

## A Note on Affordability and the Optimal Share Price

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Despite the increase in institutional ownership, decreased trading costs, and increased real personal savings, we find that the average stock price is lower today than it was in the 1920s. In the aggregate, the propensity to split is a function of recent market performance, personal savings, and the desirability of appearing to be a small firm. Our results indicate that, after decades of inflation and the average stock price falling, splitting stocks to return to an “affordable” trading range must be rejected as an explanation. This suggests that other economic forces are behind splits, whether traditional or behavioral in nature.

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## 1. Motivation

There are several possible, and not necessarily competing, explanations for stock splits. Three of the most cited include the trading range hypothesis, which suggests that firms use stock splits to keep the stock price in some “optimal trading range.” The broker promotion hypothesis states that stock splits are used to produce an optimal tick size that encourages brokers to promote the stocks. Finally, the signaling hypothesis argues that managers use stock splits to reveal positive private information to uninformed investors. In this paper we address the optimal trading range hypothesis.

Dewing (1934) suggests that the optimal trading price range is between \$30 and \$60 per share. As reported by Dyl and Elliot (2006), 70.2% of all NYSE stocks had prices between \$10 and \$50 per share in 2001. It is curious that this trading range is still appropriate in 2001 even though it is pennies on the dollar in real terms compared to the price range at the time of Dewing’s writing. Figure 1 illustrates how the distribution of nominal stock prices has changed very little from the 1920’s compared to present day.

Perhaps it is because of behavioral convention that investors prefer stocks to trade in particular *denominations* and that convention is at least one of the forces behind the splits. We prefer to use the term denomination to help distinguish between the concepts of price per share and value which is a source of most of the disagreement surrounding the “value” of a stock split. Informed common sense strongly suggests that having more shares cannot be better *in and of itself* if the denomination falls proportionally. If the split has some economic significance (such as signaling, liquidity, affordability, etc), firm value may increase. We do not mean to argue that there is no economic value to a firm splitting its stock.

The purpose of this paper is to simply point out the following: The motivation of splitting a stock to trade in “affordable” round lots is called into serious question for several reasons. Inflation has eroded the real value of the \$3,000 to \$6,000 round-lot “trading range.” The cost of trading decreased significantly with the deregulation of commissions and the passage of the Securities Acts Amendments in 1975. The significance of trading in round lots diminished further with the advent of flat-fee trading in the mid to late 1990’s. The affordability argument is also less applicable today than in the past due to the decimalization of stock prices, which helped reduce spreads beginning in 2000. Finally, the increased presence of institutional investors in the equity markets diminishes any need for low-priced stocks. Gompers and Metrick (2001) find that between 1980 and 1996, institutional ownership increased from 28.4% to 51.6% of the market value of equities. The one hundred largest institutional investors increased their ownership share from 19.0% to 37.1% during this period. Consistent with Lakonishok, Shleifer, and Vishny (1992), they also find that higher priced stocks tend to attract more institutional investors. According to the Federal Reserve’s Flow of Funds data, direct ownership of all corporate equities by households has fallen from 93.2% in 1945 to 25.4% in 2007. Institutional investors now own nearly three-quarters of all equities outstanding. Thus, the “average” investor is no longer the individual investor where the ability to buy a round lot is a binding constraint.

This suggests that other economic forces are behind splits, whether traditional or behavioral in nature, or both. We find that the average nominal stock price has not significantly increased over the last 80 years. In real terms, stock prices are at historic lows. Our results clearly indicate -- after decades of inflation and the average stock denomination remaining approximately the same in nominal terms -- that splitting stocks to return to an “affordable” trading range must be rejected as an explanation.

## 2. Review of the literature

Financial theory suggests that in efficient capital markets devoid of market imperfections, stock splits should have no impact on shareholder wealth. Prior research regarding stock splits suggests corporate managers feel otherwise. Baker and Gallagher's (1980) survey of chief financial officers found that of those whose company had split its stock, over 98% felt the split helped "make it easier for small stockholders to purchase round lots." Nearly 94% of the group responded that stock splits allow them to keep the stock price in an optimal range. Dyl and Elliot (2006) conclude that firms manage their share prices "to reflect the desires of the firm's owners."

Lakonishok and Lev (1987) find that stock splits are carried out by firms that have experienced unusual growth in their stock price. The splits return the share prices to market and industry-wide price ranges. So and Tse (2000) conclude that companies split their stock so that the price will conform to market norms. Copeland (1979) suggests that one of the rationales for an optimal price range is the result of the trade-off between lower transaction costs and diversification. Higher priced securities minimize transaction costs, while lower priced securities allow investors to purchase round lots of a wider variety of stocks. Thus, the demand for shares is maximized when the price is in the "optimal" range. Ikenberry, Rankine, and Stice (1996) point out that the optimal trading range hypothesis suggests that stock splits are a function of past price performance, since they typically occur after a significant price run-up. They postulate that stock splits cause prices to fall into a preferred trading range after a run-up in price, but managers condition the decision on expected future performance. Providing further support for the optimal price range argument, McNichols and Dravid (1990) find that stock splits are often based on psychological factors. For example, investment bankers may suggest stock split factors that keep a stock from falling into a range that is too low and "not befitting a company."

Muscarella and Vesuypens (1996) examine American Depositary Receipts and find that at issuance, ADRs are priced at an “optimal” U.S. level. For some unsponsored ADRs, the split is initiated by the depository bank rather than the company; the authors conclude that these types of splits cannot be motivated by signaling, but rather are done to increase liquidity. Angel (1997) also examines ADRs and demonstrates that the apparent optimal stock price range is an international phenomenon, and that the range varies dramatically between countries. He cites as evidence that “when foreign shares are packaged as American Depositary Receipts (ADRs), the ratio of foreign shares per ADR is designed so that the ADR trades in the same price range as other U.S. stocks. Sometimes ADRs split when the home country stock does not.”

Weld, Bernatzi, Michaely, and Thaler (2007) examine average nominal stock prices from 1933 through 2005 with a focus on what stock prices would have been had the splits never occurred. They show this focus on nominal price also extends to open-end investment companies. Since investors can purchase fractional shares, there is no economic rationale for mutual fund shares to split, yet some still do. The observation is consistent with Rozeff’s (1998) finding that mutual funds split to bring their price back into the conventional price range.

Baker, Greenwood, and Wurgler (2008) suggest a “catering” rationale. Given the observation that small market capitalization firms tend to have lower stock prices, they conclude that when the valuations for low-price firms are attractive, relative to high-price firms, high-price firms will split their stock to appear to be small cap firms. When investors place a lower value on small cap firms, large cap firms will split less often.

We examine the optimal price range hypothesis from a different perspective. Considering the amount of inflation over the last eighty years, the nominal optimal price range should have increased over time. If stock splits make shares “more affordable” for investors by reducing the

nominal price per share, then increases in nominal income or nominal wealth should also make those same shares more affordable. Although the optimal price in real terms may remain constant, we hypothesize that the nominal price per share today should be significantly higher than the nominal price eighty years ago. To test the hypothesis, we examine the nominal and inflation-adjusted median share price over eight decades.

The only study that formally examines the fact that stock prices have not kept pace with inflation is Weld, Bernatzi, Michaely, and Thaler (2007). Our findings are consistent with theirs; however, their evidence is descriptive in nature. We segment stock prices by decade for both firms that split and those that do not, giving separate consideration to reverse splits. We find that, even on a nominal basis, median share prices have declined during the time under study, suggesting that managers split their stock for reasons other than affordability for small investors.

### **3. Data and empirical methods**

We obtain the distribution, price, index return and market capitalization decile information for all NYSE and AMEX stocks from 1926 through 2007 from the Center for Research in Security Prices (CRSP) U.S. stock database. We do not include Nasdaq stocks because the data are not available before 1972. We divide the sample into three parts for each year – stocks that split, stocks that reverse split, and those with no split. We examine year-end prices for all firms for all years, as well as prices one day before and one day after the split for those firms that split.

The inflation-adjusted price is defined as the price of the stock multiplied by the CPI for 2007 divided by the CPI in the year the stock price is measured. Hence, we measure all prices in real terms in 2007 dollars for comparison across years. CPI data are from the Bureau of Labor Statistics. Real personal savings is from the Bureau of Economic Analysis, while the percent of

direct equity holdings by households is from the Federal Reserve. Baker, Greenwood and Wurgler (2008) provide the small-stock premium and the low-price premium data.

To investigate why firms, in the aggregate, split, we regress the log-level of the number of splits in a given year against the one-year lag of the number of splits, the two-year (including the year of the split and the previous year) real or nominal index returns, the log-level of real personal savings, the percent of equities directly owned by households, and the small stock and low price premiums as described by Baker, Greenwood, and Wurgler (2008).<sup>1</sup> A lag of the number of splits is included to control for autocorrelation. The number of splits should be positively related to the two-year index returns. Higher returns generate higher prices, potentially necessitating a split. As real personal savings increases, there is less need to split, if the rationale for splitting is affordability. As direct household ownership decreases, we similarly expect fewer splits. Given the Baker, Greenwood, and Wurgler (2008) results, we expect the number of splits to increase given an increase in the small stock or the low price premium.

#### **4. Results**

Panel A of Table 1 shows a comparison of means winsorized at 10% and median prices between forward split, reverse split, and non-split firms and for the entire sample. The means are winsorized in order to remove the influence of outliers, such as Berkshire Hathaway. The post-split mean price is \$22.73 for non-split firms, \$33.04 for split firms, and \$9.14 for reverse split firms. These prices are all significantly different at the 1% level. As shown in Panel B, the mean price for all stocks fell from \$30.31 in 1926-1935 to \$25.13 in 1996-2007. This is statistically different at the 1% level. For the subsets of split firms and non-split firms, the direction of this

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<sup>1</sup> This choice of dependent variable improves inference, since the residuals are normally distributed. We also used the percentage of firms that split in a given year as the dependent variable, and the results were virtually identical. However, the residuals were non-normal in those regressions. We use White's correction for heteroskedasticity.

relationship remains. Prices have fallen over the examined period, while for reverse splits, the nominal mean is not significantly changed.

Table 1 also reports real prices in 2007 dollars and shows the decline in mean prices is even more dramatic. As shown in Panel B, the mean real price for all stocks fell from \$408.67 in 1926-1935 to \$29.65 in 1996-2007. This is statistically different at the 1% level. The same pattern is seen in the non-split, split, and reverse split subsets. These results indicate that, if there is an optimal trading range, it has not been adjusted for inflation.

If firms carry out splits for the purpose of keeping prices in an affordable trading range, then both forward and reverse splits should result in similar stock prices for splitting firms after the split. As Table 2 shows, this is not the case. In fact, the mean post-split price for split firms exceeds the mean price from Table 1 for all firms for all sub-periods. For reverse split firms, the opposite is true; the post-split price is below the mean price for all firms in all sub-periods. These differences are statistically significant at the 1% level in nearly all cases.

Consistent with Lakonishok, Shleifer, and Vishny (1992) and Gompers and Metrick (2001), Table 3 shows that median prices increase with market capitalization decile for the non-split firms during all sub-periods and the split firms for most periods. However, the median prices for both the non-split and split firms fall over time. Weld, Bernatzi, Michaely, and Thaler (2007) find evidence that firms tend to split to their market capitalization median price. We find that to be true for only the large capitalization firms. For the three largest deciles, the median split price is typically no more than 25% above the median non-split price. However, for the three smallest deciles, the median split price is typically more than 70% above the median non-split price. It is difficult to establish any discernable pattern for the reverse split stocks due to the limited number of observations.

We investigate the factors related to the aggregate level of split activity among NYSE and AMEX stocks, with results reported in Table 4. The dependent variable in each OLS regression is the log-level of the number of splits in a given year. Explanatory variables are the one-year lag of the number of splits, the two-year (including the year of the split) real and nominal index returns, the log-level of real personal savings, the percent of equities directly owned by households, and the small stock and low price premiums as defined by Baker, Greenwood and Wurgler (2008). In all cases, the lagged value of the number of splits is significant at the 1% level, indicating first-order autocorrelation. We find that coefficients on both the two-year nominal and real index returns are positive and significant at the 1% level, which indicates that split activity increases during periods of strong market performance. Higher levels of real personal savings should reduce the need for low stock prices. We find the opposite; the level of real personal savings is positively related to the number of stock splits at the 5% level. Though the affordability argument would suggest that a decrease in the percentage of direct ownership of equities by households would be accompanied by a decrease in the level of split activity, we find no significant relationship. The Baker, Greenwood, and Wurgler (2008) variables give conflicting results. The small stock premium is positively and significantly related to the number of stock splits, while the low price premium is not statistically significant. This result suggests that it is the illusion of being a small firm rather than the low price that influences the propensity to split.

## **5. Conclusions**

Studies continue to point to the affordability argument as one of the motivating factors behind stock splits. We find evidence to the contrary. Despite the increase in institutional ownership, decreased trading costs, and increases in real personal savings, the average nominal stock price is lower today than it was eighty years ago. In real terms, stock prices today are dramatical-

ly lower. These results indicate that, if there is an optimal trading range, it has actually declined over time on an inflation-adjusted basis. There is no longer a rational reason for individual investors to prefer an optimal trading range, but the convention appears to persist. In the aggregate, the propensity to split appears to be a function of recent market performance, the level of real personal savings, and the desirability of appearing to be a small firm.

This suggests that other economic forces are behind splits, whether traditional or behavioral in nature, or both. Splits as signals or behavioral convention may both be contributing factors and may be difficult to separate. But we assert that our results clearly indicate -- after decades of inflation and the average stock *denomination* continuing to range in the double digits -- that splitting stocks to return to an “affordable” trading range must be rejected as an explanation.

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**Table 1****Nominal and real prices**

Nominal and real price for all firms falling into each of the categories. All prices are reported as of the last trading day of the year. Panel A includes all years from 1926-2007. Panel B separates the data by decade – the final “decade” includes 12 years, so as not to ignore data. All means are winsorized at 10%. The non-split sample includes split firms until the year of their first split, but never includes those firms after their first split. The split samples are separated into two categories: those that split in the current year and those that split in a prior year. The inflation adjustment is given by:  $Adjusted\ Price_t = \frac{CPI_{2007}}{CPI_t} (Price_t)$ .

		Full Sample		Non-Split		Current Year Forward Split		Current Year Reverse Split	
		Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real
Panel A: All years									
	Winsorized mean	23.22	115.00	22.73	65.25	33.04	123.64	9.14	41.14
	Median	19.75	65.98	19.00	114.73	30.00	76.97	6.75	21.85
	Firm-years	111,102	111,102	105,004	105,004	5,810	5,810	288	288
Panel B: By decade									
		Nominal	Real	Nominal	Real	Nominal	Real	Nominal	Real
1926-1935	Mean	30.31	408.67	30.09	406.54	61.13	756.79	8.38	117.92
	Median	20.00	282.64	20.00	279.39	51.25	629.36	6.13	85.46
	Firm-years	6,535	6,535	6,423	6,423	73	73	39	39
1936-1945	Mean	23.15	311.21	23.07	310.33	38.23	499.95	9.45	130.56
	Median	18.50	251.52	18.50	250.51	34.56	459.26	7.63	112.09
	Firm-years	7,699	7,699	7,616	7,616	62	62	21	21
1946-1955	Mean	28.30	238.34	28.04	236.24	36.64	310.02	14.24	121.51
	Median	24.75	207.94	24.38	205.53	33.88	281.57	13.75	108.32
	Firm-years	9,656	9,656	9,363	9,363	284	284	9	9
1956-1965	Mean	27.96	196.87	27.35	192.75	39.58	277.69	9.76	66.41
	Median	25.13	176.64	24.25	170.71	35.88	252.58	7.00	48.77
	Firm-years	14,204	14,204	13,448	13,448	729	729	27	27
1966-1975	Mean	20.09	107.80	19.38	103.59	34.81	193.87	8.79	47.86
	Median	16.75	85.14	16.00	81.18	32.25	177.64	7.63	37.17
	Firm-years	22,869	22,869	21,704	21,704	1,133	1,133	32	32
1976-1985	Mean	19.32	49.60	18.64	47.98	27.02	68.36	9.76	28.52
	Median	17.25	44.40	16.38	42.14	25.38	62.01	8.13	18.12
	Firm-years	18,761	18,761	17,186	17,186	1,558	1,558	17	17
1986-1995	Mean	21.66	34.50	21.18	33.67	28.80	46.84	7.57	12.09
	Median	19.00	30.09	23.43	28.59	26.25	42.31	5.50	8.42
	Firm-years	14,452	14,452	13,332	13,332	1,050	1,050	70	70
1996-2007	Mean	25.13	29.65	24.45	28.75	38.86	46.82	9.65	11.76
	Median	22.10	26.11	21.13	25.02	36.63	43.12	7.18	8.50
	Firm-years	16,926	16,926	15,932	15,932	921	921	73	73

**Table 2****Pre- and post- split prices**

Average price one day before and one day after the ex-day of the split. All data are winsorized at 10% and means are reported. Panel A reports nominal prices, while Panel B reports inflation-adjusted prices, where the inflation adjustment is given by:  $Adjusted\ Price_t = \frac{CPI_{December, 2007}}{CPI_t} (Price_t)$ .  $CPI_t$  is the CPI for the month of the split. Number of firm-years is reported in parentheses.

	Forward Splits		Reverse Splits	
	Before	After	Before	After
Nominal Price	56.65	29.34	4.02	10.21
Real Price	217.57	110.75	18.92	51.02
Firm-years	5,847	5,842	299	297
Panel A: Nominal Prices				
1926-1935	181.24 (77)	58.99 (75)	5.01 (41)	11.99 (41)
1936-1945	83.47 (62)	31.58 (62)	2.63 (21)	10.08 (21)
1946-1955	75.00 (284)	33.08 (284)	12.05 (9)	15.88 (9)
1956-1965	70.73 (730)	33.74 (728)	4.90 (27)	9.75 (26)
1966-1975	56.30 (1,138)	29.92 (1,138)	4.15 (32)	12.46 (32)
1976-1985	41.72 (1,570)	23.61 (1,570)	7.33 (17)	9.05 (17)
1986-1995	51.32 (1,058)	27.50 (1,058)	1.59 (71)	8.63 (71)
1996-2007	66.95 (928)	35.02 (927)	5.56 (81)	9.69 (80)
Panel B: Real Prices				
1926-1935	2246.63 (77)	729.32 (75)	67.57 (41)	162.07 (41)
1936-1945	1100.37 (62)	412.47 (62)	38.28 (21)	146.18 (21)
1946-1955	639.89 (284)	285.32 (284)	102.93 (9)	135.31 (9)
1956-1965	500.99 (730)	238.01 (728)	34.82 (27)	73.28 (26)
1966-1975	319.71 (1,138)	169.59 (1,138)	21.63 (32)	66.15 (32)
1976-1985	106.76 (1,570)	60.62 (1,570)	17.76 (17)	25.08 (17)
1986-1995	85.48 (1,058)	45.73 (1,058)	2.47 (71)	13.62 (71)
1996-2007	81.75 (928)	42.82 (927)	6.38 (81)	11.41 (80)

**Table 3****Median nominal price by decade and market capitalization decile**

Median nominal price for all firms falling into each of the categories. All prices are reported as of the last trading day of the year. Market cap deciles are defined by CRSP Portfolio 2 – only NYSE and AMEX firms.

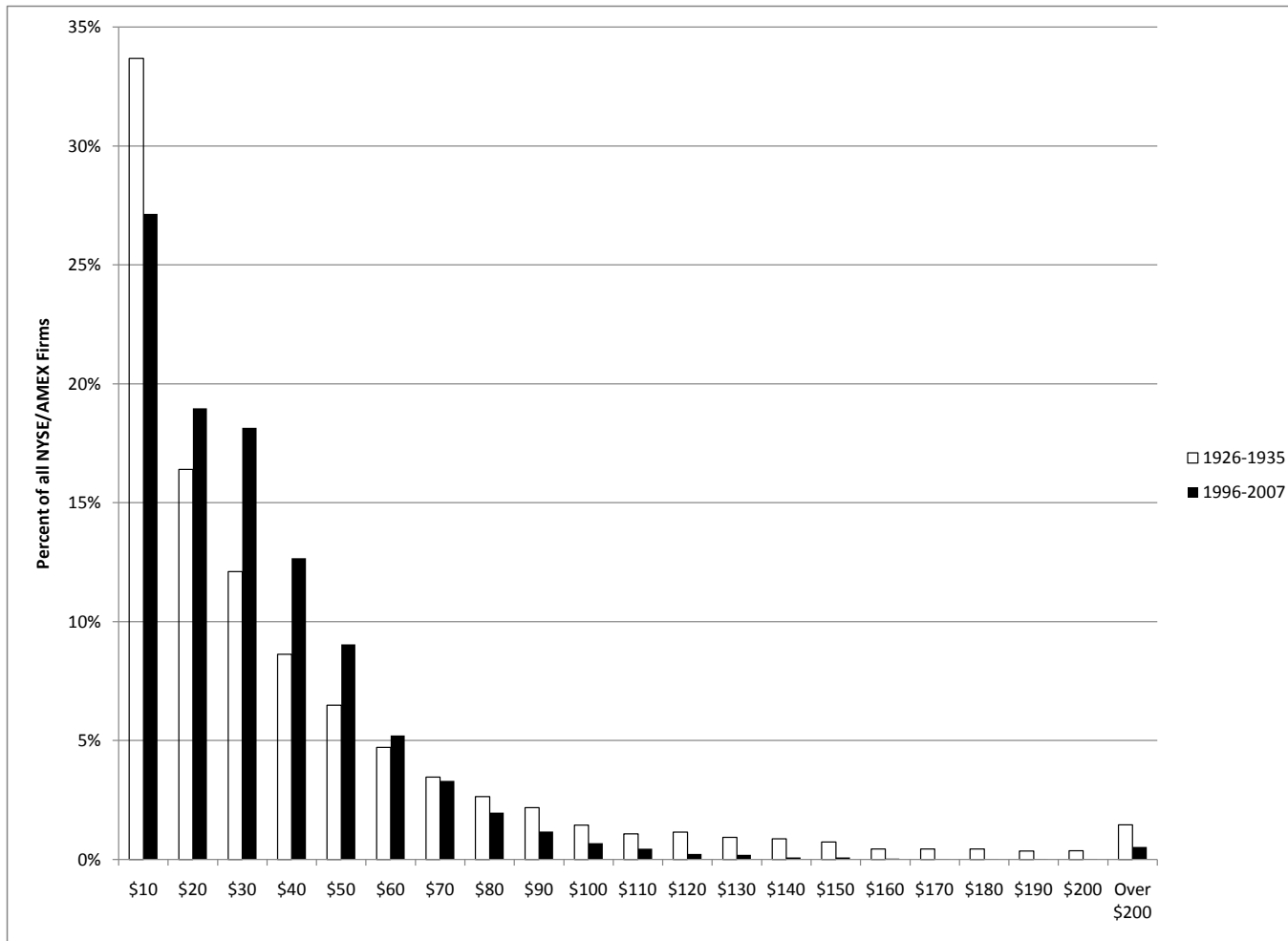
Panel A: Non-split firms								
	1926- 1935	1936- 1945	1946- 1955	1956- 1965	1966- 1975	1976- 1985	1986- 1995	1996- 2007
1	2.75	3.50	9.75	6.13	4.50	3.75	2.88	2.86
2	6.00	6.75	15.69	11.00	7.00	6.63	5.75	5.44
3	8.88	11.03	17.75	14.50	9.00	9.25	7.75	7.87
4	14.75	14.81	21.63	17.38	11.88	12.50	10.75	10.84
5	19.38	18.75	23.13	22.50	14.25	14.88	13.25	16.36
6	22.63	20.88	26.50	27.63	19.23	18.13	16.50	20.06
7	29.88	24.25	30.63	30.75	21.13	21.00	21.50	23.56
8	32.94	29.13	32.75	36.50	25.13	25.00	25.13	29.13
9	43.50	34.00	41.13	43.00	30.25	28.13	29.75	34.13
10	55.63	47.25	52.13	54.63	40.75	37.13	44.50	49.47
Panel B: Forward Splits								
1	--	--	18.38	17.63	17.50	7.94	9.88	11.25
2	3.00	28.63	23.13	19.25	16.75	14.13	14.75	12.06
3	43.56	31.00	22.37	29.00	21.06	16.00	13.50	20.88
4	39.25	15.13	23.56	25.63	23.50	18.63	15.81	21.78
5	37.38	36.88	24.13	26.25	27.57	21.63	19.25	27.40
6	39.38	17.25	33.69	29.50	30.88	23.63	22.00	29.29
7	44.13	35.31	31.00	35.50	32.00	25.31	23.13	29.99
8	57.94	30.94	31.75	37.00	34.50	28.75	27.13	33.02
9	52.19	41.31	37.88	41.13	37.25	33.13	31.00	39.84
10	76.19	43.38	57.06	56.39	43.50	37.75	39.25	50.75
Panel C: Reverse Splits								
1	3.25	4.38	15.31	5.50	6.19	8.13	2.63	4.08
2	5.00	19.25	--	3.13	6.63	4.13	6.19	3.50
3	6.25	10.75	--	6.75	8.13	3.94	6.75	5.22
4	4.50	8.69	5.75	8.00	4.63	15.19	4.69	3.01
5	5.94	--	--	10.44	9.00	9.75	5.56	13.28
6	10.25	7.00	--	10.00	4.63	--	16.50	--
7	--	--	--	25.44	13.31	22.50	18.88	15.53
8	14.88	--	15.13	23.75	14.19	--	13.13	19.18
9	6.38	29.88	11.75	--	8.19	--	37.00	27.97
10	50.25	11.13	22.00	--	--	--	30.75	26.11

**Table 4****Regression analysis**

OLS regressions with White's correction. The dependent variable is the natural log of the number of splits in a given year. The independent variables are the nominal annual return on the CRSP NYSE-AMEX value weighted index over the previous two years, the real return on the same index, the natural log of the level of real personal savings for the year, the percent of the total market owned by households, the value-weighted small size premium from Baker and Wurgler (2008), and the value-weighted low price premium from Baker and Wurgler (2008). White's corrected t-statistic appears in parentheses.

Intercept	Lagged dependent variable	Nominal two-year return on the index	Real two-year return on the index	Ln(real personal savings)	Percent of market owned by households	Small stock premium	Low price premium	Adjusted R-squared
0.058 (0.423)	0.904 (24.07***)	2.675 (6.601)***						0.885
-0.645 (-1.089)	0.648 (6.978)***	2.816 (6.768)***		0.260 (2.585)**				0.728
0.835 (2.169)***	0.750 (11.139)***	2.916 (6.649)***			-0.161 (-.576)			0.701
2.199 (4.674)***	0.454 (4.585)***	2.741 (8.193)***				1.163 (1.925)*	-0.863 (-1.533)	0.647
0.077 (0.466)	0.927 (21.958)***		2.512 (6.458)***					0.875
-0.765 (-1.253)	0.668 (6.739)***		2.650 (7.271)***	0.284 (2.596)**				0.723
0.845 (2.191)**	0.773 (10.640)***		2.640 (6.252)***		-0.109 (-0.411)			0.682
2.249 (4.160)***	0.481 (4.271)***		2.505 (7.244)***			1.357 (2.225)**	-0.916 (-1.621)	0.610

\*\*\*, \*\* and \* indicate statistical significance at the 0.001, 0.01 and 0.05 levels, respectively.



**Figure 1: Distribution of Nominal Stock Prices**