Leverage, Labor Market Size, and Employee Pay*

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Abstract

We study the effect of firm leverage on employee pay. Our empirical approach exploits within-firm variation in expected unemployment costs due to variation in labor market size. We find that, following an increase in firm leverage, workers with higher ex ante unemployment costs experience higher wage growth relative to workers at the same firm with lower ex ante costs. The results are consistent with higher wages compensating for unemployment risk; the effect is strongest at distressed firms and we do not find a similar relationship in labor productivity or firm growth. Finally, firms with high payrolls reduce leverage when the labor markets of their workers shrink.

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Financial distress imposes significant costs on employees. Following periods of financial distress, firms significantly reduce employment (Hotchkiss (1995), Agrawal and Matsa (2013), Falato and Liang (2014)). This imposes costs on employees through two channels. First, search and matching frictions give rise to periods of unemployment (Mortensen and Pissarides (1994)), leading to lost wages and a deterioration in skills. Second, an unemployment spell can lead to lower wages in the long run due to the elimination of firm-specific capital (Becker (1962)) or due to a lower quality match between employee and employer (Jovanovic (1979)). Consistent with this theoretical evidence, Graham et al. (2015) find empirically that workers experience significantly lower wages for at least five years following a bankruptcy of their employer.

The ex post reduction in lifetime earnings suggests that employees of highly levered firms should be compensated for the increased distress risk. In other words, higher firm leverage should lead to higher employee compensation (Berk, Stanton, and Zechner (2010)).

However, estimating the effect of leverage on wages is challenging due to endogeneity concerns. First, selection bias is likely important. In particular, if firms need to compensate individuals for distress risk, optimal leverage ratios will be lower than if workers do not demand compensation. Second, omitted variables such as the marginal product of labor will also lead to biased estimates. For instance, firms may issue equity to finance new investment in labor-augmenting technology. As a result, leverage ratios decrease and, because the marginal product of labor increases, wages will likely increase. Therefore, the observed relationship between leverage and employee compensation does not represent a causal effect but rather arises due to an important omitted variable.

Our empirical approach addresses these concerns by using worker-level data from the Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) program to exploit within-firm variation in the expected costs of unemployment. The expected costs of unemployment vary across workers due to factors such as geographical differences in search and matching frictions. Therefore, when a firm increases its leverage, workers at the firm with higher expected costs of unemployment should demand a higher wage premium than other workers. At the same time, by exploiting within-firm variation, we are able to account for firm-level shocks that determine firm leverage.

Using this framework, we provide evidence that higher leverage does lead to higher employee compensation. For each worker, we proxy for the expected cost of unemployment using the relative size of the individual's labor market, which we calculate as the industry share of state employment relative to the industry share of national employment.[1] We find that, within a firm, wages for employees with smaller labor markets grow faster than other employees at the firm in response to an increase in firm leverage. The estimates imply that, in response to a 10 percentage point increase in leverage, employees in small labor markets earn a wage premium of 0.5% relative to employees who work in larger labor markets at the same firm.

We then use this cross-sectional result to estimate the effect of firm leverage on employee pay. Under the assumption that workers in the largest labor markets require no wage premium in return for higher firm leverage, our estimates imply that an 10 percentage point increase in leverage increases total employee pay at the firm by approximately 52 basis points of firm value, implying that labor costs are an important consideration for firms when choosing their capital structure.

These results may understate the effect of leverage on labor costs because the employee wages are relatively sticky.[2] In particular, the wages of new employees are likely to be more responsive to changes in firm leverage. Indeed,

[1]For evidence on the relationship between labor market size and the costs of unemployment, see, for example, Helsley and Strange (1990), Petrongolo and Pissarides (2006), and Bleakley and Lin (2012).

[2]For evidence, see Barattieri, Basu and Gottschalk (2014).

we find that the effect remains significant for the sample of new employees and that the magnitude of the effect is larger than for continuing employees. We find that, among new employees at a given firm, a 10 percentage point increase in leverage leads new employees in small labor markets to earn approximately 0.9% more than new employees in larger labor markets.

Our main set of results proxies for an individual's labor market using the industry share of state employment relative to the industry share of national employment. While this measure has the benefit of being available for all public firms, it almost surely misstates the size of any individual's labor market. In robustness tests, we identify the individual's labor market by further restricting it to employees with similar age, education and income. The results are qualitatively unchanged.

Furthermore, the results are strongest for workers at firms that are more likely to become distressed, consistent with the interpretation that the effect arises from compensation for distress risk. We compute the probability of default for each firm following the methodology of Bharath and Shumway (2008) and then split the sample into workers at firms with high and low default probabilities. We find that the effect is approximately two and a half times stronger for workers at high default probability firms. At high default probability firms, workers in small labor markets earn about 1.1% more than workers in large labor markets due to a 10 percentage point increase in firm leverage. At low default probability firms, in contrast, the wage premium for workers in small labor market earn is approximately 0.4%. We also identify distressed firms following the spirit of Opler and Titman (1994) and similarly find larger effects for the population of workers at distressed firms.

An alternative explanation of our results is that higher wages are in response to higher productivity. While we control for shocks to firm-level productivity, it may be the case that omitted variables at the firm-state level account for the result. For instance, the results may be due to new equity being used to finance new investment in labor-augmenting technology in specific states. We conduct a number of analyses to rule out this explanation.

First, using establishment-level data on output at manufacturing firms, we study the relationship between changes in leverage, labor market size, and changes in labor productivity. We find no evidence that greater changes in leverage are associated with greater changes in labor productivity for workers in smaller labor markets.

Second, we study firm-state growth rates. If our results are due to a localized productivity shock, we would expect the establishments benefitting from positive shocks to grow faster than the firm's other establishments.[3]. We find no evidence of differential effect on growth rates in employment, establishment counts, sales, or valued added.

Given that increased leverage leads to significantly higher labor costs for the firm, particularly those located in small labor markets, we study the effect of labor market size on firm leverage choices. We find that no significant relationship for the sample of all firms. However, we find important heterogeneity across firms. Larger labor markets are associated with higher leverage for firms with high labor costs, who would experience significant increases in costs and large decreases in profits. For firms with low labor costs, in contrast, the relationship is negative and insignificant. Thus, for at least a subset of firms, labor market size does appear to play a role in firm leverage decisions.

This paper contributes to the growing literature on the relationship between finance and the labor market. The most closely related papers are Chemmanur, Cheng, and Zhang (2013), Graham et al. (2015), Agrawal and Matsa (2013), and Kim (2015).[4] Chemmanur, Cheng, and Zhang (2013) study the relationship between leverage and employee compensation. However, their measure of employee compensation is based on Compustat data on labor and related expenses. This variable is missing for approximately

[3]The firm's internal capital markets will also reallocate scarce resources toward those establishments as well (Stein (1997)).

[4]See also Peters and Wagner (2014).

90% of firms and cannot account for the changing composition of workers. Graham et al. (2015) study the long term effects on employee earnings following bankruptcy and uses the ex post wage loss to calculate an ex ante premium required to offset the realized losses. Agrawal and Matsa (2013) study the effects of changes in state unemployment benefits on firm leverage and use the observed relationship to calculate the labor costs of financial distress. Kim (2015) studies the opening of new manufacturing plants leads to an increase in leverage for other manufacturing firms in the same county. In contrast, our approach calculates the ex ante wage premium that employees do receive as compensation for the increased probability of financial distress.

Second, it more broadly relates to the labor economics literature on compensating differentials. For example, Topel (1984) use variation in unemployment insurance coverage to estimate a compensating differential of 2.5% for a one point increase in the probability of unemployment.[5] While papers in this literature typically exploit variation in aggregate risk, we incorporate firm-specific variation in unemployment risk into the analysis, which likely better captures the risk of employment of individual workers.

Finally, there is a significant literature in trying to understand the costs of financial distress, most notably Andrade and Kaplan (1998) and Graham (2000). Recent papers such as Agrawal and Matsa (2013) and Graham et al. (2015) have incorporated labor costs into these calculations. Unlike these papers, however, we estimate the labor costs of financial distress using actual ex ante employee compensation.

The paper is organized as follows. Section I describes the theoretical motivation and empirical framework. Section II describes the data. Section III describes the results and section IV concludes.

[5] See also Abowd and Ashenfelter (1981), Li (1986), Rosen (1986), and Moretti (2000).

1 Theoretical and Empirical Framework

Firm financial distress leads to a significant decline in employment, imposing large costs on its employees. These costs arise due to the fact that unemployment leads to lower lifetime earnings. The reduction in earnings is due both to long unemployment spells (Katz and Meyer (1990), Meyer (1990), and Krueger and Mueller (2010)) and lower wages in subsequent employment (Gibbons and Katz (1991), Farber (2005), Couch and Placzek (2010)).

Theoretical and empirical evidence suggests that firms compensate individuals for bearing unemployment risk. For instance, in Abowd and Ashenfelter (1981), workers require a wage premium, also known as a compensating differential, to work for a sector with unemployment risk. Exploiting variation in unemployment risk across industries, they estimate individuals earn compensating differentials of up to 14%. Berk, Stanton, and Zechner (2010) provide theoretical support for a positive relationship between leverage and employee compensation which Chemmanur et al. (2010) find to be true empirically.

While the evidence suggests that increased firm leverage will lead to higher compensation for workers, the costs of unemployment are not constant across workers at a firm. For example, the individual's labor market plays an important role in the magnitude of lost earnings. In particular, individuals in larger labor markets face lower expected unemployment costs as they earn higher wages upon returning to employment (Helsley and Strange (1990) and Petrongolo and Pissarides (2006)).

Therefore, the compensation that workers receive in return for bearing financial distress risk should vary, even within a single firm. Workers with relatively larger labor markets should receive a lower wage premium for unemployment risk than workers with relatively small labor markets. In other words, when a firm increases its leverage, workers with large labor markets should experience lower pay growth than workers with small labor markets.

To test this implication, we run panel regressions using worker-firm level data relating changes in worker pay to labor market size and its interaction with changes in firm leverage. Specifically, we estimate:

$$\begin{aligned}\Delta Pay_{ijkl,t\rightarrow t+1} &= \alpha+\beta_1\Delta Lev_{j,t-2\rightarrow t-1}Size_{kl,t-1}\\ &+ \beta_2\Delta X_{j,t-2\rightarrow t-1}Size_{kl,t-1}\\ &+ \beta_3 Y_{i,t-1}+\gamma_{jt}+\eta_{kt}+\nu_{ijkl,t\rightarrow t+1}\end{aligned} \quad (1)$$

where $\Delta Pay_{ijkl,t\rightarrow t+1}$ is the growth in pay for employee i at firm j in state k and industry l from year t to $t+1$, $\Delta Lev_{j,t-2\rightarrow t-1}$ is the change in leverage for firm j from year $t-1$ to t, $Size_{kl,t-1}$ is the size of the labor market in state k and industry l, $\Delta X_{j,t-2\rightarrow t-1}$ represents a vector of controls for firm j from year $t-1$ to t, and $Y_{i,t-1}$ represents controls for employee i in year $t-1$. In addition, firm-year fixed effects γ_{jt} and state-year fixed effects η_{kt} are included. Therefore, estimates of β_1 measure the differential effect on wages that changes in firm leverage have on workers at the same firm residing in labor markets of different size.

Furthermore, if the size of labor markets affect the wage premium for distress risk, they may also play a role in determining the optimal leverage of a firm. According to the tradeoff theory of capital structure, firms choose debt levels such that the value of debt tax shields offsets the costs of financial distress. As Agrawal and Matsa (2015) argue, the need to compensate workers for added distress risk is an additional factor firms consider when choosing debt levels. Consistent with this argument, Agrawal and Matsa (2015) find that increases in state unemployment insurance benefits lead to increases in leverage for firms headquartered in the state.

If smaller labor markets amplify the premium that firms pay employees for bearing distress risk, variation in labor market size across firms and over time will also affect firm financing decisions. In other words, when the size of labor market increases, the costs of unemployment declines and therefore the wage premium declines. The decline in additional labor costs should then induce firms to increase leverage.

We test this implication by estimating panel regressions using firm-level data relating changes in firm leverage to changes in the average labor market size for its employees. Specifically, we estimate:

$$\begin{aligned} \Delta Leverage_{j,t-1\to t} &= \alpha + \beta_1 \Delta AvgSize_{j,t-2\to t-1} \\ &+ \beta_2 \Delta X_{j,t-2\to t-1} + \eta_{i,t-1\to t} \end{aligned} \quad (2)$$

where $\Delta AvgSize_{j,t-2\to t-1}$ is the change in average labor market size for employees at firm j from year $t-2$ to $t-1$. Therefore, estimates of β_1 measure the response of firm leverage to changes in the average labor market size.

2 Data and Summary Statistics

2.1 Data

We construct a unique worker-firm-level dataset that combines data on individual workers with data on the firms for which they work. Worker-level data is from the U.S. Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) program. The LEHD data cover 25 states[6] and provides detailed data on worker earnings and other characteristics. The Employment History File (EHF) provides data on quarterly earnings for each worker-firm pair. The Individual Characteristics File (ICF) provides data on worker age, gender, education, and race.

We match the worker data to firm data from other Census datasets as well as Compustat and CRSP. We use the Census Bureau's Longitudinal Business Database (LBD) to construct measures of employment and the number of establishments at the level of the firm and the firm-state. We also use

[6]There is considerable variation across states in terms of the time period covered with some states having coverage from 1991 to 2008 while data for other states not beginning until 2000.

the Census Bureau's Census of Manufacturers (CMF) and Annual Survey of Manufacturers (ASM) to calculate measures of the value of shipments and value added at the level of the firm and the firm-state. The Census data are matched with Compustat and CRSP using the Compustat-SSEL bridge.[7]

We exclude financial firms (SIC codes 6000-6999), utilities (SIC codes 4900-4999), and public administration firms (SIC codes 9000-9999) and restrict the sample to workers between the ages of 25 and 64. Due to the size of the dataset as well as the large number of fixed effects in many of our specifications, we currently use a 5% random sample of the full dataset. This yields a sample of 2,556,000 observations, covering 706,700 workers at 3,900 firms between the years 1991 and 2008.[8]

Our key variables are constructed as follows. Our main dependent variable is the change in log average quarterly earnings at the firm. We calculate leverage as debt in current liabilities plus long-term debt relative to assets. We follow Leary and Roberts (2014) to construct firm-level controls for profitability, size, market-to-book ratio, and asset tangibility. Marginal tax rates are from John Graham's website.

Finally, our primary measure of labor market size is based on data from the LBD. This measure is calculated as the industry share of employment in a state relative to the industry share of employment for the nation, where industry is defined using three-digit SIC codes. In robustness tests, we use alternative measures of labor market size based on LEHD data on worker age, education, and earnings. To do so, we create age groups (22-25, 26-30, etc.), education groups (did not graduate high school, high school graduate, attended some college, college graduate, attended graduate school), and earnings groups (less than $25,000, etc.). We then calculate the number of

[7]The current version of the Compustat-SSEL bridge is only available through 2005. We extend the bridge through 2008 using employer name and EIN following the procedure described in McCue (2003).

[8]Counts have been rounded to the nearest hundred following disclosure guidelines by the U.S. Census Bureau.

workers in the same state, industry, age group, education group, and earnings group. Similar to our primary measure, we then deflate this count by the number of workers in the same industry, age group, education group, and earnings group across the country.[9] While this measure is only available for a subset of states and therefore cannot be used in our analysis of firm leverage choices, it very likely more accurately captures the availability of jobs for a given worker. In addition, because it varies across workers in the same firm and state, it allows for firm-state-year fixed effects in order to control for productivity shocks at the level of the firm-state.

2.2 Summary Statistics

Table 1 provides summary statistics for our sample.[10] Panel A presents statistics for worker data. Interestingly, average pay growth is -2.5% per year. This appears to due to a mass of large declines in pay growth and is likely due to the fact that half of all new jobs end within one year (Farber (2005)). Median pay growth, in contrast, is 3.6% per year. Average quarterly earnings are approximately $11,000 with a median of approximately $8,800. Because these are earnings at specific firms, this relatively low level of earnings again suggests that turnover is an important factor in the earnings data. Finally, the average labor market size is noticeably larger than one for all three measures, reflecting a high degree of industry agglomeration.

Panel B presents statistics for data consolidated to firm-year observations. Average (median) firm leverage is approximately 23% (21%). Consistent with the literature on the stability of firm leverage,[11] the average (median) change in leverage is only 0.3% (-0.1%). However, the standard deviation is approximately 8%, suggesting that a substantial set of firms do exhibit large changes

[9]Note that, because the LEHD only includes data on 25 states, this national count only covers those 25 states.

[10]All variables are winsorized at the 1st and 99th percentiles.

[11]See, for example, Lemmon, Roberts and Zender (2008) and Graham and Leary (2011)

in leverage.[12]

3 Results

In this section, we examine the effect that firm leverage has on employee compensation. Before we present the estimates of equation 1, we first analyze the correlation between leverage and pay. To do so, we estimate the regression

$$Pay_{ijt} = \alpha + \beta_1 Leverage_{j,t-1} + \beta_2 X_{i,t-1} + \beta_3 Y_{j,t-1} + \eta_{it} \qquad (3)$$

The results are presented in Table 2.

We find no evidence that higher leverage is associated with higher employee pay. The estimated effect of leverage is negative in four of the five specifications and marginally significant in only one of those specifications.

As discussed above, this analysis fails to account for potential selection bias, where firms will choose lower levels of leverage if doing so reduces employee compensation, and omitted variable bias, where unobservable factors such as investment opportunity and productivity shocks affect both firm leverage and employee compensation. To account for these sources of bias, we then estimate equation 1 and present the results in Table 3.

In contrast to the previous results, we find that leverage has an important effect on employee wages. Column 1 presents the main specification. We find that the estimate of the interaction between the change in firm leverage and labor market size is negative and highly significant. In other words, the pay of employees in relatively small labor markets increases in response to increased firm leverage, relative to employees at the same firm in larger labor markets. In column 2, we include worker fixed effects to control for worker-level unobservable characteristics. The coefficient on the interaction term remains negative and significant and is largely unchanged in magnitude.

[12] See, for example, DeAngelo and Roll (2015).

In columns 3 and 4, we use a binary version of labor market size. In every year for every firm, we identify the median labor market size for employees at the firm. Employees whose labor market size is larger than the median are classified as working in large labor markets while other workers are classified as working in small labor markets. Again, the interaction between our measure of labor market size and the change in firm leverage remains negative and significant.

In columns 5 and 6, we interact labor market size with the log change in total firm debt, rather than the change in leverage. One potential concern is the firm leverage is changing due to changes in the denominator of the leverage ratio, firm assets, rather than the numerator, firm debt. However, the estimates in columns 5 and 6 show that the effect is due to changes in debt levels. The interaction of labor market size and the change in firm debt also enters negatively and significantly.

To understand the economic magnitudes of the estimate, consider two employees at a firm. The labor market of Employee A is in the 25th percentile of size while the labor market of Employee B is at the 75th percentile of size. If the firm increases its leverage by 10 basis points, the estimates in column 2 imply that Employee A earn approximate 0.5% more than Employee B due to the change in leverage.

Furthermore, we can use these cross-sectional estimates to calculate the effect of firm leverage on compensation. To do so, we split the samples into deciles based on labor market size and classify workers in the top decile as the control group. We then calculate the wage effect as the by multiplying the estimated coefficient for the interaction term by each decile's average labor market size minus the top decile's average labor market size. Under the assumption that the top decile is a legitimate control group, the estimate implies that, for a worker in middle two deciles of the labor market size distribution, a 10 percentage point increase in firm leverages increases pay by approximately 3.6%.

We then map these estimates to yield a firm-level estimate of the effect of firm leverage on employee compensation. For each worker at each firm, we calculate the effect of an increase in leverage in the manner described above.[13] We then sum the worker-level effect across all workers at the firm to calculate the total change in pay at the firm.

Assuming again that the top decile is a legitimate control group, the estimate in column 2 implies that, for a 10 percentage point increase in the leverage of the average firm, total firm payroll increases by approximately 52 basis points of firm market value. This estimate, similar in magnitude to the estimates in Agrawal and Matsa (2013), implies a substantial cost of higher leverage for firms. Almeida and Philippon (2007) calculate that the difference of the tax benefits and costs of financial distress range are at most 65 basis points of firm value (for BBB-rated firms). Our estimates imply that added labor costs can account for a large fraction of this difference.

Consistent with the literature on the effects of agglomeration, we find that the estimate on labor market size is consistently positive and significant. Workers in larger labor markets experience higher wage growth, possibly reflecting higher growth in productivity as in Glaeser and Mare (2001).

While we document an wage effect, sticky wages may mean that the estimates in Table 2 might understate the effect of leverage on total firm wage costs. For instance, Barattieri, Basu and Gottschalk (2014) find that workers that switch jobs are much more likely to have a change in wage than workers that remain at the same firm.[14] Therefore, we next examine the effect on wage levels for new employees at the firm. Specifically, we re-estimate equation 1 where the dependent variable is the log average quarterly wage in year t for all workers who joined the firm in year t. The results are presented in Table 3.

[13]Note that we are able to use the LBD for this calculation because labor market size is defined using only the industry and state of the worker. As a result, this calculation incorporates all U.S. employees at the firm.

[14]See also Topel and Ward (1992).

As expected, the effects on new employee wages are stronger than the effects on existing employees. The estimate on the interaction term is positive and statistically significant in all three specifications. Using the estimate in column 1, a new employee whose labor market size is equal to the 25th percentile will earn approximately 0.9% more than a new employee at the 75th percentile of labor market size due to a 10 percentage point increase in leverage. Exploiting the cross-sectional results to estimate the effect of leverage on pay as described above, the estimate implies that the 10 percentage point increase in leverage increases pay for the average new worker by 6.8%.

In our previous analysis, we have defined the size of an individual's labor market on the basis of location and industry. This definition has the benefit of being easily calculated for all firms regardless of whether or not they are located in states covered by the LEHD. However, the measure also is a noisy measure of the individual's actual labor market. For instance, a 25 year old administrative assistant and a 55 year old manager have very different skill sets and very different labor markets even if they work at the same establishment. Therefore, in Table 4, we use the labor market size variables that only count jobs held by individuals with similar age, education, and income. The results are presented in Table 4.

The estimates are similar to the estimates in Table 2. The interaction term enters negatively and significantly in all six specifications. Unlike in previous specifications, the definition of labor market size allows us to include state-industry-year fixed effects in columns 3 and 4 to control for state-industry-level shocks. The estimates are virtually unchanged in comparison to the estimates in columns 1 and 2, providing further evidence that local shocks are not driving the results. The economic magnitudes are also virtually unchanged from the main specifications; the estimates imply that employees at the 25th percentile of labor market size will earn about 0.5% more than employees at the 75th percentile as a result of a 10 percentage point increase in firm leverage.

Thus far, we have documented an important relationship between employee wages, firm leverage, and labor market size. If this relationship arises as compensation for increased risk of financial distress and unemployment, we would expect that the effects are strongest in firms with a meaningful probability of distress. Workers at firms with extremely low probabilities of distress, in contrast, are unlikely to require a significant premium when firm leverage increases. Therefore, in Table 5, we split the sample on the basis of the probability of firm distress.

In columns 1 and 2, we estimate equation 1 separately for workers at firms with a probability of default of at least 5% and those at firms with a probability of default of less than 5%, where the probability of default is calculated using the methodology of Bharath and Shumway (2008).

In both samples, we find a negative and significant estimate for the interaction of the change in leverage and labor market size. While both are significant, the magnitude of the estimate is approximately two and a half times larger for the sample of workers at firms with a higher probability of default. The estimates imply that, at high default probability firms, a worker at the 25th percentile of labor market size will earn approximately 1.1% more than a worker at the 75th percentile as a result of a 10 percentage point increase in leverage. At low default probability firms, workers at the 25th percentile earn 0.4% more following a similar increase in leverage.

Translating this into a firm-level effect following the methodology outlined above, the estimates imply that a 10 percentage point increase in leverage increases employee compensation by 130 basis points of firm value for the high default probability firms. For low default probability firms, however, the increase in leverage would increase compensation by only 40 basis points of firm value.

As discussed above, one potential concern is that the changes in leverage arise due to changes in firm assets rather than debt levels. This concern may be particularly valid for firms that already have a high probability of default.

Therefore, in columns 3 and 4, we present estimates where we interact labor market size with the log difference in total debt.

The results are similar to the estimates in columns 1 and 2. For both populations, the interaction term enters negatively and significantly. However, the magnitude of the estimate implies that the effect is approximately three times larger for high default probability firms.

Finally, similar to the approach of Opler and Titman (1994), we identify distressed firms as firms with negative sales growth and stock market declines of at least 30% in the previous year. We then estimate equation 1 for workers at distressed firms and non-distressed firms separately. The results for these samples are in columns 5 and 6.

Again, the interaction term for both samples is negative and significant, suggesting workers in smaller labor markets do experience higher wage growth in response to increased firm leverage. However, the magnitude of the estimate for the distressed firm sample is more than four times larger than for the non-distressed firm sample. Thus, the results are consistent with the explanation that the higher wages are compensation for distress risk.

An alternative explanation for the effect on wages is that it is due to higher labor productivity rather than compensation for distress risk. For instance, suppose that there is a positive productivity shock in a given state-industry. Firms respond by increasing employment, thereby increasing the size of the labor market. At the same time, public firms raise equity to increase more heavily in their establishments in that market. These investments increase labor productivity and therefore wages rise. While this provides an explanation for our previous results, we rule out this explanation in two ways.

First, we test directly for an effect on labor productivity. We use data on establishment-level output from the Census of Manufacturers and Annual Survey of Manufacturers to calculate measures of average labor productivity at the firm-state level. We then re-estimate equation 1 with labor productivity as the dependent variable. The results are presented in Table 7.

In columns 1 and 2, we first replicate the analysis in Table 3 for the manufacturing subsample. The estimates are virtually unchanged; the interaction term is negative and significant and the magnitude is very similar to the full sample estimates. In column 3 and 4, we study the effect on the growth in average output per worker. Unlike the wage regressions, the estimate on the interaction of the change in firm leverage and labor market size is insignificant with an inconsistent sign. Similarly, in the estimates of the growth in average value added per worker, the interaction term enters positively and insignificantly. Thus, while the manufacturing subsample continues to show higher wage growth for workers in smaller labor markets following increases in firm leverage, there is no differential effect for labor productivity. In other words, workers in smaller labor markets receive higher wages without an accompanying increase in productivity.

Second, we test whether firm performance is consistent with localized productivity shocks. In particular, if a particular set of a firm's establishments become more productive, we would expect those establishments to grow faster than the firm's other establishments. To test for difference in growth rates with a firm, we calculate firm-state measures of growth in employment and number of establishments from the LBD and growth in output per worker and value added per worker for manufacturing firms from the CMF and ASM and then re-estimate equation 1. The results are presented in Table 8.

In all four tests, we find an insignificant effect of the interaction of the change in leverage and labor market size. In addition, three of the four estimates are positive, in contrast to the negative estimates in the pay growth regressions. Thus, there is no evidence that firms are reallocating resources towards its operations in smaller labor markets following an increase in leverage, which is inconsistent with those markets receiving a positive productivity shock.

We have found that labor market size has a significant role in how firm leverage affects employee wages; employees in smaller labor markets have relatively larger wage growth in response to increases in firm leverage. These results suggest that, when increasing leverage, firms in smaller labor markets therefore need to pay larger wage premiums than other firms. Given this implication, we test the relationship between labor market size and level by estimating equation 2.[15] To generate a firm-level measure of labor market size, we calculate the mean size across workers, weighted by compensation. The results are presented in Table 9.

In columns 1 and 2, we find little evidence that firm leverage responds to changes in the labor market size of its employees. In both cases, while the estimate is positive, it is insignificant and small in magnitude, with a change in labor market size equal to the sample mean of 0.9 increases leverage by 0.4 percentage point.

However, while firms in smaller labor markets need to compensate their employees when increasing leverage, the effect of this additional compensation on the firm's earnings and valuation varies with the firm's use of labor. Holding the labor market size of its employees constant, firms with relatively high initial payroll will experience greater increases in costs and greater declines in profitability. Therefore, the leverage of firms with high levels of payroll are likely more responsive to changes in labor markets than firms with relatively low payrolls.

We therefore split the sample and re-estimate equation 3 for high- and low-payroll firms separately, where high-payroll firms are firms whose payroll relative to operating costs are above the sample median. The estimates in column 3 do show that the leverage of high-payroll firms does respond to changes in labor market size. The estimate is positive, large, and statistically significant. The estimate implies that a change in labor market size equal to the sample mean increases leverage by approximately 1.2 percentage

[15]Because we are using only firm-level data, this sample consists of the entire CRSP-Compustat sample, not only the firms that also are in the LEHD.

points. Relative to the average leverage of 23%, this represents an increase of approximately 5%. In contrast, the estimate in column 4 is negative and insignificant, suggesting that low-payroll firms do not adjust their leverage in response to changing labor markets.

4 Conclusion

We find evidence that higher firm leverage increases employee compensation. Exploiting within-firm variation in labor market size as a proxy for expected unemployment costs, we find that employees in smaller labor markets experience higher wage growth than other employees in response to increased firm leverage. This effect is stronger for new employees and is robust to alternative specifications of labor market size.

The results suggest that the increased pay is compensation for distress risk. The results are strongest for employees at firms with an elevated probability of default and at distressed firms. Moreover, there is no evidence that the increased pay reflects higher productivity.

We also find evidence that labor market size affects firm leverage, at least for the subset of firms with high labor costs. Higher labor cost firms significantly increase leverage following increases in the size of the labor market. The leverage of low labor cost firms does not respond. These results are consistent with the effects of leverage and labor market size on wages. For the former set of firms, operating costs and profits are more sensitive to growth in employee compensation. Therefore, because of the relationships that we document, their optimal leverage is more closely tied to the size of the labor market than other firms.

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Table 1: Summary Statistics

This table presents summary statistics for worker-level variables in Panel A and firm-level variables in Panel B. The sample consists of 2,556,000 worker-firm-year observations from 1991 through 2008, representing a 5% random sample of the intersection of the LEHD, LBD, CRSP, and Compustat. See text for variable definitions.

	N	Mean	Std. Dev.	Median
Panel A: Worker Level Variables				
ΔPay	2,556,000	-0.025	0.570	0.036
Pay	2,556,000	11,043.020	8,876.562	8,046.560
Size	2,556,000	1.705	1.858	1.086
Size (Age and Ed)	2,556,000	1.501	1.507	1.080
Size (Age, Ed, and Inc)	2,556,000	1.566	1.831	1.064
Panel B: Firm Level Variables				
Leverage	25,100	0.233	0.190	0.213
ΔLeverage	25,100	0.003	0.077	-0.001

Table 2: Employee Pay and Leverage

This table presents OLS regressions using worker log average quarterly pay as the dependent variable. The key independent variable is lagged firm leverage. Worker controls include worker age and age squared and indicator variables for race, male, high school graduate, and college graduate. The unit of observation is worker-firm-year. T-statistics are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Leverage	0.243	-0.022	-0.053	-0.035	-0.041
	(1.00)	(0.47)	(1.21)	(1.55)	(1.66)*
Profitability		-0.023	-0.08	0.046	0.030
		(0.22)	(0.59)	(1.07)	(0.77)
Market-Book		0.012	0.012	0.006	0.003
		(1.47)	(2.40)**	(2.05)**	(1.14)
Ln Sales		-0.006	0.027	0.029	0.047
		(0.37)	(2.37)**	(2.04)**	(2.73)***
Asset Tangibility		-0.159	-0.114	-0.089	-0.113
		(2.13)**	(1.53)	(1.52)	(1.80)*
Marginal Tax Rate		0.012	0.089	0.038	0.037
		(0.15)	(1.08)	(0.45)	(0.34)
Worker Controls	no	yes	yes	yes	yes
Levels/First Diff	Levels	Levels	Levels	First Diff	First Diff
Year FE	no	yes	yes	yes	yes
State FE	no	yes	yes	yes	yes
Firm FE	no	yes	yes	yes	yes
Worker FE	no	no	yes	no	yes
Obs	2,556,000	2,556,000	2,556,000	2,556,000	2,556,000
R-squared	0.00	0.46	0.85	0.05	0.56

Table 3: Employee Pay, Labor Market Size, and Leverage

This table presents OLS regressions using change in worker log average quarterly pay as the dependent variable. The key independent variable is the interaction of lagged labor market size and the lagged change in firm leverage. Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in all specifications. Worker controls include log lagged average quarterly pay, worker age and age squared and indicator variables for race, male, high school graduate, and college graduate. The unit of observation is worker-firm-year. T-statistics are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Size * ΔLeverage	-0.070	-0.077				
	(3.18)***	(2.94)***				
Large * ΔLeverage			-0.091	-0.086		
			(2.93)***	(2.27)**		
Size * ΔTotalDebt					-0.011	-0.012
					(3.66)***	(3.00)***
Size	0.004	0.005			0.004	0.005
	(3.52)***	(2.39)**			(4.00)***	(2.48)**
Large			0.009	0.004		
			(3.97)***	(1.20)		
Firm Controls	yes	yes	yes	yes	yes	yes
Worker Controls	yes	yes	yes	yes	yes	yes
Firm-Year FE	yes	yes	yes	yes	yes	yes
State-Year FE	yes	yes	yes	yes	yes	yes
Worker FE	no	yes	no	yes	yes	yes
Obs	2,556,000	2,556,000	2,556,000	2,556,000	2,556,000	2,556,000
R-squared	0.08	0.58	0.08	0.58	0.08	0.58

Table 4: Employee Pay, Labor Market Size, and Leverage — New Employees

This table presents OLS regressions using worker log average quarterly pay as the dependent variable. The key independent variable is the interaction of lagged labor market size and the lagged change in firm leverage. The change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in column 1. Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in columns 2 and 3. Worker controls include log lagged average quarterly pay, worker age and age squared and indicator variables for race, male, high school graduate, and college graduate. The unit of observation is worker-firm-year and the sample is restricted to new employees at the firm. T-statistics are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
Size * ΔLeverage	-0.198		
	(2.49)**		
Large * ΔLeverage		-0.185	
		(2.10)**	
Size * ΔTotalDebt			-0.029
			(2.77)***
Size	0.014		0.012
	(1.73)*		(1.57)
Large		0.033	
		(3.60)***	
Firm Controls	yes	yes	yes
Worker Controls	yes	yes	yes
Firm-Year FE	yes	yes	yes
State-Year FE	yes	yes	yes
Obs	968,900	968,900	968,900
R-squared	0.48	0.48	0.48

Table 5: Employee Pay, Labor Market Size, and Leverage — Alternative Definitions of Size

This table presents OLS regressions using change in worker log average quarterly pay as the dependent variable. The key independent variable is the interaction of lagged labor market size and the lagged change in firm leverage. Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in all specifications. Worker controls include log lagged average quarterly pay, worker age and age squared and indicator variables for race, male, high school graduate, and college graduate. The unit of observation is worker-firm-year. T-statistics are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Size * ΔLeverage	-0.052	-0.065	-0.058	-0.060	-0.028
	(2.95)***	(2.87)***	(4.01)***	(3.03)***	(2.43)**
Size	0.003	0.003	0.000	0.002	0.000
	(3.06)***	(2.04)**	(0.16)	(1.23)	(0.18)
Size Definition	age, ed	age, ed	age, ed	age, ed	age, ed, income
Firm Controls	yes	yes	yes	yes	yes
Worker Controls	yes	yes	yes	yes	yes
State-Year FE	yes	yes	no	no	no
Firm-Year FE	yes	yes	yes	yes	yes
Worker FE	no	yes	no	yes	yes
State-SIC3-Year FE	no	no	yes	yes	yes
Obs	2,560,000	2,560,000	2,560,000	2,560,000	2,560,000
R-squared	0.08	0.58	0.10	0.59	0.59

Table 6: Employee Pay, Labor Market Size, and Leverage — Subsamples

This table presents OLS regressions using change in worker log average quarterly pay as the dependent variable. The key independent variable is the interaction of lagged labor market size and the lagged change in firm leverage. Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in all specifications. Worker controls include log lagged average quarterly pay, worker age and age squared and indicator variables for race, male, high school graduate, and college graduate. The unit of observation is worker-firm-year. Columns 1 and 3 restricts the sample to workers at firms with a default probability of at least 5%, columns 2 and 4 restricts the sample to workers at firms with a default probability of less than 5%, column 5 restricts the sample to workers at distressed firms, and column 4 restricts the sample to workers at non-distressed firms. T-statistics are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)		
Size * ΔLeverage	-0.159	-0.050			-0.275	-0.059
	(2.58)***	(2.35)**			(2.22)**	(2.69)***
Size * ΔTotalDebt			-0.025	-0.008		
			(2.71)***	(2.66)***		
Size	0.005	0.003	0.005	0.003	-0.014	0.004
	(1.89)*	(2.19)***	(1.79)*	(2.37)**	(0.89)	(3.31)***
Subsample	High P(Def)	Low P(Def)	High P(Def)	Low P(Def)	Firm Distress	No Firm Distress
Firm Controls	yes	yes	yes	yes	yes	yes
Worker Controls	yes	yes	yes	yes	yes	yes
Firm-Year FE	yes	yes	yes	yes	yes	yes
State-Year FE	yes	yes	yes	yes	yes	yes
Obs	605,000	1,951,000	605,000	1,951,000	90,200	2,466,000
R-squared	0.08	0.07	0.08	0.07	0.10	0.08

Table 7: Labor Productivity, Labor Market Size, and Leverage

This table presents OLS regressions with three dependent variables. The dependent variable in columns 1 and 2 is the change in worker log average quarterly pay, the dependent variable in columns 3 and 4 is the change in the firm-state value of shipments per worker, and the dependent variable in columns 5 and 6 is the change in the firm-state value added per worker. The key independent variable is the interaction of lagged labor market size and the lagged change in firm leverage. Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in all specifications. Worker controls include worker age and age squared and indicator variables for race, male, high school graduate, and college graduate. Columns 1 and 2 also include log lagged average quarterly pay, columns 3 and 4 also include log lagged firm-state value of shipments per worker, and columns 5 and 6 also include log lagged firm-state value added per worker. The unit of observation is worker-firm-year. The sample is restricted to workers at firms with data in the CMF and ASM. T-statistics are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Size * ΔLeverage	-0.061	-0.067	-0.001	0.027	0.047	0.111
	(2.55)**	(2.60)***	(0.02)	(0.55)	(0.74)	(1.32)
Size	0.002	0.000	0.000	0.000	-0.001	0.002
	(1.02)	(0.01)	(0.15)	(0.02)	(0.34)	(0.38)
Dep. Var.	Qtr Pay Growth		Labor Productivity Growth		Value Add Per Emp Growth	
Firm Controls	yes	yes	yes	yes	yes	yes
Worker Controls	yes	yes	yes	yes	yes	yes
Worker FE	no	yes	no	yes	no	yes
Firm-Year FE	yes	yes	yes	yes	yes	yes
State-Year FE	yes	yes	yes	yes	yes	yes
Obs	1,050,300	1,050,300	1,050,300	1,050,300	1,050,300	1,050,300
R-squared	0.10	0.55	0.70	0.83	0.71	0.83

Table 8: Firm-State Growth Rates, Labor Market Size, and Leverage

This table presents OLS regressions using firm-state growth rates as the dependent variable. The dependent variable in column 1 is employment growth, the dependent variable in column 2 is growth in the number of establishments, the dependent variable in column 3 is sales growth, and the dependent variable in column 4 is growth in value added. The key independent variable is the interaction of lagged labor market size and the lagged change in firm leverage. Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in all specifications. The unit of observation is worker-state-year. The samples in columns 3 and 4 are restricted to firms with data in the CMF and ASM. T-statistics are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
Size * ΔLeverage	0.017	0.004	0.009	-0.012
	(0.51)	(0.19)	(0.18)	(0.16)
Size	0.015	0.009	0.010	0.018
	(6.79)***	(6.72)***	(4.04)***	(5.14)***
Dep. Var.	Emp Growth	Estab Growth	Sales Growth	Value Add Growth
Firm Controls	yes	yes	yes	yes
Firm-Year FE	yes	yes	yes	yes
State-Year FE	yes	yes	yes	yes
Obs	118,900	118,900	23,900	23,900
R-squared	0.46	0.58	0.55	0.54

Table 9: Leverage and Labor Market Size

This table presents OLS regressions using change in firm leverage as the dependent variable. The key independent variable is the lagged change in average labor market size. The unit of observation is firm-year. The sample in column 3 is restricted to firms with payroll relative to operating costs above the sample median and the sample in column 4 is restricted to firms below the sample median. T-statistics are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
ΔAvgSize	0.004	0.005	0.011	-0.001
	(1.52)	(1.58)	(2.20)**	(0.28)
ΔProfitability		-0.039	-0.050	-0.013
		(4.45)***	(4.95)***	(0.66)
ΔMB		-0.001	0.000	-0.002
		(1.50)	(0.49)	(2.38)**
ΔLog Sales		0.005	0.005	0.001
		(2.07)**	(1.79)*	(0.28)
ΔAsset Tangibility		0.07	0.039	0.113
		(6.07)***	(2.40)**	(6.85)***
ΔMargTaxRate		-0.017	0.016	-0.053
		(1.69)*	(1.13)	(3.61)***
ΔAltmanZ		0.005	0.006	0.005
		(4.88)***	(4.63)***	(2.18)**
Sample	All	All	High Payroll	Low Payroll
Year FE	no	yes	yes	yes
State FE	no	yes	yes	yes
Firm FE	no	yes	yes	yes
Obs	42,500	42,500	19,000	23,500
R-squared	0.00	0.16	0.22	0.17