**ABSTRACT**

Firms that hire MBA graduates from two prominent MBA programs, consistently ranked in the top 10, exhibit abnormally high risk-adjusted stock returns in months leading up to hiring. This paper tests three factors that could explain this phenomenon: self-selection of the MBA graduate, self-selection of hiring firms, and underestimation of risk in firms undergoing expansion. The paper finds the most likely causes of the phenomenon to be the self-selection of hiring firms and the underestimation of firm risk as measured by market beta.

**Keywords**: Abnormal Returns, Human Capital, Risk Modeling, Corporate Investment, Job Placement

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1. Introduction

Stock market indicators offer a fanciful but imprecise method to predict future returns in the market. Widely followed by the general public but widely dismissed by the academic world, these indicators defy a fundamental rule established in finance: consistent risk-adjusted outperformance of the market cannot be sustained. If a well-publicized indicator were to consistently beat the market, then an influx of investors would begin to follow the strategy to receive the excess gains until the excess gains were eliminated.

A certain stock market indicator known as the “Harvard MBA Indicator” has been receiving increasing attention, cited recently in the New York Times and Businessweek. Developed by HBS alum Ray Soifer, the indicator uses the job choices of HBS graduates to predict the market: “If more than 30% of HBS graduates take market sensitive jobs\(^1\), it means the market is inflated, and it’s a long-term sell signal. Fewer than 10% taking those jobs is a long-term buy signal.” Soifer claims the indicator has predicted the three most recent recessions in 1990, 2001, and 2008. However, a test of the claims using job placement data from another leading business school reveals that an indicator based on job placement offers weak predictive power to the future performance of the stock market.

While job placement data may provide a weak forecast for future returns, this information may provide a strong forecast of past returns. Three factors could help to explain this hypothesis. First, MBA graduates may look at the past performance of firms to decide which firm to work for. Second, recently profitable firms will choose to hire more aggressively to size-up their profitability. Finally, the market may underestimate the risk of firms undergoing expansion, and analysis of returns based on market estimates of beta would yield abnormal past

\(^1\) Defined as jobs closely tied to investing (Banking, Venture Capital, Leveraged Buyouts, Etc.)
returns. A test of this hypothesis shows that job placement is driven by past returns. The paper discerns between the three factors set forth and finds the strongest evidence in support of the second and third factors.

The paper continues as follows: Section 2 looks at relevant literature on the topics of the job-entrance decision, the job-hiring decision, and financial pricing applications. Section 3 describes the data used in the study. Section 4 tests the claims of the Harvard MBA Indicator. Section 5 tests the claims of the main hypothesis and differentiates between the three different factors set forth. Section 6 concludes the findings and suggests directions for future study.

2. Literature Review

The following section organizes the relevant literature for the study into three sections: the job-entrance decision, the job-hiring decision, and financial pricing applications. The first section develops the framework for modeling the job choice decision from the perspective of the MBA graduate. The second section develops the framework for the job hiring decision from the perspective of the employer. The third section looks at the relevant financial theory on the pricing of firms in expansion and summarizes the literature on the efficient market hypothesis and stock momentum.

2.1 Employee Job Entrance Decision

The human-capital wealth-maximizing theory presented by Gary Becker (1964) provides a foundational model for the job placement decisions of MBA graduates. Becker likens any employment decision to a wealth-maximization framework—given a set of possible employment options, the individual will choose the option that provides the highest present value of the
future utility streams. Mathematically, given a finite set of employment options 
\( X = (x_1, x_2, \ldots, x_n) \), the selected path of employment will be given by 
\( \arg \max_{x_i \in X} V(x_i) \) where 
\( V(x_i) \) is given in (2.1), \( r \) is the market discount rate, and \( x_i \) is the sum of monetary and non-monetary earnings and benefits at time \( t \).

\[
V(x_i) = \sum_{t=0}^{n} \frac{x_i}{(1 + r)^{t+1}}
\]

Boskin (1974) empirically validates the wealth-maximizing theory of human capital by applying a conditional logit decision model to analyze the job choice decisions of individual workers. Looking at the occupational choice observations from the 1967 Survey of Economic Opportunity, Boskin finds that workers generally choose occupations that maximize \( V(x_i) \), the net present value of potential future earnings over a lifetime. As such, this paper uses the model in (1) as the simple theoretical model to base all other presumptions off of.

The stream of future earnings \( x_i \) is influenced by a variety of factors. In particular, the initial job placement has large implications for future job success. Oyer (2006) looks at the labor market for economists and the effect of market conditions on academic career success. Oyer finds that, ceteris paribus, initial placement has a causal effect on future placement—initial placement in a tenure-track position increases the probability of holding a tenure-track position in a later year by 55 percent and initial placement in a top-50 university increases the probability of holding a position in a top-50 university by over 60 percent. In a separate paper, Oyer (2008) looks at the labor market for investment bankers and the effect of market conditions on career success for entrants into the industry. Oyer finds a causal relationship that shows that taking an initial job on Wall Street increases the chances of working on Wall Street later in life and
estimates the difference in lifetime income from starting a career on Wall Street against not starting a career on Wall Street to range from $1.5 to $5 million.

The importance of the first job can be explained by the development of firm-specific and industry-specific human capital. On-the-job training can increase human capital accumulation that leads to higher future wages. Black and Lynch (1996) study the effect of human-capital investment from employer training on productivity. The results found suggest compelling evidence of the effects of training on productivity. Dearden, Reed, and Van Reenen (2000) empirically measure the effects of training on value-added per worker and wages in a panel of British industries from 1983 to 1996. Using cross-sectional data, the paper finds that an increase in training of 5 percentage points is associated with a 1.6 percent increase in hourly wages and a 4 percent increase in value-added per worker. In the model, the development of human capital causes the future earnings stream $x_t$ to be dependent upon the initial job choice.

In practice, the stream of future earnings $x_t$ is unknown for each job placement option. The decision to choose an employer is based on the perception of future earnings for each option. In this sense, $x_t$ in (1) is a random variable whose distribution is assigned by the prior beliefs of the MBA graduate. The prior beliefs of each option are based on the information that the graduate is exposed to. In this sense, the job placement decision is the equivalent of an investment decision— under uncertainty, choosing the optimal option instead of a non-optimal option results in comparatively larger future payouts. The MBA graduate must use the information at hand to make the best possible investment decision.

Many factors influence the job-choice decision process under uncertainty. The perception of future on-the-job satisfaction plays a central role in the decision. O'Reilly (1980) looks at the effect of intrinsic and extrinsic job-choice factors measured at the time of the initial
decision on subsequent satisfaction and commitment. O’Reilly finds that job-choice decisions based on the intrinsic features, notably interest in the specific job or industry of entrance, are likely to lead to higher satisfaction and attitudinal commitment in the future. Given the high transaction costs of switching jobs from job-specific human capital development, higher initial interest in a job yields higher future earnings $x_{it}$. Following the subtle implications set forth by the Harvard MBA Indicator, interest in an industry can rise and wane with the success of a particular industry. For example, industry interest in the tech-sector could expectedly drop off after the dot-com bubble burst. Likewise, job interest in a career in trading financial derivatives could plunge after the recent financial crisis. Following this theory, the decision to enter into a certain company or industry could be based in part from the recent performance of the company or industry.

Refocusing the job-choice decision to be an investment decision, the idea of looking at the recent performance of companies to choose whether to invest into a company or industry has been commonly observed in the literature. Grinblatt, Titman, and Wermers (1995) highlight the tendency of mutual funds to buy stocks based on past returns. Grinblatt, Titman, and Wermers categorize 77 percent of all mutual funds in their study to be “momentum investors”—investors that abnormally bought stocks that were past winners. Given that institutional investors are susceptible to looking at past returns to select future investments, MBA graduates may also be prone to such backward-looking behavior. This theory will be tested in this paper.

2.2 Employer Job Hiring Decision
From the perspective of the firm, the job-hiring process of MBA graduates can be simplified as a profit-maximizing decision. Becker (1962) sets forth the foundation for human capital investment theory and the relation between and employee’s wages and marginal product in light of human capital development. Becker proposes the model that relates marginal product to wages in (2) where \( G \) is given by (3), \( i \) is the discount rate, and \( k \) is the firm outlays for training.

\[
\begin{align*}
(2) \quad MP_0 + G &= W_0 + k \\
(3) \quad G &= \sum_{t=1}^{n} \frac{MP_t - W_t}{(1+i)^t}
\end{align*}
\]

This model establishes the fact that wages should equal marginal product; moreover, in cases where training occurs, the differences of future marginal product and wages should equal the cost of training. Because this simple model accounts only for training in time period 0, the model can be extended to represent the firm’s decision of wages in hiring, where \( k \) represents the initial hiring and training costs to the firm.

The firm decides whether to hire an MBA graduate based on whether the graduate will increase the profitability of the firm. In other terms, (2) must be such that the left hand side is greater than or equal to the right hand side. Becker argues that given an unexpected increase in demand for a specific firm’s output, the marginal product of each employee should increase. In the equation, an increase in output demand should increase both \( MP_0 \) and \( G \) in (2). When extending the model to hiring decisions, this suggests that given an increase in demand, more MBA graduates should be hired.
When relating the job-hiring decision to stock market returns, the observation of positive alpha, abnormally high returns, indicates that the market perceives the profitability of the firm to have increased. This would occur when the output demand increases or when production costs are reduced holding output constant. In either case, the marginal product of each employee increases. Thus, according to the model set forth by Becker, such firms with positive alpha should hire more MBA graduates.

2.3 Financial Pricing Applications

The Capital Asset Pricing Model (CAPM) set forth by Sharpe (1964) conjectures that the expected returns of any given stock depend solely on the risk exposure to the market, known as the \( \beta \) of the stock. Fama and French (1992) highlight a notable contradiction to this theory: the cross-section of expected stock returns are strongly correlated to the book-to-market ratio, the accounting value of the firm divided by the market capitalization value of the firm. Berk, Green, and Naik (1999) create a model that allows for changes in firms’ risk to address this empirical finding; the model allows firms to hold two assets: common cash-flow assets and real options. Berk, Green, and Naik argue that the investment options and the firms’ decision to exercise these options inherently change the systematic risk of the firm. The risk of each project from an option is given by (4) where \( j \) indicates the project and \( v \) indicates the firm’s future cash flows.

\[
\beta_j = \sigma_j \sigma_z \text{cov}(\epsilon_j(t),v(t))
\]

The risk of each project is realized only at the point of execution. When incorporating the value of these options into the entire risk profile of the firm, the systematic risk as measured
by CAPM can inaccurately predict the actual risk of the firm. As such, abnormal returns, such as those in the book-to-market anomaly, may be witnessed.

Carlson, Fisher, and Giammarino (2004) extend this risk model to be applicable when firms are undergoing periods of expansion. The paper notes that companies undergoing a seasoned equity offering (SEO) exhibit abnormal returns, with returns averaging 72% prior to the offering and -30% for the five years following the offering. Using a rational theory model based off of Berk, Green, and Naik (1999), the paper attributes the abnormal returns to endogenous changes in firm risk. The SEO marks a period of firm expansion. In the process of expansion, the firm transforms growth options into realized assets. Carlson, Fisher, and Giammarino argue that the growth options are more risky than the realized assets because the levered growth option becomes deleveraged when investment occurs. According to this line of argument, the pre-expansion firm that holds growth options is more risky than the post-expansion firm that holds exercised options in the form of realized assets.

The model presented provides two separate measures of firm risk $\beta$: intrinsic betas and market-perceived betas. The model for intrinsic betas is given in (5), where the first normalized term represents revenue beta, the second term accounts for operating leverage, and the third term accounts for the value from growth options.

\[
\beta_{i\theta} = 1 + \frac{V^F_{i\theta}}{V_{\theta}} + \frac{V^G_{\theta}}{V_{\theta}} (v_{\theta} - 1)
\]

The firm is categorized into one of two types, $\theta \in \{b, g\}$, where a firm of type $b$ will lose its growth option sooner than a firm of type $g$. According to the model, this implies that the optimal time for investment will occur earlier for type $b$ firms than for type $g$ firms. In other
terms, a type b firm is more likely to exercise a growth option as it has less value from time. The model for market-perceived betas is given in (6), where \( \omega_{it} \) represents the weights given by investors based on the perception of firm type.

\[
\beta_i(X_t, Y_t, \Pi_t) = \omega_{it} \beta_{igt} + (1 - \omega_{it}) \beta_{ibt}
\]

Given the risk discrepancy between the two firms, \( \beta_{igt} \) and \( \beta_{ibt} \), the market-perceived beta will differ from the intrinsic beta. Anderson and Garcia-Feijoo (2006) empirically test the growth-option risk model proposed; creating a portfolio of firms based on investment growth rates, the paper finds that firms that have recently accelerated investment spending exhibit significantly lower subsequent monthly returns.

When looking at the job placement patterns of MBA graduates, those firms that aggressively hire should have higher intrinsic betas than the market betas that are observed, according to the model set forth. Although hiring schemes in business schools may provide a modest proxy for growth options and the exercise of growth options, this paper will test the model set forth to see first whether observed risk differs before and after hiring and second whether an underestimate of observed betas before hiring can explain any possible abnormal returns of the companies that MBA graduates choose to work for. If hiring schemes serve as a good proxy for investment growth rates, then the empirical results on the returns of the hiring firms should be similar to that found by Anderson and Garcia-Feijoo.

The strong efficient market hypothesis (EMH) states that the share price of firms reflects all information; in other terms, stock picking cannot result in significantly better or significantly worse risk-adjusted returns than the market. The implication of the Harvard MBA Indicator that the future returns of the firms where graduates go to work abnormally differs from the
market goes against this hypothesis; if proven true, the indicator would be one of many contradictions found against the hypothesis. Fama (1998) creates a summary of the literature on market efficiency and underlines the abundance of different investment strategies found in the literature that seem to defy the efficient-market hypothesis.

A particular investment strategy noted by Fama to produce abnormal returns is known as momentum trading. Grinblatt and Han (2005) explain the predictive strength on returns of momentum by creating a model that accounts for the common tendency that investors have to hold on to losing stocks. Given the job-choice model in (2.1), graduates may inadvertently select into firms that have high momentum that could exhibit abnormal returns. This paper provides a simple test on the EMH to check whether MBA graduates in choosing their future employers are able to choose firms that significantly outperform or underperform the market.

3. Data

The study uses three types of data: unemployment data, MBA job placement data, and stock market data. The unemployment data comes from the Current Population Survey (CPS) given by the Bureau of Census for the Bureau of Labor Statistics. The CPS provides an estimate of the national unemployment rates, defined as the proportion of individuals currently available and actively looking for work for over four weeks against the labor force. The data comes as a monthly time-series, starting from 1975 to 2005.

The MBA job placement data is taken from two business schools that are consistently ranked in the top 10. The MBA Placement Surveys from School 1 begin in 1984 until 2005, without gaps. The survey includes a list of the names of major employers and the number of
graduates that each major employer hires. To be categorized as a major employer, a company must hire four or more graduates of the class to a full-time position. The survey also includes a list of all the employers who either made offers to School 1 graduates or summer interns or recruited on campus. This list does not include a number for total hires, however companies that hire three or more students from the previous two graduating classes are listed in bold. In order to preserve this data, these companies are kept in the data and conservatively estimated to have employed only one person in the year the survey was published.

The Placement Reports from School 2 begin in 1980 until 2005, without gaps. Similar to the counterparts at School 1, the report also includes a list of the names of major employers and the number of graduates that each major employer hires. To be included in this list, a company must hire three or more graduates to a full-time position. The reports also include an industry classification of the job placements of the graduating class; the percent totals from this classification will be used in the test of the Harvard MBA Indicator.

The financial data is taken from the CRSP database. Daily returns and monthly returns are taken for any company that is listed as an employer in the placement reports from either school. The daily returns are used solely to calculate the beta of the stock. The monthly returns are used for all other purposes. Also taken from CRSP, the monthly risk-free rate is the one-month T-bill rate and the monthly market return is defined to be the value-weighted return on all AMEX, NYSE, and NASDAQ stocks. Many of the major employers are not publicly traded companies. Moreover, several other employers become publicly traded companies sometime between 1980 and 2005. The data includes all available returns with the expectation that the private employers do not differ significantly from the public employers.
For the study, the structure of the combined data is organized based according to company, class year, and months relative to graduation. Each company contains financial data for each class year from 24 months before graduation to 24 months after graduation. The data is not a simple time-series but includes overlapping observations; for example, the returns for company $i$ in class year 1990 with 0 months relative to graduation will be equivalent to the returns for company $i$ in class year 1991 with -12 months relative to graduation. Graduation occurs in the month of June. This structure is necessary to analyze the performance of the employers of each class, however the results of any regression are prone to clustering effects—correlation of returns between each of the firms at one point in time. As a result, the proper adjustments must be made when making any inference using the firms’ returns data.

4. Analysis of MBA Stock Indicators

The following section looks at the validity of the claims of the Harvard MBA Indicator. Using job placement data from School 2, I test whether MBA job placement patterns can predict future market crashes or corrections with any significance. The section summarizes the Harvard MBA Indicator, conducts a simple test of the indicator, and then conducts a test to adjust for serial correlation. This section does not use any firm-specific returns data, but uses market returns as a whole, so no clustering effects will be observed.

4.1 Harvard MBA Indicator

The Harvard MBA Indicator claims that the future behavior of the market can be forecasted by the career decisions of MBA students at Harvard. More specifically, the percentage in each graduating class of Harvard MBA students choosing careers in market-
sensitive industries is inversely related to the future performance of the market; Ray Soifer, the creator of the indicator, notes that “If 10% or less of the year’s class take market-sensitive jobs, that is a long-term buy signal. If 30% or more do so, that is a long-term sell signal.” Soifer defines market-sensitive industries as those in investment banking, investment management, sales and trading, hedge funds, venture capital, private equity or leveraged buy-outs. Soifer does not define a clear notion for the phrase “long-term”.

4.2 Methodology of Testing

Because the Harvard MBA job placement data could not be attained for replication in this study, the job placement data used in this section comes from placement reports that are published annually by School 2. The reports cover twenty graduating classes from 1980 to 2000. The market returns data is the value-weighted return on all AMEX, NYSE, and NASDAQ stocks.

The placement reports for each graduating class include an overview of job acceptances by industry. Categorization of the industries varies year-to-year within the reports; that is, the set of categories are not the same for all of the reports. In order to create a consistent method that replicates the claims of the Harvard MBA Indicator, any finance related industry is lumped into one collective category. This includes the following categories: Banking, Commercial Banking, Financial Services, Diversified Financial Services, Investment Banking/Securities, Investments/Securities, Investment Management, and Venture Capital. The percentage totals of the collective group can be seen in Fig. 4.1.
In order to duplicate a sell signal, the variable $X_t$ is created to equal 1 if the percentage total of the collective group is greater than 25% and equal 0 if the percentage total of the collective group is less than or equal to 25%. Although the Harvard MBA Indicator suggests a sell signal if the total percent of entrants into the finance industry is greater than or equal to 30%, this occurs only one time in the data set. Because a smaller proportion of graduates go into the finance industry from School 2, to increase the number of sell-signals, the cut-off value of 25% is selected.

In order to represent a market crash, the variable $Y_{t+i}$ is created to equal 1 if the value of the market falls 20% from the current value at any time in the next $i$ years. The measurement is done on a month-to-month basis: the value of the market must be 20% less at the beginning of the month to be counted. In order to represent a market correction, the variable $Z_{t+i}$ is created to equal 1 if the value of the market falls 10% from the current value at any time in the next $i$
years. The selection of 10% for a market correction and 20% for a market crash are chosen based on the common industry definition of a correction and of a bear-market.

4.3 Failures of Simple Linear Probability Model and Probit Model

The natural strategy to proceed would be to use a linear probability model (7) or a probit model (8) to test whether \( X_t \) has any significant ability to predict \( Y_t^i \) or \( Z_t^i \).

\[
(7) \quad Y_t^i = \beta_0 + \beta_1 X_t + u_t
\]

\[
(8) \quad \Pr(Y = 1 | X) = \Phi(\beta_0 + \beta_1 X)
\]

As pointed out early on by Cochrane and Orcutt (1949), the estimation of the standard errors will be incorrect in standard OLS if the error terms are serially correlated. Because the time series occurs monthly, \( Y_t^i \) and \( Z_t^i \) will both be serially correlated; from month-to-month the future time-interval used to measure whether a market crash or correction occurs overlaps. For example, the market crash of 1987 will cause both the June 1987 and the July 1987 months to register that a market correction occurred. This means that the error terms will be serially correlated.

Using the linear probability model as an example, the variance of \( \beta_1 \) is given by (9), where \( f_T \) is given by (10), where \( v_i = (X_t - \mu_X)u_i \) and where \( \rho_j = corr(v_i, v_{i-j}) \).

\[
(9) \quad \text{var}(\beta_1) = \left[ \frac{1}{T} \frac{\sigma_v^2}{(\sigma_X^2)} \right] f_T
\]

\[
(10) \quad f_T = 1 + 2 \sum_{j=1}^{T-1} \left( \frac{T-j}{T} \right) \rho_j
\]

\footnote{Stock and Watson, Introduction to Econometrics. Pp. 604-608}
The bracket term is the variance of $\beta_1$ when serial correlation is not present. However, due to serial correlation, the variance of $\beta_1$ is adjusted by $f_T$. In the case of estimating $\beta_1$ in (7), this causes the standard errors to be too small, skewing the inference in favor of strong predictive ability of $X_t$. The effects of this can be seen in Table 4.2, a series of six linear probability models that allow $i$ to vary between 2, 3, and 4.

4.4 Linear Probability Model with Newey-West Standard Errors

Newey and West (1987) present a method to consistently estimate the variance of $\beta_1$ when serial correlation is present. They construct an estimate for $f_T$ given by (11), where $p_j$ is given by (12) and where $S_t = (X_t - \bar{X})S_t$.

(11) $f_T = 1 + 2\sum_{j=1}^{m-1} \left( \frac{m-j}{m} \right) p_j$

(12) $p_j = \frac{\sum_{i=j+1}^{T} S_i S_{i-j}}{\sum_{i=1}^{T} S_i^2}$

Since the serial correlation only exists for observations that share overlapping future time intervals in the creation of $Y_i^t$ or $Z_i^t$, the parameter $m$ is set so that $m = 12i + 1$. That is, serial correlation should not occur between different $Y_i^t$ or $Z_i^t$ that do not have overlapping future time-intervals. Using $f_T$ the original standard error estimates are adjusted to become consistent Newey-West standard errors. The results of this procedure are seen in Table 4.2.
### Table 4.2

**Linear Probability Model: Rate of Finance Industry Entrance on Occurrence of Correction Within $i$ Years**

<table>
<thead>
<tr>
<th></th>
<th>With Uncorrected Standard Errors</th>
<th>With Newey-Whitney Standard Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-Years</td>
<td>3-Years</td>
</tr>
<tr>
<td>Dummy,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Greater than 25%</td>
<td>0.208</td>
<td>0.202</td>
</tr>
<tr>
<td>Class Entrance Into</td>
<td>(0.00119)</td>
<td>(0.00190)</td>
</tr>
<tr>
<td>Finance Industry)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.304</td>
<td>0.333</td>
</tr>
<tr>
<td></td>
<td>(0)</td>
<td>(0)</td>
</tr>
</tbody>
</table>

*p*-values in parentheses

### Linear Probability Model: Rate of Finance Industry Entrance on Occurrence of Crash Within $i$ Years

<table>
<thead>
<tr>
<th></th>
<th>With Uncorrected Standard Errors</th>
<th>With Newey-Whitney Standard Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-Years</td>
<td>3-Years</td>
</tr>
<tr>
<td>Dummy,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Greater than 25%</td>
<td>0.125</td>
<td>0.0655</td>
</tr>
<tr>
<td>Class Entrance Into</td>
<td>(0.0120)</td>
<td>(0.228)</td>
</tr>
<tr>
<td>Finance Industry)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.125</td>
<td>0.185</td>
</tr>
<tr>
<td></td>
<td>(1.71e-05)</td>
<td>(1.15e-08)</td>
</tr>
</tbody>
</table>

*p*-values in parentheses

The results of the change in standard error estimates can be seen by comparing the right side of the table from the left side in Table 4.2. The coefficients on the series of six linear probability models are noticeably less significant than their non-adjusted counterparts. The results suggest that job placement patterns into market-sensitive jobs have little predictive power.
in forecasting market crashes. The job placement patterns seem to have marginally stronger predictive power in forecasting market corrections, most notably when a four-year time horizon is used. However, this assumption can be misleading. Because six tests are conducted, the minimum significance level of each test should be lowered to avoid mining for results. Using the Bonferroni correction method with the minimum significance level of $\alpha = 0.1$ for the whole family of six tests, the individual significance level for each test should be $\beta = \alpha / 6 = 0.0167$. At this level, none of the six tests are significant. Without a transparent definition of the time length of a “long-term” signal, the validity of the indicator comes into question. As such, the Harvard MBA Indicator seems to be based on whimsical foundation—only after fitting the data to the desired time horizon, the job placement rates of MBA graduates into the finance industry deceptively seem to be correlated to the occurrence of market corrections.

5. Methodology

This section tests the three major claims developed by the literature. The first claim states that MBA graduates looking to maximize their future wealth may tend to look backward at the performance of firms in order to choose which firm to work for. The second claim states that firms that have done well in the past will aggressively hire and firms that have done poorly in the past will not hire. The third claim states that firms in expansion are riskier and abnormal returns can be explained by a failure of the market to account for this risk. This section also looks at the EMH in light of job placement decisions of MBA graduates.

5.1 Calculation of Excess Returns
Excess returns for each stock are calculated using the Capital Asset Pricing Model (CAPM) framework developed first by William Sharpe (1964). The CAPM model is given in (13). Established as the standard pricing-model in modern finance, the CAPM offers a simplistic interpretation of excess returns; the excess return, given by alpha, represents the portion of the expected returns that are not explained by fluctuations of the market as a whole. The CAPM asserts that the expected value of alpha must equal zero for all securities; in other terms, the average of the realized historical alphas should equal zero. Any average of alpha significantly greater than zero signify abnormal returns that should not be able to be obtained through a simple random sample.

\begin{equation}
E(r_i) - r_f = \alpha_i + \beta_i \left[ E(r_{mkt}) - r_f \right]
\end{equation}

Several different empirical methods exist to calculate $\beta_{i,mo}$, each trying to avoid introducing serial correlation across each estimate. To avoid the problem of serial correlation completely, a single $\beta_{i,mo}$ is calculated for each month using daily returns. Then, $\alpha_{i,mo}$ is calculated using monthly returns and $\beta_{i,mo}$. Although switching from daily returns to monthly returns limits the total number of observations in the data set, this is considered an acceptable tradeoff to reduce potential bias. This process is given in (14) and (15) where $d$ is the total trading days in the month, $r_{i}^{ex} = r_i - r_f$, $r_{mkt}^{ex} = r_{mkt} - r_f$, $\bar{r}_{i,j}^{ex} = \frac{1}{d} \sum_{j=1}^{d} r_{i,j}^{ex}$, and $\bar{r}_{mkt}^{ex} = \frac{1}{d} \sum_{j=1}^{d} r_{mkt,j}^{ex}$.

\begin{equation}
\beta_{i,mo} = \frac{\sum_{i=1}^{d} (r_{i}^{ex} - \bar{r}_{i}^{ex})(r_{mkt}^{ex} - \bar{r}_{mkt}^{ex})}{\sum_{i=1}^{d} (r_{mkt}^{ex} - \bar{r}_{mkt}^{ex})^2}
\end{equation}
The result of this process yields the measure of monthly abnormal returns, $\alpha_{i,mo}$, that will be used continually throughout the rest of this paper. It can be interpreted as the risk-adjusted excess return of the stock against the market.

5.2 Failures of Simple Regression Model

Before being able to test the assumptions developed in the literature, one should note that the peculiar data structure makes the data liable to clustering effects. The data is arranged so that every observation of $\alpha_{i,mo}$ and $\beta_{i,mo}$ is a function of the market return, $r_{mkt}$, of the particular month; when trying to perform any inference based on $\alpha_{i,mo}$ or $\beta_{i,mo}$, the error terms for each month across firms could potentially be correlated with each other.

Moulton (1990) points out the danger of conducting inference when correlated disturbances are present. A standard linear model with correlated disturbances is given in (16), where $y$ is an $n$ by 1 vector of random variables, $X$ is an $n$ by $k$ matrix of explanatory variables, $Z$ is an $n$ by $p$ matrix of 0-1 indicators based on membership in the $p$ groups, $\varepsilon$ is an $n$ by 1 vector of random disturbances, and $\rho$ is the correlation of the disturbances within each group.

\begin{align*}
\mathbf{y} &= \mathbf{X}\beta + \mathbf{\varepsilon} \\
E(\mathbf{\varepsilon}) &= 0 \\
E(\mathbf{\varepsilon}\mathbf{\varepsilon}') &= \sigma^2\mathbf{V} = \sigma^2[(1-\rho)\mathbf{I}_n + \rho\mathbf{Z}\mathbf{Z}'\mathbf{Z}] \\
\end{align*}

While the estimates of $\beta$ will be unbiased, the standard errors of $\beta$ will be biased. Moulton sets forth the true covariance matrix given below in (17), where $N = X'Z\mathbf{Z}'X(X'X)^{-1}$.\[\text{(17)}\]
The true covariance matrix in (17) suggests a downward bias of the standard errors of $\beta$ that increases with the average group size, correlation of disturbances within groups, and correlation of regressors within groups. Within the data, the average group size, the number of observations at every given month, will be relatively large. For comparison sake, each regression that is run will include a measure of standard error that corrects for clustering and a measure of standard error that does not correct for clustering.

In addition to the modifications necessary for clustering that addresses correlation across firms at one point in time, an additional check is conducted for autocorrelation that addresses correlation across time for one firm; autocorrelation could potentially skew inference by causing error terms to be correlated with each other.

The majority of inference done uses the alphas calculated in the previous section. Using one-month and two-month lags, the regression in (18) yields expected results that past alphas have no predictive power on future alphas.

\[ \alpha_t = \gamma_0 + \gamma_1 \alpha_{t-1} + \epsilon \quad \text{and} \quad \alpha_t = \gamma_0' + \gamma_1' \alpha_{t-2} + \epsilon \]

The coefficients $\gamma_1$ and $\gamma_1'$ are insignificant with p-values of 0.928 and 0.401 respectively. This result is as expected, since alpha should vary randomly across time. If past alphas could predict future alphas, then investors would seize the opportunity to make abnormal profits, thereby reducing alpha to zero. Having examined all potential pitfalls from using cross-sectional time-series data, the paper continues with a series of tests on the hypotheses set forth from the literature.
5.3 Test of Alpha

According to the hypothesis developed through the literature, the wealth-maximizing decision of an MBA graduate to choose a firm to work may be influenced toward those firms that have performed well in the recent past. This backward-looking inclination draws a parallel in the investment management industry, where the majority of mutual fund managers choose to invest in firms that have abnormally strong past returns. Moreover, the profit-maximizing firm chooses to increase hiring following periods of strong profitability. As such, when viewing the matching process of firms to new hires, the performance of firms that hire MBA graduates should be particularly strong in the period before hiring occurs. In conducting measurement through stock market performance, this suggests that the alpha of firms that hire graduates should be significantly greater than zero prior to hiring.

The structure of the data is organized based according to company, class year, and months relative to graduation. In order to look at the performance of companies prior to hiring, the data is limited to observations with months relative to graduation less than -3. This implies that full-time hiring decisions are completed by the month of March prior to graduation. Because the minimum months relative to graduation for each class year is set at -24, the observations on stock returns take place starting two years prior to graduation until the month of March in the year of graduation.

The placement reports from either School 1 or School 2 contain the number of graduates that go to work for a specific firm. The number from either schools are combined to create a total index for each firm that indicates how many graduates were hired from both schools. In the test for significance, each observation of returns will be weighted according to
the frequency of this combined index. For example, if Firm A hires 8 graduate and Firm B hires 1 graduate, the stock returns of Firm A will be weighted at 8 times that of Firm B.

The test for significance of alpha greater than zero uses the formula given in (18), where \( \mu \) represents the frequency-weighted average of alpha with the standard errors of \( \mu \) adjusted for clustering effects.

\[
\alpha_t = \mu + \varepsilon_t
\]  

(18)

The results are given below in Table 5.1 and include standard errors adjusted for clustering and standard errors not adjusted for clustering. The large difference in the two standard error measurements suggest that clustering does occur and creates a large downward bias on the estimate for standard error.

<table>
<thead>
<tr>
<th></th>
<th>Clustering Adjustment</th>
<th>No Clustering Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \mu )</td>
<td>0.0049 *** (0.00150)</td>
<td>0.0049 *** (0.00033)</td>
</tr>
<tr>
<td>(Weighted-Average Alpha of Hiring Firms)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The weighted average of alpha is significantly positive. The results follow the hypothesis set forth by the literature that suggests that the performance of hiring firms should be strong in months prior to hiring. However, this finding may be caused by any combination of three separate factors—from the labor supply side, the labor demand side, or possible market misestimation of betas. The following sections will aim to distinguish the effect of each factor.
While the alpha of firms is significantly positive prior to hiring, the question remains whether the alpha of firms is significantly positive after hiring occurs, especially when job placement information becomes readily available. Any significant predictive strength would offer a violation of the strong efficient market hypothesis and would provide a fair investment strategy to achieve abnormal returns.

Two sets of tests are run using the same model in (18), with months relative to graduation set to be greater than -3 and greater than 3. The choice of -3 represents the performance of firms immediately after hiring takes place in the month of March. The choice of 3 represents the date when job placement reports become publicly available in the month of September. The tests both include standard error estimates that are adjusted for clustering. The results are given below in Table 5.2.

Table 5.2

<table>
<thead>
<tr>
<th>Test of Significance on Alpha Following Hiring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Months After March</td>
</tr>
<tr>
<td>( \mu ) (Weighted-Average Alpha of Hiring Firms)</td>
</tr>
<tr>
<td>(0.00158)</td>
</tr>
</tbody>
</table>

standard errors in parentheses

The results do not differ significantly from zero. The claims of the efficient market hypothesis hold when viewing the job placement decisions of MBA graduates. This suggests that graduates have no special ability to select firms that fair better or worse than the market in the future.

5.4 Test of Alpha Controlling for Selection Into Firms
The first effort to distinguish the factors causing abnormal alphas prior to hiring uses unemployment rates to control for MBA graduate selection into strong performing firms. In times of high unemployment, the number of jobs available to MBA graduates is relatively low and graduates have less job offers to choose from. In times of low unemployment, MBA graduates have more job offers to choose from. If unemployment at the time of hire can significantly explain differentiation in alpha prior to hiring, then this could suggest that the number of job offers that the MBA graduate has is correlated with positive alpha of firms they choose to work for; this result would favor the theory that graduates select into companies that performed well in the past.

The test to see the relationship between unemployment and alpha is given in (19). Unemployment data is taken in the month of March, the time that the job-matching process occurs. Just as before, the observations on alphas take place starting two years prior to graduation until the month of March in the year of graduation. Observations are frequency-weighted and standard errors are adjusted for clustering effects. The results are given below in Table 5.3.

(19) \[ \alpha_t = \beta_0 + \beta_1 \text{unemp} + \epsilon_t \]

Table 5.3

| \( \beta_0 \)               | 0.01155  
| (0.00767)     |  
| \( \beta_1 \) (Unemployment at time of hiring) | -0.00106  
| (0.001095) |  

standard errors in parentheses
The lack of significance on the coefficient of $\beta_1$ suggests that the unemployment rate at time of hiring and firm alpha before hiring have no relation to each other. Assuming that unemployment rate provides a good proxy for a graduate’s range of job choice, the labor supply-side tendency to select into firms with high alpha seems to be a weak factor in explaining the positive alpha observed in hiring firms.

5.5 Test of Beta

The hypothesis set forth by the literature suggests that firms undergoing expansion experience higher risk before and during expansion and lower risk after expansion; this difference of risk could be observed or latent. Using job placement as a proxy for expansion, this section looks at the difference of firms’ betas before and after hiring and looks to see if abnormal returns prior to hiring can be explained by the market’s underestimate of beta.

The test for significance of difference in pre-expansion betas and post-expansion betas serves as a stepping-stone to further analyze the effect of job placement size on risk. The model to test for any difference is given in (20), where $D_{\text{post-hiring}}$ represents a dummy that equals 1 if monthstograd is less than -3 and 0 otherwise. Observations are frequency weighted and standard errors are adjusted for clustering effects.

\[(20) \quad \beta_t = \gamma D_{\text{post-hiring}} + \varepsilon_t\]

The results are below in Table 5.4. The simple test shows that firms experience relatively higher betas before hiring than after, when weighting based on the frequency of MBA placements into the firm. As such, the market does account for some variation in betas due to firm expansion.
Table 5.4

Test of Difference of Pre-Expansion and Post-Expansion Beta

| $D_{\text{post-hiring}}$ | 0.02170*  
|                         | (0.01269) |

standard errors in parentheses

The model above does not account for acceleration of hiring within each firm. For example, if Firm A normally hires 30 graduates but hires 20 graduates and Firm B normally hires 2 graduates but hires 6 graduates, then Firm A will still be counted more than Firm B. To adjust for this shortcoming, the new model includes a normed variable for job placement called NORM, the firms’ total number of hires in a given year divided by the firms’ average number of hires over the span of the observed data. Because the job placement surveys only include firms that hire more than three individuals for the year, many firms have missing observations from year to year. To avoid miscalculation of a firm’s average hires, only firms with 8 or more consecutive observations are included. The adjusted model to test whether acceleration of hiring can help to explain differencing in firm risk is given in (21).

(21)  
$$\beta_i = \gamma_0 + \gamma_1 D_{\text{post-hiring}} + \gamma_2 NORM + \gamma_3 D \cdot NORM$$

The results are given below in Table 5.5. The School 1 data and the School 2 data differ dramatically in significance. From the significance of the interaction term, the School 2 data supports the claim that a firm that exhibits an accelerated hiring scheme would likely have higher betas in months prior to hiring. However, the lack of significance when using the School 1 data suggests that this result is not exceedingly strong.
Table 5.5

<table>
<thead>
<tr>
<th></th>
<th>School 1 Data</th>
<th>School 2 Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$D$</td>
<td>0.0287</td>
<td>-0.57190**</td>
</tr>
<tr>
<td></td>
<td>(0.0533)</td>
<td>(0.02581)</td>
</tr>
<tr>
<td>NORM</td>
<td>0.00509</td>
<td>-0.5623***</td>
</tr>
<tr>
<td></td>
<td>(0.03453)</td>
<td>(0.01943)</td>
</tr>
<tr>
<td>$D$*NORM</td>
<td>-0.03069</td>
<td>0.04620*</td>
</tr>
<tr>
<td></td>
<td>(0.0499)</td>
<td>(0.02653)</td>
</tr>
</tbody>
</table>

standard errors in parentheses

While the previous two tests show that the market estimates the beta of a pre-expansion firm differently from a post-expansion firm, according to the theory set forth by Carlson, Fisher, and Giammarino, the market could still potentially underestimate the beta of the firm. The underestimation of the pre-expansion firms’ beta could explain the abnormal positive alpha in the time leading up to hiring.

Using the School 2 job placement data, a new variable, sNORM, is created by taking the firms’ total number of hires in a given year divided by the firms’ average number of hires over all non-zero observations. The data is split into two parts, one with sNORM greater than 1.5 to represent observations with abnormally high hiring activity, and one with sNORM less than 1.5 to represent observations with normal hiring activity. Running the same test for significance on alpha prior to hiring with this differentiation, the following results are found below in Table 5.6.

Table 5.6

<table>
<thead>
<tr>
<th></th>
<th>sNORM &lt; 1.5</th>
<th>sNORM &gt; 1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\mu$</td>
<td>-0.0005928</td>
<td>0.0084143***</td>
</tr>
<tr>
<td>(Weighted-Average Alpha of Hiring Firms)</td>
<td>(0.00197)</td>
<td>(0.002077)</td>
</tr>
</tbody>
</table>

standard errors in parentheses
This suggests that the abnormal returns witnessed are explained almost entirely by the observations where accelerated hiring occurs. When artificially inflating the betas of the firms by a factor of 1.25, 1.5, and 1.75 when accelerated hiring occurs (defined as sNORM greater than 1.5), the significance of the difference in alpha disappears. The results of this found in Table 5.7 below.

**Table 5.7**

<table>
<thead>
<tr>
<th>Test of Significance on Alpha Prior To Hiring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta Inflated By 1.25</td>
</tr>
<tr>
<td>$\mu$ (Weighted-Average Alpha of Hiring Firms)</td>
</tr>
<tr>
<td>(0.00226)</td>
</tr>
</tbody>
</table>

The elimination of abnormal returns by inflating the beta of firms with accelerated hiring only shows that the underestimation of beta could serve as an explanation for abnormal returns in firms prior to hiring. According to the literature, some underestimation should exist. As such, the underestimation of beta would serve as a contributing factor to explain the abnormal returns in firms prior to hiring.

**6. Conclusion**

The Harvard MBA Indicator does not forecast the future performance of the market well. However, the job placement of MBA graduates does provide insight into the nature and strength of hiring firms. This paper brings to light a notable phenomenon: firms that accelerate hiring exhibit anomalously large risk-adjusted returns in the months leading up to hiring. This outperformance is not sustained in the months following hiring. The anomalous returns can be
explained in part by an increase in demand for MBA graduates from strong performing firms and in part by an underestimation of the beta of firms undergoing expansion.

The empirical results corroborate the theory developed on the topics of human-capital, labor economics, and risk modeling set forth in the literature review. Although each factor cannot be clearly differentiated, the general result suggests a combination of things: (1) In line with Becker’s MP-Wage model, profitable firms hire more people. (2) In line with Berk, Green, and Naik’s risk model, firms are riskier prior to expansion. (3) In line with the Efficient Market Hypothesis, MBA graduates do not select into firms that outperform the market, and stock market indicators do not provide strong predictive power.

Future studies could work towards differentiating between the various factors that cause this phenomenon to occur. By using balance sheet information published by the SEC, a future study could look deeper into the profitability of firms at the point of hiring and help to differentiate between the two previously stated factors. By distinguishing between each factor, the empirical results can more directly provide an empirical confirmation to each model set forth.
7. Bibliography


