate their trading to avoid failing-to-trade costs. This will intensify any tendency to move towards the limit. Therefore, conditional on a given overnight return, prices will be more likely to move by the limit amount when imposing a formal price limit than otherwise. I focus on this implication of the magnet effect in the empirical analysis that follows. Similar to Kim and Sweeney (2002), I examine the probability of reaching the limit conditional on the day's opening price.

Under the magnet hypothesis, the conditional probability of moving by the limit amount during any close-to-close period should be higher when enforcing price limits than otherwise. As the key conditioning variable, I use the overnight (close-to-open) return, R_t^{night}. This overnight return establishes the proximity of opening price to the limit. Given the known positive autocorrelation of returns in emerging markets, which I document below for the EGX, the conditional probability of rising (falling) by the limit amount over the close-to-close period should be an increasing (decreasing) function of this overnight return. The inquiry focuses on how this function changes upon the imposition of limits.

In order to provide a statistical model of the conditional probability of reaching a price limit, I begin by constructing two dichotomous variables, $L^U{}_t$ and $L^L{}_t$, for upper and lower limits, respectively. For each type of limit, the variable takes the value zero if the close-to-close return on day *t* is within the limit and the value one otherwise. This serves as the dependent variable in a set of panel logit regressions.

I assume that the odds of reaching a limit are determined as a linear function of overnight return, as discussed above, as well as other lagged returns and volatility[9]:

$$\text{Odds}(L_t^U = 1) = \alpha + \varphi_0 R_t^{night} + \sum_{j=1}^{p} (\psi_j R_{t-j}^{day} + \varphi_j R_{t-j}^{night}) + \gamma VOL_t + \varepsilon \quad (1)$$

Thus I use a logit regression to estimate the conditional probability of reaching the limit. The detailed variable definitions presented below apply to regressions for price rises. The suitably adjusted definitions would apply to regressions for price declines (subscripts indicating individual firms are suppressed).

R_t^{night} : Close-to-open return from day *t*-1 to *t*, $R_t^{night} = \ln\left(\frac{Open_t}{Close_{t-1}}\right)$ (2)

R_{t-j}^{day}: Open-to-close return within day *t-j*, $R_{t-j}^{day} = \ln\left(\frac{Close_{t-j}}{Open_{t-j}}\right)$ (3)

VOL_t : Volatility, measured as a twenty-day trailing average of the daily proportionate distance between high and low prices: $Vol_t = \sum_{i=1}^{20} HLSpread_{t-i}$, where

$$HLSpread_t = \left[\frac{HIGH_t - LOW_t}{0.5(HIGH_t + LOW_t)}\right] \quad (4)$$

The additional lags of daily and overnight returns are intended to capture return autocorrelation, which tends to be higher in emerging markets than in developed markets (Bekaert and Harvey 1997). I determined that two lags of each are sufficient by re-estimating the model repeatedly, beginning with four lags and eliminating insignificant terms.[10]

Volatility, VOL_t, is included because, given the strong autocorrelation of volatility in financial markets, high volatility in recent days increases the likelihood that prices reach the limit on day *t*. I measure volatility in terms of the average proportionate distance between daily highs and lows, rather than the other common approach, which involves the sum of lagged squared returns. This measure is more appropriate for this study because it is directly related to whether prices will move enough intraday to reach a price limit. Results are robust to using the other volatility measure, as shown below.

The null hypothesis, then, is that the imposition of limits does not change the relationship between the overnight return and the probability of a 5 percent price move, φ_0. According to the magnet hypothesis, the imposition of limits should bring an increase in the absolute magnitude of φ_0. Thus φ_0 should rise for upper limits and decline for lower limits.

I can also analyze the implications of the possibility that price limits stabilize prices. If price limits stabilize prices by providing a cooling off period or by reducing transactional risks, then the imposition of limits should bring a decrease in the absolute magnitude of φ_0.

Since prices hit limits only occasionally, I increase the power of the proposed tests by combining the data from all five firms. I then run four panel logit regressions, for upper and lower limit hits, where the upper- and lower-limit samples are partitioned into no-limit and limit periods.

IV. RESULTS

The results indicate that the price limits, which the EGX imposed in 1997, exerted an economically and statistically significant magnet effect. This section first presents the main results. It then shows that the results are generally consistent across individual firms. Finally, it demonstrates that the main qualitative conclusions are robust to a number of alternative estimation strategies.

A. Main Results

Before examining the evidence pertaining to the magnet effect, I note that the results of estimating Equation (1), presented in Tables 3 and 4, seem broadly sensible. As expected, the coefficients on lagged returns suggest substantial return momentum and the coefficient on volatility is consistently positive and significant. The explanatory power is substantial as indicated by the McFadden R^2s, which range between 32 percent and 45 percent. The signs of the coefficients on current overnight returns conform to the simple statistical proposition that when the overnight return is greater, the probability of hitting the upper limit is greater and that when the overnight price drop is greater, the probability of hitting the lower limit is greater. Hence, φ_0 is positive for upper limits and negative for lower limits.

Table 3
Logit estimation of the probability of reaching the upper limit.

	Upper Limit	
	No-Limit	Limit
φ_0	**1.582** **(0.183)**	**2.482** **(0.108)**
ψ_1	**0.475** **(0.062)**	**0.724** **(0.125)**
φ_1	**0.639** **(0.112)**	**0.183** **(0.061)**
ψ_2	-0.179 (0.119)	-0.058 (0.117)
φ_2	**0.376** **(0.131)**	-0.209 (0.118)
γ	**1.692** **(0.448)**	**1.811** **(0.524)**
α	**-2.504** **(0.046)**	**-2.666** **(0.056)**
LR statistic	684.5	523.3
McFadden R^2	0.293	0.372
Semi-Elasticity (at sample means)	38.2%	50.2%

Note: I run logit regressions for the probability that prices for five firms on the EGX moved up by 5 percent or more relative to the previous close, where the independent variables are: R_t^{night}, close-to-open returns on day t. R_t^{day}, open-to-close returns on day t; and Vol_t captures price volatility measured as a twenty-day trailing average of the daily proportionate distance between high and low prices. Values aligned with the variables names are estimated coefficients. The marginal effect of the overnight return is reported at the bottom. Standard errors in parentheses and results in **boldface** statistically significant at the 5% level. The no-limit period covers January 3, 1994 to January 31, 1997; the limit period covers March 2, 1997 through December 31, 2001.

As discussed earlier, the change in the φ_0 coefficients between the no-limit and limit periods is the focus of testing for the magnet effect. Consistent with the magnet hypothesis, the absolute magnitude of φ_0 is higher in the limit period than the no-limit period for both upper and lower limits. For upper limits, φ_0 increases by about two thirds, rising from 1.6 to 2.5. Also, for lower limits, the absolute magnitude of φ_0 increases by about two thirds, changing from -0.7 to –1.1. Both changes are statistically significant.

Of course, statistical significance need not imply economic significance, so I will next examine marginal effects. Before imposing limits, an increase in overnight returns of one percentage point increased the likelihood of hitting the upper limit by 38 percent (with all variables measured at sub-sample means). After the imposition of limits, this figure was roughly a third higher, at 50 percent. For lower limits, the corresponding figures are -18 percent and -22 percent. I conclude that the effects of both upper and lower limits were economically substantial.

Table 4
Logit estimation of the probability of reaching the lower limit.

	Lower Limit	
	No-Limit	Limit
φ_0	**-0.741**	**-1.104**
	(0.063)	**(0.071)**
ψ_1	**-0.476**	**-0.493**
	(0.085)	**(0.076)**
φ_1	**-0.144**	**-0.183**
	(0.063)	**(0.101)**
ψ_2	-0.069	-0.072
	(0.088)	(0.079)
φ_2	-0.127	-0.072
	(0.201)	(0.152)
γ	**2.427**	**1.951**
	(0.718)	**(0.982)**
α	**-2.598**	**-2.607**
	(0.052)	**(0.050)**
LR statistic	498.3	505.6
McFadden R^2	0.361	0.401
Semi-Elasticity (at sample means)	-18.0%	-22.3%

Note: I run logit regressions for the probability that prices for five firms on the EGX moved up by 5 percent or more relative to the previous close, where the independent variables are: R_t^{night}, close-to-open returns on day t. R_t^{day}, open-to-close returns on day t; and Vol_t captures price volatility measured as a twenty-day trailing average of the daily proportionate distance between high and low prices. Values aligned with the variables names are estimated coefficients. The marginal effect of the overnight return is reported at the bottom. Standard errors in parentheses and results in **boldface** statistically significant at the 5% level. The no-limit period covers January 3, 1994 to January 31, 1997; the limit period covers March 2, 1997 through December 31, 2001.

The similarity here between the proportionate effects of upper and lower price limits is notable. Cho et al. (2003) find a strong effect of upper price constraints and little or no effect of lower price constraints on the Tokyo Stock Exchange, and suggest that short-sales constraints explain this asymmetry. However, short sales are also constrained – indeed, they are strictly prohibited – on the EGX. Thus short-sales constraints may not explain the apparently small effect of lower limits observed by Cho et al.

On the basis of these results, I draw three central conclusions:

- The relationship between the close-to-open return and the conditional likelihood that prices rose by 5 percent from close-to-close was higher after price limits were imposed on the EGX in February of 1997 than before. The relationship between the close-to-open return and the conditional likelihood that prices fell by 5 percent close-to-close was lower after imposing the price limits. Both of these observations are consistent with the magnet effect.

- This change was statistically and economically significant for both upper and lower price limits.

- The change was roughly similarly pronounced for upper and lower price limits.

a. Generality

In order to examine the generality of these results across firms, I run similar tests for each individual firm and find the results are generally consistent with those reported above. McFadden R^2s range from 12 percent to 48 percent, and average 23 percent. Of the ten pairs of regressions (five firms, upper and lower limits for each firm), the change in the coefficient on concurrent overnight returns, φ_0, rises in absolute magnitude in all but one case. This finding is consistent with the magnet effect. These estimated changes are surprisingly precise given the relatively small number of limit hits per firm. In four of the ten cases, the coefficient on φ_0 is insignificantly different from zero in the absence of limits and statistically significant (and larger in absolute value) under limits. This is consistent with the magnet hypothesis. In a fifth case, the coefficient is significant for both periods but increases significantly in absolute magnitude upon the imposition of limits. This broad applicability of the magnet effect across firms suggests that it would not be unreasonable to generalize results to the market overall.

b. Robustness

In order to further substantiate the previous central conclusions, I present four robustness tests. In all cases the main conclusions are sustained. I also test a secondary implication of the Subrahmanyam (1994) model, that the fraction of individuals, which will accelerate trades will rise as the price becomes closer to the limit. With respect to the conditional probability of moving by the limit amount, this implies that the effect of the price limit on this probability should be stronger for prices closer to the limit. For prices far from the limit, the probability of moving by the limit amount will not rise much with the enforcement of limits. For prices close to the limit, the probability of moving by the limit amount will rise substantially.

1. Measures of Volatility

Volatility is frequently measured in terms of returns rather than high-low price differentials. I re-estimate Equation (1) with volatility measured as the square root of the mean of squared close-to-open and open-to-close returns over the previous twenty days. The results are quite similar to those associated with the previous volatility measure. The only notable difference is that the economic magnitude of the effect of price limits seems more pronounced, as does the difference between upper and lower limits. In the base case, the imposition of limits was associated with a one-fifth to one-third rise in the marginal effect of a one-percentage-point rise in overnight returns. When volatility is measured in this alternative way there is a 100 percent rise in the effect for upper limits and a 50 percent rise for lower limits.

2. Volatility Spillovers

Previous research suggests that there can be “volatility spillovers” when prices reach limits. That is, volatility suppressed by trading halts on one day may spill over into extra volatility the next day. Evidence consistent with this hypothesis is presented in Kim and Rhee (1997), Kuhn, Kuserk, and Locke (1991), and Tooma (2005). Ideally, I would retain the full sample and capture this effect by including a lagged dependent variable. However, this would distort the statistical properties of the panel logit regressions, leaving the results unreliable (Arellano 2000), and no one identified a solution to this statistical difficulty in the literature.

As an alternative, I limit the sample to dates on which volatility spillovers are not a concern. That is, I exclude any day for which a price limit was reached the previous day. The results show that the three main qualitative results are sustained in the more limited sample.

3. Volatility from Mid-1996 through Mid-1997

The introduction of the price limits on the EGX was during a period of great market volatility, as is apparent in Figure I. Since the dramatic price action of this period may be disproportionately influencing the results, I re-run regressions excluding this interval entirely. Specifically, I exclude data from July 1, 1996 through July 31, 1997. The results remain qualitatively consistent with the earlier findings.

4. Probit Estimation

To further verify the robustness of the results, I re-run baseline regression using the probit estimation technique and once again, this analysis did not qualitatively change the main conclusions. There appears to have been a pronounced magnet effect associated with both upper and lower price limits on the EGX.

V. CONCLUSION

I investigate in this paper whether stock prices tend to accelerate as they approach price limits, a phenomenon termed the magnet effect (Subramanyam, 1994). As the laboratory, I use the EGX, where imposing tight 5 percent price limits in early 1997 brought relatively frequent trading halts on individual firms, permitting statistical analysis with reasonable power. Using logit regressions on intraday data, I examine the conditional likelihood that close-to-close returns reach 5 percent for a given (overlapping) close-to-open return. Results show that, upon the imposition of limits, the conditional probability of reaching an upper (lower) limit was more (less) strongly related to the overnight return, consistent with a magnet effect. The effects were roughly similar in magnitude for upper and lower limits.

These results suggest that price limits are at best a mixed blessing. They may have benefits, such as enabling more informationally efficient pricing (Greenwald and Stein 1991), to offset the cost of greater conditional volatility, but these have not been fully explored. To fully evaluate the consequences of price limits, it would be important to examine their effects on unconditional volatility and overall market efficiency. I leave these inquiries for future research

ENDNOTES

1. Chan et al define an order imbalance as the ratio of buy orders to total orders (in shares). If this ratio is 0.5 then demand equals supply. A ratio greater than 0.5 implies that there are more buys than sells creating an upward price pressure and vice versa.
2. In July 2002 the Egyptian Stock Exchange applied new circuit breaker rules to a selected list of active stocks. The new circuit breaker rules impose graduated impediments to trading as prices move farther from opening levels. The most inconsequential impediment is a simple announcement; the most severe is the cessation of trading through the end of the session.
3. The current market capitalization as of March 2010 is $84bn.
4. The number of shares listed on EGX in 2010 is around 220 companies. The drop in the number of companies listed results from stricter listing rules by EGX passed in 2004 and the removal of corporate tax incentives in 2005.
5. Studying the no-limit sub-period is important part of this paper. An example can illustrate this: The magnet effect says that prices that open 1% from the limit are naturally more likely to subsequently move 1% more compared to a price that opens 5% from the limits subsequently moving 5% more. To say that price limits affects these likelihoods, we need to know what the ‘normal’ likelihoods of these subsequent movement in absence of the limits, which is why it is important to study the no-limit period.
6. I actually allow for a tiny margin of error around the 5 percent figure, specifically 15 basis points, to account for rounding errors associated with price adjustments for stock splits, dividends, and capital distributions. In this, I follow Charemza and Majerowska (2000).
7. This implies a decline in the unconditional likelihood that prices moved by the limit amount. We do not investigate this further, however, since the focus of the magnet effect is the conditional likelihood of reaching the limit.
8. The theory behind the magnet effect implies changes in trading behavior. While it would be interesting to examine trading records for evidence of those changes, as in Chan et al. (2005) and Hiseh et al. (2009), trading records are not available. Fortunately, the key prediction of the magnet effect for policy purposes concerns price behavior, which is our focus.
9. The statistical validity of this approach might be undermined if prices occasionally move by over 5 percent overnight, in which case the overnight return series would be truncated during the limit sample period. However, absolute overnight returns never exceeded 3.2 percent while price limits were in force.
10. One advantage of including these extra lags is that we can distinguish magnet effects from momentum effects by comparing the behavior of prices before and

after the imposition of price limits. The response of prices to overnight and other lagged returns before the imposition of limits should capture momentum effects; any change in the response to the most recent overnight return upon the imposition of price limits should capture magnet effects.

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