The Impact of U.S. Firms' Investments in Human Capital on Stock Prices

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I. Introduction

Economists have long pointed to investments in "human capital" – the productive capability that is embedded in people – as one of the most important determinants of economic growth. A large and growing body of literature has examined the returns to investments in human capital from both a societal and individual perspective. There is much less research available, however, on the impact of human capital investments from the perspective of shareholders (and firms themselves), which is the perspective considered in this paper.

The current dearth of knowledge has a number of important implications. Most obvious is that investors have incomplete information regarding the returns on those investments that firms make in order to improve future performance. Although information on some forms of such investment – notably research and development and capital expenditures – is available, the lack of information on firms' investments in their people represents a conspicuous hole.

In addition, there are public policy implications. Currently, firms' human capital investments – most notably, spending on employees' development – are treated as a "hidden" cost that is buried in overhead (specifically, in the general expenditure category labeled "selling, general, and administrative expenses," or SG&A). This treatment makes information on human capital investments difficult to obtain.

Indeed, the paucity of research on this issue reflects the general absence of data with which to analyze the impact of firms' human capital investments on their subsequent performance. Precisely because these investments are treated only as an overhead cost, and not separately reported, it has been difficult for researchers to systematically examine the impact of such investments. Given the important role that human capital investments play in economic growth at a societal and individual level, the inability of the current accounting and reporting system to provide the necessary information should be examined and addressed.

Our hypothesis is that firms that make unusually large investments in employee development subsequently enjoy higher stock prices than comparable firms that make smaller investments in employee development. The premise for this hypothesis, which is discussed in more detail in the next section, is that the current accounting treatment and reporting requirements cause "high investment" firms to be under-priced in the short run, although they are fairly valued in the long run.

We use a unique database to test this hypothesis by assessing the impact of a firm's spending on its subsequent stock price. Specifically, we use firm-level data from 1996 to 1998 on 388 U.S.-based companies to analyze the impact of their investments in human capital (measured as formal employee education and training expenditures) on their subsequent stock prices. We deploy a variety of multivariate techniques and control variables to disentangle the effect of the training variable from all other potentially confounding factors.

Our basic finding is that there is a relationship between a firm's training investments and its stock performance in the following year. Indeed, there appears to be a "super-normal" return to firms' investments in human capital. A variety of techniques were deployed to examine the sensitivity of the findings to the effects of outliers, estimation techniques, functional form, and the possibility of "reverse causality." This main finding is generally robust, although differences across the analyses raise some questions about the specific interpretations of the results. Since the analysis is based on non-experimental data, it was, of course, not possible to determine that the relationships being estimated are truly causal with no effects from confounding or omitted variables (this is discussed in additional detail in Section V).

To better understand how human capital investments specifically affect firm value, we also undertook a number of additional tests. In particular, we examined the effects of different forms of training. We found that the returns on technical training and basic skill training exceeded the returns on other major forms of training. This suggests that investments in human capital are especially important for firms that are making an above-average effort to leverage technological advances and/or upgrade the skills of their workforce.

We believe that our main finding in particular has important implications for shareholders and investors. It indicates that a firm's human capital investments represent a material piece of information that should be considered in evaluating a firm's stock for possible investment.

Section VI describes an example of an effort to use such information directly in active portfolio management. Currently, information on publicly-traded firms' human capital investments is typically not publicly available, so an additional implication of our research results is that the investment community should take active steps to seek the information from publicly-traded firms. Strong consideration should also be given to revising existing accounting and reporting regulations in the United States in order to ensure that this material information is no longer buried as a hidden component within SG&A.

The remainder of this paper is organized as follows. Section II provides a brief overview of the relevant body of theory and empirical research, and includes a discussion of why the current accounting and reporting treatment of human capital investments is likely to generate above-normal returns. Section III describes conceptual and estimation issues, and section IV focuses on the data that we used to test our main hypothesis. Section V presents the results of our empirical research. Section VI describes the practical implications of the research, and how it has been translated into an investment strategy that provides further confirmation of the research results. The final section contains our summary and conclusions.

II. Human Capital and Firm Performance

The existing state of knowledge

In 2001 the United States devoted nearly $800 billion to human capital investment within our elementary, secondary and post-secondary educational institutions (National Center for Education Statistics, 2004).[1] An enormous literature has developed within economics to estimate the returns to schooling (Card, 1999).

By comparison, relatively little is known about the level of private-sector human capital investment, much less what the returns to such private-sector training might be. Estimates for annual spending on private-sector training range from $68 to $493 billion (Lynch 1998), which

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[1] In 2001 total government spending on educational institutions at all levels equaled $797 billion, converted to 2004 dollars (from http://nces.ed.gov/programs/digest/d02/tables/dt029.asp, accessed June 16, 2004).

imply that such training could account for up to one-third of the nation's human capital investment.[2]

Becker's seminal work describes the incentives that workers and firms face for investing in human capital (Becker, 1964). Predictions that emerge from Becker's model are that:

- Firms are willing to invest in training workers to develop firm-specific skills that are productive at the current firm but not at other firms.
- Firms are unwilling, however, to invest in general skills training for their workers (because they cannot recoup their investments in general skills training because workers can simply move to new firms if they are paid less than their marginal value product). As a result, workers themselves must bear the cost of any general skills training that they receive, either directly or by accepting lower wages.

More recently a number of refinements have been offered to the standard Becker model to help explain why firms may invest in general skills training. These hypotheses focus on frictions in the labor market that enable firms to capture part of the returns to general skills training (Acemoglu and Pischke, 1998, 1999a,b), as well as the role of training in screening worker ability (Autor, 2001). The key point for our purposes is that while firms as well as workers may be willing to pay for general skills training, in general we would expect that workers should not be willing (or certainly be less willing) to pay for firm-specific training.

Becker's, and most subsequent, arguments assume that training enhances the productivity of workers and their firms. Empirically determining the degree to which this is true in practice has proven to be difficult. That firms voluntarily train workers might be viewed by some as *prima facie* evidence that training produces a sufficiently large gain in productivity to justify the costs. Yet private training may simply be a form of worker consumption, as appears to be the case with employee involvement programs (Freeman and Kleiner, 2000). Alternatively training may

[2] The figures reported in Lynch (1998, p. 406) are converted into 2004 dollars. A recent estimate from the Bureau of Labor Statistics, using data from the 1995 Survey of Employer-Provided Training, suggests that firms with 50 employees or more devote from $33 to $41 billion each year to training (Frazis, Gittleman, Horrigan and Joyce 1998).

simply serve as a signaling device for productive worker attributes that are difficult for firms to observe directly (Spence, 1973, 1976).

Much of the research to date on the effects of private training on productivity has relied on micro-data for individual workers, in which productivity is typically measured through wages.[3] This type of analysis will miss any gains in productivity that arise from training that are captured by the firm rather than the worker, as may occur when there are labor market frictions (Acemoglu and Pischke, 1998, 1999a,b),[4] or may confound the effects of training with those of worker ability.[5] Moreover the micro-data that have been used in this literature are limited in a number of ways (Brown, 1990). First, many studies obtain individual-level data by asking firms to report information on the most recently hired worker. This practice may lead studies to understate both the prevalence and effects of private training if workers in high-turnover jobs are less likely to receive or benefit from training (Lynch and Black, 1998). National population surveys such as the Panel Study of Income Dynamics and the National Longitudinal Survey may provide more representative samples of workers, but typically provide relatively little information about respondents' firms (Brown, 1990, Lynch and Black, 1998). And most studies rely on workers to self-report their training experiences, which may lead to substantial measurement error with the key explanatory variable of interest (Bartel, 1995).

A recent review of the literature that uses firm-level data to identify the impact of human capital investments on firm performance concludes that "increasingly, studies provide evidence that training generates substantial gains for employers. The most compelling evidence is presented in several recent papers connecting training investment with changes in productivity, profitability,

[3] These studies relate the training participation and productivity of individual workers using data obtained from surveys of either individuals directly, or of firms (who are then asked to report on selected workers). See for example Barron, Black and Loewenstein (1989), Brown (1989), Lillard and Tan (1986), Holzer (1990), Booth (1991), Bartel (1992), Lynch (1992), Mincer (1993), Groot, Hartog and Oosterbeek (1994).

[4] Studies by Bishop (1994) and Bartel (1995) attempt to address many of the problems with wages by focusing on worker performance as judged by subjective supervisor ratings (either on a survey or as part of the company's performance scoring system). Krueger and Rouse (1998) supplement earnings and subjective productivity assessments with other productivity measures such as job attendance, although these data are only available for employees in two firms.

[5] Bartel (1995) attempts to address this endogeneity problem by using the employee's salary relative to others within the firm in the same job category as an instrument for training participation.

and stock market performance." This review (Hansson, et al., 2003) highlights six specific studies that most strongly support this general conclusion: Barrett and O'Connell (1999), Dearden et al. (2000), Groot (1999), Hansson (2001), d'Arcimoles (1997), and Bassi et al. (2001).

Since the review of the firm-level research by Hansson, et al. is far more comprehensive than anything than we could undertake for the purpose of this paper, we will merely note that with the exception of the last article cited above, the others were all done using data from one or more European countries, where researchers have access to better data on firms' investments in employee development. These data have been unavailable to most researchers on U.S. firms, and hence, most of the U.S.-based literature has been confined to examining aspects of firms' training other than the actual spending level on training. Nonetheless, there are important conclusions that have emerged from the analysis in the United States as well.

Effects on productivity, sales, and profitability

Bartel (1994) presents one of the first attempts to estimate the effects of training on productivity in U.S., using a 1986 sample of 495 U.S. manufacturing firms. She finds that the provision of training programs between 1983 and 1986 is positively correlated with firms' 1986 sales per employee. However, the key explanatory variable of interest in her analysis is simply an indicator for whether the firm provides any formal training to employees, and not the dollar amount spent on training.

Holzer *et al.* (1993) analyze data for 157 Michigan manufacturing firms that had applied for state subsidies to support private training programs. They find that receipt of a training subsidy increases training hours within a firm by a factor of two to three in the short term, and reduces output "scrap rates" by around 13 percent. The dollar value of this reduction in scrap rates is between $30,000 and $50,000 per year. The survey does not, however, identify the training costs actually borne (invested) by the firm.

Black and Lynch (1996) analyze data from the National Center on the Educational Quality of the Workforce (EQW)'s national 1994 telephone survey of 2,945 private firms with more than 20 employees.[6] Respondents were asked to report on a variety of 1993 firm characteristics, as well as questions about training practices such as whether the firm provides any formal or structured training or any informal training to its employees. The survey does not include information on firm training expenditures, or any information that would enable us to convert the available indirect training measures into dollar terms. Black and Lynch find that the log of the number (or proportion) of workers who are trained in either 1990 or 1993 does not have a statistically significant correlation with the log of the firm's 1993 sales for either manufacturing or non-manufacturing firms. The provision of computer training has a positive, statistically significant correlation with sales for non-manufacturing firms (although only at the 10 percent significance cutoff), but not for manufacturing establishments. Interpretation of these estimates is complicated further by the fact that the EQW provides only cross-sectional data on firms, which limits the authors' ability to control for unmeasured firm characteristics.[7]

In one of the few U.S.-based studies that analyzed actual training expenditures, a 2004 analysis of financial institutions conducted by the American Bankers Association found that those financial institutions with higher-than-average training expenditures per employee subsequently had better outcomes than other institutions on five key financial measures examined--return on assets, return on equity, net income per employee, total assets per employee, as well as stock return.

Effects on employee retention

Heskett et al. (1994) found that one of the most important predictors of whether an employee will stay with his/her current employer is the employee's satisfaction with the opportunities provided for learning and development. Further, the same study found that a firm's ability to retain its key employees is, in turn, a fundamental determinant of a number of important outcomes, such as customer satisfaction, sales per employee, and market capitalization.

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[6] Our discussion of the EQW survey data draws on Black and Lynch (1998); also see www.irhe.upenn.edu/~shapiro/.

[7] For further discussion of this literature see Bartel (2000).

Effects on customer retention

Research by ASTD (2000) found that there is a powerful correlation between training expenditures per employee and firms' customer retention rates. This can have a significant effect on firm performance – one study found that a 1 percent reduction in customer attrition can add as much as 5 percent to a company's bottom line (Peppers and Rogers 1993).

Effects of other related learning and human capital factors

Numerous other recent studies, although they do not look specifically at learning and development expenditures, also point to the centrality of learning as a key driver of future financial performance. The studies cited below are among the strongest examples of this literature, and include a number of large-scale empirical studies.

- A study using a sample of 750 large, publicly-traded firms and found that organizations with the best human capital practices provide returns to shareholders that are three times greater than those of companies with weak human capital practices (Pfau and Kay, 2002).[8]
- A study of the importance of "intangible" factors found that the quality of a firm's human capital is one of the four most important determinants of a firm's future financial performance (Low and Kalafut, 2002).
- A study by the Gallup Organization found that the quality of management was a key factor in determining employee retention, customer satisfaction, and productivity (Buckingham and Coffman 1999).

The significance of current accounting and reporting treatment

It is an accepted tenet of economics that a necessary condition for maximizing profitability is for the firm to invest in each "factor of production" – labor, capital, natural resources, etc. – up to the point at which the marginal return on an additional dollar spent is the same for each of the

[8] The Pfau and Kay study also reported that a group of human resource practices that they generally label "Prudent Use of Resources" is associated with a decrease in market value. Some have incorrectly interpreted this finding to mean that there is a negative relationship between market value and training and development expenditures. The name of the category is highly misleading, however, as only two of the six specific elements in the category are in any way related to training and development, and neither captures more than an extremely small slice of any firm's overall investment in training.

factors. Over-investment in any particular factor will result in a lower return on that factor. Similarly, an under-investment in a factor will result in a *higher* return on that factor.[9]

To put it another way, if a business is allocating its scarce resources efficiently, it would find that, at the margin, its "return" on investments in its people is identical to its returns on investments in its other factors of production. If returns on certain factors are higher than returns in other areas, we would conclude that the firm is under-investing in that factor. As we discuss in Section V, this is exactly what we find in the area of human capital investments. Specifically, our research suggests that returns to investments in employee training are consistently "super-normal." This suggests that there is a general under-investment in human capital; the average firm tends to invest less than the efficient amount in its people.

Why would firms ignore the obvious and under-invest in this particular factor? Consider two organizations that are identical in all but one respect: Company A makes substantial investments in skills, while Company B does not. What will be evident to any investor comparing the companies' income statements is that Company A has higher overhead (SG&A) and correspondingly lower reported earnings than Company B. What will not be evident, however, is that some of what were classified as "expenses" for Company A is actually an investment in future productivity.[10] Consequently, Company A's stock prices would be expected to be lower – at least in the short-run – than Company B's. The decision of Company A to invest in learning and development thus occurs *despite* pressures from financial markets. All firms – even those that have made significant human capital investments in the past – continually face this structural pressure to cut those investments in the short run to generate temporary increases in earnings. Hence, we would expect a "super-normal" return on human capital investments.

Moreover, as noted above, workers' mobility hinders firms' ability to recoup their return on investments in human capital. This introduces an element of risk into the investment – above and beyond the usual level of risk inherent in any form of investment. To the extent that firms

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[9] The marginal return is higher on factors in which there has been under-investment (i.e., an inefficiently low level of investment) because additional higher returns could have been achieved with additional marginal dollars of investment.

[10] Note that although investments in research and development are also accounted for as an expense, they are separately reported.

are averse to risk, the disincentives to invest in human capital development noted above are compounded.[11]

III. Conceptual and Estimation Issues

If training activity by firms generates economic returns then they should ultimately be reflected in the firm's equity valuation. The value that the stock market attaches to firm training activities should arise regardless of the channel through which training affects productivity – through increased output per worker, reduced costs per worker, improvements in worker morale or reductions in turnover, improved use of technology, and so on.

We follow the R&D literature (Hall 1999 and Jaffe 1986) in writing the market value of a firm as a function of its assets:

$$(1) \qquad V = f(A_1, A_2, A_3, \ldots).$$

Hall (1999) points out that this approach is analogous to a hedonic price equation using the market price of a heterogeneous good to measure pseudo-prices of bundled attributes or components. For tractability and ease of interpretation, we assume a linear function where firm (i)'s stock market value in period (t) is a function of the firm's assets, X(i,t-1), the accumulated stock of human capital embedded within the firm's workforce:

$$(2) \qquad V(i,t) = \beta_0 + \beta_1 X(i,t-1) + \sum_k \beta_{2k} \text{Training}(i,t-k) + \alpha(i) + \alpha(t) + \alpha(i,t)$$

where the parameters β_{2k} implicitly reflect depreciation in this human capital investment over time, α(i) is unmeasured firm-specific attributes that are fixed over time, including unmeasured or difficult-to-measure assets such as managerial talent, α(t) is a period shock common to all firms, and α(i,t) is a period- and firm-specific shock.

[11] If firms are risk-neutral as is typically posited in the classical theory of the firm, the risk that results from worker mobility would not have the effect outlined above.

One problem with identifying the returns to training from equation (2) is that for three-quarters of the firms in our sample (see section IV for further discussion) we observe training expenditures at only one point in time, and so are unable to construct either the firm's training stock or a history of training flows. Another complication with equation (2) is the possibility that unmeasured firm-specific attributes are systematically related to training. For example, firms with higher-quality management or human resources practices may be more likely to engage in training, in which case ordinary least squares estimates for the parameters in (2) will yield biased estimates for the returns to training.[12]

Our solution to both of these problems is to estimate a version of equation (2) that focuses on the *change* in the firm's stock market valuation as our outcome measure of interest, $\Delta V(i,t)$, measured as the change in the price of a share of the firm's stock. In this case the effects on the firm's stock valuation level from any unmeasured firm attributes – both the unmeasured firm fixed-effects as well as the accumulated history of training activities – should be reflected by the firm's initial stock price, and so essentially differenced-out of our estimating equation. To further control for omitted variables our reduced-form estimates condition on 2-digit industry fixed effects, firm characteristics such as profitability, and period fixed-effects to account for changes in market conditions that affect the trend in stock valuation for all firms. In addition we account for "momentum" in changes in the firm's valuation by also conditioning on the lagged value of the dependent variable (that is, the lagged change in stock price).

$$(3) \qquad \Delta V(i,t) = \delta_0 + \delta_1 X(i,t\text{-}1) + \delta_2 \Delta V(i,t\text{-}1) + \delta_3 \text{Training}(i,t\text{-}1) + \varepsilon(t) + \varepsilon(i,t)$$

Of course omitted variables are nonetheless a concern even with the fairly rich model specified by equation (3). However for a sub-set of firms in our sample, we have two or more measures of annual training expenditures recorded at different points in time. For this "repeat sample" we can examine how changes in training and other firm characteristics over time relate to changes in changes in stock price, as in equation (4).

[12] Conversely, although less likely in practice, is the possibility that firms that have unusually large deficiencies in their labor force make large investments in training (which would have the effect of imparting a downward bias in the estimates).

(4) $[\Delta V(i,t+1)-\Delta V(i,t)] = \gamma_0 + \gamma_1 \Delta X(i,t) + \gamma_2 [\Delta V(i,t)-\Delta V(i,t-1)] + \gamma_3 \Delta \text{Training}(i,t) + \upsilon(t) + \upsilon(i,t)$

By relating changes in the trajectory of the firm's stock price to changes in the firm's training expenditures, we are able to account for the influence of time-varying unmeasured firm attributes that cause some firms to have different stock trends than others. In addition, the repeat sample enables us to explore the possibility of reverse causation (as described in additional detail below). Specifically, we can examine whether changes in the firm's stock price from periods (t-2) to (t-1) affect changes in the firm's training expenditures. The cost of differencing the data is that our repeat sample is much smaller than our full analytic sample of firms, which in turn reduces our statistical power to detect the effects of training on stock price changes.

IV. Data

The data for our analysis come from 1996 to 1998 training information collected (between 1997 and 1999) by the American Society for Training & Development (ASTD), which were then merged with Compustat (Standard and Poors) financial data on publicly-traded companies.[13]

The ASTD data were collected using standard measures and definitions for formal education and training investments that were developed by ASTD in partnership with a group of large corporations. The measures include categories of training expenditure by content and activity, percent of employees receiving training, the components of key training ratios (overall training expenditures, payroll, number of employees, number of training staff).[14]

The measures were then distributed to interested organizations as part of ASTD's "Benchmarking Service," in which any organization that submitted their data using those measures would receive in return free benchmarking information from ASTD on how their training investments compared with a variety of comparison groups. All participating

[13] This analysis uses a revised database to the one used for the analysis in Bassi et al. (2001). This database includes updated dependent variable for the final year of the sample, and the scope of the analysis is significantly expanded and more comprehensive.

[14] These data only capture the direct cost of "formal training." These direct costs do not include the "indirect costs" (employees' compensation cost and lost productivity while they are in training, or travel cost and time, or overhead). Nor do these direct costs capture the cost of "informal learning."

organizations were guaranteed that their data would be kept confidential. The voluntary nature of firms' participation in this process generated a convenience sample.

Participating firms were asked to report on their training investments for the previous year, so that the ASTD sample used here captures firm training activities for the period from 1996 to 1998. A few training measures (such as content categories) were slightly modified in some years.

Table 1a shows that of the 2,500 firms that responded to the ASTD survey, 575 were from companies that are publicly traded on a major United States stock market (either the New York Stock Exchange, the American Stock Exchange, or NASDAQ). Of these, 493 reported training spending. Most organizations that chose to participate then submitted data in only one year, although some did submit data for two or all three years. Firms were permitted to submit data either for a self-contained subunit or for the organization as a whole.

Training data for the publicly-traded firms in our sample were merged with publicly-available financial data obtained from Standard and Poors (S&P) for the years surrounding the training data. Multiple observations were included in the sample for publicly-traded companies that submitted data in multiple years, with standard errors adjusted to account for this clustering. Data from companies that had submitted data from multiple subunits in a single year were combined into a single observation, with the subunits weighted by number of employees for purposes of consolidation.

One complication for our analysis comes from the fact that training information was reported by sub-units within firms, while Compustat measures report on the productivity, profitability and market valuation of the firm as a whole. Table 1b provides some sense for the scale of this problem. The average firm in the ASTD sample reports training data that covers 43 percent of the firm's total workforce. The distribution for this coverage variable is highly skewed – the median firm reports training data that covers 22 percent of all employees. Our baseline regression estimates implicitly assumes that the training investments made by the one-quarter of each firm for which we have training information is representative of the firm as a whole. One way that we attempt to control for potential deviations from this assumption is to include an indicator variable that is equal to 1 for the firms in our sample for which the ASTD survey reports training information for half or more of all the employees in the overall firm. We also re-calculate our estimates using only the sub-sample of firms in which we have training information for at least half of all employees (about 40 percent of our sample of firms), and again using only firms for which we have this information for at least 85 percent of employees (around one-quarter of our analytic sample).

Since the ASTD dataset is a convenience sample, one important issue is how this sample relates to the larger population of publicly traded private-sector firms in the U.S. Table 1b shows that the sample of firms used in our analysis looks very similar to the typical S&P 500 firm during our observation period (1996-98) with respect to a number of measures, including total employees, total assets, leverage ratio, return on assets and price-to-earnings ratio. The ASTD sample has somewhat lower sales and income per employee. In general, however, the sample seems similar to the typical large firm in the S&P 500 with respect to size and financial performance.

V. Empirical Results

Determinants of training

Before considering how training is related to stock valuation, we first use the dataset to explore what factors determine the amount of training in a given firm. The first column of Table 2 shows that industry explains relatively little of the variation in training expenditures within our analytic sample. Firms in the chemical, technology, and telecommunications industries spend more on training than firms in other industries, but overall our series of industry fixed-effects explain only around 14 percent of the variation in training within our sample. The second column of Table 2 shows that measures of the firm's prior financial performance aside from leverage are not very predictive of the firm's training activity in the next period. Put differently, high- and low-training firms do not appear to be fundamentally different with respect to observable firm characteristics. This finding is consistent with what has been reported for the nationally representative sample of firms interviewed by the Bureau of Labor Statistics in 1995.[15]

[15] Data from the Bureau of Labor Statistics' 1995 employer survey of firms with 50 or more employees suggests that firm size and industry explain relatively little of the variation in training activities across firms: Larger firms are

Training and stock performance: quartile analysis

Table 3 shows that investments in training are positively correlated with stock price returns. As seen in the table, firms in the 3rd and 4th quartiles with respect to training expenditures subsequently experience annual changes in share prices equal to 34.3 and 30.7 percent, respectively, roughly double the return experienced by firms in the bottom quartile (15.3 percent). The table reveals similarly substantial differences across quartiles with respect to sales per employee, gross profit margin, and market capitalization per employee, and somewhat less dramatically for sales per employee, return on assets and Tobin's Q (which is essentially the ratio of market to book value of the firm).

Training and stock performance: regression analysis

Given that industry and previous firm performance is not highly predictive of future training expenditures, it is not surprising that the relationship between training and future stock price returns is not sensitive to conditioning on industry or other firm characteristics. The first column of Table 4 shows that each additional dollar of training expenditures per employee is associated with an increase in the firm's stock return equal to more than 1 basis point, statistically significant at the 5 percent cutoff. This relationship holds true in additional specifications, even after conditioning on variables that include the following: each firm's investments in other areas (capital expenditures and, when relevant, R&D), measures of the firm's financial performance from the past year including gross profit margin, assets, the debt to asset ratio, the price to earnings ratio, the price to book ratio, a series of industry dummies for 2-digit SIC codes, and the lagged value of the dependent variable. To account for the fact that firms completed the ASTD training survey at different points in time we include a series of year dummies to control for period effects. We also include an indicator for whether the business unit that reports on the ASTD survey accounts for more than 50 percent of the firm's total employees. All of our variables are initially measured on a per-employee basis. Because the control variables typically have the expected correlations with firm performance, we focus our attention on describing the results for the training expenditure variable. Note that with the inclusion of industry fixed effects

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somewhat more likely to engage in training than smaller firms, and firms in retail trade and manufacturing of durable goods are somewhat less likely to train than those in other industries, these differences are fairly modest (Frazis et al., 1998, p. 6).

the training/stock price relationship is identified based on differences in stock price changes within industries between high- and low-training firms, so that our training estimate is not the spurious result of across-industry differences in training and firm performance.

Understanding the magnitude of this relationship is complicated in part by the fact that the training variable is highly autocorrelated over time. Using the repeat sample (that is, the one-quarter of firms in our sample for which we have at least two training observations) we find that the correlation between training observations at different points in time is on the order of +0.8. Even with all of the control variables included in the regression, we cannot be certain whether the training coefficient captures the effects of training expenditures in year (t-1) on changes in the firm's stock price in (t), or might also capture (at least in part) the accumulated effects of prior training expenditures that may not be fully captured by the initial stock price of the firm.

Nonetheless, the rate of return implied by the training coefficient shown in column 5 of Table 4, while seemingly quite large at first glance, is easily justified. A one standard deviation increase in training per employee would be expected to raise the firm's stock price by 6.34 percentage points (.0095 x $667 = 6.34). But, because training is an investment that presumably requires a stream of payments and eventually produces a stream of benefits in the form of greater earnings, the stock market rewards it with a multiple. One way to see this is to imagine that a one standard deviation increase in training per employee this year implies a sustained increase in perpetuity. For instance, applying a discount rate of 4 percent, then the $667 down payment today has a present value of $16,675 per employee while generating gains in the market value per employee of about $19,000 (6.34 percent of $300,000, which is the median market value per employee). Or, put differently, with a price/earnings ratio averaging 30, any indication of greater earnings today can generate substantial stock price gains.

Considering the direction of causality

While the performance controls in the regression above should prevent a spurious correlation between training and stock returns, we also show that training expenditures are not driven by past returns. Table 5 addresses this question of causality by examining the relationship between training and stock returns in various years. The only significant relationship uncovered is between training in year (t-1) and stock return in year t. There is no significant relationship between training in year (t-1) and stock returns in either year (t-1) or (t-2). This supports the thesis that training investments help to determine stock price performance, and not the opposite. The effect of our controls are also illustrated in Table 5 by splitting training into a predicted part and a residual. As expected, the part predicted by past performance does not move stock prices, but the unpredicted part is highly significant.

Effects of different types of training

Table 6 shows that some forms of training[16] appear to be more productive than others. Specifically, training devoted to technical skills (column 2) has a point estimate of .0343, more than 3.5 times the average effect of all training (column 1) and more than 6 times the effect for training in business skills (column 3). The point estimate for training in other fundamental skills (column 4) is almost 75 percent higher than for technical skills. When combined in a single regression (column 5), the point estimates for technical and fundamental skills remain high and significant (technical skills at the 1% level, fundamental skills at 10%).

An alternative way to disaggregate training expenditures are by "general" and "firm-specific" skills, given that economic theory yields sharply different predictions about the willingness of firms and workers to pay for each of these types of training. Table 6 also presents the results from re-running our basic model specification with per employee expenditures on general and firm-specific training substituted for the overall training measure. As seen in the table (columns 7 and 8), the effects of firm-specific training are significant and similar in magnitude to the

[16]Different types of training are identified using training categories defined by ASTD. Training was broken up into two different sets of categories: technical versus business versus fundamental, and firm-specific versus general. The latter breakdown was designed to reflect the standard general versus firm-specific categories described in the model first proposed by Becker (1964). Specific types of training in each category are as follows. (Lengthy specific definitions for each category were provided by ASTD as part of its Benchmarking Service and are available upon request from the authors.) *Technical skills training* include firm-specific technical skills, general information technology skills, and professional skills. *Business skills training* includes customer relations, sales/dealer training, uality/competition/business practices, managerial/supervisory skills, executive development, and new employee orientation. *Fundamental skills training* includes interpersonal communication, basic skills, and occupational safety/compliance. *Firm-specific skills training* include product knowledge, new employee orientation, and firm-specific technical skills. *General skills training* include customer relations, sales/dealer training, quality/ competition/ business practices, managerial/supervisory skills, executive development, interpersonal communication, general information technology skills, basic skills, professional skills, and occupational safety/compliance.

effects of all training. The effects of general training on stock performance, on the other hand, are insignificant.

Alternative specifications

It is also important to consider the sensitivity of the overall results to alternative specifications. Qualitatively similar results come from using the change in stock price returns across years as the outcome measure, rather than conditioning on the lagged stock price return. Our data suggest that the latter should be preferred given that the former constrains the implicit coefficient on lagged stock price change to equal +1.0, while our data identify this coefficient to be equal around +0.3. The results are also quite robust to measuring our explanatory and dependent variables on a per-firm rather than per-employee basis.[17] Re-estimating our models with weighted least squares (WLS) using firm size (number of employees) as the weighting variable has little effect on our key findings.[18]

The one dimension along which the previously-discussed results for all training are sensitive to altering the basic estimation approach is with respect to including or excluding those firms in the top and bottom 1 percent of the training distribution. Column 1 of Table 7 shows that dropping these four firms reduces the estimated point estimate for the training variable by approximately 40 percent, which is now no longer statistically significant with a t-statistic equal to 1.24.

Other significant measures of training (technical skills, fundamental skills, and the predicted component of training) in the full results are less sensitive to the exclusion of outliers. Columns 2 to 4 of Table 7 shows that when the top and bottom 1 percent of firms in the training distributions are removed from the sample, the regression coefficients for each variable do decrease in magnitude to some degree (between 15 and 22 percent), but remain statistically significant (at the 5% level for technical and fundamental skills and at the 10% level for predicted training).

[17] Results not shown; they are available from the authors upon request.

[18] The advantage of WLS over OLS is that the former addresses the possibility of heteroskedasticity in the error structure, although at the cost of assigning more weight to larger firms. Put differently, OLS has the advantage of treating changes in a given firm's training expenditures as the thought experiment of interest underlying the regression analysis, which seems more natural than the WLS approach of implicitly treating each individual worker as the experimental unit of interest.

Removing the firms in the top and bottom 1 percent of firms in stock price return (columns 5 to 8 of Table 7) also reduces the magnitude of the coefficients for all training, predicted training, technical skills training, and fundamental skills training, although all results (including for the overall training variable) remain statistically significant.

Analysis of the interaction of technical training

Table 8 addresses the question of how the benefits to technical skills training are being realized. We investigate the hypothesis that the returns to technical training vary systematically across certain firm types by interacting the technical training variable with the measures of capital spending per employee, research and development per employee, and assets (that is, firm size). While technical training appears to interact positively with both capital spending and R&D, it only does so significantly with R&D. Notice, for a firm with no R&D the coefficient on technical skills training is cut nearly in half. It is also worth noting that technical training interacts negatively with assets, suggesting that larger firms have a much lower return on training than smaller firms.

Analysis of repeat sample

Table 9 uses data from our repeat sample to examine how changes in firm training expenditures change the trajectory of firms' stock price movements. The top panel presents descriptive results from a very simple empirical test, comparing the change in stock price returns and the level of stock price returns[19] for firms that increased training expenditures from one wave of the ASTD training survey to the next with the change in stock price returns for those firms that showed a reduction in training expenditures across survey waves. Those firms that increased training expenditures experienced a median annual excess return of 2.00 percent (versus firms in the sample without repeat training observations), compared to a median of -6.90 percent for those firms that decreased their spending on training. The firms that increased expenditures also had a larger *change* in excess stock price return than those that decreased their spending, 1.57 percent versus -7.39 percent.

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[19] Please note that stock price return is itself a "change" variable (it measures the annual change in market capitalization of a firm).

The second panel of Table 9 presents the results from a more formal regression analysis. The first column shows the results of estimating a parsimonious model that simply regresses the first difference in the stock-price change variable against the first difference in the training variable. The second column presents the results of estimating equation (4) above, which essentially first differences the basic model specification used in the previous tables. This repeat-sample analysis yields a point estimate for the returns to training equal to .02 to .04 for stock price return and .03 to .05 for change in stock price return. The regression analyses that include year and industry dummies and changes in other control variables finds that the change in training variable is significant at the 5 percent level for stock price return (with covariates only) and at the 10 percent level for change in stock price return (with and without covariates).

Although the point estimates generated by the relatively small sample of firms in our longitudinal data base are (not surprisingly) somewhat imprecise, the results in Table 9 suggest that there is, in fact, a truly causal relationship between training expenditures and subsequent stock prices. If these point estimates were accepted at face value, they would imply an even larger rate of return than that which was calculated in the example outlined above.

Summing up

As previously noted, however, in the absence of data from an experimental design it is impossible to rule out the possibility that the training measure used in our analysis is serving, at least in part, as a marker for other unmeasured firm-level attributes that are correlated with a firm's long-term profitability (and thus equity market valuation). From the perspective of an individual firm, this possibility means that an incremental increase in training expenditures may not yield the same dramatic increase in stock share prices that are implied by our estimates.

From the perspective of an individual investor, however, it is far less important whether the correlation between training and stock value represents a causal training effect on firm performance or whether training is instead simply a leading indicator for other productive firm activities or attributes. In the short run, so long as the underlying relationship between training and whatever firm characteristics affect productivity continues to hold, investment portfolios that incorporate information about firm training expenditures will yield supernormal rates of return.

VI. Investment Implications of the Research

Consistent with the results described above, hypothetical portfolios selected on the basis of a firm's training expenditures per employee yielded returns that were significantly higher than major market indices. Hypothetical investment portfolios comprised of only firms that spent more than $1,000 per worker on training in a given year, weighted by regression-predicted returns using a reduced set of variables (including training per employee), outperformed the S&P 500 index (including dividends) in the following year by 46.9 percentage points cumulatively from 1997 to 2001 (5.6 percentage points on an annualized basis). This period included both the bull market of 1997 to 1999 and the bear market of 2000 to 2001.

In an effort to put the findings from their earlier research on this subject into action in the U.S. stock market, two of the co-authors of this paper founded a money management firm, Bassi Investments, Inc. (BI), in 2001.[20] The foundation of their firm's investment strategy was an earlier research finding that publicly-traded firms that spend more than average on training outperformed others in the stock market, and that this outperformance was particularly pronounced for those firms that invested most intensively in training.[21] The founders believed that an important step in spurring investors and analysts to treat training investments (as well as other forms of human capital development and management) as a material factor in analyzing stocks' investment potential would be to demonstrate that training investments could indeed be used successfully as a fundamental component of an active investment strategy.

The firm's experience since it began actively managing funds in December 2001 is instructive on a number of different dimensions. First, it provides an additional perspective on the "real world" investment implications of the research described in this paper: is training investment indeed

[20] Laurie Bassi and Daniel McMurrer are co-founders of Bassi Investments (which was known as Knowledge Asset Management before its name was changed in 2004).

[21] See, for example, Bassi et al. (2001). In constructing the exact composition of its active investment portfolio(s), the firm also conducted additional non-published research and applied those findings to its portfolio decisions.

useful in constructing a portfolio strategy that can outperform relevant market indices? (In addition, the performance of the firm's portfolios also provides an out-of-sample test of the research findings.) Second, and more generally, it provides a window into the methodological and portfolio management decisions that must be made when attempting to translate an academic research finding into a viable investment strategy in the stock market.

First, a brief discussion of the firm's portfolios and their performance: Bassi Investments currently has three equity-only portfolios and one lower-volatility "covered calls" portfolio that have been in operation for at least 12 months. (One was launched in December 2001; the other three were launched in January 2003.) The composition of each of the portfolios was determined primarily by the training investments and other human capital management practices of the firms under considerations for portfolio inclusion. After deducting all fees and expenses, each has outperformed its benchmark index since inception, by between one and seven percentage points cumulatively (see Tables 10a and 10b.) The outperformance of all portfolios holds true on both an absolute and a risk-adjusted basis (each portfolio has a positive value for alpha, a measure of risk-adjusted performance).[22]

Although the firm's track record is still quite short, its performance provides additional support for the conclusion that firms' training investments represent a material factor that should be considered by analysts and investors in assessing firms as possible investments. At the same time, the fact that the portfolios have not outperformed to the extent expected based on the results and hypothetical portfolios described above is also worthy of inquiry: it may be a result of the short time period available for examination, and may also reflect the importance of the decisions that must be made in moving from research results to investment strategy deployed in the real world marketplace.

Before launching its first portfolio (Portfolio A), it was decided that the firm's investment strategy would generally reflect the "efficient market" hypothesis, with the expectation that the market would price equities efficiently based on all existing available information but would be

[22] Nothing in this discussion should be interpreted as a recommendation to buy or sell securities. Past performance is not a guarantee of future results, and it is always possible to lose money when investing in securities. For full information on its investment offerings, Bassi Investments should be contacted directly.

unable, of course, to incorporate any non-public but material information (such as information on some firms' training investments). While research results pointed variously to the importance of a few financial variables along with information on training, it was determined at the time that none of the results for financial variables were consistent enough to include them in the decision-making model for identifying firms eligible for inclusion in the portfolios.[23] So the firm's investment strategy rested in part on the assumption that training information by itself had sufficient predictive power to drive portfolio outperformance, given that the market was efficiently incorporating all other information.

A number of elements were added to the selection process for Portfolio A in order to ensure that its holdings would be able to be drawn from a relatively large pool of eligible stocks,[24] and that the weights of its holdings would generally resemble the industry mix of the S&P 500 index.[25] Although these elements were not part of the process of selecting the hypothetical research portfolios, they were added to help ensure that the firm's first portfolio would be well-balanced and representative of the industry mix of the market as a whole. Portfolio A was launched in

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[23] For a short time, a volatility variable was considered in determining eligibility for inclusion, but this effort was discontinued in the first year of operation. Although training investments per employee was the primary variable used in considering stocks for inclusion in BI portfolios, other financial variables were also considered as exclusionary screens (i.e., firms that failed to qualify for a number of basic screens were considered ineligible for the portfolio). See http://www.bassi-investments.com/portfoliostrat_set.html for full discussion of portfolio selection process.

[24] In constructing the portfolio, BI had sought information on firms that might meet its primary investment criteria (i.e., firms that spend more than a certain amount on training per employee, with the exact cutoff based on a refined version of the research described in Bassi et al. 2001). It directly contacted a range of publicly-traded firms (identified as likely candidates for inclusion based on information drawn from a number of public sources) to request information on their training expenditures, and was able to gather data from a small percentage of the firms contacted. Data were not provided by most of the firms contacted. (Among the most common reasons cited were firm policies against the release of non-public information or inability to provide accurate information on training investments.) Thus, the data available to the firm included information on some, but not all, firms that met the threshold to be considered for inclusion in the portfolio. As a result, BI also decided to use, in a small number of cases, available *qualitative* information to treat as "eligible for inclusion" firms which specific quantitative data had not been provided. This decision was made in order to avoid having the data request process itself play a fundamental role in determining the shape of the investment portfolio (i.e., BI did not want to eliminate a stock from consideration simply because available contacts at a given firm had been unwilling to provide the requested information). This standard was applied primarily to those firms in industries that would have otherwise been under-represented relative to the S&P 500.

[25] The firms that did meet the original threshold were distributed disproportionately across industries. The use of qualitative information for some companies in under-represented industries partially ameliorated this issue, as it reduced the under-representation of some industries in BI's initial portfolio. The over-representation of other industries was addressed by placing a relative maximum (150 percent of the industry's weight in the S&P 500) on the weight of any given industry.

December 2001, a product of the primary research results, as supplemented by additional portfolio selection elements. As seen in Table 10a, this portfolio's relative outperformance has been the smallest of the four portfolios that have at least a 12-month performance record.

In January 2003, three additional portfolios were launched. For purposes of this discussion, Portfolio B is the most interesting to explore.[26] The process for selecting this portfolio was designed to adhere more closely than Portfolio A to the research-based model used for the earlier hypothetical annual portfolios. Its holdings include only those companies that qualified based on their quantitative training data, and no efforts were made to strike a balance in representation across industries.[27] The portfolio would thus neither enjoy the advantages (such as lower volatility) nor incur the disadvantages (such as the added uncertainty of including stocks without full quantitative information on the variable of interest) that resulted from the additional processes used in selecting Portfolio A.

Interestingly, Portfolio B's outperformance relative to the S&P 500 index has been larger than any of the other live portfolios (see Table 10a), as it has outperformed by over seven percentage points in 17 months. Again, it is possible that its strong performance is due, at least in part, to the short period of time in which this portfolio has been operated. It is also possible, however, that this portfolio has come closer to the performance of the research portfolios because it is the portfolio that most closely reflects the research model that is the base of the firm's investment strategy.

In conclusion, the "real world" performance of the Bassi Investments portfolios helps illuminate the implications of this paper's research findings in two ways. First, it provides additional support for the research conclusion above, that training investments are positively related to stock market performance, with those firms that spend more on training likely to outperform other firms in subsequent years. Second, it points to some of the decisions that must be made in

[26] Portfolios C and D were designed to provide portfolio alternatives to investors seeking lower-risk options, with Portfolio C tied more closely to industry weights and Portfolio D hedged using a covered calls strategy.

[27] Firms in the portfolio, like the others, are still required to meet a series of fundamental screens (e.g. no legal issues, no corporate governance problems, no significant concerns about long-term viability), but only a small percentage of otherwise qualified firms fail to pass these screens.

translating research results into an investment strategy that is deployed with clients' money in the stock market. One particularly difficult issue was identifying the proper balance between the research-based model and other, more traditional, portfolio management concerns (industry mix, etc.). The early results suggest that a strategy that adheres as closely as possible to a research model may outperform other strategies that more directly incorporate other issues in constructing a portfolio. As noted above, however, these results are based on a relatively short period of performance. This question will be able to be answered more definitively following additional years of portfolio operation.

VII. Summary and Conclusions

In this paper we estimate the returns to private-sector training using firm-level data, an approach that has heretofore been widely used to estimate the effects of a different form of investment – research and development (for example Griliches, 1998, Hall, 1999, Eberhart, Maxwell, and Siddique, forthcoming). We exploit a unique firm-level data set generated by the American Society for Training and Development (ASTD), which collected 1996 to 1998 data on a sample of over 400 U.S. publicly traded firms to obtain detailed training information, including dollar expenditures on training and training content. Our main outcome measure is the percent change in the firm's stock return, obtained from matching firms in the ASTD sample with the detailed firm financial information from Compustat. The longitudinal nature of Compustat's financial information also enables us to control for a rich set of prior measures of firm performance to account for characteristics that may influence both firm training and performance.

In addition, for a subset of the ASTD on which longitudinal data were available, we were able to deploy "differences of differences" estimation techniques. Although this brings us as close to being able to identify a causal relationship as is possible in the absence of experimental data, omitted variables bias cannot be entirely ruled out.

From the perspective of an individual firm, this possibility means that an incremental increase in training expenditures may not yield the same dramatic increase in stock share prices that are implied by our estimates. From the perspective of an individual investor, however, it is far less important whether the correlation between training and stock value represents a causal training effect on firm performance or instead whether training is simply a leading indicator for other productive firm activities or attributes. In the short run, so long as the underlying structural relationship between training and whatever firm characteristics affect productivity continues to hold, investment portfolios that incorporate information about firm training expenditures will yield supernormal rates of return.

The research evidence in section V, along with the preliminary evidence from an investment strategy that has deployed the research outlined in section VI, strongly suggests that the return on firms' investments in "human capital" (as measured by their spending on employee education and training) generate super-normal returns. It seems likely that at least a part of the reason for this super-normal return is that investments in human capital (specifically employee training) are a non-reported "investment" that is buried in SG&A "costs." Hence, all but the most diligent investors are unable to ferret out which of these "costs" are, in fact, investments that might be expected to generate future profitability. This has the effect of causing "high investment" firms to be under-valued in the short-run.

This research has two important implications. First, investors would be well served by considering firms' human capital investment strategies as an integral part of their investment decision. Second, the current accounting and reporting treatment of human capital tends to perpetuate an under-investment in human capital relative to other forms of investment among publicly traded firms.

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Table 1a. Training expenditures data, sample creation

		Training expenditures per employee ($)						
				Percentiles				
	N	mean	std.dev.	10th	25th	50th	75th	90th
Survey responses	2,500	641						
Publicly-traded firms	575							
with training spending	493	704	660	106	246	510	920	1507
with all data available	388	703	667	106	246	502	920	1502

Table 1b. Firm variables, descriptive statistics for training sample

	Final sample			S&P 500 time-average	
	mean	std. dev.	median	mean	median
Firm variables:					
Total employees	41,523	90,372	12,100	42,334	21,092
trng data based on what % of emps	43%	42%	22%		
Total assets ($1,000,000s)	21,150	62,738	3,765	23,043	6,386
Leverage ratio (debt/assets) (%)	19	16	16	19	17
Return on assets (%)	4.6	7.2	4.3	5.3	4.5
Price/earnings ratio	30	54	20	26	19
Sales/employee ($1,000's)	269	220	208	308	231
Income/employee ($1,000's)	16	31	11	24	15
Capital exp/employee ($1,000's)	22	53	11	25	12
R&D exp/employee ($1,000's)	6	12	6	7	0
Market cap/employee ($1,000's)	484	755	291	615	370
Tobin's Q	1.64	1.75	1.11	1.51	1.00
Stock price percentage change	25.1	62.1	16.9	22.1	16.3

Table 1c. Industry distribution, training sample

	%
Agriculture	0.0
Mining/construction	3.2
Food/tobacco	3.4
Textiles/apparel	0.8
Lumber/furniture/paper	4.7
Chemicals/petroleum	9.5
Rubber/leather/stone/glass	1.0
Metals	2.6
Machinery	6.1
Technology	13.0
Transportation equipment	8.3
Transportation services	2.4
Telecommunications services	5.3
Utilities	7.3
Trade	8.7
Financial	18.9
Services	4.7

Table 2. Predictors of firm training expenditures

Dependent variable: training $ per employee, year (t)

	(1)	(2)
Industry dummies		
Machinery (omitted)		
Mining/construction	-29.41 [192.71]	-96.51 [239.66]
Food/tobacco	62.93 [188.98]	33.11 [209.21]
Textiles/apparel	-524.49 [331.36]	-493.61 [469.59]
Lumber/furniture/paper	-77.95 [172.53]	-53.33 [186.74]
Chemicals/petroleum	336.92** [145.48]	350.57** [172.41]
Rubber/leather/stone/glass	-260.09 [300.71]	-179.53 [312.25]
Metals	40.18 [207.71]	84.40 [223.98]
Technology	380.78** [137.74]	284.33* [162.38]
Transportation equipment	-143.18 [149.57]	-96.62 [166.90]
Transportation services	-260.30 [212.63]	-168.33 [233.35]
Telecommunications	617.30** [166.80]	744.57** [186.75]
Utilities	165.91 [153.89]	228.15 [179.26]
Trade	-245.01* [148.09]	-210.06 [170.83]
Finance	2.58 [130.71]	22.75 [183.04]
Services	-135.84 [172.53]	-42.02 [194.21]
Sales/employee (t-1)		0.1201 [.1570]
Income/employee (t-1)		1.2811 [1.6896]
Tobin's Q (t-1)		7.7105 [28.9647]
Stock price return (t-1)		0.3392 [.9054]
Capital expenditures (t-1)		-0.0088 [.0204]
Total assets (t-1)		.0012 [.0011]
Leverage (t-1)		-529.59** [240.09]
Constant	631.43** [113.66]	623.42** [141.33]
# obs.	493	376
R-squared	.14	.17

NOTE: Authors' calculations from ASTD and Compustat data. Standard errors in brackets.
* = Statistically significant at 10 percent.
** = Statistically significant at 5 percent.

Table 3. Firm productivity, profitability, and market valuation, by training investments

	Quartiles of training expenditures per employee			
	Bottom quartile	2nd quartile	3rd quartile	Top quartile
N=	118	120	121	117
Annual stock market price return (% change)	15.3	20.0	34.3	30.7
Tobin's Q	1.63	1.42	1.75	1.79
Sales per employee ($1,000s)	175.7	302.5	343.8	320.8
Income per employee ($1,000s)	11.5	15.0	19.3	24.5
Gross profit margin	22.8	37.4	35.7	40.4
Return on assets	4.2	4.4	3.2	5.5
Market capitalization per employee ($1,000s)	263.2	533.5	638.5	668.2

NOTES: Authors' calculations from ASTD training and Compustat data.

Table 4. Regressions for training and stock price returns

Outcome measure = percent change in stock price (t)

	(1)	(2)	(3)	(4)	(5)
Training / employee (t-1)	0.0113*** [2.62]	0.0081 * [1.82]	0.0076 * [1.77]	0.0094 ** [2.20]	0.0095 ** [2.19]
Capital investment / employee (t-1)	--	--	-0.0007 [1.32]	-0.0010 * [1.82]	-0.0010 * [1.82]
R&D / employee (t-1)	--	--	0.0006* [1.66]	0.0006 [1.50]	0.0006 [1.50]
Dummy, no R&D (t-1)	--	--	-5.17 [0.08]	-4.40 [0.45]	-4.36 [0.44]
Stock Price Change (t-1)	--	--	--	0.355 *** [4.60]	0.355 *** [4.59]
ln (Total assets) (t-1)	--	--	1.42 [0.80]	-0.87 [0.48]	-0.77 [0.39]
Price / book (t-1)	--	--	-0.2235 [0.65]	-0.5508 [1.62]	-0.5472 [1.60]
Debt / assets (t-1)	--	--	-15.01 [0.65]	-5.49 [0.65]	-5.38 [0.24]
Return on assets (t-1)	--	--	-0.4918 [0.53]	-1.285 [1.38]	-1.280 [1.38]
Price / earnings (t-1)	--	--	-0.0245 [0.44]	-0.0392 [0.73]	-0.0399 [0.74]
Sales / employee (t-1)	--	--	-0.0069 [0.42]	-0.0113 [0.71]	-0.0114 [0.71]
Income / employee (t-1)	--	--	0.0796 [0.33]	0.0146 [0.06]	0.0153 [0.07]
Share Reporting (t-1)	--	--	--	--	0.0107 [0.14]
Industry / Year Fixed Effects?	No	Yes	Yes	Yes	Yes
# obs	388	388	388	388	388
R-squared	0.01	0.22	0.27	0.27	0.27

NOTES: OLS regressions, constant term is included but is insignificant and not reported. T-statistics are in brackets below the coefficients;
* = Statistically significant at 10%.
** = Statistically significant at 5%.
*** = Statistically significant at 1%.

Table 5. Investigation of direction of causation

Lead and lag regression relation between stock price returns and training expenditures:

Alternative outcome measures:	Stock Price Returns		
Independent variable:	(t)	(t-1)	(t-2)
All training (t-1)	0.0113*** [2.62]	0.0019 [0.61]	0.0009 [0.28]
Includes control variables?	No	No	No
# obs	388	388	388
R-squared	0.01	0.00	0.00

Two-stage regression results using the predicted and unexpected components of training from a first stage regression of training expenditures (t-1) on (t-2) values of the control variables with industry dummies:

Alternative outcome measures:				
	(5)	(6)	(7)	(8)
All training (t-1)	0.0095 ** [2.19]			
Unpredicted piece of training (t-1)		0.0117** [2.38]	0.0118** [2.39]	
Predicted piece of training (t-1)		0.0104 [0.20]		0.0151 [0.28]
Includes control variables?	Yes	Yes	Yes	Yes
# obs	388	388	388	388
R-squared	0.27	0.35	0.35	0.33

NOTES: OLS regressions, constant term is included but is insignificant and not reported. Included control variables are the same as in column 5 of Table 4, but are not reported for expositional ease. T-statistics are in brackets below the coefficients.
* = Statistically significant at 10%.
** = Statistically significant at 5%.
*** = Statistically significant at 1%.

Table 6. Regressions for different training types

Outcome measure = percent change in stock price (t)

Alternative training per employee measures (t-1):	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
All training	0.0095** [2.19]							
Technical skills		0.0343*** [3.84]			0.0280*** [2.80]			
Business skills			.0055 [0.82]		-0.0038 [0.55]			
Fundamental skills				0.0598*** [3.12]	0.0375* [1.73]			
General skills						0.0064 [1.14]		0.0033 [0.58]
Firm-specific skills							0.0178** [2.43]	0.0168** [2.22]
Full set of control variables?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# obs	388	388	388	388	388	388	388	388
R-squared	0.27	0.33	0.30	0.32	0.34	0.31	0.31	0.32

NOTES: OLS regressions, constant term is included but is insignificant and not reported. Included control variables are the same as in column 5 of Table 4, but are not reported for expositional ease. T-statistics are in brackets below the coefficients.

Different types of training are identified using training categories defined by ASTD.

Technical skills training include firm-specific technical skills, general information technology skills, and professional skills.

Business skills training includes customer relations, sales/dealer training, quality/competition/business practices, managerial/supervisory skills, executive development, and new employee orientation.

Fundamental skills training includes interpersonal communication, basic skills, and occupational safety/compliance.

Firm-specific skills training include product knowledge, new employee orientation, and firm-specific technical skills.

General skills training include customer relations, sales/dealer training, quality/competition/business practices, managerial/supervisory skills, executive development, interpersonal communication, general information technology skills, basic skills, professional skills, and occupational safety/compliance.

* = Statistically significant at 10%.

** = Statistically significant at 5%.

*** = Statistically significant at 1%.

Table 7. Robustness to outliers

Outcome measure = percent change in stock price (t)

	Remove top and bottom 1 percent of Training Observations				Remove top and bottom 1 percent of Stock Price Return Observations			
Alternative training measures (t-1):	(1)	(2)	(3)	(4)	(6)	(7)	(8)	(9)
All training	0.0061 [1.24]				0.0063* [1.65]			
Unexpected training		0.0100* [1.71]				0.0078* [1.65]		
Predicted training		-0.009 [0.72]				-0.007 [0.65]		
Technical Skills			0.027** [2.97]				0.023*** [3.06]	
Fundamental skills				0.0497** [2.36]				0.0511*** [3.00]
Includes control variables?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# obs	378	378	378	378	378	378	378	378
R-squared	0.32	0.29	0.32	0.32	0.32	0.34	0.36	0.36

NOTES: OLS regressions, constant term is included but is insignificant and not reported. Included control variables are the same as in column 5 of Table 4, but are not reported for expositional ease. T-statistics are in brackets below the coefficients.
* = Statistically significant at 10%.
** = Statistically significant at 5%.
*** = Statistically significant at 1%.

Table 8. Where does tech training generate returns?

Outcome measure = percent change in stock price (t)

Interactions (t-1):	(1)	(2)	(3)	(4)	(5)
Tech training	0.0343*** [3.84]	0.028** [2.22]	0.019* [1.69]	0.135*** [2.84]	0.106** [2.08]
Tech training x capital exp/emp		0.345 [0.73]			-0.039 [0.07]
Tech training x R&D/emp			0.012** [2.12]		0.010 [1.53]
Tech training x assets				-0.012** [2.16]	-0.010* [3.06]
Includes control variables?	Yes	Yes	Yes	Yes	Yes
# obs	388	388	388	388	388
R-squared	0.33	0.33	0.34	0.34	0.34

NOTES: OLS regressions, constant term is included but is insignificant and not reported. Included control variables are the same as in column 5 of Table 4, but are not reported for expositional ease. T-statistics are in brackets below the coefficients.
* = Statistically significant at 10%.
** = Statistically significant at 5%.
*** = Statistically significant at 1%.

Table 9. Training and stock price returns, repeat sample

Summary of stock price performance next year after change in training this year:

Outcome measure:	Change in Stock Price Return		Stock Price Return	
	More Training (# = 45)	Less Training (# = 45)	More Training (# = 45)	Less Training (# = 45)
Number Outperforming:	23 (51.1%)	17 (37.7%)	23 (51.1%)	21 (46.7%)
Number Under-performing:	22 (48.9%)	28 (62.3%)	22 (48.9%)	24 (53.5%)
Median Annual Excess Return (%): (sign t-test for median ≠ 0)	+1.57 (0.14)	-7.39* (1.75)	+2.00 (0.14)	-6.90 (0.47)
Difference in Two Sample Proportions (t-test):	1.34		0.46	

Regression analysis of stock price performance next year after change in training this year:

Dependent variable:	Change in Stock Price Return		Stock Price Return	
Change in Training:	0.0316* [1.76]	0.0477* [1.98]	0.0181 [1.39]	0.0394** [2.36]
Year Dummies:	Yes	Yes	Yes	Yes
Industry Dummies:	No	Yes	No	Yes
Changes in Other Control Variables:	No	Yes	No	Yes
R-squared	.11	.41	.04	.49

NOTES: Analysis is for the 90 observations with training expenditures for multiple years. The benchmark return is calculated versus the firms in the sample without repeat training observations.
* = Statistically significant at 10%.
** = Statistically significant at 5%.

Regression analysis of reverse causality between training and stock price returns:

Dependent variable:	return (t)	return (t-1)	return (t-2)	change in return (t)	change in return (t-1)
Change in Training (t-1):	0.0181 [1.39]	-0.0142 [1.07]	-0.0015 [0.16]	0.0316* [1.76]	-0.0136 [0.95]
Year Dummies Only:	Yes	Yes	Yes	Yes	Yes
R-squared	.04	.06	.04	.11	.10

NOTE: * = Statistically significant at 10%.

Table 10a. Performance of Bassi Investments equity-only portfolios, December 2001 to May 2004

	Return since 1/2/03*	Return since 12/3/01*
Portfolio A (created 12/3/01)	33.7%	3.7%
Portfolio B (created 1/2/03)	38.0%	n/a
Portfolio C (created 1/2/03)	33.6%	n/a
S&P 500	*30.8%*	*2.7%*

*Portfolio performances as of 5/31/04, includes fees and dividends.
NOTES: Past performance is not a guarantee of future results, and it is always possible to lose money when investing in securities. For full information on its investment offerings, Bassi Investments should be contacted directly.

Table 10b. Performance of Bassi Investments covered calls hedged portfolio, January 2003 to May 2004

	Return since 1/3/03*	Return since 12/3/01*
Portfolio D (created 1/3/03)	24.1%	n/a
CBOE BuyWrite Index	*19.4%*	*n/a*

*Portfolio performances as of 5/31/04, includes fees and dividends.
NOTES: Past performance is not a guarantee of future results, and it is always possible to lose money when investing in securities. For full information on its investment offerings, Bassi Investments should be contacted directly.