The Nominal Price Puzzle

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ABSTRACT

Nominal prices of common stocks have remained constant at around $30 per share since the Great Depression as a result of firms splitting their stocks. It is surprising that firms actively maintained constant nominal price for their shares while general prices in the economy went up more than ten fold. This is especially puzzling given that commissions paid by investors on trading ten $30 shares are about ten times those paid on a single $300 share. We estimate, for example, that had share prices of General Electric kept up with inflation, investors in that stock would have saved $100 million in commissions in 2005. We review potential explanations, including signaling and optimal trading range and find that none of the existing theories are able to explain the observed constant nominal prices. We suggest that the evidence is consistent with the idea that Norms (e.g. Akerlof, 2006) can explain the nominal price puzzle.

Introduction

Nominal share prices have remained remarkably constant around $30 to $40 since the Great Depression, despite a more than ten fold increase in general prices in the economy. In Table I we report the average prices of six well-known securities for each decade from 1935 until 2005. General Electric (GE), for example, was trading at $38.25 a share on Dec. 31, 1935 and at $35.05 a share on Dec. 31, 2005. Of course, keeping its share price down required many stock splits. Had GE not split its shares from 1933 to 2005 its share price on December 31, 2005 would have been $10,094.40. GE, like most firms, is pro-active at keeping its nominal share price constant.

In this paper, we attempt to explain the pro-active efforts of firms to keep their share prices constant in nominal terms. Financial economists might wonder why this question merits investigation: it is the total value of a firm that is relevant, not necessarily the price per share. Furthermore, the direct administrative costs associated with a stock split, while non-negligible, are generally less than a million dollars, not a very large amount for a firm such as GE.[1] However, the puzzling regularity is non-trivial: What could motivate managers to keep the price of their stock constant in nominal terms, even if splits were costless? After all, the prices of cars and housing have not been kept constant in nominal terms. Why then should firms want to keep their share prices constant?

The puzzle is compounded by the fact that splits are far from costless. First, the relative bid-ask spread increases after splits (Copeland (1979), Conroy, Harris, and Benet (1990), Kadapakkam, Krishnamurthy, & Tse (2005)), increasing the trading costs for investors. Second,

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[1] We estimate the direct costs of splits to be in the range of $250,000 to $800,000 for a large firm, based on several discussions with lawyers and bankers who have been involved in these transactions, and we are comforted that this is similar to the estimated cost of a stock split in Ryser (1996).

institutional investors do care about the price per share, since (at least since the mid-1970s) they tend to pay a fixed brokerage commission per share, regardless of share price. Thus, trading 288 shares of GE at $35.05 would be 288 times more expensive than trading a single share at $10,094.40. Had GE never split its stock, investors could have saved more than 99% of their brokerage commissions. To estimate the potential dollar savings, we multiplied GE's 2005 trading volume of over 5 billion shares by a very modest commission of 2 cents per share, resulting in annual brokerage commissions of over $101 million.[2] Had GE never split, investors would have saved $100 million in 2005 alone. Third, the NYSE charges a per-share fee to companies listed on its exchange, so clearly this fee increases after a split. Fourth, there are annual administrative servicing costs per shareholder, which increase with the number of shareholders.

Another alternative to consider is what if GE did split, but less frequently. Suppose, for example, that GE used splits to pro-actively follow the Consumer Price Index. In this case, GE's price per share would have gone up about ten fold and the number of outstanding shares would be 90 percent lower than it is today. This would translate into 90 percent savings on commissions, equivalent to savings of $90 million in 2005. From the perspective of any individual firm, being inactive (and thereby avoiding splits) would have saved its investors significant amounts of money[3]. So, why do firms pro-actively keep their share prices at $30 to

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[2] We use a cost estimate of 2 cents/share which we believe to be conservative. In discussions with several large and active money managers, we have been told that commissions are typically between 3 and 5 cents per share. The total cost estimate is also conservative by a factor of 2, as each trade involves a buyer and seller. In essence, we are assuming that each trade is a trade with the market maker, and none of the trades are driven by institutions on both the buy and sell side, each of which would have to pay the commission.

[3] We have confirmation from several money managers that even a very high priced stock, such as Berkshire Hathaway Class A shares, can be traded at a commission that is very close to the 3 to 5 cent per share usual commission. A few managers claimed that they would actually pay their prime broker their usual commission for this trade, while others said they would incur a slightly larger commission, but dramatically less than the $150/share implied by a value based commission. Therefore, we are comfortable that our GE savings example is reasonable.

$40, given the economic consequences for investors? This is the main question we attempt to address in this paper.

Looking at other markets around the world, we document that the nominal price puzzle is not a global phenomenon. In some countries, firms almost never split their stocks (Japan), and the correlation between nominal stock prices and returns is very high (0.85). Even in countries where firm split their stocks, stock prices are not constant in nominal terms. These cross-country variations in the time series can not be explained by differences in trading mechanisms or incentives to signal. This additional evidence compounds the puzzle. Why would US firms maintain their prices at nominal value while other firms around the world would not?

We investigate the standard explanations of why firms may want to split their stock, and whether these explanations provide insight into the constant nominal price. The first two explanations focus on optimal trading ranges, where optimal is determined by either investor or intermediary considerations; for example investors' wealth constraints or inducing broker dealer to provide liquidity through higher market making profitability. We find that the investor-determined optimal trading range hypothesis is inconsistent with the data, as prices are invariant to changes in investor income and composition. Similarly, the intermediary-determined optimal trading range hypothesis is inconsistent with the data; prices are invariant to changes in commission structure and minimum bid ask spreads.

The third explanation focuses on signaling: "Good" (undervalued) firms signal their quality through splitting, a costly action that will not be mimicked by lower quality firms. As with the previous two hypotheses, the signaling hypothesis is inconsistent with the data. Post-split prices are centered on those of peer firm prices (rejoining the herd is not consistent with a separating equilibrium). There are many settings in which we observe splits that cannot be

motivated by signaling (e.g. ADRs, mutual funds and ETFs). Post split performance is not superior, calling into question exactly what firms are trying to signal. We conclude that none of these explanations appear to be consistent with all of the stylized facts.

Having ruled out the standard explanations (where splits are undertaken to optimize value) we turn to what we consider the most plausible alternative. Specifically, keeping the prices of their shares in the same range for 70 years is the result of firms following traditions and norms that have evolved over time. In this framework, a firm's share price is part of the firm's culture. This explanation is consistent with, and draws upon, George Akerlof's (2007) presidential address in which he stresses the important role of norms in macroeconomics. He shows how norms nullify five important "neutrality" results: the dependence of consumption on wealth, not income; the Modigliani-Miller theorem; the natural rate theory; rational expectations; and Ricardian equivalence. To that list we add nominal stock price—surely the setting of the numeraire is the greatest neutrality of them all! In using norms and culture to explain corporate behavior, we also follow the recent work of Cronqvist, Low and Nilsson (2006) who show how corporate spin-offs follow the same financial culture of their former parents and of Bertrand and Schoar (2003) who show how managers' norms are persistent as they move across firms.

According to the norms view of stock splits, firms are simply following convention in setting their stock prices. While the norm may have been the result of optimization at some point in the distant past, it has become merely a market tradition. Why does a firm actively split its stock and maintain a constant nominal price? Our answer is simply norms. Firms split because they always split when the price gets that high, and because their peers are doing the exact same thing. What price should it split to? The norm price, the price at which investors expect the firm

and its peers to trade. Why is this phenomenon almost unique to the US? Because it (like American football) is the norm, and a norm is unique to its location and culture.

We are not alone in thinking that stock splits may be a silly tradition. We are joined in this by Warren Buffet of Berkshire Hathaway, whose class A shares now trade in the neighborhood of $100,000. In the 1983 annual report (when the shares traded for a “mere” $1,300) Buffet wrote: "Were we to split the stock or take other actions focusing on stock price rather than business value, we would attract an entering class of buyers inferior to the existing class of sellers. At $1,300 there are very few investors who can't afford a Berkshire share. Would a potential one-share purchaser be better off if we split 100 for 1 so he could buy 100 shares? Those who think so and who would buy the stock because of the split or in anticipation of one would definitely downgrade the quality of our present shareholders group. (Could we really improve our shareholder group by trading some of our present clear-thinking members for impressionable new ones who, preferring paper to value, feel wealthier with nine $10 bills than one $100 bill?)"

The rest of the paper is organized as follows. In the next section we review stylized facts related to the constant share prices, mutual fund share prices, and international exchanges. We use these stylized facts to evaluate potential explanations for the constant nominal share price. In Sections 2 and 3 we discuss whether the optimal trading-range hypotheses can explain why prices are nominally constant. The signaling hypothesis is evaluated in Section 4. Section 5 examines some of the implications of norms and tradition to optimal price ranges. We provide a summary in Section six.

1. Stylized facts

1.1. Share prices remained constant since the Great Depression:

Figure 1 displays the annual average (equal-weighted and value-weighted) share price of every NYSE and AMEX stocks from 1933 through 2005. Table II reports the average prices for each decade; the value-weighted portfolio return over the period, number of splits and the average split factor.[4] The equal-weight average share prices remained around $25 throughout the entire period. While the value-weight price is higher (with a mean of $36.56), the overall pattern is rather similar, suggesting that the results are not driven by just few large stocks. This is quite intriguing, given the major changes that took place over the past 70 years. For example, the minimum tick size has decreased 12.5 fold from 1/8 of a dollar to a penny, and with an average annual inflation of 3.9%, the Consumer Price Index has increased by 1526%. It is not surprising that the constant nominal prices resulted in a dramatic decrease in real prices. Figure 2a illustrates that real share prices have declined by more than 90 percent over this period. Figure 2b shows that the equivalent, in today's dollars, of average stocks prices from the 1930s and 1940s, is a price per share of around $450!

Of course it is not a coincidence that nominal prices remained constant. Firms have made many stock splits to keep prices low. This can be seen by calculating what share prices would have been had firms never split their stock and never paid stock dividends. The result of this analysis is presented in Figure 2c, as the "UnSplit" price series. Without splits share prices would have gone to approximately $900. However, this analysis underestimates what UnSplit prices might have looked like, since it includes new issues being added to the sample and new issues are typically priced at a nominally constant and relatively lower level. To avoid the effect

[4] We exclude Berkshire Hathaway Class A and Class B shares, traded in 2005 at almost $90,000 and $3,000 a share, from all of our analyses to avoid skewing the results.

of new issues, we re-calculated the unsplit price series, using the 140 firms that survived from 1940 through 2000.[5] We find that the unsplit share price would have exceeded $1,400 by 2005 (Figure 3a). We also show in Figure 3b that the Real UnSplit price series (which first adjusts nominal prices for the cumulative effects of stock splits and stock dividends, and then restates the price series in real 1933 dollars) shows far greater variability than the nominal price series, which reinforces our claim that managers systematically and consistently targeted a specific price, and that the stationary nominal price series is not the result of market returns. Hence, constant nominal share prices are not a coincidence, but are rather maintained pro-actively by firms at approximately $30.

As we show in Figure 4, not only do the mean and median prices remain constant, but also their cross sectional variance remains constant: We calculate the cross-sectional coefficient of variation of prices and the difference between the 75th percentile and 25th percentile prices, relative to the 50th percentile prices $[(P_{75} - P_{25})/P_{50}]$. Comparing these monthly measures over time gives an indication of the evolution in cross sectional variability of prices. There is no trend in the cross-sectional variability of prices, and it remained roughly constant over the last 70 years.

1.2. Share prices of open end mutual funds have remained constant since the 60s:

Whatever the reason is for common stocks to split their share and maintain a constant nominal price, it is difficult to think how that reasoning can be applied to open-end mutual funds. Mutual fund shares are divisible, so the share price is truly irrelevant. Individuals do not buy a

[5] The choice of 1940 as the starting date is admittedly arbitrary. We repeat the analysis with other starting dates such as 1933 or 1950, and the overall results do not change. We have a number of firms that drop out of the sample after 2000. These firms had a long series of splits, so when they disappear from the sample, (due primarily to mergers and acquisitions) the average price drops.

certain number of shares but rather invest a certain amount of money in the fund, and the resulting number of shares most often extends to the third decimal point.

We construct a portfolio of open end funds from the CRSP Mutual Fund Database. We find that the average net asset value per share of mutual funds from 1961 to 2004 has remained almost constant in nominal dollars at approximately $13.[6] Figure 5 present the results. Over the period 1961 to 2004, the average open-end mutual fund net asset value per share drifted slightly upward. For example, the average price in the first 20 years of the sample is around $9 and it is around $13 in the second part of the sample; about a 50% increase. While this increase is larger than what we have documented for NYSE and AMEX common stocks, it is most puzzling that open end mutual funds keep their share prices constant at any level. At most, we see less than a 50% increase in net asset value per share over a time period that experienced a change in consumer prices in excess of 630% and a change in the value-weight index in excess 7000%. Maintaining a constant price is a pro-active decision by fund managers and is not a coincidence. Indeed Rozeff (1998) documents that funds split their shares and have an average NAV/share of approximately $13, consistent with our findings.

1.3. The pattern of share prices varies dramatically across countries:

In Table III we report summary statistics on 16 international stock exchanges. Even a cursory examination of the data shows that there is a great deal of cross sectional variation across the exchanges in terms of average stock price, variation of stock price, and covariation of stock prices and the exchange index.[7]

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[6] The CRSP mutual fund database starts in 1961.

[7] Using the data available from the World Stock Exchange Factbook, 2005 and the World Federation of Exchanges Annual Reports, we are able to investigate the correlations of the local nominal currency trade weighted average price per share on the local exchange and the local index in nominal local currency. Due to limitations in the data, it is difficult for us to make any strong conclusions, however the data is suggestive of the fact that the nominal price

To highlight the differences, we compare three large exchanges: Tokyo, London and the NYSE. Figures 6a and 6b display share prices for the Tokyo and London stock exchanges. Share prices in Tokyo seem to have followed the Tokyo Stock Price Index over the past 30 years. When returns are positive, prices increase and when they are negative, prices decrease. Even through the more-than ten-fold increase in market value during the 1980s, share prices increased as the same pace; which suggests that stock splits are rather rare in Japan.[8] For example, from 1975 to 1990 the index increased by 436% and the average share price increased by 409%, while over the entire sample the index increased by 410% and share prices increased by 193%, and consumer prices increased by 80%.[9] The overall correlation of stock price and index in Tokyo is 0.85.

Share prices in the UK are not constant in nominal terms, and share prices are highly correlated with changes in market value. The London Stock exchange index and the average share prices on the exchange both increased over the past 25 years, generating a correlation of 0.79. Since 1981 (the first year of data), nominal share prices increased approximately from £1.33 to £2.99, an increase of 124%. At the same time, however, the FTSE index has increased by 806% and consumer prices have increased by 176%.[10]

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fixation is primarily a US or North American phenomenon. The NYSE to DJIA correlation is the lowest that we were able to estimate, at 0.41, followed by the Toronto Stock Exchange, with ρ=0.64. On the other extreme are the Johannesburg Stock Exchange, the Mexican and Italian Stock Exchanges with ρ >0.90. When compared to other stock exchanges, we find the US nominal price stationarity unusual. In fact, it has the smallest coefficient of variation over the time series of 0.14, which is less than half of the variation on all the other exchanges (except for Toronto at 0.24) There is a statistically significant difference in the correlation between the US and the rest of the world exchanges. We are unable to reject the hypothesis that the US and Toronto exhibit similar price paths through time.

[8] We thank Mr. Yamaguchi from Ibbotson Associates for sharing data and information on the Tokyo stock exchange.

[9] Japan inflation data is from the Japanese Ministry of Internal Affairs and Communication's Statistics Bureau, available at http://www.stat.go.jp/english/data/cpi/index.htm

[10] UK Inflation data is the CDKO index, available at http://www.statistics.gov.uk/default.asp

For comparison, in Figure 6c we also plot the evolution for the average share price and the Dow index for the US during the same time period (1975-2005). Unlike the Japanese evidence or the evidence from the UK, the US share prices remain roughly constant while the index increases dramatically. For example from 1975 to 2005, the index increased by 1157% and the share price changed from $27.00 to $34.98, and change of 30%, while consumer prices increased by 275%. The difference between the evolution of share prices in the US vs. the UK or Japan does not appear to be driven by different levels of inflation, as Tokyo share prices increased at approximately 2.4 times the rate of inflation, UK share prices at approximately 70% of inflation, and US prices increased at 10% of inflation. Why some countries experience constant nominal share prices and others do not is another piece of the puzzle.

1.4. Prices do matter:

Despite the strong evidence that US firms maintain a certain price level for their stocks by actively using splits, one might argue that the price levels do not matter, and that stock splits are a "neutral mutation."[11] As Miller (1977, p. 273) states, "neutral mutations that serve no purpose, but do no harm, can persist indefinitely." However for an act to be a neutral mutation it cannot be costly. But nearly all the event studies demonstrate increased costs for firms after a split (for example, Copeland (1979), Conroy et al (1990)). Moreover, the argument also implies that trading cost in general is unrelated to price level. We test this implication using Hasbrouck (2006) price and bid-ask spread information on several hundred stocks starting in the 1920 until 2005, which uses Gibbs sampling over daily stock data to estimate bid ask spreads for over 190,000 firm year observations, and test the relation between prices and the cost of trading, defined as the relative bid-ask spread.

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[11] We thank Owen Lamont for this idea.

In Table IV we report the results of both the linear (Panel A) and non-parametric regressions. Using the Fama-Macbeth procedure we regress the relative bid-ask spread on price, trading volume, turnover, and market capitalization. The Table reports the cross sectional average and T-stat of these regressions. Our results are consistent with the empirical tests that find relative BAS increases after a split: We find that higher priced firms have lower relative BAS. In our non-parametric specification, we find that not only is price a statistically significant determinant of relative BAS, but also the relationship is monotonic, and there is a statistically significance difference between the lowest and highest quintiles. We conclude that prices do, in fact matter, and therefore this is not a neutral mutation.

1.5. Summary of stylized facts

That firms split their stock is one thing, but that they split their stock to maintain a constant nominal price is another. So far we document that this phenomenon is extremely robust in the US: stocks prices have been constant at a nominal level of around $30 share since the Great Depression. Interestingly, even open-end mutual funds maintain a consistent nominal price through time. Other countries do not seem to share the same norm. In the next few sections we examine whether any of the existing explanation for splits is able to explain our findings.

2. The marketability hypothesis

A popular explanation for keeping share prices low is the marketability hypothesis, according to which individuals cannot afford to buy round lots unless share prices are low (Baker and Gallagher (1980)). Historically, buying odd lots was difficult and expensive. The hypothesis claims that by keeping share prices low, individuals can own the stock, which in turn increases liquidity. Another variant of the hypothesis would argue that splits also enhance marketability by bringing prices to a preferred trading range (e.g., Lakonishok and Lev, 1987).

There seems to be a wide-spread belief that the marketability hypothesis has considerable explanatory power. In Dolley's (1933) early study he reported that 33 of 36 corporations that split their shares in the 1920s indicated that the primary object was to increase the marketability of the common stock and thus to bring about a wider distribution of the shares. Half a century later, Baker and Gallagher (1980) surveyed CFOs of two groups of firms, one that split and another that did not. For both groups, they report that the most popular reason for splitting is to "… make it easier for small stockholders to purchase round lots (more shares, lower price)." Within the stock split group, 98.4 percent agreed with the trading-range hypothesis, and even within the non-split group, 93.8 percent supported the trading-range hypothesis. In a follow up study, Baker and Powell (1993) report similar results. Even some open end mutual fund managers support the trading-range hypothesis, with 40.4 percent agreeing that "a lower NAV per share attracts more investors" (Fernando et al, 1999).

Several empirical studies have also provided evidence that can be interpreted as supportive of the marketability hypothesis. Dyl and Elliott (2005) document a positive correlation between share price and institutional ownership, suggesting individuals might not be able to afford higher-priced stocks. Fernando et al (2004) document a positive correlation between institutional ownership and IPO share prices. One could conclude that institutional investors prefer high share prices due to lower brokerage commissions, whereas individual investors can only afford buying round lots of low-priced shares. However, direct tests of the increased marketability for common stocks suggest that there is no long-term increase in marketability (e.g. Lakonishok and Lev (1987), and if there are any short term effects, they are very small (e.g., Byun and Rozeff (2003)).

More importantly, it is difficult to see how the marketability hypothesis can explain why firms maintain constant nominal prices, or how it explains mutual fund splits? Lastly, how does the evolution in ownership and in trading composition should relate to stock prices according to the marketability hypothesis? We address these questions now.

2.1. Why did share prices not keep up with inflation?

According to the marketability hypothesis, individuals have a budget constraint that restricts them to lower-priced shares. Suppose, for example, that an individual would like to diversify across ten stocks, and she has only $25,000 to invest. By allocating $2,500 to each stock, our investor can pay no more than $25 a share, if she buys round lots. This simple arithmetic ignores one important consideration: the investor who had $25,000 to invest in 1933 is likely to have much more money (in nominal terms) today. Why should the budget constraint of individual investors have remained constant in nominal dollars?

Assuming that the funds available for investing increase with inflation then the marketability hypothesis has a clear prediction about nominal share prices: they should keep up with inflation. Taking the 1930s average share price as a base, it implies an average share price of around $450 today. The data refutes what is arguably the most basic prediction of the marketability hypothesis.

The idea that splits are undertaken by firms to maintain a preferred trading range for retail investors is problematic for other reasons as well. First, over the past 10 to 20 years the pricing of retail brokerage services does not seem to support the marketability hypothesis. Many firms charge a flat fee for trades up to 20,000 shares. Retail investors should rationally be agnostic about the number of shares that they trade because of this commission structure. Also,

odd-lot trades are no longer particularly difficult to execute.[12] So, if we ignore any irrational preferences as well as norms, an individual investor should be indifferent between any possible combination of ways to invest X dollars in ABC for a Y% stake.

Barber and Odean (2001) provides data that is relevant to this discussion as well. They report that the average investor in their sample owns 4 stocks worth $47,000 and the median investor owns 2.6 stocks worth $16,000. This suggests that the investment per stock is approximately $12,000 (average) or $6,000 (median). That stocks split to a price of $30 in order to be possible investments for the "average" retail investor is inconsistent with this evidence of a $6,000 median investment. Given the current discount brokerage market, and the severe easing of odd-lot trading difficulties, it is hard to conceive that firm and fund managers are setting their prices to target investors who can only trade $30 at a time.[13]

2.2. Why do open end mutual funds split?

The marketability hypothesis has a clear prediction about open end mutual funds: the share price is irrelevant, since shares are divisible. Furthermore, since many mutual funds are diversified investment portfolios, the investor in our earlier algebraic example need not "diversify" across ten mutual funds. Hence, mutual funds will not spend money splitting their

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[12] In fact, there is some evidence that odd-lot trades get better execution on the NYSE, because of Rule 124, and the elimination of the odd-lot differential in 1991. Rule 124 effectively requires specialists to execute odd-lots at the same price as the most recent, or next, trade. An example of the benefits of odd-lot trading was highlighted in 2004 when the NYSE announced that it was imposing a censure and $50,000 fine against Westminster Securities Corporation. The alleged abuse by Westminster was breaking up customer round-lot orders into odd- lot orders to sneak them ahead of other round-lot orders awaiting execution. The full text of Rule 124 is available at http://rules.nyse.com/NYSE/Help/Map/rules-sys186.html.

[13] Firms engage in odd-lot buyback programs specifically to eliminate these small investors, as the servicing costs of $19 per shareholder per annum can be high when compared to the value held by a small shareholder (Frieswick, (2002)). Curiously, firms that have odd-lot buyback programs continue to split their shares, presumably making their shares attractive to the same class of small investors they intentionally bought out. For example, ESCO Technologies, (NYSE: ESE) held a voluntary buyback program for shareholders with fewer than 100 shares from March 3rd to April 3rd, 2003 when its stock was trading at approximately $34, and subsequently did a 2:1 stock split on September 26th, 2005, reducing its stock price from approximately $100 to $50 per share. We also note that many mutual funds have a minimum initial investment requirement, which is consistent with the idea that very small shareholders are not the preferred investors.

shares. Consider, for example, an individual planning to invest $2,500 in a mutual fund. Even if the share price is very high, say $10,000, our investor could simply buy 0.25 shares. This is quite different from individual stocks, which are not divisible.

The data, however, is inconsistent with this prediction as well. Mutual funds did spend money over the past 40 to 50 years splitting their shares. Exchange traded funds ("ETFs") also split their shares, and in a setting where a retail investor can obtain a well diversified portfolio by purchasing one security, how can the marketability hypothesis justify splits?[14] Ironically, mutual fund share prices have remained constant in nominal terms around $13. But here, since trading in fractional shares is a common practice and does not add any transaction costs, the trading range hypothesis predicts no splits at all.

As we mentioned before, about 40 percent of mutual fund managers seem to believe that lower NAV/share makes the fund more attractive. There are at least two issues with this explanation. First, why would the reference point of, say, $13 not keep up with inflation? Second, the evidence on fund flows post-split is far from conclusive. Fernando et al (1999) suggest an increase in fund flows post-split, while Rozeff (1998) finds no correlation between fund splits and flows.

2.3. Share prices and changes in the composition of stock ownership:

The composition of stock ownership has changed dramatically, as seen in Figure 7. The NYSE Factbook also gives data that is informative: in 1950, 90.2% of corporate stocks were owned by individuals directly, declining to 41.1% by 1998. At the same time, indirect holdings, such as mutual fund holdings, have increased many fold from 3.3% to 27.5%. And, the fraction of stock owned by non-households, such as defined benefit pensions, has increased from 6.5% to

[14] For example, on April 24, 2006, the Rydex equal weight S&P index fund received a 4:1 split, and on June 13, 2005 12 iShares funds managed by Barclays Global Investors split either 2:1 or 3:1

31.4%.[15] All this data highlights the dramatic increase in institutional ownership. Furthermore, institutional trading dominates the market. Jones and Lipson (2004) argue that non-retail trading accounted for 96% of New York Stock Exchange trading volume in 2002.

One might have expected that the major reduction in direct household holdings, and the corresponding increase in institutional holdings and trading, would have resulted in a shift of the "optimal trading range". That is, the greater dominance of institutional investors should result in higher optimal trading range. As our GE example illustrated, institutional investors pay a lot more in commissions when the share price is kept at $30 by repeatedly splitting the stock. Therefore, the marketability hypothesis would predict higher prices as this investors' composition shift occurs. However, we already saw that share prices remained around $30 throughout the entire period, not reflecting the major changes in stock ownership.

The nominal price puzzle could also be related to characteristics of the retail investor.[16] Namely, perhaps a few very wealthy individuals held stocks in earlier periods, but now many more, though less-wealthy individuals hold equity securities directly. The reduction in real price over time can then be a consequence of the fact that those less wealthy individuals are the marginal investors. In Figure 8, we present our estimates of the percentage of US households who directly hold stocks. Roughly speaking, the level of participation is not that different now and 80 years ago. For example, direct holdings in the 1920s were around 20%, roughly the same as in the late 1990s.[17] Moreover, even nowadays stock ownership is highly concentrated: The top wealth decile in the US owns 85.1% of common stock, and approximately one half of all

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[15] Data from NYSE factbook: http://www.nysedata.com/factbook and Federal Reserve Flow of Funds Accounts releases

[16] We thank George Akerlof for his suggestion to investigate this point.

[17] Mutual funds became increasingly popular since the mid 1960s. Nowadays, most individuals-stock-holdings are indirect, through funds.

households have zero stock holdings (Mishel, Lawrence (2005). Therefore, it is unlikely that the nominal price stationarity can be attributed to changing characteristics of retail investors.

3. The Pay To Play Hypothesis

A related hypothesis, which also posits an optimal trading range for stock prices, is based in the notion that firms set their share prices to induce brokers/dealers to provide liquidity through higher market making profitability. Angel (1997) suggests a theory of "relative tick size". Firms split their stock to lower share price and increase the ratio of tick size (defined as the minimum possible difference between the bid and the ask price) to share price. The higher the relative tick size, the more dealers are motivated to make markets for the stock, and the more liquidity providers are motivated to provide liquidity.

Regardless of plausibility, the relative tick size hypothesis is not consistent with the facts. Although it can explain the pattern observed in the US over the period 1930-1996 where both tick sizes and prices remained constant, the theory clearly predicts that if tick sizes fall, prices should fall as well. A natural test is provided by the decimalization that has occurred on the NYSE. As Angel (1997) explicitly states: "a reduction in the minimum price variation from \$0.125 to \$0.01 could eventually lead to a reduction in the average share price by the same factor, 12.5 resulting in an average share price around \$3" (p. 678). Starting in 1997 the tick size on the NYSE changed from $1/8^{th}$ to $1/16^{th}$ and then to $1/100^{th}$. Such changes should have been accompanied by changes in prices: that is, prices should have gone done by a factor of 12.5 and the equilibrium average price should be \$2.5/share. Needless to say that there is no indication that NYSE stock prices are moving in that direction. Similarly, the reduction in minimum tick

size on the Toronto stock exchange did not result in a like reduction in the average prices of shares traded on the exchange.

In addition it is hard to see why large firms would feel any need to pay anyone to provide liquidity. Does Microsoft or GE think that their shares would not trade if the price were $500 or $1000 when Berkshire Hathaway at $100,000 is among the most consistently profitable stocks traded by specialist firm LaBranche?[18] Even putting aside Berkshire Hathaway, Google's management seems to share our view that this argument is implausible since their share price has recently gone above $500 and the firm has announced they have no intention of splitting.[19]

4. The signaling hypothesis:

In a world of asymmetric information between insiders (managers) and outsiders (investors), it is possible that insiders may wish to convey their private information to the market, even if it is costly to do so. There are several papers that suggest that a stock split is a signaling device. As in all signaling models, two immediate questions are asked: (1) what do managers signal, and (2) what is the cost of the signal? Unless the signal is costly, then it cannot be credible.

Brennan and Copeland (1988) develop a model in which undervalued firms use stock splits to signal the quality and strength of their future prospects. In their model, splits are credible signals, because they inflict higher trading costs on investors. First, they increase the overall trading costs to both individuals and institutional investors, since trading costs are often a

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[18] "As a rule, the spread on Berkshire A shares fluctuates between $100 and $200 a share. (On most other shares on the Big Board, the spread is a matter of pennies.) Like other chief executives, Mr. Buffett doesn't want to see big spreads between buyers and sellers of his stock. However, large spreads can be lucrative for specialist firms. "I want Berkshire to be a good stock for LaBranche, but not the best stock," says Mr. Buffett, referring to Mr. Maguire's employer, the specialist company LaBranche & Co. Berkshire shares rank among LaBranche's most consistently profitable stocks, but not the most profitable, says owner Michael LaBranche." Richardson (2005)

[19] In a CNNmoney.com story (Nov 21st, 2006) about Google surpassing the $500/share mark, Clayton Moran, an analyst with Stanford Group, remarked that "All the indications I get from the company is that they are comfortable with a stock price that implies a superiority to competitors so I don't think they are motivated to split the stock."

function of the number of shares traded. Second, the relative bid-ask spread (i.e., the bid-ask spread for a $1 worth of trade) is greater post-split (consistent with the empirical findings). Finally, there are administrative costs adding to the cost of the split. These costs are typically around $500,000 (see footnote number one).

In the signaling model, under-valued firms increase the number of shares and decrease share prices to signal their higher quality. The signal ought to be credible, since it is costly.[20] In equilibrium, one might expect under-valued firms to end up with lower share prices than over-valued firms in their peer group of firms. The greater the split factor and the lower the price, the more credible the signal and the more likely the firm is under-valued. Another implication of the signaling hypothesis is that the market reaction to the split is positive, which seems to be the case (e.g., Ikenberry, Rankine, Stice (1996)).

4.1. What do firms signal?

It is not necessarily clear what firms try to signal. However, it seems reasonable that whatever firms try to signal, it ought to be correlated with future profitability. Lakonishok and Lev (1987) report that profitability does increase significantly, but it does so *prior* to the split rather than *after* the split. Splitting firms have reached a peak in term of their operating performance. There is no evidence that they signal future increases in earnings or profitability. Hence, do splitting firms try to signal that they have already reached their peak and their growth rate should revert back to a lower level? That seems highly unlikely.

The signaling model also predicts less information asymmetry after splits, since management's private information has already been conveyed to the market via the split. This

[20] Note that the signaling explanation is the opposite of the "pay to play" explanation: In the first, the split reduces liquidity and the costs have no benefit and are truly just burning money, whereas in the second, the costs are effectively a payment for better liquidity and promotion. However both stories (and the entire literature related to splits) are premised upon the fact that costs of trade are increased by stock splits.

ought to lead to a reduction in informed trades following splits. Easley, O'Hara, and Saar (1998), however, examined this prediction and find no evidence that splits reduce the probability of the arrival of new information.

Several of the stylized facts we discussed earlier also seem at odds with the signaling hypothesis. Many ETFs are passive index funds, and it is very difficult to believe that they somehow have superior "inside information" that the underlying index they hold is going to outperform in subsequent periods, and yet they split. Other mutual funds split too, yet it is difficult to construct a model in which the funds can actually predict out-performance. Unsponsored ADRs split, while their home country security, where most of the trades are done, does not (Muscarella and Vetsuypens (1996)). The depository bank is unlikely to have greater "inside information" on the future prospects of the firm than the mangers of the firm itself. Hence, it seems difficult to identify what exactly stock splits signal.

4.2. The costs of signaling

Signaling theories have some costs, explicit or implicit, associated with the signaling device. Unless signaling is costly, it cannot be credible. In the case of stock splits, the main costs are related to trading. One component of the costs is brokerage commissions. Since commissions are related to the number of shares traded, investors would save money by trading a smaller number of shares, each having a higher share price. In the case of GE, we have estimated that more than 99 percent of the commissions, or $100 million could have been saved last year, had the firm never split its stock. Another component of the costs is the bid-ask spread. The data suggests that the relative bid-ask spread increases after stock splits (Conroy, Harris, Benet (1990)), so again, signaling is costly as the theory suggests.

The second implication is that as the cost of the signal changes, the intensity of the signal should change as well. Thus when brokerage commissions dramatically decreased with the shift from fixed minimum to negotiated commission on "Mayday" May 1975 and the penetration of discount brokers, we should observe a like decline in share price.

Similarly, the decline in the minimum bid-ask over a very brief period in time should have had an abrupt impact on share prices, which it did not. From 1933 to 1997 the minimum tick size remained constant at $1/8^{th}$ of a nominal dollar, June 23, 1997 marked the first change in nominal tick size from $1/8^{th}$ to $1/16^{th}$, and January 29, 2001, marked the NYSE's transition to having all stocks quoted in decimals.

Finally, and most importantly, if signaling is used to distinguish a firm, one would expect the price to be distinct from other firms. However, the evidence points strongly to the fact that the targeted post-split price is centered at the price of the firms' peers, which is less of a mark of distinction and is consistent with "rejoining the herd". In summary, the evidence casts doubt that signaling could explain share prices remaining at $30 since the Great Depression.

5. Norms

As Sherlock Holmes liked to say, "Once you eliminate the impossible, whatever remains, no matter how improbable, must be the truth." The standard explanations for stock splits cannot explain the stylized facts surrounding the nominal price puzzle, so we must consider alternatives. We consider the possibility that firms are simply following convention when they set the share price. They set the price to whatever is considered normal, that is, the norm. The norm is like a coordination game that is played in each market. However, it is important to note that the norms differ from a traditional coordination game because there is no penalty - here, driving on the "wrong" side of the road (i.e. having an outlier price, for example Google) will not get you

killed. However, the norm is sufficiently engrained in the culture of the institution that to go against it is to invite scrutiny, and returning to the norm gives comfort (and perhaps the 3% abnormal return at the announcement that you are making your price conform to the norm).

The norm depends on the firm's size, industry, and country of listing. For example, Muscarella and Vetsuypens (1996) note a consistency in the pricing of ADRs, the share price on the home exchange is in line with that exchange's pricing, and the number of shares packaged in an ADR brings its price in line with other securities on the foreign exchange, and that solo-splits keep the prices at the appropriate norms. Lakonishok and Lev (1987) report that post-split share prices converge to the industry norm. Similarly, McNichols and Dravid (1990) show that the further away the share prices are from the norm, the higher the split factor.

Firm culture and norms can have a strong influence on many facets of corporate behavior (Akerlof (2007), and Cronqvist et al. (2006)). Why do some firms have almost no debt? When and why do firms initiate dividend payments (which are also irrelevant in an MM world)? Why are some firms sensitive to cash flows when others are not? (Kaplan and Zingales) Why do spin-offs behave like their parents? (Cronqvist et al). A parsimonious explanation for all these phenomena is that this is they way things have always been done. We argue that maintaining a nominal price falls in the same category. We can only speculate at this stage about the process of the formation of the "price-range norm". One possible story motivation for lower priced securities being more "attractive" might be that naïve investors view lower-priced per-unit securities to have larger upside. It is possible, due to an availability heuristic, that it is easier for investors to recall more cases of low priced stocks having large price increases, and few cases of high priced stocks having similar gains; and hence it became the norm for firms to split their

stocks when the per-share price has gotten large, and since there are few violations of this norm, it is difficult for investors to recall high priced securities having good subsequent performance.

Interestingly, the norm of an average price of $30 has been formed only since the 1929 crash. Figure 9 shows that until the crash in 1929 stock prices were much higher. It is not obvious what to make out of the very early data, since prior to 1915 share prices were quoted as a percentage of their par value, not in dollars (Angel, 1997) and it was very common for par values to be to set at $100 a share. However, after the market crash of 1929 share prices dropped from roughly $70 to $30 and have never increased. This is suggestive that the norm around prices can be changed in response to a dramatic shock.[21]

Norms might not only be about an average price of $30/share but perhaps that firms with different characteristics cluster around different prices. We present some evidence to that effect below.

5.1. Larger firms tend to have higher share prices:

Figure 10 shows that for the past 70 years large firms had higher share prices than small firms. For example, NYSE and AMEX firms in the top quintile of market capitalization tend to trade around $50 a share. In contrast, firms in the bottom quintile tend to trade below $10 a share. The relation between price and market value is monotonic over the sample period: in each year of the sample, the average price of the 5th quintile firms in terms of market value was greater than the average price of the 4th quintile firms and so on. (This monotonic price to size relationship is also apparent when the firms are divided into size deciles.)

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[21] It is likely that the change in quotation form percent of par to $/share was driven, at least in part, by the large increase in low and no par stocks traded on the exchange. This change in the way that securities were quoted, due to real fundamental changes in regulations and the way that the securities were being issued, could have primed the market for the change in norms. Once primed, the market collapse was able to kill the old norm, and a new norm emerged after the Great Depression – a norm that is still with us today!

These findings imply that as firms "graduate" from one size group to the other - primarily through price appreciation - they adapt to the norms of their new peers and choose a new higher trading range for their shares. To show this phenomenon we sort firms based on their 5-year price returns, which proxies for their change in market capitalization over the same period (and is equivalent, assuming no capital issuances). We then look at their actual ending share price and compare it to their starting price, multiplied by their period return. This allows us to look at the price that firms select after a large market capitalization decrease (Return Decile 1), and the price that firms select after a significant market capitalization increase (Return Decile 10). Table V shows that firms with a large market capitalization increases adopt higher share price levels. Apparently almost every firm uses splits to manage its prices, and it targets via the split a price determined by the norm of their capitalization group.

It is also interesting to note that both the price that firms select at the end of the period and the implied split ratio are strictly monotonically increasing and generally increasing in their past returns respectively, while their pre-return prices are hump shaped around their future returns. Both the highest (31%) and lowest (-21%) returns are experienced by, on average, relatively low-priced stocks (< $16), while the higher priced stocks (> $20) have less extreme returns (5% to 13%)[22]. We also performed the analysis using mean (instead of median) values which we do not report here since the results were quantitatively similar, except that the firms with the lowest realized returns had reverse implied splits.

[22] Interestingly, this data supports the idea that (1) firms with large market capitalization increases choose a higher price and (2) lower priced securities are riskier. If lower priced securities are, in fact, perceived by the market as being riskier, then splitting ones stock could have the (presumably) unintended consequence of increasing a firm's cost of capital.

5.2. Targeted prices are clustered at industry and size peers:

The split factor selected by managers appears to be driven by an attempt to bring their share price back in line with that of their peers. As we have shown above, peers can be defined by size, and is consistent with the idea of norms determining price selection. In Table VI, we report that over 62% of the variance in post-split prices can be explained by a simple model that predicts the split-targeted price by a firms share price deviation from its size and industry peers. When we restrict the sample to "large" splits, defined as 1.25:1 or greater (which reduces the number of firms that have a policy of nearly constant annual stock dividends), we have even stronger results, with an R-square of over 78%. This result is strongly supportive of the idea that firms are reluctant to deviate from the norm, and when they find themselves violating the pricing norm, they are quick to rectify it.

5.3. IPO share prices have remained constant since the Great Depression:

We find a similar pattern in setting the prices on new issues as we found for equity pricing in general. IPOs have been issued at approximately the same share price since the Great Depression. We have IPO data going back to 1976 shown in Figure 11a which shows that IPO share prices have been remained in the $15-20 range for the past 30 years. To extend the time series back to 1933 we use the first appearance on the CRSP tapes as a proxy for IPOs, as shown in Figure 11b. Again, the same picture emerges: if anything, IPO prices were higher in the 50s, but have remained roughly in the same range since 1933. [23]

While IPO share prices also tend to be constant, they are significantly lower than the average equal-weighted price of $25. This should not be too surprising given the evidence on the

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[23] We also investigated the time series of IPO prices using the IPO data from Gompers and Lerner (2003). The results are quantitatively similar to those of the CRSP first appearance proxy. We thank Paul Gompers for his generosity in providing us with the data.

relation between price and market capitalization we just presented. IPO firms are smaller in size and their "norm" price is not the average price in the market but rather their peer group. Indeed the average IPO firm is smaller in terms of market capitalization than the average NYSE and AMEX company, and their prices are indeed in line with the average share price of this group, as seen in Table VII.

6. Summary

Share prices have remained constant at around $30 since the Great Depression, despite prices in the economy having gone up more than ten fold over this period. We document that the constant share prices are not a coincidence, but rather a pro-active effort by firms splitting their stocks. Had firms never split their shares; share prices would have reached $1,500. In terms of 1933 prices, today's average share price should have been around $500. Since transaction costs are a function of the number of shares traded, investors end up paying a lot more in brokerage commissions when stocks split and the number of shares increases. These additional trading costs are significant. Different market cap stocks have a different level of prices, where small cap stock prices hover around a lower focal point than high cap stocks. The fixation on nominal prices is common to new issues, as well as to shares that have survived the entire period.

Why do firms keep their share prices at $30? Current explanations can be broadly described as fitting into three categories: (1) Trading range hypothesis motivated by catering to investor constraints or "marketability", (2) Trading range hypothesis motivated by "pay to play" considerations such as bid-ask spread and brokerage commissions, and (3) Signaling. We are able to critically examine these hypotheses using a very long time series (more than 70 years of data), mainly from the US, but also from other countries. During our sample period many

features critical to these hypotheses have changed, helping us to assess the validity of these hypotheses.

We find these popular explanations inconsistent with the data. The price choice of firms and funds in the US has remained stable in the face of changing tic size, investor composition, trading costs, inflation, real wealth, and market returns. We conclude that the nominal share prices are a puzzle when viewed through the conventional lenses. The puzzle is complicated by the positive and significant market reaction to the announcement of the very actions that lead to the constant nominal prices. Thus not only managers but also shareholders view these actions as value enhancing. These positive reactions are present not only for common stock (e.g., Grinblatt et. al. 1984) but also for ADR solo splits (Muscarella and Vetsuypens (1996)) and mutual funds (Rozeff (1998)) where signaling or liquidity can not explain why nominal prices are maintained.

The choice of price for each firm, individually, has implications for the trading costs of its investors. Recalling the potential savings in trading costs for investors if GE had merely kept its real, instead of nominal, price constant, the nominal price puzzle could be rightfully renamed "The Hundred Million Dollar Question". Why do firm actively forgo such saving and why investors greet those actions with enthusiasm requires an explanation.

Having ruled out the conventional explanations for stock splits we have turned to an explanation based on convention. In this view, firms are following norms when they determine their "optimal" trading range. Firms follow the norms in many domains (Akerlof, 2007) As Tevya (the central character in the play *Fiddler on the Roof*), who, when asked why things were done as they had always been done, he replied that he had a simple explanation: "And what is that you may ask? I can tell you that in one word. "Tradition!""

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Table I
Selected Prices and Spits on the NYSE, 1933 to 2005.

Data is from The Center for Research in Security Prices (CRSP). We select six well known companies that have survived from 1933 to the present for illustrative purposes. Over each time period, we calculate the average month end closing price (Panel A) and the average of what would have been the month end closing price if the firm had never issued any stock splits or stock dividends (Panel B, "UnSplit Price") . Cumulative Split is the magnitude of the accumulated stock splits and stock dividends undertaken by the company from January 1933 to December 2005. ADM is the ticker symbol for Archers Daniel Midland Co., AYE is Allegheny Energy Inc, ED is Consolidated Edison, Inc, GE is General Electric, GM is General Motors, and HSY is The Hershey Company.

Panel A: Average Price

Sample Years	ADM	AYE	ED	GE	GM	HSY
1933-1935	$32.58	$17.99	$34.68	$22.80	$32.43	$63.50
1936-1945	$36.80	$11.05	$26.44	$38.23	$51.16	$59.37
1946-1955	$39.54	$26.79	$33.48	$51.86	$66.96	$46.69
1956-1965	$37.73	$37.07	$65.41	$76.41	$58.90	$66.60
1966-1975	$39.42	$21.26	$25.58	$75.32	$70.46	$22.95
1976-1985	$21.32	$20.79	$25.13	$58.43	$60.96	$31.08
1986-1995	$23.39	$37.96	$34.10	$67.57	$53.49	$40.94
1996-2005	$16.43	$27.28	$39.32	$62.14	$53.64	$61.91
Average	**$30.74**	**$25.70**	**$35.60**	**$59.84**	**$58.26**	**$47.75**

Panel B: Average UnSplit Price

Sample Years	ADM	AYE	ED	GE	GM	HSY
1933-1935	$32.58	$17.99	$34.68	$22.80	$32.43	$63.50
1936-1945	$40.15	$11.05	$26.44	$38.23	$51.16	$59.37
1946-1955	$118.62	$29.66	$33.48	$69.68	$111.96	$114.78
1956-1965	$113.18	$83.85	$69.89	$229.22	$353.41	$384.33
1966-1975	$299.82	$85.03	$51.16	$302.33	$422.75	$358.13
1976-1985	$1,300.40	$83.15	$69.43	$439.58	$365.79	$631.65
1986-1995	$5,879.48	$174.15	$211.60	$1,738.45	$500.29	$3,580.41
1996-2005	$10,157.04	$218.25	$314.54	$9,630.20	$643.63	$13,003.05
Cumulative Split	**679 : 1**	**8 : 1**	**8 : 1**	**288 : 1**	**12 : 1**	**375 : 1**

Table II
Summary of Prices, Returns, and Splits on the NYSE and AMEX.

Data is from The Center for Research in Security Prices (CRSP), and includes all ordinary common shares (SHRCD=10, 11, 12) that are listed on the NYSE and AMEX exchanges (EXCHCD= 1, 2, 31, 32), but excludes Berkshire Hathaway (PERMNO=17778, 83443). For each time period, we calculate the VW Price and the EW Price as the time series average of the monthly VW and EW prices respectively. The number of splits represents the sum of all stock splits and stock dividends (DISTCD=5523, 5532, 5533, 5543, 5552, 5553). If a firm makes multiple stock distributions in one month, we count this as a single stock distribution. The split size is the average of (1+FACSHR), and represents the number of shares you would hold at the end of the distribution. If Berkshire Hathaway is retained in the sample, the results are quantitatively similar for VW Price but significantly higher for EW Price post 1996. Returns are reported as the geometric annual average return over the sample period from the CRSP Value and Equal Weighted return indices, Average Splits is an annual average number of splits, and split size is the implied average annual split ratio.

Sample Years	VW Price	EW Price	# of Splits	Split Size	VWReturn	EWReturn
1933-1935	*$24.80*	*$21.40*	*33*	*1.04 : 1*	*33.5%*	*66.2%*
1936-1945	$30.62	$25.75	150	1.93 : 1	9.0%	17.2%
1946-1955	$40.53	$31.48	822	1.65 : 1	14.9%	13.1%
1956-1965	$46.61	$32.32	2,099	1.42 : 1	11.4%	12.8%
1966-1975	$36.71	$23.05	2,928	1.43 : 1	3.0%	4.8%
1976-1985	$30.94	$20.27	3,029	1.53 : 1	15.4%	24.3%
1986-1995	$34.13	$22.15	2,208	1.56 : 1	13.8%	11.4%
1996-2005	$36.36	$25.17	1,935	1.64 : 1	10.1%	13.5%
Average	**$36.56**	**$25.74**	**188**	**1.59 : 1**	**11.9%**	**15.5%**

Table III
Summary of International Exchanges

Data is from World Stock Exchange Fact Book 2005. Average Price (Current US$) is the average of the most recent five years of trade weighted average price per share in current US$ equivalent. Average Price (Nominal Local) is the average over the whole time series of the trade-weighted average price, denominated in nominal local currency. Δ Index is the average annual increase in the local stock index over the time series. Specifically, it is calculated as $\left(\frac{INDEX_T - INDEX_0}{INDEX_0} + 1\right)^{1/T} - 1$. Δ Nominal Price is calculated the same way. ρ is the correlation between the price series and the index series. CV is the time series standard deviation in average prices, scaled by the time series average nominal price.

Exchange	Years	Average Price (Current US$)	Average Price (Nominal Local)	Δ Index, Annual	Δ Nominal Price, Annual	ρ	CV
Australia	1979-2005	2.23	2.01	9%	5%	0.81	0.33
Brussels	1980-2004	23.82	1,033.72	11%	3%	(0.21)	0.33
Italian	1975-2004	6.16	3,697.67	12%	8%	0.93	0.73
Jakarta	1977-2005	0.08	4,169.84	9%	-9%	(0.32)	0.99
JSE (South Africa)	1975-2005	2.91	7.91	16%	8%	0.94	0.61
Korea	1975-2005	5.88	7,918.53	27%	6%	0.70	0.97
Kuala Lampur	1975-2005	0.50	2.95	8%	-1%	0.44	0.49
London	1981-2005	5.45	2.66	10%	3%	0.79	0.30
Mexican	1975-2004	1.66	5.60	46%	20%	0.90	1.14
NYSE	1975-2005	37.15	34.40	9%	1%	0.41	0.14
Philippine	1980-2005	0.02	0.43	9%	14%	0.36	1.08
Singapore	1980-2005	0.71	2.19	4%	-5%	(0.44)	0.43
Taiwan	1975-2005	0.80	36.64	10%	1%	0.69	0.67
Thailand	1975-2005	0.22	108.25	7%	-11%	(0.37)	0.82
Tokyo	1975-2005	8.33	820.70	6%	4%	0.85	0.43
Toronto	1975-2005	12.65	13.20	8%	2%	0.64	0.24

Table IV
Prices and Trading Costs

Data is from Joel Hasbrouck website and CRSP, and has 197,755 firm year observations, and 80 years of data. We estimate the cost per dollar of trade for each security as c_bma/average monthly price ("Cost"). Volume is the annual sum of the monthly volume ("Volume"). We estimate turnover as the total annual volume/monthly average of shares outstanding ("Turnover"). We estimate size as the monthly average price*monthly average number of shares outstanding ("Size"). We create dummy variables D1, D2, D3, D4 and D5 based on annual quintile ranking of the monthly average price of the security. We use Fama-MacBeth (1973) procedure for the two models shown below. We exclude Berkshire Hathaway and all stocks traded below $5/share from the analysis, but the results are robust to their incusion.

Linear:

$$\text{Cost} = \alpha + \beta_1[\text{Price}] + \beta_2[\text{Volume}] + \beta_3[\text{Turnover}] + \beta_4[\text{Size}] + \varepsilon$$

Non-Parametric:

$$\text{Cost} = \alpha_1[D_1] + \alpha_2[D_2] + \alpha_3[D_3] + \alpha_4[D_4] + \alpha_5[D_5] + \beta_1[\text{Price}] + \beta_2[\text{Volume}] + \beta_3[\text{Turnover}] + \beta_4[\text{Size}] + \varepsilon$$

Panel A: Linear
80 years

Variable	Parameter Estimate	Standard Deviation	t-value	P
Intercept	0.0011727	0.000666441	15.74	<0.0001
Price	-0.000018551	0.0000134333	-12.35	<0.0001
Volume	-8.836361E-9	1.43443979E-9	-5.51	<0.0001
Turnover	2.4568466E-6	0.000014439	1.52	0.1320
Size	1.50849E-10	3.296133E-10	4.09	0.0001

Panel B: Non-parametric
80 Years

Variable	Parameter Estimate	Standard Deviation	t-value	P
D1	0.001933600	0.009477070	18.25	<0.0001
D2	0.000818957	0.000566277	12.94	<0.0001
D3	0.000438461	0.000294971	13.30	<0.0001
D4	0.000264426	0.000183728	12.87	<0.0001
D5	0.000151383	0.000104815	12.92	<0.0001
Volume	-6.265869E-9	1.108626E-8	-5.06	<0.0001
Turnover	-5.098328E-6	9.586958E-6	-4.76	<0.0001
Size	2.876687E-12	1.392011E-10	1.85	0.0683

T-value of $(D_1\text{-}D_5)=0 = 16.72$, $P(\alpha_1 = \alpha_5)<0.0001$

Table V
Price and Split Distributions by Returns.

Data is from CRSP as described in Table I. We divide the data into non-overlapping five year intervals from 1930 to 2004. For each of these 15 sub-samples, we rank the securities into deciles based on their cumulative return excluding dividends ("CRETX") over the sub-sample period. For each decile, we obtain the median price at the beginning of the sub-sample ("$Price_{t=0}$"), the median CRETX, and the median price at the end of the sample ("$Price_{t=T}$"). "Split" is the implied split ratio for firms in each decile that generates the difference between the expected price at the end of the period ("$E[Price_{t=T}]$"), defined by $Price_{t=0}$*CRETX and the actual price at the end of the period $Price_{t=T}$. "Median Return" is reported as the geometric annual average return. We report the time series average of the results by deciles below. The results using means, instead of medians, is quantitatively similar to the reported results.

Return Decile	$Price_{t=0}$	Median Return	$E[Price_{t=T}]$	Split	$Price_{t=T}$
1	$15.38	-21%	$4.86	1.21 : 1	$4.00
2	$17.75	-9%	$10.80	1.15 : 1	$9.38
3	$19.50	-4%	$15.60	1.16 : 1	$13.50
4	$18.88	-1%	$17.98	1.15 : 1	$15.63
5	$19.75	2%	$21.72	1.17 : 1	$18.50
6	$21.13	5%	$27.25	1.21 : 1	$22.50
7	$20.44	9%	$31.29	1.32 : 1	$23.63
8	$20.25	13%	$37.69	1.42 : 1	$26.63
9	$18.75	19%	$45.08	1.60 : 1	$28.25
10	$14.50	31%	$55.61	1.80 : 1	$30.88

Table VI
The Price Targeted By Managers via Stock Splits

Data is from CRSP as described in Table I. We determine for each firm the month end price prior to the month in which it announces its split (Pre-Split Price), the price at month end of the split announcement ("Post-Split Price"), the median price of its size peers (as determined by size deciles) at the end of the year prior to the split announcement, ("Size Median Price"), and the median price of its industry peers (as determined by the Fama French 48 industry definitions) at the end of the year prior to the split announcement (FF48 Industry Median Price"). Panel A shows the regression results from all firms from 1933 through 2005 that had a forward split, and Panel B shows the results for all firms from 1933 through 2005 that had a 1.25:1 or greater split. The regression model is

$$[(\text{Pre}-\text{Split Price})-(\text{Post}-\text{SplitPrice})] = \alpha + \beta_1[(\text{Pre}-\text{Split Price})-(\text{Size Median Price})] + \\ + \beta_2[(\text{Pre}-\text{Split Price})-(\text{FF48 Industry Median Price})] + \varepsilon$$

Panel A: All Forward Splits
Adj. R^2 =0.6284
N=16092

Variable	Parameter Estimate	Standard Error	t-value	P
Intercept	2.65406	0.12688	20.92	<0.0001
(Pre-Split Price)-(Size Median Price)	0.34356	0.1080	31.82	<0.0001
(Pre-Split Price)-(FF48 Industry Median Price)	0.24427	0.00945	25.85	<0.0001

Panel B: Average All Splits greater than or equal to 1.25:1
Adj. R^2 =0.7851
N=8370

Variable	Parameter Estimate	Standard Error	t-value	P
Intercept	3.00831	0.18731	16.06	<0.0001
(Pre-Split Price)-(Size Median Price)	0.45406	0.01328	34.19	<0.0001
(Pre-Split Price)-(FF48 Industry Median Price)	0.27384	0.01198	22.85	<0.0001

Table VII
Summary of Initial Listings by Size Quintiles and Date

Data is from CRSP as described in Table I, except we exclude the year 1962 from this analysis as this is the first year the AMEX appears on the CRSP tape. We determine the size quintile to which each new listing on CRSP belongs, and report the results in 10 year sub-samples. Panel A shows the percentage of new listings by each quintile in each sub-sample. The overall average is an equal weighted average. Panel B shows newly listed prices by size quintile. Again, the overall averages are equal weighted averages. The average new listing price across the entire sample is $18.15.

Panel A: Distribution of New Listings by Size Quintile

Sample Years	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
1933-1935	18.7%	19.3%	21.2%	21.6%	19.2%
1936-1945	6.4%	30.1%	38.6%	18.6%	6.4%
1946-1955	10.6%	28.0%	23.4%	24.8%	13.1%
1956-1965	32.3%	31.8%	21.5%	9.8%	4.6%
1966-1975	16.0%	33.4%	26.4%	17.4%	6.7%
1976-1985	21.3%	34.5%	22.7%	14.0%	7.4%
1986-1995	21.1%	25.8%	28.4%	19.1%	5.6%
1996-2005	27.1%	25.8%	23.6%	16.2%	7.2%
Average	**22.5%**	**28.5%**	**24.8%**	**16.5%**	**7.7%**

Panel B: Average Price of New Distributions by Size Quintile

Sample Years	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
1933-1935	$1.52	$5.22	$10.10	$18.13	$30.81
1936-1945	$13.98	$18.66	$26.27	$30.95	$42.61
1946-1955	$14.11	$21.49	$21.22	$28.99	$36.93
1956-1965	$7.39	$15.23	$23.10	$33.10	$45.35
1966-1975	$11.89	$17.27	$23.35	$32.20	$45.79
1976-1985	$7.85	$12.89	$17.19	$23.89	$38.64
1986-1995	$6.49	$11.25	$17.83	$24.92	$30.33
1996-2005	$6.63	$13.53	$23.03	$32.49	$35.70
Average	**$7.29**	**$13.97**	**$20.46**	**$28.12**	**$36.69**

Figure 1: Nominal Value-Weighted Average Price ("VWPrice") and Nominal Equal-Weighted Average Price ("EWPrice") of Securities on the NYSE and AMEX, 1933 to 2005.
This figure shows the time series of nominal value-weighted averages ("VWPrice") and nominal equal-weighted averages ("EWPrice") of security prices. Data is from The Center for Research in Security Prices (CRSP), and includes all ordinary common shares (SHRCD=10, 11, 12) that are listed on the NYSE and AMEX exchanges (EXCHCD= 1, 2, 31, 32), but excludes Berkshire Hathaway (PERMNO=17778, 83443). If Berkshire Hathaway is retained in the sample, the results are quantitatively similar for VWPrice but significantly higher for EWPrice post 1996.

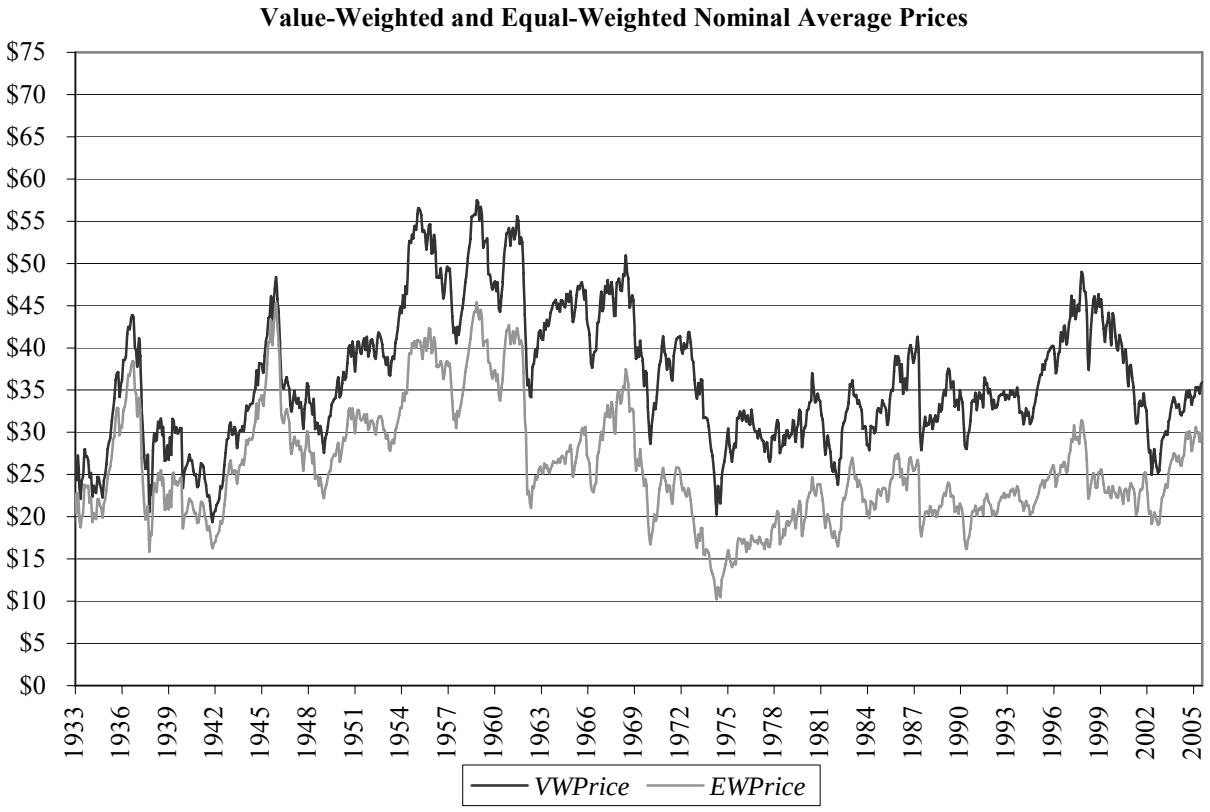

Figure 2a: Real Value-Weighted Average Price ("VWPrice") and Real Equal-Weighted Average Price ("EWPrice") of Securities on the NYSE and AMEX, 1933 to 2005.

This figure shows the Real (inflation adjusted) time series of security prices from Figure 1, and depicts the cost of average security prices throughout the time series. All real prices are quoted in 1933 dollars. The monthly inflation data comes from the Bureau of Labor Statistics Consumer Price Index – All Urban Consumers, U.S.

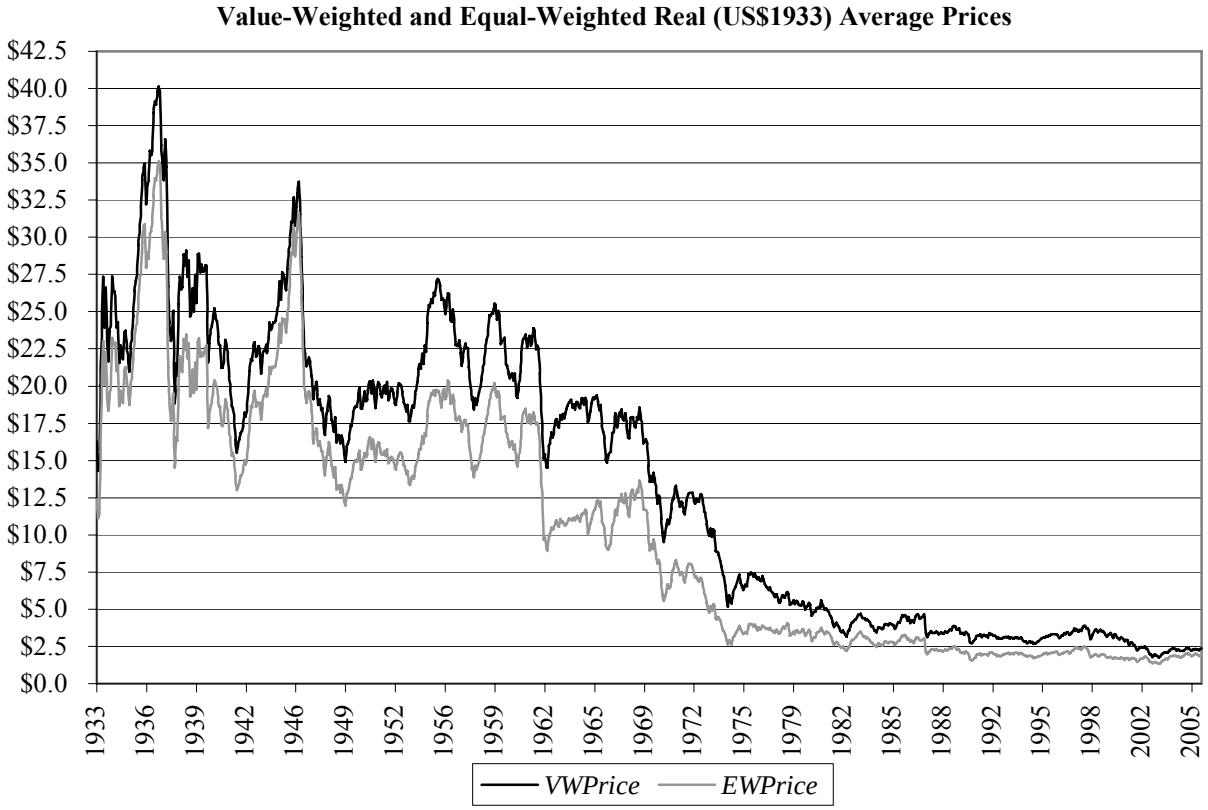

Figure 2b: Value-Weighted Average Price ("VWPrice") and Equal-Weighted Average Price ("EWPrice") of Securities on the NYSE and AMEX from 1936 to 1945, Adjusted for Inflation.

This figure shows what the price series on the NYSE and AMEX would have looked like if the prices from the 1936 to 1945 time series from Table II had grown at the rate of inflation. This chart approximately depicts what the nominal price series would have looked like if prices of securities were constant in real 1933 purchasing power. The monthly inflation data comes from the Bureau of Labor Statistics Consumer Price Index – All Urban Consumers, U.S.

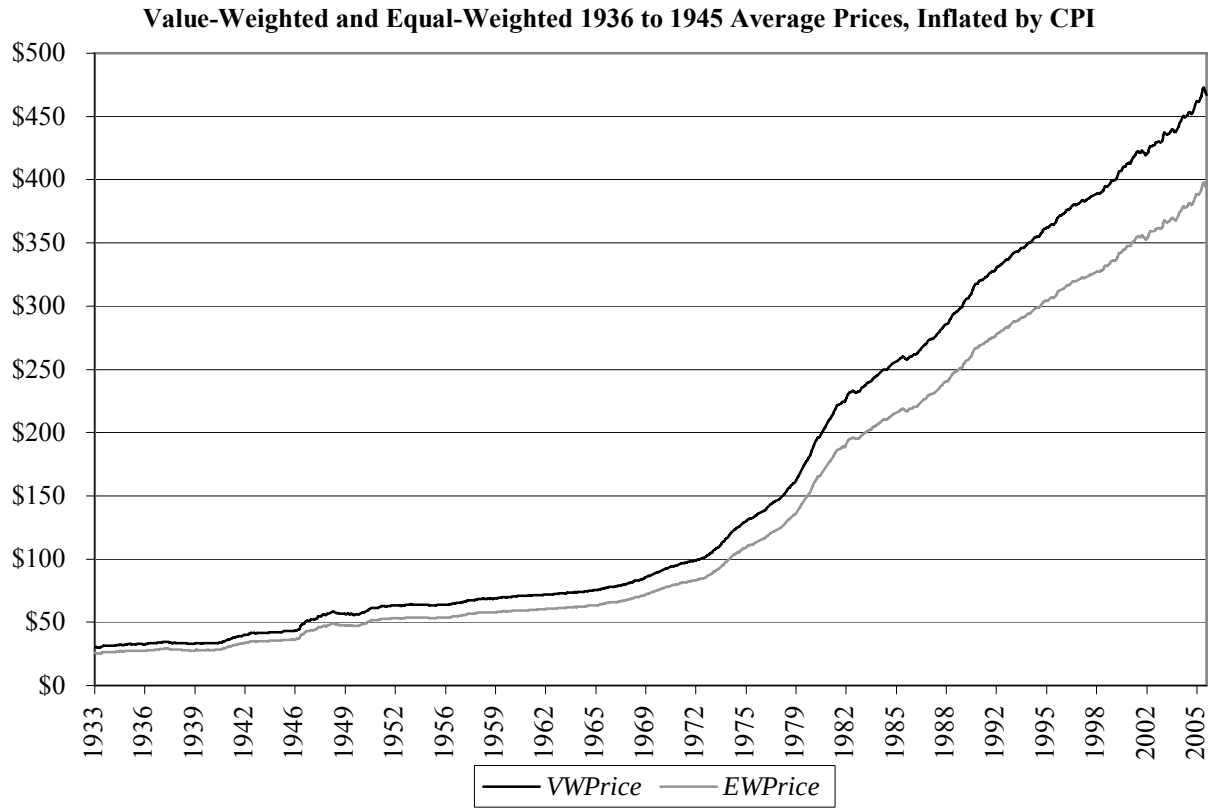

Figure 2c: Nominal UnSplit Value Weighted Average Price ("UnSplit VWPrice") of Securities on the NYSE and AMEX, 1933 to 2005.

For the UnSplit series, we undo the cumulative effect of forward and reverse stock splits and stock dividends on a security-by-security basis, and then take the value-weighted average of the adjusted security prices. This "UnSplit" measure allows us to estimate the cumulative effect of stock splits and distributions on the average price of listed securities. The UnSplit series portrays what the time series of security prices would have looked like if there had never been a stock split or stock dividend.

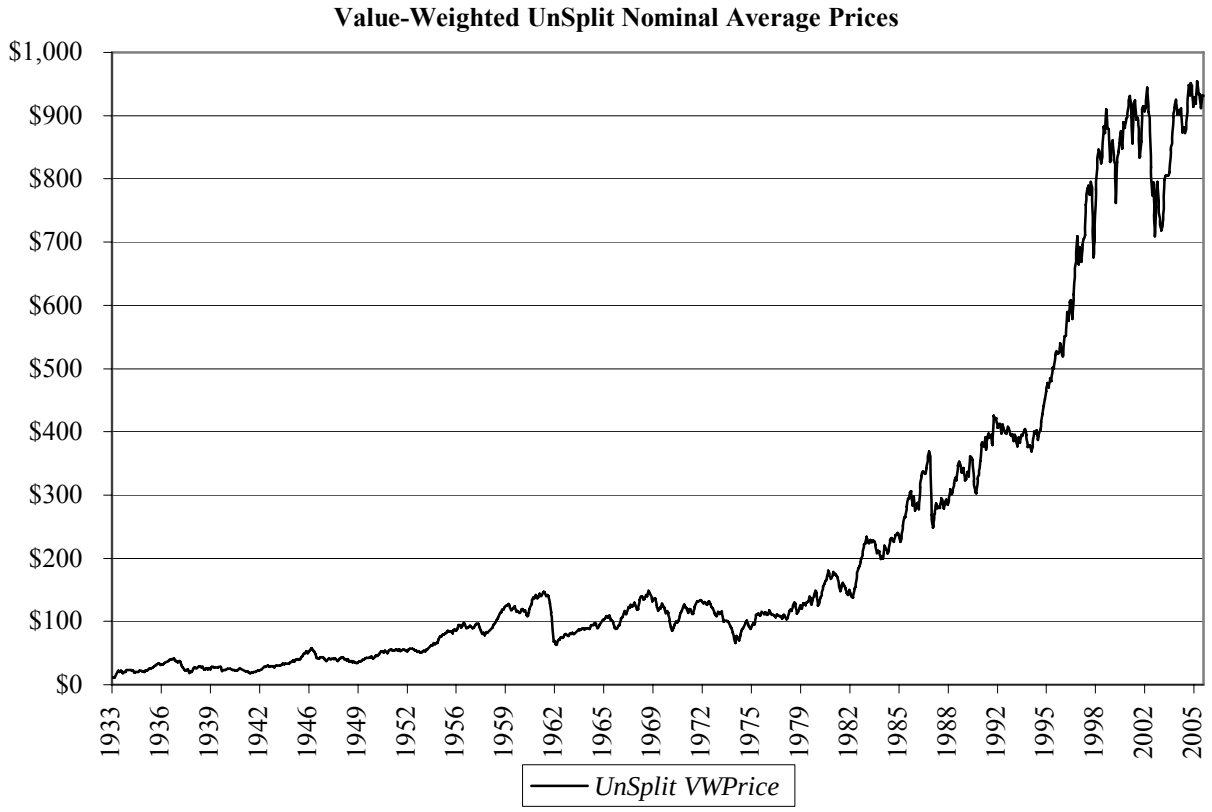

Figure 3a: Nominal and Nominal UnSplit Value Weighted Average Price of "Survivor" Securities on the NYSE and AMEX, 1933 to 2005.

To adjust out price series for the effects of IPOs and new listings, we select a sample of "Survivor" firms. Survivor firms are defined as those securities that were in existence in both 1940 and 2000. The 1940 and 2000 dates were arbitrarily selected to ensure a sample in excess of 100 firms. The actual sample size increases from 102 securities in 1933 to 139 securities in the 1940 to 2000 time frame, then declines to 99 firms by Dec, 2005. For the Nominal Unsplit series, we undo the cumulative effect of forward and reverse stock splits and stock dividends on a security-by-security basis, and then take the value-weighted average unsplit price of the securities, as before.

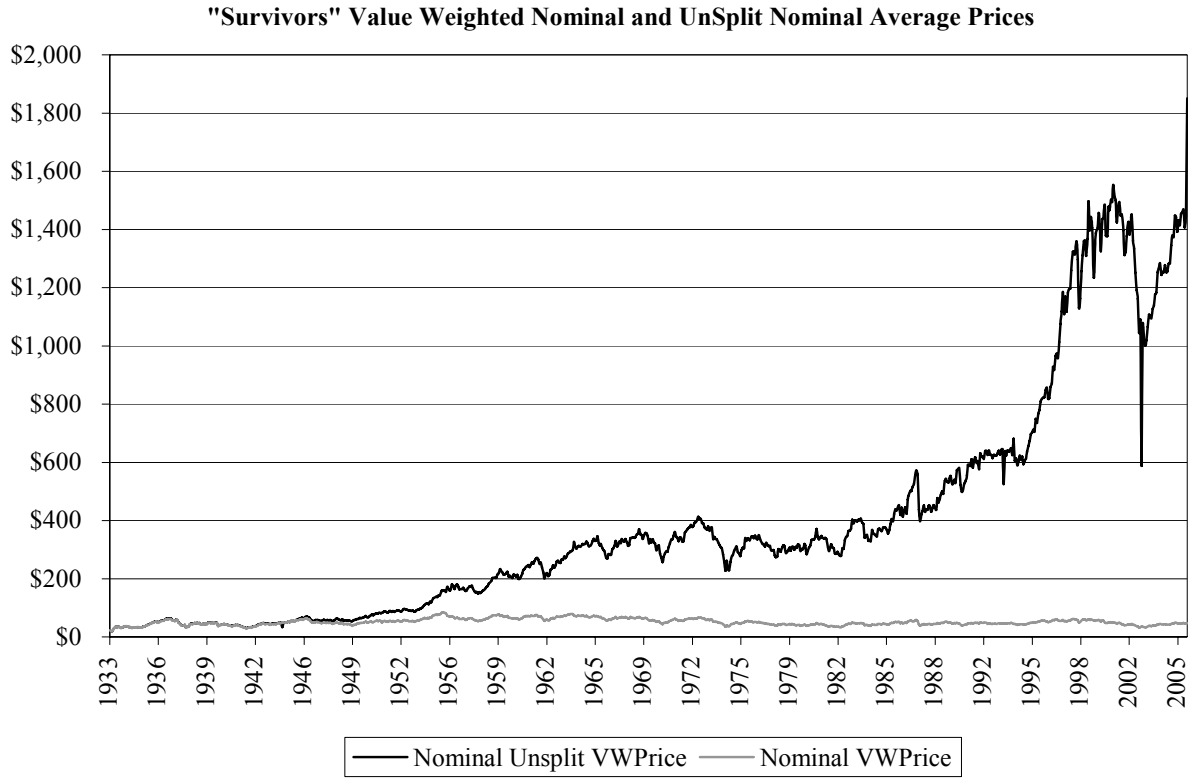

Figure 3b: Nominal Value Weighted and Real UnSplit Value Weighted Average Price of "Survivor" Securities on the NYSE and AMEX, 1933 to 2005.

Survivor firms are defined as in Figure 3a. For the Real Unsplit series, we take the Unsplit series as in Figure 3a, and convert the values in real 1933 dollars.

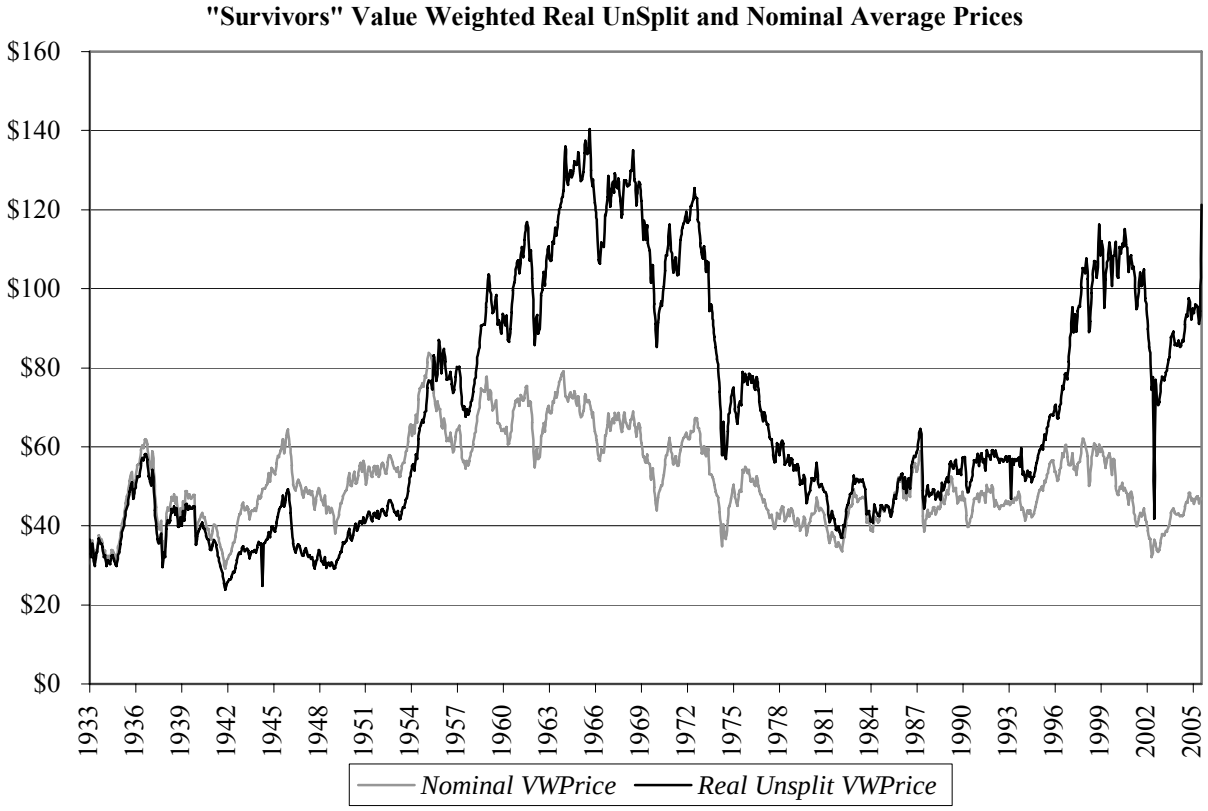

Figure 4: Relative Variability in Prices, 1933 to 2005.
This chart depicts the monthly coefficient of variation of stock prices and a non-parametric estimator that also measures the variability of stock prices.

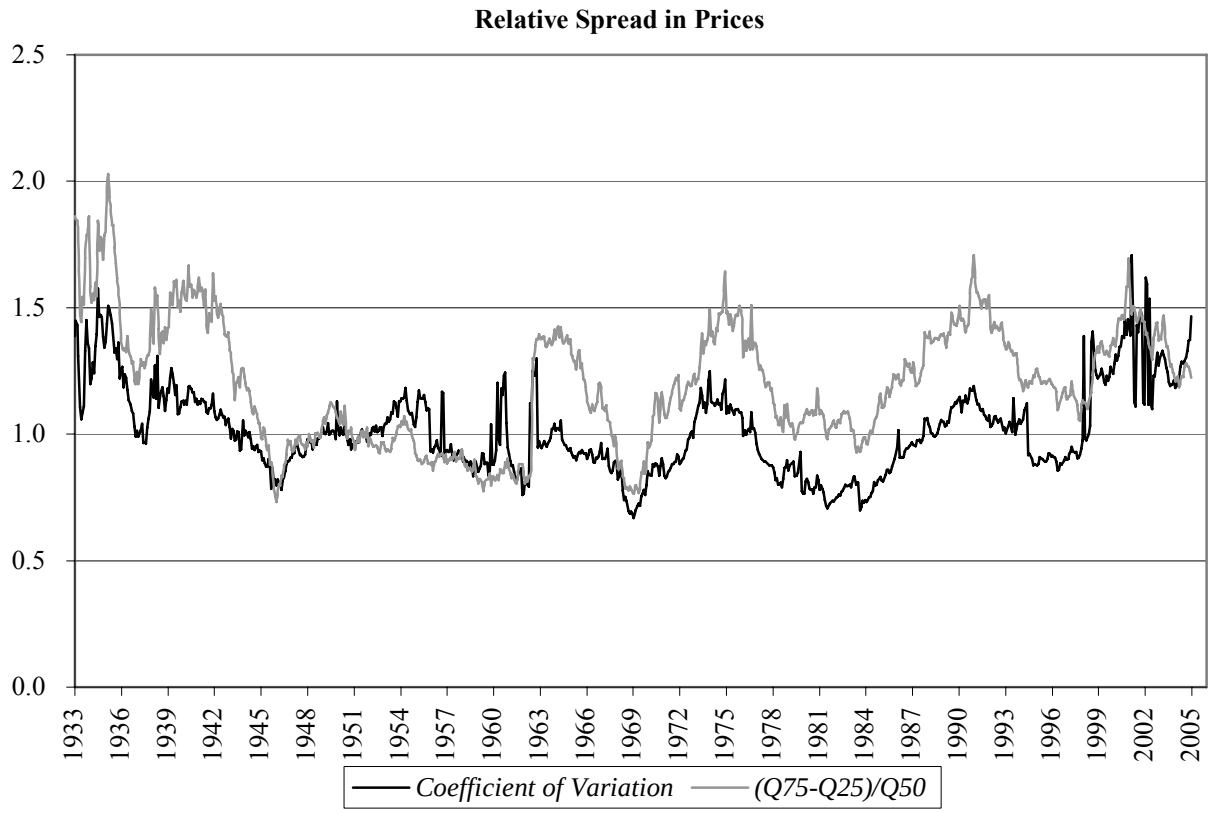

Figure 5: Nominal Equal Weighted Average Net Asset Value per Share ("Nominal EWNAV") and Real Equal Weighted Average Net Asset Value per Share ("Real EWNAV") of Open End Funds, 1961 to 2005.

Data is from the CRSP Mutual Fund Database. To proxy for equity funds, the data is screened to exclude those funds with a net asset value per share of less than $5, and those funds that do not have a strong correlation with the market. Specifically, we regress each fund's return ("RETM") against the CRSP value Weighted Market Return ('VWRETD") and eliminate those funds that have an adjusted R-Square of less than 0.25. The BLS CPI is used to set all prices in 1961 dollars.

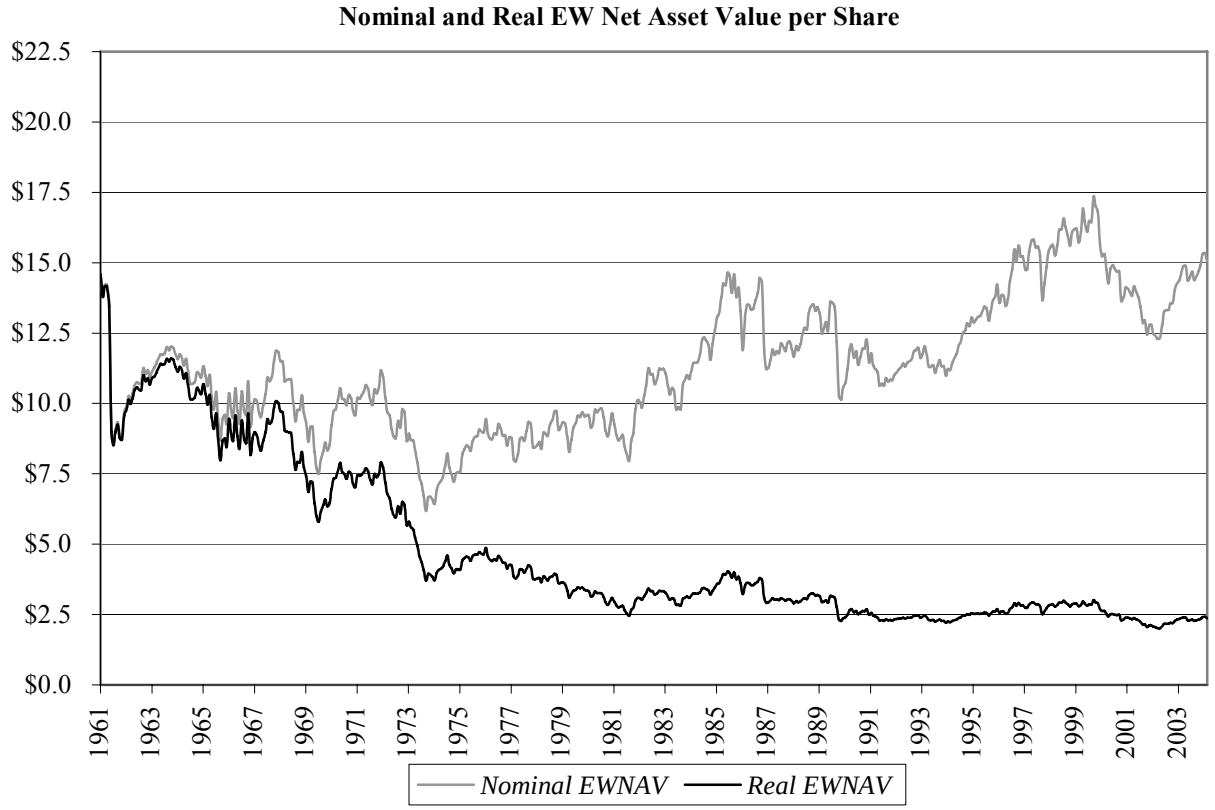

Figure 6a: Nominal Trade Weighted Average Price per Share of Securities listed on the Tokyo Stock Exchange, 1975 to 2005.

Data for Figure 6a is from the Tokyo Stock Exchange Factbook 2006, available online at www.tse.or.jp/english/data/factbook/fact_book_2006.pdf . Trade weighted average price is calculated as the total value of shares traded on the exchange, divided by the total number of shares traded on the exchange. For consistency of scale in comparisons of the Tokyo, London and New York stock exchanges, we force the left hand scale (which indicates the average price per share in local, nominal currency) to be comparable to the right hand scale (which indicates the annual index close level). The average price over the past five years on the Tokyo exchange, converted into 2005 US$, is $8.33.

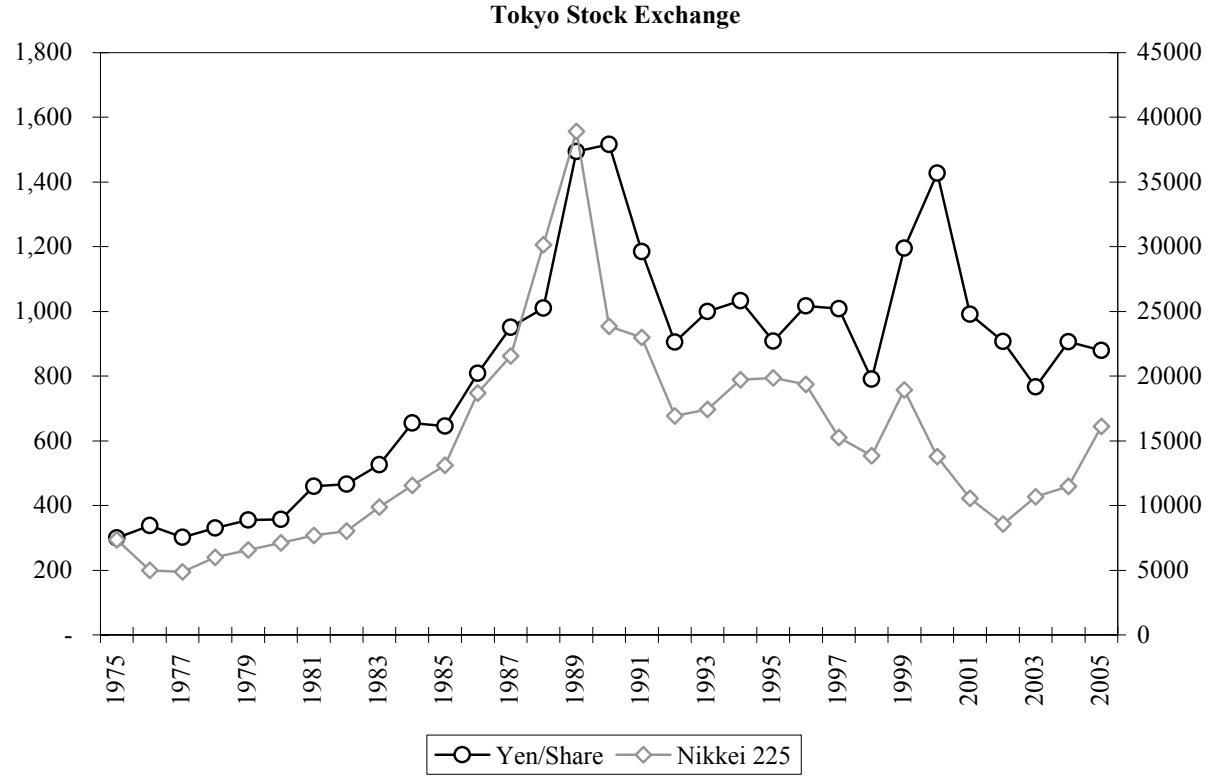

Figure 6b: Nominal Trade Weighted Average Price per Share of Securities listed on the London Stock Exchange, 1975 to 2005.

Data are from the World Stock Exchange Factbook, 2005 and World Federation of Exchanges Annual Reports. The data for value traded, shares traded and FTSE Index are not available from our sources until 1975, 1981 and 1979, respectively. Trade weighted average price is calculated as in Figure 6a. The left hand and right hand convention and scale are maintained as described in Figure 6a. The average price over the past five years on the London exchange, converted into 2005 US$, is $5.45.

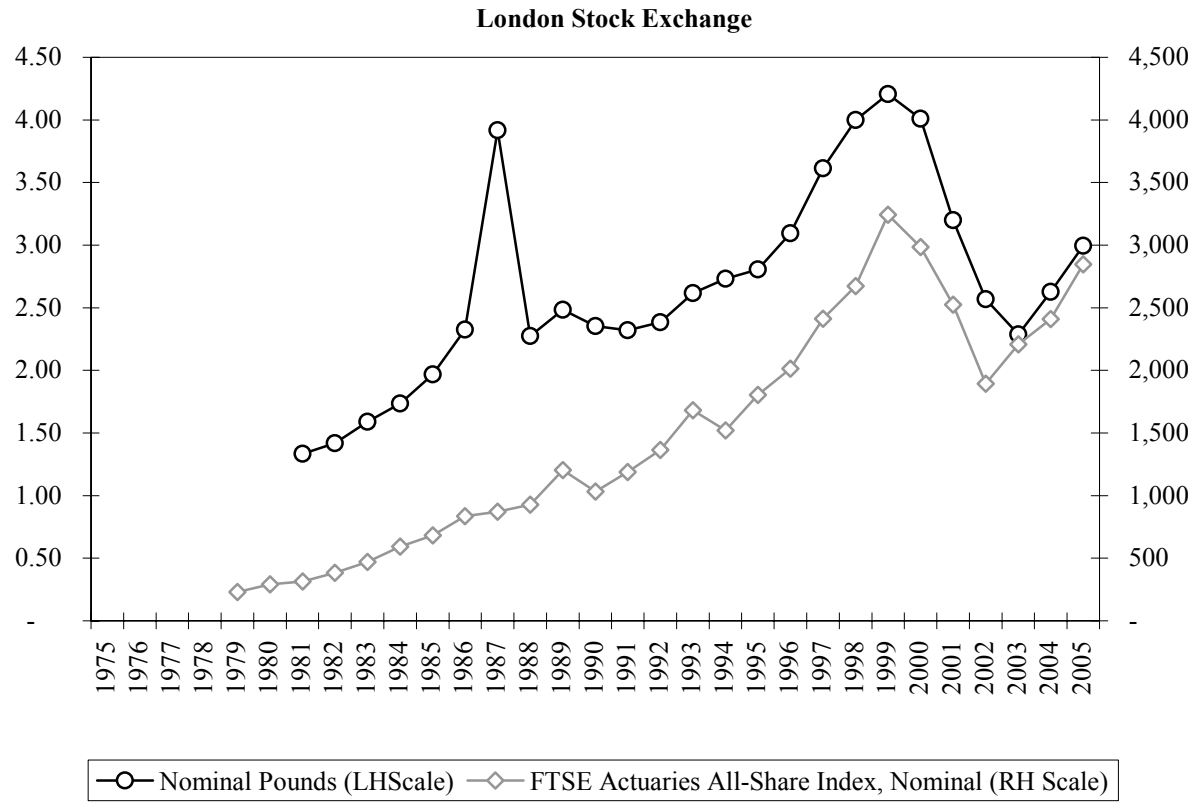

Figure 6c: Nominal Trade Weighted Average Price per Share of Securities listed on the New York Stock Exchange, 1975 to 2005.

Data are from the World Stock Exchange Factbook, 2005 and World Federation of Exchanges Annual Reports. Trade weighted average price is calculated as in Figure 6a. Trade weighted average price is calculated as in Figure 6a. The left hand and right hand convention and scale are maintained as described in Figure 6a. As is evident from the data, both the Tokyo and London share prices co-move with their respective indices far more than on the New York Stock Exchange

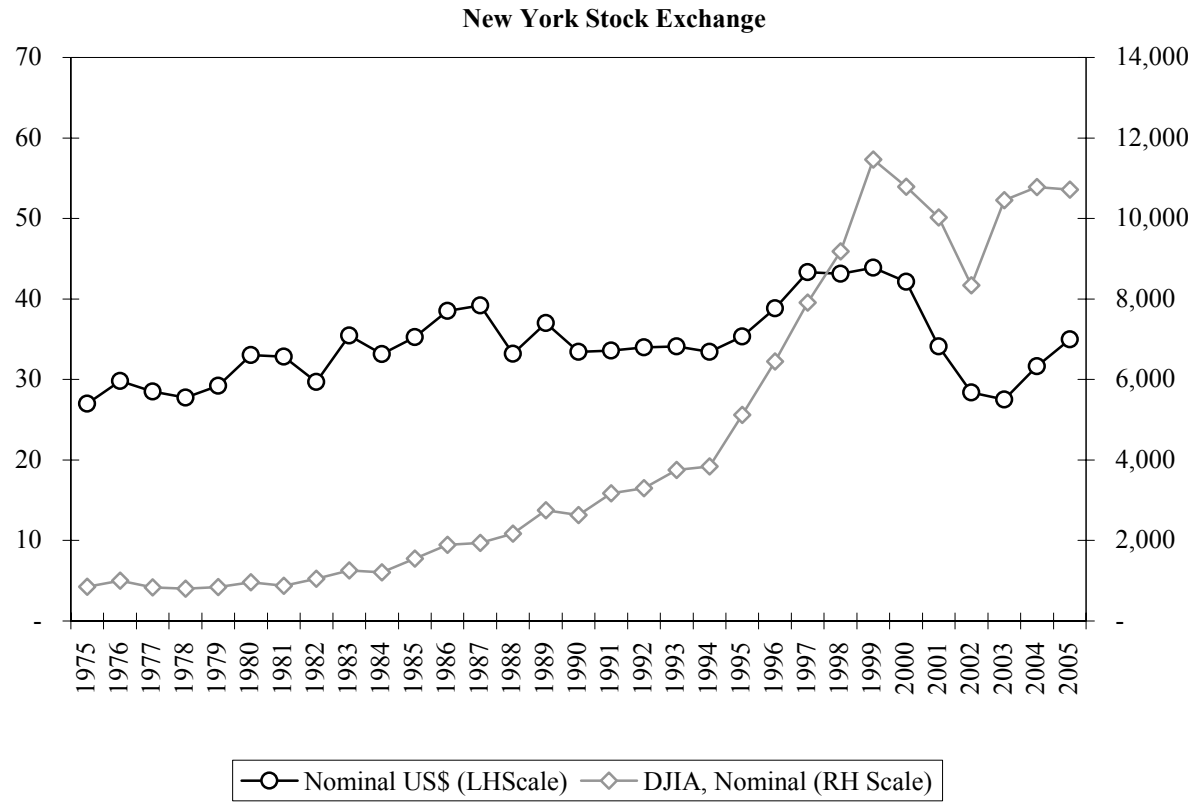

Figure 7: Equity Holdings by Households and Institutions expressed in percentage ownership, 1965 to 2005.

Data is from Federal Reserve Flow of Funds Accounts available at http://www.federalreserve.gov. "Households" is defined to include nonprofit organizations

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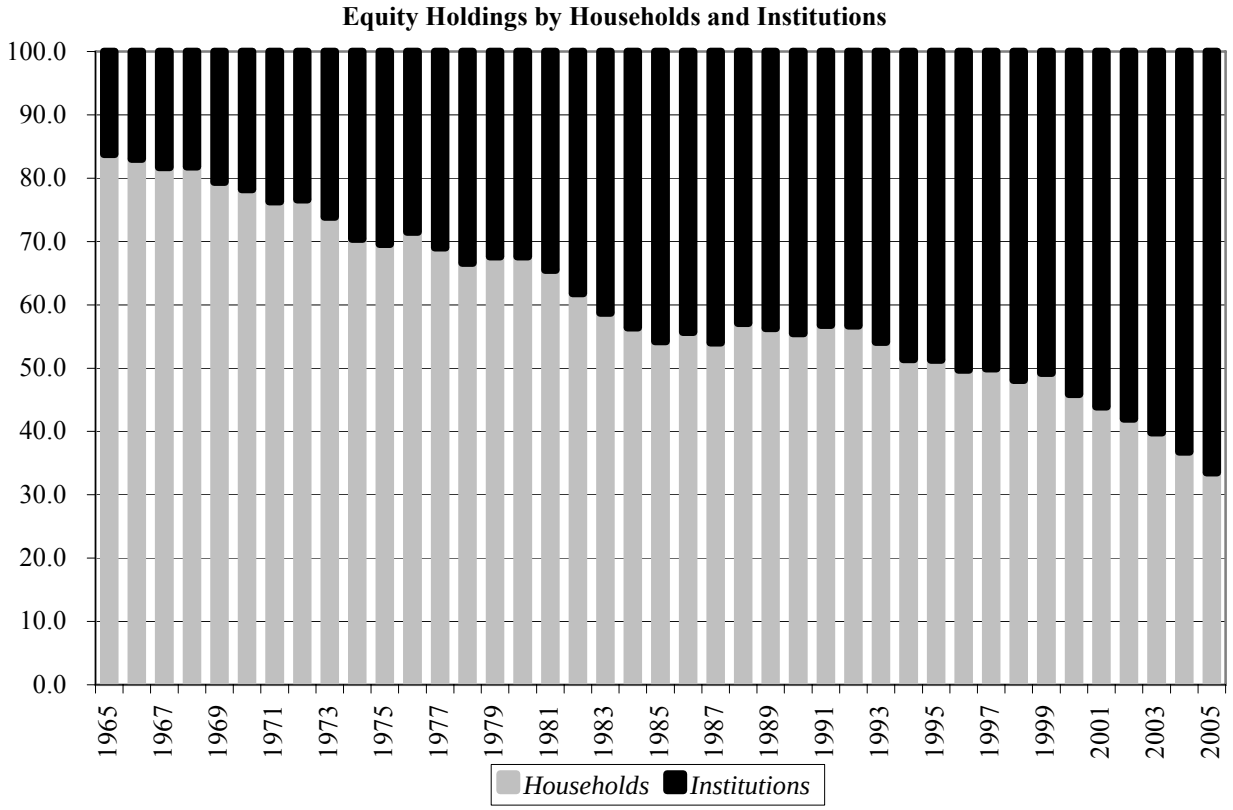

Figure 8: Percentage of US households which directly owns publicly traded equities.
Data for 1900 and 1923 comes from Warshaw, H. T. (1924), Data for 1927 comes from Berle, Adolf A., and Means, Gardiner C. 1932 p. 347, Data for 1928 comes from Means, Gardiner (1930), Data for 1937 comes from Monograph No. 29, (1940) page 16, Data for 1952 to 1985 come from the NYSE Factbook, Data for 1995 comes from the NYSE Shareownership 1998 report, and the 2000 data comes from the Shareownership 2000 report, and the 2002 data comes from Equity Ownership in America, 2002, ICI/SIA. All 1952 to present data are available at http://www.nysedata.com/nysedata/Default.aspx?tabid=115. Data for Direct Household Holdings comes from Mishel, Lawrence (1999, 2005) Table 5.9, page 268 and table 4.8, page 288. In 1928, over 25% of adults in the US owned equity securities. We estimate the Percent of US households owning equity by converting the percent of US population owning equity and percent of US adult population owning equity by the average number of persons per household, and controlling for the market capitalization of "indirect" ownership investment mechanisms (such as closed end funds and mutual funds, from the CRSP database) scaled by the market capitalization of common stock equities. We calibrate the estimation off the recent data, where reports of both direct ownership by household and individual ownership data are available. For example, in 1928, 25% of the adult population owned stocks, and the ratio of "indirect" ownership to market capitalization of common equity was fairly low, resulting in the estimate of greater than 20% of households owning common stock directly.

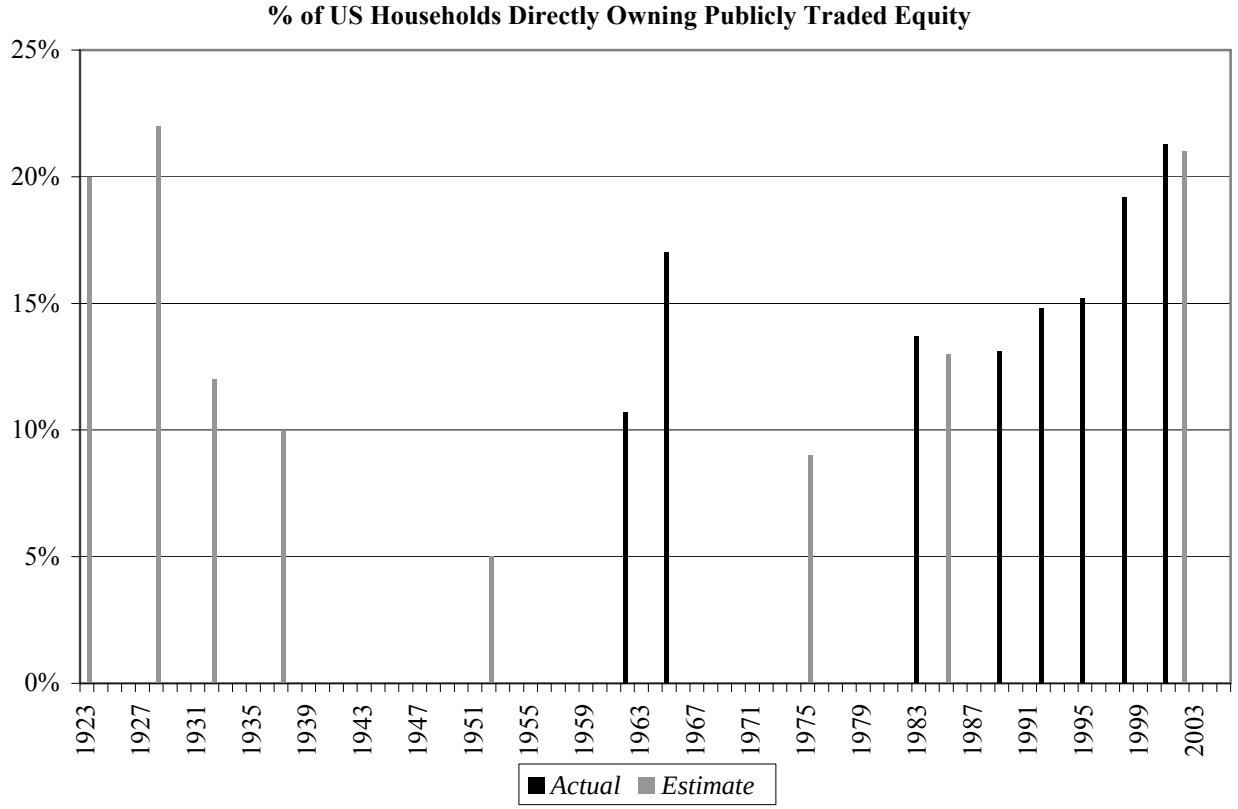

Figure 9: Nominal Equal Weighted Average Price per Share of Securities listed on the NYSE and AMEX, 1815 to 200

January 1815 to December 1925 data is from the "NYSE Monthly Price File from 1815 to 1925" made available from The NYSE History Research Project by the International Center of Finance, Yale University. The January 1926 to present data is from CRSP.

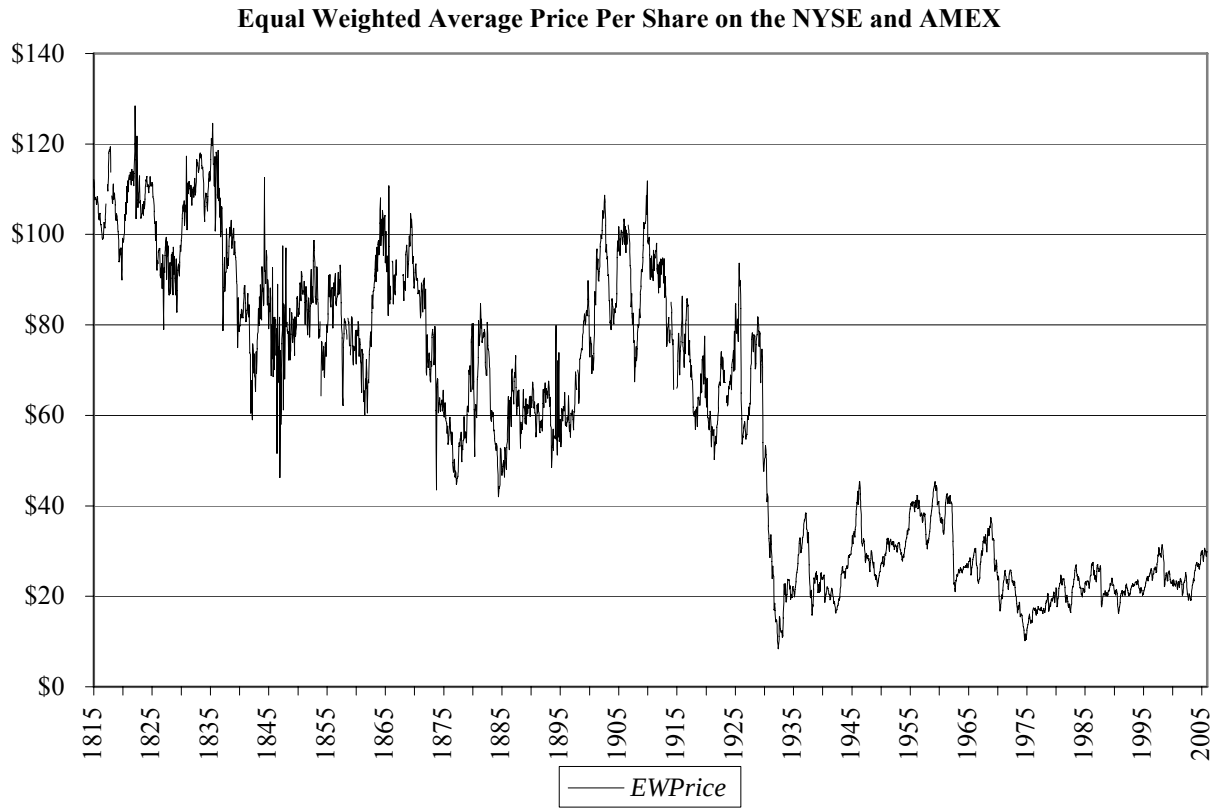

Figure 10: Nominal Equal Weighted Average Prices by Size Quintile of Securities listed on the NYSE and AMEX, 1933 to 2005.

The figure presents the twelve month average of equal weighted security prices by quintile. Quintile 1 are small firms, and have the lowest average prices, Quintile 5 are the largest firms, and have the highest average stock prices, and the relationship of average price and size is monotonic. The results are robust to size deciles.

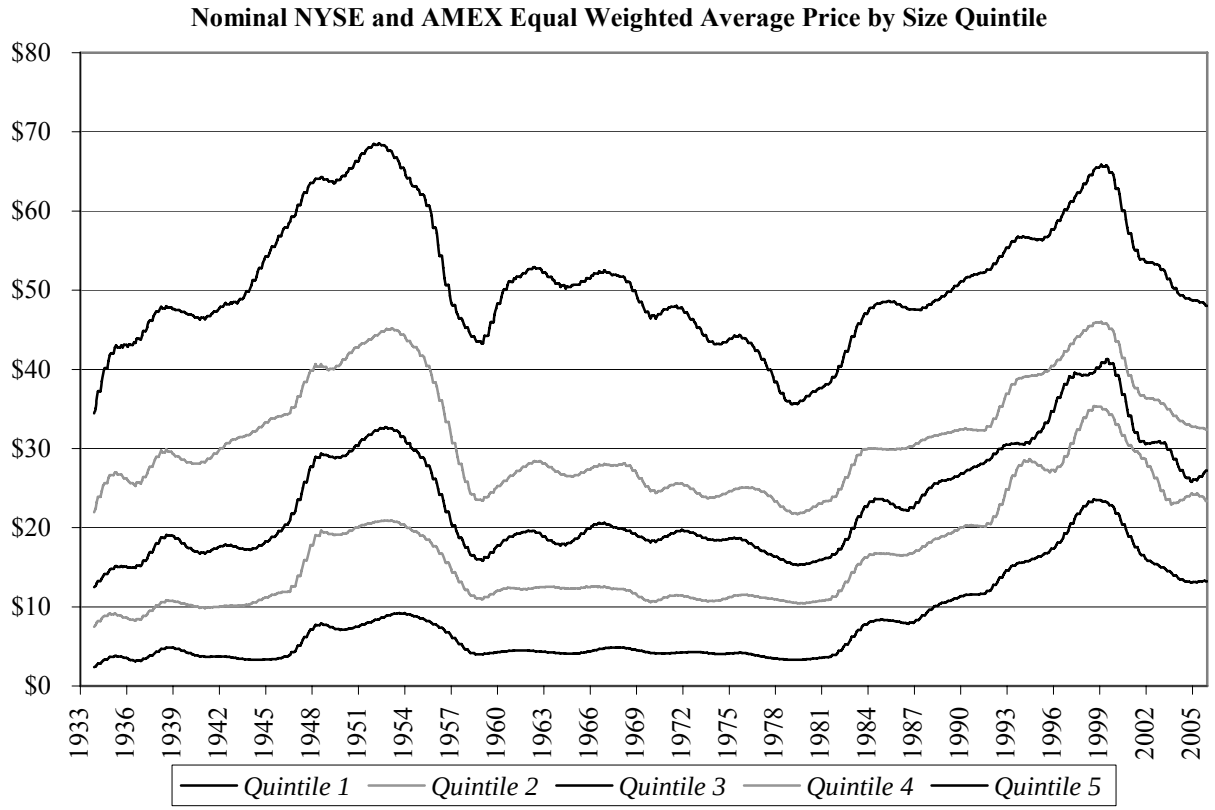

Figure 11a: Nominal Value Weighted and Equal Weighted Average IPO Prices of securities listed on the NYSE and AMEX, 1976 to 2005.

Data is from SDC. We select those securities that are (i) IPOs (IPO Flag=Yes), (ii) Common Shares, (iii) Offer price greater than $4.99, and whose primary exchange is the NYSE or the AMEX. There are few (<20) observations prior to 1983, so we caution against relying on the early part of the time series.

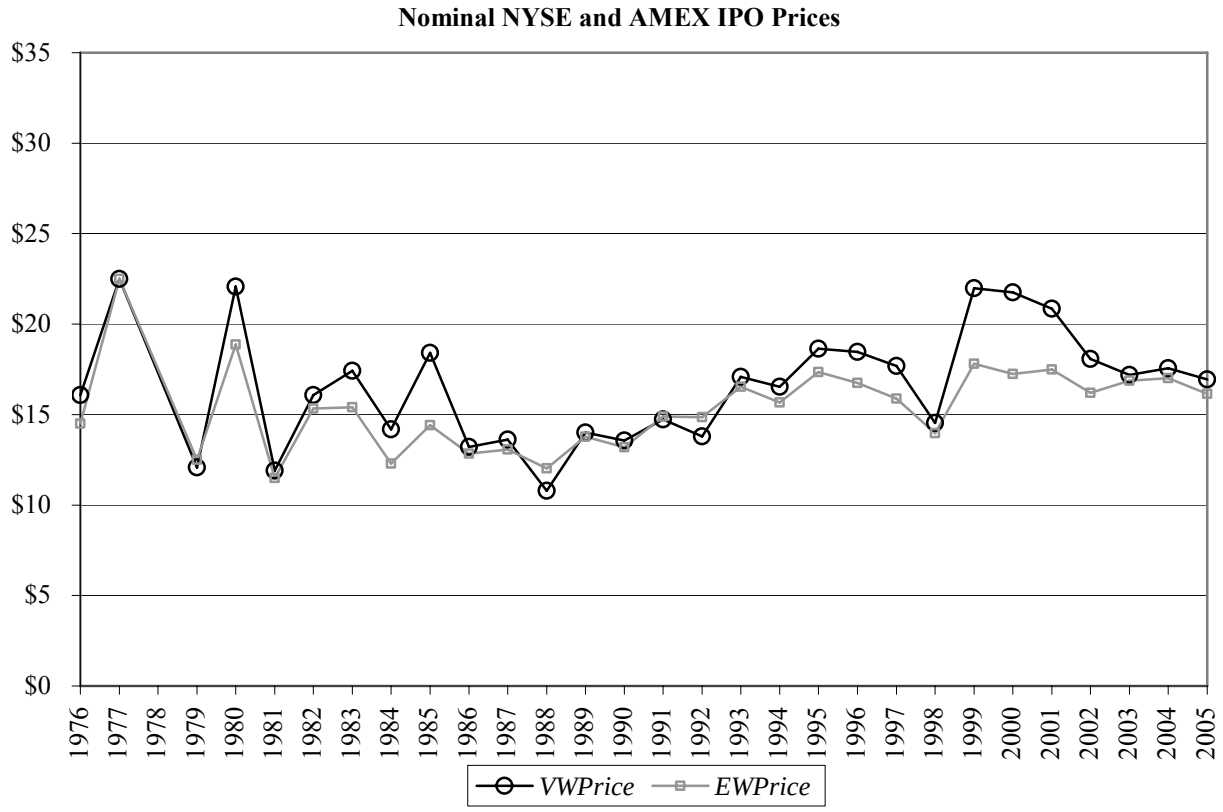

Figure 11b: Nominal Value Weighted and Equal Weighted Average Prices of Newly Listed Securities on the NYSE and AMEX, 1933 to 2005.

To construct a longer time series that should approximate IPO pricing, we define "first appearance on CRSP" as a proxy for IPO, and take the month end price of the securities for this figure. We recognize that it is a noisy proxy for IPO pricing as it includes securities that "graduate" from other exchanges to the NYSE and AMEX. Excluding 1962 (the year that the AMEX enters the CRSP data) we have an average of 94 "first appearances" per year over the 1933 to 2005 period.