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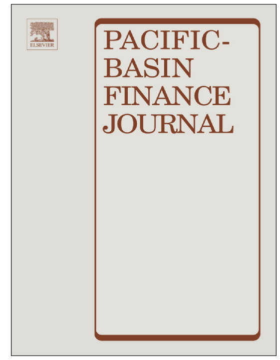

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Abstract: Labor input is an important factor in a firm's production and affects stock return. We use an optimization model to explore the stock return-labor hiring relation with the effects of employment frictions and labor supply. Our model illustrates that labor hiring is negatively related to the expected stock return from the discount rate channel; the negative return-hiring relation becomes steeper when the firm's employment frictions are higher; positive labor supply shock leads to a flatter return-hiring relation. Using Chinese-listed firm data, we provide evidence for the existence of the return-hiring relation and the impact of employment frictions and labor supply confirming the theoretical predictions.

Key words: Hiring, Stock return, Employment friction, Labor supply, Discount rate.

JEL classification：J21; G12

1. Introduction

Traditional studies of stock returns mainly focus on the effects of a firm's financial variables and relevant systematic risks. These studies usually leave no role for the labor input by assuming that labor can be adjusted without costs. However, the labor market does experience frictions. For example, the labor adjustment costs paid by a firm when adjusting the labor force size reduce the income attributable to investors and thus should be reflected in its asset prices. Danthine and Donaldson (2002) suggest the impact of operating leverage on stock returns due to labor contracts. More recent studies have already looked into the effect of the labor force on financial markets and find some crucial labor features significantly affect asset prices. Donangelo (2014) suggests that labor mobility has a positive effect on a firm's stock returns since it increases the firm's operating leverage. Favilukis and Lin (2016a,b) report that stock returns increase with wage rigidity because smoother wages make dividends riskier. Donangelo et al. (2019) find the relative size and inflexibility of labor costs result in labor leverage for a firm, and higher labor share increases the risk and equity premium. Labor hiring, as an important labor market characteristic, is closely related to the development of a firm needing competent employees. Thus, some studies investigate the impact of labor hiring. Belo et al. (2014) illustrate the U.S. firm's return-hiring relation with a neoclassical model, and Belo et al. (2017a) extend the study of this relation to the aggregate level. Belo et al. (2017b) suggest the high-skill industry in the U.S. and G7 countries has a steeper return-hiring relation than low-skill industry because workers with high-skill are more costly to be replaced.

However, previous studies on the return-hiring relation have not explored how the labor supply and firm-level employment frictions affect a firm's decision and the return-hiring relation. All else being equal, greater labor supply lowers the average wage and allows the firm to recruit workers more easily; while higher employment frictions incur more labor adjustment costs. Both of the factors may exert significant influence on the firm's hiring behavior. Therefore, this paper establishes an optimization model to study the implications of a firm's hiring for its stock returns, considering the employment friction and labor supply effects. And we use this model to empirically examine Chinese market.

Our theoretical model is constructed on the basis of an infinite horizon through the discount rate channel. We propose that a firm's labor hiring is negatively related to its expected stock returns (Proposition 1). The rationale is that a firm's optimal hiring is determined by the inter-temporal trade-off between the marginal labor adjustment cost when hiring workers at present and the discounted marginal net benefit contributed by these workers in the future. Optimal hiring decreases in accord with the discount rate (expected stock return). By maximizing a firm's current market value, we specify an objective function for a labor-hiring decision, and swiftly solve it with the Lagrange method. We further propose that the negative return-hiring relation is steeper if the firm has higher employment frictions (Proposition 2) and flatter when a positive labor supply shock occurs (Proposition 3). Higher employment frictions lead to greater employment dead-weight costs, and a positive labor supply shock increases the profits by reducing labor expenses as well as search costs. These changes affect the sensitivity of the firm's hiring to the discount rate, thus, the return-hiring relation.

Our empirical tests examine the predictability of a firm's hiring rate to its stock returns. We use China's listed firms on the A-share market of the Shanghai and Shenzhen Stock Exchanges from 2007 to 2015. The firms are sorted into 10 portfolios of equal size based on their hiring rate. The average annualized excess return of the lowest portfolio is about 4.6% higher than that of the highest portfolio, indicating a negative cross-sectional return-hiring relation. We then specify the baseline regression model, in which the lagged hiring variable is included as the explanatory variable and stock returns as the explained variable. The year- and firm-fixed effects are also controlled. The regression results show a significantly negative relation between hiring and future stock returns; specifically, a 10% increase in the firm's hiring rate is related to a 1.24% decrease in its annual stock returns. This finding confirms our first proposition.

Next, we take the proportion of staff with a bachelor degree and higher as the proxy for the degree of employment frictions. The reason is that the firm's greater reliance on high-educated workers usually incurs more costs in labor search, selection, and training. And we incorporate the interaction term between this proxy and labor hiring into the baseline return-hiring equation. We find that the interaction coefficient is significantly negative, confirming Proposition 2, that a firm's negative return-hiring relation becomes steeper if the firm has higher employment frictions.

Then, we examine the impact of labor supply. We perform regressions based on the sample split at year 2011 when China's working age population reached its peak. Intuitively, the decline of working age population after 2011 approximates a negative shock to China's labor supply, which might cause a firm to revise its labor cost policy. Thus, it is reasonable to perform the regressions for the periods before and after 2011. Our results show that the coefficients of the hiring rate in the rising phase of working age population are lower than those in the declining phase. In addition, we add an interaction term between labor hiring and labor supply growth into the baseline equation and find its coefficient is significantly positive. These results are consistent with our hypothesized relation in Proposition 3. We also employ the Fama-French (2015) five-factor model for asset pricing tests, and use alternative proxies and other means to confirm the robustness of our results.

Our study contributes to the literature on the impact of the labor market on equity returns, such as labor mobility (Danangelo, 2014), wage rigidity (Favilukis and Lin, 2016a,b), labor leverage (Danangelo et al. 2019), labor unions (Addessi and Busato, 2009; Chen et al. 2012) and labor hiring (Belo et al. 2014, 2017a,b). The vast majority of the existing literature provides empirical evidence for developed countries, mainly the U.S., while very little for emerging markets. Relating to labor hiring and stock return, this paper mainly makes two important contributions. First, we extend Belo et al. (2014, 2017a,b) by establishing an optimization model to explore the firm-level return-hiring relation, the effects of employment frictions and labor supply from the discount rate channel.

Belo et al. (2014, 2017b) analyze the return-hiring relation with a neoclassical model which belongs to the type of model that conducts stock return research in business cycles (e.g., Jermann, 1998; Zhang, 2005; Papanikolaou, 2011). They explain this relation from the aspect of aggregate adjustment cost shock. One pronounced challenge of the business cycle model is to identify the sources of the aggregate shocks and accurately evaluate their impact (Romer, 2012). Greater labor supply can reduce a firm's search costs. Thus, labor supply change is an important source of the labor adjustment cost shock. In the case of a positive labor supply shock, not only the adjustment costs but also wages can be reduced. However, the model of Belo et al. (2014, 2017b) fails to capture this shock's overall effects on the whole system. Neither its baseline wage equation nor the alternative specification reflect the reduction of wages from such a shock, underestimating the firm's final profits. Another problem is that the model of Belo et al. (2014, 2017b) cannot provide an analytical solution with complex functions and state variables. It adopts a parameter calibration method which yields simulated data for further quantitative comparative statics. However, this simulated data generated from the structural model tends to be more regular than the real data.[1] Thus, it may not be able to replicate the stock data of the emerging economies (such as China) due to their more volatile markets, which may weaken its explanatory power to these economies.

Differing from the aggregate shock approach, we use a model of optimal employment to analyze the firm's return-hiring relation and relevant effects through the discount rate channel. Our model overcomes the above problems. Belo et al. (2017a) also explain the return-hiring relation through the discount rate channel, but they proceed to discuss the connection between a firm's size, age, market beta and the return-hiring relation. Their model is also not available analytically, and their subsequent study is on the aggregate level. By comparison, we focus on the firm-level relation both theoretically and empirically. And our model achieves a precise analytical solution. This allows us to explore how the changes in employment frictions and labor supply affect the overall equilibrium outcome, which is not discussed by Belo et al. (2014, 2017a,b). In addition, compared to the single labor market friction in their works, we consider a second friction, namely the labor cost stickiness. It plays an important role in constructing the labor cost equation and deriving the last proposition. and improves the generality of the model to better reflect the imperfect (frictional) labor market. Hence, our paper extends the strand of literature of exploring stock returns from the discount rate channel.

Our discussion of the effect of employment frictions extends the finding of Belo et al. (2017b). They document that the negative return-hiring relation is steeper in the high-skill industry than the low-skill industry. They explain that the high-skill industry has greater labor adjustment costs, generating higher return exposure to the aggregate adjustment cost shock. We suggest that a firm's employment frictions steepen its return-hiring relation. The hypothesis is on the firm-level, and the hiring frictions have a wide range of possible sources, such as the labor union and employment protection, although labor force structure is the main factor. Moreover, we provide a new suggestion that labor supply affects the return-hiring relation. Labor supply is a critical factor to a firm's labor expenses and search costs. Thus, it affects the firm's hiring decision in an imperfect labor market, which might further affect the return-hiring relation. This has not been considered in the previous literature.

Second, our empirical studies are conducted with the data of listed firms in China, providing new evidence from a vital emerging market to contribute to the existing literature. Belo et al. (2014, 2017a,b) show empirical evidence from the U.S. and G7 markets. According to our knowledge, this is the first paper that examines the return-hiring relation for an emerging market. In 2015, China had a large employed population of 774.5 million persons. And its mean weekly working hours per employed person were 45.5, and labor force participation rate was 69.9%. By comparison, the working hours per employed person in the U.S. were 38.6 per week and labor force participation rate was 62.7% in 2015. However, the ratio of China's high-quality labor force was still at a very low level. Its percentage of employed population with a bachelor's

[1]The simulation of the model of Belo et al. (2014) matches the regression results of the U.S. data after excluding the micro-cap observations, firms below the bottom 20th percentile of New York Securing Exchange firms. This matching implies that the price behavior of micro-cap firms fluctuates so much that it may not be simulated by this model.

degree and higher was 8.2% in 2015, while that percentage in the U.S. was 34.13%. Another noticeable attribute of China's labor market was the decline of the working age population (those aged between 15 and 59 years) in recent years. After reaching the peak of 940.7 million persons in 2011, the working age population declined continuously, with a total reduction of 15.2 million persons in 2015. In contrast, the working age population in the U.S. continued to grow from 231.9 million persons in 2007 to 250.8 million in 2015. Thus, the Chinese labor market differed greatly from the U.S. market during our sample period. With the Chinese data, we conduct tests on the return-hiring relation and make a brief comparison with the results of the U.S. Then, we use the Chinese firm's reliance on high-educated employees to test the effect of employment frictions on stock returns. We may be also the first to use the firm-level data to measure labor adjustment costs in the existing literature. Furthermore, the declining trend of the working age population indicates the country's demographic dividend is disappearing. Our empirical tests study the effect of China's labor supply on a firm's stock returns. Therefore, we provide Chinese evidence of the return-hiring relation with a consideration of employment frictions and labor supply to enrich the existing literature.[2]

The rest of this paper is organized as follows. The next section presents the economic model and provides our propositions. Section 3 describes the sample data. Section 4 shows the results of the empirical studies. Section 5 examines the robustness of our findings, and Section 6 concludes.

2. Model

This model aims to clarify the argument that labor hiring is negatively related to the expected stock returns, and the relationship becomes steeper when the firm's employment frictions are greater, or flatter if a positive labor supply shock occurs. The typical firm in the model, indexed by *i*, is assumed to operate infinitely. Its timing is described by Figure 1.

[INSERT FIGURE 1]

We intend to find how firm *i* chooses the optimal hiring rate in each period to maximize its market value, and inspect the expected return-hiring relation. Suppose at the beginning of date t, firm *i* decides to hire workers $h_{i,t}$. Together with the employees $m_{i,t-1}$ at date t-1, the total staff is $m_{i,t} = m_{i,t-1} + h_{i,t}$. We assume that firm *i*'s long-term per capita sales are π_i, and the firm obtains revenue $S_{i,t} = \pi_i m_{i,t}$ at the end of date t.

Similar to the setting of sticky salaries in Favilukis and Lin (2016a), we assume firm *i*'s labor costs at date t are the weighted average of the last period's labor costs $L_{i,t-1}$ and a target proportion of this period's sales: $L_{i,t} = \eta L_{i,t-1} + (1-\eta)\alpha\pi_i(m_{i,t-1} + h_{i,t})$. In this equation, η is the weight of $L_{i,t-1}$, representing the degree of labor cost stickiness, and α is the ideal proportion (i.e., the firm's target labor share); both η and $\alpha \in (0,1)$.

Since hiring staff is not costless, firm *i* also incurs labor adjustment costs $LAC_{i,t}$ when

[2]The sources of the data for demography and labor markets in China and the U.S. are aggregated in Appendix B.

adjusting the labor force size at date t (e.g., costs of training new workers), besides paying labor costs $L_{i,t}$ in the form of employee salaries and benefits. Similar to the classic labor adjustment cost model, we set $LAC_{i,t}$ as a quadratic function, as do Cooper and Willis (2004):

$$LAC_{i,t} = \frac{\lambda}{2}\left(\frac{h_{i,t}}{m_{i,t-1}}\right)^2 m_{i,t-1}, \tag{1}$$

where the scale parameter $\lambda > 0$.

In this way, firm *i* operates infinitely. Differing from the model of Belo et al. (2014, 2017b), our model does not include the stochastic processes along with Cochrane (1991) and Li and Zhang (2010). This allows us to obtain an analytical solution. But both of the two models belong to the production-based model, so we focus on the firm's production activities, and do not consider the consumer side. We further assume that the quit rate of staff is zero, and the level or change in capital investment is not considered, thus identical to Donangelo (2014) and Favilukis and Lin (2016a). These assumptions simplify the following deduction, but do not qualitatively affect the result.

Firm *i*'s management needs to decide its optimal hiring position $h^*_{i,t}$ to maximize current market value. Its objective function is:

$$M_{i,t} = \max_{\{h_{i,t}\}} \sum_{t=1}^{\infty} \frac{1}{(1+r_i)^t}[S_{i,t}(h_{i,t}) - L_{i,t}(h_{i,t}) - (1+r_i)LAC_{i,t}(h_{i,t})], \tag{2}$$

where $M_{i,t}$ is firm *i*'s gross market value at date t, and r_i is the discount rate representing the firm's risk loading. Equation (2) includes $(1+r_i)LAC_{i,t}(h_{i,t})$ in the square bracket, because the labor adjustment costs $LAC_{i,t}$ are paid at the beginning of each date, while the revenue $S_{i,t}$ and labor costs $L_{i,t}$ occur at the end. As Ross et al. (2010) explain, a firm's discount rate (r_i in Equation (2)) in the production decision can also be regarded as the expected stock return to stockholders.

We obtain the following optimal hiring ratio $\frac{h^*_{i,t}}{m_{i,t-1}}$ of Equation (2) by constructing and solving a Lagrange function as described in Appendix A:

$$\frac{h^*_{i,t}}{m_{i,t-1}} = \frac{\pi_i[1-(1-\eta)\alpha]}{\lambda(1+r_i)}. \tag{3}$$

Based on Equation (3), we derive the following important proposition for the relation between a firm's labor hiring and its expected stock returns.

Proposition 1. In equilibrium, a firm's labor hiring decreases at its expected returns:

$$\frac{d}{dr_i}\left(\frac{h^*_{i,t}}{m_{i,t-1}}\right) < 0 . \quad (4)$$

Proof. Totally differentiating Equation (3) with respect to r_i on both sides yields:

$$\frac{d}{dr_i}\left(\frac{h^*_{i,t}}{m_{i,t-1}}\right) = \frac{-\lambda\pi_i[1-(1-\eta)\alpha]}{[\lambda(1+r_i)]^2} < 0 . \quad (5)$$

The scale parameter of the labor adjustment cost function λ and the expected per capita output π_i are both greater than zero. It is assumed above that $\eta \in (0,1)$ and $\alpha \in (0,1)$, meaning $0 < 1-(1-\eta)\alpha < 1$. Accordingly, the numerator on the right side of Equation (5) is less than zero. Thus, Equation (4) is proven.[3]

The economic logic of the negative return-hiring relation can be illustrated with Figure 2 (a). When hiring workers, a firm has to bear the labor adjustment costs. Its hiring is an inter-temporal trade-off determined by the current marginal labor adjustment cost $\lambda(h_{i,t}/m_{i,t-1})$ (shown as the MC_1 line in the figure), the discount rate r_i, and future marginal benefit (i.e., marginal output π_i minus marginal labor cost $(1-\eta)\alpha\pi_i$). The line of DMB_1 refers to the firm's marginal benefit after being discounted by $(1+r_i)$ at the outset. In equilibrium, the current marginal labor adjustment cost is equal to the discounted marginal benefit (at the intersection of MC_1 and DMB_1), and can be displayed algebraically as:

$$\lambda\left(\frac{h^*_{i,t}}{m_{i,t-1}}\right) = \frac{\pi_i - (1-\eta)\alpha\pi_i}{1+r_i} . \quad (6)$$

Equation (6) is actually the adjusted form of Equation (3). Thus, a lower discount rate leads to higher discounted marginal benefit, ceteris paribus. In Figure 2(a), the DMB_1 line shifts upward, resulting in more hiring (from H_1 to H_2, where H denotes the hiring rate $h_{i,t}/m_{i,t-1}$). Therefore, hiring is negatively associated with the discount rate (expected returns).

[INSERT FIGURE 2]

Next, we further explore the effects of employment frictions and labor supply shock on the deduced relation between labor hiring and discount rate.

Proposition 2. The negative expected return-hiring relation is steeper for firms with higher employment frictions.

Proof. The scale parameter of the labor adjustment cost function is λ. It represents the degree of a firm's employment frictions when the firm intends to adjust its labor force size. According to Equation (1), all else being equal, higher employment frictions lead to greater labor adjustment costs.

[3]Labor adjustment costs and labor cost stickiness are regarded separately in this model for they are two types of labor market frictions with different sources. The former includes the costs of employee search, recruitment, training, and the like, while the latter is mainly from wage stickiness due to fixed wage contracts.

We totally differentiate the absolute value of Equation (5) with respect to λ on both sides, and obtain:

$$d\left|\frac{d(h_{i,t}^{*}/m_{i,t\text{-}1})}{dr_i}\right|/d\lambda=\frac{-\pi_i[1-(1-\eta)\alpha]}{[\lambda(1+r_i)]^2}<0\,. \tag{7}$$

where π_i is greater than zero, and $0<1-(1-\eta)\alpha<1$, so Equation (7) is less than zero.

The intuition of Equation (7) is as follows. When the employment frictions increase, a firm's hiring incurs more dead-weight costs. The firm's hiring decision then responds less elastically to the change of discount rate, namely, $d(h_{i,t}^{*}/m_{i,t-1})/dr_i$ is flatter. This means a given change of the hiring rate is related to a larger change in the magnitude of the discount rate. Therefore, the expected negative return-hiring relation $dr_i/d(h_{i,t}^{*}/m_{i,t-1})$ becomes steeper when the firm faces higher employment frictions. This reasoning can also be illustrated by reference to Figure 2 (b). The degree of employment frictions as well as the slope of the *MC* lines is represented by λ. Thus, higher employment frictions increase the slope of the firm's marginal cost line, where MC_1 is rotated to MC_2. With the decrease in the discount rate (i.e., the shift of DMB_1 to DMB_2), the change in the hiring rate is from H_3 to H_4, less than the change from H_1 to H_2 when the employment frictions were lower. In other words, if the change in magnitude from H_3 to H_4 was as large as from H_1 to H_2, there should be a larger decrease in the discount rate that shifted DMB_1 to a position higher than DMB_2. This corresponds to the implication of Equation (7) that a firm with higher employment frictions has larger (i.e., steeper) expected return-hiring relations.

Now we turn to explore the labor supply effect. A positive labor supply shock can be caused by large scale immigration, upsurge in the local labor force, larger importation of foreign workers, and other factors. In response to the dramatic change in the labor market, the firm will adjust its labor cost policy in the new period. We derive the following proposition.

Proposition 3. The negative expected return-hiring relation is flatter after a positive labor supply shock occurs.

Proof. A positive shock to labor supply can decrease workers' average wage, leading to reduced labor costs for the firm, given the firm's optimal hiring rate in Equation (3). So the value of the labor supply shock is negatively related to the firm's target labor share α in the model; that is $d\alpha/dLSS<0$, in which LSS represents the labor supply shock. As Belo et al. (2014) suggest, a positive labor supply shock can also reduce a firm's search costs in the labor market, and the firm's employment frictions decrease. Hence, the labor supply shock is negatively related to the scale parameter of the firm's labor adjustment cost function λ, algebraically $d\lambda/dLSS<0$.

Furthermore, wage stickiness makes the firm inflexible to change its labor expenses resulting in risky dividends (Favilukis and Lin, 2016a,b). And a smaller labor share can lower both the risk and premium of the firm's equity (Donangelo, 2019). Thus, it is conjectured that the labor supply shock has a negative effect on the discount rate, that is $dr_i/dLSS<0$.

We totally differentiate the absolute value of Equation (5) with respect to labor supply shock on both sides, and obtain:

$$d\left|\frac{d(h_{i,t}^{*}/m_{i,t-1})}{dr_i}\right|/dLSS=\frac{-\frac{d\alpha}{dLSS}\pi_i(1-\eta)\lambda(1+r_i)^2-\pi_i[1-(1-\eta)\alpha]\beta}{[\lambda(1+r_i)^2]^2}>0\,, \qquad (8)$$

in which $\beta=\frac{d\lambda}{dLSS}(1+r_i)^2+2\lambda\frac{dr_i}{dLSS}(1+r_i)<0$.

While $d\alpha/dLSS$, $d\lambda/dLSS$ and $dr_i/dLSS$ are negative, the signs of other terms in β and Equation (8) are positive. So Equation (8) is greater than zero.

Equation (8) implies that the firm's hiring decision responds more sensitively to the change of the discount rate if there is a shock of greater value to labor supply. In other words, if the change to the hiring rate is given, the discount rate should be of lower magnitude. This means the absolute value of $dr_i/d(h_{i,t}^{*}/m_{i,t-1})$ decreases, when the value of labor supply shock increases. Figure 2(c) might aid in clarifying this reasoning. A positive shock to labor supply increases the firm's discounted marginal benefit by reducing its labor share as well as the discount rate. This is the major influence of such a shock on the firm's hiring decision, since labor expenses take a high proportion of a firm's total costs. Thus, DMB_1 shifts upward to DMB_3. And this shock also lowers the firm's employment frictions to some extent by reducing the search costs, and rotates MC_1 to MC_2. Then, we compare the return-hiring relations before and after the labor supply shock. Before the shock, a lower discount rate shifts DMB_1 to DMB_2, leading to a change in the hiring rate from H_1 to H_2. And after the shock, the same decrease in the magnitude of the discount rate shifts DMB_3 to DMB_4. The difference between DMB_3 and DMB_4 is greater than the difference between DMB_1 and DMB_2, because DMB_3 is in a position higher than DMB_1. Meanwhile, DMB_4 intersects with MC_2 at a new point. Thus, the change in the hiring rate from H_3 to H_4 is greater after the shock. This implies that if the change in magnitude from H_3 to H_4 was as small as H_1 to H_2, there should be a smaller decease in the discount rate that shifted DMB_3 to a position lower than DMB_4. Thus, after a positive labor supply shock, the expected return-hiring relation becomes narrower (i.e., flatter).

Among the three propositions, Proposition 1 reveals the basic relation between the expected return and labor hiring, while Propositions 2 and 3 provide necessary complements. The latter two propositions extend the deduction based on the sides of marginal cost and benefit through the discount rate channel.

3. Data

To test the propositions, we use data from the Chinese market. The sample contains 2789 Chinese firms listed on the A-share market of the Shanghai and Shenzhen Stock Exchanges from 2007 to 2015 with 15,571 annual observations in total. Following Fama and French (2015), we match the firms' annual accounting data at the end of year t-1 to their annual stock returns from July of year t to June of year t+1. The six-month gap ensures that investors obtain the accounting information earlier, and the predictability of labor hiring to stock returns can be tested. Thus, the stock return data for the full sample is from July 2008 to June 2017. We obtain the accounting data from the Wind Database and the stock return data from China Stock Market and Accounting Research Database (CSMAR). Both Wind and CSMAR are mainstream databases for academic researchers studying the Chinese stock markets according to prior literature (e.g., Giannetti et al., 2015; Bradshaw et al., 2019; Wu et al., 2019). In this study, we exclude financial firms and firms with negative net assets, or with negative net profit, for two or more consecutive years. We also eliminate firms with less than 100 staff reported. As the firms listed in China's A-share market are most influential within their industries, it is possibly erroneous to report firms with staff less than 100 persons.

We construct the key variable, labor hiring rate (*Hiring*), following Belo et al. (2014) and using the annual growth rate of a firm's staff as the proxy. It is defined as the staff number at the end of year t minus that in year t-1, divided by the mean staff numbers in these two years.

On the employment frictions, they are affected by factors such as a firm's labor force structure, employment protection (Bozkaya and Kerr, 2014), labor union influence (Chen et al., 2011), and the like. Since Chinese firms operate under the same institutional background, this paper considers a firm's ratio of high-quality employees as the firm specific proxy in the spirit of Ochoa (2013), Belo et al. (2017b), and Ghaly et al. (2017). We use the proportion of high-educated workers to capture Chinese firm's employment frictions. Employers have greater difficulty and spend more resources in selecting an employee with high education level and training him or her for important positions. Greater reliance on this type of labor incurs more labor adjustment costs.[4] The International Standard Classification of Education 2011 released by UNESCO（United Nations Educational, Scientific and Cultural Organization) classifies different education programs into eight levels. From levels six to eight (i.e., from bachelor's to doctoral degrees), participants receive theoretically-based education, are informed by best professional practice, or are devoted to original research in universities or other equivalent institutions. We regard these people as high-educated, and take the proportion of employees with bachelor's degrees and higher as the proxy for a firm's employment frictions (*HEducation*). It is defined as the number of bachelor's degrees and higher in year t divided by the mean staff numbers at the end of years t and t-1. The data is from the Wind Database which has collected the staff education-level information of most China's listed firms since 2011. We use these firms as a sub-sample to test the effect of employment frictions on the return-hiring relation.

On labor supply, this paper uses China's working age population as the measure, as in the work of Yang et al. (2017). This measure reflects a region's total labor resources in size and its demographic dividend important for the economic performance (Williamson, 1998). In China, the retirement age for males is 60. The data for the population aged 15 to 59 is separately listed in the annual Statistical Communiqué on the National Economic and Social Development by China's National Bureau of Statistics. Hence, the working age population in our paper is defined as the population between 15 and 59 years. The growth of labor supply (LS^g) is used in regressions, calculated as the working age population in year t divided by the population in year t-1, minus 1. The proxies for hiring rate and employment frictions and the interactions containing them are winsorized at 2.5% of the distribution to mitigate the outlier effect on the observed variables.

The control variables are constructed as follows. The capital expenditure of the firm (*Investment*) is defined as cash payments for fixed assets, intangible assets, and other long-term assets, divided by total book assets. The book-to-market ratio (*B/M*) is calculated as the ratio of equity book value to market value at the end of December. The profitability of a firm (*Profit*) is

[4]Related evidence is found, for instance, in the work of Dolfin (2006) that a higher educated worker is correlated with larger employment costs of search and training from the 1982 Employer Opportunity Pilot Project in the U.S. Similar evidence is also provided by Ochoa (2013).

calculated as the firm's operating income divided by equity book value. The firm size (*Size*) is measured by the firm's market value in June. The stock market performance (*Market*) is measured by the annual Hushen 300 Stock Index, one of the benchmark stock indices in China, composed of the 300 most important stocks on the Shanghai and Shenzhen Stock Exchanges.

Table 1 presents summary statistics for the variables. Hiring rate (*Hiring*) has a mean value of 0.0745 and a standard deviation of 0.2173. With the standard deviation divided by the mean value, the hiring rate has a coefficient of variation (CV) equaling 2.92. This magnitude is relatively large, suggesting a wide difference in the hiring rate of China's listed firms. The mean and median of the proportion of bachelor's degrees and higher (*HEducation*) are 0.2461 and 0.1856, respectively. It is obvious that the listed firms have a higher proportion of university graduates than the nationwide level, which indicates China's listed firms require and also attract more high-educated employees. As for China's annual growth of working age population (LS^g), it averaged 0.24% during the sample period.

[INSERT TABLE 1]

Table 2 reports the Pearson correlation between the independent variables, indicating that there is no serious multicollinearity between these variables. In the full sample, hiring rate is positively related to the firm's investment rate, size and the country's working age population growth, and negatively related to book-to-market ratio and market performance. In the sub-sample consisting of firms that disclose their staff education level, the proportion of bachelor's degrees and higher (*HEducation*) is positively related to hiring, profitability, size and market performance, and negatively related to investment, book-to-market ratio and working age population growth.

[INSERT TABLE 2]

We make a brief comparison of the hiring data and ratio of high-educated employees between China and the U.S. Since Belo et al. (2014) report the U.S. hiring data in portfolios we also list Chinese data in such a form. Table 3 shows the time-series average of Chinese and American employment data sorted on portfolios. The Chinese hiring data of portfolios 1 (Low), 2 and 5 are smaller than that of the U.S., while Chinese hiring data of portfolios 9 and 10 (High) are greater. The range between the high and low portfolios for China is 0.8 compared to 0.63 for the U.S. It implies the hiring data of Chinese firms is more dispersed in terms of range than in the U.S. One reasonable explanation is that a typical Chinese firm generally has smaller labor adjustment costs, so they reallocate labor resources more actively, especially in extremely good or poor situations. And this will be further analyzed in Section 4. On the ratio of high-educated employees, China's percentage of employed population with a bachelor's degree and higher was 8.2% in 2015. By comparison, the percentage in the U.S. was 34.13%, which was even higher than the 33.74% of China's 75th percentile listed firm. This may reflect that the two countries are at different economic development stages.

[INSERT TABLE 3]

4. Empirical Tests

This section examines the predictability of the firm's labor hiring to its future stock returns with the data of China's listed firms, providing empirical evidence for the theoretical propositions.

4.1 Cross-Section Tests and Regression Analysis

To examine the return-hiring relationship in the cross section, we construct ten portfolios sorted on the hiring rate as follows. At the end of June in year t, the universe of stocks is sorted into ten portfolios of equal size based on *Hiring*. The average equal-weighted returns in each portfolio are tracked monthly from July of year t to June of year t+1. We repeat this procedure at the end of June in every year during the research period.

Table 4 shows the mean annualized excess returns r^e over one-month of the fixed deposit rate of China's central bank[5] for portfolios 1 (L), 2, 4, 6, 8 and 10 (H). The L–H portfolio is zero net investment with a long position on the lowest decile portfolio and a short position on the highest decile portfolio. Panel A reports the results of all firms in the sample. The L–H portfolio earns a mean 4.59% of annualized excess returns, and the return spread is significantly greater than zero at the 5% level. Similar to Belo et al. (2014), we exclude all firms lying below the bottom 20th percentile of the market value distribution of all firms at the end of the year, before sorting them into portfolios. This can mitigate the possible effect of volatile price behavior by "micro" firms on the portfolio returns. Results are reported in Panel B. The L–H portfolio earns 3.59% of annualized excess returns, significantly different from zero. This confirms the theoretical prediction of the negative relation between hiring rate and stock returns in the cross-section.

[INSERT TABLE 4]

In addition to cross-section tests, we quantitatively investigate the predictability of a firm's labor hiring rate to its future stock returns. We construct the following empirical equation:

$$\begin{aligned} Return_{i,t} &= \alpha_1 Hiring_{i,t-1} + \alpha_2 Investment_{i,t-1} + \alpha_3 B/M_{i,t-1} + \alpha_4 Size_{i,t-1} \\ &+ \alpha_5 Profit_{i,t-1} + \alpha_6 Market_{t-1} + Firm_{i,t-1} + Year_{t-1} + \varepsilon_{i,t-1} \end{aligned} \quad (9)$$

The coefficients of Equation (9) are estimated by the OLS method with year- and firm-fixed effects.[6] All standard errors of estimated coefficients are robust to White heteroskedasticity and clustered by firm. Table 5 reports the estimated results of several variations of Equation (9). Column (1) is a univariate regression with fixed effects. The coefficient of *Hiring* is -0.124 and significantly negative at the 1% level. Documented in prior studies (Watanabe et al., 2013; Lin, 2016), there exists the negative return-investment relation in the stock market. Logically, the expansion of investment may cause a firm to hire more employees, which also possibly yields a negative relation between hiring and stock returns. To inspect the independence of the return-hiring relation empirically, Column (2) controls for the factor of investment. The regression result shows that the coefficient of *Hiring* is -0.1183, significantly negative at the 1% level. This implies the negative relationship between hiring and future stock returns is independent, but not caused by the return-investment relation. To test the additional explanatory power of hiring for stock returns, Column (5) includes other control variables. The coefficient of *Hiring* is -0.0802, remaining significantly negative at the 1% level. As for the estimates of another two variations of Columns (3) and (4), the coefficients of *Hiring* are also significantly

[5]The fixed deposit rate of the central bank is usually taken as the risk-free rate in China. For example, the CSMAR database uses it as the riskless rate when forming portfolios of the Fama-French five-factor model with China's stock market data. So we also take the fixed deposit rate of China's central bank as a risk-free rate.

[6] We have conducted endogeneity tests between *Hiring* and *Return* by the instrumental variable (IV) approach. Lags 1 and 2 of *Hiring* are confirmed as suitable IVs because their Cragg-Donald Wald F statistic is 90.8 and Sargan statistic 1.3 with a p-value 0.25, which means the IVs are relevant to *Hiring* but uncorrelated with the error term. The statistic of the endogeneity test is 0.89 with a p-value 0.35, showing no endogeneity between the firm's hiring rate and future realized returns in the empirical equation. Thus, we prefer the OLS approach.

negative.

The magnitude of labor hiring is economically non-trivial. We consider the overall return-hiring relation as analyzed by the theoretical analysis. Column (1) implies that an increase of 10% in a firm's hiring is associated with a decrease of 1.24% in the firm's annual returns. Compared with the mean value 22.88% of the annual stock returns during our sample period, the decrease is as large as 5.42% for this statistic. Including the control variables in Column (5), the magnitude of the decrease still reaches 3.51% of the mean of the annual returns. In sum, the Chinese evidence is consistent with Proposition 1, as well as with the Belo et al. (2014) data, which, coincidentally, was based upon the U.S. data.

[INSERT TABLE 5]

The U.S. return-hiring coefficient (-0.18) reported by Belo et al. (2014) is of relatively greater magnitude than that of China (-0.124) shown in Table 5. One plausible rationale resides in the differences of labor adjustment costs between the two countries: a typical U.S. firm has greater labor adjustment costs than a typical Chinese firm. As predicted by Proposition 2, which will be empirically tested later, a firm with greater labor adjustment costs has a steeper return-hiring relation. Hamermesh and Pfann (1996) suggest labor adjustment costs are implicit and rarely reported on a firm's accounting records. Although no direct data of these costs seems to be currently available for comparison, the rationale can be justified by the differences of some critical institutional factors between the two countries.

The first relates to the labor force structure and the proportion of high-quality employees. China's percentage of employed population with a bachelor's degree and higher was 8.2% in 2015, while the percentage in the U.S. was 34.13%, even higher than the 33.74% of China's 75th percentile listed firm. A firm's labor quality usually matches its business pattern (e.g., capital or labor-intensive). A larger ratio of high-educated employees in American firms can incur higher costs in hiring, job-orientation, training and production disruption. The second institutional factor relates to employment protection. The U.S. initiated its New Deal labor program as early as 1935 (Harper et al., 2007), and continually passed other labor laws in the following decades. For instance, the federal WARN Act was passed in 1989, and the wrongful discharge laws (WDL) were adopted in the vast majority of states. The damages for wrongful labor dismissals are very costly. Acharya et al. (2014) document that the average compensatory damages and punitive damages ranged from about US$449,000 to US$675,000, respectively in California between 1992 and 1996, and such awards were common in other states adopting the WDL.[7] Orey (2007) attributes the caution of employers to fire workers to the distraction and high costs of litigation processes, even when the firm finally wins. In China, the first Labor Law was passed in 1994, then the amended version in 2007. The new law is stricter than before, but its penalties for wrongful dismissal are less harsh than those in the U.S. As estimated by Yang (2016), the damages for a wrongfully dismissed employee working in a group company for seven years were no more than 68,632 RMB yuan (about US$11,200) in 2013. The third factor relates to labor unions. The U.S. labor union has stronger bargaining power and still exerts some influence on the industrial activities although with a sharp decline in membership numbers in recent years. Aidt and Tzannatos (2002) report that the union wage premium in the U.S. is historically about 15% above non-union based agreements. Woods et al. (2019) suggest American union members receive higher wages and benefits, such as severance pay and paid holidays, than non-union

[7] Acharya et al. (2014) quote the damage from Jung (1997) and the situation of other states from Abraham (1998).

workers. In China, the labor union has controversial bargaining performance (Wang and Lien, 2018). Sun and He (2012) show that labor unions can protect the most fundamental rights of workers (e.g., the minimum wage specified by law), but few of them strive for more benefits, including bargaining for a higher wage. Stronger employment protection and union bargaining power make dismissals more expensive, inducing greater labor adjustment costs.

In addition, the explanation of labor adjustment cost differences can be also confirmed by the hiring behavior of the two countries' firms. As shown in Table 3, Chinese firms have a larger range of employment rates between high and low hiring portfolios than the U.S. firms. This indicates that Chinese firms more easily adjust their labor force with smaller labor adjustment costs in response to favorable (or unfavorable) shocks.

Now we empirically examine the prediction of Proposition 2. We specify Equation (10) and employ the sub-sample consisting of firms with their staff education level reported. *HEducation* denotes the proportion of employees with bachelor's degrees and higher in a firm. It is the proxy for employment frictions, because a high-educated worker is more costly to recruit and replace. What we focus on is the coefficient of the interaction term between *Hiring* and *HEducation*.

$$\begin{aligned} Return_{i,t} &= \alpha_1 Hiring_{i,t-1} + \alpha_2 Hiring_{i,t-1} \times HEducation_{i,t-1} + \alpha_3 HEducation_{i,t-1} \\ &+ \alpha_4 Investment_{i,t-1} + \alpha_5 B/M_{i,t-1} + \alpha_6 Size_{i,t-1} + \alpha_7 Profit_{i,t-1} \\ &+ \alpha_8 Market_{t-1} + Firm_{i,t-1} + Year_{t-1} + \varepsilon_{i,t-1} \end{aligned} \quad (10)$$

Table 6 shows the regression results of Equation (10) and its variations. The interaction coefficient in Column (1) is -0.6587, which is significantly negative. The return-hiring relation in Equation (10) is reflected by the partial derivative $\partial Return / \partial Hiring = \alpha_1 + \alpha_2 \times HEducation$. This relation could be interpreted in the sense of the mean of *HEducation*. After the estimates of Column (1) and the mean of *HEducation* (0.2461) are substituted, the partial derivative equals -0.1278 (i.e., 0.0343-0.6587×0.2461). This implies the negative return-hiring relation holds and is non-trivial at the average level of employment frictions in this sub-sample. Further, because $\partial(\partial Return / \partial Hiring) / \partial HEducation = \alpha_2 < 0$, the negative return-hiring relation becomes steeper as the proxy *HEducation* increases. This means higher proportion of high-educated staff in a firm incurs more labor adjustment costs and this effect enlarges the negative return-hiring relation.[8] From Columns (2) to (4), other specifications are tested and their interaction coefficients vary from -0.7551 to -0.5547. Column (5) reports the results of the baseline Equation (10), in which the interaction coefficient remains significantly negative. Therefore, Proposition 2 is empirically proven by Chinese firm-level evidence. This is consistent with the U.S. industrial evidence found by Belo et al. (2017b).

[INSERT TABLE 6]

We proceed to test Proposition 3, the effect of labor supply on the stock return-hiring relation. China is a country with a large population. Its tremendous economic growth after the implementation of the "reform and opening up" policy is largely attributed to the demographic dividend (Cai and Lu, 2013). However, China's labor market has experienced a critical demographic change during our sample period. As shown in Figure 3, the working age population grew until the end of 2011, peaking at 940.7 million persons, before continuously decreasing thereafter. The shrinking of the working age population depressed the size of China's

[8]For instance, if the *HEducation* is 0.2961 (five percentage points higher than the mean value 0.2461), the return-hiring relation becomes steeper with a partial derivative result of -0.1607.

labor resources, resulting in greater difficulty for firms in recruiting workers in more recent years. Does this demographic change affect the return-hiring relation of Chinese firms? Proposition 3 predicts that a positive (negative) labor supply shock narrows (enlarges) a firm's return-hiring relation. Because the decline of the working age population after 2011 approximates a negative shock to China's labor supply, this might cause the firms to revise their labor cost policies. In this light, we conduct regressions with the data before and after 2011, respectively, to test Proposition 3.

[INSERT FIGURE 3]

The full sample is split into two sub-samples with firm accounting data for the periods 2007–2011 and 2012–2015 (accordingly, the annual stock return is from July 2008 to June 2013 and from July 2013 to June 2017). Regressions of Equation (9) are performed and the results are shown in Table 7. The coefficient of *Hiring* in the sub-sample of 2007–2011 is -0.1061 with an absolute value less than the corresponding magnitude for 2012–2015 (-0.1666 in Column (3)). Added to the control variables, the coefficient of *Hiring* in the sub-sample 2007–2011 is -0.0934. Its absolute value is also about 35% less than the magnitude for 2012–2015 (-0.1445 in Column (4)). Thus, the return-hiring relation is flatter during the period of China's working age population rise than in the subsequent period of decline, consistent with the prediction of Proposition 3.

[INSERT TABLE 7]

Alternatively, we specify the following equation to explore the effect of labor supply on the return-hiring relation. China's annual labor supply growth is denoted by LS^g. We are concerned with the coefficient of the interaction term between *Hiring* and LS^g.

$$\begin{aligned} Return_{i,t} &= \alpha_1 Hiring_{i,t-1} + \alpha_2 Hiring_{i,t-1} \times LS^g_{t-1} + \alpha_3 LS^g_{t-1} + \alpha_4 Investment_{i,t-1} \\ &+ \alpha_5 B/M_{i,t-1} + \alpha_6 Size_{i,t-1} + \alpha_7 Profit_{i,t-1} + \alpha_8 Market_{t-1} \\ &+ Firm_{i,t-1} + Year_{t-1} + \varepsilon_{i,t-1} \end{aligned} \quad . \tag{11}$$

Table 8 reports the regression results of Equation (11) and its variations. Column (1) shows the coefficient of the interaction term is significantly positive at the 1% level, while the coefficient of *Hiring* is significantly negative. This implies the magnitude of the return-hiring relation becomes smaller (i.e., the relation is flatter) when there is a greater labor supply growth. With some control variables in Columns (2)–(4), the interaction coefficients remain significantly positive. As shown in Column (5), the interaction coefficient of the baseline regression is also significantly positive at the 1% level. The results in Table 8 are consistent with Proposition 3.

[INSERT TABLE 8]

4.2 Asset Pricing Tests

The previous subsection examines the return-hiring relation by sorting and regression approaches. We proceed to further explore this relation using risk factors in the unconditional CAPM and Fama-French (2015) five-factor model. This investigation is vital. It reveals whether the negative return-hiring relation has a risk-based interpretation, which would verify the rationality hypothesis of the optimization method in Section 2.

To conduct the CAPM analysis, we run the time-series regressions of the portfolio excess returns of all firms on a constant basis and the excess returns of the market portfolio. Results are displayed in Panel B of Table 9. The market beta (b) of portfolio L is significantly larger than the measure for portfolio H. This shows that the firms with a lower labor hiring rate have higher systematic risks when tested by the one-factor model. However, the pricing error (abnormal return α) in portfolio L–H is significantly greater than zero, which implies that the CAPM fails to explain the return spread between the portfolios of lowest and highest hiring rates.

As a result, we switch to adopt the Fama-French five-factor model and extend the CAPM regressions with the size (SMB), value (HML), profitability (RMW) and investment (CMA), factors. The factor data is quoted from the CSMAR database. The database forms the factor portfolios with Chinese data, shown in the most common way of a 2×3 matrix, as does Kenneth French when he processes and shares the U.S. factor data on his web page. As shown in Panel C of Table 9, no pricing errors (α) are significantly different from zero from the portfolio 1 (L) to portfolio 10 (H). This means the excess returns in each portfolio are well captured by the five factors. In the portfolio L–H, the pricing error is also insignificantly different from zero at the 10% level. Moreover, the coefficients of determination (R^2) in portfolios 1 to 10 are close to or larger than 97%. Comparing these with the corresponding R^2 in the CAPM, the five-factor model shows extraordinary explanatory power of the portfolio excess returns sorted on the labor hiring rate. Overall, the Fama-French five-factor model confirms the rational basis of the negative return-hiring relation, and the optimization method in the theoretical section is applicable.

[INSERT TABLE 9]

5. Robustness Check

We conduct a series of checks to test the robustness of our findings. We do not winsorize any variable, and perform the regressions of Equations (9) and (11). The coefficient of *Hiring* in Equation (9) is -0.0446 with its *p*-value 0.006 and the interaction coefficient in Equation (11) is 0.0431 with the *p*-value 0.008. We also winsorize the interaction term of Equation (10) at 1% of the distribution, but no other variables are so treated. The newly estimated coefficient of the interaction is -0.4358 with a *p*-value 0.04[illegible], remaining significantly negative at the 5% level. This shows that our findings are robust in terms of data processing.

Then we check the empirical robustness of the key variable setting. We adjust the calculation of *Hiring* and *HEducation* by setting their denominators as the actual staff number at the end of year t-1, instead of the mean numbers of years t and t-1 as specified before. Also, we substitute the population aged 15–64 as the proxy for China's working age population. The unreported results are qualitatively unchanged, implying that our findings are robust to the settings of the key variables.

We also use alternative measures to check the robustness of the employment frictions and labor supply effects on the return-hiring relation. According to Dube (2010), the wage information can partly reflect the level of labor adjustment costs. We scale the proportion of high-educated workers by the firm's annual average wage[9] ($HEducation^{adj}$) similar to Ghaly et al. (2017). In addition, we use a firm's proportion of high-skill workers as another proxy of employment frictions. Besides the education-level information, the Wind Database collects the information of the staff specialty formation classified into 11 categories. They include technicians, finance personnel, human resource personnel, administrative personnel, executives, risk controlling and internal auditing personnel, production workers, salespersons, customer service staff, purchasing and warehouse staff, and the residual category of all other positions. We

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[9]The adjusted proxy is defined as: (the percentage of workers with bachelor degrees and higher in a firm)×log (wage).

conjecture that the employees in the first six categories are high-skill workers, since their positions generally require more professional skills compared to the last five categories.[10] So we take the proportion of these employees as the proxy for employment frictions (*HSkill*). The regression results of Equation (10) and their variations with these alternative proxies are reported in Table 10. The proxies for $HEducation^{adj}$ and *HSkill* are denoted by *X* in Columns (1) and (2) and Columns (3) and (4), respectively. The economic meaning of the new estimates is similar to that in Section 4. For instance, in Column (1), the mean of $HEducation^{adj}$ is 2.7635, so the return-hiring relation is -0.1329 (i.e., 0.0301-0.059×2.7635) in the sense of the mean of $HEducation^{adj}$. That is close to -0.1278 calculated from Column (1) of Table 6. What we focus on are the interaction term coefficients. They are all significantly negative, which is consistent with those in Section 4.

[INSERT TABLE 10]

In terms of the labor supply, we use some other proxies. Employment is frequently used to reflect labor supply, such as in the works of Yang et al. (2013) and Disney and Gathergood (2018). In the spirit of the previous studies, we use China's population in employment as the proxy. It measures the number of job-holders in the aggregate labor supply. With China's relatively fast growing economy during the sample period, the change in its employed population basically reflects the trend of labor supply. Second, China's urbanization progressed rapidly in the past two decades, and the ratio of the urban population to the total population has been more than 50% from 2011. Hence, we adopt the urban population in employment as a substitute proxy for labor supply. Third, we use the country's labor force participation rate as another indicator. It reflects the willingness of people to take part in work and is positively related to the change of labor supply (Borjas, 2016). The growth rate of China's nationwide employed population spiked at 0.41% in 2011, then declined to 0.26% in 2015, while the firms' recruitment remained active during this period (Yu and Tian, 2018). In other words, the number of new job-takers generally decreased after 2011, as fewer available labor resources could convert into actual employment as the working age population contracted. Similarly, the urban employed population growth rate spiked in 2010, and the labor force participation rate also had a kink in 2010. Together with the transition of the working age population, all these signs verified the trend of China's labor supply, that it experienced a negative shock and substantively changed around 2011. To check the robustness of the sample-split results, we also split the sample in 2010 to perform the regressions of Equation (9). The unreported results are qualitatively the same. In addition, we perform the regressions of Equation (11) and variations with these alternative proxies. The results are shown in Table 11. The symbol *X* denotes the growth of the employed population across the country ($Employed^{g}$) in Columns (1) and (2), from cities and towns ($CTEmployed^{g}$) in Columns (3) and (4), and labor force participation rate (*LFPR*) in Columns (5) and (6). Although these variables are proxies for the labor supply from different aspects, the economic meaning of relevant estimates is similar to that in Table 8. For example, the return-hiring relation, when the labor supply impact is considered, is -0.0974 (i.e., -11.6341+16.2626×0.7094) in Column (5) with the mean 0.7094 of *LFPR*. It is close to -0.0933 calculated from Column (1) of Table 8. As above, we are concerned with the signs of the interaction term, which are all significantly positive, confirming the labor supply effect on stock returns.

[10]We also only take the percentage of technicians, finance and administrative personnel, and executives as the proxy, and multiply the percentage of these high-skill employees by the average wage of the firm. The results remain unchanged.

[INSERT TABLE 11]

6. Conclusion

Labor is a crucial factor of production. This paper shows that the incremental labor of a Chinese firm also has important implications for its asset prices. The economic model reveals that labor hiring is negatively related to the expected stock returns from the discount rate channel. Besides, the negative relation is steeper if the firm has higher employment frictions and flatter when a positive labor supply shock occurs. The logic is that a firm's hiring decisions reflect the trade-off between the marginal cost of recruiting a worker at present and the discounted net benefit in the future. All else being equal, optimal labor hiring decreases at the discount rate, namely, the expected stock return. Additionally, as employment frictions increase, hiring is less elastic to the discount rate. In contrast, a positive labor supply shock reduces the firm's labor expenses and search costs, making its hiring decisions more sensitive to the discount rate. Thus, a given change in the hiring rate is associated with a greater magnitude change of the discount rate for the firm with higher employment frictions, while a smaller magnitude change of the discount rate when there is a positive labor supply shock.

Empirical results confirm the theoretical predictions, showing that a 10% increase in a Chinese firm's hiring is related to a 1.24% decrease in its annual stock returns. The negative return-hiring relation is greater for Chinese firms with more employees having the degrees of bachelor and higher (the proxy for employment frictions), and is smaller if the growth of China's working age population is higher. These results are confirmed by a series of robustness checks. In addition, the magnitude of the linkage between U.S. hiring and stock returns is larger than that of China. We suggest that the reason lies in the differences in labor adjustment costs between the two countries. The Fama-French five-factor model well captures the returns of the hiring spread portfolio, providing a rationality based interpretation for the optimal employment model. Our findings imply that the importance of a Chinese firm's labor hiring should be underlined when its asset prices are inspected.

References

Abraham, S., 1998. Can a wrongful discharge statute really benefit employers[J]? Ind. Relat., 37 (4), 499–518.

Acharya, V.V., Baghai, R.P., Subramanian, K.V., 2014. Wrongful discharge laws and innovation[J]. Rev. Financ. Stud., 27 (1), 301–346.

Addessi, W., Busato, F., 2009. Fair wages, labor relations and asset returns[J], J. Financ. Stability. 5, 410–430.

Aidt, T., Tzannatos, Z., 2002. Unions and collective bargaining: Economic effects in a global environment. The International Bank for Reconstruction and Development, Washington, DC.Weltbank.

Borjas, G.J., 2016. Labor Economics, 7th Edition [M]. The McGraw-Hill Companies, New York.

Bozkaya, A., Kerr, W.L., 2014. Labor regulations and European venture capital[J]. J. Econ. Manage. Strat. 23 (4), 776–810.

Belo, F., Lin, X., Bazdresch, S., 2014. Labor hiring, investment, and stock return predictability in the cross section[J]. J. Polit. Econ. 122 (1), 129–177.

Belo, F., Donangelo, A., Lin, X., Luo, D., 2017a. Labor Hiring and Discount Rates. Working Paper.

Belo, F., Lin, X., Li, J., Zhao, X. F., 2017b. Labor-force heterogeneity and asset prices: The importance of skilled labor[J]. Rev. Financ. Stud. 30 (10), 3669–3709.

Bradshaw, M., Liao, G., Ma, M., 2019. Agency costs and tax planning when the government is a major shareholder. J. Account. Econ. Forthcoming.

Cai, F., Lu, Y., 2013. Population change and resulting slowdown in potential GDP growth in China[J]. China. World. Econ. 21 (2), 1–14.

Chen, H., Kacperczyk, M., Ortiz-Molina, H., 2011. Labor unions, operating flexibility, and the cost of equity[J]. J. Financ. Quant. Anal. 46 (1), 25–58.

Chen, H., Kacperczyk, M., Ortiz-Molina, H.,2012. Do nonfinancial stakeholders affect the pricing of risky debt? Evidence from unionized workers[J], Rev. Finance. 16, 347-383

Cochrane, J. H., 1991. Production-based asset pricing and the link between stock returns and economic fluctuations[J]. J. Financ. 46 (1), 209–237.

Cooper, R., Willis, J. L., 2004. A comment on the economics of labor adjustment: Mind the gap[J]. Am. Econ. Rev. 94 (4), 1223–1237.

Danthine, J., Donaldson, J.B., 2002. Labor relations and asset returns[J], Rev. Econ. Stud. 69, 41–64.

Disney, R., Gathergood, J., 2018. House prices, wealth effects and labour supply[J], Economica. 85, 449–498.

Donangelo, A., 2014. Labor mobility: Implications for asset pricing[J]. J. Financ.69(3), 1321–1346.

Donangelo, A., Gourio, F., Kehrig, M., Palacios, M., 2019. The cross-section of labor leverage and equity returns[J]. J. Financ. Econ.132 (2), 497-518.

Dolfin, S., 2006. An examination of firms' employment costs[J]. Appl. Econ. 38, 861-878.

Dube, A., Freeman, E., Reich, M., 2010. Employee Replacement Costs. Working Paper, Institute for Research on Labor and Employment, University of California, Berkeley.

Fama, E.F., French, K.R., 2015. A five-factor asset pricing model[J]. J. Financ. Econ. 116(1), 1–22.

Favilukis, J., Lin, X., 2016a. Does wage rigidity make firms riskier? Evidence from long–horizon return predictability[J]. J. Monetary. Econ. 78, 80–95.

Favilukis, J., Lin, X., 2016b. Wage rigidity: A quantitative solution to several asset pricing puzzles[J]. Rev. Financ. Stud., 29 (1), 1–45.

Ghaly, M., Dang, V.A., Stathopoulos, K., 2017. Cash holdings and labor heterogeneity: the role of skilled labor[J]. Rev. Financ. Stud., 30 (10), 3636–3668.

Giannetti, M., Liao, G., Yu, X., 2015. The brain gain of corporate boards: Evidence from China. J. Financ., 70(4), 1629-1682.

Hamermesh, D.S., Pfann, G.A., 1996. Adjustment costs in factor demand[J]. J. Econ. Lit., 34 (3), 1264–1292.

Harper, M.C., Estreicher, S., Flynn, J., 2007. Labor Law: Cases, Materials, and Problems, 6th Edition[M]. ASPEN Publishers, New York.

Jermann, U. J., 1998. Asset pricing in production economies[J]. J. Monetary. Econ., 41 (2), 257–275.

Jung, D., 1997. Jury verdicts in wrongful termination cases[R]. Public Law Research Institute Report, University of California Hastings College of the Law.

Li, D., Zhang, L., 2010. Does q-theory with investment frictions explain anomalies in the cross section of returns[J]? J. Financ. Econ., 98 (2), 297–314.

Lin, Q., 2016. Market efficiency and asset growth anomaly: An empirical investigation between optimal investment effect hypothesis and mispricing hypothesis [J]. China. Econ. Quart. 15 (2), 767–796(in Chinese).

Ochoa, M., 2013.Volatility, labor heterogeneity and asset prices. Working Paper, Federal Reserve Board, Washington.

Orey, M., 2007. Fear of firing[J]. Business Week. 4031, 52-62.

Papanikolaou, D., 2011. Investment shocks and asset prices[J]. J. Polit. Econ. 119 (4), 639–685.

Romer, D., 2012. Advanced Macroeconomics, 4th Edition [M]. McGraw-Hill Companies, New York.

Ross, S.A., Westerfield, R.W., Jaffe J.F., 2010. Coporate Finance, 9th Edition [M]. The McGraw-Hill Companies, New York.

Sun, Z., He, X., 2012. Union and protection for labor rights of migrant workers: Is the union a scarecrow[J]? Manag. World. (12), 46-60 (in Chinese).

Wang, W., Lien, D., 2018. Union membership, union coverage and wage dispersion of rural migrants: Evidence from Suzhou industrial sector [J]. China. Econ. Rev. 49, 96–113.

Watanabe, A., Xu, Y., Yao, T., Yu, T., 2013. The asset growth effect: Insights from international equity markets[J]. J. Financ. Econ.108(2), 529–563.

Williamson, J.G., 1998. Growth, distribution and demography: some lessons from history [J]. Explor. Econ. Hist. 35, 241–271.

Woods, K., Tan, K.J.K., Faff, R., 2019. Labor unions and corporate financial leverage: The bargaining device versus crowding-out hypotheses[J]. J. Financ. Intermed. 37, 28–44.

Wu, X., Tian, G., Li, Y., Zhou, Q., 2019. On the pricing of the persistence of earnings components in China[J]. Pac-Basin.Financ. J. 53, 112–132.

Yang, H., 2016. On the shortcomings and improvement of Chinese protection system against termination: From a perspective of comparative study of China-US protection systems against termination[J]. J. Shanghai U. Financ. Econ.18 (1), 97–108 (in Chinese).

Yang, J., Beirne, J., Liu, G., Sheng, P., 2013. Labour supply and pollution in China [J]. Appl. Econ. Lett. 20 (10), 949–952.

Yang, L., G, S., Han, F., 2017. The effects of labor supply changes on structural optimization of manufacturing industry[J]. Financ.Econ. J. 43 (2), 122–134 (in Chinese).

Yu, X., Tian, Y., 2018. Analysis report on China human resource market[R]. Social Sciences Academic Press, Beijing (in Chinese).

Zhang, L., 2005. The value premium [J]. J. Financ. 60 (1), 67–103.

Appendix A

In this Appendix, we specify the objective function of the model in Section 2 with its constraints, and solve it by Lagrange's method.

The optimization problem is:

$$\max_{(h_{i,t})} \sum_{t=1}^{\infty} \frac{1}{(1+r_i)^t} [S_{i,t}(h_{i,t}) - L_{i,t}(h_{i,t}) - (1+r_i) LAC_{i,t}(h_{i,t})]$$

$$\text{s.t. } S_{i,t} = \pi_i m_{i,t}$$

$$L_{i,t} = \eta L_{i,t-1} + (1-\eta)\alpha\pi_i (m_{i,t-1} + h_{i,t}) \tag{A1}$$

$$LAC_{i,t} = \frac{\lambda}{2}\left(\frac{h_{i,t}}{m_{i,t-1}}\right)^2 m_{i,t-1}$$

$$m_{i,t} = m_{i,t-1} + h_{i,t}.$$

The objective function maximizes firm *i*'s total value at the beginning of date t. The constraints are the equations of sales, labor costs, labor adjustment costs and labor accumulation. All the denotation is the same as in the main text.

After we substitute the equations of sales and labor adjustment costs into the objective function, Equation (A1) can be equivalently expressed as:

$$\max_{(h_{i,t})} \sum_{t=1}^{\infty} \frac{1}{(1+r_i)^t} [\pi_i m_{i,t} - L_{i,t}(h_{i,t}) - (1+r_i)\frac{\lambda}{2}\left(\frac{h_{i,t}}{m_{i,t-1}}\right)^2 m_{i,t-1}]$$

$$\text{s.t. } m_{i,t} = m_{i,t-1} + h_{i,t} \tag{A2}$$

$$L_{i,t} = \eta L_{i,t-1} + (1-\eta)\alpha\pi_i (m_{i,t-1} + h_{i,t}).$$

To solve Equation (A2), we construct the following Lagrange function:

$$\begin{aligned} L = & \sum_{t=1}^{\infty} \frac{1}{(1+r_i)^t} [\pi_i m_{i,t} - L_{i,t}(h_{i,t}) - (1+r_i)\frac{\lambda}{2}\left(\frac{h_{i,t}}{m_{i,t-1}}\right)^2 m_{i,t-1}] \\ & - \theta_{i,t}(m_{i,t} - m_{i,t-1} - h_{i,t}) - \gamma_{i,t}[L_{i,t} - \eta_{i,t} L_{i,t-1} - (1-\eta_{i,t})\alpha\pi_i m_{i,t}] \end{aligned} \tag{A3}$$

where $\theta_{i,t}$ and $\gamma_{i,t}$ are the Lagrange multipliers. Set the first-order derivative of Equation (A3) with respect to $h_{i,t}$, $m_{i,t}$ and $L_{i,t}$ to zero, respectively, yielding:

$$\frac{1}{(1+r_i)^{t-1}} \times [-\lambda(1+r_i)\left(\frac{h_{i,t}}{m_{i,t-1}}\right)] + \theta_{i,t} = 0 \tag{A4}$$

$$\frac{1}{(1+r_i)^t}\pi_i - \theta_{i,t} + \gamma_{i,t}(1-\eta_{i,t})\alpha\pi_i = 0 \tag{A5}$$

$$-\frac{1}{(1+r_i)^t}-\gamma_{i,t}=0\,. \tag{A6}$$

Solving these three equations, we obtain the optimal hiring ratio:

$$\frac{h_{i,t}^*}{m_{i,t-1}}=\frac{\pi_i[1-(1-\eta)\alpha]}{\lambda(1+r_i)}\,. \tag{A7}$$

Appendix B

The Sources of Data for Demography and Labor Markets

Country	Data	Source
China	Total population Urban population Employed population Labor force participation rate	CEIC Data (https://www.ceicdata.com/en/country/china)
	Mean weekly working hours per employed person Percentage of employed population with a bachelor degree and higher	China Labor Statistical Yearbook 2016 (http://www.mohrss.gov.cn/SYrlzyhshbzb/zwgk/szrs/tjsj/201803/t20180302_289122.html)
	Working age population	The Annual Statistical Communiqué on the National Economic and Social Development (http://www.stats.gov.cn/tjsj/tjgb/ndtjgb/)
U.S.	Employed population Employed population with a bachelor degree and higher Mean weekly working hours per employed person Labor force participation rate Working age population	The U.S. Bureau of Labor Statistics (https://www.bls.gov/cps/cps_aa2015.htm#charemp)

Note: This appendix documents the sources of data for demography and labor markets in China and the U.S. in this paper.

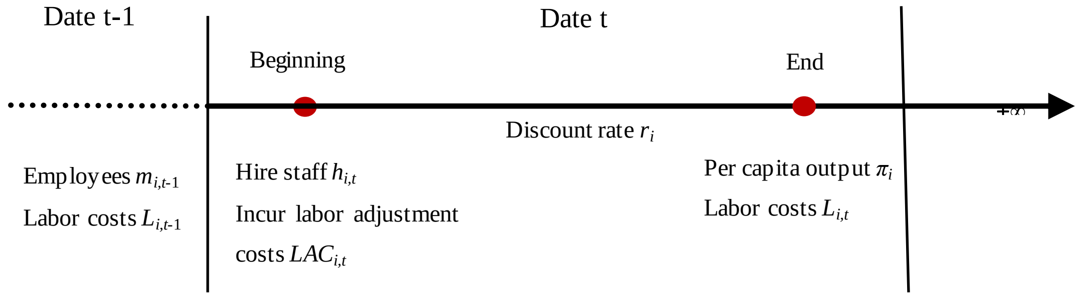

Figure 1. The Sequence of the Firm's Actions in the Model

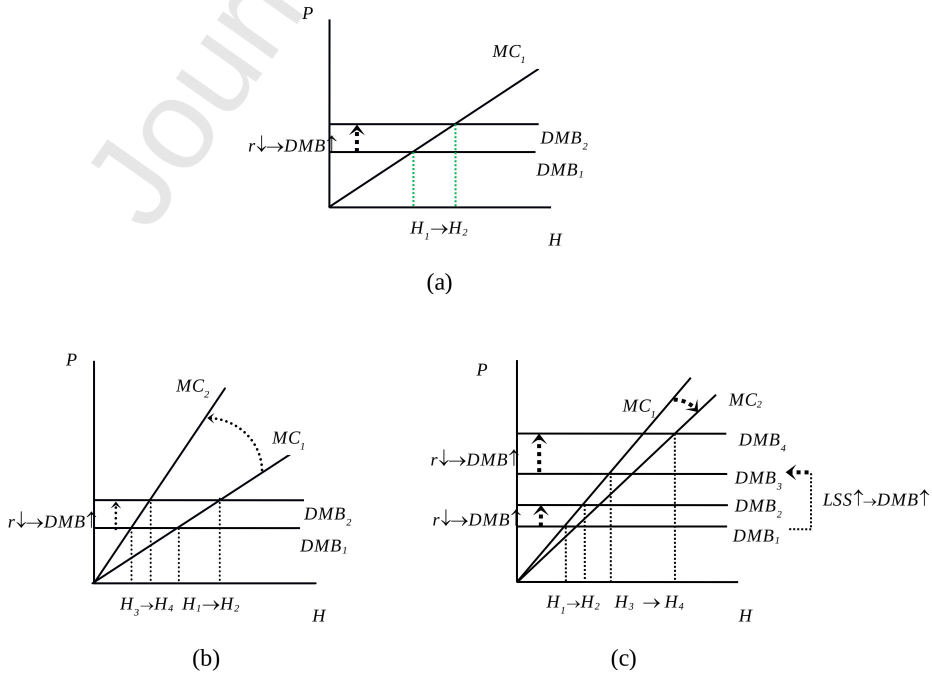

Figure 2. Expected Return-Hiring Relation and Effects of Employment Frictions

and Labor Supply

Note: This figure shows the economic logic of the expected return-hiring relation (a) and the effects of employment frictions (b) and labor supply (c) on this relation. *H* represents the firm's hiring rate, *P* represents the firm's costs (or benefits), *r* means the discount rate (expected return), and *LSS* denotes the labor supply shock. The lines of *DMB* represent the firm's discounted marginal benefit, and the lines of *MC* refer to the marginal labor adjustment cost. In the equation form, *DMB* equals $[\pi_i - (1-\eta)\alpha\pi_i]/(1+r_i)$, and *MC* equals $\lambda(h_{i,t}/m_{i,t-1})$, in which $(h_{i,t}/m_{i,t-1})$ is the hiring rate denoted as *H* in the figure.

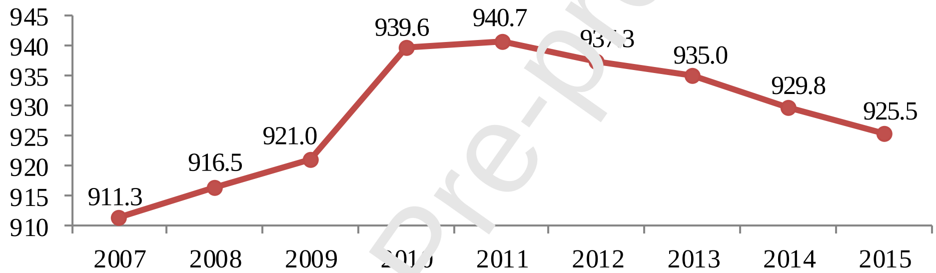

Figure 3. China's Working Age Population from 2007 to 2015

Note: The measurement unit of population in this figure is million persons. The data is from China's National Bureau of Statistics.

Table 1 Summary Statistics

Statistics	Mean	Median	St. Dev.	25th Pct	75th Pct
Hiring	0.0745	0.0303	0.2173	-0.0355	0.1431
HEducation	0.2461	0.1856	0.1963	0.1023	0.3374
LS^g	0.0024	0.0012	0.0081	-0.0037	0.0057
Investment	0.0587	0.0427	0.0564	0.0182	0.0817
B/M	0.3987	0.3304	0.2826	0.205	0.5132
Size	1.0753	0.4781	4.5155	0.2587	0.9541
Profit	0.0637	0.0771	1.6644	0.0271	0.1331
Market	0.3696	0.0241	0.8770	-0.0409	0.5689
Return	0.2288	0.0338	0.7062	-0.2177	0.4389

Note: This table reports descriptive statistics for the variables used in the empirical tests. The accounting data is collected from the Wind Database, the stock-return data from CSMAR, and the working age population data from China's National Bureau of Statistics. The key independent variable is *Hiring*, denoting a firm's labor hiring calculated as the staff number in year t minus that in year t-1, divided by the mean staff numbers in these two years. The unit of the firm size is ten billion RMB yuan.

Table 2 Correlation Matrix

	Hiring	*HEducation*	LS^g	*Investment*	*Profit*	*B/M*	*Size*	*Market*
Hiring	1							
HEducation	0.2069***	1						
LS^g	0.0238***	-0.0655***	1					
Investment	0.1269***	-0.1290***	0.0750***	1				
Profit	0.0076	0.0437***	0.0136*	0.0169**	1			
B/M	-0.0674***	-0.1105***	-0.0873***	0.0182**	0.0016	1		
Size	0.0195**	0.0587***	-0.0239***	0.0461***	0.0128*	0.0461***	1	
Market	-0.0196**	0.0565***	0.0361***	-0.0287***	-0.0048	-0.2981***	0.0118	1

Note: This table presents the Pearson correlation coefficients between the independent variables in the regressions. All variables are defined in the text. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 3 Hiring of the U.S. and China in Portfolios

	Low	2	5	9	High	High–Low
U.S.	-0.19	-0.06	0.03	0.21	0.44	0.63
China	-0.24	-0.08	0.02	0.25	0.56	0.80

Note: This table shows the time-series average of the *Hiring* variable of the U.S. and China. The hiring data is sorted into 10 portfolios. The data of portfolios 1 (Low), 2, 5, 9, 10 (High) and the range between high and low portfolios (High–Low) are reported here. The U.S. data is quoted from Table 2 of Belo et al. (2014).

Table 4 Cross-Section Tests of Excess Returns

	L	2	4	6	8	H	L－H
Panel A: Excess Returns of All Firms							
r^e	0.2516*	0.2410*	0.2154*	0.2064	0.2175*	0.2057	0.0459**
(se)	(0.1353)	(0.1306)	(0.1276)	(0.125)	(0.1271)	(0.1272)	(0.0227)
Panel B: Excess Returns of All Firms, but excluding Micro Firms							
r^e	0.2364*	0.2175*	0.2077	0.2018	0.2130*	0.2005	0.0359*
(se)	(0.1322)	(0.1296)	(0.1273)	(0.1239)	(0.1264)	(0.1269)	(0.0203)

Note: This table presents the cross-section tests of excess stock returns. Panel A shows the mean equal-weighted annualized excess returns (r^e) of portfolios 1 (L), 2, 4, 6, 8, 10 (H) and labor hiring spread (L–H) of all firms in the sample. Panel B shows the results of the firms above the bottom 20th percentile of the market value distribution of all firms. The standard errors (*se*) are reported in parentheses and of Newy-West heteroscedasticity and autocorrelated consistency.

Table 5 Regressions of Stock Returns on Hiring

	(1)	(2)	(3)	(4)	(5)
Hiring	-0.1240***	-0.1183***	-0.1143***	-0.0914***	-0.0802***
	(0.0233)	(0.0234)	(0.0231)	(0.0237)	(0.0229)
Investment		-0.3237***			-0.2297**
		(0.1122)			(0.1086)
B/M			0.4867***	0.4420***	0.5617***
			(0.0415)	(0.0438)	(0.0469)
Size				-0.039*	-0.0325*
				(0.0213)	(0.0185)
Profit					0.0001
					(0.0019)
Market					0.2817***
					(0.0077)
Firm & Year Eff.	Yes	Yes	Yes	Yes	Yes
Obs	15571	15571	15571	15289	15289
R^2(%)	59.24	59.26	60.13	60.88	63.52

Note: This table presents the regression results of several variations of Eq. (9) using the OLS method with year- and firm-fixed effects. These regressions examine the relation between a firm's labor hiring and its expected stock returns. All coefficients are estimated with standard errors robust to White heteroskedasticity and clustered by firm. The standard errors are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 6 The Effect of Employment Frictions on Return-Hiring Relation

	(1)	(2)	(3)	(4)	(5)
Hiring	0.0343		0.0392	0.0359	0.0692
	(0.0803)		(0.0807)	(0.0769)	(0.0770)
Hiring×HEducation	-0.6587**	-0.5547***	-0.6675**	-0.7551**	-0.6886**
	(0.3198)	(0.1558)	(0.3203)	(0.3119)	(0.3124)
HEducation	-0.1107	-0.1208	-0.1131	0.2120	-0.0486
	(0.1251)	(0.1199)	(0.1253)	(0.1331)	(0.1343)
Investment			-0.1660		0.0068
			(0.1870)		(0.1998)
B/M				0.8818***	1.0740***
				(0.0729)	(0.0816)
Size				-0.0427**	-0.0484**
				(0.0170)	(0.0195)
Profit					-0.0131
					(0.0243)
Market					0.4735***
					(0.0475)
Firm & Year Eff.	Yes	Yes	Yes	Yes	Yes
Obs	9436	9436	9436	9183	9183
R^2 (%)	67.33	67.33	67.33	70.34	70.83

Note: This table presents the OLS estimates of several variations of Eq. (10). *HEducation* is the proxy for labor adjustment costs, defined as the ratio of bachelor degrees and higher, to the mean staff numbers in the firm in years t and t-1. All coefficients are estimated with standard errors robust to White heteroskedasticity and clustered by firm. The standard errors are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 7 Regressions of Stock Returns on Hiring in Different Periods

	(1) 2007-2011	(2) 2007-2011	(3) 2012-2015	(4) 2012-2015
Hiring	-0.1061***	-0.0934***	-0.1666***	-0.1445***
	(0.0318)	(0.0315)	(0.0443)	(0.0416)
Controls	No	Yes	No	Yes
Firm & Year Eff.	Yes	Yes	Yes	Yes
Obs	6991	6975	858[illegible]	8314
R^2(%)	48.85	50.11	6[illegible]0	73.34

Note: This table presents the regression results of Eq. (9) and its variation with the sub-samples of firm accounting data from 2007 to 2011 and from 2012 to 2015. All coefficients are estimated with standard errors robust to White heteroskedasticity and clustered by firm. The standard errors are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 8 The Effect of Labor Supply on Return-Hiring Relation

	(1)	(2)	(3)	(4)	(5)
Hiring	-0.1159***	-0.10[illegible]3***	-0.1025***	-0.0839***	-0.0806***
	(0.0230)	(0.0228)	(0.0225)	(0.0229)	(0.0229)
Hiring×LS^g	0.0941***	0.0982***	0.1396***	0.1013***	0.1017***
	(0.0352)	(0.0351)	(0.0349)	(0.035)	(0.0351)
LS^g	-0.4047**	-0.4069***	-0.4565***	-0.4437***	-0.2370***
	(0.0114)	(0.0114)	(0.0112)	(0.0130)	(0.0885)
Investment		-0.4291***			-0.2363**
		(0.1085)			(0.1084)
B/M			0.6224***	0.5834***	0.5734***
			(0.0440)	(0.0466)	(0.0475)
Size				-0.0298*	-0.0308*
				(0.0173)	(0.0182)
Profit					0.0002
					(0.0019)
Market					0.1348***
					(0.0533)
Firm & Year Eff.	Yes	Yes	Yes	Yes	Yes
Obs	15571	15571	15571	15289	15289
R^2	61.47	61.52	62.90	63.52	63.55

Note: This table presents the OLS estimates of several variations of Eq. (11). LS^g represents China's annual labor supply growth with the proxy of the working age population growth. Because the magnitude of LS^g is minimal, we use the percentage point as its measurement unit in regressions. All coefficients are estimated with standard errors robust to White heteroskedasticity and clustered by firm. The standard errors are reported in parentheses. *** , ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 9 Asset Pricing Tests

	L	2	4	6	8	H	L－H
				Panel A: Excess Returns of All Firms			
r^e	0.2516*	0.2410*	0.2154*	0.2064	0.2175*	0.2057	0.0459**
(se)	(0.1353)	(0.1306)	(0.1276)	(0.125)	(0.1271)	(0.1272)	(0.0227)
				Panel B: CAPM			
α	0.1751***	0.1671***	0.1415***	0.1334***	0.1451***	0.1328**	0.0423*
(se)	(0.0579)	(0.0532)	(0.0487)	(0.0483)	(0.0535)	(0.0527)	(0.0214)
b	14.4845***	13.996***	13.990***	13.8349***	13.7097***	13.8157***	0.6688**
(se)	(1.0716)	(1.0874)	(0.9693)	(0.9562)	(1.0254)	(1.0380)	(0.3260)
R^2 (%)	80.29	80.49	82.65	81.80	79.00	79.57	4.55
				Panel C: Fama-French Five-Factor Model			
α	0.0272	0.0190	0.0168	-0.0030	0.0035	-0.0046	0.0318
(se)	(0.0179)	(0.0239)	(0.0211)	(0.0215)	(0.0201)	(0.0251)	(0.021)
b	12.5095***	12.1590***	12.1569***	12.152***	12.[illegible]212***	12.3387***	0.1708
(se)	(0.3018)	(0.3928)	(0.3487)	(0.2940)	(0.2441)	(0.3545)	(0.3017)
s	8.3552***	8.4305***	6.4278***	8.1574***	9.240***	9.9134***	-1.5582
(se)	(0.6796)	(1.0783)	(1.1161)	(1.0592)	(0.9054)	(1.081)	(0.9705)
h	-1.818*	-0.7932	-1.7459	-0.8549	-1.5179	0.1037	-1.9217**
(se)	(1.0536)	(1.3201)	(1.3827)	(1.13[illegible]0)	(1.1914)	(1.4004)	(0.8918)
r	-2.9933**	-2.4882	-4.0068**	-2.2126	-1.2313	-1.3688	-1.6245
(se)	(1.4529)	(1.512)	(1.91[illegible]4)	(1.4915)	(1.3704)	(1.7466)	(1.5531)
c	3.1418**	4.101***	2.5767	2.3458	0.9564	-2.3377	5.4794***
(se)	(1.3738)	(1.5538)	(2.17[illegible])	(1.7611)	(1.3280)	(2.1638)	(1.6519)
R^2 (%)	97.97	97.43	96.[illegible]	97.55	97.63	96.86	34.14

Note: This table presents the estimates of asset pricing tests on the portfolio excess returns for all firms with the CAPM and Fama-French five-factor model. Panel A shows the mean excess returns as reported in Table 4. Time-series regressions of the portfolio excess returns are run with CAPM in Panel B and with the Fama-French five-factor model in Panel C. The symbols *b*, *s*, *h*, *r*, *c*, are market portfolios, SMB, HML, RMW and CMA betas, respectively; α stands for the pricing error. The standard errors (*se*) are reported in parentheses and of Newy-West heteroscedasticity and autocorrelated consistency.

Table 10 The Effect of Employment Frictions with Alternative Measures

	(1)	(2)	(3)	(4)
Hiring	0.0301	0.0688	0.0715	0.0884
	(0.0804)	(0.0772)	(0.1059)	(0.1022)
Hiring×X	-0.0590**	-0.0629**	-0.5256**	-0.4701*
	(0.0289)	(0.0283)	(0.2609)	(0.2534)
X	-0.0094	-0.0037	-0.0084	-0.0339
	(0.0107)	(0.0116)	(0.0895)	(0.0924)
Investment		0.0054		0.0062
		(0.2007)		(0.2036)
B/M		1.0741***		1.0881***
		(0.0816)		(0.0835)
Size		-0.0484**		-0.0487**
		(0.0195)		(0.0197)
Profit		-0.0131		-0.0101
		(0.0243)		(0.0220)
Market		0.4733***		0.4733***
		(0.0477)		(0.0488)
Firm & Year Eff.	Yes	Yes	Yes	Yes
Obs	9434	9181	9294	9043
R^2 (%)	67.33	70.83	67.50	71.00

Note: This table presents the OLS estimates of Eq. (10) and their variations with different proxies. *X* denotes the $HEducation^{adj}$ in Columns (1) and (2), and *HSkill* in Columns (3) and (4). $HEducation^{adj}$ represents the proportion of workers with high education in a firm multiplied by the natural logarithm of the firm's annual average wage. *HSkill* indicates the firm's proportion of high-skill workers. Both $HEducation^{adj}$ and *HSkill* are the proxies for labor adjustment costs. The regressions use the sub-sample of the firms with information of staff education level and specialty collected by the Wind Database from 2011. All coefficients are estimated with standard errors robust to White heteroskedasticity and clustered by firm. The standard errors are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 11 The Effect of Labor Supply with Alternative Proxies

	(1)	(2)	(3)	(4)	(5)	(6)
Hiring	-0.9560***	-0.8655***	-0.9572***	-0.9310***	-11.6341***	-13.6184***
	(0.1645)	(0.1664)	(0.1735)	(0.1775)	(2.4593)	(2.5715)
Hiring×X	2.3903***	2.2337***	0.2487***	0.2515***	16.2626***	19.1197***
	(0.4675)	(0.4716)	(0.0501)	(0.0513)	(3.4701)	(3.6284)
X	-1.6556***	-1.2901***	-0.1435***	-0.1186***	-0.4460***	-0.6664***
	(0.1139)	(0.4795)	(0.0094)	(0.0430)	(0.0654)	(0.2464)
Investment		-0.2267**		-0.2275		-0.2380**
		(0.1083)		(0.1079)		(0.1081)
B/M		0.5713***		0.5743***		0.5776***
		(0.0475)		(0.0474)		(0.0474)
Size		-0.0305*		-0.0305*		-0.0303*
		(0.018)		(0.018)		(0.0179)
Profit		0.0002		0.0002		0.0002
		(0.0019)		(0.0019)		(0.0019)
Market		0.3318***		0.3021***		0.2806***
		(0.0244)		(0.0128)		(0.0085)
Firm&Year Eff.	Yes	Yes	Yes	Yes	Yes	Yes
Obs	15571	15289	15571	15289	15571	15289
R^2 (%)	61.54	63.59	61.53	63.59	61.29	63.61

Note: This table presents the OLS estimates of Eq. (11) and their variations with different proxies. *X* denotes the *Employed*^{g} in Columns (1) and (2), *CTEmployed*^{g} in Columns (3) and (4), and *LFPR* in Columns (5) and (6). *Employed*^{g} represents China's annual employed population growth, *CTEmployed*^{g} represents the annual employed population growth in cities and towns, and *LFPR* indicates the labor participation rate. As in the data treatment in Table 8, we use the percentage point as the measurement unit of *Employed*^{g} and *CTEmployed*^{g} in regressions due to the relatively small magnitude of the growth rate. All coefficients are estimated with standard errors robust to White heteroskedasticity and clustered by firm. The standard errors are reported in parentheses. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Highlights:

- Hiring is negatively related to the expected stock return from the discount rate channel.
- The negative relation becomes steeper if the firm's employment frictions are higher.
- Positive labor supply shock leads to a flatter return-hiring relation.