The impact of financial participation on workers

Martyn Andrews
University of Manchester

Lutz Bellmann
Institut für Arbeitsmarkt- und Berufsforschung
Friedrich-Alexander Universität Erlangen-Nürnberg

Thorsten Schank
Friedrich-Alexander Universität Erlangen-Nürnberg

Richard Upward
University of Nottingham

April 30, 2009

Abstract

We investigate the impact of financial participation (profit-sharing and share ownership) on workers' welfare in terms of the level and the variance of workers' total compensation. A widespread finding is that financial participation is associated with higher productivity. But some workers' representatives have argued against the introduction of profit sharing because they fear that profit sharing would be a way for firms to reduce the marginal cost of hiring workers, while at the same time transferring some of the risk of variable profits from firms to workers. In addition, Lemieux, MacLeod & Parent (2009) have recently provided evidence that the increasing use of performance pay in the US has resulted in greater wage inequality amongst workers who receive performance pay. We provide detailed evidence on the relationship between the use of financial participation schemes and total worker compensation using a large panel of German plants linked to data on the workers in those plants.

1 Introduction

The financial participation of employees in their firm, in the form of profit sharing or share ownership, continues to increase across almost all European countries, albeit from a low level in many countries.[1] To a greater or lesser extent these schemes have been encouraged by European governments via the use of tax incentives and legislation. The second "Pepper Report" (Commission of the European Communities 1996), argued that increased use of profit-sharing would encourage greater productivity, wage flexibility, employment and employee involvement, and called on member states to promote the greater use of financial participation by employees.

The academic debate on financial participation initially focussed on a series of papers by Weitzman (e.g. Weitzman 1984, Weitzman 1987), which suggested that profit sharing could lower the marginal cost of hiring workers and hence permanently increase the level of employment. However, a key finding of the empirical literature on profit sharing is that the introduction of such schemes is not generally associated with reductions in the basic wage.[2] This suggests that the widespread introduction of profit sharing schemes would not have the positive employment effects advocated by Weitzman. A second finding of the literature is that the introduction of profit schemes is associated with higher productivity. Prendergast (1999) implicitly suggests that these two facts may be linked. If the introduction of profit sharing leads to higher total compensation for workers, this might explain higher productivity, either because of worker selection or efficiency wage mechanisms.

In contrast, some workers' representatives have argued against the introduction of profit sharing because they fear precisely what Weizman hoped for: that profit sharing would be a way for firms to reduce the marginal cost of hiring workers, while at the same time transferring some of the risk of variable profits from firms to workers. The European Foundation argues that employee representatives are more likely to accept the introduction of financial sharing if there is protection of workers from "unreasonable risk" and there is a prohibition of wage substitution (Welz & Macias 2007) .

In this paper we provide detailed evidence on the relationship between the use of financial participation schemes and total worker compensation using a large panel of German plants linked to data on the workers in those plants. Essentially, we examine

[1] See, for example, Figure 8 and 9 of the 2007 European Foundation report (Welz & Macias 2007).

[2] Indeed, Welz & Macias (2007) argue that "...in practice, most schemes are devised in such a way that participants only benefit: they are not exposed to financial risk either individually or collectively."

the extent to which workers gain from financial participation. The data allow us to measure total worker compensation, including any bonus payments which arise as a result of profit sharing schemes (though not from share ownership). We are able to control for a wide range of worker and plant characteristics which might affect the use of financial participation schemes as well as total compensation.

The use of linked worker-firm data allows us to control for unobserved firm and worker effects on compensation. In particular, we can examine whether the introduction of financial participation has an effect on the selection of workers in and out of the firm.[3] In theory, workers' preferences for increased risk (or firms' preferences for workers with certain characteristics) could lead to changes in the composition of the workforce. By comparing workers who remain in the firm with those who join or leave we can effectively control for this when calculating the effect on workers' compensation.

The use of financial participation potentially exposes workers to greater risk from any variability in profits or firm share prices. We therefore consider both the mean and the variance of workers' total compensation, since both have an impact on workers' welfare.

The fact that financial participation might change the variance of workers' compensation raises the question of wage inequality. Lemieux *et al.* (2009) have recently provided evidence that the increasing use of performance pay in the US has resulted in greater wage inequality amongst workers who receive performance pay. While financial participation is not so directly linked to individual performance, it seems plausible that the same mechanism might apply. Our analysis of changes in the variance of wages will also shed light on this issue.

We begin in Section 2 by briefly reviewing the evidence on financial participation and worker compensation. The data we use and some basic descriptives are presented in Section 3. Our methods are described in Section 4 and the result are presented in Section 5. Section 6 concludes.

2 Literature

The first wave of papers followed from Weitzman's (1984) book and accompanying articles, such as Weitzman (1987). Three key questions emerge from the literature,

[3]Bellmann & Möller (2009), using the same plant-level data, find a significant positive effect on hirings and a significant negative effect on layoffs, although results obtained from matching estimators are not significant.

only the first of which directly relates to Weitzman's hypothesis.

First, does profit sharing reduce the base wage? If the introduction of profit sharing is not accompanied by a reduction in the base wage, or the marginal cost of labour, then we would not expect to observe increases in the demand for labour. The empirical consensus is that the introduction of profit sharing does not reduce the base-wage. For example, Wadhwani & Wall (1990) and Bhargava & Jenkinson (1995) (using firm-level data) and Hart & Hübler (1991) (using German household survey data) find no evidence that profit sharing reduces the base wage. In some cases, in fact, profit sharing is associated with increases in the base wage. These findings are more compatible with rent-sharing and efficiency wage theories. One exception to these findings is Estrin & Wilson (1986), who found that the introduction of profit sharing reduced total compensation while at the same time increasing employment. Most recently, Buchele, Kruse, Rodgers & Scharf (2009, p.13) note some recent high-profile examples of US workers who have accepted lower wages in return for ownership shares and stock options. However, their own empirical evidence confirms the stylised fact that there is positive relationship between total compensation and financial participation.

Second, there is a large empirical literature which has established as a stylised fact that profit sharing firms have higher productivity than similar non-profit sharing firms. FitzRoy & Kraft (1987) is an early example using a small cross-section of West German engineering firms, who find a positive relationship between total factor productivity and profit sharing. Cable & Wilson (1989) estimate production functions for a small sample of UK engineering firms. The estimated models predict output differentials of between 3–8 percent between profit sharing and other firms. However, they argue that the productivity effects of profit sharing are likely to require other aspects of organisational design. Kruse (1992, 1993) finds that profit sharing increases productivity significantly in a sample of 3,000 US firms. Knez & Simester (2001) analyse the effect of the introduction of a firm-wide incentive scheme in a large US company, and show that it significantly increased worker performance. Jones & Kato (1995) uses firm-level panel data from Japan to show that firms which introduce employee stock ownership plans (ESOPs) experience a 4-5% increase in productivity, and that it takes a few years for this effect to be felt.

Prendergast is somewhat skeptical as to whether these results are evidence of a causal relationship between profit sharing and productivity. First of all, the correlation might just reflect the selection of more productive firms into profit sharing schemes. But many of the studies use within-firm changes to deal with this problem, and the results generally hold up. Some authors have explicitly considered selection into modes of payment. FitzRoy & Kraft (1995) use the same data as in FitzRoy & Kraft (1987) but consider selection, since firms are assumed to choose the incentive structure which maximises profits. Kraft & Ugarković (2006), using the same data as we do in this paper, use propensity score matching to compare firms which start profit sharing with observably equivalent firms which do not.

A second problem raised by Prendergast with this literature is that the theory considers the effect of incentives holding utility constant. But, as noted, the base wage does not fall with profit sharing, and so total compensation will generally increase. Prendergast therefore wonders "Could the empirical results simply reflect the effect of giving workers more money, and not the effect of team production?" (Prendergast 1999, p.43) He suggests instead that higher compensation might induce positive selection of workers into the firm, or it might have efficiency wage effects.

The third main strand of the literature relates to this question, and asks *how* profit sharing can improve productivity in the face of the well-know free-rider problem, often referred to as the "$1/n$" problem. One solution to this problem is the use of peer-monitoring or peer-pressure. Knez & Simester (2001) argue that the positive effects of the incentive scheme they studied were achieved because of the organization of employees into autonomous work-groups which allowed for mutual monitoring of performance.

One might expect that team-based performance measures would encourage the less productive, since they can free-ride. But Weiss (1987) finds a inverse U-shaped relationship between worker turnover and prior productivity. The most able and the least able are more likely to leave the company. Wilson, Cable & Peel (1990) and Wilson & Peel (1991) use a small sample of UK engineering firms and examine how quit rates and absenteeism vary as a function of firm characteristics, including unionism and profit sharing. They find that firms with financial participation schemes have significantly lower absenteeism and quit rates.

The most recent evidence comes from an NBER project: see, for example Freeman (2008), Blasi, Freeman, Mackin & Kruse (2008) and Kruse, Freeman & Blasi (2008). Freeman concentrates on the idea that worker co-monitoring can get around the free-rider problem. Blasi *et al.* (2008) examine whether the mechanism by which profit sharing increases worker productivity is via gift exchange. They interact a measure of pay with an index of shared capitalism. Kruse *et al.* (2008) find that "greater involvement in the programs [shared compensation schemes] is generally linked to greater participation in decisions, higher quality supervision and treatment of employees, more training, higher pay and benefits, greater job security, and higher job satisfaction."

We make a number of contributions to this literature. Instead of examining the base wage, we ask whether workers are better off *overall* if they work in plants which introduce financial participation in the form of profit sharing or share ownership. We do this by measuring the mean and the variance of workers' total compensation. We use both difference-in-differences and matching to control for non-random selection of plants into financial participation schemes. Because we use a linked worker-firm data we are also able to examine the selection effects of financial participation, and to control for this selection effect in determining any change in average wages.

3 Data and institutional background

There are two data sources. The first is the *Institut für Arbeitsmarkt- und Berufsforschung (IAB) Establishment Panel*, an annual survey of approximately 16,000 plants located across the whole of Germany. It covers 1% of all plants and 7% of all employment in Germany, and is therefore a sample weighted toward larger plants. The sample covers all industries. Information is obtained by personal interviews with plant managers, and comprises about 80 questions per year, giving us information on, for example, total employment, bargaining arrangements, total sales, ownership, investment, wage bill, location, industry, profit level and nationality of ownership. We restrict the analysis to plants in the private sector. A detailed description of the IAB Establishment Panel can be found in Fischer, Janik, Müller & Schmucker (2009).

The question on profit sharing/share ownership was asked in 2000, 2001, 2005 and 2007.[4] The question asked is as follows: "Are there, in your plant, additional financial incentives for employees in the form of profit- or capital-sharing?" Respondents could tick "Yes" or "No" for each type of scheme, together with an estimate of the proportion of workers covered by the scheme.

The second source of data is the employment statistics register of the German Federal Office of Labour (*Beschäftigtenstatistik*), which covers all workers or trainees registered by the social insurance system. The register covers about 80% of workers in Western Germany and about 85% in Eastern Germany. However, almost all workers in the private sector are covered by the social insurance system, so the data we use covers nearly 100% of workers. Information on workers includes basic demographics, start and end dates of employment spells, occupation and industry,

[4] A question was also asked in 1998, but it was part of a multi-choice question which asked about various diverse aspects of employment policy. There was also a smaller change in the question between 2000 and 2001; see the discussion following Table 1.

earnings, qualifications (school and post-school), and a plant identification number. A detailed description of the employment data can be found in Bender, Haas & Klose (2000).

For each worker we observe the average daily total compensation, y_{it}, for each calendar year. We only use observations where the information on compensation covers the whole calendar year. This is because information on part-year spells might not include bonuses which are paid at a particular point in the year (typically at the end of the year). We use information only on full-time workers[5] because, for part-time workers, changes in y_{it} are more likely to reflect changes in hours of work, which we do not observe.

By using the plant identification number we can associate each worker with a plant in the panel. Because the employment register is spell-based (one record for each employment spell), the combined data is potentially complex. To simplify, we select all workers in the employment register who are employed by the surveyed plants on June 30th each year. This yields an unbalanced annual panel of workers together with detailed information on the plants in which they work. It is then straightforward to aggregate the data to plant-level after recording summary information on the workers in those plants.

After removing plants which are not in the private sector, and which have missing values on the variables relating to profit- or capital-sharing, we have a sample of over 10,000 plants in each year. Table 1 reports the sample size together with the proportion of plants operating profit- or capital-sharing. The incidence of profit sharing and share-ownership has been growing in our data. However, most of this increase occurs between 2000 and 2001. As noted, the question became more precise from 2001 onwards, and it seems possible that this is responsible for the apparent increase in the proportion of plants reporting sharing arrangements.[6] This proportion adopting either profit- or capital-sharing is much lower once we use the sampling weights, reflecting in part the fact that larger plants (who are oversampled) are more likely to adopt such schemes.

Some more detailed characteristics of the incidence of sharing arrangements are shown in Table 2. The table shows that larger plants, plants in Western Germany and plants in banking and finance are far more likely to have sharing arrangements.

Figure 1 shows the pattern of sharing by industry more clearly. Industries which

[5] "Full-time" is reported by the employer; we do not know exactly how many hours this definition corresponds to.

[6] We therefore ensure that in our empirical work we do not rely on "changers" between 2000 and 2001.

Table 1: Incidence of financial participation in the IAB establishment panel

		Unweighted			*Weighted*[a]		
	Number of plants	Any sharing	Profit-sharing	Capital sharing	Any sharing	Profit-sharing	Capital sharing
2000	10,874	0.143	0.119	0.044	0.069	0.062	0.016
2001	11,423	0.187	0.174	0.046	0.095	0.085	0.025
2005	12,946	0.193	0.181	0.037	0.094	0.087	0.019
2007	12,957	0.195	0.187	0.038	0.105	0.098	0.019

[a] Weights used are those described in Fischer *et al.* (2009, Section 4.2).

Table 2: Incidence of financial participation by plant characteristics

	Any sharing	profit sharing	Capital-sharing
Number of employees			
< 5	0.056	0.051	0.015
5–9	0.088	0.079	0.019
10–19	0.132	0.122	0.025
20–49	0.193	0.180	0.038
50–99	0.252	0.234	0.048
100–199	0.294	0.273	0.058
200–499	0.350	0.325	0.075
500–999	0.433	0.398	0.111
≥ 1000	0.591	0.534	0.247
Bargaining arrangements			
No collective bargaining	0.140	0.131	0.027
Bargaining at the plant level	0.220	0.202	0.054
Bargaining at the industry level	0.267	0.242	0.070
Works councils			
No works council in the plant	0.118	0.110	0.022
Works council in the plant	0.352	0.323	0.092
Location of plant			
Western German	0.206	0.191	0.047
Eastern German	0.139	0.127	0.031
Industry			
Agriculture	0.101	0.085	0.039
Mining, energy	0.276	0.247	0.078
Food	0.127	0.114	0.028
Consumer goods	0.152	0.136	0.029
Producer goods	0.203	0.186	0.048
Investment goods	0.272	0.254	0.059
Construction	0.097	0.087	0.027
Trade	0.178	0.166	0.034
Transport, communication	0.157	0.145	0.035
Banks, insurance	0.466	0.406	0.165
Catering	0.090	0.086	0.014
Education	0.176	0.167	0.028
Health service	0.091	0.085	0.013
Services for companies	0.220	0.208	0.054
Other services	0.127	0.120	0.018

Pooled sample 2000,2001,2005 and 2007. Weighted by cross-sectional weights.

use profit sharing intensively are also much more likely to use capital sharing. It is striking that the least labour intensive industries (mining and energy, banking and finance, wholesale and retail trade, investment goods, producer goods) are much more likely to have financial participation.

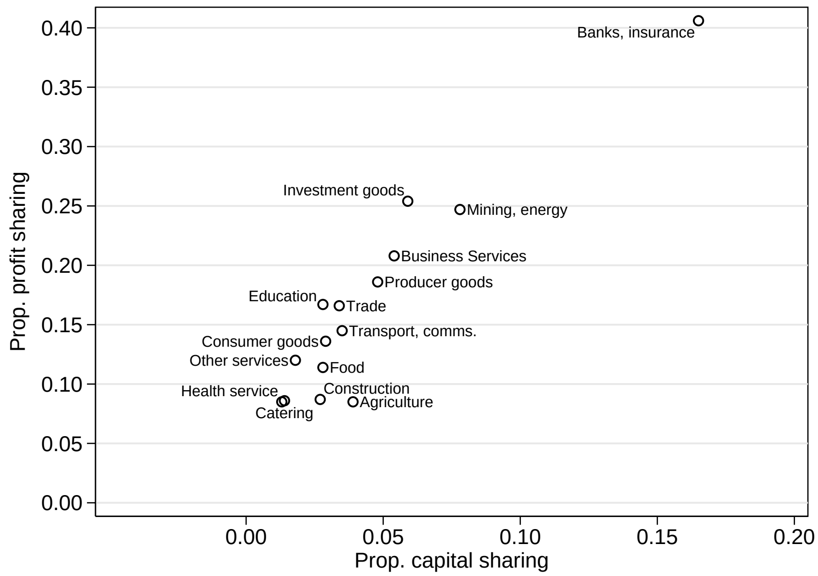

Figure 1: Proportion of plants profit- and capital-sharing by industry

What proportion of workers are covered by profit sharing or capital-sharing schemes? Although we do not know whether individual workers are covered, firms do report an estimate of the share of workers covered by the scheme in 2000, 2001 and 2005. Table 3 shows that the share of workers covered is rather higher than the (weighted) share of plants. Again, this will reflect the fact that large plants are more likely to have these schemes.

Table 3: Incidence of financial participation amongst workers in the IAB establishment panel

	Number of plants	Number of workers	Profit-sharing[b]	Capital sharing[b]
2000	10,874	1,677,995	0.087	0.045
2001	11,423	1,778,496	0.132	0.050
2005	12,946	1,855,923	0.147	0.033
2007[a]	12,957	1,610,415	—	—

[a] Share of workers covered not available in 2007.
[b] Weighted by sampling weights.

4 Methodology

For simplicity, assume just two time periods. In the empirical work we relax this restriction. The basic estimating equation takes the form:

$$y_{jt} = \beta_P P_{jt} + \beta_S S_{jt} + \beta_D D_{2t} + \boldsymbol{\beta}_{\mathbf{x}} \mathbf{x}_{jt} + \theta_{jt} + \boldsymbol{\beta}_{\mathbf{w}} \mathbf{w}_{jt} + \psi_j + \epsilon_{jt}, \quad t = 1, 2 \tag{1}$$

where y_{jt} is the plant-level average of y_{it}. The variable P_{jt} indicates whether the firm is operating profit sharing in year t; the variable S_{jt} indicates whether the firm is operating a share-ownership scheme in year t. D_{2t} is a dummy variable indicating the second period in the data.

We then have a set of characteristics which capture the productivity of the worker. These include observable characteristics $\mathbf{x}_{jt}$ and an unobservable component represented by θ_{jt}. Both of these components are averaged over all workers in the plant. Although each worker is assumed to have a time invariant unobserved productivity θ_i, after averaging to the plant level it will vary over time because workers may join or leave the plant.

Finally, we have a set of characteristics for the plant. Observable characteristics are captured by the vector $\mathbf{w}_{jt}$. Each plant also has a time invariant unobserved component of total compensation, ψ_j. In theory, in a competitive labour market these terms should be unimportant: workers' compensation is determined solely by their marginal product, captured in this model by $\mathbf{x}_{it}$ and θ_i. But in practice it is well-known that wages vary systematically across observably identical workers depending on the characteristics of their firm (such as industry, size and so on). Abowd, Kramarz & Margolis (1999), for example, show that variation in ψ_j is an important component of total compensation.

As usual, OLS estimates of β_P and β_S will be biased if any of the unobserved components of compensation are correlated with P_{jt} or S_{jt}. The usual way to deal with this problem is to remove the fixed unobserved components by differencing. If we restrict the analysis to a balanced panel of plants, we can also deal with this problem using a simple panel difference-in-differences estimator. Define a treatment and control group:

$$T_j = \begin{cases} 1 & \text{if } P_{j1} = 0 \text{ and } P_{j2} = 1 \\ 0 & \text{if } P_{j1} = 0 \text{ and } P_{j2} = 0, \end{cases}$$

A similar definition can be applied for the introduction of share ownership, S_{jt}.

Equation (1) can then be re-written as

$$y_{jt} = \beta_T T_j + \beta_D D_{2t} + \beta_{TD} T_j D_{2t} + \beta_{\mathbf{x}} \mathbf{x}_{jt} + \theta_{jt} + \beta_{\mathbf{w}} \mathbf{w}_{j1} + \epsilon_{jt}. \qquad (2)$$

In this model β_T can be thought of as a selection effect. If plants in the treatment group were paying higher wages before the introduction of a financial participation scheme this will be captured by β_T. Because the panel is balanced the treatment dummy T_j captures any difference in average ψ_j between the treatment and control groups, and so Equation (2) is robust to any unobserved fixed differences between plants in the treatment and control groups. The difference-in-differences estimate of the treatment effect is captured by β_{TD}. This is the additional impact on compensation in the treatment group over and above the selection effect.

However, Equation (2) still includes θ_{jt}. In principle therefore a positive estimate of β_{TD} could merely be the result of plants which introduce sharing arrangements selecting workers with higher θ_i. To deal with this, we also consider a variant of Equation (2) which compares the compensation only of "stayers": workers who remain in the same plant in both periods. By definition, because we are looking at the same workers in both periods, $\theta_{j1} = \theta_{j2}$, and therefore any worker selection effect drops out of Equation (2).

One further difference between Equations (1) and (2) is that in the second case we use plant characteristics from the "before" period only, $\mathbf{w}_{j1}$.[7] This is because, in theory, the introduction of financial participation could change other aspects of the firm captured by $\mathbf{w}_{jt}$ which might themselves affect worker compensation.[8] In contrast, because we are interested in the impact of the introduction of financial participation on workers, we do allow for changes in the quality of the workforce captured by $\mathbf{x}_{jt}$ and θ_{jt}.

Matching

An alternative approach to control for differences in observed characteristics is to estimate the propensity to introduce financial participation schemes using a binary choice model (Probit) of the following form:

$$\Pr(P_{j2} = 1) = \Phi(\gamma_0 + \gamma_{\mathbf{x}} \mathbf{x}_{j1} + \gamma_{\mathbf{w}} \mathbf{w}_{j1}). \qquad (3)$$

[7] Which now also includes the measure of share-ownership at $t = 1$, S_{j1}. In theory it is possible that β_{TD} captures the effect of simultaneously introducing a profit sharing scheme and a share-ownership scheme. But in practice, less than 10 plants are observed doing this.

[8] In practice this makes little difference since $\mathbf{w}_{jt}$ is quite stable over time.

We then use nearest-neighbour one-to-one matching without replacement to explicitly match plants from the treatment and control group whose propensity to introduce sharing is similar. The advantages and disadvantages of this approach compared to linear regression are summarised by Angrist & Pischke (2009, Section 3.3). The most significant effect of matching is that a plant in the treatment group whose propensity to start sharing arrangements is greater than any plant in the control group is not part of the comparison.[9]

Variance estimation

We also wish to examine whether the introduction of financial participation increases the risk faced by workers. A natural way of measuring risk is the variance of total compensation. This variance decomposes into a between and a within component, each of which captures a different aspect of the risk facing a worker whose firm enters into sharing arrangements.

If the introduction of financial participation schemes increases the variance of compensation because some firms are more profitable than others, this will be reflected in an increase in the between variance for the treatment group relative to the control group. If the introduction of financial participation schemes increases the variance of compensation over time within a plant (because plants' profits fluctuate over time), this will be reflected in an increase in the within variance for the treatment group relative to the control group. The within component can only be measured if we observe multiple periods for plants both before and after the treatment. If we only have a single time period before and after then the within variance is automatically zero.

Define the total variance of compensation for the treatment group ($T_j = 1$) in the "before" treatment periods (B) to be σ^2_{1B}. This decomposes almost exactly into the between variance $\bar{\sigma}^2_{1B}$ and the within variance $\ddot{\sigma}^2_{1B}$. Similarly, the total variance for the treatment group in the "after" treatment period is σ^2_{1A}.

To assess whether the total variance increases by more in the treatment group we apply the familiar difference-in-difference approach:

$$(\sigma^2_{1A} - \sigma^2_{1B}) - (\sigma^2_{0A} - \sigma^2_{0B}),$$

where the second two terms are the "after" and "before" variances for the control

[9]Known as the off-support condition.

group. Two further analagous equations apply to the between and within components.

5 Results

5.1 Financial participation and average compensation

Table 4 summarises all our basic estimates of Equation (1). Row (1) shows the result of estimating Equation (1) by OLS for the whole sample without controlling for observed or unobserved covariates. In this initial analysis we consider total compensation from 2000, 2001, 2005 and 2007[10] since these are the years in which we observe P_{jt} and S_{jt}. In the raw data, firms which have financial participation schemes pay much higher wages, over 0.25 log-points more in the case of profit-sharing and over 0.18 log-points more in the case of share ownership. Of course, this raw difference partly reflects large differences in the observable characteristics of plants which operate these schemes. As noted, such plants are larger, situated in Western Germany, and in industries with high labour productivity.

We then include a rich set of observed plant and worker covariates. Means of $\mathbf{x}_{jt}$ and $\mathbf{w}_{jt}$ for different plant types are summarised in Tables A.1 and A.2. The results are shown in Row (2) of Table 4. The inclusion of covariates greatly reduces the estimated effect of financial participation. Profit-sharing is now associated with wages which are 0.046 log-points higher, and share ownership with wages which are just 0.015 log-points higher. The smaller effect of share ownership is unsurprising, because the value of any shares owned by workers will not be directly reflected in their annual compensation as measured by the *Beschäftigtenstatistik*.[11] Thus any effect on y_{jt} is an additional impact above the value of any shares.

We now investigate whether various sample restrictions affect our result. In row (3) we show what happens when "singleton" plants are removed from the analysis. This is important because any panel data analysis always removes these plants. This has very little effect on the estimated value of β_P, but reduces the estimate of β_S still further so that it is neither economically or statistically significant.

In row (4) we re-estimate Equation (1), now removing the unobserved plant-level fixed component of wages. This reduces the effect of financial participation on wages still further. However, for a number of reasons this is not our preferred specification.

[10] In the current draft of the paper we have not yet included the 2007 data.

[11] In contrast, workers' annual compensation does include any bonuses received as a result of profit-sharing.

First, as is well known, the fixed effects estimates will be biased towards zero if there is measurement error in the explanatory variables. Second, this model does not use a clearly specified treatment and control group, and assumes that the impact of adopting financial participation is equal and opposite to the impact of stopping financial participation. For these reasons, we prefer to define the treatment and control groups more carefully.

Before we do this, in row (5) we further restrict the sample to a balanced panel of plants which are observed in 2000, 2001, 2005 and 2007. This is a significant sample restriction which is required if we are to estimate Equation (2) on a well-defined treatment and control group. In row (6) we report first-differenced estimates of Equation (1) on the balanced panel. In both cases the use of a balanced panel does not substantially change the estimated coefficients, so the estimates from row (5) are similar to those from row (2), and the estimates from row (6) are similar to those from row (4).

Table 4: Profit-sharing, share-ownership and total compensation: estimates of Equation (1)

	β_P	β_S	Sample size
(1) Pooled OLS, no covariates	0.256	0.185	28,744
	(0.006)	(0.011)	
(2) Include $\mathbf{x}_{jt}$ and $\mathbf{w}_{jt}$	0.046	0.015	20,909
	(0.005)	(0.008)	
(3) No singletons	0.045	0.008	16,620
	(0.005)	(0.009)	
(4) Fixed-effects	0.007	−0.002	16,620
	(0.003)	(0.005)	
(5) Balanced panel (pooled OLS)	0.040	0.014	7,638
	(0.008)	(0.014)	
(6) Balanced panel fixed-effects	0.010	−0.002	7,638
	(0.004)	(0.008)	

Standard errors in parentheses are all robust to clustering at the plant level.

We now define the treatment and control groups more precisely for the introduction of profit-sharing. The control sample consists of those plants with $P_{jt} = 0$ in 2000, 2001, 2005 and 2007. The treatment sample consists of those plants observed in the same four years which have $P_{jt} = 0$ in 2000 and 2001, but which have $P_{jt} = 1$ in both 2005 and 2007. This treatment group are called "adopters". The groups are defined in this way in order to reduce the possibility of measurement error, since we do not observe P_{jt} in every year. A plant with $P_{jt} = 1$ in 2005 and 2007 is very unlikely to have $P_{jt} = 0$ in 2006. The precise date on which the financial participation scheme is introduced is not observed. Our definition of the treatment group implies that the profit-sharing scheme was introduced at some point between July 1st 2001 and June 30th 2005.[12]

Although compensation is defined as the average for the whole calendar year, S_{jt} relates to 30th June in each year. It is therefore possible that some of the compensation paid in 2001 and 2005 could fall inside the treatment window. The cleanest definition of compensation in the "before" and "after" periods are therefore those covering 2000 and 2006. We report various difference-in-differences estimates in Table 5.

Table 5: Profit-sharing and total compensation: difference-in-difference estimates from Equation (2)

	β_D	β_T	β_{TD}	Sample size
(1) No covariates	0.057	0.277	0.057	3,304
	(0.005)	(0.035)	(0.013)	
(2) Include $\mathbf{x}_{jt}$ and $\mathbf{w}_{jt}$	0.052	0.014	0.041	3,180
	(0.009)	(0.019)	(0.015)	
(3) Stayers	0.056	0.022	0.052	2,986
	(0.016)	(0.019)	(0.012)	
(4) Movers	0.041	0.022	0.023	2,542
	(0.010)	(0.022)	(0.029)	
(5) All workers, matched pairs	0.086	0.037	0.025	332
	(0.012)	(0.048)	(0.018)	

Standard errors in parentheses are all robust to clustering at the plant level.

Row (1) shows the raw difference-in-differences results from Equation (2) without covariates. The estimate of β_T tells us that firms in the treatment sample (adopters) pay much more (0.27 log-points) *before* the adoption of profit sharing. The estimate of β_{TD} tells us that, in addition, workers in plants which adopt profit sharing also experience a significant increase in compensation of 0.057 log points.

Row (2) also includes plant- and worker-level covariates. This has the effect of wiping out the selection effect ($\hat{\beta}_T = 0.014$ with a standard error of 0.019), which implies that the pre-treatment difference in compensation between adopters and the control group is due to differences in these observed covariates. The additional impact of introducing profit sharing is only slightly reduced to 0.041 log-points and is still highly significant (standard error 0.015).

As noted, although the DiD estimates control for any unobserved plant component of compensation, it is still possible that the positive effects of profit sharing on total

[12] The number of plants in our sample who satisfy our rigorous definition of the treatment group for share ownership (no share ownership in 2000 and 2001, share ownership in 2005 and 2007) is very small (less than 20 plants), and so we do not estimate (2) in the case of share ownership schemes.

compensation are the result of worker turnover. For example, a plant which introduces profit sharing might hire more highly paid workers and separate from more low-paid workers. In Equation (2) this is captured by θ_{jt}, the average unobserved worker component of compensation. In row (3), we therefore re-calculate the plant-level mean wages, y_{jt}, and restrict the sample of workers to those who remain in the plant between 2000 and 2006. Because we are now comparing the same workers in both periods, $\theta_{j1} = \theta_{j2}$, and therefore any worker selection effect drops out of Equation (2).

Row (3) shows out that the estimate of β_{TD} for stayers is actually larger than for all workers, increasing to 0.052 log-points. In row (4) we also report estimates for workers who do not remain in the same plant between 2000 and 2006. The estimate of β_D tells us that the average compensation of workers who joined plants in the control group in 2006 was 0.041 log-points more than the average compensation of workers who left plants in the control group in 2000. The estimate of β_T tells us that the average compensation of workers who left plants in the treatment group in 2000 was not significantly different from the average compensation of workers who left plants in the control group in 2000. Finally, the estimate of β_{TD} tells us that the average compensation of workers who joined adopters was not significantly greater than the average compensation of workers who joined non-adopters, after controlling for any pre-selection effect ($\hat{\beta}_{TD} = 0.023$ with a standard error of 0.029). In short, rows (3) and (4) clearly show that the observed overall effect of introducing profit sharing is not due to worker selection effects.

In row (5), we follow the method described in Section 4 and explicitly match plants in the treatment and control groups. The effect of matching is to greatly reduce the sample size because for each plant in the treatment group we draw just one plant in the control group. In Figures A.1 and A.2 we plot the propensity scores for plants in the treatment and control group before and after matching, to show that the process of matching ensures that the propensity for adopting profit-sharing (as a function of observable characteristics) is far more similar after matching.[13] After matching, the estimated treatment effect is now smaller and insignificantly different from zero ($\hat{\beta_{TD}} = 0.025$ with a standard error of 0.018.)

[13] A series of t-tests of the means of $\mathbf{x}_{jt}$ and $\mathbf{w}_{jt}$ shows that matching also removes any significant difference in means for all covariates. Before matching 31 out of 61 covariates had significantly different means between the treatment and control groups; after matching none of the means were significantly different at 10% significance levels.

Departures from the base model

In Table 6 we consider various departures from the base model for the effect of profit sharing on compensation. First, we include information from all the relevant post-treatment waves rather than just $t = 2006$. This allows the impact of the introduction of financial participation to vary across 2005–2006. Equation (2) is modified so that there is an estimate of β_D and an estimate of β_{TD} for each post-treatment wave. Row (2) of Table 6 shows that the addition to wages after the introduction of profit-sharing is very stable.

Table 6: Profit sharing and total compensation: departures from the base model

	β_D	β_T	β_{TD}	Sample size
(1) Base model	0.052	0.014	0.041	3,180
	(0.009)	(0.019)	(0.015)	
(2) Varying post-treatment effect by year				
2005	0.028	0.009	0.043	4,920
	(0.008)	(0.018)	(0.012)	
2006	0.036		0.043	
	(0.009)		(0.013)	
(3) Interacted with proportion of workers affected by profit sharing				
<20%	0.052	0.007	0.018	3,180
	(0.009)	(0.026)	(0.018)	
20–99%		0.023	0.078	
		(0.045)	(0.040)	
100%		0.021	0.055	
		(0.028)	(0.028)	
(4) Interacted with bargaining arrangements				
No collective bargaining	0.052	0.029	0.026	3,180
	(0.009)	(0.032)	(0.027)	
Collective bargaining		0.006	0.049	
		(0.022)	(0.018)	
(5) Interacted with works council				
No works council	0.052	0.062	0.023	3,177
	(0.009)	(0.034)	(0.027)	
Works council		−0.021	0.045	
		(0.019)	(0.017)	
(6) Interacted with plant size				
< 20 employees	0.052	0.093	0.010	3,180
	(0.009)	(0.060)	(0.050)	
20–199 employees		0.012	0.055	
		(0.023)	(0.023)	
> 200 employees		−0.025	0.031	
		(0.029)	(0.015)	

Standard errors in parentheses are all robust to clustering at the plant level.

Although we don't know which individual workers are covered by the profit-sharing agreement, we do know what proportion of workers in a plant are covered. It seems likely that the strength of any wage effect will vary with the proportion. In row (3) we modify Equation (2) by interacting T_j and $T_j D_{2t}$ with the proportion of workers covered by profit-sharing. The results show that the DiD wage effect is insignificantly different from zero in plants with a low proportion of workers covered (0.018 log points with a standard error of 0.018), while the effect is larger and significant for plants with a higher proportion of workers covered (0.055 with a standard error of 0.028).

We would expect that the industrial relations environment in the plant would have an effect on the wage effect of introducing profit-sharing. As noted by Welz & Macias (2007), when unions agree to the introduction of financial participation schemes, it typically depends on an implicit agreement that basic wages will be protected. In rows (4) and (5) we investigate this by interacting T_j and $T_j D_{2t}$ with dummy variables indicating whether the plant bargains with unions (either at the firm or sectoral level) or whether the plant operates a works councils. In both cases our prior hypothesis is confirmed: the DiD estimate is larger and significant in the presence of union bargaining or works councils. Of course, this might be picking up a plant size effect, since bargaining and works councils are strongly associated with larger plants. Row (6) confirms that the wage effect is insignificant in small plants, but larger and significant in plants employing more than 20 workers.

5.2 Sharing and the variance of compensation

Most of our results from the previous sub-section suggest that the introduction profit-sharing is associated with modest increases in plant-level wages of between 2% and 5%. However, in a smaller sample of matched pairs the increase is insignificantly different from zero. At the very least, we can say that workers are not worse off in terms of mean wages from the introduction of profit-sharing. However, we also need to assess whether the introduction of profit-sharing leads to more uncertainty in total compensation. In Table 7 we report estimates of the variance of plant-level wages, decomposing into within and between components as described in Section 4.

The first row of Table 7 shows that the total variance of earnings increases by 0.009 (standard error 0.004) between 2000/2001 (before) and 2005/2006 (after). The treatment group actually has a slightly lower variance of earnings before the introduction of profit-sharing, but this is not significantly different from zero. After the introduction of profit-sharing the variance of earnings increases by 0.0139 more in

Table 7: Changes in the variance of compensation: profit sharing

	Time effect $\sigma^2_{0A} - \sigma^2_{0B}$	Selection effect $\sigma^2_{1B} - \sigma^2_{0B}$	Diff. in Diff. $(\sigma^2_{1A} - \sigma^2_{1B}) - (\sigma^2_{0A} - \sigma^2_{0B})$
Total variance of y_{jt}	0.009	-0.018	0.0139
	(0.004)	(0.014)	(0.0195)
Between variance	0.008	-0.020	0.018
	(0.004)	(0.013)	(0.019)
Within variance	0.0002	0.002	-0.004
	(0.0003)	(0.0009)	(0.0013)

the treatment group than the control group, but again this estimate has a relatively large standard error and is insignificantly different from zero. What increase in variance there is due to an increase in the variance of earnings between plants. There is no evidence of an increase in the within component of variance; in fact the coefficient is significantly negative.

6 Conclusion

In this paper we provide evidence on the relationship between the use of financial participation schemes and worker compensation using a large linked panel of German firms. The data allow us to measure total worker compensation, including any bonus payments which arise as a result of profit sharing schemes. We are also able to control for a wide range of worker and plant characteristics which might affect the use of profit sharing schemes and total compensation. The use of linked worker-firm data allows us to control for unobserved firm and worker effects on compensation. We consider both the mean and the variance of workers' total compensation, since both have an impact on workers' welfare.

Our findings are as follows:

1. The incidence of financial participation schemes in Germany has not increased significantly over the period 2001–2007, and in fact the use of capital sharing arrangements appears to have declined slightly.

2. The use of financial participation is much higher in large plants and in sectors with low labour intensity.

3. Workers in plants which operate financial participation schemes earn significantly more: 25% in the case of profit-sharing and 18% in the case of share ownership.

4. However, econometric models which deal with selection by plants and workers into profit-sharing schemes suggest that the wage effect is much smaller: between 0.041 log-points (from a difference-in-difference regression) and 0.025 log-points (from a comparison of matched pairs). The estimate from a comparison of matched pairs is not significantly difference from zero at conventional significance levels.

5. The wage effect of profit-sharing is larger for plants with a higher proportion of workers covered, for plants with collective bargaining arrangements and for plants with works councils.

6. The effect of the introduction of profit-sharing on the variance of wages appears to be minimal, and therefore we would not expect any significant effects on wage inequality.

References

Abowd, J., Kramarz, F. & Margolis, D. (1999), "High wage workers and high wage firms", *Econometrica* **67**(2), 251–333.

Angrist, J. & Pischke, J.-S. (2009), *Mostly harmless econometrics*, Princeton University Press.

Bellmann, L. & Möller, I. (2009), "Profit-sharing and employment stability", Mimeo, Institut für Arbeitsmarkt- und Berufsforschung.

Bender, S., Haas, A. & Klose, C. (2000), "IAB employment subsample: opportunities for analysis provided by the anonymised subsample", IZA discussion paper 117. *Forschungsinstitut zur Zukunft der Arbeit*, Bonn.

Bhargava, S. & Jenkinson, T. (1995), "Explicit versus implicit profit sharing and the determination of wages: microeconomic evidence from the UK", *Labour* **9**(1), 73–95.

Blasi, J., Freeman, R., Mackin, C. & Kruse, D. (2008), "Creating a bigger pie? the effects of employee ownership, profit sharing, and stock options on workplace performance", NBER working paper 14230.

Buchele, R., Kruse, D., Rodgers, L. & Scharf, A. (2009), "Show me the money: Does shared capitalism share the wealth?", NBER working paper 14830.

Cable, J. & Wilson, N. (1989), “Profit-sharing and productivity: An analysis of uk engineering firms”, *The Economic Journal* **90**(396), 366–375.

Commission of the European Communities (1996), “Pepper II: promotion of participation by employed persons in profits and enterprise results”.

Estrin, S. & Wilson, N. (1986), “The microeconomic effects of profit-sharing: the British experience”, Centre for Labour Economics Discussion Paper 247.

Fischer, G., Janik, F., Müller, D. & Schmucker, A. (2009), “The IAB establishment panel — things users should know”, *Schmollers Jahrbuch* **129**(1), 133–148.

FitzRoy, F. & Kraft, K. (1987), “Cooperation, productivity and profit sharing”, *Quarterly Journal of Economics* **102**(1), 23–35.

FitzRoy, F. & Kraft, K. (1995), “On the choice of incentives in the firm”, *Journal of economic behaviour and organisation* **26**, 145–160.

Freeman, R. (2008), “When workers share in profits: Effort and responses to shirking”, CEP Discussion Paper 882.

Hart, R. & Hübler, O. (1991), “Are profit shares and wages substitute or complementary forms of compensation?”, *Kyklos* **44**(2), 221–231.

Jones, D. C. & Kato, T. (1995), “The productivity effects of employee stock-ownership plans and bonuses: Evidence from japanese panel data”, *The American Economic Review* **85**(3), 391–414.

Knez, M. & Simester, D. (2001), “Firm-wide incentives and mutual monitoring at continental airlines”, *Journal of Labor Economics* **19**(4), 743–772.

Kraft, K. & Ugarković, M. (2006), “Profit sharing and the financial performance of firms: evidence from Germany”, *Economics Letters* **92**, 333–338.

Kruse, D. (1992), “Profit sharing and productivity: microeconomic evidence from the United States”, *The Economic Journal* **102**(410), 24–36.

Kruse, D., Freeman, R. & Blasi, J. (2008), “Do workers gain by sharing? employee outcomes under employee ownership, profit sharing, and broad-based stock options”, NBER working paper 14233.

Kruse, D. L. (1993), “Does profit sharing affect productivity”, NBER working paper 4542.

Lemieux, T., MacLeod, W. & Parent, D. (2009), "Performance pay and wage inequality", *Quarterly Journal of Economics* **74**(1), 1–49.

Prendergast, C. (1999), "The provision of incentives in firms", *Journal of Economic Literature* **37**, 7–63.

Wadhwani, S. & Wall, M. (1990), "The effects of profit-sharing on employment, wages, stock returns and productivity: Evidence from UK micro-data", *Economic Journal* **100**(399), 1–17.

Weiss, A. (1987), "Incentives and worker behaviour", NBER working paper 2194.

Weitzman, M. (1984), *The Share Economy*, Harvard University Press.

Weitzman, M. (1987), "Steady-state unemployment under profit-sharing", *The Economic Journal* pp. 86–105.

Welz, C. & Macias, E. (2007), "Financial participation of employees in the european union: Much ado about nothing?", European Foundation for the Improvement of Living and Working Conditions.

Wilson, N., Cable, J. & Peel, M. (1990), "Quit rates and the impact of participation, profit-sharing and unionization: empirical evidence from UK engineering firms", *British Journal of Industrial Relations* **28**(2), 198–211.

Wilson, N. & Peel, M. (1991), "The impact on absenteeism and quits of profit-sharing and other forms of employee participation", *Industrial and Labor Relations Review* **44**(3), 454–468.

A Appendix

A.1 Figures

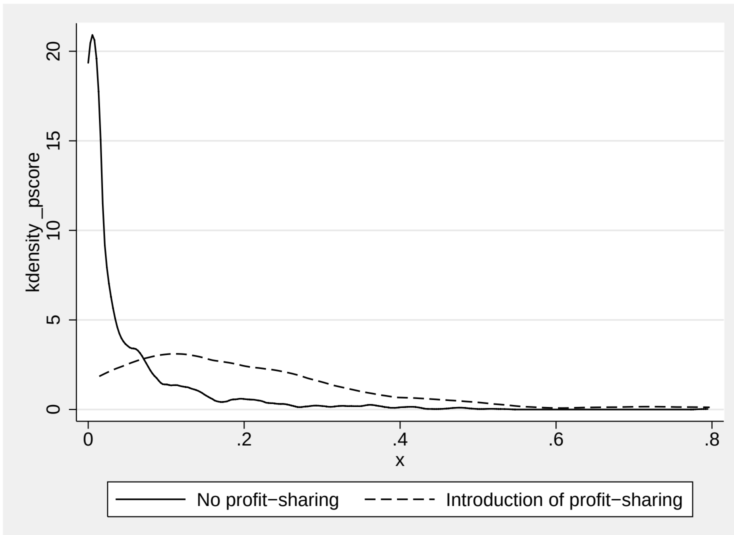

Figure A.1: Propensity score of treated and untreated plants, unmatched

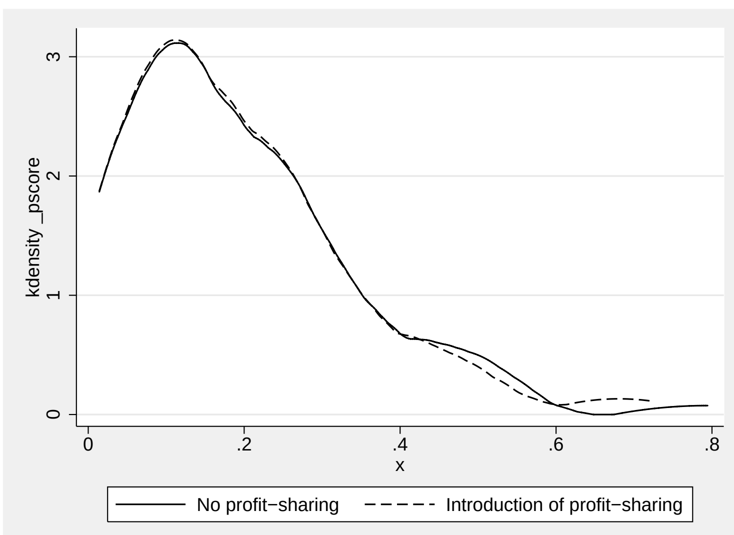

Figure A.2: Propensity score of treated and untreated plants, matched

A.2 Tables

Table A.1: Means of plant covariates by plant type

	$P_{jt} = 0$	$P_{jt} = 1$	$S_{jt} = 0$	$S_{jt} = 1$
Works council	0.279	0.568	0.312	0.668
Bargaining at sectoral level	0.441	0.536	0.451	0.581
Barganing at firm level	0.070	0.089	0.072	0.109
Plant has new technology	0.672	0.775	0.684	0.801
Workers receive overtime	0.403	0.610	0.430	0.615
Plant born 1990-1994	0.337	0.264	0.328	0.263
Plant born after 1995	0.144	0.132	0.141	0.164
Plant not part of a larger firm	0.790	0.529	0.762	0.404
Plant located in Eastern *Land*	0.421	0.267	0.401	0.284
5–9 employees	0.175	0.069	0.161	0.077
10–19 employees	0.160	0.094	0.152	0.076
20–49 employees	0.197	0.186	0.197	0.159
50–99 employees	0.109	0.140	0.114	0.115
100–199 employees	0.083	0.133	0.090	0.117
200–499 employees	0.078	0.156	0.089	0.136
500–999 employees	0.029	0.085	0.036	0.098
$\geq$ 1000 employees	0.020	0.103	0.027	0.189
Mining, energy	0.014	0.022	0.015	0.029
Food manufacturing	0.040	0.027	0.038	0.027
Consumer goods manufacturing	0.054	0.039	0.052	0.033
Producer goods manufacturing	0.116	0.128	0.118	0.128
Investment goods manufacturing	0.158	0.238	0.169	0.223
Construction	0.134	0.068	0.125	0.073
Wholesale and retail trade	0.168	0.175	0.170	0.141
Transport & communications	0.048	0.043	0.048	0.040
Financial services	0.010	0.039	0.011	0.095
Hotels & restaurants	0.031	0.018	0.030	0.010
Education	0.011	0.010	0.011	0.010
Health services	0.055	0.023	0.051	0.013
Business services	0.106	0.133	0.109	0.148
Other services	0.034	0.025	0.034	0.009

Table A.2: Means of worker covariates by plant type

	$P_{jt} = 0$	$P_{jt} = 1$	$S_{jt} = 0$	$S_{jt} = 1$
Average age 21-30	0.172	0.159	0.171	0.151
Average age 31-40	0.316	0.333	0.318	0.347
Average age 41-50	0.306	0.306	0.306	0.308
Average age 51-55	0.109	0.112	0.109	0.116
Average age 56-65	0.093	0.087	0.093	0.076
Average tenure 1-2 years	0.120	0.113	0.119	0.116
Average tenure 2-5 years	0.246	0.236	0.246	0.227
Average tenure 6-10 years	0.351	0.300	0.343	0.315
Average tenure 11-15 years	0.122	0.141	0.125	0.127
Average tenure 16-20 years	0.042	0.056	0.044	0.053
Average tenure 21-25 years	0.034	0.046	0.035	0.051
Average tenure $>$ 25 years	0.027	0.042	0.029	0.043
Proportion of workers:				
Multiple jobs	0.032	0.033	0.033	0.028
German workers	0.957	0.947	0.955	0.956
females	0.352	0.298	0.346	0.272
Apprenticeship, no Abitur	0.689	0.636	0.683	0.623
Abitur, no Apprencticeship	0.004	0.008	0.005	0.010
Apprenticeship and Abitur	0.030	0.050	0.032	0.061
Technical College Degree	0.028	0.049	0.031	0.058
University Education	0.033	0.068	0.036	0.095
Unknown education	0.133	0.102	0.130	0.082
Qualified manual occupation	0.256	0.182	0.246	0.181
Engineers and technicians	0.083	0.128	0.089	0.144
Basic service occupation	0.115	0.089	0.112	0.070
Qualified service occupation	0.054	0.030	0.052	0.018
Semi-professional	0.018	0.014	0.017	0.013
Professional	0.012	0.011	0.012	0.010
Basic business occupation	0.071	0.072	0.071	0.071
Qualified business occupation	0.173	0.247	0.181	0.268
Manager	0.037	0.046	0.038	0.050

Table A.3: Estimates of Equation (1)

	(1)		(2)		(3)		(4)	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
P_{jt} (Profit sharing)	0.256	(0.006)	0.046	(0.005)	0.045	(0.005)	0.007	(0.003)
S_{jt} (Capital sharing)	0.185	(0.011)	0.015	(0.008)	0.008	(0.009)	−0.002	(0.005)
Year = 2001	−0.006	(0.003)	0.013	(0.002)	0.012	(0.002)	0.014	(0.001)
Year = 2005	0.041	(0.005)	0.042	(0.005)	0.043	(0.005)	0.038	(0.005)
Works council			0.092	(0.006)	0.090	(0.007)	−0.005	(0.008)
Bargaining at sectoral level			0.074	(0.005)	0.078	(0.006)	0.011	(0.004)
Barganing at firm level			0.053	(0.007)	0.053	(0.007)	0.007	(0.005)
Plant has new technology			0.039	(0.004)	0.037	(0.005)	0.002	(0.003)
Workers receive overtime			0.051	(0.004)	0.051	(0.005)	0.012	(0.005)
Plant born 1990-1994			0.004	(0.007)	0.013	(0.009)	—	
Plant born after 1995			0.016	(0.008)	0.031	(0.011)	—	
Plant not part of a larger firm			−0.065	(0.005)	−0.063	(0.006)	−0.003	(0.006)
Plant located in Eastern *Land*			−0.258	(0.008)	−0.270	(0.009)	−0.045	(0.052)
5–9 employees			0.106	(0.011)	0.109	(0.013)	0.020	(0.011)
10–19 employees			0.166	(0.010)	0.169	(0.013)	0.038	(0.013)
20–49 employees			0.207	(0.010)	0.205	(0.013)	0.033	(0.015)
50–99 employees			0.206	(0.011)	0.206	(0.013)	0.026	(0.016)
100–199 employees			0.219	(0.012)	0.220	(0.014)	0.029	(0.017)
200–499 employees			0.235	(0.012)	0.240	(0.014)	0.026	(0.018)
500–999 employees			0.251	(0.013)	0.254	(0.016)	0.029	(0.023)
$\geq$ 1000 employees			0.228	(0.014)	0.228	(0.017)	−0.009	(0.029)
Mining, energy			0.210	(0.019)	0.208	(0.022)	—	
Food manufacturing			0.024	(0.019)	0.037	(0.021)	—	
Consumer goods manufacturing			0.122	(0.017)	0.129	(0.020)	—	
Producer goods manufacturing			0.107	(0.016)	0.104	(0.018)	—	
Investment goods manufacturing			0.123	(0.016)	0.127	(0.018)	—	
Construction			0.117	(0.016)	0.117	(0.019)	—	
Wholesale and retail trade			0.100	(0.017)	0.105	(0.020)	—	
Transport & communications			0.112	(0.019)	0.110	(0.023)	—	
Financial services			0.171	(0.026)	0.193	(0.031)	—	
Hotels & restaurants			−0.060	(0.024)	−0.067	(0.029)	—	
Education			0.083	(0.030)	0.107	(0.034)	—	
Health services			0.184	(0.027)	0.202	(0.032)	—	
Business services			0.088	(0.018)	0.081	(0.022)	—	
Other services			−0.018	(0.024)	−0.022	(0.030)	—	
Average age 21-30			0.202	(0.061)	0.265	(0.072)	0.180	(0.062)
Average age 31-40			0.285	(0.061)	0.346	(0.072)	0.207	(0.062)
Average age 41-50			0.278	(0.061)	0.342	(0.072)	0.220	(0.063)
Average age 51-55			0.275	(0.063)	0.346	(0.074)	0.197	(0.064)
Average age 56-65			0.325	(0.064)	0.392	(0.075)	0.215	(0.066)
Multiple jobs			−0.036	(0.026)	−0.024	(0.029)	−0.004	(0.022)
German workers			0.077	(0.029)	0.056	(0.037)	0.052	(0.049)
females			−0.387	(0.012)	−0.388	(0.014)	−0.288	(0.023)
Apprenticeship, no Abitur			0.041	(0.016)	0.027	(0.019)	0.052	(0.034)
Abitur, no Apprencticeship			0.023	(0.086)	0.093	(0.093)	−0.047	(0.123)
Apprenticeship and Abitur			0.176	(0.033)	0.160	(0.039)	0.129	(0.051)
Technical College Degree			0.329	(0.030)	0.318	(0.036)	0.327	(0.052)
University Education			0.363	(0.032)	0.346	(0.038)	0.228	(0.058)
Unknown education			0.049	(0.017)	0.043	(0.020)	0.022	(0.037)
Qualified manual occupation			0.024	(0.010)	0.028	(0.011)	0.046	(0.030)
Engineers and technicians			0.319	(0.017)	0.327	(0.020)	0.152	(0.042)
Basic service occupation			−0.094	(0.016)	−0.078	(0.019)	−0.038	(0.040)
Qualified service occupation			0.067	(0.027)	0.062	(0.032)	0.054	(0.070)
Semi-professional			0.181	(0.041)	0.160	(0.052)	0.173	(0.087)
Professional			0.289	(0.052)	0.241	(0.064)	0.283	(0.076)
Basic business occupation			0.028	(0.019)	0.035	(0.023)	0.002	(0.040)
Qualified business occupation			0.292	(0.016)	0.303	(0.019)	0.085	(0.035)
Manager			0.398	(0.028)	0.421	(0.033)	0.284	(0.049)
Average tenure 1-2 years			0.017	(0.018)	0.003	(0.023)	0.013	(0.013)
Average tenure 2-5 years			0.023	(0.017)	0.026	(0.022)	0.033	(0.013)
Average tenure 6-10 years			0.058	(0.017)	0.069	(0.022)	0.060	(0.014)
Average tenure 11-15 years			0.078	(0.020)	0.076	(0.025)	0.081	(0.018)
Average tenure 16-20 years			0.086	(0.030)	0.062	(0.036)	0.111	(0.033)
Average tenure 21-25 years			0.096	(0.035)	0.107	(0.040)	0.114	(0.050)
Average tenure $>$ 25 years			0.157	(0.032)	0.158	(0.037)	0.157	(0.050)
Constant	4.140	(0.004)	3.499	(0.068)	3.453	(0.082)	3.825	(0.089)

Table A.4: Estimate of Equation 3

	Coeff.	S.E.	*p*-value
age_21_30	4.892	(6.883)	[0.477]
age_31_40	4.919	(6.837)	[0.472]
age_41_50	5.306	(6.851)	[0.439]
age_51_55	5.404	(6.876)	[0.432]
age_56_65	3.826	(6.890)	[0.579]
mjob	−0.516	(4.079)	[0.899]
foreign	−0.173	(0.721)	[0.810]
female	−0.460	(0.334)	[0.169]
qual2	−0.510	(0.447)	[0.254]
qual3	−6.422	(7.638)	[0.400]
qual4	−1.347	(1.174)	[0.251]
qual5	0.626	(0.873)	[0.473]
qual6	−0.218	(0.858)	[0.799]
qual7	−0.662	(0.538)	[0.219]
occ2	−0.399	(0.384)	[0.299]
occ3	0.616	(0.509)	[0.226]
occ4	−0.506	(0.484)	[0.296]
occ5	2.166	(0.727)	[0.003]
occ6	2.851	(0.952)	[0.003]
occ7	−0.053	(1.854)	[0.977]
occ8	−0.075	(0.595)	[0.900]
occ9	0.832	(0.479)	[0.082]
occ10	1.584	(0.633)	[0.012]
ten_1_2	0.647	(0.700)	[0.355]
ten_2_5	−0.304	(0.619)	[0.623]
ten_6_10	−0.078	(0.613)	[0.898]
ten_11_15	0.053	(0.922)	[0.954]
ten_15_20	0.859	(1.038)	[0.408]
ten_20_25	0.534	(1.026)	[0.603]
ten_25plus	0.860	(1.200)	[0.474]
workcoun	0.275	(0.193)	[0.155]
bar1	−0.107	(0.173)	[0.534]
bar2	−0.276	(0.259)	[0.286]
technew	−0.021	(0.156)	[0.894]
D	0.203	(0.143)	[0.157]
birth_90_94	0.372	(0.284)	[0.191]
birth_95_99	0.720	(0.317)	[0.023]
single	−0.391	(0.147)	[0.008]
East	−0.006	(0.275)	[0.982]
size2	5.825	.	.
size3	6.142	(0.308)	[0.000]
size4	6.539	(0.288)	[0.000]
size5	6.690	(0.325)	[0.000]
size6	7.231	(0.341)	[0.000]
size7	7.191	(0.358)	[0.000]
size8	7.084	(0.448)	[0.000]
size9	7.272	(0.475)	[0.000]
ind2	−0.778	(0.677)	[0.250]
ind3	−0.770	(0.592)	[0.194]
ind4	−0.715	(0.553)	[0.196]
ind5	−0.365	(0.465)	[0.432]
ind6	−0.159	(0.470)	[0.736]
ind7	−0.534	(0.514)	[0.299]
ind8	0.150	(0.507)	[0.768]
ind9	−0.360	(0.570)	[0.527]
ind10	0.851	(0.961)	[0.376]
ind12	−1.563	(1.006)	[0.120]
ind13	−1.625	(0.771)	[0.035]
ind14	−0.416	(0.521)	[0.424]
ind15	−0.700	(0.773)	[0.365]
_cons	−12.482	(6.850)	[0.068]