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Are Online Job Postings Informative to Investors?

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Abstract

Human capital is a key factor in value creation in the modern corporation. Yet the disclosure of investment in human capital is scant. We propose that a company's online job postings are disclosures made outside of the investor relations channel that contain forward-looking information that could be informative to investors about future growth. We find that changes in the number of job postings are positively associated with changes in future performance and that this relation is stronger when postings likely represent growth rather than replacement. Consistent with job postings providing new information to the market, investors react positively to changes in the number of job postings. The market reaction to postings is stronger when firms are likely to be hiring for growth rather than replacement and for firms with low labor intensity (and therefore high marginal productivity of labor).

Keywords: Human capital, Hiring, Disclosure, Job postings, Market reaction

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1. Introduction

In the modern knowledge-based economy, human capital is a key factor in firm operations. Although the acquisition of this capital is likely to be relevant to investors, financial reporting relating to hiring is quite limited. Unlike numerous disclosures on acquisitions of nonhuman resources, such as property, plant, and equipment, companies are not required to disclose their hiring activities, except for the number of people they employ at the end of the year.[1]

The well-recognized inadequacy of disclosures of human capital, including hiring, has prompted a group of institutional investors to submit a rulemaking petition to the Securities and Exchange Commission (SEC 2017). The petition states that there is a broad consensus that "human capital management is important to the bottom line" and requests that the commission adopt rules that will "require issuers to disclose information about their human capital management policies, practices, and performance."[2] A number of organizations in the United States and abroad have also called for greater disclosure of human capital.[3]

In this study, we propose that company online job postings represent a leading-indicator disclosure of hiring that companies make outside of their financial reports. We examine whether these disclosures contain news to investors. In contrast to the standard disclosure

[1] The disclosure of the number of employees in 10-K filings is required by Item 101 (Description of Business) of Regulation S-K.

[2] The proposal has generated strong support among comment letters writers (https://www.sec.gov/comments/4-711/4-711.htm). In his public comments, the SEC chairman Jay Clayton, acknowledges that human capital is an important driver of firm performance. However, he argues that, since human capital circumstances vary widely across industries and firms, developing a uniform set of disclosure requirements is difficult (SEC 2019). So, as it stands now, the disclosure of human capital in general and hiring in particular remains quite limited.

[3] For example, the Global Reporting Initiative (GRI) advocates for disclosure of hiring rates and employee replacement (https://www.globalreporting.org/standards/gri-standards-download-center/).

channel, where information is disclosed by the investor relations (IR) department, job postings are disclosed by the human resources (HR) department.

We evaluate investor reaction to job postings announcements and how it is influenced by firm economic conditions. While hiring increases the level of the firm's human capital, this comes at a cost.[4] If the managers and shareholders' incentives are aligned, management will only hire if doing so benefits shareholders. However, hiring may harm shareholder value if firms hire too many employees. For example, firms can overinvest, due to empire building (e.g., Hope and Thomas 2008), CEO overconfidence (e.g., Malmendier and Tate 2008), or to mimic the behavior of good managers while manipulating earnings (Kedia and Philippon 2009). Relatedly, in the context of acquiring human and nonhuman capital through mergers, research finds a significant loss of acquiring-firm shareholder value, as indicated by negative announcement returns (e.g., Moeller, Schlingemann, and Stulz 2005; Harford, Humphery-Jenner, and Powell 2012). Thus, how the market reacts to hiring news and which factors affect investor reaction to hiring are important questions.

We employ novel data on the number of job postings at the firm-day level obtained from one of the leading job search engines in the United States.[5] Our measure of news about a

[4] In addition to compensation to new employees, direct hiring costs include job advertising, in-house recruiters' salaries, headhunter fees, and relocation costs. Indirect costs include a decrease in productivity during recruiting, training, and initial lower productivity after hiring. The benefits of hiring could also be reduced by the fact that new employees are more likely to leave than longer-tenured employees (Griffeth, Hom, and Gaertner 2000).

[5] The interest in job postings data is currently at such a high level that on May 7, 2019, S&P Dow Jones Indices announced the launch of the S&P 500 Job Index that will track weekly changes in job postings by S&P 500 companies (https://us.spindices.com/documents/index-news-and-announcements/20190507-sp-linkup-jobs-indices-launch.pdf).

firm's hiring is the change in the number of active job postings on the company's career website from the previous day.

To better understand the nature of the information contained in job postings, we first examine their relation with future number of employees and financial performance. Consistent with job postings predicting hiring and employee-related expenditures, we find that changes in the number of job postings are positively associated with one-year ahead growth in the number of employees and selling, general, and administrative expense (SG&A). We also find a positive association between job postings and one-year ahead growth in sales and earnings. Further, we find that job postings are a stronger predictor of future performance when the likely purpose of hiring is growth rather than replacement (proxied by recent growth in sales and employee count). While we cannot measure specific benefits and costs inherent in job postings, the finding that postings convey incremental positive information about future performance implies that investors should on average price job postings positively.

Consistent with this expectation, we find a significant positive association between changes in the number of job postings and cumulative abnormal returns over the two trading days around the change (trading days 0 and +1). The reaction remains significant when, in addition to removing earnings announcement days, we also exclude days with company filings or management guidance and when we control for the number and sentiment of news articles for the firm.

We next examine factors affecting the investor reaction to job postings. First, the purpose of hiring someone is either to replace an employee (replacement) or fill a new position (growth). While adding a new employee increases the firm's output, the effect of employee

replacement is unclear. Thus we expect that the market reaction to hiring will be stronger when the firm is more likely to be filling a new position rather than replacing an employee. We use growth in sales and employee count from the most recent year prior to the job posting to proxy for the purpose of the hiring. Consistent with our prediction, we find that the market reaction to job postings is concentrated in firm–years in which the firm is likely to be hiring for new positions. Second, in a typical production function where the firm's output is generated by labor and nonhuman capital, the marginal product of labor is increasing (decreasing) in the amount of nonhuman capital (labor), i.e., decreasing in labor intensity. Thus we expect the effect of hiring to be stronger for firms with lower labor intensity. In line with this prediction, we find that the market reaction to job postings is more pronounced when labor intensity is low.[6]

Concurrent work by Liu (2019) examines the relation between long-term changes in job postings and cost of capital. The author finds a negative association between the average level of job postings during the quarter as compared to the average job posting in the past two years and cost of capital proxies (implied cost of capital and stock returns over the next three months). The theme of Liu's work is parallel to that of Belo, Lin, and Bazdresch (2014), who find that annual changes in the number of employees are negatively associated with stock returns over the next twelve months. Liu (2019) and our study differ in two major respects. First, while Liu's data contain job postings aggregated at the quarterly level, our data track job

[6] In additional analyses reported in the Online Appendix, we find that the market reaction is concentrated in firms with higher quality information environments (proxied by firm size and analyst following), which is consistent with the view that high-quality information can lead to more efficient labor investments by mitigating agency issues (e.g., over-hiring due to empire building). We also find that the investor reaction to job postings is more pronounced in recent years. This finding is consistent with our expectation that the decline in the acquisition and processing costs due to the surge in job search companies should lead to stronger investor reaction to job postings in recent years. However, it is also possible that the informativeness of job postings increased over time.

postings at the daily frequency. Second, Liu examines the relation between quarterly job postings and cost of capital (i.e., firm risk), whereas we examine investor reactions to firms' job announcements.[7]

Our study contributes to the literature on the importance of human capital in the modern corporation. Lev and Schwartz (1971) propose to measure human capital asset and liability as expected future compensation, and Rosett (2001) finds that human capital liability estimated in this way for unionized firms is associated with higher equity risk. Zingales (2000) argues that human capital has become the firm's most valuable asset and calls for research on how this capital is acquired and lost. Several studies examine the determinants of annual changes in the number of employees (e.g., Pinnuck and Lillis 2007; Kedia and Philippon 2009; Jung et al. 2014). Finally, research investigates the relation between human capital and firm risk (e.g., Belo et al. 2014; Donangelo 2014; Liu 2019). We add to this literature by studying how investors react to hiring news in the form of job postings and examining factors that influence the market reaction.

Our study also contributes to the disclosure literature. (For reviews, see Healy and Palepu 2001; Beyer et al. 2010; Leuz and Wysocki 2016.) The rise of new technologies changes how firms disseminate disclosures (e.g., Bushee, Matsumoto, and Miller 2003; Blankespoor, Miller, and White 2014) and how investors acquire information (e.g., Drake, Roulstone, and Thornock 2012). The literature has modeled disclosure as the communication between investor

[7] The difference between our study and prior work can be most easily seen using Campbell's (1991) return decomposition. Campbell (1991) shows that stock returns are comprised of three distinct components: expected returns, cash flow news, and discount rate news. While Liu (2019) and Belo et al. (2014) examine the first component of stock returns, that is, expected returns (long-term risk), we examine the second component, that is, cash flow news (immediate announcement reaction).

relations (IR) and the capital markets. In contrast, job postings are disclosed by human resources (HR) and driven by different incentives, that is, to inform and attract job candidates. They are not regulated by the SEC and likely erode the investor relations' control over the timing and amount of the information revealed to outsiders. The usefulness of job postings to investors is potentially impaired by lower comparability and higher information acquisition costs. Our results suggest that, despite these limitations, job postings are informative to investors. Our findings enhance understanding of the corporate disclosure environment and its effects on capital markets.

2. Data and Summary Statistics

2.1 Sample Data

The daily job posting data are obtained from one of the largest job search engines in the United States. The firm scrapes job postings in real time directly from companies' websites. At the end of 2016, the data covered more than 14,000 public and private companies. The firm uses the data to provide search services for job seekers. The firm also provides job market data to employers, data analytics companies, and other data seekers including institutional investors.

We obtain data that contain the number of job postings that are currently active and open for a given firm-day. Although information on the job function and level, geographic location, and the number of employees the company plans to hire would be useful for our analysis, unfortunately we do not have this information.

Table 1 presents details of the sample selection. We begin with a sample of 33,431 public and private firms from August 1, 2007, the day when the data commence, to December 31, 2016. Removing firms that are not covered by Compustat or CRSP reduces the sample by

30,437 firms.[8] We then drop observations with missing necessary financial data or stock returns and observations that coincide with earnings announcement dates. Our final sample contains 2,826,160 firm-day observations for 2,255 firms.

2.2 Changes in the Number of Job Postings

We calculate the daily change in the number of active job postings for firm *j* day *t* as the percentage change in the number of active job postings for firm *j* day *t* from day *t−1*. We then rank the daily changes into five quantiles.[9] Quantiles 1 to 2 contain an equal number of negative changes, quantile 3 contains zero changes, and quantiles 4 and 5 contain an equal number of positive changes. We assign the rank values of 0, 0.25, 0.5, 0.75, and 1 to observations in quantiles 1, 2, 3, 4, and 5, respectively.[10] We denote the resulting variable as $\Delta JobPostings_{jt}$.

3. Empirical Results

3.1 Descriptive Statistics

Table 2 Panel A reports descriptive statistics for key variables and control variables. The mean (median) number of active job postings, *JobPostings*, on the firm's career website is 187 (40). The mean (median) daily percentage change in the number of job postings, *ΔJobPostings(%)*, is 0.0427 (0.0000) percentage points, and the standard deviation is 3.1571 percentage points. While the number of job postings does not change on the majority of firm-

[8] When we exclude utilities and financial services firms (SIC codes 4900–4999 and 6000–6999), the results are similar (see the Online Appendix).

[9] The results (reported in the Online Appendix) are robust to using unranked changes.

[10] Given the distribution of daily changes in the number of job postings (see Section 3.1), quantiles 1, 2, 3, 4, and 5 contain 6.61%, 6.60%, 74.14%, 6.37%, and 6.27% of the sample observations, respectively.

days (74.14%), a substantial number of firm-days (25.86%) have nonzero changes in the number of job postings (untabulated). The mean (median) number of employees is 11,574.46 (2,964).

Panel B of Table 2 reports the mean daily percentage change in the number of job postings by calendar month. The number of job postings tends to increase throughout most of the calendar year, followed by a noticeable drop in November and December. The largest increases are found in January, February, and March (0.1187, 0.841, and 0.0856 percentage points per day, respectively). The only two months in which the average number of job postings decreases are November and December (−0.0569 and −0.0256 percentage points per day, respectively), suggesting that there is a decline in the hiring activity around the holiday season. While we are not aware of studies examining the reasons for the hiring slowdown at the year-end, anecdotal evidence suggests that end-of-year deadlines and holiday vacations may divert resources away from hiring and that companies may reduce hiring in response to the decline in job applications during the holiday season (Smith 2018).[11]

3.2 Future Financial Performance and Number of Employees

To better understand the nature of the information contained in job postings, we begin our analysis by examining how job postings relate to future accounting performance and future changes in the number of employees.

The most direct effect of greater hiring, all else equal, is an increase in the number of employees and employee-related expenses. Since most US firms do not separately disclose

[11] It is also possible that the cost of hiring in December is higher because new employees are entitled to time off around the winter holidays. The cost for qualified job seekers to change employers may also be higher in December, since they may forgo bonuses earned during the year.

labor costs, we follow prior research and use selling, general, and administrative expense (SG&A) as a noisy proxy for employee-related expenditures (e.g., Bell, Landsman, Miller, and Yeh 2002; Banker, Huang, and Natarajan 2011; Bova, Kolev, Thomas, and Zhang 2015). For firm performance, we use revenues and earnings.

Motivated by the firm production function, where output is generated by physical and nonphysical capital, Lev and Sougiannis (1996) and Rajgopal, Venkatachalam, and Kotha (2003) model earnings as a function of the firm's tangible and intangible assets. Since we study changes in hiring, we adopt a growth (or change) perspective by specifying growth in earnings (revenue, SG&A, and number of employees) as a function of growth in tangible and intangible capital.

As discussed earlier, job postings provide more timely information to outsiders than do periodic financial reports. While the first set of financials for fiscal year *t+1* is released after the end of the first quarter of year *t+1* at the first-quarter earnings announcement, firms begin to disclose job postings immediately after the beginning of year *t+1*. We incorporate the more timely availability of job postings disclosures to investors by estimating the regression of growth in earnings (revenue, SG&A, and number of employees) in year *t+1* on growth in the number of job postings in the first three months of year *t+1* (i.e., prior to the release of first-quarter financial results for year *t+1*) and the control variables of year *t*, as follows.

$$\begin{aligned} \Delta Earnings_{jt+1}\,(\Delta Revenue_{jt+1},\, \Delta SG\&A_{jt+1},\, \text{or}\, \Delta Employees_{jt+1}) = {} & \alpha_1 \\ + \beta_1 \Delta JobPostings_{jt+3m} + \beta_2 \Delta Earnings_{jt} + \beta_3 \Delta Revenue_{jt} + \beta_4 \Delta SG\&A_{jt} & \\ + \beta_5 \Delta Employees_{jt} + \beta_6 \Delta CapEx_{jt} + \beta_7 \Delta R\&D_{jt} + \beta_8 \Delta ADV_{jt} + \beta_9 BM_{jt} + \varepsilon_{jt}, & \qquad (1) \end{aligned}$$

where $\Delta Earnings_{jt+1}$ ($\Delta Revenue_{jt+1}$, $\Delta SG\&A_{jt+1}$, $\Delta Employees_{jt+1}$) is the change in operating

income after depreciation (revenue, SG&A expense, number of employees) for firm *j* year *t+1*, relative to year *t*, scaled by total assets at the end of year *t*. $\Delta JobPostings_{jt+3m}$ is the change in the average number of active job postings in the first three months of year *t+1*, relative to the same period in year *t*, scaled by total assets at the end of year *t*. We ranked $\Delta JobPostings_{jt+3m}$ into five quantiles in a similar way to the daily change in the number of job postings. To proxy for growth in tangible (intangible) capital, we use $\Delta CapEx_{jt}$ ($\Delta R\&D_{jt}$, ΔADV_{jt}), defined as the change in capital expenditure (R&D expense, advertising expense) for firm *j* year *t* relative to year *t−1*, scaled by total assets at the end of year *t−1*. We also add growth in earnings (revenues, SG&A, and number of employees) in year *t* and BM_{jt}, the book-to-market ratio at the end of year *t*, to control for other potential effects of growth not captured by the above measures.

The results, presented in Table 3, are consistent with job postings containing positive information about future financial performance. $\Delta JobPostings_{jt+3m}$ is positively associated with subsequent growth in the number of employees, SG&A expense, revenue, and earnings. The results are in line with the expectation that hiring boosts growth in employee count, labor-related costs (SG&A expense), and output (revenue). The positive coefficient on $\Delta JobPostings_{jt+3m}$ in the earnings growth regression indicates that the effect on revenue is greater than on expenses.[12]

3.3 Announcement Returns

We evaluate the news contained in firms' job postings announcements by using their association with stock returns. We assess the investor reaction to changes in the number of

[12] In an additional analysis reported in the Online Appendix, we find that job postings are more informative about future performance when they are more likely to represent growth rather than replacement (that is, when the firm's growth in sales and employee count is high).

active job postings by estimating the following regression of announcement returns on daily changes in the number of job postings.

$$CAR_{jt} = \alpha_1 + \beta_1 \Delta JobPostings_{jt} + \beta_2 Size_{jt} + \beta_3 BM_{jt} + \varepsilon_{jt}, \quad (2)$$

where CAR_{jt} is the cumulative abnormal return for firm *j* over the two-day window around the change in the number of job postings (trading days 0 and +1). The abnormal return is the firm's daily return minus the CRSP value-weighted daily return. The change in the number of job postings, $\Delta JobPostings_{jt}$, is defined in Section 2.2. To control for risk, we include firm size, *Size*, defined as the market value of equity at the end of the previous fiscal year, and the book-to-market ratio, *BM*, calculated at the end of the previous fiscal year. In addition to removing earnings announcement days, we also estimate equation (2) excluding days when the firm files 10-Q, 10-K, or 8-K filings and days when management issues guidance. This avoids the need to control for news contained in company filings and management guidance and enhances the reliability of our inferences.

To further control for concurrent news, we estimate the following regression on a subsample of observations with available data on news articles and news sentiment:

$$CAR_{jt} = \alpha_1 + \beta_1 \Delta JobPostings_{jt} + \beta_2 Size_{jt} + \beta_3 BM_{jt} + \beta_4 NewsArticles_{jt} + \beta_5 NewsSentiment_{jt} + \varepsilon_{jt}, \quad (3)$$

where *NewsArticles* is the number of news articles for the firm for the day obtained from Bloomberg. *NewsSentiment* is the sentiment of the news articles for the firm for the day obtained from Bloomberg. Bloomberg uses a proprietary algorithm to assign each news article

a sentiment score on a scale of −1 (most negative) to 1 (most positive). The scores are then aggregated for the firm over a 24-hour period.[13]

The results, reported in Table 4, are consistent with a positive market reaction to job postings. The first column shows the results for the sample that includes all observations. The coefficient on *ΔJobPostings* is positive and significant. The coefficient on *ΔJobPostings* remains significant when we exclude days when there is a nonzero change in the number of job postings on the day before or the day after the event date, observations with a zero change in the number of job postings, and days with company filings or management guidance (the second column). The last column shows that the finding is robust to controlling for the number and sentiment of news articles. Since *ΔJobPostings* ranges from 0 to 1 (in the bottom and top quantile, respectively), the coefficient of 0.0307 on *ΔJobPostings* in the last column implies a difference in the incremental CAR of 0.0307 percent over the two-day window, when moving from the bottom to top quantile of *ΔJobPostings*. The effect is likely to be larger for explaining returns over longer time periods because longer intervals include many changes in the number of job postings.

3.4 Factors Affecting Market Reaction to Job Postings

The results so far suggest that job postings convey positive information to investors. However, investor reaction to job postings is likely to vary across firms. In this section, we

[13] Since equations (2) and (3) examine market reactions to daily announcements, they do not control for information disclosed in past announcements such as past financial performance. As a robustness check, we add controls for past growth in employee count, earnings, sales, SG&A expenses, CapEx, R&D expenses, and advertising expenses, and find similar results (reported in the Online Appendix).

identify and test factors, described below, that are likely to influence the market reaction to hiring news.

A firm hires for two reasons. The first is when the firm is growing and hires for a new position. The second is when an employee has left or plans to leave the firm. Then the firm needs to hire a replacement employee. While adding a new employee increases the firm's output, the effect of employee replacement is unclear. Thus we expect that hiring will have a stronger effect on shareholder value when the firm hires for growth than when it replaces someone. To proxy for whether hiring represents growth or replacement, we use recent growth in sales and employee count. If the firm is in the top half of the sample for the previous year's sales (employee) growth, then we assume that the firm is hiring for growth. If the firm is in the bottom half of the sample for the previous year's sales (employee) growth, then we assume that job postings are more likely to represent replacement.[14]

The market reaction to hiring news is also likely to be a function of labor intensity. In a typical production function, where the firm's output is generated by labor and nonhuman capital, the marginal product of labor is increasing (decreasing) in the amount of nonhuman (labor) capital employed (e.g., Imrohoroglu and Tuzel 2014).[15] The higher marginal productivity of labor, in turn, increases the effect of labor investment on firm value. Thus hiring new employees is likely to have a bigger impact on shareholder value for firms with relatively larger (smaller) amounts of nonhuman (labor) capital, i.e., for firms with low labor intensity.

[14] As a robustness check, we use sales growth and employee growth in the *current* year to proxy for the market expectation for growth and find similar results (see the Online Appendix).

[15] For example, in the Cobb-Douglas production function, the output (Q) is a function of labor (L) and capital (K): $Q = AL^{\alpha}K^{\beta}$. The marginal product of labor, $\partial Q/\partial L = \alpha AK^{\beta}/L^{1-\alpha}$, is an increasing (decreasing) function of capital (labor).

We use labor intensity at the industry level, calculated as the ratio of the number of employees to total assets. We also use the number of employees divided by total assets at the firm level.

We estimate the market reaction model (2) within subsamples (of the final sample in Table 1), based on the factors described above, and report the coefficients on the daily change in the number of job postings, *ΔJobPostings*. Observations above (below) the median are allocated into high (low) subsamples.

The results, presented in Table 5, are consistent with our predictions. The market reaction to job postings is concentrated in the firm-years in which the firm is more likely to hire for growth than replacement. The coefficient on *ΔJobPostings* is positive and significant when hiring for growth and insignificant when the firm hires for replacement. As indicated by the F-test, the difference between the two subsamples is significant. The market reaction to job postings is also more pronounced when labor intensity is low. The difference between the two subsamples is significant at the two-sided p = 4.4% (10.7%) level, when using the industry- (firm-) level proxy for labor intensity. The result is consistent with the expectation that hiring an employee has a stronger effect on the output when the number of employees is relatively low (and therefore the marginal productivity of each employee is higher).

4. Conclusion

Motivated by the limited financial reporting on human capital, this study proposes that job postings on company career websites represent disclosures to outsiders about the company's hiring plans and thus could be informative to investors about future growth. We use novel data to examine the information contained in companies' job postings disclosures. We find that changes in the number of job postings are positively associated with future changes

in employee count, employee-related expenditures, and financial performance. The market reacts positivley to changes in the number of job postings. Our cross-sectional analyses show that the positive market reaction to hiring news is more pronounced when the likely purpose of hiring is to add new employees rather than to replace employees leaving the firm, and for firms with low labor intensity. The market reaction to job postings is more pronounced in recent years, which is consistent with the increased accessibility of structured job postings data to investors or the increased informativeness of job postings over time, a topic we suggest for future research.

Our study contributes to the literature on the importance of human capital by introducing a measure of hiring news based on job postings disclosures and examining the investor reaction to hiring news and how it is affected by firms' economic conditions. We also extend the disclosure literature by examining disclosures made through the human resources channel, rather than the investor relations channel. Our evidence on the immediate market reactions to job postings disclosures should be relevant to regulators who wish to ensure that companies disseminate information in ways that do not disadvantage some investors. The findings should also be relevant to managers and investor relations departments, who are responsible for effective communication of company disclosures to investors.

Job postings convey news about human capital investments. Since the decision to invest in human capital is likely to be affected by several factors, including firm growth opportunities, CEO change, labor market conditions, and financing frictions, further research on how these factors influence firms' decision to hire and the market reaction to job postings would be worth

pursuing. Furthermore, research can examine how the increased availability of job postings data from alternative data marketplaces changed firm and investor behavior.

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Table 1
Sample Selection

	No. of firms	No. of firm-days
Available job postings data	33,431	38,852,028
Less:		
Not covered by Compustat or CRSP	(30,473)	(34,372,765)
Missing necessary financial data	(667)	(1,236,208)
Firm-day observations that coincide with earnings announcement dates	(0)	(126,513)
Missing stock returns	(36)	(290,382)
Final sample	2,255	2,826,160

Table 2
Summary Statistics

Panel A: Descriptive Statistics

Variable	Mean	StdDev	P10	P25	Median	P75	P90
Market Reaction Tests							
JobPostings	187	470	3	12	40	126	417
ΔJobPostings(%)	0.0427	3.2978	-1.3605	0.0000	0.0000	0.0000	1.2238
CAR(0,+1)(%)	0.002	2.822	-3.103	-1.367	-0.029	1.330	3.116
Market Value	6,306.72	14,534.57	149.91	460.25	1,516.63	4,618.46	15,340.89
Size	7.3035	1.7670	5.0100	6.1318	7.3242	8.4378	9.6383
BM	0.5390	0.4716	0.1101	0.2458	0.4432	0.7336	1.0979
Employees	11,574.46	24,384.99	313	824	2,964	10,049	29,537
Employees/TA	4.0466	6.1597	0.2065	0.6951	2.1043	4.3459	9.1744
Industry Labor Intensity	0.0393	0.0557	0.0023	0.0102	0.0228	0.0452	0.0853
Future Performance Tests							
$\Delta JobPostings_{t+3m}$	0.0013	0.0065	-0.0005	-0.0001	0.0000	0.0002	0.0021
$\Delta Earnings_t$	0.0057	0.0645	-0.0537	-0.0131	0.0058	0.0256	0.0615
$\Delta Revenue_t$	0.0439	0.1754	-0.1128	-0.0103	0.0373	0.1128	0.2226
$\Delta SG\&A_t$	0.0129	0.0472	-0.0185	0.0000	0.0048	0.0256	0.0604
$\Delta Employees_t$	0.0001	0.0008	-0.0004	0.0000	0.0000	0.0003	0.0007
$\Delta CapEx_t$	0.0021	0.0252	-0.0181	-0.0043	0.0009	0.0088	0.0235
$\Delta R\&D_t$	0.0026	0.0170	-0.0019	0.0000	0.0000	0.0024	0.0150
ΔADV_t	0.0007	0.0050	-0.0011	0.0000	0.0000	0.0001	0.0032

Panel B: The Distribution of the Average Daily Change in the Number of Job Postings by Calendar Month

January	February	March	April	May	June	July	August	September	October	November	December
0.1187	0.0841	0.0856	0.0683	0.0303	0.0279	0.0270	0.0614	0.0415	0.0592	-0.0569	-0.0256

The table reports summary statistics. Panel A provides the descriptive statistics of key variables. *JobPostings* is the number of daily active job postings on the firm's career website. *ΔJobPostings(%)* is the change in the number of job postings from the previous day, expressed as percentage points. *CAR(0,+1)* is the cumulative abnormal return over the two-day window that includes the date when the number of active job postings changed and the following day, expressed as percentage points. The abnormal return is the firm's daily return minus the CRSP value-weighted daily return. *Market Value* is the market value of equity at the end of the previous fiscal year. *Size* is the logarithm of the market value of equity at the end of the previous fiscal year. *BM* is the book-to-market ratio at the end of the previous fiscal year. *Employees* is the number of employees at the end of the previous fiscal year. *Employees/TA* is the number of employees divided by total assets at the end of the previous fiscal year. *Industry Labor Intensity* is labor intensity at the industry level calculated as the ratio of the number of employees to total assets. $\Delta JobPostings_{t+3m}$ is the change in the average number of active job postings in the first three months of the year relative to the same period last year, scaled by total assets. *ΔEarnings* (*ΔRevenue*, *ΔSG&A*, *ΔEmployees*, *ΔCapEx*, *ΔR&D*, *ΔADV*) is the change in operating income after depreciation (revenue, SG&A expense, number of employees, capital expenditure, R&D expense, advertising expense) from to the previous year, scaled by total assets. Panel B reports the distribution of the mean daily change in number of job postings expressed as percentage points, *ΔJobPostings(%)*, by calendar month. All continuous variables are winsorized at the 1% and 99% levels.

Table 3
Future Performance

	Dependent Variable			
	$\Delta Employees_{t+1}$	$\Delta SG\&A_{t+1}$	$\Delta Revenue_{t+1}$	$\Delta Earnings_{t+1}$
$\Delta JobPostings_{t+3m}$	0.0017**	0.1491***	0.9927***	0.3216***
	[2.36]	[3.05]	[6.30]	[4.44]
$\Delta Earnings_t$	0.0006***	0.0474**	-0.0055	-0.1278***
	[2.64]	[2.30]	[-0.07]	[-3.38]
$\Delta Revenue_t$	0.0002*	0.0092	0.0548	0.0058
	[1.91]	[1.20]	[1.24]	[0.53]
$\Delta SG\&A_t$	0.0010**	0.2397***	0.3046***	0.0013
	[2.40]	[4.90]	[3.70]	[0.03]
$\Delta Employees_t$	-0.0000	0.0312	0.0501	-0.1001
	[-0.08]	[0.96]	[0.47]	[-1.64]
$\Delta CapEx_t$	0.1864***	10.3163***	40.8352***	-2.7009*
	[4.25]	[6.96]	[8.53]	[-1.65]
$\Delta R\&D_t$	0.0004	0.2241***	0.0798	-0.4058***
	[0.72]	[3.37]	[0.51]	[-2.96]
ΔADV_t	0.0028	0.6735**	1.3305**	-0.0049
	[0.95]	[2.47]	[2.16]	[-0.02]
BM_t	-0.0001***	-0.0033**	-0.0383***	-0.0126***
	[-3.15]	[-2.06]	[-5.05]	[-4.10]
Observations	6,241	6,253	6,253	6,253
Adjusted R^2	0.129	0.228	0.176	0.0683

This table reports the results of estimating equation (A1). The dependent variable $\Delta Earnings_{t+1}$ ($\Delta Revenue_{t+1}$, $\Delta SG\&A_{t+1}$, or $\Delta Employees_{t+1}$) is the change in operating income after depreciation (revenue, SG&A expense, and number of employees) for year $t+1$, relative to year t. $\Delta JobPostings_{t+3m}$ is the ranked change in the average number of active job postings in the first three months of year $t+1$ relative to the same period in year t. $\Delta CapEx_t$ ($\Delta R\&D_t$, ΔADV_t) is as the change in capital expenditure (R&D expense, advertising expense) for year t, relative to year $t-1$. BM_t is the book-to-market ratio at the end of year t. Values in brackets represent t-statistics. The regressions are estimated with industry and year fixed effects. Standard errors are clustered by firm. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests.

Table 4
Market Reaction

	Full sample	Restricted sample	Restricted sample with available data for news articles and sentiment
ΔJobPostings	0.0242**	0.0258**	0.0307**
	[2.17]	[2.32]	[2.57]
Size	-0.0018	-0.0051	-0.0136**
	[-0.34]	[-0.81]	[-2.09]
BM	0.0266	0.0348	0.0652**
	[1.44]	[1.41]	[2.27]
NewsSentiment			0.0000
			[1.53]
NewsArticles			0.0001*
			[1.76]
Observations	2,826,160	704,296	512,647
Adjusted R^2	0.0038	0.0038	0.0042

This table reports the results of estimating market reaction equations (2) and (3), where cumulative abnormal return, *CAR*, over the two-day window (trading days 0 and +1) is regressed on the ranked change in the number of job postings for day 0 from day −1, *ΔJobPostings*, the market value of equity, *Size*, the book-to-market ratio, *BM*, the number of news articles, *NewsArticles*, and the average sentiment of news articles, *NewsSentiment*. Values in brackets represent t-statistics. The restricted sample in the second column excludes observations with a nonzero change in the number of job postings in the previous or next day, observations with zero change in the number of job postings on the event day, days when the firm files 8-K, 10-Q, or 10-K, and days when management issues guidance. In the last column, we also exclude observations without available data for news articles and sentiment. The regressions are estimated with year-month fixed effects. Standard errors are clustered by firm and time (year-month). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests.

Table 5
Factors Influencing Market Reaction to Job Postings

Panel A – Hiring for Growth Versus Replacement

Replacement		**Growth**	
Low Sales Growth	0.0066	High Sales Growth	0.0409***
	[0.43]		[3.36]
F-test (p-value):	(0.033)		
Low Employee Growth	0.0071	High Employee Growth	0.0402***
	[0.49]		[3.25]
F-test (p-value):	(0.024)		

Panel B – Labor Intensity

Low Labor Intensity		**High Labor Intensity**	
Low Industry Labor Intensity	0.0402***	High Industry Labor Intensity	0.0071
	[3.15]	Intensity	[0.48]
F-test (p-value):	(0.044)		
Low Employees/TA	0.0368***	High Employees/TA	0.0109
	[2.78]		[0.76]
F-test (p-value):	(0.107)		

This table reports the results of estimating market reaction equation (2) within the indicated subsamples. The table reports the coefficient estimates on *ΔJobPostings*. Values in square brackets represent t-statistics. The p-values, reported in round brackets, are for the two-tailed F-test of the difference in the coefficients between the indicated subsamples. The regressions are estimated with time (year-month) fixed effects. Standard errors are clustered by firm and time (year-month). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests.

Online Appendix

In this appendix, we conduct several robustness tests and additional analyses.

A.1 Robustness Tests

We conduct several additional robustness checks of the market reaction test. Table A1 reports the results of estimating market reaction equations (2) and (3) under different research design choices. Panel A shows the results when we exclude utilities and financial services firms (SIC codes 4900–4999 and 6000–6999). Panel B shows the results using the unranked measure of the change in the number of job postings. Panel C reports the results of estimating market reaction equations, where we add controls for past financial performance. Specifically, we add past growth in earnings, sales, SG&A expenses, employee count, CapEx, R&D expenses, and advertising expenses. Consistent with the results reported in Table 3, the coefficient on job postings is positive and significant in all specifications. The results indicate that our findings are robust to various research design choices.

Table A2 Panel A shows the results of estimating the market reaction model (2) within growth and replacement subsamples, where we use sales growth and employee growth in the current rather than the previous year. Consistent with the results in Table 5, the market reaction to job postings is more pronounced when firms hire for growth than for replacement. The differences between the subsamples are significant, as indicated by the F-test.

A.2 Additional Analyses

A.2.1 Replacement versus Growth

In our cross-sectional analyses, we find that the market reaction to job postings is more pronounced when the firm is more likely to hire for growth rather than replacement. To provide further evidence that job postings are a signal of future financial performance when they represent growth, we examine the relation between future financial performance and the

interaction between the change in the number of job postings and a growth indicator. We use two growth indicators, $HighSalesGrowth_{jt}$ ($HighEmployeeGrowth_{jt}$), which equal 1 if the change in change in revenue (employee count) for firm j year t is above the median and 0 otherwise. We use next year's change in revenue and earnings to proxy for future financial performance. We estimate the following regressions:

$$\begin{aligned} \Delta Revenue_{jt+1} \text{ or } \Delta Earnings_{jt+1} = \alpha_1 + \beta_1 \{ & HighSalesGrowth_{jt} * \Delta JobPostings_{jt+3m} \text{ or} \\ & HighEmployeeGrowth_{jt} * \Delta JobPostings_{jt+3m}\} + \beta_2 \Delta JobPostings_{jt+3m} \\ + \beta_3 \Delta Earnings_{jt} + \beta_4 \Delta Revenue_{jt} + \beta_5 \Delta SG\&A_{jt} + \beta_6 \Delta Employees_{jt} + \beta_7 \Delta CapEx_{jt} & \\ + \beta_8 \Delta R\&D_{jt} + \beta_9 \Delta ADV_{jt} + \beta_{10} BM_{jt} + \varepsilon_{jt}, & \end{aligned} \quad \text{(A1)}$$

where we include the same control variables as in equation (1).

The results, reported in Table A3, are generally consistent with the prediction that job postings are more informative about future performance when they are likely to represent growth. Except for the regression in the third column, where growth is proxied by the previous year's growth in employee count and future performance is proxied by the next year's growth in earnings, the interaction between job postings and growth is positive and significant.

A.2.2 Factors Affecting Market Reaction to Job Postings: Information Environment

In our cross-sectional analyses in Section 3.4, we examine factors that influence market reaction to job postings. To provide further evidence on this issue, we consider the effect of information environment.

The investor reaction to hiring news is likely to be affected by the quality of the firm's information environment. When the information asymmetry between the management and outsiders is high, monitoring is more difficult, and so agency conflicts can lead to more inefficient labor investments. Managers can engage in empire building by hiring too many employees or attempt to meet earnings expectations by cutting labor investments. By improving the ability of outsiders to monitor managers, a high-quality information environment

can mitigate agency issues and lead to labor investments that benefit shareholders more. Consistent with this perspective, Jung et al. (2014) show that higher financial reporting quality, which reduces information asymmetry between managers and shareholders, is associated with more efficient labor investments, as reflected by lower abnormal hiring. Given that shareholder benefits from hiring should be positively affected by labor investment efficiency, we predict that the positive market reaction to job postings should be more pronounced when the quality of the information environment is high. On the other hand, it is possible that the information contained in job postings is preempted by information provided through other channels in firms with richer information environment, leading to lower market reaction to job postings. Thus, the effect of information environment is unclear ex ante. We use firm size and analyst following to proxy for information environment.

The results, presented in Table A2 Panel B, provide some evidence that the market reaction to job postings is concentrated in firms with high-quality information environments. The coefficient on job postings is positive and significant for large firms and firms with greater analyst coverage and insignificant for small firms and firms with lower analyst coverage. However, the difference between the subsamples is not statistically significant.

A.2.3 Information Acquisition Costs: Early Versus Later Years

The way job postings are disseminated by firms and acquired by outsiders has changed substantially over time. With the rise of the Internet, firms began to post their job announcements on company websites. The greater availability of job announcements also led to a surge in companies that scrape and process job postings. Initially, the job postings data were primarily used to help job seekers more efficiently find relevant openings. Subsequently, the data were also processed and sold to investors. Given that these changes happened during the period we study, it is likely that investor reaction to job postings changed over the sample years. Specifically, we expect that the increased availability of job postings data to investors in

recent years will lead to a stronger reaction to job postings.

Table A4 presents the results of estimating the investor reaction model (1) separately in the earlier and later sample years (i.e., the first five and last five years). The first column shows the results for the earlier years (2007–2011), and the second column shows the results for the later years (2012–2016). Consistent with our prediction, investor reaction to job postings is concentrated in the recent years. The coefficient on *ΔJobPostings* is positive and significant for the recent years and insignificant for the earlier years, although the difference between the two subsamples is not statistically significant.

References

Jung, B., W. Lee, and D. Weber. 2014. Financial reporting quality and labor investment efficiency. Contemporary Accounting Research 31: 1047–1076.

Table A1
Market Reaction: Robustness Tests

Panel A: Excluding Utilities and Financial Firms

	Full sample	Restricted sample	Restricted sample with available data for news articles and sentiment
ΔJobPostings	0.0263**	0.0260**	0.0294**
	[2.12]	[2.08]	[2.15]
Size	0.0018	-0.0006	-0.0111
	[0.31]	[-0.09]	[-1.60]
BM	0.0353	0.0598*	0.0967**
	[1.54]	[1.94]	[2.58]
NewsSentiment			0.0000
			[1.45]
NewsArticles			0.0001*
			[1.76]
Observations	2,182,706	538,943	388,109
Adjusted R^2	0.0045	0.0046	0.0049

Panel B: Using Unranked Change in Job Postings

	Full sample	Restricted sample	Restricted sample with available data for news articles and sentiment
ΔJobPostings	0.1414**	0.1438**	0.1824**
	[2.00]	[2.11]	[2.54]
Size	-0.0018	-0.0051	-0.0136**
	[-0.34]	[-0.81]	[-2.08]
BM	0.0266	0.0347	0.0651**
	[1.44]	[1.41]	[2.27]
NewsSentiment			0.0000
			[1.53]
NewsArticles			0.0001*
			[1.76]
Observations	2,826,160	704,296	512,647
Adjusted R^2	0.0038	0.0038	0.0042

Panel C: Adding Controls for Past Performance

	Full sample	Restricted sample	Restricted sample with available data for news articles and sentiment
ΔJobPostings	0.0242**	0.0258**	0.0307**
	[2.17]	[2.31]	[2.57]
Size	-0.0019	-0.0053	-0.0138**
	[-0.37]	[-0.85]	[-2.12]
BM	0.0291	0.0388	0.0690**
	[1.58]	[1.55]	[2.38]
NewsSentiment			0.0000
			[1.49]
NewsArticles			0.0001
			[1.40]
$\Delta Earnings_{t-1}$	0.2143*	0.3674**	0.4011**
	[1.86]	[2.50]	[2.48]
$\Delta Revenue_{t-1}$	0.0013	-0.0600	-0.0754
	[0.03]	[-1.20]	[-1.18]
$\Delta SG\&A_{t-1}$	0.0752	0.0802	0.1056
	[0.59]	[0.48]	[0.47]
$\Delta Employees_{t-1}$	-1.4571	5.6142	-1.1514
	[-0.27]	[0.77]	[-0.17]
$\Delta CapEx_{t-1}$	-0.2715	-0.3115	-0.2340
	[-1.11]	[-1.22]	[-0.87]
$\Delta R\&D_{t-1}$	0.4150	0.6419	0.6421
	[1.26]	[1.47]	[1.15]
ΔADV_{jt-1}	-1.1022	-0.9895	0.0709
	[-1.28]	[-1.06]	[0.07]
Observations	2,826,160	704,296	512,647
Adjusted R^2	0.0039	0.0039	0.0043

This table reports the results of estimating market reaction equations (2) and (3), where cumulative abnormal return, *CAR*, over the two-day window (trading days 0 and +1) is regressed on the change in the number of active job postings for day 0 from day −1, *ΔJobPostings*, the market value of equity, *Size*, the book-to-market ratio, *BM*, the number of news articles, *NewsArticles*, and the average sentiment of news articles, *NewsSentiment*. Panel A shows the results when we exclude utilities and financial services firms (SIC codes 4900–4999 and 6000–6999). Panel B shows the results using unranked measure of the change in the number of job postings. In Panel C, we add controls for past growth in earnings ($\Delta Earnings_{t-1}$), sales ($\Delta Revenue_{t-1}$), SG&A expenses ($\Delta SG\&A_{t-1}$), employee count ($\Delta Employees_{t-1}$), CapEx ($\Delta CapEx_{t-1}$), R&D expenses ($\Delta R\&D_{t-1}$), and advertising expenses (ΔADV_{jt-1}) for the previous fiscal year. The restricted sample in the second column excludes observations with a nonzero change in the number of job postings in the previous or next day, observations with zero change in the number of job postings on the event day, days when the firm files 8-K, 10-Q, or 10-K, and days when management issues guidance. In the last column, we also exclude observations without available data for news articles and sentiment. Values in brackets represent t-statistics. The regressions are estimated with time (year-month) fixed effects. Standard errors are clustered by firm and time (year-month). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests.

Table A2
Factors Influencing Market Reaction to Job Postings: Information Environment

Panel A – Hiring for Growth Versus Replacement

Replacement		**Growth**	
Low Current Sales Growth	0.005	High Current Sales Growth	0.042***
	[0.46]		[3.61]
F-test (p-value):	(<0.001)		
Low Current Employee Growth	0.005	High Current Employee Growth	0.042***
	[0.36]		[2.68]
F-test (p-value):	(<0.001)		

Panel B – Information Environment

Low-quality information environment		**High-quality information environment**	
Low Size	0.0109	High Size	0.0358***
	[0.60]		[3.30]
F-test (p-value):	(0.183)		
Low Analyst Coverage	0.0165	High Analyst Coverage	0.0352**
	[1.23]		[2.57]
F-test (p-value):	(0.230)		

This table reports the results of estimating market reaction equation (1) within the indicated subsamples. The table reports the coefficient estimates on $\Delta JobPostings$. Values in square brackets represent t-statistics. The p-values, reported in round brackets, are for the two-tailed F-test of the difference in the coefficient estimates between the indicated subsamples. The regressions are estimated with time (year-month) fixed effects. Standard errors are clustered by firm and time (year-month). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests.

Table A3
Future Financial Performance: Growth versus Replacement

	Dependent Variable			
	$\Delta Earnings_{t+1}$	$\Delta Revenue_{t+1}$	$\Delta Earnings_{t+1}$	$\Delta Revenue_{t+1}$
$HighSalesGrowth_t * \Delta JobPostings_{t+3m}$	0.3894***	0.9858***		
	[4.67]	[4.57]		
$HighEmployeeGrowth_t * \Delta JobPostings_{t+3m}$			0.0965	0.9491***
			[1.07]	[4.28]
$\Delta JobPostings_{t+3m}$	-0.2615*	-0.4832	0.1783	-0.4163
	[-1.85]	[-1.30]	[1.21]	[-1.08]
$\Delta Earnings_t$	-0.1376***	-0.0302	-0.1283***	-0.0105
	[-3.63]	[-0.38]	[-3.40]	[-0.13]
$\Delta Revenue_t$	-0.0017	0.0359	0.0054	0.0507
	[-0.15]	[0.80]	[0.49]	[1.15]
$\Delta SG\&A_t$	-0.0109	0.2737***	-0.0007	0.2845***
	[-0.22]	[3.37]	[-0.01]	[3.43]
$\Delta Employees_t$	-0.1034*	0.0418	-0.1017*	0.0338
	[-1.70]	[0.39]	[-1.67]	[0.32]
$\Delta CapEx_t$	-2.8783*	40.3862***	-3.1026*	36.8837***
	[-1.76]	[8.40]	[-1.81]	[7.34]
$\Delta R\&D_t$	-0.4167***	0.0523	-0.4102***	0.0370
	[-3.05]	[0.34]	[-3.00]	[0.24]
ΔADV_t	0.0085	1.3645**	0.0012	1.3911**
	[0.03]	[2.21]	[0.00]	[2.25]
BM_t	-0.0121***	-0.0372***	-0.0125***	-0.0374***
	[-3.99]	[-4.90]	[-4.07]	[-4.92]
Observations	6,253	6,253	6,253	6,253
Adjusted R^2	0.0713	0.178	0.0684	0.178

This table reports the results of estimating equation (A1). The dependent variable, $\Delta Earnings_{t+1}$ ($\Delta Revenue_{t+1}$), is the change in operating income after depreciation (revenue) for year $t+1$, relative to year t. $\Delta JobPostings_{t+3m}$ is the change in the average number of active job postings in the first three months of year $t+1$ relative to the same period in year t. $HighSalesGrowth_t$ ($HighEmployeeGrowth_t$) are indicator variables that equal 1 if the change in change in revenue (employee count) for year t is above the median and 0 otherwise. $\Delta CapEx_t$ ($\Delta R\&D_t$, ΔADV_t) is as the change in capital expenditure (R&D expense, advertising expense) for year t, relative to year $t-1$. BM_t is the book-to-market ratio at the end of year t. Values in brackets represent t-statistics. The regressions are estimated with industry and year fixed effects. Standard errors are clustered by firm. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests.

Table A4
Market Reaction in Earlier Versus Later Years

	Earlier Years (2007–2011)	Later Years (2012–2016)
ΔJobPostings	0.0060	0.0346**
	[0.32]	[2.48]
Size	-0.0047	-0.0001
	[-0.58]	[-0.01]
BM	0.0433*	-0.0057
	[1.85]	[-0.22]
F-test (p-value):	(0.226)	
Observations	1,157,677	1,668,483
Adjusted R^2	0.0038	0.0039

This table reports the results of estimating market reaction equation (1) separately in the earlier (2007–2011) and later (2012–2016) years. The regressions are estimated with time (year-month) fixed effects. Standard errors are clustered by firm and time (year-month). Values in square brackets represent t-statistics. The p-values, reported in round brackets, are for the two-tailed F-test of the difference in the coefficients on *ΔJobPostings* between the indicated subsamples. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests.

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