Firm ownership and rent sharing*

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Abstract

In this paper we analyse – theoretically and empirically – how the degree of private versus public ownership of firms affects the degree of rent sharing between firms and their workers. Using a particularly rich linked employer-employee dataset from Portugal, covering a large number of corporate ownership changes across a wide spectrum of economic sectors over more than 20 years, we find that rent sharing is significantly higher in firms with a larger share of private ownership. Estimates from our most preferred empirical specification suggest that an increase in the private ownership share of 10 percentage points increases (on average) the rent-sharing elasticity by 0.0002. Based on a theoretical analysis that incorporates union-firm wage bargaining and efficiency wage effects within the same modelling framework, this result cannot be explained by private firms being more profit oriented than public ones. However, the result is consistent with a scenario whereby privatisation leads to less job security for workers, implying stronger efficiency wage effects.

Keywords: rent sharing; private vs public ownership; panel data

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1 Introduction

Rent sharing between firms and their workers is a widely documented feature of labour markets in many countries (e.g., Mumford and Dowrick, 1994; Blanchflower et al., 1996; Black and Strahan, 2001; Arai, 2003; Estevão and Tevlin, 2003; Budd et al., 2005; Güertzgen, 2009). Still, the understanding of which characteristics of firms and workers that contribute to the size and extent of such rent sharing is still not fully developed. The present paper explores the effect of an hitherto rather neglected explanatory variable of rent sharing, namely corporate ownership. More precisely, we analyse – theoretically and empirically – how the degree of private versus public ownership of firms affects the level of rent sharing.[1]

To our knowledge, there exists little or no documented theoretical understanding of the link between firm ownership and rent sharing, and so far, the empirical evidence on this relationship is fairly scant and also geographically narrow, almost exclusively limited to economies from Eastern Europe. For example, Grosfeld and Nivet (1999), Dobbeleare (2004) and Luke and Schaffer (2000) explore this relationship in Poland, Bulgaria and Russia, respectively. Monteiro and Portela (2010) is one exception, but their analysis is confined to a specific economic industry (banking) in a Western European economy (Portugal). The evidence from these studies is consensual in suggesting that the degree of rent sharing is larger in publicly owned firms. However, these studies all suffer from some common drawbacks. They all use data representing only one or a subset of industries. Data is also collected at firm level, for relatively short time periods, and contains, at best, a very limited number of firm attributes.[2] In addition, these studies lack a theoretical mechanism that might explain their findings.

By combining a theoretical model with a comprehensive empirical analysis, we are able to contribute both to the literature on rent sharing and to the quite separate literature on public versus private firm ownership. Our empirical contributions rely on the quality and

[1] The distinction we make in this paper is between privately owned and state-owned (government-owned) firms. Throughout the paper we use the terminology *public firms* as synonymous for state-owned firms.

[2] Monteiro and Portela (forthcoming) is an exception as they use very rich data available for 18 years.

scope of our data as well as various aspects of our empirical methods and strategies.

We provide evidence from a country (Portugal) that offers a particularly rich opportunity to analyse the effects of firm ownership changes. Indeed, Portugal has experienced a comprehensive corporate restructuring process, which included both privatisations and nationalisations (although more of the former) of a very large number of firms (more than 1000 in total) in several economic sectors (including both manufacturing and services) over a long period of time. These reforms also led to a number of firms with different ownership configurations (fully private, fully public or mixed ownership) within each industry. These firms are then used as alternative comparison groups to control for industry-specific shocks and to disentangle ownership from industry effects.

We also benefit from a very rich matched employer-employee dataset (*Quadros de Pessoal*) available for more than 20 years. These linked data allows us to build panel datasets defined at different units of observation, firm and worker, as these units are assigned unique and invariant identifiers. Therefore, we are able to control for two sources of unobserved heterogeneity (worker and firm) and to assess directly the importance of the level of data aggregation for the magnitude of rent sharing. In the context of rent sharing, this is, to our knowledge, the first study that accounts for the effect of the level of data aggregation. In our empirical analysis we implement a recent procedure, discussed in Guimarães and Portugal (2009), that allows for the estimation of models with two high-dimensional fixed effects. As we show later, using data disaggregated at worker level and controlling for both sources of heterogeneity significantly reduces the magnitude of rent sharing.

In contrast to most previous studies, when defining firm ownership we do not impose any threshold value of private ownership, but rather treat it as a continuous variable representing the fraction of shares held by private shareholders. The richness of our data also allows us to compare the magnitude of rent sharing, and the respective impact of firm ownership, across different economic sectors.

Our empirical analysis is preceded by a theoretical section where we build a model

that combines union-firm wage bargaining with efficiency wage effects, and allows us to define a measure of the degree of rent sharing. The received theoretical literature does not offer a consensual answer to the question of what distinguishes firms with private and public ownership. The two most commonly explored differences are related to firm objectives and productive efficiency, where the latter can sometimes be a result of the former. Public and private firms having different objectives is a standard approach in the literature on mixed oligopolies, where it is typically assumed that private firms maximise profits while public firms have a broader objective, taking also the interests of consumers and workers into account (see, e.g., DeFraja and Delbono, 1989; Cremer et al., 1991; Haskel and Szymanski, 1993; Ishida and Matsushima, 2009). Regarding productive efficiency, although the empirical literature is far from unanimous, there is ample evidence that private firms have lower production costs than comparable public ones (see Megginson and Netter, 2001, and several references therein). Such a difference in productive efficiency might be explained by agency theory and contract incompleteness.[3]

The two above-mentioned differences between public and private firms are also included in our theoretical analysis, where we explore two alternative hypotheses within the same modelling framework: i) private firms are more profit oriented, and/or ii) private firm ownership implies less job security for workers, leading to increased effort through a stronger efficiency wage effect. While these two hypotheses are clearly not mutually exclusive, we show that the implications for the degree of rent sharing are quite different. This enables us to use the empirical analysis as an implicit test of the relative importance of these two explanations.

Our main empirical result is that rent sharing is significantly higher in firms with a higher degree of private ownership. Estimates from our most preferred empirical specific-

[3]For example, Schmidt (1996a, 1996b) shows that the presence of soft budgets implies that managers of publicly owned firms have weaker incentives to minimise costs, since ex ante threats by the owner (government) to shrink or shut down inefficient firms are not credible. In a context of mixed oligopoly, Matsumura and Matsushima (2004) show that higher productive efficiency in private firms could also be due to strategic investment in cost-reducing efforts. In a different approach, Haskel and Sanchis (1995) focus on worker effort rather than managerial effort and find that, under certain conditions, privatisation increases worker effort, which is assumed to be a result of bargaining between firms and workers. See also Cavaliere and Scabrosetti (2008) for a survey of the theoretical literature on privatisation and efficiency.

ation, where we simultaneously account for firm and worker unobserved heterogeneity, suggest that an increase in the private ownership share of 10 percentage points increases (on average) the rent-sharing elasticity by 0.0002. This result is qualitatively robust to different levels of analysis – firm or worker level. It is also robust to alternative definitions of ownership (based on threshold values of private ownership shares) and to the use of different control groups. Thus, using a particularly rich and extensive panel dataset, we obtain a result that runs contrary to the existing (though scant) empirical literature on this particular topic. Based on our theoretical analysis, this result cannot be explained by differences in the degree of profit orientation and is thus *not* consistent with the hypothesis that the only effect of privatisation is that firms become more profit oriented. However, the result can be explained by stronger efficiency wage effects due to less job security in private firms.

The plan for the rest of the paper is as follows. In the next section, we lay out the conceptual framework to explain how firm ownership can affect the degree of rent sharing. In Section 3, we describe the data and the institutional background, and present descriptive statistics of the sample. The empirical analysis, both at firm and worker level, is reported in Section 4. Section 5 offers some extensions and robustness results, while Section 6 concludes the paper.

2 A theoretical framework

Our point of departure is a right-to-manage bargaining framework where wages are subject to bargaining between a firm and a trade union prior to the firm's choice of employment level. In order to allow for several different effects of public versus private firm ownership, we extend the standard framework in two directions: (i) allowing firms to deviate from profit-maximising behaviour, and (ii) allowing for efficiency wage effects.

Abstracting from non-labour inputs, we assume that the firm's production function is given by $y = \phi L$, where L denotes the level of employment and ϕ is a productivity parameter reflecting worker effort. We allow for efficiency wage effects by assuming that

labour productivity is given by

$$\phi = \alpha + \mu \left(w - \overline{w} \right)^{\gamma}, \quad \gamma \in (0,1), \tag{1}$$

where w is the wage paid by the firm and $\overline{w}$ is the workers' reservation wage level. This is a standard reduced-form efficiency wage relationship, where worker effort depends, partly, on the difference between inside and outside options.[4] The parameter $\mu \geq 0$ measures the strength of the efficiency wage effect. Thus, as long as μ is strictly positive, the wage level affects production directly through the efficiency wage mechanism, implying that the firm's output can be expressed as $y(w, L) = \phi(w) L$.

Assuming that the firm faces a downward sloping demand curve, $p(y)$, profits are given by

$$\pi(w, L) = R(w, L) - wL, \tag{2}$$

where the revenue function is $R(w, L) = p(y(w, L)) y(w, L)$. We allow for non-profit-maximising behaviour by assuming that the firm's objective function is given by

$$\Phi(w, L) = \pi(w, L) + \delta_s S(w, L) + \delta_u U(w, L), \quad \delta_s \geq 0, \quad \delta_u \geq 0, \tag{3}$$

where $S(\cdot)$ is consumers' surplus and $U(\cdot)$ is union utility (to be defined below). Thus, the parameters δ_s and δ_u are inverse measures of the degree of profit orientation. Strictly positive values of δ_s and δ_u are frequently used assumptions for public firms, reflecting the fact that governments' concern for re-election would lead them to take the preferences of various interest groups into consideration (see, e.g., Haskel and Szymanski, 1993; Haskel and Sanchis, 1995; Ishida and Matsushima, 2009).

Workers are represented by a trade union whose objective is to maximise a Stone-Geary-type utility function given by

$$U(w, L) = \left(w - \overline{w} \right)^{\theta} L, \tag{4}$$

[4] Similar functional forms are used by, e.g., Summers (1988) and Garino and Martin (2000).

where the parameter $\theta > 0$ measures how much the union values wages relative to employment. Assuming Nash bargaining with zero fallback payoff for both players, the wage is given by

$$w^* = \arg\max \left\{ \beta \ln U\left(w, L\left(w\right)\right) + \left(1-\beta\right) \ln \Phi\left(w, L\left(w\right)\right) \right\}, \tag{5}$$

where $\beta \in (0,1)$ represents the relative bargaining strength of the union and $L\left(w\right)$ solves $\partial \Phi\left(w, L\right) / \partial L = 0$.

By some manipulation of the first-order condition of the maximisation problem specified in (5), we can express the bargained wage as follows:

$$w^* = \left(1-\rho\right) \overline{w} + \rho \left(\frac{R\left(w, L\right)}{L} + \delta_s \frac{S\left(w, L\right)}{L} + \delta_u \frac{U\left(w, L\right)}{L} \right), \tag{6}$$

where

$$\rho := \frac{\beta\left(\theta - \eta\right)}{\beta\left(\theta - \eta\right) + \left(1 - \left(\kappa + \delta_s \psi + \delta_u \xi\right)\right)\left(1-\beta\right)}, \tag{7}$$

and κ, ψ and ξ denote the marginal effects of a wage increase (for a given level of employment) on, respectively, revenues per worker, consumers' surplus per worker and union utility per worker, while η is the elasticity of labour demand with respect to the union wage premium $(w - \overline{w})$.[5] With the above wage formulation, the degree of rent-sharing is given by the parameter ρ, which depends on the parameters β, θ, δ_s and δ_u, as well as the endogenous variables κ, ψ, ξ and η.[6,7]

How is the degree of private versus public firm ownership likely to affect the degree of rent-sharing? In order to answer this question, we need to identify which of the exogenous parameters of the model that are likely to be affected by changes in firm ownership. It

[5] The bargained wage in (6) is an interior solution. However, if δ_s and δ_u are sufficiently large, this solution implies negative profits for the firm. Thus, if we impose a limited liability constraint on the firm, the solution might be one where this constraint binds. Suppose that the profits of the firm must be at least B (in the case of a public firm, B might even be negative). If this constraint binds, the firm will always set employment such that $w = -\frac{B}{L} + \frac{R(\cdot)}{L}$, implying that the rent-sharing coefficient is equal to one (i.e., the maximum degree of rent-sharing). For the remainder of the analysis, we disregard this possibility, which essientially implies that we assume $\delta_s + \delta_u$ to be sufficiently small for an interior solution to exist.

[6] If we assume away non-profit-maximising behaviour and efficiency wage effects, i.e., $\delta_s = \delta_u = \kappa = 0$, the wage formulation in (6), and the corresponding rent-sharing coefficient, are similar to the ones derived by Mumford and Dowrick (1994).

[7] Notice that a well-defined maximisation problem implies $\theta > \eta$ and $\kappa + \delta_s \psi + \delta_u \xi < 1$ for $w = w^*$.

is straightforward to show that more (less) wage-oriented union preferences and higher (lower) relative union bargaining strength will increase (decrease) the degree of rent sharing. The economics literature on trade unions suggests different interpretations of the degree of wage orientation. One standard interpretation is that θ represents the relative power of insiders versus outsiders, where the former are more interested in pushing for higher wages than the latter (see, e.g., Sanfey, 1995). Another interpretation, following Pemberton (1988), is that θ represents the bargaining power of union members (represented by the median worker) relative to union leaders, where the former are interested in excess wages while the latter are interested in size (employment). Regarding the potential sources of differences in relative bargaining strength, the standard interpretations (Binmore et al., 1986) are that $\beta \neq \frac{1}{2}$ reflects either different time preferences (where the more 'impatient' player has lower relative bargaining strength) or different beliefs about the probability that negotiations will break down (where a higher fear of breakdown implies a lower relative bargaining strength).

It is not easy to see how either of these standard interpretations of θ and β should be affected by firm ownership. In fact, in the existing theoretical literature on privatisation with union-firm bargaining, it is typically assumed that neither union preferences nor relative bargaining strength depends on firm ownership.[8] We make the same assumption and take the wage orientation (θ) and relative bargaining strength (β) of unions to be constant across different ownership configurations. Instead, we postulate two different (but not necessarily mutually exclusive) hypotheses about the effects of firm ownership changes (privatisations or nationalisations), both of which have a foundation in existing theory.

(i) Privatisation implies a change in firm objectives towards more profit orientation. A standard assumption in the economics literature on private versus public corporate ownership is that private firms maximise profits while public firms maximise something else, usually some linear combination of profits and the utility of different interest groups

[8] See, e.g., De Fraja (1993), Haskel and Szymanski (1993), Goerke (1998) and Ishida and Matsushima (2009).

in the economy. In our model, this hypothesis corresponds to an inverse relationship between the degree of private ownership and the parameters δ_s and δ_u; in other words, privatisation of a firm implies a reduction in one or both of δ_s and δ_u.

(ii) Privatisation implies a reduction in job security for workers. With respect to labour market characteristics, an important difference between public and private firms (at least in most European countries) is that workers in public firms are subject to specific employment rules which, due to more restrictive dismissal rules, allow them to enjoy a higher degree of job security (see, e.g., Friebel and Magnac, 2007; OECD, 2008). It seems reasonable to expect that the degree of job security would influence the strength of any efficiency wage effect. More specifically, a relative improvement in inside versus outside options should have a stronger motivational effect on workers (in terms of effort) if the degree of job security is lower.[9] In the extreme case of 100% job security, there would be no efficiency wage motive for expending effort, since the inside option can be secured with certainty.[10] In our model, we would therefore expect an inverse relationship between the degree of job security and the parameter μ in the labour productivity function (1).

In order to analyse the effects of δ_s, δ_u and μ on the degree of rent-sharing, we need to make some assumptions on the demand function $p(y)$. In the following we qualitatively summarise the main results for two standard cases: linear and iso-elastic demand. For further technical details, including closed-form solutions for the key variables and numerical simulations based on these, we refer the interested reader to the working paper version, **** (2010).

It turns out that the bargained wage does not depend on the degree to which the firm cares about consumers' surplus (δ_s). The reason is that, while more consumer-oriented preferences lead to higher labour demand, it also makes labour demand more wage-sensitive. Whether demand is linear or iso-elastic, these two effects exactly cancel each other, making labour demand elasticity unchanged. An important implication of this

[9] See also Goerke (1998) for a discussion of stronger efficiency wage effects in private firms due to lower job security.

[10] Although higher job security reduces the efficiency wage effect, there might of course still be a positive relationship between wages and effort, for example due to fair wage considerations (Akerlof and Yellen, 1990), even for the case of 100% job security.

result is that δ_s does not affect the degree of rent sharing. Thus, the only way a change in profit orientation can affect the degree of rent sharing is through the weight on union utility in the firm's objective function.

The two remaining parameters of interest are therefore δ_u and μ, implying two very different mechanisms for firm ownership to affect rent sharing. Based on numerical simulations for the two specific demand functions considered, it is possible to show that changes in these two parameters have opposite effects on the degree of rent sharing. These effects are closely (but not perfectly) related to how the bargained wage is affected. While more profit orientation (lower δ_u) leads to lower wages, the wage effect of less job security (higher μ) is the opposite. The implication for the degree of rent sharing is unambiguous in the case of profit orientation. All else equal, more profit-oriented firms will engage in less rent sharing with their workers. This result is quite intuitive; if firms care less about their workers, they are willing to share less of the generated rents.

The effect of lower job security on rent sharing is not unambiguous, but most likely positive. Except for the case of linear demand and very low values of α (see (1)), an increase in μ leads to higher rent sharing. From numerical simulations, we are also able to show that this result is driven by the fact that lower job security reinforces the positive relationship between wages and revenues per worker (technically, the relationship between μ and κ). In other words, the stronger the rent-augmenting effect of a wage increase, the more the firm is willing to share the rents with its workers (in the form of higher wages). This leads us to the following conclusion: If an increase in private firm ownership leads to less rent-sharing, this is most likely explained by a shift in firm objectives towards more profit orientation. However, we cannot rule out an efficiency wage explanation. On the other hand, if an increase in private ownership leads to more rent-sharing, this can only be explained (within our class of possible explanations) by an efficiency wage mechanism related to changes in job security.

3 Data and institutional background

3.1 Data

In the empirical analysis we rely on data from *Quadros de Pessoal* (QP). This is a comprehensive matched employer-employee dataset collected annually for the Portuguese economy. QP provides rich and detailed information for each firm or worker observed. For instance, we know the number of employees, sales, precise geographic location and legal status of each firm. The worker records contain a number of different characteristics, such as gender, education, age, labour earnings, length of working time, exact admission date in the firm and wage bargaining regime.

For the specific purposes of this study, QP offers several advantages that are particularly relevant. First, QP covers virtually the whole corporate sector, comprising both state-owned and privately owned firms. It also contains detailed information about the ownership structure of each firm. In particular, the exact ownership shares held by the state and private owners are known at each moment in time. This allows us to build a continuous variable – intensity of private ownership – in order to assess the effects private versus public ownership on the degree of rent-sharing. Traditionally, related literature (on public-private wage differentials and effects of privatisation) has relied on a dichotomous ownership variable which obviously depends on a pre-defined threshold of private (public) ownership share.[11] We are also able to distinguish between domestic and foreign private shareholders.

Second, our linked data allows us to build panel datasets defined at different observed units. As firms and workers are assigned unique and invariant identifiers, it is possible to follow each unit over time and then build panel datasets at different levels.[12] Therefore, beyond the control of different sources of fixed unobserved heterogeneity (worker and firm), we are able to assess directly the importance of the level and the quality of data for the magnitude of rent sharing. Until now, despite the flurry of studies on this topic, no study

[11] In the present study, we also use the dichotomous approach as a robustness check (Section 5).

[12] Notice that, in contrast with other rich datasets, our data covers all workers (not only worker samples) within each firm.

has yet controlled for this specific dimension.

Finally, QP are available since the mid-80s. This extensive time coverage makes the data particularly appropriate for our analysis. During this period, Portugal launched an ambitious and successful privatisation program which fully reversed the ownership of several companies that had been nationalised after the April revolution of 1974 (OECD, 2001). The privatisation program involved a large number of firms covering almost all industries. Initially, privatisation took place mainly in the financial sector (banking and insurance) but later spread to other services and manufacturing.[13] The process has not yet been concluded but the government has withdrawn its presence in most sectors, such as brewery, paper and pulp, cement, oil and highways. In some strategic sectors (telecommunications and energy) the state has retained a qualified stake in capital or special voting rights ('golden shares'), which allows some control of firm management. Therefore, QP not only offers a group of firms that switch ownership over time, which is important for identification of the effects, but also contains a number of firms with different ownership shares in each industry. As we document below, we use this latter group of firms to control for industry-specific shocks and to disentangle ownership from industry effects.

We have performed extensive checks to guarantee the accuracy of firm and employee data. Excluding agriculture, our initial panel for the period 1986-2007 comprises 757 984 firms. Unfortunately, our data has missing and incomplete information about ownership for, respectively, 40% and 7% of the firms. For the 54 401 firms with incomplete ownership information, we were able to recover correct information for 47 301 firms after numerous consistency checks. This means that we lose only 13% of the firms with incomplete information about ownership.[14] Due to our careful consistency checks, we believe that measurement error in the ownership variable is a negligible problem.

However, since there is missing information on a relatively large fraction of firms from the initial panel, we may still have a problem of sample selection bias. Descriptive stat-

[13] For details about the privatisation program in Portugal, see Sousa and Cruz (1995) and OECD (2001, 2003).

[14] Additionally, we also drop 35 firms for which information on ownership structure is unreliable and 68 563 firms which appear only once in the total panel.

istics for the firms with missing ownership information suggest that, though statistically different, they represent a subgroup of the fully private firms, the strongest indication being that the firms with missing ownership information are mainly very small firms.[15] On average, the firms in this subgroup are even smaller, with a less educated and more male-dominated workforce, than the fully private firms with ownership information intact. They also pay less and have lower level of rents per worker. We return to this issue in Section 5, where we analyse and discuss how this missing information might bias our results.

After the above-mentioned consistency checks we kept 379 033 firms for the analysis. Almost all these firms (99,6%) do not experience any change in ownership structure over time. Among these, 377 364 are fully private, 287 are fully public and 121 have mixed private-public ownership. The remaining 1 261 firms experience a change in public-private ownership shares. Due to computational limitations, we further restrict the panel by keeping a random sample of 5% of the fully private firms.

We then merged the resulting firm panel with worker records.[16] We include only full-time wage earners working at least 25 hours per week, aged between 16 and 65. The resulting panel comprises information on 16 498 fully private firms, 252 fully public firms, 98 firms with mixed public-private ownership and 950 firms that change public-private ownership structure, yielding a total of 118 691 firm-year observations which correspond to 4 621 075 worker-year observations.

3.2 Descriptive statistics

The distribution of ownership changes for the 950 firms that change ownership structure over the period 1986-2007 is illustrated in Figure 1, where we distinguish between *total net* ownership changes over the entire period and *yearly* ownership changes. For example, a firm with 10% private ownership in the first recorded year and 80% private ownership in

[15] The average size of the firms with missing ownership information (averaged over all observations) is 4.1 employees, while the corresponding number for the firms with confirmed changes in private ownership share over time is 242.4.

[16] Before merging, the worker records has been extensively cleaned to remove inconsistencies and to improve missing longitudinal linkages.

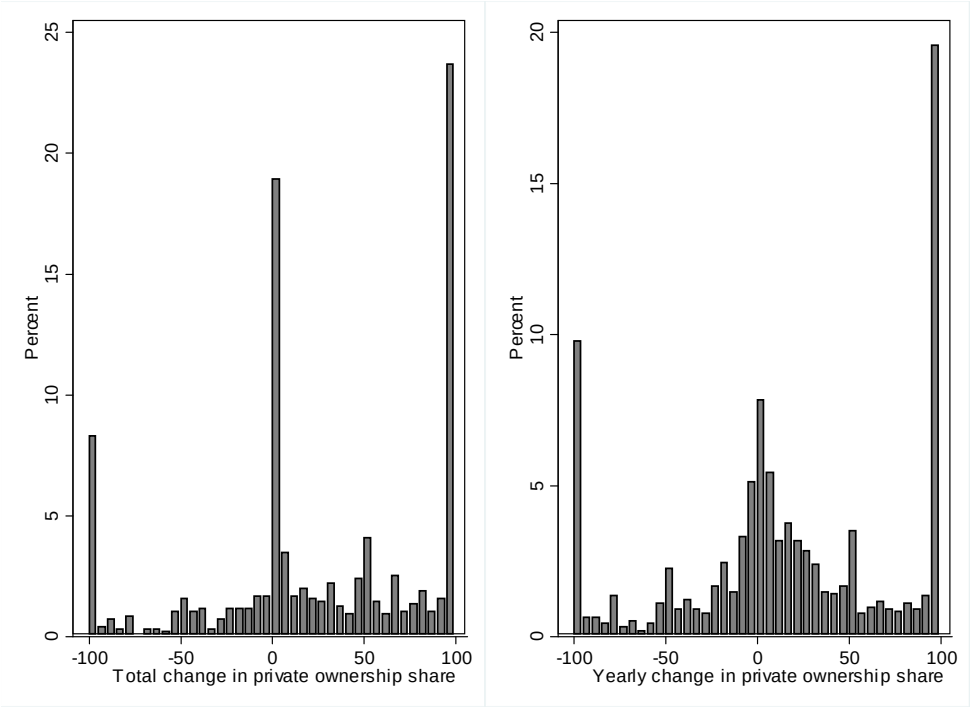

Figure 1: Distribution of ownership changes

the last recorded year has experienced a net change in private ownership over the recorded period of 70%. The distribution of all the 950 net ownership changes is displayed in the left graph of Figure 1. However, the net change in private ownership between the first and last year may be a result of several ownership changes throughout the period. In fact, the 950 firms experienced a total of 1 543 yearly ownership changes over the period 1986-2007. The distribution of these yearly ownership changes is displayed in the graph on the right-hand side of Figure 1.[17] Both graphs exhibit substantial positive and negative variations in the private ownership share, implying the coexistence of contrasting reforms: privatisation and nationalisation. Nevertheless, privatisations are clearly more abundant. Almost two thirds of the 1 543 yearly changes in private ownership are positive. In net terms, 566 (231) firms experience an increase (reduction) in private ownership while 153

[17] In Figure 1 we use a bandwidth of 5 percentage points. Notice that, in the graph on right side of the figure, we display changes in private ownership shares that are different from zero. Thus, the spike at 0-5 consists of all yearly changes in private ownership share that are strictly positive but no more than 5 percentage points.

Table 1: Distribution of firms by ownership categories and industries

	Changing ownership	Fully public firms	Fully private firms	Mixed ownership
Mining	8 (323)	0 (0)	72 (31)	1(80)
Food, beverage and tobacco	55 (239)	3 (97)	347 (37)	2 (20)
Textiles and leather	25 (196)	0 (0)	847 (40)	2 (284)
Wood, cork and paper	40 (201)	5 (930)	572 (19)	2 (128)
Non-metallic manufacturing	72 (272)	5 (278)	395 (33)	0 (0)
Metallic manufacturing	79 (459)	7 (1352)	915 (34)	8 (101)
Furniture and other	14 (83)	0 (0)	305 (18)	0 (0)
Electricity, gas and water	35 (907)	27 (365)	9 (16)	3 (68)
Construction	52 (115)	11 (57)	2296 (15)	4 (30)
Wholesale and retail trade	169 (58)	11 (123)	5944 (11)	6 (60)
Hotels and restaurants	51 (131)	2 (28)	1741 (11)	6 (157)
Transport and communications	72 (217)	31 (2782)	955 (83)	10 (26)
Post and telecommunications	17 (1328)	2 (18614)	17 (12)	1 (121)
Financial intermediation	108 (659)	5 (2983)	104 (24)	1 (68)
Real estate and renting	243 (38)	77 (61)	2704 (12)	39 (17)
Education	33 (33)	6 (40)	199 (10)	8 (27)
Health and social work	24 (193)	23 (229)	588 (12)	3 (373)
Other social activities	80 (156)	81 (303)	598 (14)	17 (28)

Note: Each cell reports the number of firms and its the average size in parentheses.

firms are subject to symmetric ownership changes over time.[18] Full privatisation involves 203 firms (around 21%) while full nationalisation includes 70 (below 8%).[19] Moreover, the number of firms that changed from a public majority to a private majority (351) is almost three times the number of firms that changed in the opposite direction (120). Finally, in terms of *speed* of ownership changes, firms experience on average less than 2 (1543/950 = 1.62) annual rounds on the sale of shares. Approximately 60 per cent of firms were sold in the first annual round whereas only 6 per cent involved four or more annual rounds.

Table 1 shows the distribution of ownership categories – firms that change ownership over time, firms that remain fully public, firms that remain fully private, and firms that

[18] Suppose that a firm experienced two changes in private ownership share during the recorded period; an increase of 20 percentage points followed later by a decrease of 20 percentage points. This firm would then be recorded with a zero net change in private ownership. Nevertheless, the two ownership changes are used for identification of the ownership effect in our econometric analysis.

[19] Notice that there was no nationalisation program in place during the relevant time period. However, after the restructuring that took place during privatisation reforms, some newly privatised entities were acquired by existing public firms in the same industry.

have a constant mixed ownership – across 18 industries over the period 1986-2007, with average firm size reported in parentheses. Importantly, as the table illustrates, the category of firms we rely on for identification – the ones that change the share of private ownership over time – is featured in all industries. Although the share of firms that experience ownership changes is relatively small in some industries (e.g., construction; wholesale and retail trade; hotels and restaurants), this category is still well represented, in absolute terms, in most industries. Furthermore, the presence of other ownership categories within each industry allows us to disentangle ownership from industry effects, such as industry-specific business cycles or regulatory regimes.

Table 2 reports means and standard deviations of variables for the four groups of firms defined according to ownership status: changing ownership, fully public, fully private and mixed ownership. Summary statistics are presented using data aggregated at firm and worker level. The wage variable is the logarithm of hourly wage computed as the ratio between overall monthly wage paid to each employee (including the base wage, tenure-related and other regularly paid components, but excluding overtime payment) and normal working hours (excluding overtime).[20] For measuring rents per worker, we use the logarithm of revenues per worker. Ideally, it would be preferable to use net revenue per worker net of non-labor costs (see, e.g., Mumford and Dowrick, 1994). However, to the extent that variation in the share of non-labor costs occurs mainly *across* rather than *within* industries, the availability of multiple units (both firms and workers) per industry, and the use of industry fixed effects in the regressions, will capture most of this variation.[21] Both variables, wages and rents per worker, have been deflated and are expressed in real terms (prices for 2007) using CPI and GDP deflators, respectively.

[20] Since the data is reported for a single month (October) every year, we cannot be sure that the amount of overtime worked in this particular month is representative for the whole year. Information on overtime and overtime payment are therefore not used when calculating the hourly wage.

[21] The use of revenues per worker as a proxy for measuring rents, in similar context, has also be done by Grosfeld and Nivet (1990), Nickell and Wadhwani (1990), Van Reenen (1996), Carneiro and Portugal (2008), among others.

Table 2: Descriptive statistics

	Changing ownership		Fully public firms		Fully private firms		Mixed ownership	
Aggregation level	Firm	Worker	Firm	Worker	Firm	Worker	Firm	Worker
Log hourly wage	1.818	1.890	1.969	1.864	1.204	1.341	1.883	1.648
	(.565)	(.565)	(.475)	(.494)	(.400)	(.506)	(.554)	(.653)
Rents per worker	11.324	11.640	10.579	10.313	10.717	10.772	10.879	10.883
	(1.517)	(1.349)	(1.740)	(1.673)	(1.120)	(1.253)	(1.589)	(1.390)
Private ownership share	.763	.620	0	0	1	1	.506	.464
	(.370)	(.438)	-	-	-	-	(.280)	(.299)
Foreign capital	.214	.334	0	0	.017	.185	.111	.199
	(.410)	(.471)	-	-	(.138)	(.388)	(.315)	(.399)
Log firm size	3.758	7.022	4.555	8.739	1.868	4.416	2.811	4.951
	(1.874)	(1.582)	(2.307)	(1.317)	(1.100)	(2.006)	(1.574)	(1.205)
Age	39.599	41.331	38.439	42.443	37.840	36.662	37.733	38.985
	(6.213)	(10.057)	(5.738)	(10.106)	(7.63)	(11.241)	(6.216)	(11.117)
Tenure	9.756	14.640	7.718	16.544	6.281	7.894	5.066	8.952
	(6.473)	(9.659)	(6.628)	(9.961)	(5.223)	(8.145)	(4.202)	(9.105)
Tenure < 1	.113	.050	.146	.042	.151	.150	.192	.141
	(.177)	(.218)	(.212)	(.200)	(.241)	(.357)	(.269)	(.348)
Schooling	8.917	8.293	10.133	7.793	7.345	6.890	10.459	8.614
	(3.222)	(4.104)	(2.927)	(3.884)	(2.923)	(3.559)	(3.689)	(4.662)
Gender	.359	.262	.385	.225	.397	.387	.449	.484
	(.269)	(.440)	(.249)	(.418)	(.352)	(.487)	(.307)	(.500)
Firm-level bargaining	.075	.289	.287	.907	.0002	.002	.062	.257
	(.259)	(.453)	(.450)	(.291)	(.014)	(.0480)	(.232)	(.437)
Multi-firm bargaining	.665	.660	.177	.059	.876	.943	.398	.499
	(.463)	(.474)	(.373)	(.236)	(.309)	(.232)	(.467)	(.500)
Other wage agreement	.260	.050	.534	.034	.124	.055	.539	.244
	(.430)	(.219)	(.492)	(.182)	(.308)	(.228)	(.480)	(.430)
Observations	10343	2062547	1318	1255079	106635	1287482	395	15967
Firms/workers	950	425092	252	194608	16498	370957	98	6012

Notes: Standard-deviations in parenthesis.

Table 2 shows significant variation across the four groups of firms. Changing ownership firms are large firms which pay on average the highest (unconditional) hourly wage and exhibit the higher level of rents per worker, probably reflecting the higher fraction of foreign shareholders. These firms have a relatively old and experienced, though well educated, workforce. Fully public firms, on the contrary, despite being the largest, exhibit the lowest level of rents per worker and pay on average the second largest hourly wage to the oldest and most experienced workforce in the country. This remarkably high pay level of public firms is likely to reflect considerable differences with respect to collective wage bargaining. Public employees are mainly covered by firm-level wage agreements while the majority of employees from other firms are covered by multi-firm wage agreements.

In contrast to public firms, fully private firms are the smallest in Portugal and pay the lowest (unconditional) hourly wage to the youngest, least experienced and less educated workforce. Finally, mixed ownership firms are in many aspects somewhere between fully private and public firms. For instance, mixed ownership firms are larger (smaller) and pay better (worse) than private (public) firms to an older (younger) and more (less) experienced workforce. Nevertheless, the level of rents in mixed ownership firms is much larger than in either public or private firms, probably reflecting the use of the most educated employees in the country. These firms also employ the largest proportion of female workers.

4 Empirical analysis

We start our analysis by examining how ownership affects rent sharing at firm-level. In order to control for firm-specific unobserved heterogeneity, we exploit the longitudinal nature of the data and estimate a firm fixed-effects model. More precisely we estimate the following specification:

$$w_{jt} = \alpha \overline{w}_{jt} + \beta_1 R_{jt} + \beta_2 \left(R_{jt} \cdot P_{jt}\right) + \mathbf{y}_{jt}\boldsymbol{\gamma} + \upsilon_j + \lambda_v + \tau_r + \theta_t + \varepsilon_{jt}, \tag{8}$$

where w_{jt} refers to the logarithm of the average hourly wage of firm j in year t, $\overline{w}_{jt}$ is the reservation wage (to be defined below) for workers in firm j in year t, R_{jt} measures the logarithm of revenues per worker, P_{jt} represents the fraction of privately owned shares, $\mathbf{y}_{jt}$ is a vector of firm characteristics, υ_j is a pure firm unobserved fixed effect, λ_v is a pure industry effect, τ_r is a pure region effect, θ_t is a pure time effect and ε_{jt} is an exogenous disturbance. Our main interest lies in the coefficients α, β_1 and β_2. The first coefficient measures how wages react to the reservation wage, which is influenced by outside employment opportunities. Measuring the reservation wage (outside option) is problematic as it should take into account several aspects of the labour market such as local unemployment, the level of unemployment benefits and the expected real wage for each worker. In absence of this information, we compute the reservation wage as the minimum of the logarithm of hourly wage defined at firm level, per year, industry and county.[22,23]The coefficient β_1 measures the elasticity of wages with respect to revenues per worker for fully public firms, while $\beta_2/100$ indicates how much this elasticity changes when the degree of private ownership increases by one percentage point.[24]

The vector $\mathbf{y}_{jt}$ includes the ownership variable P_{jt}. In addition, it includes further controls for firm size (log of number of employees), a dichotomous variable indicating the presence of foreign shareholders, average age of workers, average tenure of workers, share of workers with tenure less than one year, average schooling, share of females and two dummy variables that identify three different regimes of wage bargaining: firm level, multi-firm

[22] As Luke and Schaffer (2000) and Basu et al. (2005) discuss, there is a number of approaches, none universal, that have been adopted for defining the alternative wage. It can be computed as averages or minimum wages from particular regions or sectors or assumed to be proportional to them, using a local unemployment rate that lowers the alternative wage by exerting downward pressure on wages and decreasing the probability of obtaining employment. Given the richness of our data, and to guarantee that the actual wage is larger than the reservation wage, we follow Card et al. (2009) and define the reservation wage as the minimum wage within industry, region and year.

[23] Using alternative measures for the reservation wage, such as the mean wage within industry, region and year, yields similar results for the remaining coefficients of interest.

[24] Notice that our theoretical analysis is based on the concept of *average* rent sharing, where the degree of rent sharing is defined as the share of the worker's revenue contribution that is paid back to her as wage. In contrast, the empirical analysis measures rent sharing at the *margin*. There is little reason to expect, theoretically or empirically, that average and marginal rent sharing are equal. However, in the present paper we are not primarily interested in the magnitude of rent sharing *per se*, but rather how the degree of rent sharing is affected by firm ownership. Nevertheless, the interpretation of our empirical results, in light of the theoretical analysis, relies on the assumption that firm ownership affects average and marginal rent sharing in a qualitatively similar way.

bargaining and other. To control for unobserved industry effects, we include a full set of seventeen industry-dummies, corresponding to the economic classification code defined at the 2-digit level. In addition, the regressions include six regional dummies defined at NUT2 to account for disparities in earnings across regions.

4.1 Firm-level analysis

Table 3 displays the results obtained when using specification (8) or some simplified versions of it. The first three columns use all firms sampled, while columns 4 to 6 restrict our control groups to fully public, fully private and mixed ownership, respectively. For each estimate, the standard errors are clustered at firm level to accommodate for non-independence of firms over time.

Table 3: Rent sharing across ownership: firm fixed-effects estimates

		vs. All firms		vs. Fully public firms	vs. Fully private firms	vs. Mixed ownership
	(1)	(2)	(3)	(4)	(5)	(6)
Reservation wage	.003**	.004***	.004***	.009**	.004***	.013**
	(.001)	(.001)	(.001)	(.004)	(.001)	(.005)
Rents per worker (R)	.021***	.024***	.013**	.007*	.011*	.008
	(.002)	(.002)	(.005)	(.004)	(.006)	(.005)
R*Private share			.012**	.011*	.015**	.010
			(.005)	(.006)	(.006)	(.007)
Private share		.047***	-.090	-.117	-.116	-.113
		(.016)	(.061)	(.075)	(.074)	(.084)
Foreign dummy		.007	.007	.011	.007	.012
		(.014)	(.014)	(.019)	(.014)	(.019)
Firm size		.034***	.034***	-.003	.037***	-.001
		(.004)	(.004)	(.009)	(.004)	(.010)
Age		.004***	.004***	.010***	.004***	.009***
		(.0004)	(.0004)	(.002)	(.0004)	(.002)
Tenure		.001	.001	-.002	.001	-.002
		(.0007)	(.0007)	(.003)	(.0007)	(.003)

Continued on next page...

... table 3 continued

		vs. All firms		vs. Fully public firms	vs. Fully private firms	vs. Mixed ownership
	(1)	(2)	(3)	(4)	(5)	(6)
Tenure < 1		.013**	.014***	-.013	.014***	-.022
		(.005)	(.005)	(.024)	(.005)	(.025)
Education		.021***	.021***	.061***	.020***	.057***
		(.002)	(.002)	(.006)	(.002)	(.007)
Female		-.101***	-.101***	-.106**	-.101***	-.108**
		(.010)	(.010)	(.044)	(.010)	(.045)
Firm-level bargaining		.101**	.101**	.152***	.067*	.172***
		(.043)	(.043)	(.046)	(.037)	(.050)
Multi-firm bargaining		.058***	.058***	.094***	.056***	.111***
		(.008)	(.008)	(.032)	(.008)	(.036)
Observations	118691	118691	118691	11661	116978	10738
R^2	.219	.23	.23	.364	.23	.344
LogLikelihood	-2859.526	-1995.225	-1989.5	-486.196	-1908.7	-1058.946
RMSE	.248	.246	.246	.253	.246	.268

Notes: Significance levels: $*$: 10% $**$: 5% $***$: 1%. All regressions include firm, time, industry and region fixed effects. RMSE is root mean squared error.

Column 1 reports baseline estimates from our simplest model, which includes controls for firm, time, industry and regional fixed effects. The estimates show that wages react positively (as expected) to the outside wage option and the estimated elasticity of wages with respect to rents per worker is 0.021. Then we add eight firm observable attributes and two variables to account for different regimes of collective wage bargaining. As can be seen from column 2, the specification of the model improves and the estimated effect of rents on wages increases, though marginally, to 0.024.[25] This figure is well within the range of elasticities found in the domestic rent-sharing literature, between 0.006 and 0.086, as reviewed by Monteiro and Portela (forthcoming). For instance, Margolis and Salvanes

[25] Therefore, the size of the positive relation between rents per worker and wages is mainly captured by unobserved time, firm, industry and regional fixed effects levels.

(2001) find elasticities between 0.002 and 0.03 for France and between 0.006 and 0.01 for Norway, while Arai (2003) reports an elasticity of 0.01 for Sweden.

The remaining estimates shown in column 2 are almost all significant and show the expected sign. Wages increase with the fraction of private shareholding, firm size, average age, tenure, and schooling of the workforce. Average wages are particularly large in firms that bargain at firm level, even though multi-firm wage agreements lead to a sizeable wage premium. Our results also point to a noteworthy gender penalty: average wages decline by 1% when the share of female workers increase by ten percentage points.

Column 3 breaks down the effect of rents per worker on wages according to the ownership of the firm. While fully public firms exhibit a significant rent-sharing elasticity of 0.013, raising the share of private ownership by ten percentage points increases it, on average, by 0.0012. Thus, our results suggest that the rent-sharing elasticity is approximately twice as large in a fully private firm, compared with a fully public one. This interaction term is statistically significant (with a standard error of 0.005 and a corresponding p-value of 0.018). Its inclusion in the model eliminates the direct effect of private shareholding on wages, suggesting that rent-sharing is a plausible mechanism to explain wage differences across firms with different ownership.

This result is robust to the use of alternative comparison groups, such as fully public or private firms, as shown in columns 4 and 5. Comparing with mixed ownership firms, column 6, however, yields a slightly lower estimate, which is statistically insignificant (with a standard error of 0.007 the coefficient is marginally insignificant). Notice, however, that this latter model contains much more noise, probably due to a reduced number of firms in the comparison group, as the standard errors are larger for all variables. Throughout specifications 4 to 6 presented in Table 3, the additional covariates show, in general, the expected sign and statistical significance.

In sum, our empirical analysis so far, using firm-level data, provides a clear and unambiguous result: an increase in private ownership leads to more rent-sharing, as measured by the elasticity of wages to revenues per worker. Based on our theoretical analysis, this

result cannot be explained by more profit-oriented objectives in firms with larger private shareholdings. However, the result is consistent with an increased efficiency wage effect due to less job security in firms with more private ownership.

4.2 Worker-level analysis

In order to account for the role of worker unobserved heterogeneity, we estimate a similar specification to (8) defined at worker level:

$$w_{ijt} = \alpha \overline{w}_{ijt} + \beta_1 R_{jt} + \beta_2 \left(R_{jt} \cdot P_{jt}\right) + \mathbf{y}_{jt}\boldsymbol{\gamma} + \mathbf{x}_{it}\boldsymbol{\delta} + \Psi_i + \upsilon_j + \lambda_v + \tau_r + \theta_t + \varepsilon_{jt}, \quad (9)$$

where w_{ijt} is the logarithm of hourly wage of worker i employed in firm j in year t, $\overline{w}_{ijt}$ is the reservation wage for the corresponding worker i. The reservation wage is defined as the minimum wage for similar workers in terms of education, gender, occupation, experience and who work in the same industry and year. R_{jt} and P_{jt} are defined as previously whereas the vector $\mathbf{y}_{jt}$ now includes only P_{jt} and two variables that account for firm size (log of number of employees) and for foreign ownership effects. The vector $\mathbf{x}_{it}$, defined at worker level, comprises the following variables: the age of the employee and its square, his tenure (continuous variable), a dummy variable indicating if tenure is less than one year, the number of schooling years and two dummy variables identifying the regime of wage bargaining of each employee: firm-level bargaining, multi-firm bargaining or other. Ψ_i is the employee unobserved fixed effect and $\upsilon_j, \lambda_v, \tau_r$ and θ_t are defined as previously.

Table 4 presents results from individual wage estimations when we do not control for unobserved firm fixed effects ($\upsilon_j = 0$). Like Table 3, the first three columns use all employees working in any of the four firm categories, while columns 4 to 6 restrict our control groups to employees from fully public, fully private and mixed ownership firms, respectively. For each estimate, the standard errors are clustered at worker level to accommodate for non-independence of workers over time. An innovative aspect of our study is that we use all workers from the same firms used in the estimation of (8), which allows us to compare the effect of different levels of analysis – firm or worker – on the magnitude of

rent sharing.[26]

An inspection of Table 4, column2, shows two striking results: individual wages are much more responsive to the reservation wage and the magnitude of rent sharing, while statistically significant, drops remarkably. More precisely, estimates for the wage response to the reservation wage increases from 0.004 to 0.241 while the rent-sharing elasticity drops from 0.024 to 0.004. The remaining estimates from column 2 are all significant, though the magnitude of the effects tends to be lower than previously. The sizeable drop in rent sharing when we go from firm-level to worker-level analysis is consistent with previous related studies, for example Heyman et al. (2007), who find a similar drop (in profits per worker) when changing the level of analysis from firm- to worker-level, using the same (Swedish) data. This is likely caused by the fact that we are able to control for more attributes in a worker-level analysis; more specifically, we are able to control for unobserved time-constant worker heterogeneity.

Table 4: Rent sharing across ownership: worker fixed-effects estimates

		vs. All firms		vs. Fully public firms	vs. Fully private firms	vs. Mixed ownership
	(1)	(2)	(3)	(4)	(5)	(6)
Reservation wage	.245***	.241***	.241***	.221***	.270***	.254***
	(.001)	(.001)	(.001)	(.001)	(.001)	(.002)
Rents per worker (R)	.003***	.003***	.001***	.00009	.003***	.003***
	(.0001)	(.0001)	(.0001)	(.0001)	(.0002)	(.0002)
R*Private share			.007***	.004***	.007***	.004***
			(.0002)	(.0003)	(.0003)	(.0003)
Private share		.018***	-.064***	-.034***	-.048***	-.024***
		(.0007)	(.003)	(.003)	(.004)	(.004)
Foreign dummy		.022***	.022***	.022***	.017***	.016***
		(.0006)	(.0006)	(.0006)	(.0007)	(.0007)
Firm size		.019***	.019***	.018***	.022***	.013***

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[26] In order to strictly compare the effect of the level of analysis – firm or worker – we would like ideally to estimate wage regressions at worker level controlling only for firm fixed effects. Nevertheless, that is not feasible as the number of firms is very large in our dataset.

... table 4 continued

		vs. All firms		vs. Fully public firms	vs. Fully private firms	vs. Mixed ownership
	(1)	(2)	(3)	(4)	(5)	(6)
		(.0004)	(.0004)	(.0005)	(.0005)	(.0006)
Age		.049***	.049***	.056***	.045***	.053***
		(.0002)	(.0002)	(.0003)	(.0003)	(.0004)
Age^2		-.0003***	-.0003***	-.0003***	-.0003***	-.0003***
		(.000002)	(.000002)	(.000003)	(.000003)	(.000003)
Tenure		.001***	.001***	-.002***	.002***	-.001***
		(.0001)	(.0001)	(.0001)	(.0001)	(.0002)
Tenure < 1		-.031***	-.031***	-.042***	-.029***	-.045***
		(.0006)	(.0006)	(.0008)	(.0006)	(.001)
Education		.004***	.004***	.003***	.003***	.001***
		(.0003)	(.0003)	(.0003)	(.0003)	(.0004)
Firm-level bargaining		-.013***	-.013***	-.025***	.003	-.009***
		(.002)	(.002)	(.002)	(.002)	(.002)
Multi-firm bargaining		-.013***	-.012***	-.021***	.004**	-.009***
		(.002)	(.002)	(.002)	(.002)	(.002)
Observations	4621075	4621075	4621075	3317626	3350029	2078514
R^2	.534	.545	.545	.586	.508	.552
LogLikelihood	2298199	2351418	2352510	1740772	1752771	1129998
RMSE	.147	.145	.145	.143	.143	.14

Notes: Significance levels: $*$: 10% $**$: 5% $***$: 1%. All regressions include worker, time, industry and region fixed effects. RMSE is root mean squared error.

When we add an interaction term to account for the private ownership effect (column 3) the rent-sharing elasticity for public firms drops to 0.001, while the marginal effect of private ownership remains closer to earlier findings obtained with firm level data. Indeed, raising the degree of private ownership by ten percentage points increases the elasticity, on average, by 0.0007. Once more, notice that the inclusion of this interaction term reverses the direct effect of private ownership on wages.

Columns 4 to 6 suggest that the comparison group matters for determining the magnitude of rent-sharing in public and private firms. For instance, when we compare workers from changing ownership firms to those from fully public firms, rent sharing in public firms vanishes. The corresponding figure is 0.003 if we instead compare with private or mixed firms. Similarly, the marginal effect of private ownership on rent-sharing is almost twice as high when we compare with private firms, relative to using fully public or mixed ownership firms as the control groups. Nevertheless, despite all divergences in magnitude, the results reported so far are all qualitatively similar, suggesting that rent-sharing increases with the degree of private ownership.

Table 5 displays results when we account simultaneously for worker and firm unobserved heterogeneity. Given the high dimension of our matched employer-employee data (around 18 000 firms and almost one million workers), the solution to the estimation problem is not trivial. In our estimations we follow the feasible iterative procedure discussed in Guimarães and Portugal (2009). The authors propose an exact solution for the least squares estimation of the model with two fixed effects; i.e., their solution controls jointly for unobserved heterogeneity at the worker and firm level, dealing with the great number of workers and firms available in the dataset.[27]

Table 5: Rents and ownership: worker and firm fixed-effects estimates

		vs. All firms		vs. Fully public firms	vs. Fully private firms	vs. Mixed ownership
	(1)	(2)	(3)	(4)	(5)	(6)
Reservation wage	.241***	.235***	.235***	.221***	.266***	.256***
	(.0002)	(.0002)	(.0002)	(.0002)	(.0002)	(.0003)
Rents per worker (R)	.002***	.002***	.001***	.0001**	.003***	.003***
	(.00005)	(.00005)	(.00007)	(.00007)	(.0001)	(.0001)
R*Private share			.002***	.003***	.005***	.005***
			(.0001)	(.0001)	(.0001)	(.0002)
Private share		.022***	-.007***	-.024***	-.025***	-.033***

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[27] We have also estimated the model with the more widely used spell-fixed effects and the results – which are available upon request – are qualitatively equal (and quantitatively almost identical).

... table 5 continued

		vs. All firms		vs. Fully public firms	vs. Fully private firms	vs. Mixed ownership
	(1)	(2)	(3)	(4)	(5)	(6)
		(.0002)	(.001)	(.002)	(.002)	(.002)
Foreign dummy		.012***	.012***	.013***	.015***	.016***
		(.0002)	(.0002)	(.0002)	(.0002)	(.0002)
Firm size		.009***	.009***	.007***	.032***	.026***
		(.00005)	(.00006)	(.00009)	(.00006)	(.0001)
Age		.036***	.036***	.048***	.040***	.049***
		(.00005)	(.00005)	(.00006)	(.00005)	(.00008)
Age^2		-.0003***	-.0003***	-.0003***	-.0003***	-.0003***
		(5.75e-07)	(5.75e-07)	(7.47e-07)	(6.54e-07)	(9.20e-07)
Tenure		.001***	.001***	-.0005***	-.00002	-.002***
		(1.00e-05)	(1.00e-05)	(1.00e-05)	(1.00e-05)	(.00002)
Tenure< 1		-.027***	-.027***	-.040***	-.025***	-.042***
		(.0003)	(.0003)	(.0004)	(.0003)	(.0005)
Education		.003***	.003***	.003***	.002***	.001***
		(.00003)	(.00003)	(.00003)	(.00003)	(.00004)
Firm-level bargaining		.045***	.045***	.062***	.049***	.057***
		(.0004)	(.0004)	(.0005)	(.0005)	(.0006)
Multi-firm bargaining		.051***	.051***	.067***	.049***	.059***
		(.0004)	(.0004)	(.0005)	(.0004)	(.0005)
Observations	4621075	4621075	4621075	3317626	3350029	2078514
R^2	.934	.938	.938	.929	.943	.936
LogLikelihood	2228913	2364161	2364433	1723254	1723641	1099604
RMSE	.149	.145	.145	.144	.145	.143

Notes: Significance levels: $*$: 10% $**$: 5% $***$: 1%. All regressions include firm, worker, time, industry and region fixed effects. RMSE is root mean squared error.

Compared with Table 4, controlling for unobserved heterogeneity from both sides of the labour market improves a great deal the specification of the model, measured either by R^2 or Log Likelihood of the model. The results in Table 5 are thus derived from our preferred

specifications. Columns 1 and 2 show that the inclusion of both sources of unobserved heterogeneity does not affect the wage responses to the reservation wage but affects the magnitude of the rent-sharing elasticity. Indeed, while the former remains similarly strong in magnitude and significance, the latter, though statistically significant, drops from 0.003 to 0.002. Moreover, as before, the rent-sharing elasticity remains unchanged even after the introduction of several (statistically significant) controls for observable attributes from both firm and worker. While the size of the rent-sharing elasticity is now quite low when compared to previous studies, we are not aware of any study that uses such a rich set of observable attributes and controls for both sources of unobserved heterogeneity.

Our results from the worker level analysis suggest, once more, that rent-sharing is higher in private firms. Even though the difference is substantially attenuated when we make the extension to control for two instead of one source of unobserved heterogeneity, private firms still exhibit a level of rent sharing three times higher than publicly owned firms (0.003 and 0.001, respectively).

5 Extensions and robustness checks

We have extended our empirical analysis in several different directions by considering alternative definitions for some key variables, using alternative estimation methods and splitting the data according to independent variables. In this section we present the results of these extensions and discuss the robustness of our main empirical results. We also discuss the potential problem of sample selection bias. Below we only summarise the main findings, referring the interested reader to the working paper version (****, 2010) for more details.[28]

Private ownership threshold. An alternative to the continuous ownership variable used in the main analysis is to define ownership as a binary variable where the firm is classified as privately (publicly) owned if the private ownership share is above (below) a certain threshold level. Re-estimating (8) using a threshold level of 50% for private

[28] Some of the results presented below are not available in the working paper version. The details of these results are available from the authors upon request. This is explicitly indicated in the relevant cases.

ownership only confirms our previous findings, with the magnitude of rent sharing being significantly larger in private than in public firms.[29]

Endogeneity. Although we have a rich set of observable firm attributes and control for firm, worker and other unobserved fixed effects, we should address the possibility that controlling for rents' endogeneity might reverse our previous findings. In the absence of external instruments, we have used lagged rents as instruments for current rents. By construction, these are correlated with current rents, but – assuming no serial correlation in the error term – are not correlated with the residuals in a firm level equation. Performing a GMM fixed-effects type of estimation at firm level[30], which provides efficient estimates of the relevant coefficients as well as consistent estimates of the standard errors, our main finding from the previous analysis is, once more, qualitatively confirmed. Rent sharing is found to be higher in public than in private firms, although the relevant coefficients are less precisely estimated. By instrumenting firm rents we also obtain generally higher rent-sharing elasticities, which is a common finding in the rent-sharing literature.

Weighting by firm size. In our main analysis at firm level we have weighted all firms equally when estimating the effect of ownership on rent sharing. However, since firm size varies substantially across different ownership configurations, weighting observations by employment will increase the importance of large firms (mainly public, with less rent-sharing) and reduce the influence of small firms (mainly private, with more rent-sharing) in the estimation. Thus, we would expect that weighting observations by firm size will reduce the estimated level of rent sharing. This is also what we find when we re-estimate (8) and weight firms by employment. Nevertheless, the effect of private ownership on rent-sharing is qualitatively the same as in the main analysis.

Rents per working hour. Following the received literature, our measure of rents has been expressed in per capita terms. If firms adjust the labour force in terms of working hours rather than number of employees, our rent measure might be biased in either direction. It turns out that controlling for working hours only reinforces our earlier

[29] Our results are not sensitive to different choices of (reasonable) threshold levels.

[30] It is not possible to accommodate instrument variables within our routine that accounts for firm and worker unobserved fixed effect.

findings. The rent effect becomes clearly stronger in private than in public firms, using either firm-level or worker-level data.

Asymmetric effects across sectors. We have also explored the possibility that our estimated effects might vary across different sectors of the economy, due to institutional or other differences that have not yet been accounted for in our empirical analysis. One potentially important institutional heterogeneity is that wage bargaining takes place mainly along industry divisions in manufacturing, while in services wage bargaining along occupational divisions is more common. In order to account for such differences, we have run separate regressions for manufacturing and services. It turns out that rent sharing is substantially higher in manufacturing than in services. Furthermore, it appears that the evidence of higher rent sharing in private than in public firms depends both on the sector and level of analysis. The effect of increased private ownership on rent sharing is positive in both sectors for both levels of analysis. However, at firm level the effect is statistically significant only for services, while at worker level the effect is significant only for manufacturing.

We have also done a further decomposition by estimating the empirical model (at firm- and worker-level) for each industry separately. Unsurprisingly, the worker-level analysis produces significant effects for a larger number of industries than do the firm-level analysis. Using worker-level data, private ownership has a significantly positive effect on rent sharing in 8 industries, while the corresponding number in the firm-level analysis is 4. Although most of the significant coefficients are positive, there are also examples of significantly negative effects in some industries. The industries that exhibit a significantly positive effect of private ownership on rent sharing at both levels of analysis are "Food", "Non-metallic" and "Wholesale".[31]

Asymmetric effects across bargaining regimes. We have also explored whether the ownership effect varies according to different bargaining regimes. Re-estimating our empirical model (at firm- and worker-level), interacting a variable identifying each of the three bargaining regimes with rents per worker and private ownership share, we find

[31] The regression results decomposed at industry level are available upon requests.

that the effect of ownership on rent sharing does not qualitatively depend on the wage bargaining regime. The effect is also quantitatively quite similar across different bargaining regimes, although slightly larger (at both levels of analysis) for firms which are subject to firm-level bargaining.[32]

Privatisation versus nationalisation. Given the institutionally rich Portuguese context, with both privatisations and nationalisations of firms, it is natural to ask whether increases and reductions in private ownership lead to similar (symmetric) rent-sharing effects. We have explored this question by defining a threshold level of private capital of 50% and classifying firms into four different groups. Firms that cross the threshold once from below (above) during the period of analysis are classified as privatised (nationalised) firms, while firms that remain below (above) the threshold during the entire period are classified as public (private) firms.[33] By interacting a dummy variable identifying each of the four categories of firms with rents per worker and private ownership, we are able to test whether the effect of a change in private ownership on rent sharing differs between firms that are privatised and firms that are nationalised, and to which extent the effect depends on ownership changes that cross the 50% threshold level. Re-estimating the firm-level model, we find that an increase in the private ownership share has a positive and significant effect on rent sharing for private and privatised firms, while the effect is not significant (but with a positive coefficient) for nationalised and public firms. However, by re-estimating the model using worker-level data, we find positive and statistically significant effects for all groups of firms, with the magnitude of the effect being larger for privatised and nationalised firms than for firms that did not cross the threshold level of private capital. Furthermore, the magnitude of our estimated coefficients show a remarkable symmetry: the effect of a marginal increase in private ownership is quantitatively the same (0.003) for firms that are above (private) and below (public) the threshold, and it is quantitatively the same (0.009) for firms that cross the threshold from below (privatisations) and for

[32] Details of the results are available upon request.

[33] This classification implies that our sample consists of 364 privatised firms, 128 nationalised firms, 336 public firms and 16 843 private firms. 127 firms that crossed the threshold twice during the period were dropped from the sample.

firms that cross the threshold from above (nationalisations).[34]

Sample selection bias. Finally, we explore the direction of possible bias due to missing information on the ownership variable. As mentioned in Section 3, the descriptive statistics strongly suggest that the firms with missing ownership information are private firms. We have therefore explored this potential bias by classifying the firms with missing ownership information as being fully private and re-estimated our empirical model (at firm- and worker level). The magnitude of the ownership effect is slightly lower in the firm-level analysis, but slightly larger in the worker-level analysis. Thus, whether excluding firms with missing ownership information leads to an underestimation or an overestimation of the ownership effect, seems to depend on the level of analysis (given that the dropped firms are indeed private). More importantly, though, our main result is qualitatively unchanged: the degree of rent sharing is significantly higher in firms with a larger share of private ownership.[35]

6 Concluding Remarks

Private firms tend to share the rents with their workers to a larger extent than their public counterparts. This (perhaps surprising) result is the main conclusion of our empirical analysis based on an extensive and rich linked employer-employee dataset, covering a large number of ownership changes in both directions (although the proportion of firms with ownership changes is small) across a wide spectrum of economic sectors in Portugal over a long time period. Based on our most preferred empirical specification, where we simultaneously account for firm and worker unobserved heterogeneity, an increase in the private ownership share of 10 percentage points increases (on average) the rent-sharing elasticity by 0.0002.

When seen in the light of our underlying theoretical framework, the perhaps most interesting implication of this result is that it cannot be explained by the often postulated hypothesis that private firms are more profit oriented than public ones. Rather, our result,

[34] Detailed results from these regressions are available from the authors upon request.
[35] These results are available upon request.

when seen in conjunction with the theoretical analysis, indicates that other differences are more important. Although alternative explanations cannot be ruled out, we have shown that a positive relationship between the degree of private ownership and rent sharing is consistent with stronger efficiency wage effects in private firms due to less job security.

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