Do cash payouts justify share prices?

Evidence from the NYSE, Amex, and NASDAQ

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Abstract

This paper examines whether the cash that firms distribute to their shareholders justifies the firms' stock prices. To find out, we study firms traded on the NYSE, the Amex, and the NASDAQ in the 1926–2002 period. We compute the value of those payouts compounded at the risk-free rate and compare it with the value of an investment in a riskless asset. Share prices at the end of the investment horizon are ignored. We refer to the ratio of the two investment strategies as the value ratio. The evidence is roughly consistent with informationally efficient markets. Value ratios increase with the investment horizon. It takes a median 12 years for stocks to pay back an initial, compounded investment. Moreover, the payouts correlate positively with risk, unless risk is measured with CAPM-beta. The equity risk premiums implied by our analysis are similar to those computed in the most recent literature. Moreover, as observed there, they decline over time, a phenomenon we ascribe to a contemporaneous drop in risk and/or an improvement in market liquidity.

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Abstract

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1 Introduction

Finance theory commonly assumes that stock prices are the present value of the future cash payments shareholders can expect. A similar belief applies to all tradable assets. But in spite of its widespread acceptance, this paradigm is regularly questioned both theoretically and empirically. This paper examines whether the cash payments that corporations actually make justify stock prices.

To look for an answer, we follow a different approach from those used by previous researchers. Those researchers have, for instance, compared the present value of the payoffs from an investment in stocks with the stock's price. The difficulty with this approach is the assessment of the discount rate necessary to capitalize the payoffs from the stock investment. Alternatively, one can compare the volatility of stock price changes with that of their future cash payouts (Shiller, 1989), but this depends on a specific asset-pricing model (Schwert, 1991).

Another approach is to compare the performance of investing in stocks versus investing in bonds over the long run. Usually, these comparisons show that the stock investment strategy (with reinvested dividends) yields higher terminal values than the bond investment strategy. The problem is that this comparison does not really address whether postinvestment cash flows justify the original stock price, since reinvestments and terminal values still involve stock prices and are therefore still conditional on investors' expectations.

Our approach also computes future values, but it focuses on the cash actually paid by firms to its long-term shareholders while disregarding future stock prices to avoid the associated investor expectations. Specifically, we start with an initial investment in a portfolio of stocks. Every year, we put the cash distributed by the firms in the portfolio into an account that accrues at the risk-free rate. Over time, we compare the performance of that strategy with the performance of an equal investment in a risk-free asset. In the comparison, we pretend the proceeds from liquidating the stock portfolio are zero. This approach does not depend on investors' expectations, since we do not reinvest in stocks, do not participate in share repurchases, and ignore the stock price at maturity. Of course, when firms are taken over, we cannot avoid using stock price information. We also do not rely on asset pricing models, since we do not discount or compound at risk-adjusted discount rates. The drawback is that we can perform this exercise only over a limited number of years.

We test whether and how quickly the (compounded) value of the payouts catches up with the (compounded) value of the original investment in the risk-free asset. We also test whether riskier stocks eventually pay out more cash than less risky stocks, and whether stocks with a low current dividend yield pay out more than stocks with a high yield. Moreover, we examine whether riskier stocks generate more volatile cash flows than less risky stocks. Finally, for a comparison with the extant literature, we measure the equity risk premium implied by our figures.

We study firms traded on the NYSE, the Amex, and NASDAQ in the 1926–2002 period. The results suggest that it takes about 12 years for a stock investment to beat an investment in the risk-free asset. Over a 30-year investment horizon, the median equity risk premium implied by our computations is about 275 basis points, which is similar to the 345 basis points reported in Fama and French (2002) for 1872–2000. As in that study, the risk premium appears to decline over time. For portfolios formed between 1926 and 1950, we find a median risk premium of 450 basis points, compared with a median premium of 175 basis points for portfolios formed between 1951 and 1973. In comparison, Fama and French (2002) report a risk premium of 417 basis points for 1872–1950 and one of 255 basis points for 1951–2000. Our figures, however, are downward biased: first, we reinvest in our stock portfolios at the risk-free rate, and second we have a limited investment horizon. Still, the observed decline appears to reflect a contemporaneous drop in risk and/or an improvement in market liquidity.

Value ratios, defined as the quotient of the reinvested value of all payouts on a particular stock portfolio divided by the value of the riskless investment, are roughly correlated with risk. Riskier firms show larger and more volatile value ratios than less risky firms. Consistent with that, value ratios are negatively related to firm size. The exceptions are for the smallest firms, with their unusually low value ratios, and the largest firms, with unusually high value ratios. The evidence is broadly consistent with the notion that stock prices are the present value of the future cash distributions by the firm, that risk is reflected in more volatile distributions, and that it commands higher average distributions.

The paper is organized as follows. The next section presents the experiment in more detail. Section 3 discusses the data and their sources. Section 4 presents the results of the investigation. We start with a general analysis of value ratios for firms assigned to different size portfolios, discuss the characteristics of these ratios and the implied paybacks and risk premiums, and investigate the relation between value ratios and risk. Finally, we reexamine our findings in a multivariate framework. Section 5 draws the conclusions.

2 Test design

Our experiment compares two investment strategies. The first invests in a portfolio of stocks and the second in a risk-free asset. It is useful to represent the two strategies formally. Let us begin with the stock investment strategy. For simplicity, we start with \$100 at time t and invest everything in one stock (or index). We assume that all cash distributions are made at year-end. At time t+k, the value of the cash flows generated by this strategy reinvested at the risk-free rate will equal:[1]

$$V_{t+k}^{S} = \frac{100}{P_t} \times \left[\sum_{j=1}^{k} \left(d_{t+j} \times \prod_{i=j}^{k-1} \left(1 + R_{t+i+1}^{F} \right) \right) + P_{t+k} \right], \tag{1}$$

where t refers to when we start our investment and

$\frac{100}{P_t}$	=	number of shares of stock purchased with the initial investment of \$100 at time t;
P_t	=	stock price at time t;
d_{t+j}	=	annual cash flow paid per share of stock at the end of year t+j;
R_{t+i}^{F}	=	one-year T-bill rate for year t+i.

[1] To simplify the discussion, we assume there are no stock distributions such as stock dividends and stock splits. Otherwise, we would have to adjust the expression to compute the payouts to the original shares correctly. We drop this assumption in the empirical section.

The cash distributions do not include the possible proceeds from share repurchases. We ignore them because we want to prevent stock price information from affecting the performance of our strategy. The only time stock prices enter our computation is when there is a merger or a restructuring that involves receiving shares in other firms. In that case, we liquidate those shares. We face the same stock-price information problem with rights issues. In that case, we also assume that the investor sells his subscription rights, because otherwise he would have to increase his investment.

Our stock investment strategy is therefore that of a passive investor who buys and holds shares of a particular firm and liquidates all noncash payouts that involve shares in other firms as well as rights to subscribe to additional company shares. There is a potential drawback in this assumption: if firms deliberately replace dividend payments with share repurchases as their preferred way to disburse cash, our investor might never receive any cash. We will keep this problem in mind when interpreting the results. Another limitation is that we ignore taxes, as various shareholders have different tax statuses. Our representative shareholder is tax-exempt.

In comparison, the strategy of investing in the risk-free asset and rolling over that investment every year will generate the following value, V_{t+k}^{F}, k years after portfolio formation:

$$V_{t+k}^{F} = 100 \times \prod_{j=1}^{k} \left(1 + R_{t+j}^{F}\right). \tag{2}$$

If we ignore the terminal stock price in V_{t+k}^{S}, the ratio of the two investment strategies' value equals:

$$VR_{t+k} = \frac{V_{t+k}^{S}}{V_{t+k}^{F}} = \frac{\frac{100}{P_t} \times \sum_{j=1}^{k} \left(d_{t+j} \times \prod_{i=j}^{k-1} \left(1 + R_{t+i+1}^{F}\right) \right)}{100 \times \prod_{j=1}^{k} \left(1 + R_{t+j}^{F}\right)} = \frac{1}{P_t} \times \sum_{j=1}^{k} \frac{d_{t+j}}{\prod_{h=1}^{j} \left(1 + R_{t+h}^{F}\right)}. \tag{3}$$

As one can see from equation (3), whether the stock investment strategy fares better than the risk-free strategy depends on: (a) the stock price at the beginning of the investment strategy: all else being equal, the higher that price, the smaller the number of shares one can buy with the original investment, and therefore the lower the future cash flows; (b) the annual cash payouts: higher payouts increase the relative value of the stock investment strategy; and (c) the risk-free rates: higher rates lower the relative value of the stock investment strategy.

Note that if we start our investment strategies every year and compare them over time intervals longer than one year, we obtain value ratios for overlapping time periods. This is likely to induce serial correlation in these ratios. There is, however, no obvious presumption to believe that value ratios (VR) are a nonstationary time series. The numerator, cash payments per share, is probably nonstationary, but we divide it by the product of two other nonstationary processes, prices and interest rates. We will come back to the issues of serial correlation and stationarity of value ratios in the empirical section.

In the particular case of constant risk-free rates, equation (3) reduces to the following expression:

$$VR_{t+k} = \frac{V^S_{t+k}}{V^F_{t+k}} = \frac{1}{P_t} \times \sum_{j=1}^{k} \frac{d_{t+j}}{\left(1+R^F\right)^j} . \qquad (4)$$

To help interpret value ratios, the following figure performs a simple numerical simulation. The riskless strategy in the simulation assumes a constant risk-free rate, R^F, of 4% on an initial investment of 100. The stock strategy assumes a constant cash-payout yield of 6% on the initial investment, and alternative constant rates of growth, g, of that payout. Figure 1 shows the results. Value ratios converge to given levels of 1.5 and 3 for low g-values (0% and 2%, respectively). In contrast, they grow continuously for higher levels of g (4% and 6%).

It might be easier to think of risk premiums than of value ratios. Risk premiums are defined as the difference between the average return on the stock strategy and the average risk-free rate of return. We measure the average return on the stock strategy as the average annual yield implicit in the value of the stock strategy at the end of a given horizon. The average risk-free rate is the average annual yield implicit in the value of the riskless strategy at the end of the same horizon.

The problem is that the risk premium will eventually converge to zero by construction. The reason is that the value of the stock investment strategy consists of a string of random cash payments reinvested at the risk-free rate. Assuming constant risk-free rates for the sake of the argument, the only risky component is the cash payouts before they occur. Thereafter, the cash flows are known and reinvested at the risk-free rate. The longer the holding period, the greater the importance of the riskless component compared with the risky component of the stock investment strategy. Consequently, the implied return on the stock investment strategy converges to the risk-free rate, and the risk premium converges to zero. Convergence, however, can take many years to become noticeable. Under the assumptions made in Figure 1, it takes about 50 years for the risk premium to begin declining. Figure 2 illustrates this phenomenon. The risk premiums increase to levels positively related to the rate of growth of the cash payouts from the stock investment, reach their maximum about 50 years after the initial investment, and then slowly decline toward zero.

For another perspective on our results, we compute the payback of the stock investment strategy, i.e., the time it takes it to exceed the value of the riskless strategy. We then use equation (3) to test whether the evidence is consistent with semistrong efficient markets. All else being equal, we expect to observe the following regularities:

a) The value ratio of a given portfolio should reach on average, a value larger than one over time. As mentioned above, however, the riskiness of our stock investments declines over time by construction. The value ratio should therefore follow an initially convex path from values below one to values larger than one; eventually, however, the path will become concave, reach a maximum value, and should then decline to a value of one; In the absence of arbitrage opportunities, if stocks were riskless securities, the value ratio would converge to a value of one. Since stocks are risky, however, the value ratio should reach values in excess of one;
b) Riskier stock portfolios should eventually reach larger value ratios than less risky stock portfolios;
c) Riskier stock portfolios should have more volatile value ratios than other portfolios;

d) All else being equal, higher current dividend yields should not necessarily imply higher value ratios over the long-term. Stocks with low current yields are expected to pay enough cash to justify their current prices. But there is no reason to assume that stocks with high current yields will end up paying more than stocks with low current yields.

3 Data

We study the NYSE, the Amex, and the NASDAQ. For these stock markets, CRSP provides detailed information about cash distributions starting as far back as 1926. The sample period covers the years 1926–2002. In interpreting the results, we have to bear in mind that until mid 1962 CRSP covers only NYSE firms; Amex firms are added in mid 1962, and NASDAQ firms at the beginning of 1973. Figure 3 shows the number of firms in our sample over time. We compile all cash distributions that firms make to all of their shareholders. The nature and frequency of these distributions is as follows (we report the CRSP classification):

Cash distributions	*Frequencies*	
	Absolute	*Relative*
Ordinary dividends (semi-annual, quarterly, and monthly cash dividends, special cash dividends, and cash dividends with unknown frequency)	537,626	96.49%
Cash proceeds from exchanges and reorganizations	11,853	2.13%
Liquidating dividends	5,495	0.99%
Subscription rights	2,090	0.37%
Others	133	0.02%
Total	557,197	100.00%

Ordinary dividends are by far the most common form of cash payouts. Of the 557,197 payout events in the sample, 96% are ordinary dividends, 2% are cash proceeds from mergers, takeovers, and other forms of reorganization, 1% are liquidating dividends, and 0.4% are proceeds from the disposal of subscription rights. When exploring the amount of cash these payouts represent, we will notice in the next section that payments other than ordinary dividends are less frequent events but yield proportionally much more cash.

The stock investment strategy we simulate is that of a shareholder who buys and holds, does not increase his stake, and liquidates all participations received in firms other than the original one. In particular, he does not participate in share repurchases.

Moreover, preemptive rights distributions in stock offerings and stock distributions from spinoffs, mergers, and takeovers are valued as of the end of the ex-distribution date and liquidated. Our approach therefore computes all the actual cash payments made by the firm to its long-term stockholders. We thereby limit as much as possible the influence of share prices (and of the expectations they reflect) on these distributions.

Share repurchases surged in the mid-1980s. According to Fama and French (2000), who use the same database, share repurchase average 3.37% and 5.12% of aggregate earnings in 1973–1977 and 1978–1982, respectively. For 1983–1998, repurchases are 31.42% of earnings. From the evidence in Fama and French (2000), the assumption of a passive investor who does not participate in share repurchases especially affects the large firms in our sample, which are the ones that tend to engage in share repurchases. Large firms are also the ones that tend to pay dividends in the first place. We will come back to this issue when interpreting the results.

The risk-free rate of return is the 90-day T-bill rate. Cash payouts are invested in T-bills at the end of the month in which they are distributed. For 769 dividend payments, no payment date is specified on the CRSP tapes. In that case we use the ex-distribution date as a proxy.

Figure 4 presents the aggregate distributions of cash by our sample firms during 1926–2002. We distinguish between ordinary cash dividends and other cash distributions. The figure shows ordinary cash dividends that increase fairly constantly during the sample years. Other cash distributions, in contrast, start out only slightly below the level of ordinary cash dividends and then decline dramatically to about zero in 1941. Thereafter, they grow quickly, surpassing ordinary cash dividend distributions in the mid-1980s. In 2002, they fall back approximately to the level of ordinary cash dividends.

4 Results

In presenting our results, we begin with a general analysis of value ratios for firms assigned to different portfolios on the basis of their size. For simplicity, we initially ignore the problem of serial correlation in these ratios. Second, we study the statistical properties of the value ratios, looking in particular for a relation between value ratios and risk, and taking into account serial correlation. Third, we reexamine our conclusions in a multivariate test.

4.1 General considerations

4.1.1 Value Ratios

Table 1 shows the initial results of our experiment. We rank firms by market capitalization and assign them to ten portfolios in descending order. Portfolio 1 includes the largest firms, portfolio 10 the smallest ones. We form the first portfolios at the beginning of 1926. For each of the ten portfolios, we compute the equally weighted average of the cash payouts each individual stock in the portfolio yields during the following years. Portfolio composition remains the same. Stocks of firms that are taken over or liquidated make a last payment associated with that event and drop out of the portfolio (the firms in question maintain their weight in the portfolio but make no subsequent cash payments). All the cash payouts are invested at the risk-free rate. The resulting cumulated value of these payouts measures the value of an investment in stocks in the portfolio over time. Alternatively, we invest the same initial amount of money in the risk-free asset in 1926 and renew that investment during the subsequent years. The resulting value defines the value of an investment in the risk-free asset over time. At given points in time, namely 8, 15, 20, and 30 years after 1926, we then compute value ratios by dividing the cumulated value of the payoffs from the stock investment by the value of the risk-free investment. We compute these ratios for each portfolio.

In 1927, we start a new round of investments in the various size portfolios and the risk-free asset. Again, for each portfolio, we compute value ratios 8, 15, 20, and 30 years thereafter. In 1928, we start yet another round of investments. We repeat this procedure until the end of the sample period. We refer to value ratios by the variable VR. To identify these ratios by the time elapsed since the underlying portfolios were formed, we add the corresponding numeral—VR8 therefore denotes value ratios eight years after portfolio formation, VR15 value ratios 15 years after portfolio formation, etc. The last value ratios observed in the year 2002 refer to portfolios formed in 1995 (VR8), 1988 (VR15), 1983 (VR20), and 1973 (VR30).

The various panels of Table 1 provide descriptive statistics for the value ratios of different size portfolios and investment horizons. For ease of interpretation, the last column in each panel reports the relative size of each portfolio, computed by dividing the average market capitalization of firms in a particular portfolio by the average market capitalization of firms in portfolio 1. The average is computed over the full sample period of 1926–2002.

Panel A refers to value ratios observed eight years after portfolio formation. As explained above, we form the first portfolios at the beginning of 1926 and consequently observe the first VR8s at the end of 1933. From then until 2002, there are 69 additional VR8 values we can observe for each size portfolio, for a total of 70 VR8s for each portfolio. The median VR8s are between 0.497 (for portfolio 1) and 0.682 (for portfolio 8). In other words, eight years after the investment in a portfolio of stocks, its compounded payouts have increased to a value between one half and three quarters of the (compounded) initial investment. By and large, smaller size portfolios appear to grow faster than larger size portfolios, except for the two portfolios containing the smallest firms. Portfolio 9 consists of firms that are 0.6% the value of those in the largest size portfolio; portfolio 10 includes firms that are even smaller than that, namely 0.2% the value of the firms in the largest size portfolio. These could be young firms that originally paid little cash and have therefore fallen behind in cash payouts compared with other firms. Of course, if the capital market is efficient, this latter effect should only be temporary.

Panel B shows descriptive statistics for value ratios 15 years after inception (VR15). Since we observe the first VR15s in 1940 and the last in 2002, there are 63 observations we can make for each portfolio. The median value ratios have almost doubled from what they were seven years before and lie between 0.988 and 1.202. With the exception of the largest-size portfolio, they all exceed a value of one. It therefore takes fewer than 15 years for an investment in one of the size portfolios to generate sufficient cash to justify the initial outlay (remember that we ignore the possible proceeds from the sale of the stocks). We will come back later to the payback of a stock investment. The table confirms that value ratios decrease with firm size, except for the portfolios with the smallest firms. The spread between the minimum and the maximum values and the standard deviation of VR15 also decrease with firm size. Portfolio 1, in particular, has a minimum VR15 of 0.367 and a maximum of 1.672 with a standard deviation of 0.333. In comparison, portfolio 10 has a minimum of 0.182 and a maximum of 5.593 with a standard deviation of 0.957.

Overall, with the exception of portfolio 10, portfolios of smaller firms are characterized by more volatile VR15s than other portfolios. They also seem to command larger average value ratios, possibly because of higher risk. Figure 5 provides details about the aggregate frequency distribution of VR15. The median exceeds one, and that the distribution is right-skewed.

Going back to Table 1, we see that Panel C refers to the value ratio 20 years after portfolio formation (VR20). Value ratios have grown further. Not only are all medians larger than one, all first quartiles of the distributions are larger than one as well (the first two portfolios are the exception). Furthermore, all third quartiles exceed two (with the exception, once again, of the first two portfolios). The inverse relation between VR20 and firm size appears to be more pronounced, both for the measures of central tendency and for dispersion.

These relations can be confirmed by looking at the distribution characteristics of VR30 in Panel D. All average values are larger than two, the medians are larger than two (except for portfolios 1 and 10), the first quartiles are larger than one, and the third quartiles are above three (except for portfolio 1). The standard deviation and the range of VR30 have also increased in comparison with those reported for VR20. Smaller firms have greater average and median VR30s than larger firms. They also have more volatile VR30s.

Overall, Table 1 appears to roughly support the predictions we made under the assumption of semistrong efficient capital markets. Value ratios grow to values larger than one over time. And riskier stocks, assuming we can proxy risk by firm size, reach greater value ratios than other stocks over time. In what follows, we will try to calibrate these conclusions. In particular, we need to establish whether these relations are statistically significant and address the issue of risk more explicitly. Before we do so, however, we want to know more about the general characteristics of value ratios, such as the nature of the cash payouts they represent, the payback they imply, the risk premiums they imply, and the importance of current dividend payments as a predictor of future cash payouts. We begin with an analysis of the various forms of cash payouts that make up the value ratios.

4.1.2 Value ratios and cash payout types

Table 2 pursues this question by studying value ratios 15 years after portfolio creation. Panel A refers to the full sample; Panel B covers portfolios created before the 1973 inclusion of NASDAQ on the CRSP tapes; and Panel C comprises portfolios created in 1973–2002. Let us look at the overall sample first. Column (3) reports the average number of stocks in the various size portfolios at the end of the investment horizon as a proportion of the original number of stocks. The number of surviving companies declines rapidly and continuously from the 86% for the largest-size portfolio down to 41% for the smallest-size portfolio, consistent with the claim that smaller firms are riskier. Column (4) shows that ordinary dividends also decline across size portfolios, although they always represent at least 94% of all payout events. Column (5), however, documents that ordinary dividends comprise 79% of the total value of the stock strategy for size portfolio 1 and only 41% for portfolio 10. Hence, small companies pay cash dividends less frequently and are more likely to disappear because of either liquidation or takeover.

A comparison of Panels B and C buttresses the observations reported in Fama and French (2000) and DeAngelo, DeAngelo, and Skinner (2004): the monetary importance of ordinary dividends declines in portfolios that are formed after 1973, whereas that of other forms of cash distributions increases dramatically. The value of cash disbursed as ordinary dividends in the largest-size portfolio, for instance, is down to 49%, and the one in the smallest-size portfolio is only 10%. The average VR15s are, if anything, larger during these years. Hence, shareholders do receive cash, but less and less in the form of ordinary dividends. These observations could be due to a change in the sample composition of firms after 1973, when NASDAQ companies are added to the CRSP tapes. Presumably, NASDAQ companies are liquidated or taken over more often than other firms on the CRSP tapes. NASDAQ firms probably also tend to pay ordinary dividends less often than other firms.

Whether indeed there is a time effect in value ratios is an issue better left to our multivariate analysis. Before turning to that, however, we want to examine the general characteristics of value ratios further. The one we turn to next is payback—the time it takes a stock investment to pay for the initial outlay.

4.1.3 Payback

The question of a stock investment's payback is addressed in Table 3. The median payback is slower for larger firms than for smaller ones: it equals about 15 years in portfolio 1 compared with about 11 years in portfolio 9. Portfolio 10 does not quite fit this pattern, since it has a faster payback than portfolio 1 (about 14 compared with 15 years), but a slower payback than portfolio 9 (about 14 compared with 11 years). The payback's standard deviation is highest at the extremes of portfolio size, and more or less the same for portfolios in between.

A potential problem with these figures is truncation, which arises because the sample period is finite. To reduce the problem, Table 3 stops establishing new portfolios in 1988, 15 years shy of the end of the sample period (the median VR15 exceeds one for almost all size portfolios). Even so, there is a residual, albeit minor, truncation problem. We are unable to observe a payback in the following 25 cases:

Year of portfolio formation	*Number of portfolios without payback*
1968	3
1969	6
1984	2
1985	2
1986	5
1987	4
1988	3
Total	25

Most portfolios (16) that have not paid off yet have been created fairly recently, namely in the 1980s. Still, nine portfolios we set up in the late 1960s have experienced the same problem. As shown below, the portfolios that are comparatively less likely to pay off are the ones comprising smaller firms:

Size portfolios	*Number of observations without payback*
4	1
6	2
7	4
8	4
9	7
10	7
Total	25

In particular, in seven instances both portfolios 9 and 10 have not generated sufficient cash to beat the riskless investment. A look at the last column in the table shows, however, that this compares with 57 and, 58 instances in which they have. The truncation problem is significantly smaller in all the remaining size portfolios. As these numbers suggest, truncation might have some influence on the average but not on the median payback values we compute. We therefore can use the median payback figures in Table 3 as representative of the payback of an investment in stocks.

4.1.4 Risk premiums

The third aspect of our preliminary analysis is the risk premiums implied by the value ratios. As mentioned in Section 2, risk premiums measure the arithmetic difference between the yield implied by the cumulated, compounded cash payouts generated by a given size portfolio at a certain date and the yield implied by the compounded value of the riskless investment on that date. We obtain the same results when defining the risk premium as the geometric difference between the two yields in question (i.e., as the ratio of one plus the equity yield divided by one plus the riskless yield). Since inflation adjustment does not affect the geometric risk premium, this result shows that there is essentially no difference between the nominal and the real risk premium either.

Table 4 computes the risk premiums associated with the value ratios shown in Table 1 15 and 30 years after portfolio creation. Panel A shows the results for a 15-year investment horizon. Value ratios greater than one imply risk premiums larger than zero. It is therefore not surprising that all the median excess returns are larger than zero (except for portfolio 1), since we know from Table 1 that all the respective value ratios are larger than one (except for portfolio 1). Table 4, however, can help us better assess the economic significance of the value ratios. Accordingly, all portfolios except for the first three and the last ones have a median yield on their stock investments that is 100 basis points above the risk-free rate. Moreover, whereas all first quartiles of the sample distributions have negative risk premiums, the third quartiles are often 300 or 400 basis points above the risk-free rate. There is no monotone relation between risk premiums and firm size, however, a puzzling result if firm size is a proxy for risk. Since size could be a proxy for different variables, this impression will have to be confirmed by a multivariate analysis.

We do not show this in a separate table, but we also find that 20 years after portfolio inception, all risk premiums are positive and all exceed 100 basis points except for the median of portfolio 10.

To shed additional light on the risk premium issue, we repeated the analysis by ranking all firms on the basis of CAPM-beta and grouping them into ten portfolios in descending order (not shown). CAPM-betas are computed with a market model using the 48 monthly observations preceding a particular year (we require a minimum of 36 observations). The market index is the equally weighted CRSP index. When performing the analysis with a 15-year investment horizon, we obtain qualitatively the same results as those reported in Panel A of the table. There is a rough positive relation between risk and risk premiums (except for the last portfolio).

The risk premiums observed in Panel A appear to be low. It would seem that 100 basis points, even for the riskiest portfolios, is probably too small a premium to compensate for the risk in question. The problem is that we ignore the stock price at the end of the investment horizon and therefore impart downward bias to our estimates. The bias should decrease if we extended the investment horizon. Panels B, C, and D confirm this conjecture. Panel B replicates the analysis for a 30-year investment horizon for the full sample period of 1926–2002. The first portfolios are formed in 1926 and discontinued 30 years later in 1955. The last portfolios are formed in 1973 and discontinued in the year 2002. According to the results, the median risk premium is between 180 and 370 basis points. Across the full sample, the median risk premium is 275 basis points (not shown), which is similar to the 345 basis points estimated in Fama and French (2002) for 1872–2000. As in that study, the risk premium appears to decline over time. Panel C of the table shows that, for 30-year portfolios formed between 1926 and 1950, median premiums are between 370 and 515 basis points, for an overall median premium of 450 basis points (not shown). In comparison, for 30-year portfolios formed between 1951 and 1973, we observe median premiums between 80 and 210 basis points, for an overall median of 175 basis points (not shown). Fama and French (2002) estimate a premium of 417 basis points for 1872–1950, and 255 basis points for 1951–2000. In making these comparisons, however, bear in mind that our stock investment strategy assumes reinvestment at the risk-free rate. Consequently, our portfolios are less risky than actual equity investments, and the risk declines as the proportion of riskless cash invested in each portfolio grows.

4.1.5 Current dividend payers vs. nonpayers

The last aspect of general relevance we want to address is whether firms that pay dividends at the start of the investment yield higher value ratios than firms that do not pay dividends. In principle, there should be no difference. Most firms that currently do not pay dividends will eventually pay out cash, and investors should be able to price them correctly on average. Our omission of share repurchases, however, might affect the results, although it might penalize firms that pay dividends in the first place—as mentioned above, Fama and French (2000) find that larger firms tend to both pay dividends *and* repurchase shares.

Table 5 computes the value ratios of two portfolios of firms at different horizons: those that pay dividends at the time of portfolio creation and those that do not. Panel A refers to the former, and Panel B to the latter. According to this evidence, nonpayers never quite catch up with payers, except when we look out at horizons of 25 and 30 years. In those cases, nonpayers have slightly larger value ratios, at least judged on the basis of average and third quartile. For all other horizons, nonpayers have lower value ratios. For instance, they have a median VR15 of 1.255 compared with only 0.798 for nonpayers. Since we are not controlling for other determinants of value ratios, we have to take this result with a grain of salt and wait for the multivariate analysis to draw general conclusions. In addition to having lower measures of central tendency, the value ratios of nonpayers also have higher standard deviations and value ranges. Their standard deviations of VR15 and VR20, for instance, are almost twice the size observed for payers.

4.2 Value ratios and risk

4.2.1 Gauging statistical significance

So far, we have simply presented value ratios for various portfolios without making any statements about statistical significance. The purpose of this section is to fill that gap. As explained in Section 2, there is no compelling a priori reason to believe that value ratios are a nonstationary time series. Figure 6 with its plots of value ratios against time for the portfolios of size 1, 5, and 10 seems to confirm this conjecture. The figure focuses on the variable VR15. All three plots seem to be fairly mean-stationary processes, as they take trips away from their means but come back to them repeatedly. The plots also show that the VR15s of portfolios of smaller firms are more volatile than those of larger firms. The portfolios not displayed in the figure follow similar patterns.

As pointed out above, there is, however, a presumption that value ratios are serially correlated. We form portfolios on an annual basis. Hence, we have overlapping investment horizons, which could induce serial correlation. Table 6 shows that the VR15s of our size portfolios are indeed highly correlated, although they do not seem to necessarily follow the same stochastic processes. This should not come as a surprise, since the various size portfolios generate different kinds of cash payouts. Whereas most of the payouts of the first three portfolios are ordinary dividends, those of other portfolios, particularly the last three, are not. The first three portfolios have significant, declining correlation coefficients at all five reported lags (portfolio 3 might be the exception). This suggests a first-order autoregressive process. In contrast, the remaining portfolios display correlation coefficients that are significantly different from zero and sizable at the first three lags only (portfolio 10 could be the exception). Taken at face value, this is inconsistent with a first-order autoregressive process. Whatever the processes the value ratios follow, we base the significance tests on a Newey-West autocorrelation consistent covariance estimator approach.

4.2.2 Assessing the impact of risk

Table 7 performs significance tests for the value ratios 15 years after portfolio formation (VR15). Panel A compares value ratios across size portfolios. Column (2) lists the average value ratios for each portfolio. Column (3) compares all portfolios with portfolio 1, and column (4) compares each successive pair of portfolios. The test statistics are computed as follows. To test the difference of the average VR15s observed in the first and second portfolio, for instance, we compute that difference in each sample year, regress it against a constant, and estimate the regression standard error with a Newey-West procedure. We use that estimate to test whether the regression intercept is significantly different from zero.

All value ratios exceed the ratio reported for portfolio 1 with confidence 0.95 or better. As shown in the comparisons in column (4), the value ratios of portfolios 2, 3, and 4 are significantly greater than those observed in the preceding size portfolios. The remaining portfolios, however, have VR15s that do not differ significantly from that of the preceding portfolio. In fact, portfolio 10 has a significantly smaller VR15 than portfolio 9.

On the whole, assuming firm size is a proxy for risk, our significance tests confirm a rough direct relation between risk and value ratios, yet a discontinuous one. The last size portfolio is clearly not the one with the highest value ratio, and other portfolios of small firms have only insignificantly higher value ratios than portfolios of larger firms. To investigate this issue more directly, we repeat the analysis by forming portfolios on the basis of CAPM-beta. The results are reported in Panel B of the table. Our findings indicate a concave relation between average value ratios and CAPM-betas. Portfolios are ranked according to beta in decreasing order. Portfolio 1 includes firms with the highest beta, and portfolio 10 those with the lowest beta. The average value ratios start at 1.251 in the highest-beta portfolio, increase to a maximum of 1.415 for the stocks in portfolio 4, and then decline to 1.071 in the lowest-beta portfolio. Consequently, we cannot detect any positive relation between value ratios and risk. On the contrary, the first five or six portfolios have larger value ratios than the portfolio with the highest risk. To reach more definite conclusions, we will have to reexamine this issue in a multivariate context.

4.2.3 Risk and the importance of omitting terminal stock prices

We analyze the cash flows actually paid out by firms to their shareholders and compare the value of those payouts with the shareholder's initial investment. In doing so, we ignore the share prices at the end of the investment period. In computing VR15, for instance, we disregard the amount of money the shareholder would receive if he sold the stocks in his portfolio 15 years after establishing it. The rationale is that we want to measure the cash the firm pays to its shareholders, rather that the cash shareholders may receive from selling their stocks. The latter cash reflects investors' expectations and might not be justified by subsequent payments by the firm.

Table 8 examines the importance of omitting the terminal stock price in computing our value ratios. We perform the analysis for two sets of portfolios. Panel

A assigns firms to portfolios on the basis of firm size. Panel B does the same on the basis of stock return volatility (return standard deviation). Because of skewness, we focus on median values. Column (2) in both panels shows what value VR15 would have if we included the stock prices 15 years after portfolio formation. Terminal portfolio prices are equally weighted average stock prices, with weights equal to those established at the time of portfolio creation. Firms that drop out of the sample during the 15 years in question are assigned a zero price. For comparison, column (3) in both panels lists the values for VR15 observed in Table 1.

Panel A shows that, with the inclusion of terminal stock prices, VR15 is about four times as large as the value we observe without that inclusion in either panel. Again, however, the value ratios do not increase monotonically with firm size or return volatility. The relation between value ratios and risk is moderately concave in both panels. For the size portfolios, it starts from a value of 4.707 for portfolio 1 and ends at a value of 3.897 for portfolio 10. This finding is puzzling if we assume that firm size is a proxy for risk.

Panel B looks at risk more directly and documents that there is indeed a puzzle. Value ratios do not correlate positively with return volatility. The value ratios start at 0.874 for the portfolio with the highest risk, increase to a maximum of 1.308 for portfolio 6, and then fall back to 1.129 for the portfolio with the lowest risk. We obtain the same results when we form portfolios on the basis of CAPM-beta.

To assess the importance of terminal stock prices, column (4) in both panels divides terminal stock prices by the aggregate value of investing in a portfolio, reinvesting the associated cash flows at the risk-free rate, and liquidating the stocks 15 years later. According to the numbers in Panel A, that fraction goes down continuously from a median 95% for portfolio 1 to a median 76% for portfolio 9—portfolio 10 with its median 91% fraction fails again to fit the regularity observed for the remaining portfolios.

To gauge whether these figures make economic sense, we perform yet another simulation. Let’s assume the risk-free rate was 4% (the average risk-free rate during the sample period is 3.8%) and the representative firm paid a dividend that grew at a constant annual rate of 7.3%, the historical average rate of growth during the sample period. Suppose we bought shares of this representative firm and reinvested all dividend payments at the risk-free rate. How large would the share price be as a fraction of the (cum-price) value of this portfolio at the end of the investment horizon? The results are shown in Figure 7 for holding periods between 1 and 25 years and for different risk levels. Based on the 345 basis points premium reported in Fama and French (2002), we choose discount rates between 8% and 12%. As one can see, the fraction in question is a negative function of the discount rate we use, and therefore of the implicit risk we assume. At a discount rate of 8%, the fraction would equal about 97% after 15 years; at a discount rate of 12%, it would equal about 65%. That corresponds roughly to the numbers we obtain in Panel A of the table.

When we look at Panel B of Table 8, however, we find no sizable relation between the importance of terminal stock price and risk, contrary to what our simulation suggests. Risk is measured by return volatility. The numbers reveal no palpable relation. That conclusion remains even if we compare portfolios at the opposite ends of the risk range. The stock price represents 89% of the all-inclusive stock investment strategy value for the highest-risk portfolio and 92% for the lowest-risk portfolio.

4.3 Multivariate analysis

The preceding two sections have described general characteristics of the value ratios for different investment portfolios, including the impact of increasing investment horizons, and the relation with firm size and risk. The analysis is bivariate and therefore ambiguous, since some of the possible determinants of value ratios might be proxies for each other. As we mentioned, firm size, return volatility, CAPM-beta, and dividend yield could all measure risk. The purpose of this section is to examine these and other relations in a multivariate context. Specifically, we want to test the propositions that average value ratios:

a) Increase with risk. We measure risk alternatively as CAPM-beta and standard deviation of return;
b) Decrease with firm size. One possible justification is that firm size is a better proxy for risk than CAPM-beta or standard deviation of return;
c) Change over time. Time effects could occur because of different sample composition after 1973, the year CRSP adds NASDAQ companies to its tapes.

We focus again on the ratio VR15 and estimate the following regression:

$$VR15_{i,t} = \alpha_0 + \alpha_1 \times VOLA_{i,t} + \alpha_2 \times LNSIZE_{i,t} + \alpha_3 \times D\text{-}SIZE1_{i,t} + \alpha_4 \times D\text{-}SIZE10_{i,t} + \alpha_5 \times D\text{-}TIME_{i,t} + \alpha_6 \times DY_{i,t} + \alpha_7 \times D\text{-}DIV_{i,t} + \varepsilon_{i,t}, \qquad (5)$$

where the subscript i refers to a given size portfolio, the subscript t to the year in which we observe the VR15 in question, and $\varepsilon_{i,t}$ is an error term. ‹D› in front of a variable labels it as a binary variable equal to 1 if a certain condition applies, and equal to zero otherwise. We also estimate the regression equation with two alternative dependent variables, the natural logarithm of VR15 and payback. Descriptive statistics concerning the regression arguments are shown in Table 9. Variable definitions and the expected sign of their coefficients are as follows:

Variable	*Definition*	*Expected sign of the coefficient*
VOLA	Average stock return standard deviation of the firms in size portfolio i at the end of year t. Stock return standard deviations are computed using the 48 monthly observations preceding and including the end-of-year month in question (we require a minimum of 36 observations);	+
BETA	Average stock return CAPM-beta of the firms in size portfolio i at the end of year t. Stock return standard deviations are computed using the 48 monthly observations preceding and including the end-of-year month in question (we require a minimum of 36 observations). The market index is the equally weighted CRSP index;	+
VOLA	Average stock return standard deviation of the firms in size portfolio i at the end of year t. Stock return standard deviations are computed using the 48 monthly observations preceding and including the end-of-year month in question (we require a minimum of 36 observations);	+
LNSIZE	Natural logarithm of the average market value of equity of the firms in size portfolio i at the end of year t;	–
D-SIZE1	Binary variable equal to one if the value ratio refers to the largest-size portfolio, and equal to zero otherwise. The rationale for this inclusion is that the largest firms could fit a different pattern than other firms;	?
D-SIZE10	Binary variable equal to one if the value ratio refers to the smallest-size portfolio, and equal to zero otherwise. The rationale for this inclusion is that firms in the smallest size portfolio seem to follow different regularities than other firms;	?
D-TIME	Binary variable equal to one if the calendar year is 1973 or later, and equal to zero otherwise;	?
DY	Average dividend yield of the firms in a given size portfolio in a particular year. Dividend yield is defined as cash dividends paid during the year divided by stock price at year end;	?
D-DIV	Binary variable equal to one if the majority of firms in a given size portfolio pay cash dividends, and equal to zero otherwise.	?

The regression is a pooled cross-section time-series regression. We estimate it with a Prais-Winsten approach with panel-corrected standard errors, as specified in the Stata software.[2] The panels are the size portfolios. In implementing the approach, we assume that disturbances have different standard deviations across panels (heteroscedasticity across panels). That means, the regression residuals of the various size portfolios are allowed to have different standard errors. Also, we assume that the disturbances are contemporaneously correlated across panels, and that the disturbances of any one panel are serially correlated of order one. In other words, the regression residuals of the various size portfolios are allowed to be correlated across portfolios and over time.

The regression estimates are presented in Table 10. Column (1) refers to the regression specification in equation (5) using return volatility (VOLA) as a measure of investment risk. With 50%, this regression specification has fairly large explanatory power. The coefficient of VOLA is positive but only marginally significant at best. In contrast, firm size (LNSIZE) has a negative and significant coefficient with confidence better than 0.99, consistent with what we predicted under the assumption that firm size is a better proxy for risk than return volatility. The coefficients of the two binary variables D-SIZE1 and D-SIZE10 show that the risk-value-ratio relation is nonlinear. In particular, very large firms have a higher value ratio than indicated by that relation, and very small firms have a lower ratio.

In addition to these relations, the binary variable D-TIME suggests that the last three decades of the sample period yield value ratios that are unusually large (the coefficient of D-TIME is positive and significant with confidence 0.99). There is therefore no evidence that firms have reduced their aggregate cash payouts in recent years [according to Fama and French (2000) and DeAngelo, DeAngelo, and Skinner (2004), however, they do seem to have reduced their ordinary dividend payments].

Finally, the variables D-DIV and DY gauge the importance of ordinary dividend payments as possible determinants of value ratios. As pointed out above, D-DIV simply measures whether the majority of firms in a given size portfolio pay ordinary dividends; in contrast, DY measures the average ordinary dividend yield the year a

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2 StataCorp. 2003. Stata Statistical Software: Release 8.0. College Station, TX: Stata Corporation.

particular size portfolio was put together. Both variables have positive coefficients, although only DY has a coefficient that is statistically significant at customary levels. This significance suggests that the stock investment payoffs of firms with a lower ordinary dividend yield the year a particular portfolio is formed do not catch up with the payoffs of firms that pay a higher ordinary dividend yield from the start. This is contrary to what we would expect to happen in efficient markets. We are looking, however, only at the first 15 years after portfolio formation. Table 5 seems to suggest that this dividend yield effect could disappear if we look at longer investment horizons. In fact, when we repeat the analysis with value ratios estimated over longer horizons, the effect does not go away.

Column (2) of the table repeats the estimation by replacing return volatility with CAPM-beta as a direct risk measure. The new variable has a coefficient that is insignificantly different from zero at conventional levels of confidence. The remaining results are fully in line with what we observe with the preceding specification. The explanatory power of the regression is almost unchanged—44% versus the 50% we have in column (1).

In column (3), we explore whether a nonlinear specification yields better results than the one used so far. We therefore replace the dependent variable with its natural logarithm. Under this specification, all the regression coefficients turn out to be significant at conventional levels or better. In particular, both the direct measure of risk, VOLA, and the variable that identifies firms that pay ordinary dividends, D-DIV, have a positive and significant coefficient. The explanatory power of this regression, however, is lower than that obtained under the linear regression specification in the two preceding columns.

Finally, column (4) reports the estimation results of a regression specification in which we replace the dependent variable with the natural logarithm of payback. There are three things to remember. First, the investment horizon is generally shorter than 15 years. Second, as explained in the section on payback, there is a truncation problem, although we believe it is not a serious one. And third, consistency with the coefficients observed in the preceding three columns requires regression coefficients of the opposite sign here. For instance, since higher risk (VOLA) seems to induce higher VR15s, it should also lead to shorter payback. As it turns out, the results meet this condition. All the regression coefficients are significant with confidence of at least 0.95, and all have the opposite sign from that observed for the same variables in columns (1) to (3). Risk (VOLA) reduces payback; firm size (LNSIZE) increases it (except for the very largest firms); the past three decades are characterized by shorter payback; and the existence and size of a dividend yield reduces payback. This regression specification appears to have the highest explanatory power, namely 80% of the variation of the dependent variable.

For completeness, Table 11 replicates these regressions using the risk premiums as the dependent variable. We investigate the premiums implicit in the performance analysis over a 30-year investment horizon. Since average value ratios increase over that period, it would seem that shorter investment horizons would not yield meaningful measures of the risk premiums. The specifications presented in the table are the same as those discussed in the first two columns of Table 10 with regard to VR15. The results are very similar. In column (1), the explicit measure for risk is the standard deviation of return, which is positive and significant with confidence better than 0.99. Higher risk therefore appears to lead to higher risk premiums. Furthermore, except for the binary variable that identifies the years after 1972, all the other variables also have significant coefficients with confidence 0.99 or better. In particular, higher firm size (LNSIZE) reduces the risk premiums, whereas the payment of dividends at the time of portfolio formation (D-DIV) and the dividend yield itself at that time boost them. In column (2), we replace return volatility with CAPM-beta as the direct measure of risk. This specification yields the same results as the preceding column, except for the risk measure itself. Contrary to what one would expect, the coefficient of BETA is negative and significant with confidence better than 0.99. Firm size, however, maintains a positive and highly significant coefficient. And firms size could be a proxy for risk. Overall, risk premiums behave in a matter that is broadly consistent with market efficiency: they increase with risk. Their positive correlation with the dividend yield and the behavior of the portfolios at the extremes of the distribution of firm size, however, are hard to reconcile with market efficiency.

A final question we want to address is the decline in risk premiums reported in Fama and French (2002) during the second half of the last century. We observed a similar decline in Table 4: the median risk premium for 30-year portfolios formed between 1926 and 1950 is 450 basis points, whereas for similar portfolios formed between 1951 and 1973 it is 175 basis points. When we try to confirm this result with our regression by inserting a binary variable to identify portfolios formed after 1951, we obtain an insignificant coefficient. We come to the same conclusion when we replace that binary variable with a time trend. Consequently, there is no calendar time effect in our measures of risk premiums, which means that the observed decline in risk premiums has to be the consequence of one of the variables included in the regression.

As it turns out, return volatility falls from an average 14% in the 1926–1950 period to an average 8% between 1951 and 2002. This decline, combined with the positive coefficient of the variable VOLA, could therefore have induced the historical decrease in risk premiums. Overall firm size changes could also have been responsible for that decrease. The natural logarithm of firm size increases from 9.5 in 1926–2002 to 11.0 in 1951–2002 on average. Because of the positive coefficient of the variable LNSIZE, this increase in firm size could have led to the drop in risk premiums. Taken at face value, this would mean that risk premiums have fallen because of a contemporaneous fall in risk itself (measured alternatively with return variance and firm size). But firm size correlates not only with risk but also with market liquidity (Loderer and Roth, 2004). The reduction in risk premiums could therefore have been brought about by a contemporaneous improvement in market liquidity, consistent with a conjecture in Dimson, Marsh, and Staunton (2002). Of course, lower risk and improved market liquidity might have been at work simultaneously.

5 Conclusions

The purpose of this study is to find out whether the cash payouts received by shareholders justify the prices they pay. Our hypothetical shareholder is a buy-and-hold investor. He does not increase his stake in the companies he invests in, does not participate in discretionary share repurchases, and liquidates all rights issues and stock dividends he receives. We reinvest these cash flows at the risk-free rate and ask whether their cumulated value is higher than the price paid for the stocks (compounded at the risk-free rate).

Over a 15-year horizon, ordinary dividends represent between 94% and 99% of all payout events during the sample period of 1926–2002. In terms of money paid out, however, ordinary dividends are between 41% and 79% of all aggregate cash distributions during the same horizon, depending on the size portfolio. The importance of ordinary dividends as a means of cash distribution has fallen during the past three decades to a level between 10% and 49%, depending on the portfolio. We ignore stock prices at the end of the investment horizon, even though they would increase the value of a stock investment by about 400%.

Value ratios increase over time and are highly correlated from one year to the next. Median investment payback is 12 years. After 20 years, more than 75% of the value ratios of all portfolios exceed one. Over a 30-year investment horizon, the median equity risk premium implied by our computations is about 275 basis points, similar to the 345 basis points reported in Fama and French (2002) for 1872–2000. The risk premium appears to decline over time. For portfolios formed between 1926 and 1950, it equals 450 basis points; for portfolios formed between 1951 and 1973, it equals 175 basis points. Our results suggest this decline reflects a contemporaneous drop in risk and/or an improvement in market liquidity.

A multivariate analysis that controls for cross-sectional correlation in the residuals across portfolios and over time, and which allows for heteroscedasticity in the residuals of each portfolio, shows that value ratios are unrelated to CAPM-beta and positively correlated with stock return volatility. They are also inversely related to firm size, except for the largest firms (which tend to have higher value ratios) and the smallest firms (which tend to have particularly low value ratios). As indicated by the volatility of value ratios, firm size could be a proxy for investment risk. We also find that higher ordinary dividend yields tend to induce higher value ratios, and that the last three decades have yielded higher value ratios as well.

By and large, value ratios seem to meet the basic requirements of informationally efficient markets. They grow over time to values greater than one, and they increase with risk (especially if we are willing to consider firm size as a proxy for risk; not so if we limit our risk measures to CAPM-beta). Three observations, however, are inconsistent with market efficiency. First, very large firms have abnormally large value ratios. Second, very small firms have abnormally small value ratios. Third, firms with higher ordinary dividend yields at the start of the investment do better than firms with lower yields.

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Figure 1

Simulated value ratios over time

The figure shows the results of a simple numerical simulation. We compute the ratio of the value of the stock investment strategy (ignoring the terminal stock prices),

$$V^{S}_{t+k} = \frac{100}{P_t} \times \left[\sum_{j=1}^{k} \left(d_{t+j} \times \prod_{i=j}^{k-1} \left(1 + R^{F}_{t+i+1}\right) \right) + P_{t+k} \right], \qquad \text{(equation 1 in the text)}$$

divided by the value of the riskless investment strategy,

$$V^{F}_{t+k} = 100 \times \prod_{j=1}^{k} \left(1 + R^{F}_{t+j}\right) \qquad \text{(equation 2 in the text)}$$

under simplified assumptions. The stock investment strategy invests in one share of stock worth \$100 with a cash payout yield of 6% (on the initial investment) that grows at constant rates of 0%, 2%, 4%, and 6%, respectively. Cash payouts are reinvested at a constant risk-free rate of 4%. The riskless investment strategy assumes an initial investment of \$100 at the constant risk-free rate of 4%.

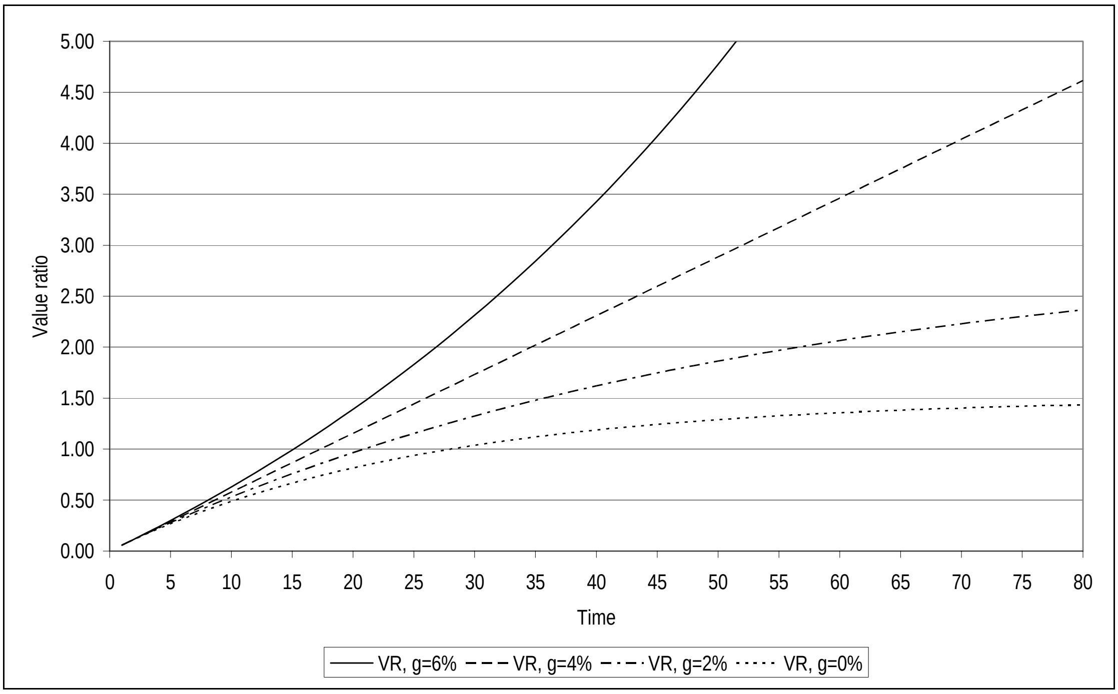

Figure 2

Simulated risk premiums over time

The figure shows the results of a simple numerical simulation. We compute the value of the stock investment strategy (ignoring the terminal stock prices),

$$V^S_{t+k} = \frac{100}{P_t} \times \left[\sum_{j=1}^{k} \left(d_{t+j} \times \prod_{i=j}^{k-1} \left(1 + R^F_{t+i+1}\right) \right) + P_{t+k} \right] \qquad \text{(equation 1 in the text)}$$

under the same simplified assumptions as in Figure 1, namely an investment in one share of stock worth $100 with a cash-payout yield of 6% (on the initial investment) that grows at constant rates of 0%, 2%, 4%, and 6%, respectively. Cash payouts are reinvested at a constant risk-free rate of 4%. We use the value of this investment strategy in year k to compute the implicit yield on the initial investment. The difference between this yield and the 4% risk-free rate is the risk premium shown in the figure.

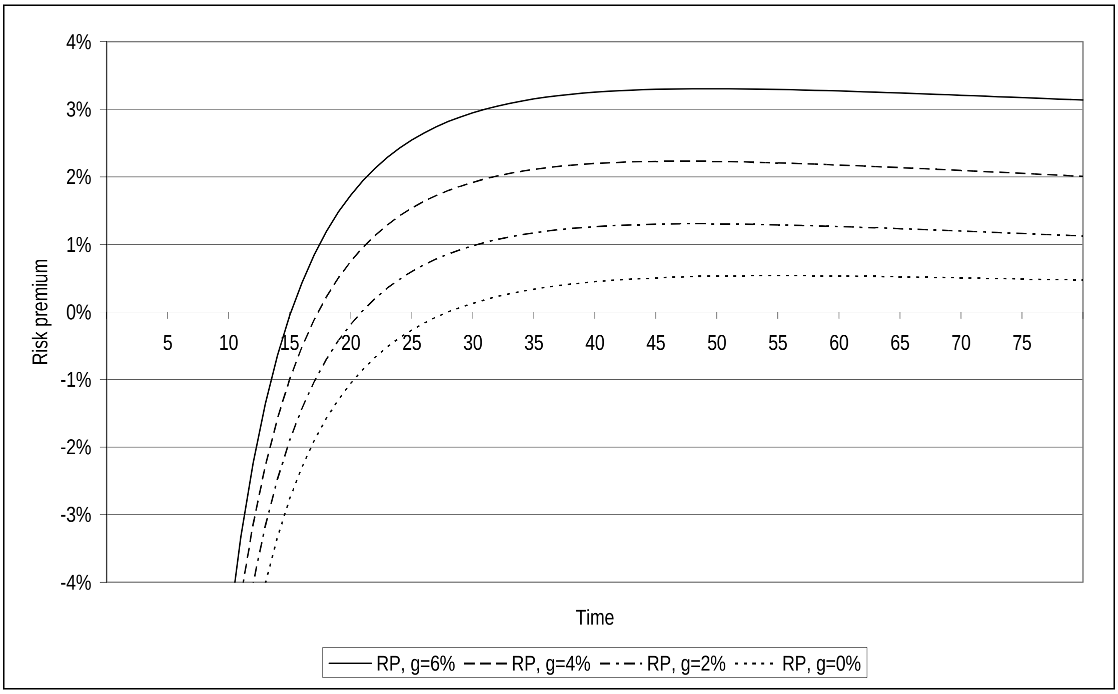

Figure 3

Aggregate number of sample companies over time

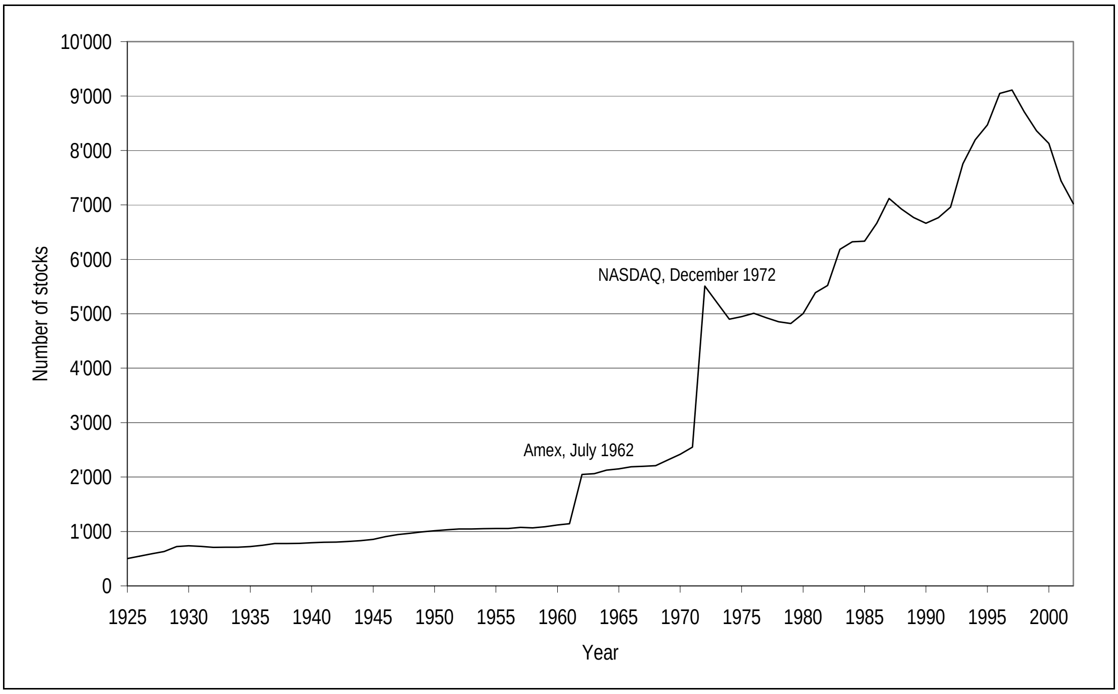

Figure 4

Aggregate cash payouts over time by type

The figure shows the aggregate cash payouts of the sample firms during the years 1926–2002. We distinguish between aggregate annual ordinary cash dividends (ordinary semiannual, quarterly, or monthly cash dividends, special cash dividends, and cash dividends with unknown frequency) and other cash distributions a passive, buy-and-hold shareholder would receive. Passive means the shareholder does not sell his shares unless given no alternative by the corporation. Moreover, he does not exercise subscription rights.

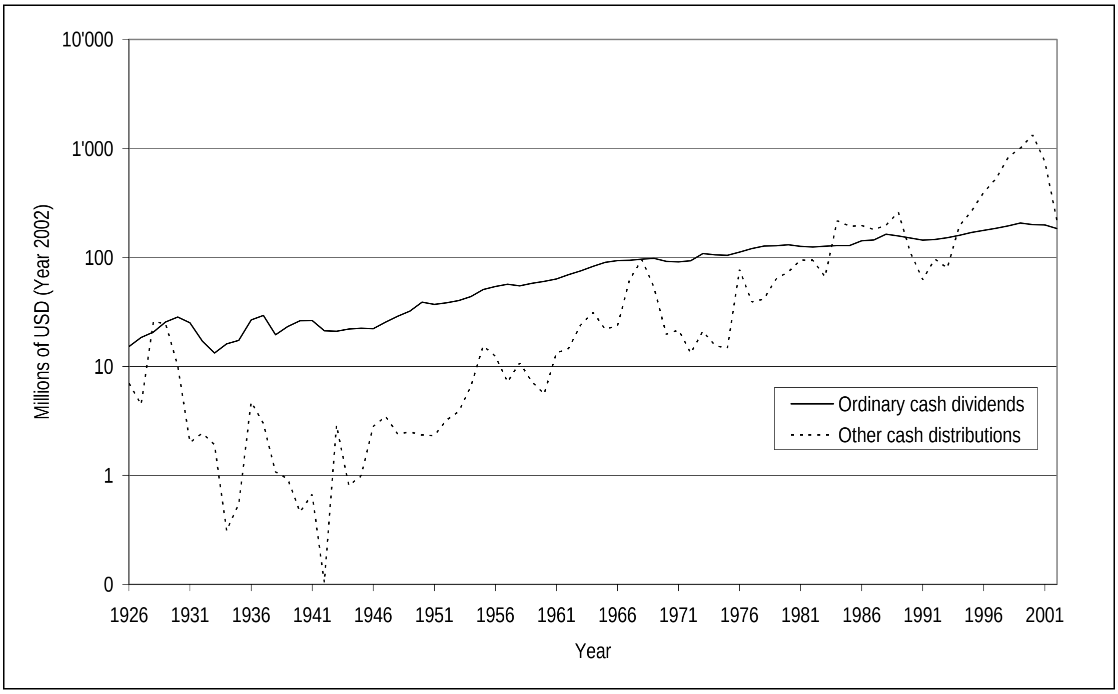

Table 1

Value ratios by firm size

The table lists the value ratios of investment portfolios a given number of years since inception. Value ratios are defined in equation (3) of the text. Portfolios are equally weighted and ranked by firm size in descending order. Portfolio 1 includes the largest firms on the CRSP monthly tapes, portfolio 10 the smallest ones. Size ratio is defined as the average market capitalization of firms in a given portfolio divided by the average market capitalization of firms in portfolio 1. New portfolios are formed annually. The sample period is 1926–2002.

Panel A: Value ratios 8 years from inception, starting with January 1, 1926; 70 annual observations between 1933 and 2002

Portfolio	*Average*	*Median*	*First Quartile*	*Third Quartile*	*Min*	*Max*	*Standard Deviation*	*Size Ratio*
1	0.476	0.497	0.311	0.607	0.204	0.782	0.161	100.00%
2	0.583	0.597	0.401	0.738	0.248	1.038	0.190	18.23%
3	0.625	0.619	0.465	0.797	0.230	1.278	0.221	8.62%
4	0.656	0.654	0.494	0.818	0.220	1.556	0.240	5.00%
5	0.697	0.653	0.514	0.857	0.211	1.666	0.276	3.20%
6	0.705	0.681	0.523	0.850	0.224	1.748	0.279	2.13%
7	0.709	0.661	0.524	0.872	0.166	1.758	0.293	1.43%
8	0.722	0.682	0.445	0.859	0.162	1.991	0.356	0.92%
9	0.670	0.600	0.429	0.862	0.162	1.758	0.344	0.55%
10	0.540	0.518	0.287	0.696	0.082	1.893	0.335	0.24%
All	0.643	0.610	0.472	0.778	0.213	1.461	0.255	N/A

Panel B: Value ratios 15 years from inception, starting with January 1, 1926; 63 annual observations between 1940 and 2002

Portfolio	*Average*	*Median*	*First Quartile*	*Third Quartile*	*Min*	*Max*	*Standard Deviation*	*Size Ratio*
1	0.919	0.988	0.600	1.154	0.367	1.672	0.333	100.00%
2	1.093	1.099	0.746	1.288	0.403	2.247	0.399	18.92%
3	1.182	1.110	0.817	1.521	0.374	2.423	0.477	9.03%
4	1.261	1.170	0.935	1.603	0.313	3.113	0.529	5.26%
5	1.321	1.160	0.940	1.623	0.427	3.213	0.601	3.38%
6	1.378	1.164	0.906	1.758	0.452	3.484	0.678	2.26%
7	1.439	1.202	0.895	1.870	0.326	4.356	0.799	1.52%
8	1.443	1.196	0.917	1.756	0.397	5.321	0.853	0.99%
9	1.446	1.174	0.812	1.751	0.343	5.047	0.965	0.60%
10	1.223	1.010	0.695	1.430	0.182	5.593	0.957	0.26%
All	1.271	1.100	0.858	1.556	0.367	3.480	0.629	N/A

Panel C: Value ratios 20 years from inception, starting with January 1, 1926; 58 annual observations between 1945 and 2002

Portfolio	*Average*	*Median*	*First Quartile*	*Third Quartile*	*Min*	*Max*	*Standard Deviation*	*Size Ratio*
1	1.273	1.291	0.789	1.658	0.526	2.363	0.513	100.00%
2	1.513	1.446	0.961	1.817	0.528	3.200	0.623	19.37%
3	1.645	1.599	1.041	2.062	0.502	3.320	0.732	9.32%
4	1.769	1.585	1.124	2.219	0.420	4.115	0.839	5.46%
5	1.867	1.622	1.206	2.411	0.582	4.541	0.931	3.52%
6	1.973	1.614	1.190	2.630	0.572	4.992	1.046	2.36%
7	2.108	1.717	1.187	2.626	0.490	6.277	1.312	1.60%
8	2.066	1.718	1.172	2.583	0.492	7.018	1.275	1.04%
9	2.160	1.823	1.151	2.978	0.460	6.980	1.439	0.63%
10	1.901	1.372	1.064	2.143	0.278	8.533	1.568	0.27%
All	1.828	1.537	1.143	2.304	0.516	5.030	0.994	N/A

Panel D: Value ratios 30 years from inception, starting with January 1, 1926; 48 annual observations between 1955 and 2002

Portfolio	*Average*	*Median*	*First Quartile*	*Third Quartile*	*Min*	*Max*	*Standard Deviation*	*Size Ratio*
1	2.114	1.669	1.199	2.904	0.973	4.520	1.021	100.00%
2	2.506	2.075	1.451	3.313	0.917	6.107	1.338	20.73%
3	2.637	2.167	1.447	3.514	0.906	5.983	1.529	10.14%
4	2.875	2.327	1.532	3.840	0.873	7.491	1.809	6.01%
5	3.024	2.314	1.573	3.846	0.785	9.011	1.982	3.91%
6	3.262	2.752	1.653	4.170	0.690	9.595	2.291	2.64%
7	3.611	2.623	1.620	4.319	0.831	12.423	2.838	1.80%
8	3.649	2.670	1.601	4.663	0.553	12.457	2.890	1.18%
9	3.671	2.854	1.623	4.459	0.569	13.503	2.900	0.71%
10	3.312	1.792	1.439	3.441	0.588	16.052	3.445	0.31%
All	3.067	2.439	1.529	3.824	0.781	9.453	3.067	N/A

Figure 5

Relative frequencies of value ratios 15 years after portfolio formation

The figure shows the relative frequency distribution of value ratios 15 years after portfolio formation (VR15). Value ratios are defined in equation (3) of the text and refer to ten different size portfolios. Portfolios are equally weighted and formed on the basis of firm size in descending order. Portfolio 1 includes the largest firms on the CRSP monthly tapes, portfolio 10 the smallest ones. New portfolios are formed annually. The sample period is 1926–2002. The first ten portfolios are formed on January 1, 1926. There are 63 annual observations for each portfolio in the 1940–2002 period. The figure therefore documents the frequency distribution of a sample of 630 value ratios.

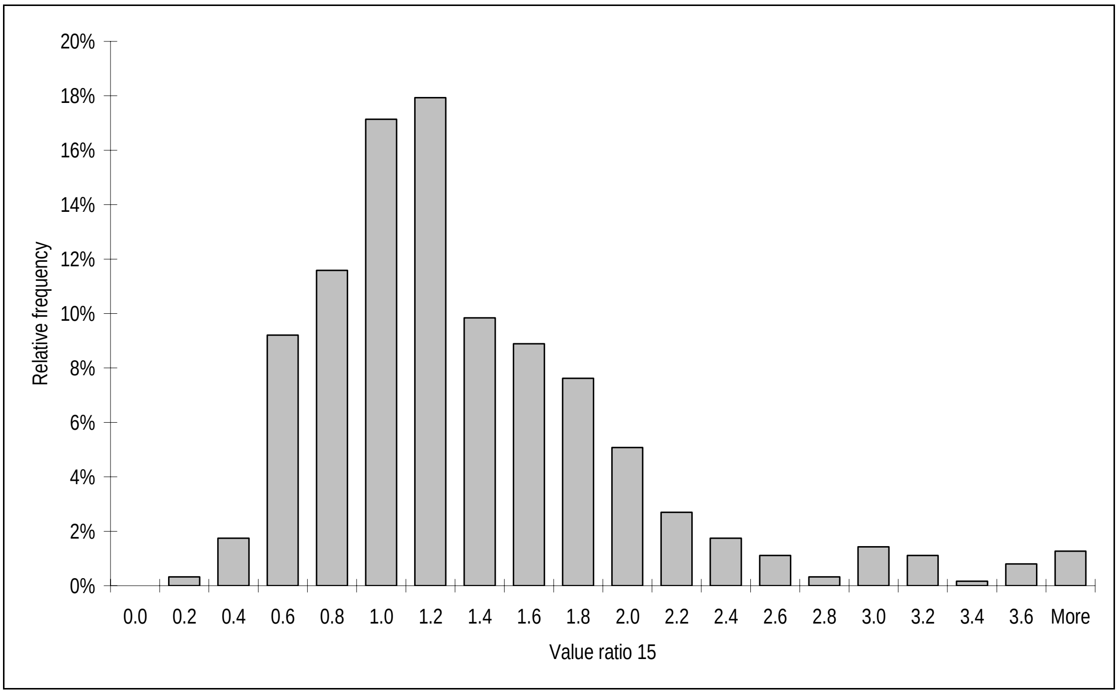

Table 2

Value ratios and cash payout types

The table shows the average value ratios 15 years after portfolio formation (VR15) and their composition by payout type. We distinguish between cash dividends (quarterly, semiannual, quarterly, monthly, and special cash dividends as well as cash dividends with unknown frequency; these payments correspond to the distribution code 1000 on the CRSP tapes) and other cash payments. Value ratios are defined in equation (3) of the text. Portfolios are equally weighted and ranked by firm size in descending order. Portfolio 1 includes the largest firms on the CRSP monthly tapes, portfolio 10 the smallest ones. New portfolios are formed annually. The sample period is 1926–2002.

Panel A: Full sample 1926–2002; 63 observations from 1940 to 2002.

Portfolio	*Average VR15*	*Number of stocks at the end of 15 years as a fraction of initial number of stocks in portfolio*	*Number of cash dividend payment events as a fraction of total payment events*	*Value of cash dividend payments (compounded at the risk-free rate) as a fraction of total value of stock investment strategy*
(1)	*(2)*	*(3)*	*(4)*	*(5)*
1	0.919	86.49%	98.55%	78.86%
2	1.093	75.53%	98.19%	66.74%
3	1.182	70.51%	98.00%	60.80%
4	1.261	67.41%	97.73%	57.37%
5	1.321	63.70%	97.46%	54.65%
6	1.378	59.16%	97.19%	49.82%
7	1.439	56.19%	96.77%	46.80%
8	1.443	54.50%	96.56%	46.36%
9	1.446	51.75%	95.85%	44.81%
10	1.223	40.97%	94.08%	40.92%

Panel B: Subsample 1926–1972; 47 observations from 1940 to 1986.

Portfolio	*Average VR15*	*Number of stocks at the end of 15 years as a fraction of initial number of stocks in portfolio*	*Number of cash dividend payment events as a fraction of total payment events*	*Value of cash dividend payments (compounded at the risk-free rate) as a fraction of total value of stock investment strategy*
(1)	*(2)*	*(3)*	*(4)*	*(5)*
1	0.869	93.87%	98.65%	89.13%
2	1.054	85.09%	98.42%	77.37%
3	1.130	80.06%	98.34%	71.50%
4	1.212	76.95%	98.13%	68.45%
5	1.304	72.96%	97.98%	65.50%
6	1.398	68.22%	97.67%	59.89%
7	1.478	65.61%	97.48%	57.16%
8	1.472	64.23%	97.41%	57.16%
9	1.496	61.59%	97.00%	55.77%
10	1.246	48.48%	96.05%	51.43%

Panel C: Subsample 1973–2002; 16 observations from 1987 to 2002.

Portfolio *(1)*	*Average VR15* *(2)*	*Number of stocks at the end of 15 years as a fraction of initial number of stocks in portfolio* *(3)*	*Number of cash dividend payment events as a fraction of total payment events* *(4)*	*Value of cash dividend payments (compounded at the risk-free rate) as a fraction of total value of stock investment strategy* *(5)*
1	1.068	64.80%	98.27%	48.71%
2	1.205	47.46%	97.50%	35.54%
3	1.337	42.46%	97.02%	29.39%
4	1.405	39.38%	96.59%	24.83%
5	1.372	36.50%	95.95%	22.80%
6	1.321	32.58%	95.76%	20.24%
7	1.324	28.53%	94.69%	16.38%
8	1.357	25.90%	94.09%	14.65%
9	1.301	22.84%	92.48%	12.62%
10	1.157	18.90%	88.31%	10.06%

Table 3

Payback

The table shows the number of years it takes for the value of the reinvested cash payouts (payout account) to exceed the compounded value of the initial investment (current value of initial investment). We refer to this variable as payback. Reinvestment and compounding are at the risk-free rate. Portfolios are equally weighted and ranked by firm size in descending order. Portfolio 1 includes the largest firms on the CRSP monthly tapes, portfolio 10 the smallest ones. New portfolios are formed annually. The sample period is 1926–2002.

Portfolio	*Average*	*Median*	*First Quartile*	*Third Quartile*	*Minimum*	*Maximum*	*Standard Deviation*	*N*
1	18.324	15.167	13.000	23.917	10.083	30.917	6.450	65
2	15.600	13.875	11.583	19.083	7.667	31.917	5.589	66
3	14.591	12.833	9.917	18.250	6.583	30.500	5.825	66
4	13.804	12.500	10.000	15.917	5.500	31.917	5.373	65
5	13.150	11.875	9.083	15.417	5.083	29.000	5.249	66
6	13.260	11.667	9.083	16.167	4.833	33.583	5.917	64
7	12.969	11.500	9.250	15.167	5.250	30.250	5.653	61
8	12.448	11.417	8.667	15.833	5.083	29.250	5.136	59
9	12.984	11.250	8.750	15.667	4.917	29.833	5.677	57
10	15.254	13.708	10.750	17.500	5.333	41.500	7.256	58

Table 4

Risk premiums

The table lists the risk premiums implied by various size portfolios. Risk premiums are defined as the arithmetic difference between the yield on the stock investment and the yield on the riskless investment. Panel A refers to equally weighted portfolios over a 15-year investment horizon, ranked by firm size in descending order. Portfolio 1 includes the largest firms on the CRSP monthly tapes, portfolio 10 the smallest ones. The first ten portfolios are formed on January 1, 1926 and maintained until 1940. The first risk premium therefore refers to the year 1940, and the last to 2002. Panel B shows the risk premiums implied by the investment portfolios formed in 1926–1973 for a 30-year holding period each. Panels C and D do the same for portfolios formed in 1926–1950 and 1951–1973, respectively.

Panel A: Risk premiums by firm size assuming an investment horizon of 15 years and formed annually in 1926–1988 (63 observations for each portfolio).

Portfolio	*Average*	*Median*	*First Quartile*	*Third Quartile*	*Min*	*Max*	*Standard Deviation*
1	–1.051%	–0.084%	–3.629%	0.965%	–6.491%	3.529%	2.663%
2	0.166%	0.640%	–2.026%	1.742%	–5.914%	5.602%	2.579%
3	0.610%	0.742%	–1.374%	2.925%	–6.392%	6.578%	2.935%
4	1.059%	1.085%	–0.467%	3.204%	–7.508%	8.511%	2.946%
5	1.309%	1.005%	–0.434%	3.408%	–5.934%	8.174%	3.078%
6	1.504%	1.096%	–0.710%	3.904%	–5.551%	8.765%	3.273%
7	1.641%	1.284%	–0.791%	4.340%	–7.255%	10.431%	3.617%
8	1.628%	1.244%	–0.623%	4.147%	–6.440%	11.907%	3.640%
9	1.339%	1.078%	–1.469%	3.929%	–7.420%	11.510%	4.253%
10	–0.073%	0.071%	–2.589%	2.462%	–10.803%	12.283%	4.597%

Panel B: Risk premiums by firm assuming an investment horizon of 30 years and formed annually in 1926–1973 (48 observations for each portfolio).

Portfolio	*Average*	*Median*	*First Quartile*	*Third Quartile*	*Min*	*Max*	*Standard Deviation*
1	2.215%	1.814%	0.628%	3.751%	–0.099%	5.210%	1.675%
2	2.761%	2.554%	1.296%	4.208%	–0.292%	6.365%	1.785%
3	2.861%	2.703%	1.320%	4.382%	–0.350%	6.291%	1.933%
4	3.102%	3.017%	1.468%	4.686%	–0.482%	7.072%	2.037%
5	3.246%	2.942%	1.578%	4.734%	–0.858%	7.682%	2.101%
6	3.398%	3.546%	1.776%	5.038%	–1.312%	7.909%	2.309%
7	3.615%	3.393%	1.729%	5.132%	–0.655%	8.852%	2.483%
8	3.634%	3.433%	1.660%	5.428%	–2.088%	8.980%	2.543%
9	3.675%	3.708%	1.736%	5.211%	–1.988%	9.157%	2.519%
10	2.945%	2.077%	1.303%	4.345%	–1.776%	9.926%	2.830%

Panel C: Risk premiums by firm size assuming an investment horizon of 30 years and portfolios formed annually in 1926–1950 (25 observations for each portfolio).

Portfolio	*Average*	*Median*	*First Quartile*	*Third Quartile*	*Min*	*Max*	*Standard Deviation*
1	3.237%	3.678%	2.362%	4.179%	–0.077%	5.210%	1.512%
2	3.829%	4.206%	2.712%	5.009%	–0.292%	6.365%	1.681%
3	3.947%	4.346%	3.174%	5.629%	–0.070%	6.291%	1.941%
4	4.249%	4.458%	3.362%	5.877%	–0.281%	7.072%	2.088%
5	4.396%	4.465%	3.580%	5.892%	0.336%	7.682%	2.142%
6	4.714%	5.029%	3.836%	6.352%	0.017%	7.909%	2.215%
7	5.056%	5.084%	3.686%	7.202%	0.105%	8.852%	2.441%
8	5.151%	5.138%	3.937%	6.824%	0.106%	8.980%	2.365%
9	5.142%	4.991%	3.849%	6.506%	0.825%	9.157%	2.302%
10	4.333%	4.273%	2.420%	6.803%	–1.776%	9.926%	3.252%

Panel D: Risk premiums by firm size assuming an investment horizon of 30 years and portfolios formed annually in 1951–1973 (23 observations for each portfolio).

Portfolio	*Average*	*Median*	*First Quartile*	*Third Quartile*	*Min*	*Max*	*Standard Deviation*
1	1.105%	0.822%	0.422%	1.796%	–0.099%	3.233%	1.013%
2	1.600%	1.417%	0.898%	2.278%	–0.206%	3.615%	1.010%
3	1.681%	1.410%	1.145%	2.106%	–0.350%	3.643%	1.038%
4	1.854%	1.918%	1.068%	2.547%	–0.482%	3.406%	0.993%
5	1.996%	2.089%	1.467%	2.488%	–0.858%	3.873%	1.139%
6	1.968%	1.962%	1.054%	2.750%	–1.312%	4.194%	1.391%
7	2.048%	1.891%	1.160%	2.930%	–0.655%	4.338%	1.322%
8	1.985%	2.076%	1.330%	2.925%	–2.088%	4.221%	1.501%
9	2.081%	2.039%	1.438%	3.202%	–1.988%	5.089%	1.635%
10	1.435%	1.623%	1.099%	2.012%	–1.592%	2.693%	0.997%

Table 5

Value ratios and dividend yield

The table lists the value ratios of investment portfolios after a given number of years since formation. Value ratios are defined in equation (3) of the text. Panel A shows value ratios for portfolios of firms that pay ordinary cash dividends at the time of their formation. Panel B shows value ratios for portfolios of firms that do not pay ordinary cash dividends at the time of their formation. Portfolios are equally weighted. New portfolios are formed annually. The sample period is 1926–2002.

Panel A: Value ratios of equally weighted portfolios of stocks with positive dividend yield when formed.

Holding Period	*Average*	*Median*	*First Quartile*	*Third Quartile*	*Min*	*Max*	*Standard Deviation*	*N*
5	0.417	0.419	0.338	0.489	0.188	0.710	0.115	73
8	0.681	0.689	0.547	0.825	0.268	1.209	0.197	70
10	0.858	0.843	0.701	1.026	0.325	1.503	0.261	68
15	1.296	1.255	0.958	1.541	0.537	2.649	0.450	63
20	1.794	1.647	1.219	2.201	0.688	3.899	0.724	58
25	2.352	2.096	1.516	3.099	0.864	5.372	1.093	53
30	2.912	2.584	1.675	3.662	0.959	7.220	1.581	48

Panel B: Value ratios of equally weighted portfolios of stocks with zero dividend yield when formed..

Holding Period	*Average*	*Median*	*First Quartile*	*Third Quartile*	*Min*	*Max*	*Standard Deviation*	*N*
5	0.250	0.233	0.162	0.288	0.061	1.037	0.141	73
8	0.474	0.395	0.294	0.572	0.099	1.372	0.280	70
10	0.623	0.540	0.387	0.733	0.130	2.284	0.383	68
15	1.097	0.798	0.645	1.304	0.231	4.335	0.796	63
20	1.715	1.154	0.913	2.132	0.314	7.570	1.383	58
25	2.482	1.586	1.133	3.071	0.370	10.562	2.090	53
30	3.248	2.019	1.380	3.727	0.429	14.217	2.984	48

Figure 6

Value ratios 15 years after portfolio formation (VR15) by size

The figure shows the value ratios over time of three size portfolios 15 years after portfolio formation.. Value ratios are defined in equation (3) of the text. Portfolios are equally weighted and formed on the basis of firm size in descending order. Portfolio 1 includes the largest firms on the CRSP monthly tapes, portfolio 10 the smallest ones. New portfolios are formed annually. The sample period is 1926–2002. The first ten portfolios are formed on January 1, 1926. For each portfolio, we can therefore make 63 annual observations of VR15 in 1940–2002.

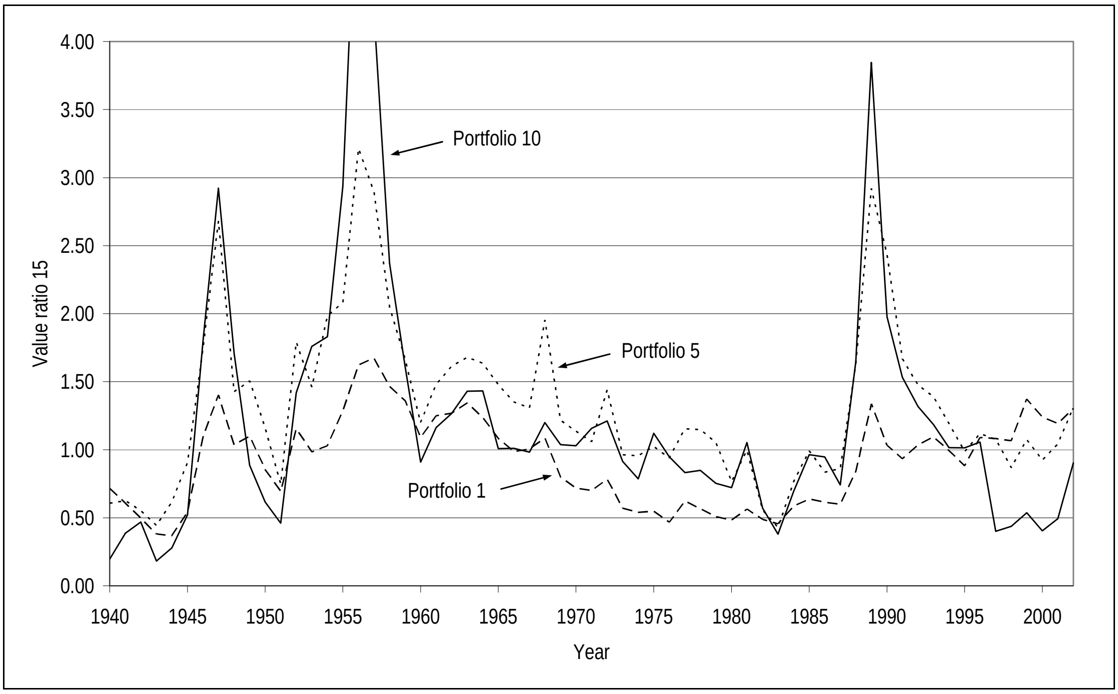

Table 6

Correlation coefficients between value ratios (VR15) at different lags

The table lists correlation coefficients between value ratios 15 years after portfolio formation. Value ratios are defined in equation (3) of the text. Portfolios are equally weighted and formed on the basis of firm size in descending order. Portfolio 1 includes the largest firms on the CRSP monthly tapes, portfolio 10 the smallest ones. New portfolios are formed annually. The sample period is 1926–2002. There are 63 annual observations for each portfolio in the sample. Numbers in parentheses are probability values. The first ten portfolios are formed on January 1, 1926.

Time lags	*Size portfolios*									
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1	0.842 (0.000)	0.789 (0.000)	0.758 (0.000)	0.706 (0.000)	0.705 (0.000)	0.772 (0.000)	0.730 (0.000)	0.689 (0.000)	0.753 (0.000)	0.712 (0.000)
2	0.674 (0.000)	0.540 (0.000)	0.481 (0.000)	0.428 (0.001)	0.422 (0.001)	0.482 (0.000)	0.469 (0.000)	0.400 (0.001)	0.431 (0.001)	0.347 (0.006)
3	0.572 (0.000)	0.355 (0.005)	0.329 (0.010)	0.278 (0.032)	0.197 (0.131)	0.283 (0.028)	0.216 (0.097)	0.200 (0.126)	0.200 (0.126)	0.139 (0.289)
4	0.470 (0.003)	0.228 (0.083)	0.230 (0.080)	0.157 (0.234)	0.054 (0.684)	0.116 (0.384)	0.077 (0.561)	0.071 (0.596)	0.064 (0.629)	–0.001 (0.995)
5	0.416 (0.001)	0.201 (0.129)	0.179 (0.180)	0.085 (0.527)	–0.022 (0.873)	0.030 (0.822)	0.057 (0.671)	–0.064 (0.631)	–0.036 (0.788)	–0.087 (0.514)

Table 7

Mean comparison tests for value ratios 15 years from portfolio inception

The table performs mean comparison tests for value ratios 15 years after portfolio formation. Value ratios are defined in equation (3) of the text. In Panel A, portfolios are equally weighted and formed on the basis of firm size in descending order. Portfolio 1 includes the largest firms on the CRSP monthly tapes, portfolio 10 the smallest ones. In Panel B, portfolios are equally weighted and formed on the basis of CAPM-beta in decreasing order. Portfolio 1 includes the stocks with the highest CAPM-beta on the CRSP monthly tapes, portfolio 10 the stocks with the lowest CAPM-beta. New portfolios are formed annually. The first numbers in each cell of columns (3) and (4) are t-statistics of a mean-comparison test. Standard errors are computed with a Newey-West correction for autocorrelation up to lag 15. Numbers in parentheses are the associated probability values. Size ratio in column (5) is defined as the average market capitalization of firms in a given portfolio divided by the average market capitalization of firms in portfolio 1. The sample period is 1926–2002.

Panel A: Mean comparison tests for different size portfolios. Ranking is in decreasing order of firm size.

Portfolio	*Average*	*Mean comparison vs. portfolio 1*	*Mean comparison vs. previous portfolio*	*Size ratio*
(1)	*(2)*	*(3)*	*(4)*	*(5)*
1	0.919	–	–	100.00%
2	1.093	6.71 (0.000)	6.71 (0.000)	18.92%
3	1.182	6.20 (0.000)	3.37 (0.001)	9.03%
4	1.261	6.12 (0.000)	3.86 (0.000)	5.26%
5	1.321	5.59 (0.000)	1.57 (0.122)	3.38%
6	1.378	4.27 (0.000)	1.24 (0.221)	2.26%
7	1.439	3.80 (0.000)	1.60 (0.114)	1.52%
8	1.443	3.86 (0.000)	0.24 (0.812)	0.99%
9	1.446	3.23 (0.002)	0.10 (0.920)	0.60%
10	1.223	2.15 (0.035)	–4.32 (0.000)	0.26%

Panel B: Mean comparison tests for portfolios of stocks with different CAPM-betas. Ranking is in decreasing order of CAPM-beta.

Portfolio	*Average VR15*	*Mean comparison vs. portfolio 1*	*Mean comparison vs. previous portfolio*	*Betas*
(1)	*(2)*	*(3)*	*(4)*	*(5)*
1	1.251	–	–	1.919
2	1.382	1.582 (0.119)	1.582 (0.119)	1.498
3	1.457	2.134 (0.037)	2.182 (0.033)	1.290
4	1.415	1.973 (0.053)	–0.968 (0.337)	1.134
5	1.362	1.813 (0.075)	–1.413 (0.163)	1.001
6	1.375	1.656 (0.103)	0.413 (0.681)	0.878
7	1.327	1.027 (0.309)	–1.858 (0.068)	0.758
8	1.291	0.413 (0.681)	–1.953 (0.056)	0.630
9	1.253	–0.049 (0.961)	–1.112 (0.271)	0.481
10	1.071	–2.279 (0.026)	–2.693 (0.009)	0.239

Table 8

Median value ratios 15 years after portfolio inception with and without terminal stock price

The table lists the median value ratios with and without terminal stock price 15 years after portfolio inception. Value ratios are defined in equation (3) of the text. Portfolios are equally weighted. In Panel A, portfolios are formed on the basis of firm size in descending order. Portfolio 1 includes the largest firms on the CRSP monthly tapes, portfolio 10 the smallest ones. In Panel B, portfolios are formed on the basis of standard deviation of return (volatility). New portfolios are formed annually. The sample period is 1926–2002. The first ten portfolios in both panels are formed on January 1, 1926. There are 63 annual observations for each portfolio in 1940–2002.

Panel A: Size portfolios

Portfolio	*VR15 (with terminal stock value)*	*VR15 (without terminal stock value)*	*Value of stocks as a fraction of stock investment strategy value (inclusive of terminal stock value)*	*Number of stocks at portfolio formation*	*Number of stocks after 15 years*
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
1	4.707	0.988	94.66%	105	99
2	4.991	1.099	93.94%	105	92
3	5.411	1.110	92.18%	105	87
4	4.345	1.170	88.88%	105	79
5	4.343	1.160	86.83%	105	74
6	4.227	1.164	85.13%	105	69
7	4.269	1.202	85.71%	105	68
8	4.163	1.196	78.49%	105	71
9	4.392	1.174	76.43%	105	68
10	3.897	1.010	91.25%	112	55

Panel B: Volatility portfolios

Portfolio	*VR15 (with terminal stock value)*	*VR15 (without terminal stock value)*	*Value of stocks as a fraction of stock investment strategy value (inclusive of terminal stock value)*	*Number of stocks at portfolio formation*	*Number of stocks after 15 years*
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
1	4.878	0.874	88.97%	99	53
2	4.191	1.148	80.96%	99	59
3	4.739	1.115	87.09%	99	63
4	4.304	1.168	85.95%	99	65
5	3.877	1.208	86.29%	99	66
6	4.003	1.308	85.98%	99	69
7	4.125	1.300	87.38%	99	70
8	4.198	1.281	84.62%	99	74
9	4.534	1.267	86.47%	99	77
10	4.268	1.129	91.94%	104	89

Figure 7

Stock price as a fraction of stock investment value

The figure buys shares of the representative firm and invests all cash payouts at the risk-free rate. It then computes the ratio of the share price as a fraction of the (cum-price) value of this investment portfolio at the end of the investment horizon. The risk-free rate is assumed to equal 4% (the average risk-free rate during the sample period of 1926–2002 is 3.8%). The calculations also assume an initial cash payout of $1 that grows at a constant annual rate of 7.3% (a figure that corresponds to the historical average rate of growth during the sample period).

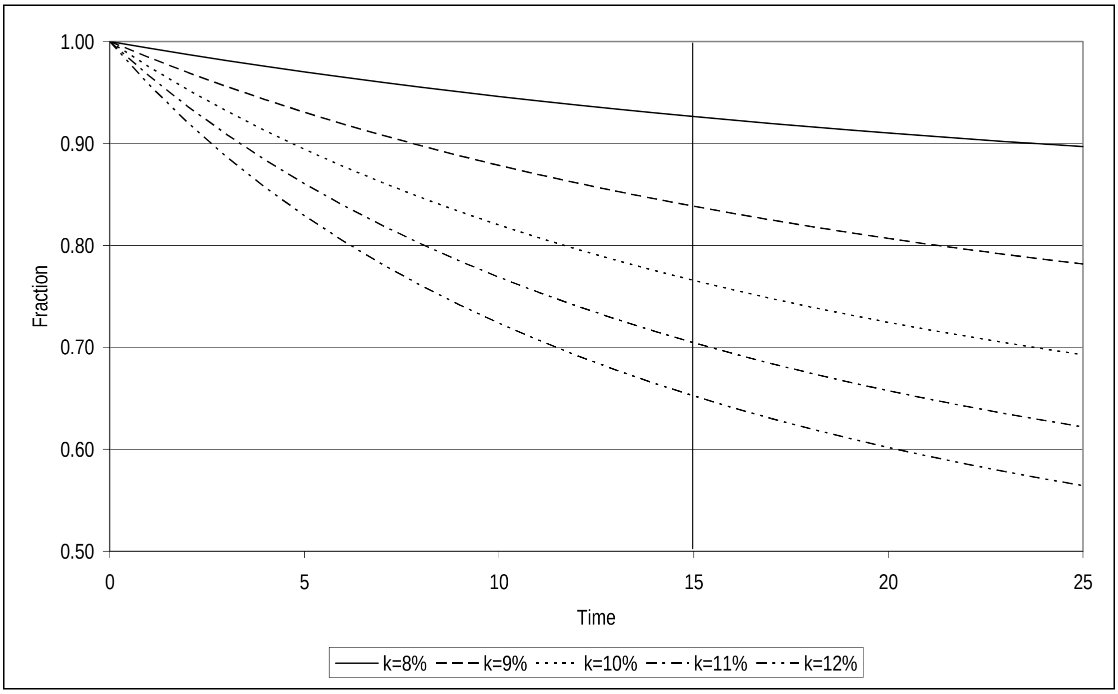

Table 9

Descriptive statistics of regression variables

The table shows descriptive statistics of selected regression variables. The dependent variables are the value ratio of given size portfolios 15 years after portfolio formation and the associated payback. The sample period is 1926–2002. For each size portfolio, we estimate average return standard deviation and CAPM-beta using the preceding 48 monthly observations. We require a minimum of 36 observations. Thus, the first ten size portfolios with the necessary information concerning return variance and CAPM-beta are those we form at the end of 1928. The first value ratios are observed 15 years later, in 1943. Consequently, there are 60 years (=2002–1943+1) of observations in this sample.

Regression argument	*Average*	*Median*	*First Quartile*	*Third Quartile*	*Min*	*Max*	*Standard Deviation*
VR15	1.312	1.172	0.910	1.596	0.012	5.756	0.717
PAYBACK	14.158	12.583	9.833	16.167	4.667	55.500	6.630
VOLA	0.114	0.102	0.078	0.136	0.051	0.337	0.049
BETA	0.981	1.000	0.888	1.076	0.552	1.652	0.159
LNSIZE	10.337	10.267	9.021	11.636	5.169	15.199	1.966
DY	0.038	0.038	0.026	0.048	0.000	0.089	0.018

Variable Definitions	
VR15	Ratio of the equally weighted average of the compounded value of the cash payouts earned by the initial investment in shares of firms in a given size portfolio divided by the compounded value of the initial investment. The ratio is computed 15 years after the investment. Compounding is at the risk-free rate;
PAYBACK	Time until the equally weighted average of the compounded value of the cash payouts earned by the initial investment in shares of firms in a given size portfolio exceeds the compounded value of the initial investment. Compounding is at the risk-free rate;
VOLA	Average stock return standard deviation of the firms in a given size portfolio in a particular year. Stock return standard deviations are computed using the 48 monthly observations preceding the year in question (we require a minimum of 36 observations);
BETA	Average stock return CAPM-beta of the firms in a given size portfolio in a particular year. Stock return CAPM-betas are computed with a market model using the 48 monthly observations preceding the year in question (we require a minimum of 36 observations). The market index is the equally weighted CRSP index;
LNSIZE	Natural logarithm of the average market value of equity of the firms in a given size portfolio in a particular year;
DY	Average dividend yield of the firms in a given size portfolio the year the portfolio was created. Dividend yield is defined as cash dividends paid during the year divided by stock price at year end.

Table 10

Value ratios, payback and their determinants

Columns (1) to (3) examine the relation between value ratios 15 years after portfolio formation (VR15) and possible determinants. Column (4) does the same for the associated payback. Value ratios are defined in equation (3) of the text. Portfolios are equally weighted and formed on the basis of firm size in descending order. Portfolio 1 includes the largest firms on the CRSP monthly tapes, portfolio 10 the smallest ones. The analysis is based on a Prais-Winsten regression with correlated panels corrected standard errors. The annual observations for the dependent variable are the cross-sectional average VR15s (as well as the associated payback) for each of the ten size portfolios. We allow for disturbances with different standard deviations across panels (size portfolios). Also, we assume that the disturbances are contemporaneously correlated across panels, and that the disturbances of any one panel are serially correlated of order one. Numbers in parentheses in the table are z-values and the associated probability values for two-sided tests of difference from zero (in the case of the Wald chi-square-statistics, the number in parentheses is the probability value). The sample period is 1926–2002.

Independent variables	*Dependent variable*			
	VR15	*VR15*	*LNVR15*	*LNPAYBACK*
	(1)	*(2)*	*(3)*	*(4)*
Constant	4.166 (4.672, 0.000)	5.202 (6.201, 0.000)	0.961 (1.726, 0.084)	1.557 (4.488, 0.000)
VOLA	3.722 (1.560, 0.119)		4.115 (2.265, 0.024)	–2.312 (–2.071, 0.038)
BETA		–0.047 (–0.132, 0.895)		
LNSIZE	–0.460 (–5.618, 0.000)	–0.473 (–5.803, 0.000)	–0.251 (–4.613, 0.000)	0.228 (6.597, 0.000)
D-SIZE1	1.227 (4.577, 0.000)	1.239 (4.481, 0.000)	0.436 (2.596, 0.009)	–0.358 (–3.553, 0.000)
D-SIZE10	–0.653 (–3.063, 0.002)	–0.773 (–3.484, 0.000)	–0.356 (–2.167, 0.030)	0.230 (3.050, 0.002)
D-TIME	0.408 (2.300, 0.021)	0.407 (2.190, 0.028)	0.458 (3.408, 0.001)	–0.473 (–5.517, 0.000)
D-DIV	0.873 (1.501, 0.133)	0.274 (0.493, 0.622)	0.992 (1.978, 0.048)	–0.896 (–2.902, 0.004)
DY	15.654 (3.957, 0.000)	16.402 (4.033, 0.000)	11.007 (2.842, 0.004)	–7.727 (–3.035, 0.002)
Number of observations	600	600	600	575
R-squared	0.501	0.440	0.278	0.795
Wald chi-square (7)	120.860	118.892	116.214	168.681

Variable Definitions	
VR15	Ratio of the equally weighted average of the compounded value of the cash payouts earned by the initial investment in shares of firms in a given size portfolio divided by the compounded value of the initial investment. The ratio is computed 15 years after the investment. Compounding is at the risk-free rate;
LNVR15	Natural logarithm of VR15;
PAYBACK	Time until the equally weighted average of the compounded value of the cash payouts earned by the initial investment in shares of firms in a given size portfolio exceeds the compounded value of the initial investment. Compounding is at the risk-free rate;
LNPAYBACK	Natural logarithm of PAYBACK;
VOLA	Average stock return standard deviation of the firms in a given size portfolio in a particular year. Stock return standard deviations are computed using the 48 monthly observations preceding the end-of-year month in question (we require a minimum of 36 observations);
BETA	Average stock return CAPM-beta of the firms in a given size portfolio in a particular year. Stock return CAPM-betas are computed using the 48 monthly observations preceding the end-of-year month in question (we require a minimum of 36 observations);
LNSIZE	Natural logarithm of the average market value of equity of the firms in a given size portfolio in a particular year;
D-SIZE1	Binary variable equal to one if the value ratio refers to the largest-size portfolio, and equal to zero otherwise;
D-SIZE10	Binary variable equal to one if the value ratio refers to the smallest-size portfolio, and equal to zero otherwise;
D-TIME	Binary variable equal to one if the calendar year is 1973 or later, and equal to zero otherwise;
D-DIV	Binary variable equal to one if the majority of firms in a given size portfolio pay cash dividends the year a particular size portfolio was assembled, and equal to zero otherwise;
DY	Average dividend yield of the firms in a given size portfolio the year the portfolio was created. Dividend yield is defined as cash dividends paid during the year divided by stock price at year end.

Table 11

Relation between risk premiums and their determinants

The table examines the relation between risk premiums and possible determinants. Risk premiums are defined as the arithmetic difference between the yield on the stock investment and the yield on the riskless investment. Stock portfolios are equally weighted and formed on the basis of firm size in descending order. Portfolio 1 includes the largest firms on the CRSP monthly tapes, portfolio 10 the smallest ones. The analysis is based on a Prais-Winsten regression with correlated panels corrected standard errors. The annual observations for the dependent variable are the cross-sectional average RP30s for each of the ten size portfolios. We allow for disturbances with different standard deviations across panels (size portfolios). Also, we assume that the disturbances are contemporaneously correlated across panels, and that the disturbances of any one panel are serially correlated of order one. Numbers in parentheses in the table are z-values and the associated probability values for two-sided tests of difference from zero (in the case of the Wald chi-square statistics, the number in parentheses is the probability value). The sample period is 1926–2002.

Independent variables	*Dependent variable*	
	RP30	*RP30*
	(1)	*(2)*
Constant	0.136 (6.456, 0.000)	0.220 (10.841, 0.000)
VOLA	0.182 (3.609, 0.000)	
BETA		–0.025 (–3.422, 0.001)
LNSIZE	–0.017 (–8.568, 0.000)	–0.018 (–9.123, 0.000)
D-SIZE1	0.047 (8.098, 0.000)	0.045 (7.775, 0.000)
D-SIZE10	–0.028 (–5.375, 0.000)	–0.032 (–5.291, 0.000)
D-TIME	0.003 (0.527, 0.598)	0.002 (0.424, 0.672)
D-DIV	0.046 (3.534, 0.000)	0.013 (1.002, 0.316)
DY	0.240 (2.673, 0.008)	0.260 (2.684, 0.007)
Number of observations	450	450
R-squared	0.675	0.624
Wald chi-square (7)	256.664	260.337

Variable Definitions	
RP30	Arithmetic difference between the yield on the stock investment and the yield on the riskless investment over a 30-year investment horizon;
VOLA	Average stock return standard deviation of the firms in a given size portfolio in a particular year. Stock return standard deviations are computed using the 48 monthly observations preceding the end-of-year month in question (we require a minimum of 36 observations);
BETA	Average stock return CAPM-beta of the firms in a given size portfolio in a particular year. Stock return CAPM-betas are computed using the 48 monthly observations preceding the end-of-year month in question (we require a minimum of 36 observations);
LNSIZE	Natural logarithm of the average market value of equity of the firms in a given size portfolio in a particular year;
D-SIZE1	Binary variable equal to one if the value ratio refers to the largest-size portfolio, and equal to zero otherwise;
D-SIZE10	Binary variable equal to one if the value ratio refers to the smallest-size portfolio, and equal to zero otherwise;
D-TIME	Binary variable equal to one if the calendar year is 1973 or later, and equal to zero otherwise;
D-DIV	Binary variable equal to one if the majority of firms in a given size portfolio pay cash dividends the year a particular size portfolio was assembled, and equal to zero otherwise;
DY	Average dividend yield of the firms in a given size portfolio the year the portfolio was created. Dividend yield is defined as cash dividends paid during the year divided by stock price at year end.