Accounting Profits, Market Profits, and the Compensation of Regular Employees*

by

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Abstract

We estimate "CEO style" wage equations using two longitudinal matched employer-employee data sets. We develop a model in which the wages of all employees in a firm are linked to those of top management, which generates specific empirical implications that have already been tested on CEOs. We provide evidence that the wages of "regular" employees in large firms are linked to accounting and stock-market profitability. Differences in the strengths of these links across firms provide support for our model.

1 Introduction

The recent introduction of longitudinal matched employer-employee data sets has proved quite valuable to labor economics by allowing integrated analyses of labor demand and supply. In particular, these data sets allow researchers to control for, and explore the consequences of, unobservable heterogeneity at both the firm and

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*This work was done while I was at the Department of Economics at Dartmouth College.

employee level. Abowd and Kramarz (1999) survey this literature, which has grown impressively large since its beginnings a decade or so ago.

Much of the literature to date has focussed on characteristics that remain fixed over time. Abowd, Kramarz, and Margolis (1999), Abowd, Finer, and Kramarz (1999), and Finer (1997) are good examples of this, estimating models in which an employee's wage is a function of her endowment of human capital, an unobservable person effect that remains constant over time and across firms, and an unobservable firm effect that remains constant over time and across employees. The contribution of this paper is to explore longitudinal aspects of the employer-employee relationship: that is, we estimate the effects of time-varying firm-level variables on employee wages, while controlling for fixed unobservable employer and employee heterogeneity. Specifically, we ask whether a "regular" employee in a firm should expect her wages to increase as a result of an increase in her firm's stock-market and accounting profitability.

While, for most categories of workers, longitudinal matched employer-employee data sets are a recent innovation, CEOs and other high-level executives provide notable exceptions. The primary focus of the executive compensation literature, as surveyed by Murphy (1999), has been to estimate the effect firm performance on executive wealth, while controlling for unobservable individual and firm heterogeneity in a manner similar or identical to the methodology we use in this paper. A reasonable summary of our paper is that we estimate "CEO-style" wage equations on two samples of regular employees. We also develop a theoretical model that predicts that pay-for-performance links of top management should spread throughout the entire firm, and show, for one of the two data sets, results that parallel the CEO compensation literature quite closely.

The paper closest to ours is Hildreth and Oswald (1997) who showed that average wages in a panel of UK firms were increasing in firm profitability, even after controlling for fixed firm effects. The next closest paper is Blanchflower and Oswald (1996) who showed that average wages in US manufacturing industries are positively correlated with industry profitability, even after controlling for fixed industry effects and the average personal characteristics of the industry workforce. Our paper improves on these papers in two important ways. First, in contrast to the two papers mentioned above, we can control for unobserved worker heterogeneity as well as unobserved firm heterogeneity. Second, we use both market and accounting measures of profits, which allows us to compare our results to pay-for-performance results in the executive compensation literature.

The organization of the rest of the paper is as follows. Section 2 describes our two data sets and our empirical methodology. Section 3 provides a model in which the owners of a firm link the CEO's wage to firm performance, which generates firm-wide pay-for-performance policies that arise from the CEO's desire to share compensation risk with her employees. Section 3 also provides evidence, from one of the two data sets, that the wages of regular employees are linked to both stock-market and accounting profits, providing support for the theoretical model. Section 4 reviews the methodology employed by Sloan (1993) to explain cross-sectional differences in the strengths of the links between market and accounting profitability. Section 4 then provides evidence, again for one of our data sets, that closely parallels Sloan's estimates for CEOs, which provides even stronger support for our model. Section 5 presents evidence on the importance of controlling for both unobserved person and firm-specific heterogeneity, and section 6 contains our conclusions.

2 Data Description and Methodology

2.1 Data Sets

This paper uses two data sets. The first is a match of NLSY respondents to Compustat, a firm-level database of publicly traded firms and stock-market data from the Center for Research in Security Prices (CRSP). The second is a match of State of Washington unemployment insurance data to employer data, also taken from Compustat and CRSP.

Individuals in the National Longitudinal Survey of Youth (NLSY 79) from 1986-1994 were matched by hand to information on the employing firm, using the information in confidential NLSY files (see Abowd and Finer 1998). Where possible, these workers were matched to their employing firms, specifically, to the firm that is the ultimate beneficial owner of the employer described in the employer supplement for each job. When these firms appear in Compustat and CRSP, a wealth of firm-level data is available. Appendix A gives the exact definitions for all firm-level variables used in this paper.

The other data set used in this paper comes from administrative unemployment insurance records from the State of Washington. This data set contains earnings reports for a 10% random sample of the Washington State workforce from 1984-1993. Personal characteristics are observed for all individuals who were unemployed at any time during this period. For those who were not unemployed during the sample frame, personal characteristics are imputed using the Current Population Survey.[1] These data are also matched to Compustat and CRSP when possible, again yielding a host of firm-level variables. The match was done on the basis of the employer tax identification number.

Tables 1 and 2 contain descriptive statistics for all of the variables used in this paper. We divide both data sets into manufacturing and non-manufacturing samples for two reasons. First, manufacturing workers are often the focus of economic analyses, with Blanchflower, Oswald, and Sanfey (1994) the most relevant example for this paper. Second, we will present evidence later in the paper that the firm-wide pay-for-performance relationships of the manufacturing sector differ substantially from those in the non-manufacturing sector.

[1] See Abowd, Finer, and Kramarz (1998) for a description of the data imputation process.

Two differences across our data sets are worth mentioning. First, the NLSY is a young sample, with a mean level of experience of 8.79 years for men and 7.95 for women. The corresponding gures from the Washington State sample are 23.73 and 20.55. We will present evidence from the Washington State data that focussing on young workers might not affect our results much. The other important difference is that the Washington State sample has an extremely high percentage of manufacturing workers. While 31% of men and 21% of women in the NLSY work in the manufacturing sector, the corresponding gures from Washington State are 83% and 62%.

2.2 Principal Methodology

The empirical estimates contained in this paper all focus on the effect of rm variables on the log wages of individuals. The dependent variable is always the log of the real hourly wage. While many control variables are included, the estimates of rm-level variables yield the coefficients of interest. Instead of using contemporaneous values for the rm variables, we include values from the previous scal year. Accounting earnings, a crucial variable for our analysis, have wage payments imbedded in them, so lagging this variable might pull the dependent variable out of the right-hand side of the estimating equations. It is not clear whether this problem should also affect market measures like stock return, but lagging market returns seems like a safer procedure.[2] It is also not clear how quickly wages should adjust in response to changes in rm variables. Firms might not have the ability to change wages as soon as the rm s nancial position changes, making lags of rm variables more appropriate.

Four types of regression models are presented in each of the regression tables in this paper. These types are

i. Models accounting for neither unobserved worker nor unobserved rm heterogeneity (simple least squares).

ii. Models accounting for unobserved worker heterogeneity (within person).

iii. Models accounting for unobserved rm heterogeneity (within rm).

iv. Models accounting for both unobserved worker and unobserved rm heterogeneity (rm within person).

The simple least squares results ignore the possibility of rm and individual heterogeneity in the wage determination process, especially heterogeneity that is unobservable to the econometrician. The within person models estimate person effects that control for unobserved heterogeneity, but this method ignores differences in rm wage setting policies that are not captured by the measured rm variables. The

[2] Abowd (1990) nds that union wage bargains to effect the market value of rms.

within firm models are the analogs of within person models, except unobserved firm heterogeneity is modeled and unobserved worker heterogeneity is ignored.

Finally, the firm within person models control for both unobserved person and firm heterogeneity. In fact, separate effects are estimated for each worker-firm match. This methodology has been referred to as the consistent method in Abowd, Kramarz, and Margolis (1999) and Finer (1997) and others. When discussing the relationship between the data and our theoretical model, we will focus only on the firm within person results, since these provide the most clear tests of our model. The coefficients on firm characteristics are identified entirely from time-series variation when the firm within person method is used, so the results cannot be driven by correlations between unobserved heterogeneity and observed firm characteristics. The model in this paper ignores worker and firm heterogeneity, so these components should not be allowed to influence the estimates of the coefficients of interest. Section 5 contains brief discussions on the differences between the firm within person estimates and the other estimates, including implications for earlier work in the literature.

2.3 Employee Pay-For-Performance Due to Managerial Risk Aversion

The model is based on the idea that managers affect firm performance by performing more than one task. In this model, firm performance is a function of the revenue generating activity of the CEO, as well as the wage decisions of the CEO pertaining to other employees. Assuming it is difficult to contract on each component of firm performance, the CEO may choose to link the wage outcomes for other employees to the firm's revenue realizations in order to smooth CEO compensation.

The literature already contains several models in which managers might take costly actions to smooth firm performance. Other models in which risk-averse managers take (possibly costly) actions to smooth compensation include Lambert (1984), Stulz (1984), Smith and Stulz (1985), and Dye (1988). The model that is most similar to ours is contained in Fudenberg and Tirole (1995), who derive income smoothing from a manager who wishes to prevent dismissal to preserve the rent she receives from the position. If performance realizations in the distant past are less informative than those of the recent past for predicting future performance, the manager will take actions that shift income to the future during good times, and shift income to the present in bad times, despite the fact that this smoothing is costly to the firm.[3]

While similar in spirit to many of the models mentioned above, the model presented in this section is tailored to derive empirical predictions on firm-wide wage policies. In particular, since our model is so similar to the models tested in the executive compensation literature, we will be able to use similar empirical methodologies. We accomplish this by explicitly modeling the actions a manager might take

[3] Empirical evidence for smoothing can be found in Defond and Park (1997) who find that managers are less likely to make income decreasing discretionary accruals during times of poor performance and good expected future performance.

to smooth rm performance and explicitly modeling the costs of such actions.

Before turning to our model, we should discuss an alternative that might yield similar empirical predictions. Since our empirical work uses large publicly traded rms, we assume away the possibility that linking the wages of all workers to rm-wide performance measures can have signi cant incentive effects. Despite the theoretical appeal of this assumption, a growing literature points to a productivity effects of group incentives.[4] The empirical predictions of our model might be identical to those of a group incentives model, provided that the optimal contracts for top executives and the rest of the workforce have similar features. We do not, however, know of any empirically viable theoretical models that solve the $\frac{1}{N}$ problem.

Our model has three players: a principal, a manager, and an employee. The principal hires the manager to do two things:

1. Take some action a_m.
2. Set W_e, the wage level for the employee The employee is necessary for the project, but can be monitored perfectly at zero cost.

The project generates

$$y = a_m + \varepsilon$$

in rm value, where $\varepsilon \sim N(0, \sigma^2)$.

Denote W_m as the manager s wage and assume the manager s utility function is $-\exp\left[-r_m\left(W_m - \frac{a_m^2}{2}\right)\right]$, and the employee s utility function is $-\exp\left[-r_e W_e\right]$. Assume further that the principal can only contract on $(y - W_e)$, and offers the manager a contract of the form

$$W_m = S_m + b_m\left(y - W_e\right), \tag{1}$$

subject to incentive-compatibility and individual-rationality constraints that will be dealt with later. The manager then chooses a wage contract of the form

$$W_e = S_e + b_e y, \tag{2}$$

subject to an individual rationality constraint. To be more precise, the timing of the game is as follows:

1. The principal offers the manager a wage contract of the form speci ed in equation 1.
2. The manager offers the wage contract speci ed in equation 2.

[4] See, for example, Kruse (1993) and Jones and Kato (1995).

3. The manager chooses a_m.

4. y is realized and compensation occurs.

Note that we abstract away from any incentive problems that might exist below the managerial level. This is not because we believe that incentive problems only exist at the CEO level, but rather because we want to model a scenario in which middle to lower level employees of large rms have their pay tied to the overall performance of the rm, despite the fact that they only have a trivial impact on overall performance. We certainly believe that lower level employees of large rms have incentive contracts based on measures that are more narrowly de ned than overall rm performance, but we want to model why their pay could depend on overall rm performance which is entirely out of their control.

One might also be concerned with the application of this model to situations in which a pro t sharing scheme is publicly observable. The principal would be better off contracting on y and W_e separately, instead of $(y - W_e)$ as a unit, so this model predicts that shareholders would not allow their managers to openly implement easily observable pro t sharing schemes. The model is therefore more applicable to implicit schemes that are not easily observable from outside the rm. It is worth noting, however, that the value of rm stock could be affected by the wages paid by the rm, and accounting measures such as earnings would certainly be affected. Since managerial stock ownership and bonuses tied to accounting measures are both important incentive aligning tools in large rms, we believe the assumed form of the managerial contract is reasonable.

2.3.1 Stage 3

The manager s problem can be expressed as

$$\max_{a_m} b_m \left[a_m - b_e a_m\right],$$

implying that

$$a_m = b_m \left(1 - b_e\right). \tag{3}$$

2.3.2 Stage 2

Substituting for a_m as in equation 3, the employee s utility constraint can be expressed as follows:

$$S_e + b_e \left[b_m \left(1 - b_e\right)\right] - \frac{r_e b_e^2 \sigma^2}{2} = \overline{U}_e, \tag{4}$$

where $\overline{U}_e$ is the certainty equivalent wage level needed to compensate the employee for accepting the job. Equation 4 allows us to write the manager s problem as

$$\max_{b_e} b_m \left(1 - b_e - \frac{(1-b_e)^2 + r_m (1-b_e)^2 \sigma^2}{2}\right) - \frac{r_e b_e^2 \sigma^2}{2},$$

implying that

$$b_e = \frac{r_m b_m \sigma^2}{b_m + r_e \sigma^2 + r_m b_m \sigma^2}. \tag{5}$$

2.3.3 Stage 1

Denoting $\overline{U}_m$ as the analog of $\overline{U}_e$, and using the results from earlier subsections, the principal s objective function can be written as

$$\begin{array}{l} b_m \left[1 - b_e(b_m)\right] - \frac{1}{2}\left[b_m \left[1 - b_e(b_m)\right]\right]^2 - \\ \frac{r_m \sigma^2}{2}\left[b_m \left[1 - b_e(b_m)\right]\right]^2 - \frac{r_e \sigma^2 b_e^2(b_m)}{2}. \end{array} \tag{6}$$

where $b_e(b_m)$ is de ned as in equation 5. To gain intuition for the above expression, the rst two terms are simply $a_m - \frac{a_m^2}{2}$ as seen from equation 3. In the rst-best, total surplus would be maximized by maximizing $a_m - \frac{a_m^2}{2}$, *i.e.*, setting $a_m = 1$. The third term represents the cost due to the manager facing compensation risk[5], while the fourth term represents the cost due to the employee facing compensation risk. Note that as r_m approaches zero (the manager becomes risk-neutral), rst-best solution arises (the last two terms in expression 6 disappear). Also note that as r_e approaches zero (the employee becomes risk neutral), the principal can set $b_m = 1$, which results in managerial incentives $(b_m(1-b_e))$ of $\frac{1}{1+r_m\sigma^2}$, which is the standard result from the single principal/single agent model.

While the derivative of expression 6 is quite messy, it is not hard to nd the value of this derivative at $b_m = 0$. In fact, it is simply the derivative of $b_m(1-b_e) = \frac{b_m^2 + b_m r_e \sigma^2}{b_m + r_e\sigma^2 + r_m b_m \sigma^2}$, which equals 1 at $b_m = 1$. This is enough information to say that $b_m > 0$ and $b_e > 0$, implying that the employee receives a pay-for-performance contract in absence of a moral hazard or adverse selection problem.

An attractive feature of this model is that it can be generalized to one in which multiple signals of a_m are incorporated quite easily. This generalization provides us with the speci c testable implications examined in section 4. Suppose, for instance, that

$$ret = a_m - W_e + \varepsilon \text{ and} \tag{7}$$

$$earn = a_m - W_e + \epsilon, \tag{8}$$

[5] As familiar from agency models such as Holmstrom (1987).

where ret is the stock market return for rm j in year t, $earn$ is the accounting earnings (not including wage payments) for rm j in year t. A linear wage contract based on both performance measures can, without loss of generality, be expressed as

$$W_m = S_m + b_m \left[\lambda ret + (1 - \lambda) earn\right],$$

where λ is chosen to minimize

$$\lambda^2 \sigma_\varepsilon^2 + (1 - \lambda)^2 \sigma_\epsilon^2 + 2\lambda (1 - \lambda) cov(\varepsilon, \epsilon),$$

which is simply the variance of the weighted average of the two performance measures. Holding b_m constant, the use of any λ other than the one implicitly de ned above results in lower managerial incentives, higher compensation risk for the manager, and higher compensation risk for the employee. Under this setup, $\frac{\lambda}{1-\lambda}$ is the ratio of the manager s share (piece rate) of stock return to manager s share (piece rate) of accounting earnings. Note, however, that once λ is xed, the model collapses down to the model with a single signal of a_m presented above. We therefore know that $\frac{\lambda}{1-\lambda}$ is also the ratio of the employee s share (piece rate) of stock return to employee s share (piece rate) of accounting earnings.[6] Now note that the optimal value for λ is

$$\lambda^* = \frac{\sigma_\epsilon^2 - cov(\varepsilon, \epsilon)}{\sigma_\varepsilon^2 + \sigma_\epsilon^2 - 2cov(\varepsilon, \epsilon)},$$

implying that

$$\frac{\lambda^*}{1 - \lambda^*} = \frac{\sigma_\epsilon^2 - cov(\varepsilon, \epsilon)}{\sigma_\varepsilon^2 - cov(\varepsilon, \epsilon)},$$

which is equation A.4 from Sloan (1993). While Sloan s model, which was based on a model by Banker and Data (1989), did not allow the manager to smooth her consumption by changing other employees wages, this addition does not change the empirical predictions relating to the manager s wage, as the above analysis demonstrates. The empirical implications relating to the manager s wage are simply extended throughout the rest of the rm, which enables us to implement our test. Assuming $\sigma_\epsilon^2 > \sigma_\varepsilon^2$ (accounting earnings are noisier measures than market returns and $\sigma_\varepsilon^2 > cov(\varepsilon, \epsilon)$ (which guarantees that earnings will positively affect wages), Sloan shows that

$$\frac{\lambda^*}{1 - \lambda^*} \text{ is deceasing in } \frac{\sigma_\epsilon^2}{\sigma_\varepsilon^2} \text{ and} \tag{9}$$

$$\frac{\lambda^*}{1 - \lambda^*} \text{ is increasing in } \rho(\varepsilon, \epsilon). \tag{10}$$

[6] The manager chooses to set the ratio of the employee s piece rates for market and accounting pro ts to $\frac{\lambda}{1-\lambda}$, even if the manager can choose other ratios.

Intuition for the above results is quite simple. Condition 9 says that market returns will have a higher weight in both the manager's wage contract and the employee's wage contract when the market returns are relatively better (less noisy) signals. Condition 10 relies on the assumption that accounting returns are noisier measures than marker returns. Despite this noise, accounting returns can be valuable as an incentive tool if the error terms are negatively correlated, since this negative correlation can help shield the executive and employee from compensation risk.

The above analysis demonstrates the empirical usefulness of our model. Not only does the model predict that firm-wide pay-for-performance should exist, even in large firms, but it also generates predictions on the nature of this relationship. Since this relationship has already been tested in the executive compensation literature, only minor adaptations of an established empirical methodology are required to test our model.

As a first step towards testing our model, we test whether accounting and market profitability affect the wages of regular employees at all. Our measure of market profitability is the rate of return to the firm's common stock over the previous fiscal year. This is a standard measure in the executive compensation literature. Our measure of accounting profitability is the firm's earnings per employee in the previous fiscal year. While accounting earnings are typically normalized by assets in the executive compensation literature, normalizing by employees seems more appropriate for estimating firm-wide pay-for-performance. We also control for the Log of total employment in the previous fiscal year to distinguish our model's empirical predictions from a model in which profitable firms choose to increase employment, leading to wage increases due to monopsony power.

Tables 3 and 4 present the results from empirical models, for manufacturing and non-manufacturing workers respectively, in which the log of the real hourly wage is regressed on the firm variables mentioned above, and a wealth of personal control variables. While simple least squares, within person, within firm, and firm within person estimates are shown, we will focus on firm within person estimates since they control for the most unobservable heterogeneity. Note that, for both manufacturing and non-manufacturing workers, none of the firm-level variables have a statistically significant effect on log wages. The NLSY therefore provides no evidence that firm-wide pay-for-performance exists.

The Washington State data, however, present a substantially different story. Tables 5 and 6 present estimates from the Washington State data, again for manufacturing and non-manufacturing workers respectively. Turning first to the firm within person results in table 5, we see that both stock-market return and accounting earnings per worker have positive and statistically significant effects on log wages in the manufacturing sector, as our model predicts. While, in this paper, we will not offer an interpretation for log employment other than as a control variable, we do note that firm growth is also associated with wage increases, even after controlling for unobserved person and firm heterogeneity. Turning to the results on non-manufacturing workers in table 6, we see that accounting earnings is the only rm-level variable that appears to affect log wages.[7] We conclude from tables 5 and 6 that the Washington State data offer preliminary support for our model, leading us to undertake the more speci c tests in section 4.

Before turning to these more speci c tests of our model, we try to explain the differences of estimates across data sets. The most obvious difference between the two data sets is that the NLSY is a young sample. In particular, the oldest person in the NLSY is 36 in 1994, 35 in 1993, ..., and 28 in 1986. We therefore examine young workers in the Washington State sample by eliminating workers older than 36 in 1993, older than 35 in 1992, ..., older than 28 in 1985, and all workers from 1984 to obtain the best possible analogy to the NLSY. Tables 7 and 8 present estimates of the pay-for-performance relationships on young workers in the Washington State data for manufacturing and non-manufacturing workers respectively. Tables 7 and 8 both show that the link between accounting earnings and log wages is actually stronger for young workers. While the coefficient on stock return in table 7 is a bit smaller than in table 5, it is still quite strong. We therefore do not view the age structure of the NLSY as a likely candidate for the differences in estimates across data sets. This leaves us with at least two possibilities, which we cannot test. The rst is simply the smaller sample size of the NLSY. Second, since the Washington State wage data come from administrative records rather than surveys, the wage data might be less subject to measurement error. We now proceed to investigating cross-sectional differences in pay-for-performance slopes using techniques from the executive compensation literature.

2.4 Cross-Sectional Differences in Pay-For-Performance Slopes

An important issue faced by the executive compensation literature was to explain why accounting measures of pro tability seemed to impact executive wages, despite the fact that the owners of the rm should only care about market returns. Sloan (1993) argues that while stock market returns are affected to a large extent by market-wide movements that are outside of any individual executive s control, accounting earnings are mainly driven by rm-speci c factors. The use of accounting earnings in executive contracts can therefore be viewed as a substitute for relative compensation policies studied by Antle and Smith (1986) Gibbons and Murphy (1990). Sloan uses his conjecture to explain cross-sectional differences in pay-for-performance slopes in CEO contracts. More speci cally, he assumes a structure for market and accounting returns that allows him to test the empirical implications given in 9 and 10. We present a slightly modi ed version of his methodology below.

[7] In addition to the monopsony story mentioned earlier, a story in which pro table rms choose to impose overtime on their workforce might also explain these results. Including Log hours, however, does not change the results.

Consider a standard market model of the form

$$ret_{jt} = \beta_{0j} + \beta_{1j} \left(vwretd\right)_t + S_{jt}, \tag{11a}$$

where ret_{jt} is the stock-market return (including dividends) for rm j in scal year t, $vwretd_t$ is the CRSP value-weighted index for scal year t. Since β_{1j} typically is not zero, stock market returns are affected by market-wide factors. Sloan therefore views S_{jt} as the true signal of executive performance and $\beta_{1j} \left(vwretd\right)_t$ as the residual, *i.e.*, the component of stock return that is outside of the executive s control. Under these assumptions, $\beta_{1j} \left(vwretd\right)_t$ is ε from equation 7.

In order to model the proposition that accounting earnings provide a signal of executive actions that is not affected by market-wide factors, we estimate

$$earnp_{jt} = \phi_{0j} + \phi_{1j} S_{jt} + E_{jt}, \tag{12}$$

where $earnp_{jt}$ is the earnings excluding extraordinary items per employee and E_{jt} is a residual, *i.e.*, outside the executive s control.[8] E_{jt} corresponds to ϵ from equation 8.

We estimate equations 11a and 12 for all scal years from 1975-1994 for which the relevant data are available. We exclude rms for which fewer than 10 years of data are available for estimation of the earnings model. Sloan shows that the ratio of variances required to test the proposition given by 9 can be estimated using the following formula

$$ratvar_j \equiv \frac{var\left[\beta_{1j}\left(vwretd\right)\right]}{var\left[\frac{E_j}{\phi_{1j}}\right]} = \frac{r^2_{ret_j,vwretd} r^2_{earnp_j,S_j}}{\left(1 - r^2_{ret_j,vwretd}\right)\left(1 - r^2_{earnp_j,S_j}\right)},$$

while the correlation of error terms needed to test the proposition given by 10 can be estimated using

$$rho_j \equiv corr\left(E_j, vwretd\right).$$

Sloan found strong support for both propositions. In particular, he found that the coefficient on stock returns was decreasing $ratvar_j$, and increasing in rho_j. Conversely, the coefficient on accounting pro ts was increasing in $ratvar_j$ and decreasing in rho_j. All four of these results are consistent with his model. Since the model we presented in section two has the same empirical implications, a similar empirical test will suffice. We now turn to the tables that test these propositions.

[8] This is the most signi cant departure from Sloan s methodology. Sloan uses both the change in earnings per share divided by price and the change in earnings divided by assets as his accounting measures. He does this because his compensation equations use the change in Log compensation as the dependent variable, the change in the accounting variable as the accounting measure, and the level of stock return as the market measure. We believe using changes in all variables, or alternatively using xed effects, is more consistent with agency theory.

Tables 9 and 10 show, for manufacturing and non-manufacturing workers respectively, estimates in which both performance variables are in interacted with $ratvar_j$ and rho_j for the NLSY data set. This allows the pay-for-performance slopes to vary as hypothesized. Since tables 3 and 4 provided no evidence of any pay-for-performance links, it should not be surprising to see that the interactions do not have much explanatory power. None of our estimates from the NLSY are precise enough to reject or validate the predictions of our model.

Tables 11 and 12, which are the analogs of tables 9 and 10 for the Washington State sample, provide evidence that is much more informative. We first examine table 11, which focuses on manufacturing workers. Note that the link between log wages and stock market return is decreasing in $ratvar_j$, while the link between log wages and earnings per worker is increasing in $ratvar_j$. Both of these relationships are predicted by our model and similar to those observed by Sloan for CEOs. We view these results as strongly supportive of our model. Now note that the strengths of the link between accounting returns is decreasing in rho_j as predicted, while the link between market returns is also decreasing in rho_j, contrary to our predictions and contrary to Sloan's findings.[9] Despite the coefficient on the interaction between market return and rho_j, we view the manufacturing results from the Washington State data as supportive of our model.

Table 12, which focuses on non-manufacturing workers in the Washington State data, yields insignificant coefficients on the interactions of interest. Recall that table 6 did provide some measure of support for our model by uncovering a positive link between log wages and accounting earnings. The fact that none of the interactions of interest are statistically significant, however, prevents us from claiming anything beyond weak support from non-manufacturing workers in Washington State.

3 Unobserved Heterogeneity and Earlier Work

As mentioned earlier, while Blanchflower, Oswald, and Sanfey (1996) and Hildreth and Oswald (1997) could not control for unobservable worker heterogeneity, we control for both unobservable worker and unobservable firm heterogeneity. We now briefly examine the importance of this contribution. The most natural way for us to compare our results to those mentioned above is to compare our within firm results (which ignore unobservable worker heterogeneity) to our firm within person results. We focus on accounting profitability since this represents the closest analog to the profitability measures in earlier work. Note that in table 5, which uses manufacturing workers in Washington State, the coefficient on earnings per worker in the firm within person results is more than double the coefficient from the within firm results. The coefficients on earnings per worker in table 6, which used non-manufacturing workers in Washington State is roughly the same in the within firm and firm within person

[9] The prediction is technically about the ratio of the pay-for-performance slopes, which we cannot test.

estimates. We therefore conjecture that the pay-for-performance estimates from prior work that could not control for unobservable worker heterogeneity are more likely to be underestimates of the true effects than overestimates, indicating that the results from these paper are probably qualitatively correct.

Table 5 provides another interesting result relating to the sorting of workers within a rm over time. Note that the coefficient on log employment is substantially larger in the rm within person model than in the within rm model. This tells us that, when manufacturing rms expand, they tend to hire workers who consistently earn wages that are lower than expected given their observable characteristics. This is clear evidence that the unobservable components of the workforces of rms change over time, and hints at an area for future research. This sorting could, for example, have important implications for estimates of the return to seniority that do not control for unobservable worker heterogeneity.

3.1 Conclusion

Evidence on the link between rm performance and the wages of regular employees is difficult to nd. Using two longitudinal matched employer-employee data sets in which individuals are matched to their employing rms, we provide estimates of this link.

Speci cally, we estimate wage equations for individual regular employees of large rms that control for unobservable heterogeneity of both the workers and rms in order to estimate rm-wide pay-for-performance links. We show evidence that stock returns and accounting earnings positively affect wages throughout large rms. We also develop a theoretical model that predicts the wages of all employees in a rm should be linked to the wages of top management, which provides speci c testable predictions that are similar to those tested in the executive compensation literature. We nd mixed support for our model.

References

Abowd, J.M., Finer H.S.C, and Kramarz, F. Determinants of Compensation: An Analysis of Matched Longitudinal American Employer-Employee Data *Cornell University Working Paper*, (1998).

Abowd, J.M. and Kramarz, F. The Analysis of Labor Markets Using Matched Employer-Employee Data, in Orley Ashenfelter and David Card, eds., Handbook of Labor Economics, Volume 3, 1999, forthcoming.

Abowd, J.M., Kramarz, F., and Margolis, D.N. High Wage Workers and High Wage Firms, *Econometrica*, (1999) forthcoming.

Blanch ower, D.G., Oswald, A.J., and Sanfey, P. Wages, Pro ts, and Rent-Sharing. *Quarterly Journal of Economics*, Vol. 111, No. 1 (February 1996): 227-251.

Chisholm, D.C. Pro t-Sharing Versus Fixed-Payment Contracts: Evidence From the Motion Pictures Industry. *Journal of Law, Economics and Organization*, Vol. 13, No.1 (1997): 169-201.

DeFond, M.L. and Park, C.W. Smoothing Income in Anticipation of Future Earnings. *Journal of Accounting and Economics*, Vol. 23, No. 2 (July 1997): 115-39.

Dye, R.A. Earnings Management in an Overlapping Generations Model. *Journal of Accounting Research*, Vol. 26, No. 2 (Autumn 1988): 195-235.

Dickens, W.T., and Katz, L.F. Inter-Industry Wage Differences and Industry Characteristics. In *Unemployment and the Structure of Labor Markets*, edited by Kevin Lang and Jonathan S. Leonard. Oxford: Basil Blackwell, (1987).

Finer, H.S.C. Firm and Individual Wage Components in the National Longitudinal Survey of Youth. *Cornell University, Department of Labor Economics Working Paper*, (1997).

Fudenberg, D. and Tirole, J. A Theory of Income and Dividend Smoothing Based on Incumbency Rents. *Journal of Political Economy*, Vol. 103, No. 1 (February 1995): 75-93.

Garen, J.E. Executive Compensation and Principal-Agent Theory. *Journal of Political Economy*, Vol. 102, No. 6 (December 1994): 1175-99.

Hall, B.J. and Liebman, J.B. Are CEOs Really Paid Like Bureaucrats? mimeo, Harvard University, (March 1997).

Haubrich, J.G., Risk-Aversion, Performance Pay and the Principal-Agent Problem. *Journal of Political Economy*, Vol. 102, No. 2 (April 1994): 258-76.

Hildreth, A.K. G., and Oswald, A.J. Rent Sharing and Wages: Evidence from Company and Establishment Panels. *Journal of Labor Economics*, Vol. 15, No. 2 (April 1997): 318-337.

Holmstrom, B. Moral Hazard and Observability. *Bell Journal of Economics*, Vol. 10, No.1 (Spring 1979): 74-91.

Holmstrom, B. and Milgrom, P. Aggregation and Linearity in the Provision of Intertemporal Incentives. *Econometrica*, Vol. 55, No. 2 (March 1987): 303-28.

Jensen, M.C and Murphy, K.J. Performance Pay and Top-Management Incentives. *Journal of Political Economy*, Vol. 98, No. 2, (April 1990): 225-64.

Jones, D.C. and Kato, T. The Productivity Effects of Employee Stock-Ownership Plans and Bonuses: Evidence from Japanese Panel Data. *American Economic Review*, Vol. 85, No. 3, (June 1995): 391-414.

Katz, L.F., and Summers, L.H. Industry Rents: Theory and Evidence. *Brookings Papers on Economic Activity (Microeconomics)*(1989): 209-75.

Kruse, D.L. Does Pro t Sharing Affect Productivity? *NBER Working Paper No. 4542*, (November 1993).

Lambert, R.A. Income Smoothing as a Rational Equilibrium Behavior. *Accounting Review*, Vol. 59, No. 4 (October 1984): 604-18.

Murphy. K.J. Executive Compensation, in Orley Ashenfelter and David Card, eds., *Handbook of Labor Economics*, Volume 3, 1999, forthcoming.

Slichter, S., Notes on the Structure of Wages. *Review of Economics and Statistics*, Vol. 32, No. 1 (February 1950): 80 91.

Sloan, R.G. Accounting Earnings and Top Executive Compensation. *Journal of Accounting and Economics*,Vol. 16, No. 1-2-3 (January-April-July 1993): 55-100.

Smith, C.W. and Stulz, R.M. The Determinants of Firms Hedging Policies. *Journal of Financial and Quantitative Analysis*, Vol. 20, No. 4 (December 1985): 391-405.

Stulz, R.M. Managerial Discretion and Optimal Financing Policies. *Journal of Financial Economics*, Vol. 26, No. 1 (July 1990): 1069-87.

Stulz, R.M. Optimal Hedging Policies. *Journal of Financial and Quantitative Analysis*, Vol. 19, No. 2 (June 1994): 127-140.