Privatisation and Changes in the Wage Structure
Evidence from Firm Personnel Records

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Abstract: We investigate wage and employment effects using person-level firm based data sets in a privatised and non-privatised public sector firm in the same country. Our observation period covers the years immediately before and after privatisation. Hence we can analyse before-after effects of privatisation controlling for individual and time fixed effects and allowing for firm specific trends. The investigated situation comes very close to a natural experiment for switching workers from the public to the private sector, as the change in the wage regime coincides with substantial losses in market share of the privatised firm but not of the non-privatised firm.
We find significant changes in the wage structure in the privatised, but not in the non-privatised firm. The distribution of wages and of wage growth became significantly wider after privatisation. Conditioning on the characteristics of the workers, we find that younger employees and those with shorter tenure had gained from privatisation. There is also evidence that high-skilled gained relative to middle-skilled workers. Surprisingly, low-skilled workers also gained; this seems to be a compensation given by the firm in order to increase the acceptance of privatisation.

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1 Introduction

Until 1979, the state in all major European industrialised countries owned at least the telecommunications and postal services, gas and electricity utilities as well as the airlines and railways companies. Subsequently, the British Prime Minister Margaret Thatcher launched a large privatisation programme. From 1979 to 1997, the share of state owned enterprises in the UK economy declined from more than 10% to almost zero. This British privatisation programme was largely perceived as a success and persuaded many other industrialised countries to sell publicly owned companies. For example, 82% of telecommunications operators in developed countries had private owners in 2003. This share was almost zero in 1980.[1]

The impacts of privatisation on the economic and financial performance of divested firms, on investment returns, on the development of capital markets and corporate government practices have been examined quite intensively, as attested by the survey by Megginson and Netter (2001). However, and surprisingly, the effects of privatisation on employment structures and particularly on wages have been neglected. Megginson and Netter (2001) conclude their survey by describing three aspects of privatisation that must be better understood. They write: 'the second vital area of research is to conclusively document the labor economics of privatization programs'. To document the effect of privatisation on the wage structure is the objective of our paper.

From a labour point of view, privatisation essentially consists of shifting workers from the public to the private sector. Since the share of public sector employment in most industrialized countries is still around 15-20 percent (Gregory and Borland, 1999), the question has naturally arisen how competitive public sector pay is. Although a substantial literature documenting and comparing public and private sector wages exists, there is little causal evidence on differences

between public and private sector wage structures. Most empirical studies find a public sector wage premium, especially for women and racial minorities. Furthermore, the descriptive international literature generally finds that the public sector compresses the unconditional as well as the conditional wage distributions. The question of whether these results are driven by self-selection of workers into either of these two sectors remains open. In this paper, we use the experiment provided by privatisation to shed light on this question.

The scarcity of data makes an empirical study of privatisations in industrialised countries difficult. Haskel and Szymanski (1993) have tried quite early to measure the wage and employment effects of the privatisation projects in Britain in the 80s. However, they only dispose of aggregated data and cannot control for individual heterogeneity or make any inferences on changes in wage *structures*. Rose (1987), Peoples and Saunders (1993), Peoples and Talley (2001) and Black and Strahan (2001), on the other hand, use individual data and analyse issues such as the effect of deregulation and privatisation on union, white and male workers' rents. They all use data from the Current Population Survey that does not have a significant panel structure and thus these authors do not control for person-level fixed effects.[2]

In contrast to these studies, and this is a particular strength of our paper, we use person-level data from a firm's complete personnel records in order to trace the changes in the wage structure before, at, and after the wage regime switch from the public to the private sector. For confidentiality reasons, empirical work with personnel record data is rare in economics. However, such datasets are indispensable in order to answer important questions that cannot be answered with traditional survey data. They have been used, for instance, to analyze the relationship between productivity and wages (Medoff and Abraham 1980, 1981) and the internal economics

[1] According to data from the International Telecommunications Union (ITU).

of the firm (Baker, Gibbs and Holmstrom 1994a). Datasets of this type will be used in this paper to examine the effect of privatisation.

We have a panel of all employees in two firms located in the same advanced industrialised country (the country is not a former socialist transition economy).[3] The first firm is working in the telecommunications sector and the second in the railways industry. The panel structure of the data allows us to follow the employees of these firms for 5 consecutive years. The first firm switched its wage regime from public to private sector regulations two years after the start of our observation period. The change in the wage regime from the public to the private sector coincided with substantial losses in market share of the privatised firm. By contrast, market share is very high and has virtually been constant in the non-privatised comparison firm. We cannot separate the effects of privatisation from the effects of competition in our research design. As we are interested in the effects of privatisation on the wage structure, we often use the term 'privatisation' to describe the legal change of employees' contracts from public to private sector regulations, rather than the privatisation process of the company itself two years before that event.

The identification strategy followed in this paper is principally simple since it is based on the comparison of the individual wage before and after the wage regime change associated with privatisation of the telecommunications company. We control for possible time effects by using the data from the second firm that remained publicly owned during the whole period. In addition, we allow for fixed differences among firms as well as for differing trends in the growth rates of productivity between the two companies. Hence, we can isolate the effect of privatisation by

[2] The Current Population Survey actually has a very short panel component (4 months in, 4 months out, 4 months in, then out for good), which has not been used by these authors.

[3] We are unable to disclose information such as the names of the firms, their country of residence and the precise time period we consider.

controlling for individual and firm fixed effects, rates of technological change as firm specific time trends, and time fixed effects.

The paper is structured as follows. Section 2 presents the international context, the reforms happening within the firms and some theoretical considerations about the impact of privatisation on wage structures. In Section 3 we report our identification strategy. Section 4 describes the data sets we use and changes in the employment structures. We use the panel structure of the data in order to control for unobserved heterogeneity and estimate changes in conditional wage structures in Section 5. Section 6 concludes.

2 Liberalisation in the Telecommunications and Railways Industries

2.1 Major Trends Across Industrialised Countries

There is a degree of communality across major industrialised countries concerning the developments of the regulatory environments in these sectors. After decades of government regulation or organisation within the public sector, the introduction of competition through privatisation and market liberalisation dominated the telecommunications and to a lesser extent also the railways industries (Parker and Saal, 2003). In Europe, this change of approach was mainly sparked by Britain in the 1980s with Germany and France partly following suit in the 1990s.

Although privatisation and the introduction of competition are in principle two separate issues, privatisation was in general regarded as a prerequisite for a functioning competitive environment. At least in the telecommunications industries in Europe, privatisation and the introduction of competition were not only seen as joint projects, but were also timed closely

together. In Britain, the company Mercury was licensed as a competitor to British Telecom in 1982, the same year when the government announced British Telecom's privatisation, which followed in 1984 (Vickers and Yarrow, 1988, Chapter 8). France Telecom was turned into a corporation in 1996 and competition was introduced in 1998. Deutsche (German) Telekom was founded in 1995 with competition introduced in 1998. In the U.S., the private company AT&T, enjoyed a *de facto* state monopoly until competition was introduced following an anti-trust court ruling AT&T's divestiture in 1982 (Vickers and Yarrow, 1988, Chapter 8).

In France and Germany, substantial shares of the major telecommunications companies still belong to the state. In France, the state still owns more than 50 percent of the shares, whereas in Germany, it holds less than 20 percent. Nevertheless, even in these countries competition in the telecommunications market is fierce and has reduced market shares of the former state enterprises and prices significantly (Galal *et al.*, 1994, Chapter 4 on British Telecom). Competition has by now even reached the local call market in all of these countries.

To the best of our knowledge, there have so far been no studies based on personnel records concerning the impacts of privatisation and competition on the wage structure of a firm. (A paragraph on formal changes in the nature of wage contracts will follow.)

In the railways industry, there has been a trend towards commercialisation in industrialised economies in recent decades, but the degree of competition remains much lower than in the telecommunications sector. Shortly after World War II, the major railways were public in Europe. In the United States, the railways just as telecommunications have traditionally been private. However, the United States railway system has been heavily regulated and subsidised. In 1970, the U.S. government created Amtrak as a publicly owned private company. In 2002, the Amtrak Reform Council suggested a restructuring plan with increased competition.

The United Kingdom is the country in Europe where competition in the railways sector has been most developed. The railways system was privatised in 1990.

Germany and France on the other hand have taken a more moderate approach to reform their railways industries: In Germany, the railway system has been formally privatised in 1994 but the state remains the sole company owner at the time of writing. Furthermore, competition in the passenger sector is virtually absent. In France, the railways system is still public, but the internal structures have been commercialised. In spite of historical differences across countries and differences in the degree to which competition has been introduced, the trend towards commercialisation in the railway sector is common across the Atlantic. Although the example of the United Kingdom shows that competition in the railways sector is possible, continental Europe is mostly keeping monopolistic structures, particularly in the passenger sector. (A paragraph on formal changes in the nature of wage contracts will follow.)

2.2 The Reforms Happening In The Companies

Our analysis refers to five years for which we have panel data from the personnel records of a telecommunications company. We call the first year we have observations on that company Year 1. During Years 1 and 2, employees were paid according to national public sector wage regulations, similar to the public administration. In Year 3, the new private sector wage structure was introduced in the form of a firm-level collective bargaining contract.

Two years before the introduction of the private sector wage structure in Year 3, the telecommunications company was formally privatised on January 1st of Year 1 and the initial public offering happened during the first year. The government has kept the majority of the shares but the company is treated on an equal footing with competitor firms. There are no special rights given to the company by the law regulating the market. The telecommunications company

is managed like a private firm and the government does not interfere with the management's decisions. The quasi-simultaneity of the changes in the legal status of the company and in its market shares (see below) make the separation of the effect of privatisation from the effect of competition impossible.

The procedure of the introduction of the new wage structure in Year 3 deserves further attention, as it is important for our empirical analysis. First, the data we observe from Year 3 onwards are the private sector wages agreed by the management and the unions. These private sector wages differ from the actually paid wages, due to a three-year wage guarantee issued by the CEO decreeing that no employee would need to suffer wage losses even if his or her new private sector wage were below the old public sector wage. The wage guarantee is important in the sense that it facilitated the management's capability to implement an efficient private sector wage structure in a 'big bang' fashion without too much hostility from employee representatives.

A second incentive for the management to press for an efficient private sector wage structure was the introduction of competition in Year 2 or at the beginning of Year 3, depending on the market considered. By Year 3, when the new wage structure was put in place, the telecommunications company had its market shares in the mobile (cellular), national long-distance and international call markets decreased to below 70 percent. Hence, during the two years between Year 1, when the company was formally privatised, and Year 3, when the public sector wage structure was abolished, significant pressure must have built up for the management to adopt a private sector wage structure in order to remain competitive.

A third reason why the new wage structure is likely to be representative for the private sector is the fact that two consultancy firms were hired to explicitly work out the private sector wage for each employee's job position. One of these consultancies is operating internationally

and was responsible for wages of the higher management levels. The second consultancy is mainly operating nationally and worked out a wage structure based on its wide experience of private sector wages in the country of concern. We have obtained documents from this latter consultancy describing their job evaluation approach. Compared to the old public sector wage structure, the consultancy more than halved the number of pay levels. The allocation of job titles to pay levels was carried out according to the significance of each job within the organisational structure of the company and the qualification required to carry out the assigned tasks. For the allocation of a job to a pay level, the responsibility associated with the job concerning other employees and the autonomy of decision making were regarded as more important than formal qualifications. The pay levels themselves were matched with the consultancy's data base on private sector wages for comparable jobs in the same country.

The three factors mentioned in the above paragraph all suggest that the change in the regime in the telecommunications company in Year 3 may be regarded as a natural experiment for shifting employees from the public to the private sector and observing their wage changes. However, the reality was not that straightforward. Employee representatives in the form of trade unions did have an impact on the new wage structure. First, the CEO conceded a three-year wage guarantee as already mentioned. This is not a problem for the empirical analysis, as we observe the new private sector wage without the supplement guaranteeing that the old nominal public sector wage could effectively be obtained. Second, however, the unions demanded that not too many 'problem cases' were created for whom the private sector wage was below the last nominal public sector wage. According to oral information from the human resources department of the

telecommunications company, the unions were partly successful in their demands.[4] We will come back to this point when we discuss the empirical results in Section 5.

In order to obtain a benchmark for public sector wage developments in the country where the telecommunications company is operating, we also observe the country's national railways company. Similar to the telecommunications company, we received panel data from the personnel records of all employees from Year 2 to Year 6 from the railways company. Data for Year 1 is not available.

In terms of market structure, the railways company was able to keep its market share at around 90 percent in both the passenger and freight sections of its business. It is therefore more representative for countries like France and Germany than for the United Kingdom. Although, the railways company received autonomy from the rest of the public sector by way of a special law in Year 2, the employees of the railways company are legally still considered as public sector workers (with the exception of high-level managers). Although managers were given significant autonomy concerning the organisation of the firm, the government interferes by setting mid-term objectives to the management. Until the end of Year 3, the personnel of the railways company was still employed and paid according to the same public sector rules as the public administration. Formally, a new wage system was introduced at the beginning of Year 4, when a firm-level collective bargaining contract was substituted for the nation-wide public sector wage regulations. However, the lack of competitive pressures in the goods market and the fact that

[4] The internal newspaper of a major union involved in the bargaining process confirms this information. Unfortunately, we could not obtain written documents or more precise information on the employee groups who were affected by this bargaining process. Hence, we cannot separate the wage regime change suggested by the management and the consultancy firms from the influence of unions.

employees remain public sector workers suggests that the wage system reform had the nature of a cosmetic change.[5]

To conclude this section, we are able to observe the evolution of two companies at a time when probably the most important determinants of wages changed in the telecommunications, but not in the railways sector: the legal status of employees and the degree of competition in the goods market. Initially, the two companies were really similar since their employees were formally public sector employees, their wages were determined centrally by the government, and they both had a monopoly in their respective sectors. The wage system of the employees of the telecommunications company changed at the beginning of Year 3: they subsequently became private sector employees by contract and worked in a firm facing a competitive goods market having lost more than 30 percent of its market share in key sectors of its business. The employees of the railways company also met some changes by being formally detached from the public administration's wage regime at the beginning of Year 4, but they remained public sector employees with (separate) public law contracts.

2.3 Theoretical considerations

Basically, we expect that a convergence of the distribution of wages in the privatised firm in direction of the wage distribution observed in the private sector. Privatisation would have no impact if public sector wages are exactly the same as private sectors ones. However, there are a number of reasons, surveyed by Bender (1998), why earning differentials between the private and the public sector exist. Most importantly, the public sector is subject to political constraints and not to profit constraints: the goal of a politician is to be re-elected while the objective of a firm is to make a profit (or, at least no deficit). The wages of public sector workers therefore depend on

[5] The only competitors are small local companies that are often publicly owned themselves.

their ability to compete with other interest groups over the allocation of the public budget and with tax-payers over the size of the budget. It is likely that wages in the public sector are higher than in the private sector because 'market forces are probably more effective in providing a floor than a ceiling for public sector wages (Gunderson 1979). Vote maximization arguments lead to similar conclusions (Reder 1975, Borjas 1980). Thus, wages are likely to decline after privatisation. This prediction can naturally be reversed if the productivity of the employees increases after privatisation, for instance as a consequence of increased efforts.[6]

Political forces are not only likely to impact on the average wage but also on the distribution of wages. Issues such as pay equity and fairness are more often encountered in the public than in the private sector. During the period we consider, there have been several discussions in Parliament and in the media about manager wages in the non-privatised firm being 'too high', although lower than in comparable private sector firms. A second element that could produce differences in the earnings distributions is the power of the unions. Union coverage is often higher in the public sector than in the private sector (this is also the case in the country where the two firms are located) and it is well known in the literature that unions compress the wage distribution (Card, Lemieux and Riddell 2004).

Finally, the degree of competition can affect the optimal level of wage compression within a firm (Lazear, 1989). Pay compression within the firm has two effects. On the one hand, it creates a cooperative work environment and avoids sabotage. On the other hand, the morale of high-quality workers is adversely affected by pay compression. The introduction of competition can exacerbate the negative effect on the morale of high-quality workers, so that privatisation with competition must be expected to widen the wage distribution by decreasing pay compression. By contrast, in the public sector, with the firm being the only employer in a given industry, the

[6] For such types of models, see Haskel and Sanchis (1995).

demoralising effect of pay compression is expected to be smaller. In our case, the public railways company is almost the only potential employer for a specialised worker, whereas competitor firms exist for the privatised telecommunications firm.

To summarize, according to all theoretical considerations above, we expect an increase in wage dispersion through privatisation and a higher level of goods market competition.

3 Identification Strategy

The identification strategy followed in this paper is based on the comparison of the wage (and employment) structures of the telecommunications company before and after the wage regime change associated with privatisation. Having access to internal data sets on wages and characteristics of all workers of the firm, we can analyse the effect of privatisation on the unconditional wage distributions. Moreover, since the data set has a panel structure, we can also compare the public sector wage with the private sector wage for each employee and thus determine who gained and who lost from the ownership change.

This simple strategy is complicated by some difficulties. First, the problem of sample selection in the form of entry into and exit from the firm must be considered. Although it is impossible to formally test for the presence of a bias, we carry out a robustness check by comparing the results using 2-year stayers in the firm with results using 5-year stayers.

Then, we allow for the fact that the time of privatisation may have been 'special' in some sense. If there had simultaneously been a boom or a recession affecting the whole economy, we would misinterpret the effect of this macro shock as an effect of privatisation. In order to control for this possibility, we use a second data set from a firm remaining in the public sector during the whole period. This second firm (the national railways company) is a valid comparison, because

before privatisation, the formal wage schedules (and associated hierarchical positions) in both companies were identical and determined at the national level. Indeed, below we show empirically how similar wage setting has been in both firms before privatisation.

A further problem is that the choice to privatise the telecommunications company may have been motivated endogenously by the development perspectives of the industry. Technological progress in telecommunications has been faster than in the railways industry during the last few decades. Thus, we may confound the effects of privatisation with the effects of rapid technological development, independent of the status of the firm. Our strategy in this respect, which is similar to that adopted by Brown, Earle and Telegdy (2006), is to allow for a firm (industry) specific trend. Using data on a period when the status of both firms did not change, we control for the effects of possibly different rates of technological change on the wage structures of the two companies. For this approach to be valid, we have to assume that the rates of technological change did not accelerate or decelerate at the time around the wage regime change.

With the data at our disposal, mild assumptions allow us to exclude that what we observe is caused by something else than the wage regime change associated with privatisation. However, we cannot exclude that privatisation would have a different impact on a different firm in a different industry. This means that we estimate the treatment effect for the treated population, which is a traditional approach in the treatment effect literature, since treatment effects for the whole population require much more stringent assumptions to be identified.

To formalise this identification strategy, consider the following model. Define $Y_{i,t}^{f,s}$ to be the potential log wage that individual *i* would earn during year *t* in firm *f* owned by *s*, where $s = 1$

if firm f is publicly owned and $s = 0$ if firm f is privately owned.[7] Assume that $Y_{i,t}^{f,s}$ can be written as

$$Y_{i,t}^{f,s} = \beta_t^{f,s} x_i + c_i^f + \varepsilon_{i,t} \text{ with } E\left[\varepsilon_{i,t} \middle| x_i, c_i^f\right] = 0 \qquad (1)$$

where x_i is a vector of observed characteristics containing a constant term and $\beta_t^{f,s}$ is the vector of returns to observable characteristics.[8] c_i^f is an individual fixed effect that may depend on the firm (in which case it would represent the matching quality).

This model is not identified without further assumptions, because at a given time, a firm is either in the private or in the public sector. We need to put some structure on how the returns to individual characteristics may vary over time, by firm and by sector of ownership. We assume that

$$\beta_t^{f,s} = \beta^f + \tilde{\alpha}^f T_t^{f,s} + c_t + \delta s = \beta^f + \alpha^f t + c_t + \delta s \quad , \qquad (2)$$

where β^f is a vector of firm-specific returns and $T_t^{f,s}$ stays for the technological level in firm/industry f in sector s in period t, which is associated with the vector of firm/industry specific labour market returns $\tilde{\alpha}^f$. c_t is a vector of time-specific components of returns and δ is the vector of public sector wage premiums for the vector of labour market characteristics x_i.

On the right-hand side of equation (2), we place some more restrictions on the model by assuming that the effect of technological change on wages is independent of the ownership of firm f. This is a reasonable assumption because firm f is a negligibly small firm compared to the world industry and, thus, can hardly influence the technological progress in this industry. This assumption would certainly be an unreasonable assumption for a firm that is large relative to the

[7] f can also be interpreted as the industry in which the firm is operating.

[8] In order to simplify the notation, x_i is assumed to be time-constant. In reality, the vector of covariates consists of time constant variables and variables with time constant first differences. This does not preclude the identification of the coefficients of interest (as presented below) on both types of variables.

world market. In this case, we could expect that privatisation could have an impact on technological progress (*X*-efficiency). Finally, we assume that the rate of technological *change* is constant over the observation period for each firm. Clearly, this assumption is too restrictive for a long or infinite time period. For a period of only a few years, as in our application, however, this can be considered as a reasonable approximation of reality. While it is certainly possible that the rate of technological progress is higher in the telecommunications than in the railways sector, the difference between both rates can be assumed to be stable over a time period of only a few years. If we had data timed at smaller intervals such as trimesters, months, days,… this assumption would be a pure continuity assumption: we would require that the level of technology does not jump exactly at the time when the firm is privatised. Thus, the identification strategy is similar to a regression discontinuity design (Hahn, Todd and Van der Klaauw, 2001, for instance). Identification results from the continuity of technological progress over time and the discontinuity of the change in the wage regime associated with privatisation.

The approach to identification of public sector wage returns applied in Section 5 is best illustrated by writing (log) wage growth equations based on the specifications in equations (1) and (2). The purpose of considering wage growth is to eliminate the person-level fixed effects c_i^f, *cf.* equation (1):

$$\begin{aligned}
\left(Y_{i,2}^{1,1} - Y_{i,1}^{1,1}\right) &= \left(\alpha^1 + c_2 - c_1\right)x_i + \left(\varepsilon_{i,2} - \varepsilon_{i,1}\right) \\
\left(Y_{i,3}^{1,0} - Y_{i,2}^{1,1}\right) &= \left(\alpha^1 + c_3 - c_2 - \delta\right)x_i + \left(\varepsilon_{i,3} - \varepsilon_{i,2}\right) \\
\left(Y_{j,2}^{2,1} - Y_{j,1}^{2,1}\right) &= \left(\alpha^2 + c_2 - c_1\right)x_j + \left(\varepsilon_{j,2} - \varepsilon_{j,1}\right) \\
\left(Y_{j,3}^{2,1} - Y_{j,2}^{2,1}\right) &= \left(\alpha^2 + c_3 - c_2\right)x_j + \left(\varepsilon_{j,3} - \varepsilon_{j,2}\right)
\end{aligned} \tag{3}$$

A regression of $\left(Y_{i,2}^{1,1} - Y_{i,1}^{1,1}\right)$ on x_i estimates $\left(\alpha^1 + c_2 - c_1\right)$. The same wage growth regression corresponding to the following two years, *i.e.* a regression of wage growth before and

after the change in the wage regime associated with privatisation, estimates $\left(\alpha^1 + c_3 - c_2 - \delta\right)$. A simple analysis of the structure of wage changes associated with the wage regime change in the telecommunications company may therefore confound public sector wage returns δ with the effects of technological change α^1 in the firm/industry and with general macro effects $c_3 - c_2$.

A first identification strategy we implement is therefore a before-after estimator of wage growth, *i.e.* from the coefficients of the wage growth regression around the wage regime change we subtract the coefficients of the wage growth regression of a base period: for example, using data for the two years before the wage regime change. This yields

$$\left(\alpha^1 + c_3 - c_2 - \delta\right) - \left(\alpha^1 + c_2 - c_1\right) = \left(\left[c_3 - c_2\right] - \left[c_2 - c_1\right] - \delta\right) \qquad (4)$$

If we believed that there were no general macro effects or that they were linear for the period of two years in question, *i.e.* if $\left[c_3 - c_2\right] = \left[c_2 - c_1\right]$, then the before-after estimator of the wage growth structure identifies the vector of public sector wage returns δ.

However, due the 'business cycle' phenomenon, we do not want to rely on this linearity assumption. One way to eliminate the fixed time effects is estimating the same before-after effects for a second firm, here the railways company, and subtracting this estimate from the before-after estimator of the telecommunications company. This difference-in-differences estimator yields:

$$\left(\left[c_3 - c_2\right] - \left[c_2 - c_1\right] - \delta\right) - \left(\left[c_3 - c_2\right] - \left[c_2 - c_1\right]\right) = -\delta \qquad (5)$$

which is the (negative of the) vector of public sector rents on the labour market characteristics x_i.

Note that another time period of wage changes could be taken as the base period. In this example, we have taken the wage change between Year 1 and Year 2 as reference. All other wage

changes give the same results, for example, the wage growth between periods 4 and 5 does the same trick:[9]

$$\left(\left[c_3 - c_2\right] - \left[c_5 - c_4\right] - \delta\right) - \left(\left[c_3 - c_2\right] - \left[c_5 - c_4\right]\right) = -\delta \qquad (6)$$

In Section 5 we will estimate the difference-in-differences estimator as defined in (6). We cannot estimate the difference-in-differences estimator (5), because no data are available to us for the railways company for Year 1. Both estimators are identical if the whole effect of privatisation is effected directly at the time immediately around the wage regime change. If privatisation affected wages only progressively then both estimates would have an attenuation bias. We discuss this possibility in Section 5 by examining before-after estimators with different post-regime change reference periods. In any case, the difference-in-differences estimator can be considered as a lower bound for the effect of interest δ.

4 Data and Descriptive Results

4.1 Data

For confidentiality reasons, empirical work with personnel record data is rare in economics. However, such data sets are indispensable in order to answer important questions that cannot be answered with traditional survey data. They have been used for instance to analyse the relationship between productivity and wages (Medoff and Abrahm 1980 and 1981), the internal economics of the firm (Baker, Gibbs and Holmstrom 1994a), the relationship between hierarchies and wages (Baker, Gibbs and Holmstrom 1994b), or to test the theory of tournaments (Lazear and Rosen 1981). Similarly, matched employer-employee data have been used to measure within-firm and between-firm variation in wages and wage growth rates, the relationship between mobility

[9] The only exception is the wage growth between Year 2 and Year 3, because the telecommunications company has

and wages and between tenure and wages. Some recent contributions in this domain are collected in the book edited by Lazear and Shaw (2006).

In this study, we are in the exceptional position to have obtained person-level panel data on all employees of a telecommunications company before and after the change of the wage regime associated with the privatisation process. In addition, we dispose of very similar data from the national railways company of the same country. Our extracts refer to the cross section of all employees on January 1st (telecommunications) or June 30th (railways) for each year between Years 1 and 5 (telecommunications) and Years 2 and 6 (railways). Since the effective wage regime change (from public to private) in the telecommunications company took place between Years 2 and 3, the data of these two years are particularly interesting. Unfortunately, the observation periods do not perfectly coincide for the two firms, since we have data starting only from the second year for the railways company. As explained in Section 3, we need data from the railways company in order to control for fixed time (macro) effects. The imperfect overlap complicates the estimation of the effects of interest. As discussed at the end of Section 3, this forces us to estimate the difference-in-differences estimator (6) instead of the more obvious difference-in-differences estimator (5).

The variables we observe for both companies are the personal identification number, the full-time full-year equivalent wage[10], age, tenure, gender, region of residence, degree of part-time employment in percent, and visa status. Unfortunately, none of the companies' data sets contains information on the educational attainment of employees.

The key outcome variable in this study is the full-time full-year equivalent wage. As indicated in Section 2.2, the private sector wage we observe does not include the temporary wage

experienced its wage regime change in this interval.

supplement guaranteed by the CEO in order to prevent effective wage decreases. Hence, as we observe the private sector wage as agreed by the company-level collective bargaining contract, observed wage decreases are possible. Note that what we observe here is what we are interested in, namely the true private sector wage. The temporary wage supplement with the purpose of easing the implementation of the new wage regime was only paid for a three-year transition period to employees who lost due to the new wage structure.

For the empirical analysis, we restrict the samples to employees between 16 and 65 years of age who are paid monthly wages. In the telecommunications company, only around three percent of employees earn hourly wages, in the railways company, the corresponding figure is below one percent. Weekly wages do not exist in either company. Table 1 provides information on the sample selection procedure. In both companies, we exclude apprentices from our analysis. In some cases, we observe inconsistencies like gender changes for a person or missing values for variables like age, tenure or the wage. Observations with such inconsistencies are excluded. For the empirical analysis, there are between 17,000 and 23,000 and between 27,000 and 28,000 observations remaining per year for telecommunications and railways companies, respectively.

4.2 Employment Structures

Privatisation and goods market liberalisation are not only expected to have effects on wages, but also on employment (see Haskel and Szymanski, 1993, for an empirical analysis at the company level). Here we describe key changes in employment in the two companies and in Section 5 we discuss how the wage structure is affected by privatisation.

Table 2 displays changes in employment as well as entry and exit rates for each company and year. Entry and exit rates are calculated with the number of employees in the base year in the

[10] A component of the wage representing a fixed percentage of 8% of the total earnings is missing in Year 2 and 3 for

denominator and the number of persons joining or leaving the company between the base and the following year in the numerator. The number of persons employed by the telecommunications company declined monotonically during the observation period, although a stabilisation of the workforce seems to be perceptible at the end of the period. On the contrary, the number of employees in the railways company is quite stable over the whole period. Entry and exit rates were both higher in the telecommunications than in the railways company, but the differences between the firms are larger in terms of the exit rates. Note that the difference between the two firms is already apparent before the change in the wage regime and the legal status of telecommunications employees in Year 3.

Table 2 also presents the excess turnover rate defined as the minimum of the entry and exit rates. If the goal of the firm was simply to adjust the number of employees, we should not observe entries and exits during the same period, with the exception of retirements and labour market entrants. Thus, the excess turnover rate gives an indication of the stability of the workforce within a firm. We observe a steep increase in excess turnover in the telecommunications company, particularly between Years 4 and 5. Part of this increase could be a general phenomenon in the economy since the excess turnover rate seems also to increase in the railways company. Yet another part of this increase may also be a consequence of the liberalisation of the telecommunications market offering employment opportunities different from those found during the public sector monopolist period. We also checked whether the high entry rate between Years 4 and 5 in the telecommunications industry can be explained by the acquisition of a new business unit, but this is not the case.

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the railways company. In order to maintain the comparability of wages over time, we have eliminate this component for Year 4 to 6.

Table 3 provides selected mean characteristics of the workforce in each firm and each year. The levels of the characteristics indicate clear differences in the composition of the workforces between the two companies. Average wages are higher in the telecommunications than in the railways company, which can be explained by the type of jobs found in these two firms, with more manual and fewer skilled jobs in the railways industry. Similarly, the proportion of women and part-time employment is higher in the telecommunications company. Concerning the share of female and part-time employees, we observe a slight convergence between the companies over the years but the differences remain very high.

Age and tenure are higher in the railways company, which is consistent with a lower turnover rate in this firm (*cf*. Table 2). The evolution of these characteristics over time follows a clear, interesting trend. The workforce of the telecommunications company is becoming monotonically younger and less tenured, contrary to what happens in the railways company. Thus, the differences in average age and tenure are increasing over time between these two firms. Indeed, the railways company signed an agreement with the unions in Year 2 where it renounced any lay-offs for several of the following years. With such an agreement, it is not surprising to observe much lower turnover in the railways than in the telecommunications company.

As the telecommunications company was privatised in Year 1, we cannot distinguish whether the differences in entry and exit rates and in the employment structures between the two firms are driven by privatisation or a higher rate of technological change in the telecommunications sector. We will see in the following section that changes concerning wages occurred abruptly between Years 2 and 3. The difference in the pattern of changes in wages and employment may be explained by the time pattern of the changes in law. The telecommunications company was formally privatised at the beginning of Year 1 but wages were still public sector wages until the end of Year 2. Thus, the management of the telecommunications company is

likely to have been under pressure to adapt the workforce in the anticipation of increased goods market competition from Year 1 on. Of course, we would need data on the period before Year 1 in order to distinguish between privatisation and technological change as major candidates driving differences in employment structures between the two firms.

5 The Effect of Privatisation on Wages

5.1 Changes in Unconditional Wage Distributions

We plot the densities of the log annual wages for the telecommunications and railways companies in Figures 1 and 2, respectively. For the telecommunications company, we observe a relatively stable wage distribution when wages were set by public sector regulations, that is, in Years 1 and 2. However, the inequality of wages increased with the introduction of private sector wage contracts in Year 3. This is exhibited in the estimated kernel densities by fatter tails and lower modes of the wage distributions in Years 3, 4 and 5. Note that there were also some changes between Years 1 and 2, visible especially at the lower part of the distribution. Nevertheless, the widening of the wage distribution is most remarkable between Years 2 and 3, but continued in the following two years. By contrast, the stability of the wage distribution in the railways company is impressive and the density functions for different years look very similar.

Table 4 confirms the visual impression with four traditional inequality measures: the Gini coefficient and the 90/10, 90/50 and 50/10 decile ratios. Not all measures give exactly the same tendency for all years, since they give different weights to different parts of the distribution, but the key feature is clear, whatever measure is used: the shift to the private sector wage structure significantly increased wage inequality.

While the changes in the employment structures began before the regime change towards private sector wages, changes in the wage distribution can be observed only at that regime change or afterwards. Moreover, we do not observe any change during the same years for the railways company, which means that macro shocks cannot explain this result, which we, therefore, interpret as a true consequence of privatisation. This increase in wage inequality is predicted by most of the models presented in Section 2.3. Unfortunately, we cannot discriminate between these theories because all potential reasons for increasing wage dispersion are present in our case: the union coverage decreased in the telecommunications firm and was stable in the railways company, there were political pressures towards less wage dispersion in the public sector, and turnover increased in the privatised telecommunications firm.

The changes in unconditional wage distributions are confounded by the ongoing changes in the employment structures (see Section 3), especially in the privatised telecommunications company. Therefore, Table 5 displays the same inequality measures as Table 4, but for the sample of workers who remained in the respective company during all five years of the observation period. Inequality among stayers is generally lower than in the full sample, but the major result still holds: The switch to the private sector wage structure between Year 2 and Year 3 is associated with a marked increase in wage inequality: the wage ratio between the ninth and tenth decile increases from 1.77 to 1.90 in the telecommunications firm, whereas is remains constant at 1.61 in the railways company.[11]

[11] The development of the Gini coefficient sometimes differs from the one of the decile ratio (it also increases with the wage regime switch but not by as markedly), but as the Gini coefficient is more sensitive to redistributions at the centre rather than the tails of the wage distribution, we prefer the decile ratios as inequality measures.

5.2 Changes in Unconditional Wage Growth Distributions

The next question we ask is: How does privatisation affect wage growth at the level of the individual worker? We use the panel nature of the personnel record data to track wage changes at the person level from year to year. Table 5 displays the 5th, 10th, and so on up to 95th, percentiles of log wage growth for the telecommunications and railways companies.

The distribution of wage changes in the telecommunications company in the public sector wage regime (between Year 1 and Year 2) is striking: from the 5th to the 60th percentile, all workers receive the same wage growth. This is virtually identical to the development of each year in the railways company, which has remained in the public sector. Although we have seen that the workforces of these two companies differ in their socio-economic composition, the centrally bargained wage changes were similar in these two companies under the public sector wage regime. This finding substantiates the role of the public sector railways company as a valid comparison to the privatised telecommunications firm.

In striking contrast to the similarities between the two companies during the public sector wage regime, the distributions of wage growth are completely different at and after the wage regime switch in the privatised telecommunications firm. Between Years 2 and 3, when the wage regime switch occurred, we observe true heterogeneity in wage changes. More than that, even 40 percent of wage changes are negative[12]. Although the dispersion of wage changes is particularly pronounced at the time of the wage regime change, the change in the structure of individual wage growth seems to be persistent after privatisation, since only a maximum of 15 percent of employees exhibit the same wage increase at the end of the observation period while this number used to be 60 percent during the public sector wage regime. Thus, it seems that a particularly high

[12] As a comparison, Lebow, Saks and Wilson (2003) find about 15% of negative wage changes. Lazear and Shaw (2006) find that the standard deviation of wage raises within firm is between 10% and 20%.

variance of wage changes was necessary in order to adjust the wages to the private sector productivity of the employees. Moreover, this variance remained higher in order to update the changes in productivity each year.

By contrast, the wage structure is rigid in the railways company as about 60 percent of wages increase by the same rate each year. This outcome had been nationaly negotiated by the unions with the government until Year 3 and with the management of the firm starting from Year 4. Our results are different from the findings of Lazear and Shaw (2006) who find a higher variance of wage raises. We find almost no negative wage changes, which is consistent with a strong rigidity in the public sector wage structure.

5.3 Who Gained and Who Lost From Privatisation?

The results of the preceding sections show that there were winners and losers from privatisation. By using the information on the characteristics of the workers, we now go one step further and determine *who* gained or lost through the wage regime switch. As indicated by the model defined in Section 3, we first regress the log real wage changes between Year t and t+1 on a set of characteristics of employees in Year t. We define 9 categories for age, 9 for tenure, 4 brackets describing the degree of part-time employment, a dummy for female gender, immigration status, as well as regional dummies.

Since we have no measure of education or ability, we use a simple proxy for skill: the position of the employee in the wage distribution. We build 10 dummy variables based on the deciles of the telecommunications company's real wage structure. Then, we basically have two alternatives: the first and straightforward solution is to regress the wage change between years t and $t+1$ on the wage position at year t. The second is to define a time-constant skill proxy evaluated in Year 1 (or in Year 2 when we also use data for the railways company). The

advantage of the first solution is that we keep the sample size as large as possible and reduce possible attrition biases. However, the problem is that by doing so we endogenously change the value of the skill proxy each year. Particularly, if privatisation has an effect on the ordering of wages, then the skill proxy in Year 1 may be quite different from the skill proxy in Year 4. At present, we consider the results using the second proxy (skill defined on the wage position of the telecommunications company's wage distribution in Year 1 or – for the difference-in-differences estimates – of both companies in Year 2). However, we show in Section 5.4 that the results are very robust to the choice of skill proxy.[13]

We regress wage changes on the described worker characteristics for each year and each firm. Then, in order to separate the effect of privatisation, we subtract the coefficients obtained before the wage regime switch of the telecommunications company from the coefficients obtained at the regime switch as well as from the coefficients referring to the periods one and two years afterwards, respectively. These simple before-after estimators of wage growth, as described in equation (4) of Section 3, are consistent in the absence of macro-shocks or if macroeconomic influences are linear over the time period considered. As a test of robustness, we will use the results for the railways company to control for time fixed effects (macro shocks) in a difference-in-differences framework in Section 5.4.

The before-after estimates are obtained by 'grand regressions' that produce the respective estimates as interaction terms in one step. This allows for arbitrary correlation of the error terms relating to the same person when calculating the standard error of the estimates (Bertrand, Duflo and Mullainathan, 2004). The estimating equations are:

[13] A second possible problem of endogeneity may exist because we regress the wage growth on the wage level at the beginning of the year. However, this is not a problem as long as the stochastic component of wages follows a random walk. This is an assumption which tends to be confirmed by the literature, *e.g.* Topel and Ward (1992).

$$\Delta Y_{ti} = x_{ti}\beta + \left(x_{ti} \times 1\left[t = 2\right]\right)\delta + u_{ti} \quad t = 1,2$$
$$\Delta Y_{ti} = x_{ti}\beta + \left(x_{ti} \times 1\left[t = 3\right]\right)\gamma_1 + u_{ti} \quad t = 1,3$$
$$\Delta Y_{ti} = x_{ti}\beta + \left(x_{ti} \times 1\left[t = 4\right]\right)\gamma_2 + u_{ti} \quad t = 1,4$$

where $1\left[t = 2\right]$ is a dummy variables indicating the period of the wage regime switch. δ is the effect of privatisation on the wage structure. The second and third equations relate to the period one and two years after the wage regime switch with associated coefficients γ_1 and γ_2, respectively.

The before-after estimation results are reported in Table 6 and displayed graphically for the human capital proxies age, tenure and skill in Figures 3, 4 and 5, respectively. The beneficiaries of privatisation are young employees, workers with few years of tenure and very low or very high skills. The difference in conditional wage growth between the youngest (age 18-25) and the oldest (age 61-65) category is slightly above 8 percentage points, *i.e.* younger workers gain significantly compared to older workers from privatisation. This difference is slightly above 2 percent points in the results for different classes of tenure. Together, these results, which are statistically significant, confirm the hypothesis that wage increases with age and tenure are more automatic and higher in the public than in the private sector.

In order to exhibit the 'big bang' nature of the wage structure change, we present the regression results of two further before-after estimators, where we relate wage growth one (Years 3-4) and two years (Years 4-5) after the wage regime change to wage growth before the wage regime change (Years 1-2). If the introduction of the private-sector wage regime led to a one-off change in the wage structure, we should observe insignificant before-after estimates for the two post-regime-switch periods. However, the development to a private sector wage structure might actually have been gradual.

The graphical displays in Figures 3 to 5 suggest that the change in the wage structure was more or less sudden from one year to the next. An exception are changes in the age dimension, where the relative returns to being young kept rising even two years after the wage regime change. Wage growth in the private sector system one year after the regime change was still about 3 percentage points higher than in the public sector for the youngest (18-25 years) relative to the oldest (61-65 years) age group. Even one year later this difference was again about 2.5 percentage points.

In contrast to age, we only observe significant changes for tenure around the wage regime switch. In the subsequent years immediately after the wage regime change, wage growth for workers with 3-5 relative to 26-50 years of tenure was at most a negligible tenth of a percentage point higher.compared to the situation before the regime switch.

Whereas changes in the wage structure turn out to be rather monotonic in age and tenure, the situation is more complex concerning the skill proxy. Ignoring the first 2 categories (the lowest 20 percent of the wage distribution), we obtain the expected result: privatisation has increased the wage of high-skilled (top decile) relative to low-skilled workers (third decile from the bottom) by almost 3 percent. This process of changes in the wage-skill profile has continued in the two years subsequent to the wage regime change, as the corresponding before-after estimates show: The top decile has gained further 0.7 and again 0.8 percent relative to the third decile from the bottom in those two years, respectively. These estimates are statistically significant.

At the very bottom of the skill distribution, our findings surprisingly run counter to the hypothesis of wage compression in the public sector. Indeed, the wage regime switch from the public to the private sector *increased* wages at the bottom decile relative to the third decile from

the bottom by statistically significant 5 percent. This relative wage increase is thus even larger than for the top skill proxy decile. However, it is only at the time of the wage regime switch itself when the bottom two deciles of the skill distribution gained significantly in wages relative to the third decile from the bottom.

A 'political' factor probably explains this result. The unions were essentially against privatisation and against the associated change of the pay system. As explained in Section 2.2, a first version of the new pay scale was rejected by them and the unions set conditions for the incidence and amount of wage losses before accepting the firm-level collective bargaining contract. The management of the telecommunications company then offered a three year wage guarantee for insiders and in addition proposed an adjusted pay scale, which was considered as acceptable by the employee representatives. Among others, this was implemented by giving a fixed bonus to all employees which, naturally, represents a higher percentage for low wage workers than for high wage workers.[14] The estimation results for the second and third year after the wage regime change in Figure 5 clearly show that this wage increase for workers at the very bottom end of the skill distribution was a unique event and has not been repeated. The positive coefficients for the lowest part of the distribution disappear unlike those for the upper part, although they are very small in absolute value. Thus, the surprising premium for low-skilled employees may be considered as the price the firm had to pay to render privatisation acceptable to its employee representatives.

Having discussed changes in the wage structure with respect to the human capital proxies age, tenure and skill, we now turn to workers' characteristics that are often discussed in the context of discrimination, although they may also be correlated with human capital: gender and

[14] This bonus can only explain a small part of the positive premium for the lowest skill categories but it is only one channel through which the political element entered.

ethnicity. We do not observe ethnicity in terms of race, but we know whether a person is a citizen or has a permanent residence permit (Green Card equivalent) in the country. Not being in this category is indicated by a dummy variable for non-permanent worker status.

Estimation results are displayed in Table 6. At the time of the wage regime switch, women lost 2 percent in wages. This wage loss was one-off, as the relative wage of women has not changed significantly in the following two years. The effect for non-permanent residents is undetermined changing from positive to negative after the wage regime switch, but not significant at the five percent level.

Finally, we discuss the changes in the effect of working hours on wages. These are measured in terms of dummy variables indicating working hours in percent of full-time employment as defined by the firm. The results are striking: the lower the degree of employment, the larger the wage loss due to privatisation. Workers employed only up to 40 percent lost almost 9 percent in hourly wages relative to full-time employees. In several industrialised countries, furthering part-time employment is discussed as 'socially desirable' for combining family and working life. Consistent with this political discussion, the results here indicate that the public sector values part-time work more than the private sector.

5.4 Robustness Checks

We now assess the robustness of these estimates with respect to two potential biases. First, we cannot exclude that the results are driven by sample selection. Second, we use data from the railways company to control for potential macro effects.[15]

[15] We also considered using survey data from the same country as a comparison. However, differences in the structure of these survey data (for example no panel component, differences in wage measurement, difficulties in identifying the public sector) render both alternative data sets we considered less suitable as comparison than the railways personnel records.

Sample selection is particularly an issue for the telecommunications company because of the significant employment declines (at about 10 percent a year) and the generally high turnover rates during the observation period. Certain activities have been outsourced and older employees have been encouraged to take early retirement. In addition, about ten percent or even more of the workforce consisted of new entrants each year. To assess possible biases generated by employee turnover, we compare the results of the before-after estimates in Table 6 with the same estimates based on the sample of 5-year stayers in the company in Table 7.[16] In fact, the estimates in Table 7 and the graphs in Appendix A show that the results are qualitatively and even quantitatively robust.

One exception is the estimate for the highest age category (61-65 years). Among stayers, this group gained relative to the adjacent group (56-60 years of age), as opposed to lost as in the full sample. The human resources department of the telecommunications company confirmed that this finding can be explained by the early retirement of an important part of the employees in this category. Early retirement also explains the imprecision of the estimated coefficient. The comparison of the point estimates between the two samples shows that the less productive old employees have taken early retirement. Thus the estimated coefficient for stayers is probably too high in the sense that it does not represent the average employee. This finding does not change but reinforces our conclusion that older workers have lost due to privatisation.

All estimates presented so far have relied on the wage decile in Year 1 as the proxy for skill. This has effectively restricted the sample to workers who were already present in the firm in Year 1. In order to make use of all available observations with observed wage growth, we apply the before-after estimator to data with an alternative skill proxy defined as the wage decile for the

[16] Of course, we cannot formally test whether there is selection based on unobserved characteristics, but if the results for 5-year stayers are about the same as those just presented, we expect that the problem is not serious.

respective year when wage growth is measured. Results are shown in Table 8. Compared to the estimates in Table 6, the differences in the point estimates for most variables are small in size, so that we do not discuss them here. Only the estimate for the youngest age group (18-25) deserves attention. In both Tables 6 and 7, this age group attained the highest wage growth relative to the other age groups, but this result does not hold any more in Table 8. Sample selection can explain this difference between the estimates in Table 8 on the one hand and Tables 6 and 7 on the other. In Tables 6 and 7, the sample contains only 3-year (by the definition of the skill proxy) or 5-year stayers, respectively. Hence, young workers in Table 6 who have stayed will be a positive section compared to young workers observed in the sample of Table 8, who (by the definition of the alternative skill proxy) are also composed of new entrants to the firm.[17] Apart from these small differences between the estimation results of Table 8 compared to Tables 6 and 7, the result that younger workers in general have gained relative to older workers still holds.

As a final robustness check, we control for general shocks to the labour market in the public sector. The results of Tables 6 to 8 are biased if the year of privatisation was different, or special, in some sense or if macro effects distort the before-after estimator (see Section 3). Hence, it is possible that the changes observed in the telecommunications company are not unique to this firm and are therefore not related to privatisation. Our strategy is to use data on the national railways company of the same country in order to control for common time (*i.e.* macro) effects. As both companies operate nationally and we control for region (results for region are not reported here), wage data from the railways company should adequately control for time effects. Ideally, we would simply subtract the before-after coefficients for the telecommunications

[17] By a similar reasoning, workers in Tables 6 and 7 who in Year 2 are still in the lowest skill decile (defined on the Year 1 wage distribution) will be a negative selection compared to workers in Table 8 who are in the lowest alternative skill decile (defined on the Year 2 wage distribution). Indeed, the coefficient of the lowest skill group is smaller in Tables 6 and 7 than in Table 8. This is true both with respect to the base category and with respect to the highest skill category.

company from the coefficients of the railways company. Unfortunately, we could only obtain data from the railways company starting from Year 2 and therefore we cannot use the wage growth between Year 1 and Year 2 as reference in order to construct the difference-in-differences estimator of equation (5) in Section 3. However, as we have shown in that section in equation (6), it is also possible to use a period after the wage regime switch as reference for the difference-in-differences estimator. Here we chose wage growth between Year 4 and Year 5 as a comparison, *i.e.* the latest period observed for both firms. If the effect of privatisation is progressive over the years instead of instantaneous with the wage regime change, the difference-in-differences estimator (6) will be downward biased. Yet, in light of the results of the before after estimator in Tables 6 to 8 (see also Figures 3 to 5) we expect this bias to be small, except for the age variables. The estimating equation is

$$\Delta Y_{ti} = x_{ti}\beta + \left(x_{ti} \times 1\left[t = 2\right]\right)\theta_1 + \left(x_{ti} \times TCOM\right)\theta_2 + \left(x_{ti} \times 1\left[t = 2\right] \times TCOM\right)\delta + u_{ti} \quad t = 2,4$$

where *TCOM* is a dummy variable equal to *1* for all observations in the telecommunications company and *0* for all workers in the railways firm. Here, the post-privatisation date *t=4* is the base period with θ_1 denoting the time effects for period *t=2*. θ_2 is the vector of returns specific to the telecommunications company. The effects of interest, *i.e.* the vector of wage structure changes associated with privatisation, is δ. As in the before-after estimates, estimated standard errors allow for clustering within observations referring to the same worker.

The difference-in-differences estimates are reported in Table 9 for all three types of sample discussed in Tables 6 to 8, and are plotted for the fixed skill proxy sample for the age, tenure and skill proxy variables in Figure 6. The coefficients are remarkably similar to the before-after results. An exception is the estimate for the youngest age group (18-25 years), who – as in Tables 6 and 7 – gains relative to the oldest workers, but loses relative to the adjacent age group

of 26-30 year olds. Considering how this estimate is composed shows that it is not larger wage growth for the youngest age group in the railways company that causes this result, but lower wage growth in the telecommunications company in Year 2 relative to Year 4 (not displayed here).[18] Nevertheless, the general result that younger workers gain relative to older ones is maintained in the difference-in-differences estimates for both age and tenure. If the difference-in-differences estimator is applied to the sample of 5-year stayers in the companies or to the sample with the alternative skill proxy, the results are similar to the ones of the full sample (see columns (2) and (3) of Table 9 and Figure A6 in the Appendix.)[19]

In sum, the difference-in-differences estimates confirm the impression obtained from the descriptive statistics discussed in Section 3 that Year 3 (the first year of the private sector wage regime in the telecommunications company) was not special for the public sector (here respresented by the railways company) compared to other years of our observation period.

6 Summary and Conclusion

Public-private sector wage comparisons are hard to interpret due to self-selection of workers into these sectors. To the best of our knowledge, no study has so far investigated the changes in the wage (and employment) structure of a firm in an industrialised country before and after privatisation by means of worker-level personnel data. In this paper, we fill this gap by examining the effects of privatisation on the wage (and employment) structures of a telecommunications company using the complete internal personnel records directly before and after the wage regime switch associated with privatisation. As a comparison, we consider the complete personnel records of a publicly owned railways company at the same period of time in the same country.

[18] One explanation for this finding might be the protracted change in the age-wage structure over the years, which may generate a downward bias in the difference-in-differences estimate.

These exceptional data sets cover all employees in both firms for a period of 5 years starting 2 years before the switch from a public to a private sector wage regime of the telecommunications company. Therefore, we can isolate the effect of privatisation by controlling for individual and firm fixed effects, rates of technological change as firm specific time trends, and time fixed effects.

Our three main findings are as follows. First, we show that the workforce of the privatised telecommunications company is getting younger and less tenured while the contrary happened for the publicly owned railways firm. Second, the distribution of wages became more dispersed after privatisation. Inequality, measured by different indices, increased significantly in the privatised but remained constant in the public sector company. This pattern is confirmed for the distribution of wage growth. In the public sector periods, individual wage increases in both companies occur mechanically and are almost the same (in percentage terms) for the vast majority of employees. Virtually no negative wage changes are found. At and after the introduction of the private sector wage regime, by contrast, a much higher diversity is exhibited with wage growths determined much more in an individual fashion. Finally, regressing the wage changes on the characteristics of the employees and using a difference-in-differences strategy to isolate the effect of privatisation, we find that young employees and workers with little tenure gained from privatisation. As expected, high-skilled employees could increase their wages but, surprisingly, very low-skilled employees also gained. According to our investigations with the company's human resources department, 'political' reasons explain this result: the management of the privatised firm had to render privatisation and the associated wage regime change acceptable for the employee representatives.

[19] Again, there is a discrepancy in the results for 5-year stayers and for the full sample due to selection in early retirement, as discussed above in the text in connection with the before-after results.

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Tables and Figures

Table 1: Entry, exit and turnover

	Year 1-2	Year 2-3	Year 3-4	Year 4-5	Year 5-6
			Telecommunications Company		
Change in Employment	-0.12	-0.11	-0.11	-0.03	-
Entry Rate	0.10	0.09	0.11	0.19	-
Exit Rate	0.22	0.20	0.22	0.22	-
Excess Turnover Rate	0.10	0.09	0.11	0.19	-
			Railways Company		
Change in Employment	-	-0.03	0.00	0.02	-0.02
Entry Rate	-	0.02	0.05	0.08	0.04
Exit Rate	-	0.05	0.05	0.06	0.06
Excess Turnover Rate	-	0.02	0.05	0.06	0.04

Source: Companies Personnel Records; own calculations.

Table 2: Sample Means

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
			Telecommunications Company			
Real wage	100,000	100,908	1000,080	101,767	105,001	-
Age	40.2	39.7	38.9	38.9	38.6	-
Tenure	11.6	11.3	10.4	10.3	9.34	-
Female	0.39	0.38	0.38	0.38	0.38	-
Native	0.94	0.95	0.94	0.93	0.91	-
Part-Time Employment	0.17	0.15	0.16	0.16	0.18	-
Main region	0.72	0.72	0.74	0.74	0.75	-
Observations	22,856	20,126	18,418	17,669	16,907	-
			Railways Company			
Real wage	-	84,385	84,204	83,765	84,222	85,429
Age	-	40.6	41.3	41.7	41.9	42.4
Tenure	-	17.6	18.3	18.4	18.0	18.3
Female	-	0.08	0.09	0.10	0.11	0.11
Native	-	0.91	0.90	0.90	0.89	0.90
Part-Time Employment	-	0.05	0.05	0.06	0.07	0.08
Main region	-	0.71	0.71	0.71	0.71	0.71
Observations	-	26,911	27,906	27,764	28,188	27,785

Note: The final samples as given by the last lines of Table A1 were used to calculate the means with 2 exceptions. The statistics for the region and the nationality are obtained by excluding the observations with missing value of the respective variable. In the rest of the paper, we use dummies for missing nationality and missing region. The wage information has been normalised to 100,000 for the telecommunications company in Year 1.
Source: Companies' Personnel Records; own calculations.

Table 3: Measures of Inequality – Full Sample

	Gini	D9/D1	D9/D5	D5/D1
		Telecommuncations Company		
Year 1	0.142	1.95	1.42	1.38
Year 2	0.139	1.86	1.40	1.33
Year 3	0.157	2.02	1.47	1.38
Year 4	0.163	2.09	1.48	1.41
Year 5	0.174	2.20	1.52	1.44
		Railways Company		
Year 2	0.120	1.66	1.27	1.30
Year 3	0.122	1.64	1.29	1.27
Year 4	0.121	1.69	1.28	1.32
Year 5	0.125	1.70	1.28	1.33
Year 6	0.122	1.70	1.30	1.31

Source: Companies' Personnel Records; own calculations.

Table 4: Measures of Inequality – 5-year Stayers

	Gini	D9/D1	D9/D5	D5/D1
		Telecommuncations Company		
Year 1	0.127	1.81	1.38	1.32
Year 2	0.133	1.77	1.38	1.28
Year 3	0.136	1.90	1.41	1.35
Year 4	0.138	1.89	1.41	1.34
Year 5	0.142	1.90	1.43	1.33
		Railways Company		
Year 2	0.115	1.61	1.26	1.28
Year 3	0.113	1.61	1.23	1.31
Year 4	0.111	1.61	1.23	1.31
Year 5	0.110	1.61	1.28	1.26
Year 6	0.109	1.59	1.28	1.24

Source: Companies' Personnel Records; own calculations.

Table 5: Log Wage Change Distributions

Percentile	Year 1-2	Wage Regime Switch Year 2-3	Year 3-4	Year 4-5	Year 5-6
			Telecommunications Company		
5	0.000	-0.149	0.000	0.015	-
10	0.000	-0.080	0.016	0.015	-
15	0.000	-0.036	0.018	0.015	-
20	0.000	-0.026	0.019	0.016	-
25	0.000	-0.020	0.021	0.019	-
30	0.000	-0.017	0.022	0.022	-
35	0.000	-0.010	0.024	0.024	-
40	0.000	-0.002	0.025	0.027	-
45	0.000	0.000	0.027	0.029	-
50	0.000	0.001	0.030	0.032	-
55	0.000	0.004	0.032	0.034	-
60	0.000	0.013	0.034	0.037	-
65	0.010	0.023	0.038	0.040	-
70	0.023	0.033	0.042	0.044	-
75	0.030	0.044	0.047	0.049	-
80	0.034	0.058	0.055	0.055	-
85	0.038	0.077	0.067	0.066	-
90	0.042	0.098	0.088	0.081	-
95	0.070	0.136	0.126	0.116	-
			Railways Company		
5	-	0.000	-0.035	0.010	0.006
10	-	0.000	0.000	0.010	0.007
15	-	0.000	0.000	0.010	0.007
20	-	0.000	0.000	0.010	0.007
25	-	0.000	0.000	0.010	0.007
30	-	0.000	0.000	0.010	0.007
35	-	0.000	0.000	0.010	0.007
40	-	0.000	0.000	0.010	0.007
45	-	0.000	0.000	0.010	0.007
50	-	0.000	0.000	0.010	0.007
55	-	0.000	0.000	0.010	0.007
60	-	0.000	0.000	0.027	0.020
65	-	0.011	0.000	0.028	0.024
70	-	0.022	0.007	0.031	0.025
75	-	0.031	0.021	0.046	0.026
80	-	0.039	0.036	0.050	0.043
85	-	0.051	0.044	0.060	0.048
90	-	0.063	0.057	0.080	0.067
95	-	0.087	0.081	0.111	0.096

Note: Because the wage information we received of the railways company for Years 2 and 3 had to be retrieved in a separate step from the retrieval of the rest of the data by the human resources department, one component of the wage is missing for Years 2 and 3. This component amounts to about 8 percent of the wage. Hence, for the purposes of this table, we subtract 8 percent of wage growth for all percentiles in the railways company in the column relating to wage growth between Years 3 and 4. The negative wage change thus observed for the 5th percentile between these two years might result from this measurement problem. In the regressions below, we never use wage growth of the railways company between Years 3 and 4.
Source: Companies' Personnel Records; own calculations.

Table 6: Before-After Estimates of Wage Growth in the Telecommunications Company – Full Sample with Fixed Skill Proxy

	(1)		(2)		(3)	
	BA: Year 2/3-1/2		BA: Year 3/4-1/2		BA: Year 4/5-1/2	
	Regime Switch		1 Y. After R.S.		2 Y. After R.S.	
	Coef.	St. dev.	Coef.	St. dev.	Coef.	St. dev.
Constant	-1.18	(0.30)	2.57	(0.16)	2.33	(0.18)
Age (36-40)						
Age: 18-25	1.21	(0.62)	1.10	(0.44)	1.61	(0.61)
Age: 26-30	0.70	(0.28)	0.11	(0.18)	0.01	(0.20)
Age: 31-35	0.36	(0.21)	0.00	(0.12)	0.24	(0.13)
Age: 41-45	-0.91	(0.21)	-0.26	(0.11)	-0.13	(0.11)
Age: 46-50	-1.99	(0.23)	-0.46	(0.11)	-0.27	(0.11)
Age: 51-55	-3.12	(0.26)	-0.63	(0.11)	-0.59	(0.12)
Age: 56-60	-4.29	(0.58)	-1.48	(0.25)	-0.39	(0.39)
Age: 61-65	-7.05	(1.87)	-1.93	(0.35)	-0.99	(0.34)
Tenure (8-10)						
Tenure: 1-2	1.83	(0.30)	-0.78	(0.27)	-1.63	(0.34)
Tenure: 3-5	1.66	(0.23)	0.16	(0.15)	0.12	(0.17)
Tenure: 6-7	0.87	(0.34)	0.23	(0.20)	0.23	(0.18)
Tenure: 11-12	-0.56	(0.24)	-0.12	(0.13)	0.09	(0.14)
Tenure: 13-15	-0.41	(0.25)	-0.02	(0.13)	-0.01	(0.14)
Tenure: 16-20	-0.34	(0.24)	-0.13	(0.11)	-0.07	(0.13)
Tenure: 21-25	-0.62	(0.31)	0.04	(0.13)	-0.01	(0.14)
Tenure: 26-50	-0.43	(0.29)	0.08	(0.12)	0.02	(0.14)
Skill (0.2-0.3)						
Skill: 0-0.1	4.97	(0.62)	0.39	(0.36)	-0.35	(0.35)
Skill: 0.1-0.2	3.00	(0.33)	-0.38	(0.17)	-0.19	(0.18)
Skill: 0.3-0.4	1.10	(0.32)	0.08	(0.14)	0.15	(0.16)
Skill: 0.4-0.5	1.64	(0.29)	-0.12	(0.14)	0.12	(0.15)
Skill: 0.5-0.6	1.18	(0.30)	-0.16	(0.15)	-0.04	(0.16)
Skill: 0.6-0.7	1.48	(0.28)	0.02	(0.15)	0.21	(0.15)
Skill: 0.7-0.8	1.66	(0.32)	0.22	(0.17)	0.40	(0.17)
Skill: 0.8-0.9	2.58	(0.30)	0.08	(0.16)	0.43	(0.16)
Skill: 0.9-1	2.92	(0.33)	0.66	(0.18)	0.78	(0.18)
Woman	-2.01	(0.21)	0.06	(0.12)	0.15	(0.12)
Non-native	0.99	(1.40)	-1.75	(1.01)	-0.26	(1.34)
Full-time (80-100)						
Part-time: 60-80	-2.87	(0.34)	0.11	(0.16)	-0.13	(0.15)
Part-time: 40-60	-3.58	(0.33)	-0.16	(0.14)	-0.70	(0.15)
Part-time: 0-40	-8.66	(0.81)	-0.35	(0.37)	-0.60	(0.35)
Number of obs.	32,138		30,430		27,842	
R^2	0.24		0.47		0.45	

Note: The dependent variable is the logged wage growth. Robust standard errors allow for clustering and hence arbitrary autocorrelation within the wage growth observations of any person. All coefficients and standard errors have been multiplied by 100. Controls for region are not reported Note that we observe the whole population and we therefore could consider the results as exact and would not need to report standard errors. However, if we consider that we are estimating the effects of privatisation in general, then we have only a sample from the whole population and we need to report standard errors in order to assess the precision of the estimates.
Source: Companies' Personnel Records; own calculations.

Table 7: Before-After Estimates of Wage Growth in the Telecommunications Company – Sample of 5-year Stayers in the Company – Fixed Skill Proxy

	(1)		(2)		(3)	
	BA: Year 2/3-1/2		BA: Year 3/4-1/2		BA: Year 4/5-1/2	
	Regime Switch		1 Y. After R.S.		2 Y. After R.S.	
	Coef.	St. dev.	Coef.	St. dev.	Coef.	St. dev.
Constant	-1.22	(0.35)	2.62	(0.18)	2.25	(0.20)
Age (36-40)						
Age: 18-25	1.80	(0.84)	1.41	(0.54)	1.80	(0.66)
Age: 26-30	0.80	(0.33)	0.26	(0.21)	0.15	(0.21)
Age: 31-35	0.21	(0.24)	0.15	(0.14)	0.32	(0.15)
Age: 41-45	-0.97	(0.24)	-0.29	(0.12)	-0.11	(0.13)
Age: 46-50	-1.84	(0.26)	-0.38	(0.12)	-0.16	(0.12)
Age: 51-55	-2.77	(0.31)	-0.48	(0.13)	-0.40	(0.14)
Age: 56-60	-4.06	(1.10)	-0.46	(0.74)	-0.20	(0.56)
Age: 61-65	-2.67	(2.87)	-1.38	(0.41)	-0.77	(0.35)
Tenure (8-10)						
Tenure: 1-2	2.41	(0.37)	-0.88	(0.32)	-1.63	(0.47)
Tenure: 3-5	2.12	(0.28)	0.19	(0.17)	0.06	(0.18)
Tenure: 6-7	1.00	(0.40)	0.42	(0.24)	0.34	(0.20)
Tenure: 11-12	-0.09	(0.28)	-0.14	(0.15)	0.13	(0.16)
Tenure: 13-15	-0.05	(0.30)	0.01	(0.16)	0.04	(0.16)
Tenure: 16-20	0.11	(0.27)	-0.09	(0.13)	0.03	(0.14)
Tenure: 21-25	-0.39	(0.35)	-0.01	(0.14)	0.01	(0.15)
Tenure: 26-50	-0.48	(0.32)	0.07	(0.14)	0.02	(0.15)
Skill (0.2-0.3)						
Skill: 0-0.1	5.09	(0.81)	0.31	(0.45)	-0.40	(0.43)
Skill: 0.1-0.2	2.57	(0.40)	-0.51	(0.20)	-0.30	(0.19)
Skill: 0.3-0.4	1.03	(0.36)	-0.08	(0.17)	-0.02	(0.17)
Skill: 0.4-0.5	1.67	(0.34)	-0.20	(0.16)	0.09	(0.16)
Skill: 0.5-0.6	1.25	(0.36)	-0.33	(0.17)	-0.10	(0.17)
Skill: 0.6-0.7	1.26	(0.34)	-0.02	(0.17)	0.09	(0.17)
Skill: 0.7-0.8	1.42	(0.38)	0.14	(0.18)	0.30	(0.18)
Skill: 0.8-0.9	2.29	(0.36)	0.06	(0.18)	0.36	(0.17)
Skill: 0.9-1	2.61	(0.39)	0.53	(0.21)	0.64	(0.19)
Woman	-1.90	(0.25)	0.22	(0.14)	0.27	(0.13)
Non-native	2.90	(1.34)	-1.11	(0.83)	0.20	(1.21)
Full-time (80-100)						
Part-time: 60-80	-2.98	(0.41)	0.12	(0.17)	-0.17	(0.16)
Part-time: 40-60	-3.91	(0.40)	-0.25	(0.18)	-0.84	(0.19)
Part-time: 0-40	-10.25	(1.05)	-0.29	(0.52)	-0.51	(0.48)
Number of obs.	19,627		19,825		19,690	
R^2	0.24		0.51		0.50	

Note: The dependent variable is the logged wage growth. Robust standard errors. All numbers coefficients and standard errors have been multiplied by 100. Regional controls are not reported. As we restrict the sample to persons not having changed their degree of employment by more than ten percentage points between two years, the number of stayers varies a little for the different before-after estimates.
Source: Companies' Personnel Records; own calculations.

Table 8: Before-After Estimates of Wage Growth in the Telecommunications Company – Full Sample with Alternative Skill Proxy

	(1)		(2)		(3)	
	BA: Year 2/3-1/2		BA: Year 3/4-1/2		BA: Year 4/5-1/2	
	Regime Switch		1 Y. After R.S.		2 Y. After R.S.	
	Coef.	St. dev.	Coef.	St. dev.	Coef.	St. dev.
Constant	-1.05	(0.28)	2.29	(0.17)	2.29	(0.18)
Age (36-40)						
Age: 18-25	-0.17	(0.55)	1.28	(0.33)	0.65	(0.30)
Age: 26-30	0.97	(0.26)	0.71	(0.17)	0.36	(0.17)
Age: 31-35	0.51	(0.20)	0.21	(0.12)	0.24	(0.13)
Age: 41-45	-0.97	(0.20)	-0.25	(0.11)	-0.29	(0.11)
Age: 46-50	-2.07	(0.22)	-0.46	(0.11)	-0.35	(0.11)
Age: 51-55	-3.21	(0.26)	-0.68	(0.11)	-0.67	(0.12)
Age: 56-60	-4.56	(0.56)	-1.55	(0.25)	-0.82	(0.33)
Age: 61-65	-6.21	(1.64)	-2.15	(0.36)	-1.00	(0.39)
Tenure (8-10)						
Tenure: 1-2	1.88	(0.27)	0.47	(0.18)	-0.47	(0.18)
Tenure: 3-5	1.58	(0.23)	0.27	(0.14)	0.36	(0.15)
Tenure: 6-7	0.94	(0.34)	0.34	(0.20)	0.26	(0.18)
Tenure: 11-12	-0.60	(0.24)	-0.15	(0.13)	-0.01	(0.14)
Tenure: 13-15	-0.40	(0.25)	0.02	(0.13)	-0.03	(0.14)
Tenure: 16-20	-0.29	(0.23)	-0.01	(0.11)	-0.03	(0.12)
Tenure: 21-25	-0.51	(0.30)	0.20	(0.13)	0.07	(0.14)
Tenure: 26-50	-0.31	(0.29)	0.26	(0.12)	0.11	(0.14)
Skill (0.2-0.3)						
Skill: 0-0.1	6.72	(0.55)	0.13	(0.25)	-0.21	(0.25)
Skill: 0.1-0.2	1.16	(0.30)	-0.31	(0.17)	-0.29	(0.18)
Skill: 0.3-0.4	1.24	(0.29)	0.12	(0.15)	0.20	(0.18)
Skill: 0.4-0.5	1.15	(0.27)	-0.07	(0.16)	0.10	(0.17)
Skill: 0.5-0.6	0.99	(0.28)	0.00	(0.17)	0.19	(0.18)
Skill: 0.6-0.7	1.29	(0.27)	0.24	(0.17)	0.12	(0.18)
Skill: 0.7-0.8	1.84	(0.28)	0.44	(0.17)	0.59	(0.18)
Skill: 0.8-0.9	2.20	(0.28)	0.37	(0.18)	0.35	(0.18)
Skill: 0.9-1	3.09	(0.30)	0.77	(0.18)	0.87	(0.18)
Woman	-1.99	(0.20)	-0.02	(0.13)	0.26	(0.12)
Non-native	0.04	(1.25)	-1.45	(1.08)	-1.32	(1.06)
Full-time (80-100)						
Part-time: 60-80	-2.92	(0.33)	0.05	(0.16)	-0.14	(0.16)
Part-time: 40-60	-3.90	(0.32)	-0.27	(0.14)	-0.69	(0.15)
Part-time: 0-40	-8.55	(0.73)	-0.81	(0.36)	-0.42	(0.37)
Number of obs.	33,078		32,542		31,054	
R^2	0.27		0.51		0.50	

Note: The dependent variable is the logged wage growth. Robust standard errors. All numbers coefficients and standard errors have been multiplied by 100. Controls for region are not reported.
Source: Companies' Personnel Records; own calculations.

Table 9: Difference-in-Differences Estimates of Wage Growth

	(1) Constant Skill Proxy		(2) Stayers Constant Sk. P.		(3) Changing Skill Proxy	
	Coef.	St. dev.	Coef.	St. dev.	Coef.	St. dev.
Constant	-2.53	(0.34)	-2.46	(0.38)	-2.16	(0.34)
Age (36-40)						
Age: 18-25	-1.53	(0.74)	-1.22	(0.98)	-0.32	(0.60)
Age: 26-30	0.50	(0.32)	0.57	(0.37)	0.58	(0.31)
Age: 31-35	0.38	(0.25)	0.08	(0.28)	0.48	(0.24)
Age: 41-45	-0.72	(0.23)	-0.80	(0.26)	-0.67	(0.23)
Age: 46-50	-1.69	(0.26)	-1.71	(0.28)	-1.73	(0.26)
Age: 51-55	-2.40	(0.30)	-2.27	(0.34)	-2.44	(0.30)
Age: 56-60	-3.21	(0.67)	-3.79	(1.22)	-3.33	(0.66)
Age: 61-65	-5.02	(1.74)	-0.80	(3.16)	-4.87	(1.72)
Tenure (8-10)						
Tenure: 1-2	1.79	(0.91)	2.53	(0.94)	2.07	(0.45)
Tenure: 3-5	1.71	(0.37)	2.16	(0.40)	2.94	(0.37)
Tenure: 6-7	2.37	(0.43)	2.39	(0.47)	1.98	(0.43)
Tenure: 11-12	0.12	(0.28)	0.57	(0.31)	0.11	(0.28)
Tenure: 13-15	0.59	(0.29)	0.91	(0.32)	0.58	(0.29)
Tenure: 16-20	0.45	(0.27)	0.85	(0.30)	0.46	(0.27)
Tenure: 21-25	0.07	(0.34)	0.30	(0.38)	0.08	(0.34)
Tenure: 26-50	0.51	(0.33)	0.53	(0.36)	0.60	(0.33)
Skill (0.2-0.3)						
Skill: 0-0.1	8.54	(0.69)	8.87	(0.98)	7.73	(0.56)
Skill: 0.1-0.2	3.42	(0.34)	3.07	(0.40)	1.24	(0.34)
Skill: 0.3-0.4	0.78	(0.32)	0.84	(0.36)	0.65	(0.34)
Skill: 0.4-0.5	-0.09	(0.33)	-0.17	(0.36)	-0.59	(0.31)
Skill: 0.5-0.6	0.46	(0.33)	0.48	(0.37)	0.97	(0.33)
Skill: 0.6-0.7	0.57	(0.34)	0.40	(0.38)	-0.98	(0.33)
Skill: 0.7-0.8	1.10	(0.37)	0.61	(0.41)	0.31	(0.36)
Skill: 0.8-0.9	1.62	(0.38)	1.61	(0.43)	0.88	(0.36)
Skill: 0.9-1	3.12	(0.49)	3.01	(0.53)	1.69	(0.39)
Woman	-2.89	(0.27)	-2.73	(0.30)	-2.63	(0.27)
Non-native	1.65	(1.12)	3.54	(1.55)	2.65	(1.08)
Full-time (80-100)						
Part-time: 60-80	-2.29	(0.42)	-2.69	(0.50)	-2.51	(0.43)
Part-time: 40-60	-2.06	(0.79)	-1.48	(0.92)	-2.27	(0.80)
Part-time: 0-40	-13.42	(4.04)	-17.45	(5.12)	-14.05	(4.06)
Number of obs.	75,639		65,385		80,070	
R^2	0.39		0.42		0.43	

Note: The dependent variable is the logged wage growth. Robust standard errors allow for clustering and hence arbitrary autocorrelation within the wage growth observations of any person. All coefficients and standard errors have been multiplied by 100. Controls for region are not reported. Note that we observe the whole population and we therefore could consider the results as exact and would not need to report standard errors. However, if we consider that we are estimating the effects of privatisation in general, then we have only a sample from the whole population and we need to report standard errors in order to assess the precision of the estimates.
Source: Companies' Personnel Records; own calculations.

Figure 1: Real Wage Distributions – Telecommunications Company

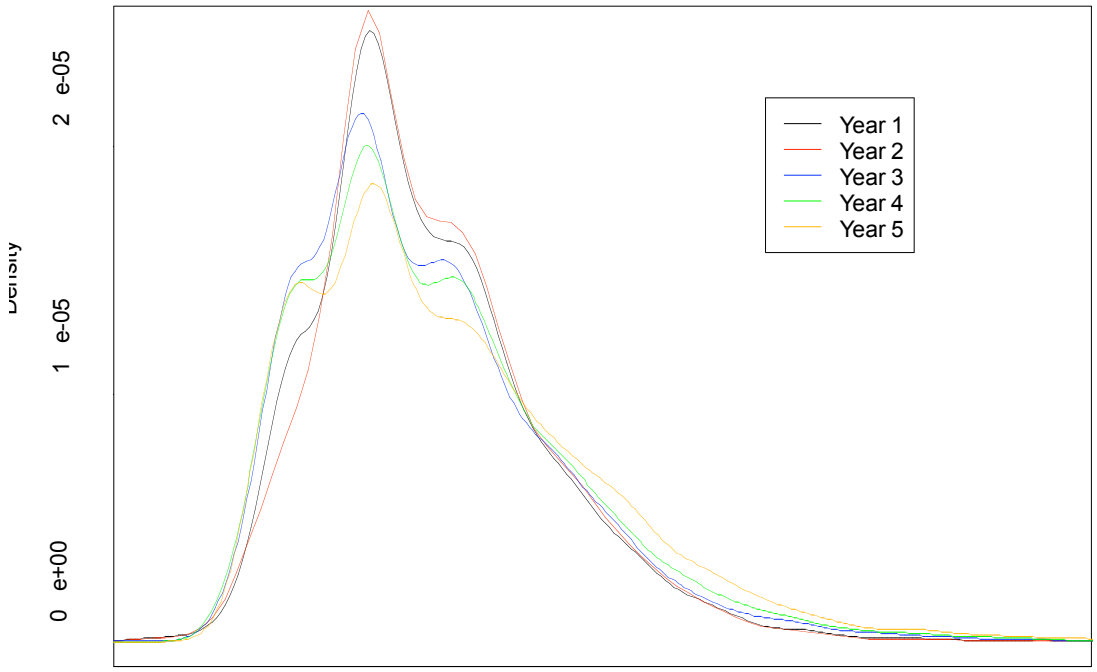


Figure 2: Real Wage Distributions – Railways Company

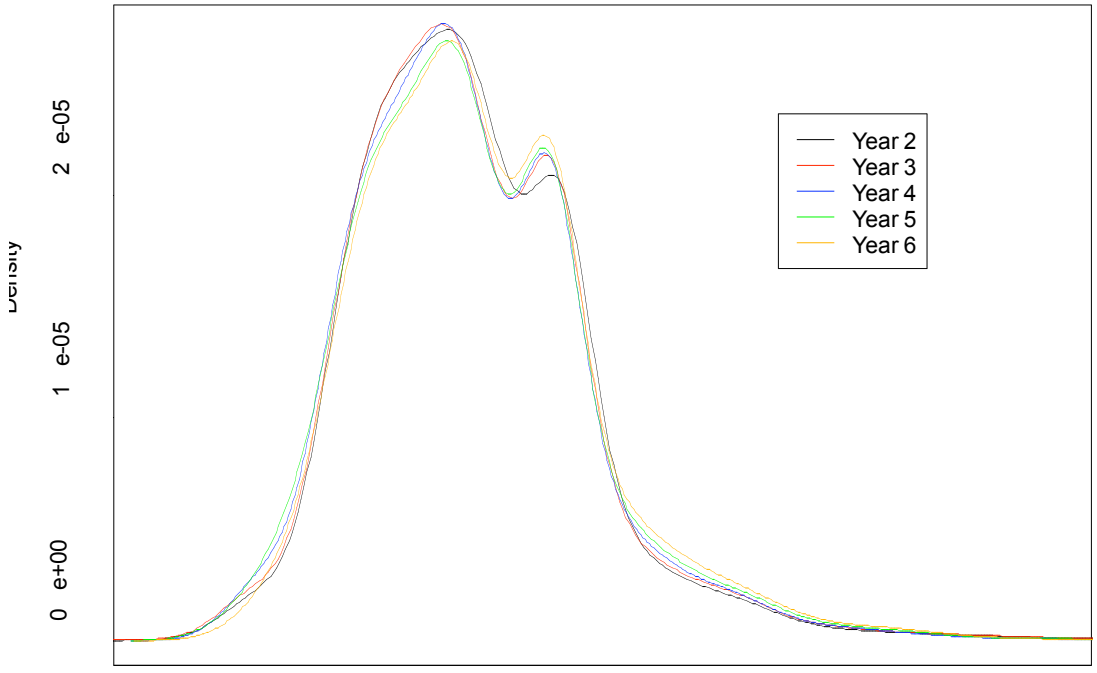


Figure 3: Before-after, age coefficients

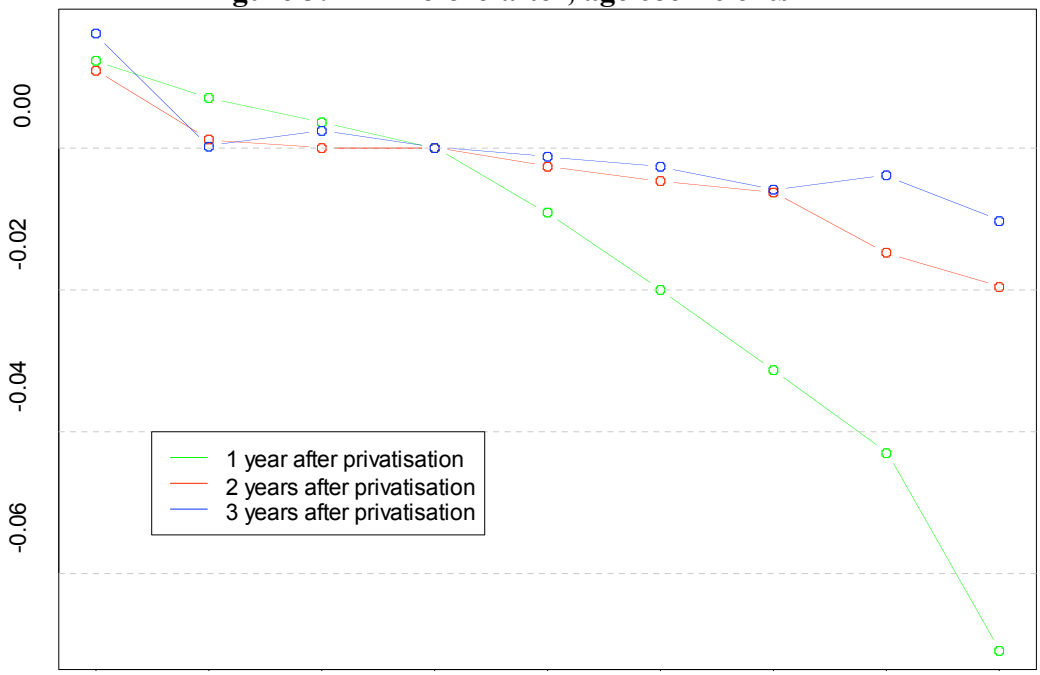


Figure 4: Before-after, tenure coefficients

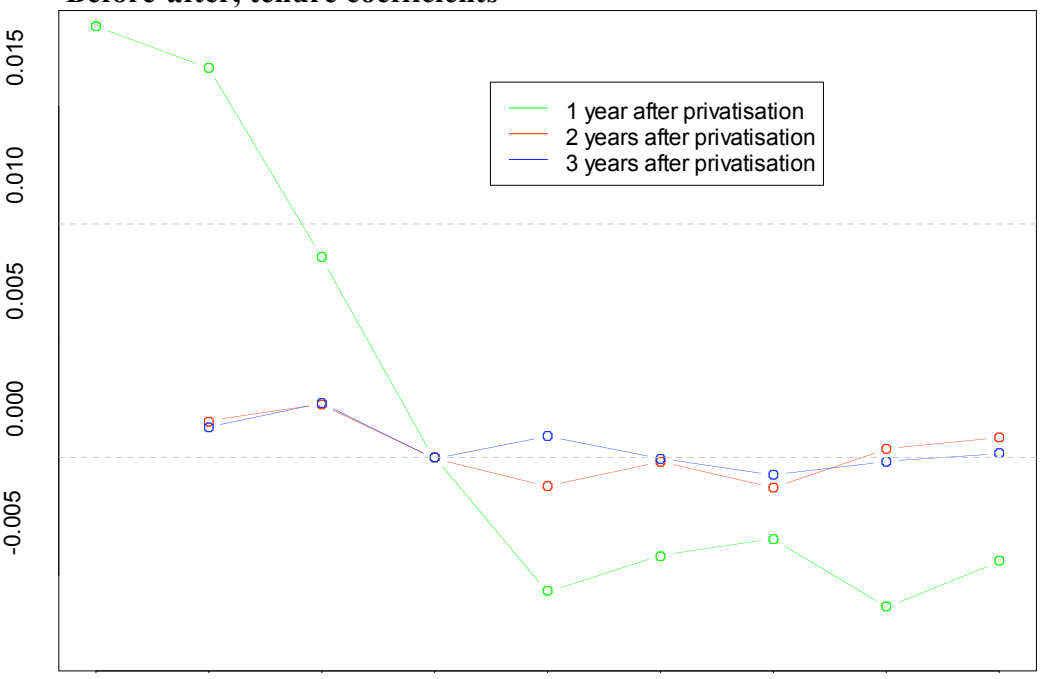


Figure 5: Before-after, "skill" coefficients

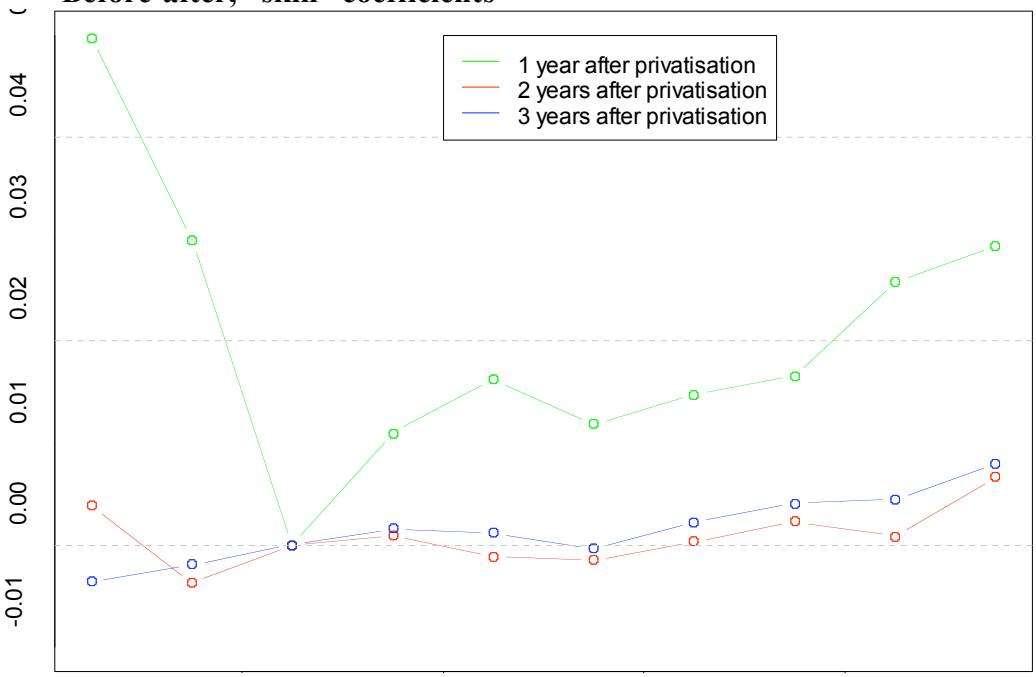
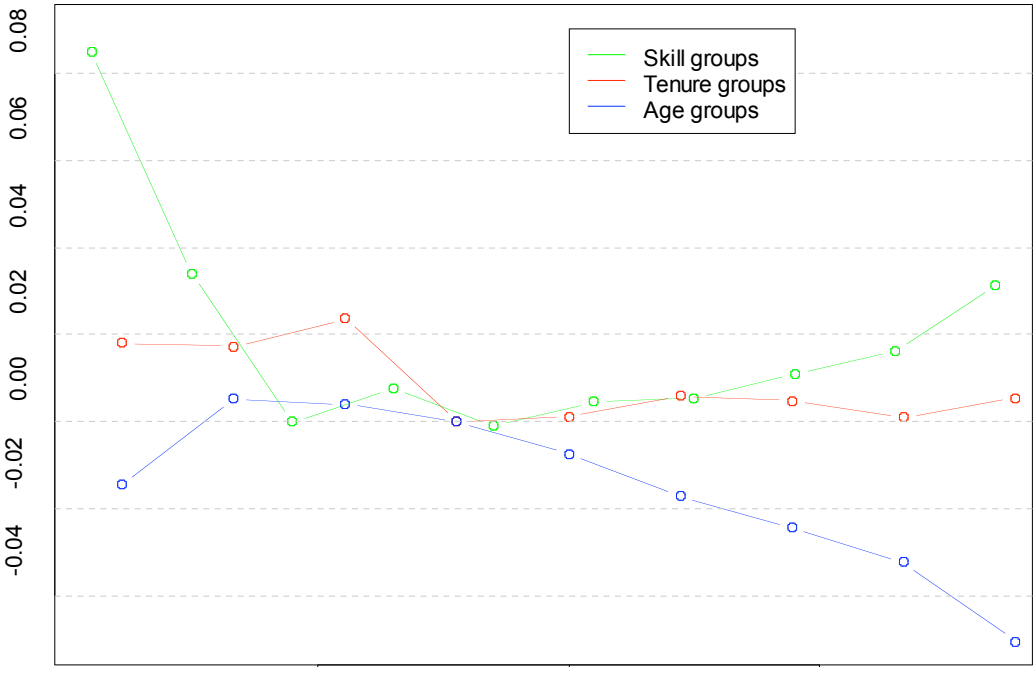


Figure 6: Difference in differences



Appendix A: Number of Observations and Results for Stayers

Table A1: Number of Observations

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
			Telecommunications Company			
All observations	27,426	24,167	21,575	19,226	18,692	-
Age not missing	26,723	23,239	21,570	19,226	18,692	-
Single ID	26,712	23,223	21,556	19,211	18,661	-
No sex change	26,708	23,219	21,550	19,203	18,654	-
Paid monthly	23,381	21,509	20,028	18,182	17,488	-
Wage observed	22,856	20,126	18,418	17,669	16,907	-
			Railways Company			
All observations	-	29,190	28,404	28,332	28,842	28,304
Tenure not missing	-	27,349	28,404	28,332	28,842	28,304
Paid monthly	-	26,922	27,922	27,767	28,190	27,786
Wage observed	-	26,914	27,909	27,767	28,190	27,786
No implausible values	-	26,911	27,906	27,764	28,188	27,785

Source: Companies' Personnel Records; own calculations.

Figure A1: Real Wage Distributions – Telecommunications company, only 5-year stayers

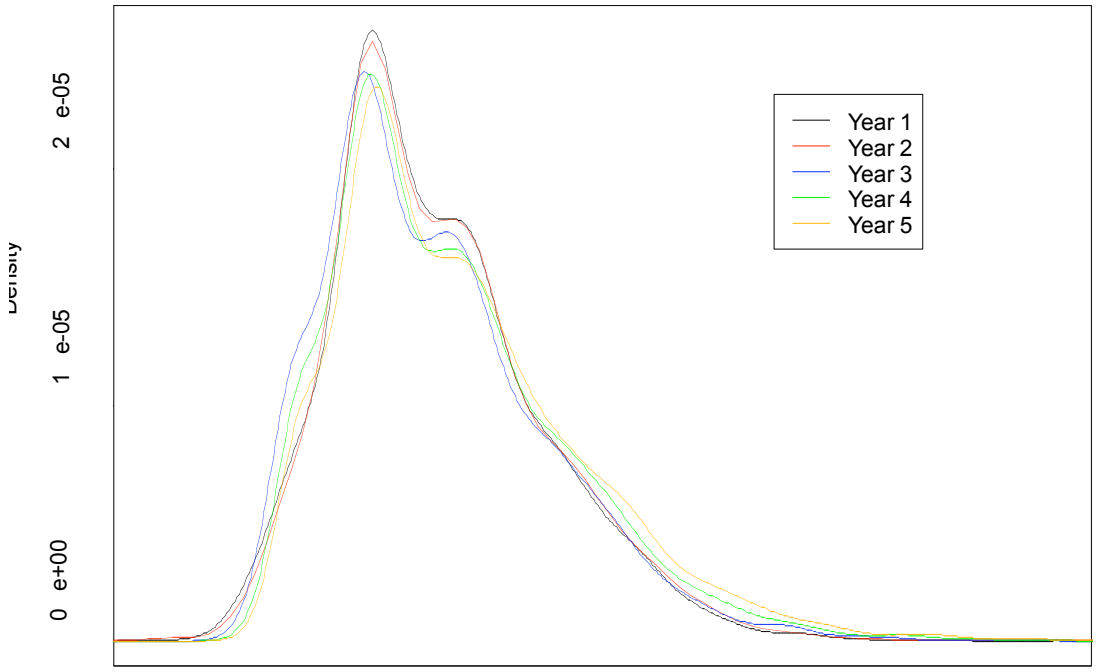


Figure A2: Real Wage Distributions – Railways company, only 5-year stayers

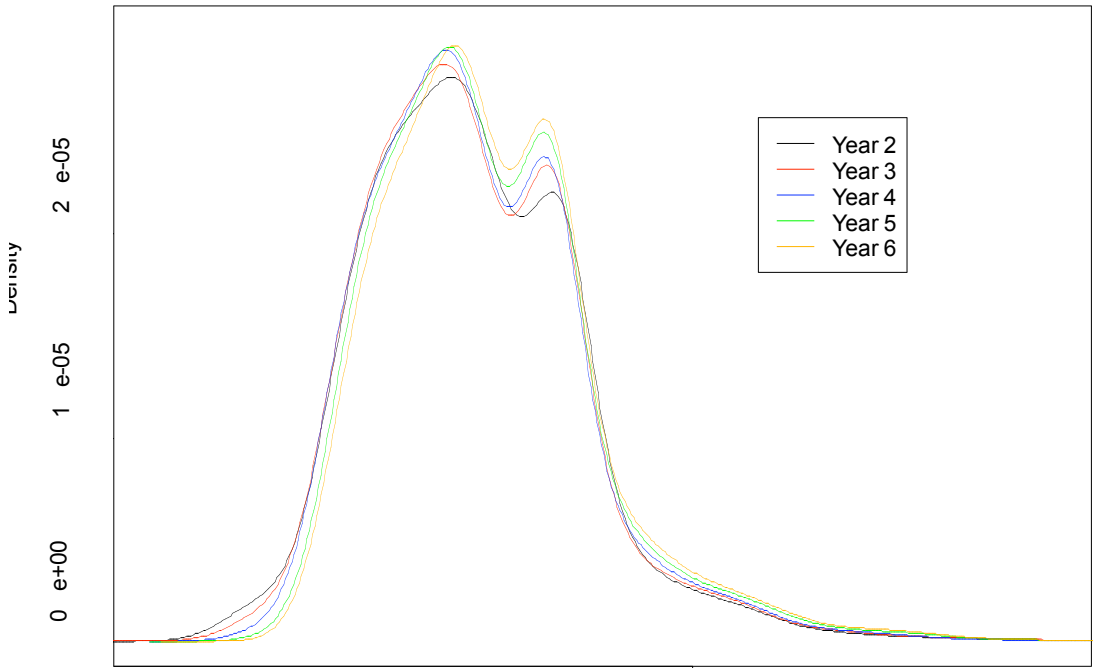


Figure A3: Before-after, age coefficients, only 5-year stayers

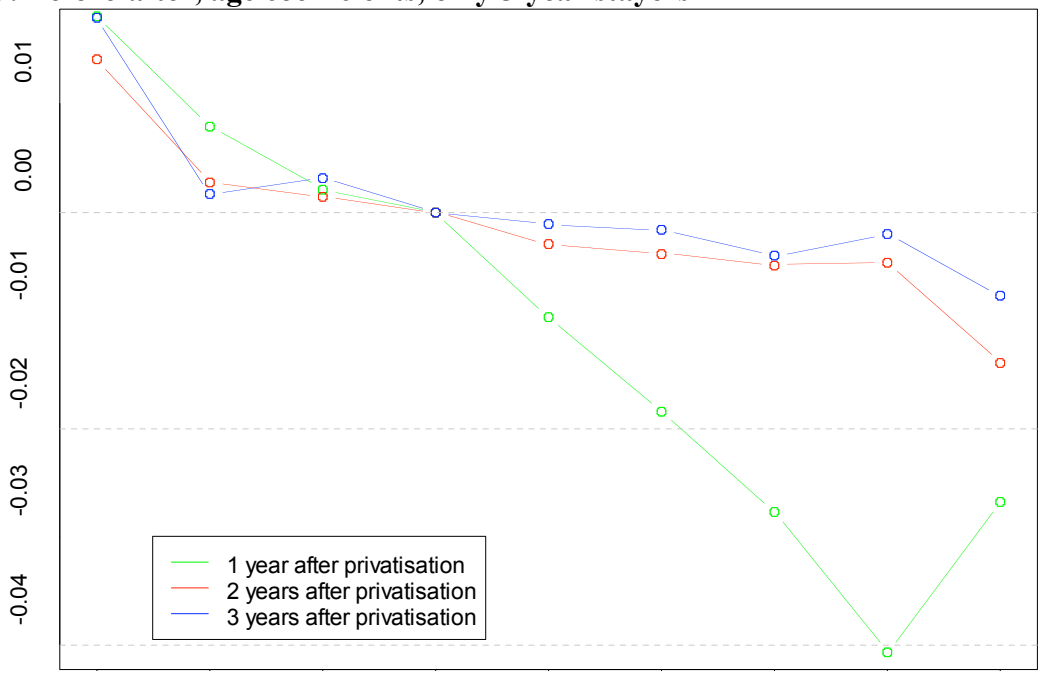


Figure A4: Before-after, tenure coefficients, only 5-year stayers

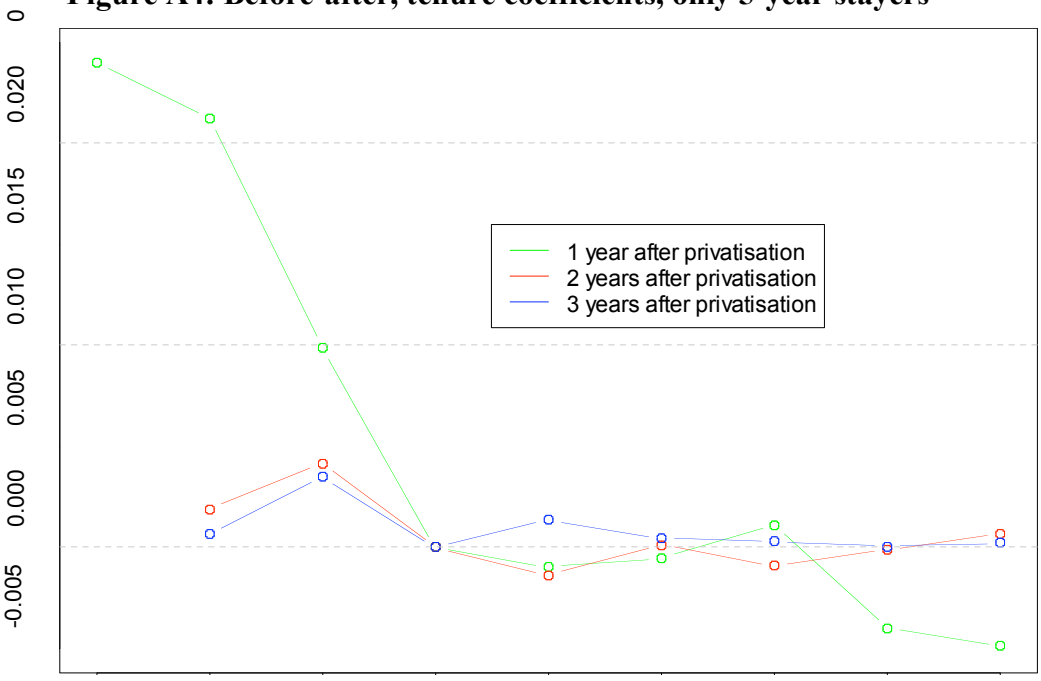
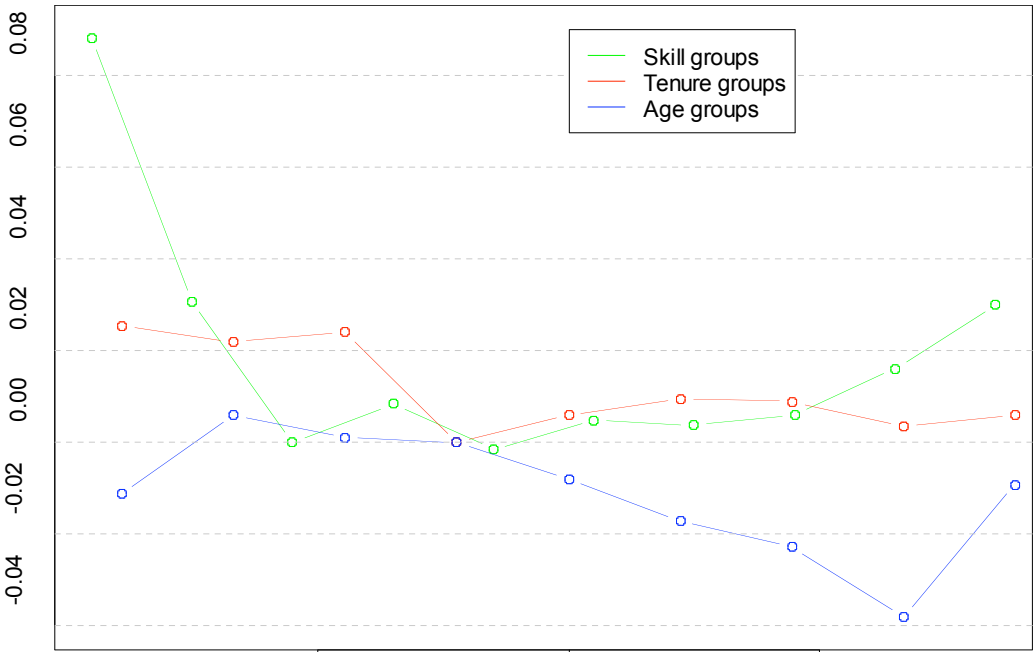


Figure A5: Before-after, "skill" coefficients, only 5-year stayers

Figure A6: Difference in differences, only-5 year stayers



Appendix B: Different definition of the skill proxy

Figure B1: Before-after, age coefficients, time-varying definition of skill

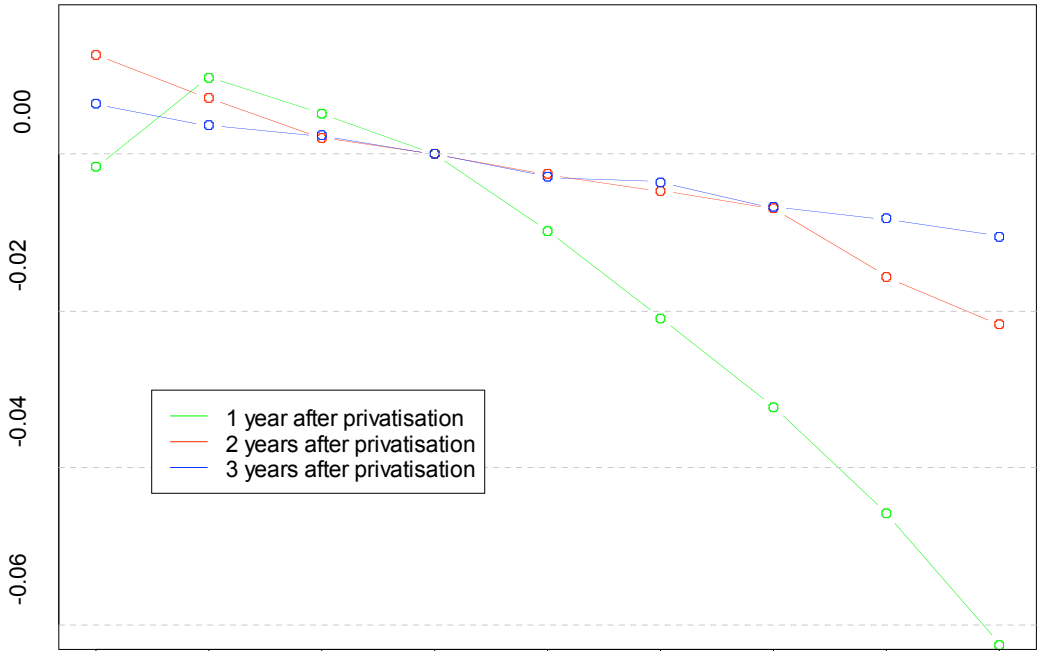


Figure B2: Before-after, tenure coefficients, time-varying definition of skill

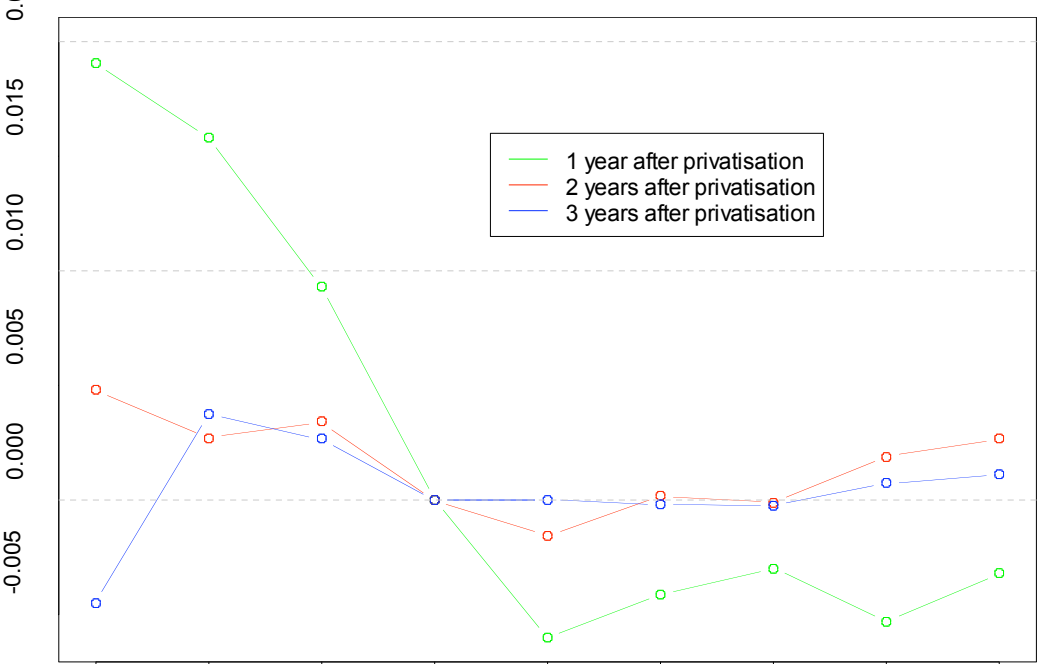


Figure B3: Before-after, "skill" coefficients, time-varying definition of skill

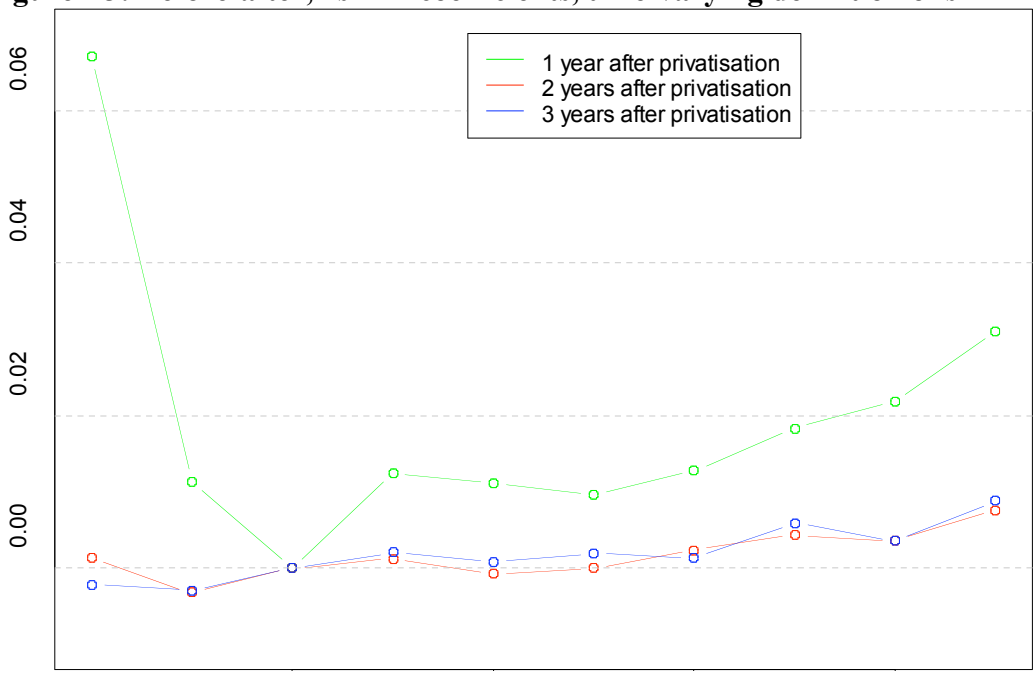


Figure B4: Difference in differences, time-varying definition of skill