Skilled Labor Risk and Compensation Policies

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Abstract

We measure U.S. publicly traded companies' exposures to skilled labor risk, i.e., the potential failure in attracting and retaining skilled labor, by the intensity of their discussions on this issue in their 10-K filings. We show that this measure effectively captures firm risk due to the mobility of skilled labor. We find that skilled labor risk is an important determinant of corporate compensation policy. Firms facing higher skilled labor risk ex ante offer a higher level of compensation to skilled labor and also structure the compensation more towards equity-based incentive pay, consistent with the theoretical predictions.

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1. Introduction

In recent decades, human capital has become increasingly important for firm productivity. Both the importance and the inalienable nature of human capital make the attraction and retention of skilled labor ever more crucial in today's businesses. In this paper, we examine firms' exposures to skilled labor risk, that is, the risk of failing to attract and retain skilled labor, and the impact of such risk on corporate compensation policies.

Our approach to identifying firms' exposures to skilled labor risk is motivated by the observation that many U.S. publicly traded companies discuss the potential failure in attracting and retaining skilled labor and key talents as a risk factor in their 10-K filings.[1] There are substantial variations both in the cross section and over time in the intensity of such discussions. We thus measure a firm's skilled labor risk in a year by the number of sentences that the firm spends discussing the reliance on and the retention of skilled labor and key talents in the 10-K.

Since our measure of skilled labor risk is based on firms' disclosures, we first conduct a number of tests to verify the information content of the measure. The first set of tests examines the relation between our measure and skilled labor turnovers. At the firm level, we find that experiencing recent turnover of inventors is associated with a 13% increase in the firm's skilled labor risk. Firms that experience recent executive turnover also tend to discuss skilled labor risk more intensely in 10-Ks. At the industry level, we find that firms in industries with higher labor skills *and* higher voluntary labor turnover rates in recent years tend to have more intense

[1] For example, Apple stated in its 2012 10-K that "the Company's success depends largely on the continued service and availability of key personnel." A tissue product provider Cybrid, Inc. stated that "If we cannot attract skilled personnel, our operations will likely suffer and any competitive edge that we have in the marketplace will quickly erode." An outdoor equipment manufacturer Johnson Outdoors Inc. stated that "The loss of key personnel, or the failure to attract qualified personnel, could have a material adverse effect on our business, financial condition or results of operations."

discussions about skilled labor risk. But the skilled labor risk measure does not respond to recent labor turnovers due to layoff or other reasons, even in high-skill industries.

In the second set of tests, we examine the relation between our measure and three state policies that restrict skilled labor mobility. We find that firms headquartered in states with more stringent enforcement of non-compete agreements discuss skilled labor risk less intensively in their 10-Ks, and the discussion is also less sensitive to local labor market competition. The adoption (rejection) of the Inevitable Disclosure Doctrine (IDD) by a state court, which can prevent a firm's former employee from working for a rival firm if the employee possesses the firm's trade secrets, also significantly decreases (increases) skilled labor risk of firms headquartered in the state. The effect of IDD on firms' skilled labor risk is larger when the need for protecting trade secrets from rivals is larger. Lastly, if skilled labor are likely homeowners, then state policies that affect homeowners' mobility could have unintended consequences on the skilled labor risk of local firms. For example, the state and local taxes levied on residential real estate transactions are taxes directly on homeowners' mobility. We find that in states with higher housing transfer tax rates, homeowners are less likely to move for job-related reasons, and firms' discussion on skilled labor risk in 10-K filings is less intense and less sensitive to local labor market competition.

In the third set of tests, we show that the above results cannot be explained away by the firm's disclosure style (more disclosure vs. less disclosure), and that the bulk part of the information content in the skilled labor risk measure is not captured by the firm's general risk disclosures. We also compare the information content of our measure with that of some existing related measures. We find that only our measure consistently responds to various proxies of skilled labor mobility. Overall, the evidence suggests that our skilled labor risk measure does contain useful information about firms' exposures to risk arising from the mobility of their skilled labor.

For firms that more intensively discuss the attraction and retention of skilled labor as a risk factor, the outside option constraints of their skilled employees are more likely to be binding.

Compensation policy should be the corporate policy that most directly responds to the attraction and retention of skilled labor. Theories suggest that the optimal compensation contract for talented employees should be sensitive to their time-varying outside options (see, e.g., Oyer (2004) and Lustig, Syverson, and Van Nieuwerburgh (2011)). These theories suggest that the optimal compensation contract in the presence of mobile talents involves higher pay and a larger equity-based incentive component. Equity-based pay achieves retention effect by not only pushing compensation more into the future but also better matching the dynamics of future compensation with that of employees' outside options. Thus, we expect firms facing higher skilled labor risk to offer higher compensation to skilled labor and structure the compensation contract more towards equity-based incentive pay.

However, empirical tests of these theoretical predictions face a challenge. If a compensation policy is effective at attracting and retaining skilled labor, then we expect firms with such a policy to have lower skilled labor risk. This reverse causality implies that the OLS estimates of the effects of skilled labor risk on compensation policy could be biased towards zero. To overcome this challenge, we consider an instrument for firms' skilled labor risk based on the insight that skilled labor are likely to be homeowners and thus their mobility is affected by housing market conditions that is reasonably exogenous to corporate compensation policies. The instrument is the local (MSA level) home equity shock driven by the national house price changes and the local topological elasticity of housing supply (Siaz (2010)). Recent studies have shown that an increase (a decrease) in home equity facilitates (hinders) labor mobility (see, e.g., Corradin and Popov (2015), Schmalz et al. (2017), Goetz (2013), and Struyven (2014)).

We utilize data on the salaries offered to highly skilled labor that are not U.S. citizens under the H-1B visa program to examine the relation between skilled labor risk and compensation to skilled labor. The key advantage of the H-1B salary data is that it allows us to absorb the effect of any geography-occupation-specific factors on skilled labor compensation by controlling for the local prevailing wage associated with a job offer. This can help to address the concern raised by Davidoff (2016) that the local topological elasticity of housing supply is correlated with local demand for housing. We argue that conditional on the local prevailing wage, the instrument satisfies the exclusion restriction. The 2SLS estimate suggests that a one-standard-deviation increase in skilled labor risk would increase the average skilled labor compensation by 20% relative to the sample mean. Given that highly skilled foreign labor may not be as mobile as U.S. citizens with comparable skills, our result can be viewed as a conservative estimate of the effect of skilled labor risk on skilled labor compensation.

We also find that skilled labor risk has a large effect on firms' compensation structure, consistent with the theoretical predictions. The 2SLS estimate suggests that a one-standard-deviation increase in skilled labor risk would increase the average incentive pay to total pay ratio by 87% relative to the sample mean for employees below the top rank. The result is robust across various alternative samples. Lastly, we examine a qualitative measure of compensation policy based on firms' social investment scores in the employee relations category. We find that firms facing higher skilled labor risk tend to score higher in employee compensation and benefits related dimensions, but not in other dimensions.

In all estimations, the OLS estimates of the skilled labor risk effect on compensation policy are close to zero, while the 2SLS estimates are more economically meaningful. This is consistent

with the reverse causality concern, which implies that these compensation practices do help to mitigate skilled labor risk.

This study contributes to a growing strand of research in the labor and finance literature, which not only highlights the increasing importance of skilled labor and key talents in production, but also analyzes its implications for firm risk (e.g., Eisfeldt and Papanikolaou (2013), Ochoa (2013), Belo et al. (2017), and Israelsen and Yonker (2017)), firm value (e.g., Eisfeldt and Papanikolaou (2014)), compensation design (e.g., Oyer (2004) and Lustig, Syverson, and Van Nieuwerburgh (2011)), and capital structure (e.g., Baghai et al. (2017) and Klasa et al. (2017)). Our first contribution to this literature is the introduction of a new and direct firm-level measure that effectively captures firms' exposures to risk due to the *mobility* of *skilled* labor. Having such a measure is crucial for research that aims to understand this increasingly important dimension of firm risk. Our measure allows for better understanding of skilled labor's outside options and factors that affect their mobility, providing a foundation for addressing skilled labor risk. It also provides a way to capture skilled labor risk in all firms (both high-tech and traditional firms), and thus can potentially provide a more complete understanding of such risk.

Second, our study suggests that skilled labor risk is an important determinant of compensation policy, providing first direct evidence for contract theories in which the agent's outside option and mobility are a key determinant of the optimal compensation contract. Furthermore, our study suggests that the mobility of skilled labor empowers them relative to shareholders, allowing skilled labor to obtain a larger share of the economic surplus in the firm. Several recent studies provide evidence suggesting that equity-based compensation has retention effect. Stock option grants tend to reduce employee turnover at least during the options' vesting periods (see, e.g., Aldatmaz, Ouimet and Van Wesep (2016) on turnover of rank-and-file

employees, and Jochem, Ladika and Sautner (2016) on CEOs). Gao, Luo, and Tang (2015) find that firms tend to increase equity-based pay for incumbent executives after losing top executives to other firms. Our study complements these studies by providing evidence on the *ex ante* compensation design for firms facing high skilled labor risk.

More broadly, our measure can be valuable for research that aims to understand the "new firm". In search of new foundations, Zingales (2000) points out that the "new firm" is characterized by human capital emerging as the most crucial asset, and human capital can move. Thus, the mobility of skilled labor could have profound implications for all important aspects of corporate finance: the way the "new firm" raises financing, the way it should be governed, and the way it should be valued. Having a direct measure of firms' exposures to risk due to skilled labor mobility can enable more future research about the "new firm".

2. Measuring Skilled Labor Risk

We define skilled labor risk as the risk of failing to attract and retain skilled labor. To quantify firms' exposures to skilled labor risk, we develop a measure based on the textual analysis of firms' discussions on risk related to skilled labor in their 10-K filings in the SEC's EDGAR database from 1996 to 2014. The relevant discussions have been mainly in Item 1A (Risk Factors) since December 1st, 2005 when the SEC Regulation S-K Item 305(c) required U.S. publicly traded companies to explicitly discuss risk factors for investors in 10-Ks. Before this regulation, the discussions on skilled labor related risk were mainly in Item 1 (Business) and Item 7 (Management's Discussion and Analysis). As a result, we focus on these three items in 10-Ks to develop our measure.

Skilled labor and talents in a company certainly includes the top leadership team, but should not be limited to talents at the very top. We wish to capture firms' attitudes toward highly skilled employees below the top rank. Based on our reading of 300 randomly selected 10-K files, we develop the following three keyword lists:

(1) "essential", "key", "core", "important", "skilled", "skillful", "trained", "experienced", "talented", "qualified";

(2) "worker", "(eligible) employee", "personnel", "colleague", "team member", "individual", "people", "specialist", "labor", "(professional) staff", "professional", "workforce", "scientist", "technician";

(3) "recruit(ing)/attract(ing) and/or retain(ing)", "retain(ing) and/or recruit(ing)/attract(ing)", "research profession", "scientific personnel", "effective/quality employee".[2]

Following Kravet and Muslu (2013), we use sentence rather than word as the analysis unit. We develop a Perl code to parse each of the three 10-K items into sentences and a sentence is defined to mention risk related to skilled labor if it contains a combination of a word in list (1) and a word in list (2) or it contains any phrase from list (3). For the first two phrases in list (3), we do not combine them with the keywords in lists (1) and (2) since firms sometimes do not mention skilled labor risk in this specific way.[3] In order to mitigate the concern that we extract sentences including any of the first two phrases in list (3) but are not related to skilled labor risk, we further exclude the hits if the noun following the phrases is "customer", "supplier", "client", "contract", "creditor", "investor", "business", "segment", "subscriber", "right" or all possible plural forms of

[2] For "employee" in the list (2), we further require that "defined/pension/retirement benefit(s)" do not follow "employee". For "personnel" or "specialist", we allow one to three words between the word from the list (1) and "personnel" or "specialist". For "labor" in the list (2), we further exclude the cases in which "atory" or "atories" follow "labor".

[3] For example, the fiscal year 2005 10-K filing of the company HEARUSA INC states that "If we are not able to attract and retain qualified audiologists, we will be less able to compete with networks of hearing aid retailers or with the independent audiologists who also sell hearing aids and our business may be adversely affected." The combination of the first two phrases in the keyword list (3) with the keyword lists (1) and (2) will fail to capture such disclosure.

these words to make sure that we mainly capture the discussions on attracting and retaining skilled employees. For all the adjective words in lists (1) and (3), we also exclude the hits that include the negative prefixes.[4]

To check the validity of our approach, we ex post randomly select 300 10-K files and manually verify whether the extracted sentences correctly identify the disclosure of risk related to skilled labor. The validation process shows that 1,340 of the 1,440 selected sentences correctly identify the risk according to our definition, implying a success rate of 93.06% for our algorithm.

Finally, we define "*Skilled Labor Risk*" as the total number of sentences including the keywords related to skilled labor risk in all three 10-K items. In Figure 1, we present the time-series trends of *Skilled Labor Risk* in each fiscal year. The figure shows that the average intensity of the discussions on skilled labor risk increased substantially over time, from about one sentence in 1996 to five sentences in 2013. There is a large jump in the intensity of the skilled labor risk discussions in fiscal year 2005 when the SEC regulation required all firms to discuss risk factors in their 10-Ks. This suggests that the mandatory requirement of the discussion on risk factors prompts firms to explicitly acknowledge skilled labor risk. The summary statistics for *Skilled Labor Risk* are presented in Table 1. The sample firms on average spend about three sentences on skilled labor risk in their 10-Ks.

In Table 2, we present the ten SIC2 industries with the highest (Panel A) and the lowest (Panel B) skilled labor risk in fiscal year 2013 based on the employment-weighted average *Skilled Labor Risk*.[5] The results show that various service industries that heavily rely on human capital are among the industries with the highest skilled labor risk. Petroleum and coal products, paper

[4] For example, we exclude the hits that contain "unskilled labor".
[5] To make sure that statistics in Table 2 is not driven by the small number of firms in each industry, we require the number of firms in each industry to be at least 20 to be included in this analysis.

products, wholesale and food industries are among the industries with the lowest skilled labor risk. The results in Table 2 are largely consistent with our prior about the differential reliance on skilled labor across industries. Furthermore, industries with high skilled labor risk are not limited to high-tech R&D-intensive industries. Our measure, applicable to *all* firms, can potential provide a more complete understanding of skilled labor risk in the economy. Finally, we find that the within-industry variation in *Skilled Labor Risk* is almost six times of the cross-industry variation, which leads us to mostly focus on understanding the former in our analysis below.

3. Information Content of the Skilled Labor Risk Measure

In this section, we examine the information content of our skilled labor risk measure by examining its relation to realized skilled labor turnover and to various policies in the firm's headquarters state that affect skilled labor mobility. We also address the concern that the variation in our measure reflects variation in firms' disclosure styles rather than true exposures to skilled labor risk. Finally, we compare our measure with several existing related measures.

3.1 Relation to Skilled Labor Turnover

Do firms with higher skilled labor risk tend to experience more skilled labor turnover? We first provide firm-level evidence regarding the turnover of a specific type of skilled labor---inventors. We then provide firm-level evidence regarding the turnover of top executives. Although our measure is more about mobility of skilled labor in general, as long as talent mobility in the top rank and below the top rank in a firm are positively correlated, for example due to firm-specific factors or geography- or industry-related factors, then evidence from executive turnover is still meaningful for verifying the information content of our measure. Finally, we provide evidence regarding skilled labor turnover at the industry level.

The firm-level inventor turnover is computed based on information in the Disambiguation and Co-authorship Networks of the U.S. Patent Inventor Database (1975 - 2010) established by the Harvard Business School (Lai et al. (2014)). For each patent in this database, we observe the name(s) and unique identifier(s) of the inventor(s), the patent filing date, and the organization that the patent is affiliated with as of the filing date. In a given year *t*, an inventor-*i* is considered to have recently left firm A for firm B if he or she is associated with patents for both firms A and B in the past three years (year *t-2* to *t* based on the patent filing year), and the association with firm B comes after that with firm A. We further require inventor-*i* to be not affiliated with any patent of firm A in the next three years (years *t+1* to *t+3*). The dummy variable "*Inventor Turnover in Past 3 Yrs*" equals one if there is at least one inventor who has left the firm in the past three years, and zero otherwise. We then use the link file in Kogan et al. (2017) to link the patent assignees to publicly traded companies in our sample. About 21% of the firm-years in our sample are covered by the inventor data. We then relate *Skilled Labor Risk* in year *t* to this inventor turnover dummy. The result is reported in Panel A of Table 3. The estimate in column (1) suggests that skilled labor risk is on average 13% (=0.390/3.01) higher relative to the sample mean for firms that experience recent inventor turnover than for those that do not.

Next, we relate *Skilled Labor Risk* in year *t* to executive turnovers in the firm in the past three years (including year *t*). The dummy variable "*Executive Turnover in Past 3 Yrs*" equals one if there is at least one top-five executive (in terms of total compensation) that has left the firm in the past three years, and zero otherwise. The results are reported in column (2). We find that experiencing executive turnovers in the recent past is also associated with an increase in the discussion of skilled labor risk in 10-Ks by about 9% (=0.284/3.01) relative to the sample mean.

The industry level labor turnover data are from the Job Openings and Labor Turnover Survey (JOLTS) conducted by the Bureau of Labor Statistics for 16 private-sector industries from 2000 to 2016. An advantage of this data is that it allows for the distinction among voluntary turnovers (quits), involuntary turnovers (layoffs), and other turnovers (due to death, disability, retirement, transfers to other locations, etc.). Accordingly, we construct "*Quit Rate*", "*Layoff Rate*", and "*Other Turnover Rate*" as the average turnover rates in the industry in the past three year (including the current year). We expect our skilled labor risk measure to be responsive only to quit rate. The disadvantage of this data is that it does not distinguish between skilled labor turnover and unskilled labor turnover. To address this drawback, we relate skilled labor risk to the interaction between industry quit rate and industry labor skill level. We expect our measure to be positively related to industry quit rate only in industries with high labor skills. Following Belo et al. (2017), we construct "*Fraction of High Skill Labor*" using the information on the required skill level in each occupation and calculate the fraction of high skilled labor in an industry.[6] We use the same industry classifications as in the JOLTS data. Panel B of Table 1 reports the summary statistics of variables related to JOLTS.

The results are reported in Panel B of Table 3. In column (1), the direct effect of *Quit Rate* is insignificant, while the interaction effect of *Quit Rate* and *Fraction of High Skill Labor* is positive and significant. This result suggests that the skilled labor risk measure is more responsive to industry quit rate in industries with higher required labor skills. Holding the industry labor skill at the sample mean, a one-standard-deviation increase in the recent industry quit rate would

[6] The labor skill data we use is from O*NET. The labor skill classification in O*NET is called Job Zones and the definition is at https://www.onetonline.org/help/online/zones. This variable ranges from 1 to 5. Higher values mean the labor skill is higher for an occupation. Following Belo et al. (2017), we treat occupations with job zones larger than or equal to 4 as high-skill occupations, and calculate the fraction of employment in an industry in the high-skill occupations.

increase skilled labor risk by 20% (=(0.033*0.84*21.34)/3.01) relative to the sample mean. Holding the industry quit rate at the sample mean, a one-standard-deviation increase in the fraction of high-skill labor in an industry would increase skilled labor risk by 30% (=(0.033*1.85*14.75)/3.01) relative to the sample mean. However, the results in columns (2)-(3) suggest that the skilled labor risk measure is not responsive to other involuntary labor turnovers, even in high-skill industries, which is what we would expect if our measure picks up firms' concern about skilled labor mobility.

Overall, the results in Table 3 suggest that our skilled labor risk measure is positively correlated with recent realization of skilled labor turnover. Furthermore, we control for a long list of firm and state characteristics. Appendix A presents the definitions of all variables. The results in Table 3 suggest that larger but younger firms have higher skilled labor risk. Skilled labor risk is positively related to firms' growth potential and negatively related to asset tangibility.

3.2 State Policies that Affect Skilled Labor Mobility

The mobility of skilled labor can be influenced by various state policies that restrain or facilitate skilled labor's ability to pursue their outside options. In this subsection we examine the effects of three policies in firms' headquarters states on their skilled labor risk.

3.2.1 State Non-Compete Agreements

Non-compete agreements prohibit employees from joining or starting rival companies in a specified geographic area,[7] and therefore restrict employees' outside options. If skilled labor risk is related to skilled employees' mobility, then we expect firms headquartered in states with stronger enforcements of the non-compete agreements to be less concerned about losing their

[7] Garmaise (2011) argues that the non-compete agreements are more easily enforced within a state boundary than across states.

talents. Furthermore, a firm's skilled labor risk should also be less sensitive to the local labor market competition when the non-compete agreements are more strongly enforced in the state.

Although the majority of states recognize various formats of non-compete agreements, the enforcement levels vary across states. The data on the enforcement index of non-compete agreements at the state level come from Garmaise (2011) and are available between 1994 and 2004. For years after 2004, we impute the enforcement index using the values in 2004. For robustness, we also use the enforcement index constructed by Starr (2017), which is available only for year 2009 in our sample.

Table 4 presents the results. In columns (1) and (2), we use the Garmaise data from 1996 to 2004. The estimation in column (1) shows that firms' skilled labor risk is lower in states with stronger enforcement of the non-compete agreements. A one-standard-deviation increase in the enforcement index of non-compete agreements is associated with a 9% (= (-0.147×1.854)/3.01) decrease relative to the sample mean in a firm's skilled labor risk. In column (2), we examine the interaction effect between the non-compete enforcement index and local labor market competition. Following Garmaise (2011), "*In-State Competition*" is measured as the fraction of total industry sales generated by the two-digit SIC industry peers in the firm's headquarters state. The interaction effect is negative and significant, which suggests that a firm's skilled labor risk becomes less sensitive to the local labor market competition when the state-level enforcement of non-compete agreements is stronger. In columns (3) and (4), we use the enforcement index from Starr (2017). The non-compete effect is robust and similar in magnitude as in earlier columns.

3.2.2 State Inevitable Disclosure Doctrine

The Inevitable Disclosure Doctrine (IDD) is a legal doctrine adopted by a state court that can prevent a firm's former employee from working for a rival firm if this would "inevitably" lead

the employee to disclose the firm's trade secrets to the rival. The IDD can further restrain the mobility of key talents beyond the effects of the non-compete agreement because it is applicable even if the employee does not sign a non-compete or non-disclosure agreement with the firm, or there is no evidence of bad faith or actual wrongdoing, or the rival firm is located in another state.[8] Based on the court rulings on the IDD identified by Klasa et al. (2017), ten states had a change in their IDD recognition during our sample period.[9] These changes allow identification of the IDD effect on firms' skilled labor risk.

We assume that a firm-year is affected by the state court decision regarding the adoption or rejection of the IDD if the year of the firm's fiscal-year-end date is after the year of the decision date. For each firm, we create an indicator variable "*IDD*" that equals zero for years before the IDD adoption decision in its headquarters state or after the decision that reversed the state court's previous favorable position on IDD, and equals one after the adoption decision and before the rejection of the previous adoption.

Our empirical approach is a difference-in-differences method.[10] The results are reported in Table 5. The estimated effect of IDD on *Skilled Labor Risk* is negative and significant, which suggests that the adoption (rejection) of the IDD in a state decreases (increases) firms' skilled labor risk. In columns (3) and (4), we use the firm-level product market concentration (*TNIC HHI*) and product total similarity (*TNIC Total Similarity*) in Hoberg and Phillips (2016) as proxies for the intensity of rival firms that may benefit from the firm's trade secrets. Lower product market

[8] Please see the discussions in Klasa et al. (2017) on the relation between the recognition of the IDD by a state court and the adoption of the Uniform Trade Secrets Act (UTSA) in the same state, and the relation between the IDD and the non-disclosure and non-compete clauses in employment contracts.

[9] They are Arkansas (adopted IDD in March 1997), Florida (rejected the previously adopted IDD in May 2001), Georgia (adopted IDD in June 1998), Kansas (adopted IDD in February 2006), Michigan (rejected the previously adopted IDD in April 2002), Missouri (adopted IDD in November 2000), Ohio (adopted IDD in September 2000), Texas (rejected the previously adopted IDD in April 2003), Utah (adopted IDD in January 1998), and Washington (adopted IDD in December 1997).

[10] Note that the specification with the IDD indicator and firm fixed effects and year fixed effects on the right-hand-side essentially produces the difference-in-differences estimator.

concentration and higher product similarity should be associated with a larger need for protecting trade secrets from rivals using IDD. We do not use the in-state competition measure since IDD applies even if a rival is located in another state. The results suggest that the adoption of IDD decreases firms' skilled labor risk more when the need for protecting trade secrets is higher.

3.2.3 Residential Real Estate Transfer Tax

Residential real estate transfer taxes are taxes imposed by states, counties and municipalities on the transfer of the title of real property within the jurisdiction. These taxes are effectively taxes on homeowners' mobility because they are relevant only when homeowners move and they increase the cost of moving. Several studies have documented a substantial negative effect of such taxes on the liquidity of houses (see, e.g., Dachis et al. (2011), Kopczuk and Munroe (2015)), suggesting a potential labor lock-in effect due to the transfer tax.

Given that there is no direct evidence on the effect of housing transfer taxes on household mobility in the U.S., we try to provide some evidence on this first. The data on the residential real estate transfer tax rate come from the Thomson Reuters Checkpoint and the Lincoln Institute of Land Policy for most of the states between 1996 and 2014.[11] The data on household mobility come from the Annual Social and Economic Supplement of the Current Population Survey from 1997 to 2015, which indicates whether a person changed residence since the previous year. If a person moved, the reason for moving is also available in four categories: job, housing, family, and others.

[11] The data from the Lincoln Institute of Land Policy is available at: https://www.lincolninst.edu/subcenters/significant-features-property-tax/Report_Real_Estate_Transfer_Charges.aspx. We do not have the transfer tax rate information for Alabama, Arkansas, Washington D.C., Delaware, Georgia, Hawaii, Kansas, Nebraska, New Jersey, Nevada, Ohio, South Carolina, and South Dakota in 1996 and Georgia in 1999. If a state has both deed recording tax and mortgage recording tax, then we aggregate these two types of tax and calculate the transfer tax rate as the ratio of transfer taxes paid to the house value, assuming that the mortgage value is 80% of the house value. For the majority of the states, the transfer tax rate is independent of the house value. However, the transfer tax rate is progressive in Connecticut, Hawaii (since 2005), New Jersey, New York and Vermont. For these five states, we assume that the house value is $1 million and calculate the transfer tax rate. But the results are robust to other house value assumptions (e.g., $0.4 million or $0.8 million).

In all estimations, we focus on household heads with age between 18 and 60 (i.e., the working age), and control for personal characteristics, state of residence conditions, and year fixed effects.

The estimations in Panel A of Table 6 show that the probability of household moving is lower in states with higher transfer tax rates. All dependent variables are scaled by their own sample mean to facilitate the comparison of effects across regressions. A one-percentage-point increase in the transfer tax rate is associated with a 9% decrease relative to the sample mean in the overall probability of moving. Among the four main reasons for moving, transfer tax has the largest effect on job-related moving (a 13% decrease relative to the sample mean). One stylized fact, which is also evident in Panel A, is that people with high education (college degrees or above) are more likely to have job-related moving. Column (3) shows that the effect of transfer tax on job-related moving for highly educated households doubles that for less educated households. In Panel B, we contrast the effect of transfer taxes on the mobility of homeowners versus that of non-homeowners. As one would expect, the transfer tax effect is concentrated among homeowners, particularly for job-related mobility. If skilled labor are likely to be highly educated homeowners, then transfer tax could be a meaningful constraint on their mobility.

Given the effect of real estate transfer tax on household mobility, we expect firms headquartered in states with higher housing transfer tax rates to mention less about skilled labor risk in 10-Ks. The results in Panel C of Table 6 suggest that this is the case. A one-standard-deviation increase in the transfer tax rate is associated with a 13% (-0.550*0.7/3.01) decrease in skilled labor risk relative to the sample mean. The result in column (2) suggests that skilled labor risk is less sensitive to local labor market competition for firms headquartered in states with higher transfer tax rates. In column (3) we further control for state fixed effects to isolate the effect of

changes in transfer tax rate on changes in firms' skilled labor risk. The result shows that an increase in the transfer tax rate is associated with a decrease in local firms' skilled labor risk.

Although firms may operate outside of their headquarters states, headquarters states likely account for a large fraction of skilled labor job positions. Using the data on the petition for an H-1B visa filed by an employer who intends to hire a highly skilled labor that is not a U.S. citizen (see details of this data in Section 4.1.1), we find that on average headquarters states account for 81% of all full-time skilled labor jobs in the H-1B visa program. Nevertheless, in a robustness check, we re-estimate the impact of the three state policies on our skilled labor risk measure for a subsample of firms that fall into the lowest quintile in terms of geographic dispersion based on Garcia and Norli (2012). The estimated headquarters-state policy effects are larger in magnitudes in this subsample relative to in the full sample, but the differences are not statistically significant: non-compete: -0.156 vs. -0.147 (p-value=0.61), IDD: -0.308 vs. -0.170 (p-value=0.16), and transfer tax: -0.583 vs. -0.550 (p-value=0.54).

Overall, the estimations in Tables 4-6 suggest that firms discuss skilled labor risk less intensively in their annual reports when state policies that intentionally or unintentionally restrain labor mobility are stronger. State policies that restrict skilled labor mobility can help firms retain their own talents, but make it harder for them to attract talents away from competitors. But given that our skilled labor risk measure is a summary measure of how concerned a firm is about skilled labor attraction and retention, the results shed light on the net effect of state policies on firms' skilled labor risk.

3.3 Addressing Concern about Disclosure Style

Since our measure is based on corporate disclosures, it can be subject to the concern that corporate risk disclosures are driven more by disclosure regulations or firms' disclosure styles than

firms' actual risk exposures. In the time series, there is a general trend for more disclosures in 10-Ks over time, driven by either the increase in mandated disclosures or investors' preference for more disclosures over time. In the cross section, some firms may be more thorough in their disclosures than others, and may have longer discussions on every risk factor than other firms with similar risk exposures.

The fact that our measure is sensitive to various proxies of skilled labor mobility suggests that it does have relevant information content.[12] Here we further address the concern in the following ways. First, in all regressions, we include year fixed effects, which means that our results essentially explain the variation in skilled labor risk across firms in a given year and mitigates the effect of the time trend in disclosure length on the results.

Second, we create a variable "*Non-Skilled-Labor-Related Discussion*" to capture the length of a firm's general risk disclosure in 10-K that is unrelated to skilled labor risk. This length should reflect both time-series trend in disclosure and a firm's disclosure style. When the *Skilled Labor Risk* measure is positive, the value of this variable equals the total number of sentences in the sections where the firm mentions skilled labor risk minus the number of sentences related to skilled labor risk. When the *Skilled Labor Risk* measure is zero, the value of this variable equals the total number of sentences in "Business" and "Management Discussion & Analysis" for 10-Ks filed before December 2005 and the total number of sentences in "Business", "Risk Factors", and "Management Discussion & Analysis" for 10-Ks filed after December 2005.

Column (1) of Panel A, Table 7 reports the benchmark estimates of the relation between firms' skilled labor risk and state policies that restrain skilled labor mobility. In column (2), we control for *Non-Skilled-Labor-Related Discussion*. We find that the skilled labor risk measure is

[12] Other studies that examine the information content of the "Risk Factor" section of 10-Ks also conclude that the disclosure is informative about the actual firm risk (see, e.g., Campbell et al. (2014), Hanley and Hoberg (2017)).

still sensitive to proxies of skilled labor mobility, and the magnitudes of the effects are comparable to those in column (1). In column (3), we put *Non-Skilled-Labor-Related Discussion* as the dependent variable. We find that the estimated skilled labor mobility effect on firms' general risk disclosure is significantly smaller than that on the skilled labor risk measure. These results suggest that *Skilled Labor Risk* is unlikely to be driven by the firm's disclosure style, and the bulk part of the information content in *Skilled Labor Risk* is not captured by the firm's general risk disclosures.

Third, a major disclosure regulation in our sample period is the Regulation S-K Item 305(c) in December 2005, which mandates the risk factor disclosure in 10-Ks and seems to have led to a jump in our measure of skilled labor risk (see Figure 1). Although this regulation is not about skilled labor risk per se, the mandates likely have prompted firms to put more effort into acknowledging all possible risks. Thus, disclosures of skilled labor risk in firms' 10-Ks before December 1st 2005 were voluntary and less subject to the boilerplate-disclosure concern, but there could be underreporting of the risk. The disclosures of skilled labor risk after 2005 were less subject to underreporting but could be more subject to the boilerplate-disclosure concern.

In Panel B, we assess the impact of this regulation on the information content of our skilled labor risk measure. Column (1) reports the results for *Skilled Labor Risk* before the regulation and column (2) reports the results after the regulation. The skilled labor risk measure is standardized by the mean value of each period to facilitate the comparison of marginal effects. We find that *Skilled Labor Risk* is sensitive to proxies of skilled labor mobility in both sub-sample periods. However, the sensitivity is significantly lower in the post-regulation period, suggesting that the regulation makes the disclosure somewhat less informative about the underlying risk exposure.

3.4 Relation to Existing Related Measures

Several existing measures are related to firms' reliance on skilled labor. The first measure is based on firms' disclosures on the "Key Man Life Insurance" in corporate filings, which insures the firm against losses from losing certain key talents due to deaths (Israelsen and Yonker (2017)). The authors create dummy variables to identify both firms that mention but do not necessarily carry such insurance (*Mention Key Man Insurance*) and those that actually carry such insurance on key employees (*Carry Key Man Insurance*). The second measure is the industry-level labor skill measure, *Industry Labor Skill*, developed in Belo et al. (2017). The authors use the information on the required skill level in each occupation and calculate the fraction of high skilled labor in an industry as a proxy for the industry's reliance on skilled labor.

The third and a more indirect measure is a measure of organizational capital based on firms' SG&A expenses (Eisfeldt and Papanikolaou (2013)). The authors define organizational capital as a production factor that is embodied in a firm's key talents, and measure the stock of *Organizational Capital* by cumulating firms' SG&A expenses using the perpetual inventory method. A part of SG&A represents labor related expenses (e.g., white collar wages, training). Two recent studies point out that the Compustat SG&A item (*xsga*) includes R&D expenses (*xrd*), and a large fraction of the reported SG&A represents operating costs unrelated to investments in organizational capital (Falato et al. (2013), Peters and Taylor (2017)). Peters and Taylor (2017) modify the organization capital measure by replacing SG&A with 0.3*(*xsga-xrd*).

On the labor mobility side, Donangelo (2014) proposes an indirect measure of labor mobility using the average occupation dispersion of employed workers in an industry ("*Industry Labor Mobility*"). The idea is that workers in occupations that are dispersed across industries possess more general skills and are more mobile than workers in occupations that are concentrated in fewer industries. This measure does not differentiate mobility of skilled versus unskilled labor.

Table 8, Panels A and B, present both the pairwise and the Spearman rank correlation matrices for our skilled labor risk measure and these related measures. For the correlations between a firm-level measure and an industry-level measure, we first calculate the average of the firm-level measure in each industry-year and then calculate the correlations at the industry-year level. The results show that our skilled labor risk measure is strongly and positively correlated with the two relatively direct measures of skilled labor reliance: the industry labor skill level (0.223-0.283) and firms' mentioning of key man life insurance in corporate filings (0.174-0.193).

Our measure, however, is less correlated with the two relatively indirect measures. It has a close-to-zero correlation with SG&A-based measures, and a large negative correlation with Donangelo's industry labor mobility measure (less than -0.2). At the same time, the SG&A-based measures and Donangelo's industry labor mobility all have small and even negative correlations with other measures of skilled labor reliance. In particularly, *Industry Labor Mobility* based on occupation dispersion across industries is negatively correlated with the industry labor skill level, which suggests that it tends to pick up the mobility of unskilled labor rather than skilled labor.

We believe that relative to these related measures, our measure better captures firms' exposures to risk due to the *mobility* of *skilled* labor. Intuitively, firms that intensively discuss the attraction and retention of skilled labor as a risk factor are likely those for which skilled labor are not only important but their participation constraints are also likely binding. In Panels C and D of Table 8, we formally compare the sensitivities of various firm-level measures related to skilled labor risk to skilled labor mobility. Each dependent variable is scaled by its sample mean to facilitate the comparison across measures. The results show that our measure is the only one that significantly and consistently responds to all proxies of skilled labor mobility.

4. Skilled Labor Risk and Compensation Policies

Compensation policy is probably the most relevant corporate policy for the attraction and retention of skilled labor. We examine the impact of skilled labor risk on both the level and structure of compensation policy for skilled labor. Contract theories suggest that the optimal compensation scheme in the presence of mobile talents should be sensitive to talents' time-varying outside options (e.g., Oyer (2004), Lustig, Syverson, and Van Nieuwerburgh (2011)). The key prediction in these theories is that the need to attract and retain skilled labor leads to a higher level of pay for skilled labor and the compensation contract would be structured to have a larger incentive pay component, often in the form of equity-based compensation. Equity-based incentive pay achieves retention effects by not only pushing the compensation more into the future but also matching the agent's future compensation with the value of her outside option, which tends to be positively correlated with the firm's performance. [13] It gives the agent a larger share of profits in high productivity states of nature when her outside option tends to more valuable, so that her future participation constraints can be satisfied. For firms that more intensively discuss the attraction and retention of skilled labor as a risk factor, the participation constraints of their skilled employees are more likely to be binding. Therefore, we expect that everything else equal, those firms ex ante offer their skilled labor higher compensation and the compensation is structured towards a larger fraction in the form of equity-based incentive pay.

4.1 Measures of Compensation Level and Structure

4.1.1 Level of Skilled Labor Compensation

[13] In Oyer (2004), the positive correlation between firm performance and the agent's outside option value is a key assumption. Lustig et al. (2011) provides a fully specified dynamic equilibrium model in which the agent's outside option endogenously depends on the industry's performance.

To capture the compensation level for skilled labor, we use the information from labor condition applications (LCAs). A LCA is the supporting evidence for the petition for an H-1B visa filed by an employer who intends to hire a highly skilled labor that is not a U.S. citizen.[14] LCA data are available online at the Foreign Labor Certification Data Center for the U.S. government fiscal years (October to September) 2001 to 2016. For each LCA, we observe the application submission date, the proposed contract start date, the name and address of the employer, the occupational code of the offer, whether the job is full time or not, the employer's proposed wage and the prevailing wage for the job, and the city and state of the employee's worksite.

The LCA data offers several advantages. First, it is specifically about the compensation offered to highly skilled labor. Second, it is at the job offer level, and thus provides location-occupation specific wage information. Third, besides the employer's proposed wage for the job offer, we also have information on the prevailing wage, which is the average wage paid to similarly employed workers in a specific occupation in the area of intended employment. [15] The ratio of H-1B salary to the corresponding local prevailing wage is closely centered on 1: the 10% cutoff is 1, the 50% cutoff (median) is 1.09, and the 90% cutoff is 1.43. This suggests that the local prevailing wage is a meaningful benchmark for H-1B salaries. This information item allows us to absorb any occupation-geography specific factors that affect skilled labor wage, which helps to identify a causal effect of skilled labor risk on compensation.

Foreign skilled labor often do not have the same degree of job mobility in the U.S. as U.S. citizens with comparable skills. Thus, the estimated relation between firms' skilled labor risk and

[14] According to the Department of Labor, the H-1B program is designed to help employers to hire nonimmigrant aliens with highly specialized knowledge and the attainment of at least a bachelor's degree or its equivalent.

[15] The definition is available at https://www.foreignlaborcert.doleta.gov/pwscreens.cfm. The definition of "area of intended employment" at 20 CFR 656.3 states: Area of intended employment means the area within normal commuting distance of the place (address) of intended employment and is available at http://www.flcdatacenter.com/skill.aspx

their compensation to H-1B workers should be viewed as a conservative estimate of the true effect of skilled labor risk on skilled labor compensation.

We keep all cases of full-time job offers in an employer's headquarters state. We then merge the LCA data with Compustat information using the employers' names and headquarters address. In the end, we have 212,885 LCAs involving 2,812 public firms from (corporate) fiscal years 2000 to 2014. To mitigate the effects of outliers, the proposed wages and the prevailing wages are winsorized at 1% and 99% percentiles.

4.1.2 Incentive Pay to Total Pay Ratio

The value of total incentive pay for employees below the top rank is proxied by the Black-Scholes value of stock option grants for all employees minus the value granted to top five executives. The data are available from Execucomp for 22% of firm-year observations in our sample between 1996 and 2005.[16] After 2005, the Compustat item "STKCO" reports the stock-based employee compensation expenses on a pre-tax basis, including stock bonus, deferred compensation and amortization of it, non-cash compensation, and stock-based compensation. The data is available for 68% of firm-year observations in our sample between 2006 and 2013. However, it is difficult to cleanly subtract the value granted to top five executives from this item, partly because executive compensation data are available only for firms covered by Execucomp. Thus we use the information in this item only as a robustness check.

For the value of total compensation to employees below the top rank, ideally we'd like to use the firm-level total labor compensation to estimate it. However, the Compustat item "Staff

[16] For each option grant, ExecuComp reports the percentage of the grant to an executive in the total options granted to all employees during a fiscal year and such information allows us to estimate the value of option grants to non-top-executive employees. The estimate of the option grants to employees below the top rank equals to the total value of options granted to all employees minus the value of options granted to the top five executives. If the estimated value of option grants to non-top-executive employees is negative, then we set the value as zero.

Expense-Total" ("XLR") is not widely available.[17] To address this issue, we rely on the wage data in the Quarterly Census of Employment and Wages (QCEW) from the Bureau of Labor Statistics, which covers 98% of U.S. jobs. The wage data in QCEW include salaries, bonuses, stock options, profit distributions and other benefits, and are comparable to the total staff expense in Compustat.[18] In particular, for firms that do not report the total staff expense, we estimate their labor compensation in a given year as the product of the firm's own employment and the average private-sector annual wage per employee in the firm's headquarters county and 3-digit NAICS industry in the year.[19] For firms that report total staff expenses, our estimated values and the reported values have a correlation of 88% and comparable distributions.[20]

We then take out the portion that goes to top executives by subtracting the average executive total compensation times five, i.e., assuming five executives for all firms, from the estimated total labor compensation. The average incentive pay to total pay ratio for employees below the top rank equals the ratio of their broad-based stock option value to their total compensation.

4.1.3 Qualitative Measure of Compensation Policy

We also consider a more qualitative measure of corporate compensation policy by looking into firms' social investment score in the employee relations category. The information is from the

[17] The "XLR" data are available for only 14% of the firm-year observations with the broad-based employee stock option grant values.
[18] The definition is available at https://www.bls.gov/cew/cewfaq.htm#Q16.
[19] To identify a firm's headquarters county, we first extract the 5-digit zip code of a firm's headquarters from its 10-K filing and then match the zip code to the county using the cross walk provided by the Missouri Census Data Center. For cases in which the zip code of a firm's headquarters crosses multiple counties, we calculate the average wage per employee in all counties. There is on average two (median is one) publicly traded companies in a county-industry bin, accounting for 53% of the total private-sector employment in the bin, suggesting that the county-industry average wage is heavily influenced by the wage paid by local public companies.
[20] The 10th percentile cutoff: $2.0 million (reported) and $1.8 million (estimated); the 25th percentile cutoff: $6.9 million (reported) and $6.2 million (estimated); the 50 percentile cutoff: $21 million (reported) and $20 million (estimated); the 75th percentile cutoff: $109 million (reported) and $108 million (estimated); the 90th percentile cutoff: $550 million (reported) and $554 million (estimated).

MSCI database.[21] MSCI rates a firm's strength in employee relations in 13 dimensions with a rating of 0 (bad) or 1 (good) in each evaluated dimension.[22] "*Total Strengths of Employee Relations"* is defined as the average rating across all evaluated dimensions in the strengths of employee relations and is between 0 and 1. This measure is constructed so that the values are comparable across firms and over time.[23] We further single out four dimensions related to employee compensation and benefits: cash profit sharing, employee involvement (related to employee stock ownership plan), retirement benefits, and compensation and benefits. "*Compensation & Benefits Related Strength*" is the average score in these dimensions, ranging from 0 to 1.

4.2 Empirical Design and Results

To test the theoretical predictions, we face a challenge. If a compensation policy is truly effective at attracting and retaining skilled employees, then firms using such a policy should be less concerned about losing their talents, leading to a lower value of *Skilled Labor Risk*. In equilibrium, such reverse causality would dampen the true effect of *Skilled Labor Risk* on compensation policy, making the estimated effects in OLS regressions biased towards zero. Indeed, regardless of the facet of the compensation policy, the OLS estimates for the effect of *Skilled Labor Risk* reported in Tables 9-11 are all close to zero.

[21]The database on CSR was originally created by KLD Research & Analytics, Inc. (KLD) in 1991. MSCI acquired KLD in 2010. The matching procedure between the CSR data in MCSI and Compustat is as follows. In the first step, we merge the MCSI data with Compustat using the 8-digit CUSIP, and then for the matched data we manually check whether the corporate names are matched. In the second step, for the MCSI data that cannot be matched to Compustat in the first step, we match them with Compustat using TICKER. Again, for the matched data, we manually check whether the corporate names are matched. Around 74% of firm-year observations in the MCSI database are matched to Compustat.

[22] The 13 dimensions are cash profit sharing, compensation & benefits, controversial sourcing, human capital development, employee involvement, employee relations, employee health & safety, non-layoff policy, retirement benefits, professional development, supply chain labor standards, union relations, and other strengths.

[23] In addition to the data on CSR strengths, MCSI also has data on CSR concerns. Therefore, an alternative measure is the difference between the total number of strengths and the total number of concerns in these four dimensions. However, as discussed in footnote 9 in Flammer and Ioannou (2016), recent research argues that the data on CSR strengths and concerns in MCSI lack convergent validity and, as a result, such methodology is questionable.

To overcome this challenge, we consider an instrument for *Skilled Labor Risk* based on the insight that skilled labor are likely to be homeowners and thus their mobility can be affected by housing market factors that are reasonably exogenous to corporate compensation policies. Following Corradin and Popov (2015) and Chetty et al. (2017), the instrument "*Home Equity Shock*" is the yearly percentage change in the national average house price index from the Federal Housing Finance Agency scaled by the local (MSA-level) topological elasticity of housing supply from Saiz (2010). The latter serves to amplify or dampen the national price changes, creating cross-MSA variation in home equity shocks. Recent studies have shown that an increase (a decrease) in home equity facilitates (hinders) labor mobility. For example, Corradin and Popov (2015) and Schmalz et al. (2017) document a causal effect of positive home equity shocks on entrepreneurship, a type of talent mobility that firms often worry about. Goetz (2013) and Struyven (2014) document a labor lock-in effect due to negative home equity shocks.

Davidoff (2016) points out that the local topological elasticity of housing supply is correlated with local demand for housing. Areas with tight supply of housing due to land availability (e.g., areas with mountains or waterfronts) could also be nice places to live. Higher housing demand could be correlated with higher compensation level through channels other than the attraction and retention of skilled labor, for example, through the local average cost of living. But fortunately, the H-1B salary data allows us to absorb the effect of geography-occupation-specific factors by controlling for the local prevailing wage associated with a job offer. We thus argue that conditional on the local prevailing wage, the instrument satisfies the exclusion restriction in the analysis on compensation level. For the analysis on the compensation structure for skilled labor, we believe that the local demand for housing are unlikely to be directly correlated with the use of incentive pay for reasons unrelated to talent attraction and retention.

A limitation of *Home Equity Shock* is that our skilled labor risk measure could be insensitive to decreased labor mobility due to negative shocks to home equity during the recent housing bust. This is because once a firm starts to disclose skilled labor risk in its 10Ks in the post SEC Regulation S-K Item 305(c) period (i.e., after 2005), the value of skilled labor risk measure is unlikely to decrease over time (see details in Appendix B). This problem can cause this instrument to be invalid in periods with national house price declines (i.e., years 2008-2011). Thus, we only use this instrument in periods with positive home equity shocks.

Table 9 reports the estimated relations between skilled labor risk and compensation level using the salaries offered to highly skilled labor under the H-1B visa program. We control for industry fixed effects in all regressions and thus focus on the variation in skilled labor compensation across MSAs. The 2SLS estimate suggests that a one-standard-deviation increase in skilled labor risk increases H-1B workers' salaries by 20% (=0.056*3.57). As we have noted before, due to the lower mobility of foreign skilled labor relative to U.S. citizens, this estimate should be viewed as a lower bound for the true effect of skilled labor risk on skilled labor compensation.

Table 10, Panel A reports the OLS and 2SLS estimates for the relation between *Skilled Labor Risk* and the average incentive pay ratio for employees below the top rank for firms in the Execucomp sample that reported stock option grants to all employees during 1996-2005. The results suggest that skilled labor risk has a large effect on the compensation structure. A one-standard-deviation increase in skilled labor risk increases the average employee incentive pay ratio by about 87% (=0.03*3.57/0.123) relative to the sample mean.

Panel B of Table 10 reports the results from several robustness tests using different samples. In alternative sample 1 (columns (1) and (2)), we assume that the incentive pay ratio for non-top-

executive employees is zero if the firm is covered by Execucomp but does not report stock option grants to all employees before 2006. This is to avoid overestimation of the skilled labor risk effect due to the omission of firms that likely use no equity-based pay for employees below the top rank. The results are very similar to those in Panel A. In alternative sample 2 (columns (3)-(4)), we include top five executives in the calculation of average employee incentive pay ratio and again find the results to be similar to that in Panel A. This suggests that our skilled labor risk measure is primarily about the mobility of skilled labor in general rather than of top executives. In alternative sample 3 (columns (5)-(6)), we use the Compustat sample (2006-2013) and rely on the item "STKCO" to compute the incentive pay ratio, since firms stopped reporting the value of stock option grants to all employees in 2005 due to an accounting rule change. Here we again include the top executives because we cannot cleanly subtract the incentive pay for top executives from "STKCO", and we do not have executive compensation data for firms not covered by Execucomp. We find that the results still hold in the later sample period and in a much larger sample of firms. The magnitude of the 2SLS estimate is a bit smaller than that in column (4) (0.022 vs. 0.033), but the two incentive pay ratios and the two samples are not directly comparable. Overall, the positive effect of skilled labor risk on incentive pay ratio is robust across these alternative samples.

Table 11 reports the OLS and 2SLS estimates for the relation between skilled labor risk and firms' strength in employee relations. The results in Panel A suggest that skilled labor risk has a positive and weakly significant effect on the firm's strength in employee relations. In Panel B, we compare and contrast the strength in compensation and benefits related dimensions and that in other dimensions of employee relations. The results suggest that the positive relation between skilled labor risk and firms' investment in employee relations mainly lies in compensation and benefits related dimensions. Firms with higher skilled labor risk tend to grand employees better

compensation and benefits packages. Note that the strength in compensation and benefits is not just about the level, as several dimensions within this category is about providing incentives to employees via profit sharing plans and employee stock ownership plans. But skilled labor risk does not explain firms' investment in other dimensions of employee relations.

In all estimations in tables 9-11, the OLS estimates of the skilled labor risk effect on compensation policy are close to zero, while the 2SLS estimates are more economically meaningful. This is consistent with the reverse causality concern, which implies that these compensation practices do help to mitigate skilled labor risk.

5. Conclusion

Skilled labor has become increasingly important for corporations. The reliance on skilled labor also exposes firms to skilled labor risk, which we define as the risk of failing to attract and retain skilled labor. We create a measure of firms' exposures to skilled labor risk based on the intensity of firms' discussions on this risk in their 10-K filings. We find that this measure effectively captures firm risk due to the mobility of skilled labor. Firms discuss more about skilled labor risk in their 10-Ks when they experience more skilled labor turnover and when their headquarters states have policies that directly or indirectly put less restrictions on the mobility of skilled labor. The results cannot be explained by firms' disclosure style.

Compensation policy is perhaps the policy that is most directly related to skilled labor risk. We find that skilled labor risk is indeed an important determinant of compensation policies. When facing higher skilled labor risk, firms ex ante offer a substantially higher level of pay to skilled labor and the compensation features a larger equity-based incentive component, consistent with

theories on optimal compensation when talents are mobile. Our findings also suggest that these compensation practices do help to mitigate risk due to skilled labor mobility.

More broadly, our measure can be valuable in future research that aims to understand the "new firm", which is characterized by human capital emerging as the most crucial asset (Zingales (2000)). Thus, the risk due to the mobility of skilled labor can be pervasive in today's economy, and is not just a problem of high-tech companies. Our measure does suggest that. Furthermore, skilled labor risk can have profound impact in all important aspects of corporate finance: the way the "new firm" raises financing, the way it should be governed, and the way it should be valued. Our analysis on compensation policy suggests that the mobility of skilled labor empowers them relative to shareholders, and skilled labor could play an important role in the corporate governance of the "new firm". This is different from the traditional corporate governance paradigm that focuses on the interaction between top management and capital providers. Having a direct measure of firm's exposure to skilled labor risk can be a valuable first step that enables more future research about the "new firm".

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Figure 1: Trend of Skilled Labor Risk

This figure presents the time-series trend of our skilled labor risk measure. Each dot in the plot represents the average of *Skilled Labor Risk* in each fiscal year.

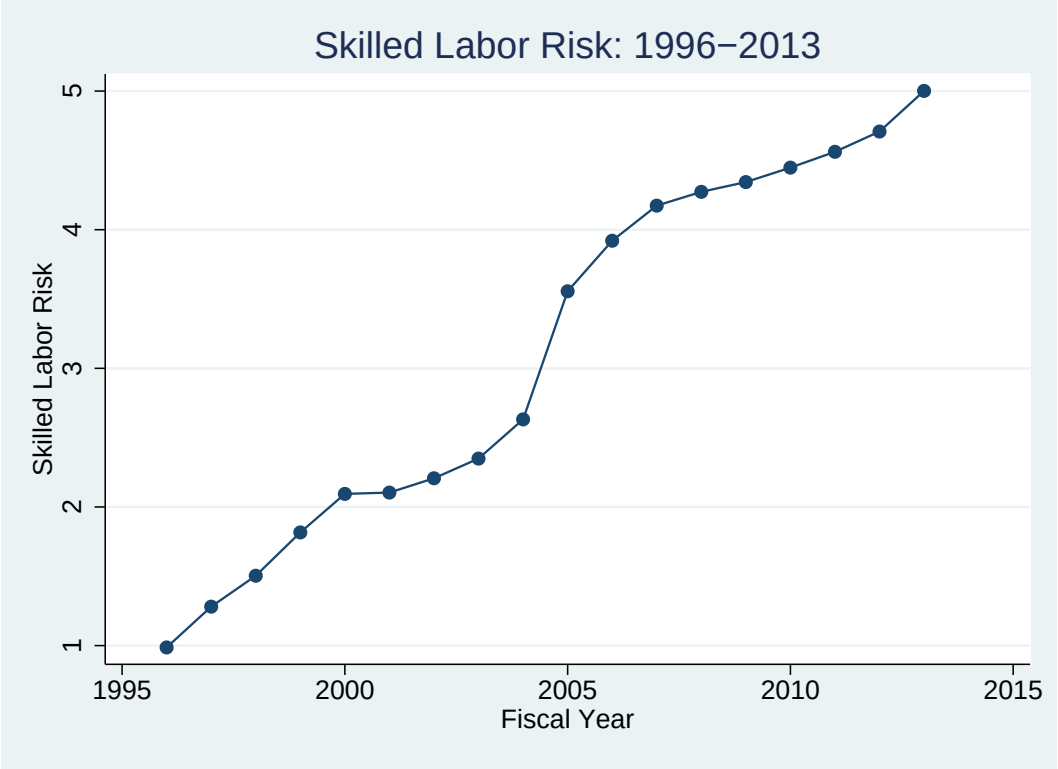

Table 1: **Summary Statistics**

This table reports the summary statistics for the firm-year, industry-year (defined in the Job Openings and Labor Turnover Survey (JOLTS)), and state-year level variables used in this study. Variables related to firm characteristics and employee compensation are winsorized at the 1% and 99% percentiles to mitigate the effects of outliers. All variable definitions and data sources are available in Appendix A.

	Panel A: Firm-Year Level Variables					
	N	Mean	P25	Median	P75	Std. Dev.
Skilled Labor Risk and Determinants						
Skilled Labor Risk	109,958	3.012	0.000	2.000	5.000	3.571
In-State Competition	109,869	0.062	0.003	0.021	0.083	0.098
TNIC HHI	85,189	0.219	0.077	0.138	0.277	0.214
TNIC Total Similarity	85,189	9.643	1.325	2.456	6.662	18.380
Inventor Turnover in Past 3 Yrs	22,558	0.559	0.000	1.000	1.000	0.496
Executive Turnover in Past 3 Yrs	68,464	0.621	0.000	1.000	1.000	0.485
Compensation Policy						
Employee Incentive Pay Ratio	10,360	0.123	0.013	0.040	0.140	0.189
H1-B Salary for Skilled Labor (in thousands)	9,908	86.825	69.534	83.662	100.500	26.623
Total Strengths of Employee Relations	28,015	0.062	0.000	0.000	0.000	0.133
Compensation&Benefits-Related						
Strengths of Employee Relations	24,427	0.085	0.000	0.000	0.000	0.200
Other Strengths of Employee Relations	28,015	0.047	0.000	0.000	0.000	0.141
Firm Characteristics						
Log(Assets)	107,992	4.771	3.215	4.966	6.496	2.571
Log(1+Firm Age)	109,958	2.804	2.197	2.890	3.466	0.943
ROA	104,650	-0.145	-0.006	0.072	0.142	1.045
Market to Book	91,895	2.061	1.031	1.317	2.104	2.210
Sales Growth	101,504	0.200	-0.063	0.049	0.209	0.830
R&D	103,897	0.265	0.000	0.000	0.041	1.358
Capex	102,152	0.048	0.008	0.027	0.060	0.065
Tangibility	104,659	0.226	0.033	0.131	0.343	0.244
Intangible Assets	101,240	0.121	0.000	0.026	0.178	0.181
Sales Volatility	103,503	0.229	0.044	0.121	0.265	0.340

	Panel B: JOLTS Industry-Year Level Variables					
	N	Mean	P25	Median	P75	Std. Dev.
Quit Rate (%)	207	1.853	1.311	1.628	2.203	0.835
Layoff Rate (%)	207	1.604	0.989	1.303	1.681	0.957
Other Turnover Rate (%)	207	0.252	0.194	0.231	0.292	0.082
Fraction of High Skill Labor (%)	207	21.335	10.763	16.662	32.130	14.746

	Panel C: State-Year Level Variables					
	N	Mean	P25	Median	P75	Std. Dev.
Non-Compete (Garmaise)	963	4.348	3.000	5.000	6.000	1.854
Non-Compete (Starr)	51	0.095	-0.170	0.230	0.700	1.033
Inevitable Disclosure Doctrine	963	0.343	0.000	0.000	1.000	0.475
Residential Real Estate Transfer Tax (%)	949	0.505	0.000	0.230	0.532	0.698
Employment Rate	963	0.607	0.557	0.590	0.628	0.112
Log(Income Per Capita) (in thousands)	963	2.861	2.751	2.837	2.963	0.166
Log(Population) (in millions)	963	1.261	0.460	1.402	1.887	1.032
Home Ownership Rate (%)	963	68.674	66.400	70.000	72.800	6.247

Table 2: **Industry Distribution of Skilled Labor Risk**

This table reports the top 10 (Panel A) and the bottom 10 (Panel B) two-digit SIC industries based on the employment-weighted average *Skilled Labor Risk* in the most recent fiscal year in our sample (year 2013).

Panel A: Industries with Highest Skilled Labor Risk		
SIC2	Industry Description	Skilled Labor Risk
87	Engineering, accounting, research, management, and related services	10.14
82	Educational services	10.00
80	Health services	9.90
73	Business Services	8.43
65	Real estate	7.03
62	Security and commodity brokers, dealers, exchanges, and services	6.98
16	Heavy construction other than buildings construction–contractors	6.69
79	Amusement and recreation services	6.26
39	Miscellaneous manufacturing industries	5.99
36	Electronic and other electric equipment	5.61
Panel B: Industries with Lowest Skilled Labor Risk		
SIC2	Industry Description	Skilled Labor Risk
29	Petroleum and coal products	0.92
26	Paper and allied products	1.42
51	Wholesale trade - nondurable goods	1.46
20	Food and kindred products	1.91
42	Motor freight transportation and warehousing	1.95
45	Transportation by air	2.01
25	Furniture and fixtures	2.11
49	Electric, gas, and sanitary services	2.13
54	Food stores	2.14
48	Communications	2.24

Table 3: **Skilled Labor Turnover and Skilled Labor Risk**

This table reports the estimated relations between skilled labor turnover and a firm's skilled labor risk. Columns (1) and (2) of Panel A report the estimated relations between a firm's skilled labor risk and its innovator and executive team turnover in the past three years, respectively. The dependent variable in columns (1) and (2) is *Skilled Labor Risk*. *Inventor Turnover in Past 3 Yrs* is a dummy variable equal to one if a firm experiences at least one innovator departure in the past three years (including the current year) and zero otherwise. *Executive Turnover in Past 3 Yrs* is a dummy variable equal to one if a firm experiences at least one executive departure in the past three years (including the current year) and zero otherwise. Panel B reports the effects of the average labor turnover at the industry level, defined in the Job Openings and Labor Turnover Survey (JOLTS), in the past three years. The dependent variable is *Skilled Labor Risk*. *Quit Rate* is the average fraction of employees who left jobs voluntarily in the past three years (including the current year) at the industry level. *Layoff Rate* is the fraction of employees who left jobs involuntarily in the past three years (including the current year) at the industry level. *Other Turnover Rate* is the fraction of employees who left jobs due to other reasons (e.g. death, disability, retirement, transfers to other locations) in the past three years (including the current year) at the industry level. *Fraction of High Skill Labor* (in percentage) is the average fraction of employees with occupation job zones larger than or equal to 4 in O*NET Online in the past three years (including the current year) in an industry. Standard errors in parentheses are robust and clustered at the firm level in Panel A and at the industry level in Panel B. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Panel A: Firm-level Labor Turnover and Skilled Labor Risk	
	(1)	(2)
Inventor Turnover in Past 3 Yrs	0.390***	
	[0.078]	
Execu.Turnover in Past 3 Yrs		0.284***
		[0.049]
Log(Assets)	0.031	0.150***
	[0.033]	[0.018]
Log(1+FirmAge)	-1.082***	-0.651***
	[0.082]	[0.043]
ROA	-0.476***	-0.082
	[0.177]	[0.098]
Market to Book	0.016	0.055***
	[0.021]	[0.015]
Sales Growth	0.225***	0.186***
	[0.038]	[0.021]
R&D	0.088***	0.185***
	[0.026]	[0.023]
R&D Missing	-0.501***	-0.405***
	[0.140]	[0.085]
Capex	4.358***	4.035***
	[0.923]	[0.443]
Tangibility	-3.180***	-2.206***
	[0.378]	[0.199]
Intangible Assets	-1.160***	-0.481**
	[0.312]	[0.194]
Sales Vol.	0.738***	0.400***
	[0.223]	[0.096]
Employment Rate	0.287	0.785
	[0.904]	[0.626]
Log(Income Per Cap.)	0.074	-0.183
	[0.403]	[0.249]
Log(Population)	0.502***	0.320***
	[0.067]	[0.042]
Ind. FE & Yr FE	Y	Y
Adj. R^2	0.373	0.315
N	18628	68464

	Panel B: Industry Labor Turnover and Firm's Skilled Labor Risk		
	(1)	(2)	(3)
Quit Rate	0.397		
	[0.262]		
Quit Rate*Fraction of High Skill Labor	0.033**		
	[0.013]		
Layoff Rate		0.520	
		[0.363]	
Layoff Rate*Fraction of High Skill Labor		0.022	
		[0.014]	
Other Turnover Rate			3.212
			[5.256]
Other Turnover Rate*Fraction of High Skill Labor			-0.044
			[0.299]
Fraction of High Skill Labor	-0.006	0.027	0.051
	[0.033]	[0.028]	[0.073]
Log(Assets)	0.049	0.079	0.027
	[0.047]	[0.048]	[0.058]
Log(1+FirmAge)	-0.569**	-0.652**	-0.572**
	[0.226]	[0.231]	[0.249]
ROA	0.236	0.223	0.321
	[0.203]	[0.203]	[0.240]
Market to Book	0.059	0.061	0.072*
	[0.038]	[0.039]	[0.036]
Sales Growth	0.134**	0.120*	0.114
	[0.061]	[0.064]	[0.067]
R&D	0.249***	0.242***	0.262***
	[0.063]	[0.055]	[0.051]
R&D Missing	-1.095***	-1.018***	-1.066***
	[0.278]	[0.284]	[0.251]
Capex	7.296***	7.531***	7.281***
	[1.368]	[1.405]	[1.526]
Tangibility	-1.739**	-1.599**	-1.401*
	[0.688]	[0.719]	[0.783]
Intangible Assets	0.978	0.944	1.596
	[0.783]	[0.728]	[1.004]
Sales Vol.	0.474	0.482	0.710*
	[0.341]	[0.339]	[0.399]
Employment Rate	1.482	1.304	1.542
	[1.081]	[1.159]	[1.152]
Log(Income Per Cap.)	0.246	0.256	0.407
	[0.481]	[0.487]	[0.542]
Log(Population)	0.443***	0.419***	0.447***
	[0.131]	[0.130]	[0.127]
Yr FE	Y	Y	Y
Adj. R^2	0.177	0.175	0.157
N	48258	48258	48258

Table 4: **State Enforcement of Non-compete Agreements and Skilled Labor Risk**

This table reports the effects of non-compete agreements enforcement in a firm's headquarters state on the firm's skilled labor risk and the sensitivity of skilled labor risk to in-state competition. In columns (1)-(2), we use the enforcement index of non-compete agreements in Garmaise (2011). In columns (3)-(4), we use the enforcement index of non-compete agreements in Starr (2017). Following Garmaise (2011), *In-State Competition* is the yearly fraction of total industry sales (excluding the focal firm's sales) generated by in-state competitors. Standard errors in parentheses are robust and clustered at the headquarters state level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Garmaise (2011)		**Starr (2017)**	
	1996-2004		2009	
	(1)	(2)	(3)	(4)
Non-Compete (Garmaise)	-0.147***	-0.096**		
	[0.043]	[0.043]		
Non-Compete (Garmaise)*In-State Competition		-0.763***		
		[0.257]		
Non-Compete (Starr)			-0.287***	-0.115
			[0.060]	[0.093]
Non-Compete (Starr)*In-State Competition				-1.678***
				[0.560]
In-State Competition		3.978***		0.545
		[0.669]		[0.677]
Log(Assets)	0.155***	0.149***	0.205***	0.197***
	[0.031]	[0.030]	[0.038]	[0.037]
Log(1+FirmAge)	-0.612***	-0.601***	-0.647***	-0.629***
	[0.078]	[0.074]	[0.079]	[0.076]
ROA	-0.161*	-0.149*	-0.200	-0.162
	[0.084]	[0.083]	[0.303]	[0.291]
Market to Book	0.075***	0.074***	0.052	0.049
	[0.011]	[0.011]	[0.045]	[0.045]
Sales Growth	0.187***	0.186***	0.184	0.186
	[0.026]	[0.026]	[0.123]	[0.121]
R&D	0.151***	0.155***	0.182***	0.191***
	[0.031]	[0.029]	[0.055]	[0.054]
R&D Missing	-0.421***	-0.405***	-0.233	-0.190
	[0.120]	[0.114]	[0.180]	[0.175]
Capex	3.065***	3.049***	1.013	0.951
	[0.364]	[0.373]	[1.256]	[1.260]
Tangibility	-1.798***	-1.800***	-1.787***	-1.778***
	[0.292]	[0.303]	[0.491]	[0.501]
Intangible Assets	-0.412	-0.367	-0.483	-0.469
	[0.265]	[0.262]	[0.449]	[0.453]
Sales Vol.	0.498***	0.492***	0.300	0.307
	[0.074]	[0.073]	[0.347]	[0.348]
Employment Rate	1.179	0.923	-2.479	-2.042
	[1.317]	[1.306]	[1.825]	[1.935]
Log(Income Per Cap.)	-0.473	-0.468	-0.204	-0.284
	[0.746]	[0.677]	[0.870]	[0.847]
Log(Population)	0.166*	0.071	-0.155	-0.189*
	[0.097]	[0.100]	[0.100]	[0.099]
Ind. FE	Y	Y	Y	Y
Yr FE	Y	Y	N	N
Adj. R^2	0.288	0.291	0.198	0.202
N	35875	35872	3867	3864

Table 5: **State Inevitable Disclosure Doctrine and Skilled Labor Risk**

This table reports the effects of the recognition of the Inevitable Disclosure Doctrine (IDD) in a firm's headquarters state on the firm's skilled labor risk and the sensitivity of skilled labor risk to the industry competition. *IDD* is a dummy variable that equals to one if the year of a firm's fiscal year end date is after the year of the adoption of IDD and before the year of the rejection of the previous adopted IDD (if applicable) in the headquarters state, and equal to zero otherwise. *TNIC HHI* is the firm-level sales-based product market concentration using the Text-based Network Industry Classifications (TNIC) in Hoberg and Phillips (2016). *TNIC Total Similarity* is the firm-level total product similarity using the TNIC in Hoberg and Phillips (2016). Standard errors in parentheses are robust and clustered at the headquarters state level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
IDD	-0.114**	-0.170**	-0.295***	-0.133*
	[0.045]	[0.070]	[0.092]	[0.067]
IDD*TNIC HHI			0.425***	
			[0.157]	
TNIC HHI			-0.539***	
			[0.106]	
IDD*TNIC Total Similarity				-0.016**
				[0.007]
TNIC Total Similarity				0.025***
				[0.007]
Firm & State Controls	N	Y	Y	Y
Firm FE	Y	Y	Y	Y
Yr FE	Y	Y	Y	Y
Adj. R^2	0.734	0.756	0.760	0.760
N	106215	72030	66575	66575

Table 6: **Residential Real Estate Transfer Tax and Skilled Labor Risk**

This table reports the effects of state residential real estate transfer tax rate on household mobility and *Skilled Labor Risk*. Panels A and B use the data from the Annual Social and Economic Supplement of the Current Population Survey. Panel A presents the estimated effects of the state transfer tax rate on households' moving decisions. Panel B presents the estimated effects of the state transfer tax rate on the decisions of moving and job-related moving for homeowners and non-homeowners, respectively. The dependent variables in Panel A are all scaled by their own sample means. In Panel B, the dependent variables in the homeowner and non-homeowner subsamples are scaled by their own subsample means. The person and state-level controls in Panel B are the same as those in Panel A. Panel C presents the estimated effects of the residential real estate transfer tax rate in a firm's headquarters state on the firm's skilled labor risk and the sensitivity of skilled labor risk to in-state competition. Following Garmaise (2011), *In-State Competition* is the fraction of total industry sales (excluding the focal firm's sales) generated by in-state competitors. The unreported firm and state-level controls in Panel C are the same as those in Table 4. Standard errors in parentheses are robust and clustered at the residence state level in Panels A and B and at the headquarters state level in Panel C. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Panel A: Real Estate Transfer Tax and Household Mobility					
	All Move	Job	Job	Family	Housing	Other
	(1)	(2)	(3)	(4)	(5)	(6)
Real Estate Transfer Tax	-0.089**	-0.130**	-0.073	-0.072*	-0.085**	-0.102**
	[0.040]	[0.062]	[0.064]	[0.042]	[0.032]	[0.045]
Real Estate Transfer Tax*College Degree or Above			-0.166***			
			[0.050]			
Age	-0.042***	-0.043***	-0.043***	-0.048***	-0.037***	-0.047***
	[0.001]	[0.002]	[0.002]	[0.001]	[0.001]	[0.002]
Female	0.015**	-0.172***	-0.171***	0.093***	0.039***	-0.118***
	[0.006]	[0.016]	[0.015]	[0.012]	[0.008]	[0.021]
White	0.022	0.158*	0.155*	0.101*	-0.034	-0.050
	[0.047]	[0.084]	[0.084]	[0.056]	[0.045]	[0.077]
Black	-0.136***	-0.309***	-0.320***	-0.110*	-0.022	-0.386***
	[0.049]	[0.091]	[0.091]	[0.061]	[0.053]	[0.079]
Asian	-0.079***	0.066	0.064	-0.238***	-0.076*	0.114*
	[0.028]	[0.086]	[0.088]	[0.058]	[0.044]	[0.058]
Married	-0.143***	0.483***	0.483***	-0.465***	-0.101***	-0.216***
	[0.010]	[0.035]	[0.035]	[0.027]	[0.012]	[0.027]
Presence of Child	-0.311***	-0.562***	-0.564***	-0.286***	-0.131***	-0.803***
	[0.008]	[0.025]	[0.024]	[0.017]	[0.011]	[0.025]
College Degree or Above	0.109***	0.965***	1.062***	-0.138***	-0.041***	0.320***
	[0.008]	[0.042]	[0.050]	[0.016]	[0.011]	[0.022]
Log(Total Personal Income)	0.009***	0.004	0.004	0.007***	0.013***	-0.002
	[0.001]	[0.004]	[0.004]	[0.002]	[0.002]	[0.004]
Homeowner	-1.200***	-1.754***	-1.754***	-1.205***	-0.964***	-1.574***
	[0.072]	[0.112]	[0.112]	[0.080]	[0.063]	[0.096]
Employment Rate	-0.153	0.167	0.249	-0.351*	-0.238	-0.095
	[0.236]	[0.445]	[0.430]	[0.204]	[0.195]	[0.320]
Log(Income Per Capita)	-0.432***	-0.848***	-0.866***	-0.647***	-0.155	-0.632***
	[0.141]	[0.297]	[0.294]	[0.162]	[0.142]	[0.191]
Log(Population)	-0.004	0.063	0.065	-0.019	-0.020	0.018
	[0.020]	[0.050]	[0.050]	[0.025]	[0.015]	[0.026]
Yr. FE	Y	Y	Y	Y	Y	Y
Adj. R^2	0.125	0.020	0.020	0.038	0.040	0.025
N	1002676	1002676	1002676	1002676	1002676	1002676

	Panel B: Homeowners v.s. Non-Homeowners			
	Homeowners		Non-Homeowners	
	All Move	Job	All Move	Job
	(1)	(2)	(3)	(4)
Real Estate Transfer Tax	-0.111***	-0.254***	-0.060	-0.078
	[0.023]	[0.056]	[0.038]	[0.061]
Person & State Controls	Y	Y	Y	Y
Yr. FE	Y	Y	Y	Y
Adj. R^2	0.032	0.005	0.061	0.019
N	641218	641218	361458	361458

	Panel C: Real Estate Transfer Tax and Skilled Labor Risk		
	(1)	(2)	(3)
Real Estate Transfer Tax	-0.550***	-0.396**	-0.558**
	[0.162]	[0.169]	[0.234]
Real Estate Transfer Tax*In-State Competition		-1.989***	-0.756**
		[0.644]	[0.286]
In-State Competition		2.781***	1.917***
		[0.572]	[0.497]
Home Ownership	-0.055***	-0.055***	0.010
	[0.015]	[0.014]	[0.012]
Firm & State Controls	Y	Y	Y
Ind. FE & Yr FE	Y	Y	Y
State FE	N	N	Y
Adj. R^2	0.325	0.327	0.340
N	71389	71362	71362

Table 7: **Addressing Concerns about Disclosure Style**

This table addresses the potential concern of our measure primarily picking up the firm's disclosure style. Panel A assesses the role of disclosure style in driving the results. Panel B assesses the effect of a major disclosure regulation in our sample period on the information content of *Skilled Labor Risk*. *Non-Skilled-Labor-Related Discussion* counts the number of sentences unrelated to a firm's skilled labor risk in the 10-K sections where the firm discusses skilled labor risk. If a firm does not discuss skilled labor risk, then *Non-Skilled-Labor-Related Discussion* counts the number of sentences in Item 1 and Item 7 before December 2005 and the number of sentences in Item 1, Item 1A, and Item 7 in 10-Ks after December 2005. To facilitate the comparison of marginal effects, the dependent variables in Panels A and B are standardized by their own sample means. Standard errors in parentheses are robust and clustered at the headquarters state level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively. In Panels A and B, letters a, b, and c represent statistical difference at 1%, 5%, and 10% levels, respectively, for the differences between the coefficients in column (1) and those in each of the other columns.

	Panel A: Non-Skilled Labor Disclosures as a Control and a Comparison		
	Baseline Estimation	Control for Disclosure Style	Non-Skilled-Labor-Related Discussion
	(1)	(2)	(3)
Non-Skilled-Labor-Related Discussion		0.001***	
		[0.000]	
Non-Compete (Garmaise)	-0.021**	-0.017*^{c}	-0.007*^{c}
	[0.010]	[0.009]	[0.004]
IDD	-0.156***	-0.135***^{c}	-0.039*^{a}
	[0.037]	[0.029]	[0.022]
Real Estate Transfer Tax	-0.104***	-0.096***	-0.015^{a}
	[0.037]	[0.032]	[0.012]
Firm&State Controls	Y	Y	Y
Ind. FE & Yr FE	Y	Y	Y
Adj. R^2	0.326	0.390	0.394
N	71389	71389	71389

	Panel B: Effects of the SEC Regulation	
	Before the Regulation	After the Regulation
	(1)	(2)
Non-Compete (Garmaise)	-0.031**	-0.014^{b}
	[0.014]	[0.009]
IDD	-0.263***	-0.104***^{a}
	[0.047]	[0.036]
Real Estate Transfer Tax	-0.151***	-0.079**^{a}
	[0.053]	[0.030]
Firm&State Controls	Y	Y
Ind. FE & Yr FE	Y	Y
Adj. R^2	0.294	0.230
N	36121	35268

Table 8: **Relation to Existing Related Measures**

This table presents relations between our measure, *Skilled Labor Risk*, and the existing related measures. Panels A and B report the pairwise and Spearman rank correlations between *Skilled Labor Risk* and existing related measures. Panel C compares the effect of inventor turnover in the past three years on our skilled labor risk measure and on existing related measures at the firm level. Panel D compares the effects of state policies that restrain skilled labor mobility on our skilled labor risk measure and on existing related measures at the firm level. The dependent variable in each column of Panels C and D is standardized by its own sample mean. *Mention Key Man Insurance* and *Carry Key Man Insurance* are measures for key human capital in Israelsen and Yonker (2017). *Mention Key Man Insurance* is a dummy variable that equals to one if a firm mentions key man life insurance in corporate filings in a year and zero otherwise. *Carry Key Man Insurance* is a dummy variable that equals to one if a firm actually carries key man life insurance on key employees in a year and zero otherwise. *Industry Labor Skill* is the industry-level fraction of high skilled labor in Belo et al. (2017). *OrgCapital* is the measure for the stock of organizational capital in Eisfeldt and Papanikolaou (2013), which accumulates the deflated value of SG&A expenses, divided by total assets. *Modified OrgCapital* is the measure for the stock of organizational capital in Peters and Taylor (2017), which accumulates the deflated value of 30% of the SG&A expenses after excluding R&D expenses, divided by total assets. *Industry Labor Mobility* is from Donangelo (2014), which measures the average occupation dispersion of employed workers in an industry. For the pairwise and rank correlations between a firm-level measure and an industry-level measure, we first calculate the average of the firm-level measures in each industry-year and then calculate the correlations at the industry-year level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively. In Panel C, standard errors in parentheses are robust and clustered at the firm level. In Panel D, standard errors in parentheses are robust and clustered at the headquarters state level. Letters a, b, and c represent statistical difference at 1%, 5%, and 10% levels, respectively, for the differences between the coefficients in column (1) and those in each of the other columns.

Panel A: Pairwise Correlations

	Skilled Labor Risk	Mention KeyMan Insurance	Carry KeyMan Insurance	Industry Labor Skill	OrgCapital	Modified OrgCapital	Industry Labor Mobility
Skilled Labor Risk	1.000						
Mention KeyMan Insurance	0.174***	1.000					
Carry KeyMan Insurance	0.071***	0.650***	1.000				
Industry Labor Skill	0.283***	0.045**	0.020	1.000			
OrgCapital	-0.025***	0.052***	0.032***	0.036**	1.000		
Modified OrgCapital	-0.034***	0.048***	0.037***	-0.001	0.972***	1.000	
Industry Labor Mobility	-0.236***	-0.021	0.015	-0.183***	0.145***	0.131***	1.000

Panel B: Rank Correlations

	Skilled Labor Risk	Mention KeyMan Insurance	Carry KeyMan Insurance	Industry Labor Skill	OrgCapital	Modified OrgCapital	Industry Labor Mobility
Skilled Labor Risk	1.000						
Mention KeyMan Insurance	0.193***	1.000					
Carry KeyMan Insurance	0.089***	0.650***	1.000				
Industry Labor Skill	0.223***	0.016	0.035*	1.000			
OrgCapital	0.066***	0.054***	0.055***	-0.070***	1.000		
Modified OrgCapital	0.034***	0.046***	0.056***	-0.104***	0.984***	1.000	
Industry Labor Mobility	-0.201***	-0.002	0.025	-0.141***	0.232***	0.213***	1.000

	Panel C: Comparisons with Existing Firm-level Measures				
	Skilled Labor Risk	Mention KeyMan Insurance	Carry KeyMan Insurance	OrgCapital	Modified OrgCapital
	(1)	(2)	(3)	(4)	(5)
Innovator Turnover in Past 3 Yr	0.129***	-0.080[a]	-0.143[a]	0.060**[c]	0.016[a]
	[0.026]	[0.063]	[0.100]	[0.025]	[0.018]
Firm&State Controls	Y	Y	Y	Y	Y
Ind. FE & Yr FE	Y	Y	Y	Y	Y
Adj. R^2	0.373	0.102	0.068	0.289	0.301
N	18628	13717	13717	18628	18628

	Panel D: Comparisons with Existing Firm-level Measures				
	Skilled Labor Risk	Mention KeyMan Insurance	Carry KeyMan Insurance	OrgCapital	Modified OrgCapital
	(1)	(2)	(3)	(4)	(5)
Non-Compete (Garmaise)	-0.021**	-0.006	0.016	-0.004	-0.000
	[0.010]	[0.015]	[0.027]	[0.003]	[0.004]
IDD	-0.156***	-0.059[c]	-0.162*	0.053**[a]	0.055**[a]
	[0.037]	[0.051]	[0.089]	[0.021]	[0.022]
Real Estate Transfer Tax	-0.104***	-0.001[b]	0.226***[a]	-0.009[b]	0.003[b]
	[0.037]	[0.022]	[0.051]	[0.011]	[0.014]
Firm&State Controls	Y	Y	Y	Y	Y
Ind. FE & Yr FE	Y	Y	Y	Y	Y
Adj. R^2	0.326	0.093	0.063	0.350	0.368
N	71389	34240	34240	71389	71389

Table 9: **Skilled Labor Risk and H1-B Salary for Skilled Labor**

This table reports the OLS and 2SLS estimations of the effects of a firm's skilled labor risk on the salary of foreign skilled labor under the H-1B visa program. *Log(H1-B Salary for Skilled Labor)* is the natural logarithm of proposed salary for a highly skilled employee who is not a U.S. citizen in the labor condition application (LCA) filed by an employer. IV indicates 2SLS estimations using home equity shock as an instrument for a firm's skilled labor risk. Home equity shock is defined as the yearly change in the national house price index divided by the topological elasticity of housing supply at the MSA level. In all estimations, we control for the natural logarithm of the prevailing wage for each job offer and firm-level characteristics including firm size, firm age, return on assets, market to book ratio, sales growth, R&D expense, a dummy variable indicating missing R&D values, capital expenditure, tangibility, intangible assets, and sales volatility. The prevailing wage is defined as the average wage paid to similarly employed workers in a specific occupation in the area of intended employment. *Skilled Labor Risk* and all firm-level controls are lagged one fiscal year. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Log(H1-B Salary for Skilled Labor)	
	OLS	IV
	(1)	(2)
Skilled Labor Risk	0.004**	0.056***
	[0.002]	[0.016]
First-stage F-stat		23.24
Log(Prevailing Wage)	Y	Y
Firm Controls	Y	Y
Ind. FE & Yr. FE	Y	Y
N	152906	152906

Table 10: **Skilled Labor Risk and Employee Incentive Pay Ratio**

This table reports the OLS and 2SLS estimations of the effects of a firm's skilled labor risk on the incentive structure of the compensation for employees. Panel A reports the estimations for employees below the top rank and Panel B report various robustness results. The dependent variable in Panel A is the average incentive pay to total pay ratio, which is the ratio of the Black-Scholes value of broad-based stock options (BBSO) granted to the non-top-executive employees to their total compensation. The sample period in Panel A is from fiscal year 1996 to 2005. Panel B reports robustness results. In columns (1) and (2), we set the incentive pay ratio for non-top-executive employees to be zero if the firm is covered by Execucomp but does not report stock option grants to all employees. In columns (3) and (4), the sample is still the Execucomp sample (1996-2005) and the dependent variable is the average incentive pay to total pay ratio for all employees, including top executives. In columns (5) and (6), we use the Compustat sample (2006-2013) and the dependent variable is the ratio of equity-based compensation on a pre-tax basis (Compustat item STKCO) to total pay for all employees, including top executives. IV indicates 2SLS estimations using home equity shock as an instrument for the firm's skilled labor risk. Home equity shock is defined as the yearly change in the national house price index divided by the topological elasticity of housing supply at the MSA level. The firm-level control variables in all estimations are the same as those in Table 9. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Panel A: Non-top-executive Employees (Execucomp sample, 1996-2005)	
	OLS	IV
	(1)	(2)
Skilled Labor Risk	0.007***	0.030***
	[0.001]	[0.010]
First-stage F-stat		28.33
Firm Controls	Y	Y
Ind. FE & Yr. FE	Y	Y
N	7611	7611

	Panel B: Robustness Results					
	Setting Missing Incentive Pay Ratio in Panel A to Zero (Execucomp sample, 1996-2005)		All Employees (Execucomp sample, 1996-2005)		All Employees (Compustat sample, 2006-2013)	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Skilled Labor Risk	0.006***	0.030***	0.007***	0.033***	0.002***	0.022***
	[0.001]	[0.009]	[0.001]	[0.010]	[0.000]	[0.006]
First-stage F-stat		29.02		28.79		31.51
Firm Controls	Y	Y	Y	Y	Y	Y
Ind. FE & Yr. FE	Y	Y	Y	Y	Y	Y
N	8958	8958	7624	7624	11446	11446

Table 11: **Skilled Labor Risk and Strengths of Employee Relations**

This table reports the OLS and 2SLS estimations of the effects of a firm's skilled labor risk on its strengths of employee relations. The data on the strengths of employee relations is from the MSCI database. The dependent variable in Panel A is *Total Strengths of Employee Relations*, which is defined as the average rating across all evaluated strength dimensions in employee relations. The dependent variable in columns (1)-(3) of Panel B is *Compensation&Benefits-Related Strengths*, which is defined as the average rating in employee relations related to compensation and benefits. There are four dimensions related to compensation and benefits including "cash profit sharing", "employee involvement", "retirement benefits", and "compensation & benefits". The dependent variable in columns (4)-(6) of Panel B is *Other Strengths*, which is defined as the average rating in employee relations that are not related to compensation or benefits. All dependent variables are forwarded one year. IV indicates 2SLS estimations using home equity shock as an instrument for the firm's skilled labor risk. Home equity shock is defined as the yearly change in the national house price index divided by the topological elasticity of housing supply at the MSA level. The firm-level control variables in all estimations are the same as those in Table 9. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Panel A: Total Strengths of Employee Relations	
	OLS	IV
	(1)	(2)
Skilled Labor Risk	0.000	0.009*
	[0.000]	[0.005]
First-stage F-stat		45.19
Firm Controls	Y	Y
Ind. FE & Yr. FE	Y	Y
N	12831	12831

	Panel B: Compensation&Benefits-Related v.s. Other Strengths			
	Compensation&Benefits-Related		Other	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Skilled Labor Risk	0.001*	0.017**	-0.001	0.001
	[0.001]	[0.008]	[0.000]	[0.005]
First-stage F-stat		46.17		45.19
Firm Controls	Y	Y	Y	Y
Ind. FE & Yr. FE	Y	Y	Y	Y
N	12696	12696	12831	12831

Appendix

Appendix A: Variable Definitions

Variable	Definition
Skilled Labor Risk and Labor Market	
Skilled Labor Risk	Number of sentences a firm spend discussing risk associated with skilled labor in the 10-K in a year. Sources: Corporate 10-K filings in EDGAR Database.
In-State Competition	Fraction of total industry sales (excluding the focal firm's sales) generated by in-state competitors. Source: Compustat.
TNIC HHI	Firm-level sales-based product market concentration using the Text-based Network Industry Classifications (TNIC). Source: Hoberg and Phillips (2016).
TNIC Total Similarity	Firm-level total product similarity using the Text-based Network Industry Classifications (TNIC). Source: Hoberg and Phillips (2016).
Inventor Turnover in Past 3 Yrs	A dummy variable that equals to one if a firm experiences at least one innovator departure in the past three years (including current year) and zero otherwise. Source: Disambiguation and Co-authorship Networks of the U.S. Patent Inventor Database (1975 - 2010).
Executive Turnover in Past 3 Yrs	A dummy variable that equals to one if a firm experiences at least one executive departure in the past three years (including current year) and zero otherwise. Source: Execucomp.
Compensation Policy	
Employee Incentive Pay Ratio	The ratio of the Black-Scholes value of broad-based stock options granted to non-top-executive employees to their total compensation. Sources: Execucomp, Compustat,and QCEW.
Log(H1-B Salary for Skilled Labor)	Natural logarithm of the salary for foreign skilled labor under the H-1B visa program. Source: The Foreign Labor Certification Data Center available at `http://www.flcdatacenter.com/`
Total Strengths of Employee Relations	The average rating across all evaluated strength dimensions in employee relations. Source: MSCI database

Variable	Definition
Compensation&Benefits-Related Strengths of Employee Relations	The average rating in employee relations related to compensation and benefits. There are four dimensions related to compensation&benefits including Cash Profit Sharing Strength, Employee Involvement Strength, Retirement Benefits Strength, and Compensation & Benefits Strength. Source: MSCI database
Other Strengths of Employee Relations	The average rating in employee relations that are not related to compensation and benefits. Source: MSCI database
Firm-year level Characteristics	
Log(Assets)	Natural logarithm of total assets. Source: Compustat.
Firm Age	Number of years since the firm's starting year. The starting year is defined in the following order: (1) the founding year; (2) the IPO year if the founding year is missing; (3) the year of first trading with non-missing price from CRSP if the IPO year is missing; (4) the first year in Compustat if there is no trading information in CRSP. Sources: Jay Ritter's IPO Database, CRSP, and Compustat.
Market to Book	(Equity value+total assets-book equity)/total book assets: (PRCCF_F×CSHO+AT-CEQ)/AT. If CEQ<0, we set it as missing. Source: Compustat.
Tangibility	(Property, Plant and Equipment)/total assets: PPENT/AT. Source: Compustat.
Intangible Assets	(Intangible assets on the balance sheet)/total assets: INTAN/AT. Source: Compustat.
Capex	Capital expenditures/total assets: CAPX/AT. Source: Compustat.
R&D	(Research and development expenses)/total assets: XRD/AT. If XRD is missing, we set it as zero. Source: Compustat.
Sales Growth	(Sales(t)/CPI(t)-Sales(t-1)/CPI(t-1))/(Sales(t-1)/CPI(t-1). Sources: Compustat and FRED Database.
ROA	(Operating Income Before Depreciation)/total assets: OIBDP/AT. Source: Compustat.
Sales Volatility	The standard deviation of 5-year (including the current year) sales to total assets ratio. Source: Compustat.
Existing Related Measures	
Organizational Capital	The measure for the stock of organizational capital in Eisfeldt and Papanikolaou (2013) divided by total assets. Source: Compustat
Modified Organizational Capital	The measure for the stock of organizational capital in Peters and Taylor (2017) divided by total assets. Source: Luke Taylor's webpage at `http://finance-faculty.wharton.upenn.edu/luket/publications/`

Variable	Definition
Mention Key Man Insurance	A dummy variable that equals to one if a firm mentions "Key Man Life Insurance" in at least on electronic corporate filing in a year and zero otherwise. Source: Israelsen and Yonker (2017)
Carry Key Man Insurance	A dummy variable that equals to one if a firm carries “Key Man Life Insurance” in a year and zero otherwise. Source: Israelsen and Yonker (2017)
Industry Labor Skill (%)	Fraction of high skilled labor in an industry. Source: Belo et al. (2017)
Industry Labor Mobility	The reciprocal of the weighted average occupation-level employment concentration in an industry. Source: Donangelo (2014)
Industry-year level Variables	
Quit Rate (%)	Average fraction of employees who left jobs voluntarily at the industry level in a year. The industry is defined in the Job Openings and Labor Turnover Survey (JOLTS). Source: JOLTS.
Layoff Rate (%)	Average fraction of employees who left jobs involuntarily at the industry level in a year. Source: JOLTS.
Other Turnover Rate (%)	Average fraction of employees who left jobs due to reasons other than quitting or being laied off at the industry level in a year. Source: JOLTS.
Fraction of High Skill Labor (%)	Fraction of employees with occupation job zones larger than or equal to 4 in O*NET Online at the industry level in a year. Source: Occupational Employment Statistics (OES) and O*NET Oline.
State-year level Variables	
Non-Compete (Garmaise)	Non-compete agreements enforcement index. Data since 2005 is imputed using the value in 2004. Source: Germaise (2011).
Non-Compete (Starr)	Non-compete agreements enforcement index for year 2009. Source: Starr (2017).
Inevitable Disclosure Doctrine (IDD)	A dummy variable that equals to one if the year of a firm’s fiscal year end date is after the year of the adoption of the IDD and before the year of the rejection of previously adopted IDD, and equals to zero otherwise. Source: Klasa et al. (2017).
Residential Real Estate Transfer Tax (%)	Transfer tax rate on residential housing transactions in a state. Source: Thomson Reuters CheckPoint Database and Lincoln Institute of Land Policy.
Employment Rate	The ratio of number of jobs to total population in a state. Source: The Bureau of Economic Analysis.

Variable	Definition
Log(Income Per Capital)	Natural logarithm of real income per capital in thousands in a state. Source: The Bureau of Economic Analysis.
Log(Population)	Natural logarithm of total population in millions in a state. Source: The Bureau of Economic Analysis.
Home Ownership Rate (%)	Home ownership rate in a state. Source: The United States Census Bureau at `http://www.census.gov/housing/hvs/data/ann15ind.html`.
MSA level Variables	
Home equity shock	Yearly change in the national house price index divided by the topological elasticity of housing supply in an MSA. Sources: Federal Housing Finance Agency and Saiz (2010)

Appendix B: The Effects of Home Equity Shock on Skilled Labor Risk

The home equity shock is defined as the yearly change in the national house price index from the Federal Housing Finance Agency divided by the topological elasticity of housing supply in an MSA. We expect that positive (negative) shocks to household home equity in an area would facilitate (hinder) labor mobility (of homeowners). Thus the home equity shock is expected to be positively related to local firms' skilled labor risk. However, the challenge we face is that once a firm starts to disclose skilled labor risk in its 10Ks in the post SEC Regulation S-K Item 305(c) period (i.e., after 2005), the value of the skilled labor risk measure does not decrease much over time. This is possibly due to concerns of litigation risk. In areas with lower elasticities of housing supply, the housing prices increased more under the long rising national house price trend, leading to higher labor mobility and higher skilled labor risk for firms in those areas. When the positive house price trend turned to negative in 2008 (which is post the SEC regulation), those areas with lower elasticities of housing supply experienced larger drops in house prices. But we may not see a larger decrease in the value of our skilled labor risk measure in those areas due to the rigidity in the measure post the SEC regulation. This problem could even lead to a negative relation between home equity shock and firms' skilled labor risk during years of negative home equity shocks. In the table below, we show that the data support our intuition. In the full sample, there is a significantly positive relation between *Home Equity Shock* and *Skilled Labor Risk*. But the positive relation is concentrated in the years of rising housing prices in the country. In the years with negative home equity shocks, the relation turns to negative, consistent with our discussion above. However, if we examine the probability of a firm initiating discussion about skilled labor risk in its 10K post 2007 (i.e., the value of *Skilled Labor Risk* increases from zero to positive), then we do find a significantly positive relation between *Home Equity Shock* and the probability of initiation in the housing market downturn. In areas with more negative home equity shocks, firms are less likely to start to concern about skilled labor mobility. Overall, the results in this table suggest that *Home Equity Shock* can be a valid instrument for our measure of firms' skilled labor risk, but only in periods with positive home equity shocks.

The Effects of Home Equity Shock on Skilled Labor Risk

This table reports the effects of home equity shock on our measure of firms' skilled labor risk. *Home Equity Shock* is the yearly change in the national house price index divided by the topological elasticity of housing supply in an MSA. The dependent variable in the first three columns is *Skilled Labor Risk*. The dependent variable in the last column is *Initiation of Skilled Labor Risk Discussion*, which is a dummy variable equal to one if the year of a firm's first-time discussion about skilled labor risk is in or after 2007 and zero otherwise. The sample in the last column includes only the post-2007 period and excludes firms that initiated the skilled labor risk discussion in 10Ks before 2007. Standard errors in parentheses are robust and clustered at the firm level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

	Full Sample	Home Equity Shock>0	Home Equity Shock<0	Post-2007
Dependent Variable:	Skilled Labor Risk	Skilled Labor Risk	Skilled Labor Risk	Initiation of Skilled Labor Risk Discussion
Home Equity Shock	6.551***	11.121***	-14.139***	0.308**
	[0.804]	[1.138]	[2.351]	[0.149]
Log(Assets)	0.194***	0.190***	0.189***	-0.009*
	[0.019]	[0.018]	[0.032]	[0.005]
Log(1+FirmAge)	-0.676***	-0.673***	-0.606***	0.036***
	[0.045]	[0.043]	[0.078]	[0.011]
ROA	-0.000	0.038	-0.061	-0.054**
	[0.094]	[0.094]	[0.194]	[0.024]
Market to Book	0.055***	0.061***	0.014	-0.002
	[0.014]	[0.014]	[0.033]	[0.004]
Sales Growth	0.160***	0.148***	0.225***	0.017***
	[0.021]	[0.022]	[0.057]	[0.005]
R&D	0.183***	0.176***	0.197***	-0.004
	[0.024]	[0.023]	[0.050]	[0.005]
R&D Missing	-0.490***	-0.482***	-0.487***	-0.040*
	[0.089]	[0.085]	[0.161]	[0.024]
Tangibility	-2.432***	-2.197***	-2.603***	0.252***
	[0.205]	[0.189]	[0.394]	[0.058]
Intangible Assets	-0.544***	-0.493***	-0.484	0.220***
	[0.202]	[0.190]	[0.352]	[0.046]
Sales Volatility	0.347***	0.375***	0.367	0.109***
	[0.096]	[0.096]	[0.229]	[0.031]
Capex	4.094***	3.837***	4.731***	-0.161
	[0.450]	[0.441]	[1.012]	[0.121]
SIC2 FE & Yr FE	Y	Y	Y	Y
Adj. R^2	0.311	0.319	0.210	0.079
N	58740	46171	12569	12333