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More hours, more jobs? The employment effects of longer working hours

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Increases in standard hours of work have been a contentious policy issue in Germany. Whilst this might directly lead to a substitution of workers by hours, there may also be a positive employment effect due to reduced costs. Moreover, the response of firms may differ between firms that offer overtime and those that do not. For a panel of German plants (2001–2006) drawn from the IAB Establishment Panel, we are the first to analyse the effect of increased standard hours on employment. Using difference-in-difference methods we find that, consistent with theory, overtime plants showed a significant positive employment response, whilst for standard-time plants there is no difference between plants that increased standard hours and those that did not. There is clear evidence of wage concession in all treated plants.

JEL classifications: J20, J30, C23.

1. Introduction

Work sharing was an important and contentious policy issue in Europe in the 1980s and 1990s. The policy stems from the belief that a reduction in working time could increase employment, based on the idea that a fixed amount of worker-hours can be spread amongst a larger number of workers. The basic policy tool was to change 'standard hours', the stipulated weekly working time excluding overtime.[1] More recently, in Germany in the early 2000s, the policy debate went into reverse. As firms became relatively more powerful, many increased standard hours because it lowers labour costs when overtime wage rates are at a premium. In this article we examine the effect of this policy on employment. In the earlier work-sharing literature, the canonical labour demand model was used to examine

[1]Synonyms for standard hours are normal working time, standard working time, normal hours and the standard workweek.

whether cutting standard hours did, in fact, increase employment. For the policy discussed here, it is tempting to argue that the effects should be in the opposite direction to that predicted by cutting standard hours. To see this, suppose that standard hours increase and assume that the hourly wage rate is fixed. This decreases the marginal cost of employment—because a smaller fraction of the costs per employee has to be compensated at a premium overtime rate—but leaves the marginal cost of an hour unchanged. Hence, there is a substitution effect, from hours towards employment. However, many workers do not work overtime. If firms choose weekly hours at exactly the standard workweek, an increase in standard hours will necessarily decrease employment for a given level of output. No matter whether firms offer overtime, there is an additional scale effect whereby the decrease in costs leads to more output and more employee-hours. Thus, at worst, the employment effect of increasing standard hours is ambiguous and even then only for firms that do not offer overtime. At best, employment will increase.

However, there are good reasons that assuming symmetry might be misleading once we allow for the possibility that hourly wage rates will be re-negotiated in response to changes in standard hours. For cuts in standard hours, it is often assumed that the hourly wage rate is negotiated upwards so as to keep workers' weekly income unchanged. This is labelled '(full) wage compensation' in the work-sharing literature, and is another reason for thinking that work sharing will not lead to favourable employment effects.[2] In the case of increasing standard hours, workers may accept decreases in their hourly wage that leaves their weekly wage unchanged. We label this '(full) wage concession'. It remains an open question whether workers accept wage concessions, so an analysis of firms' labour costs is an important part of any empirical analysis.

A second reason that assuming symmetry might be misleading is because the policy context is different. In Germany in the 1980s and 1990s, standard hours fell because of a tripartite agreement between unions, firms, and the state; in the early 2000s, the increases in standard hours have been driven mostly by firms on their own. A third reason for not assuming symmetry is simply that the firm's hiring and firing costs are asymmetric: firing a worker can be more expensive than hiring one.

At the turn of the century Western Germany had one of the shortest standard workweeks in the OECD.[3] The economic environment changed in the early 2000s, when some firms reversed recent trends and increased standard hours. Well-publicized examples included Siemens, Daimler-Chrysler, and Volkswagen. The European Economic Advisory Group (2005, p.56) (EEAG) notes that these increases in standard weekly hours were introduced to reduce labour costs in response to increased competitive pressures; such increases were agreed at the

2 Wage compensation is when the hourly wage rate increases, but weekly income falls; it is 'full' when weekly income stays the same.

3 See Carley (2004). Average collectively agreed standard hours in Western Germany in 2003 was 37.4, compared to an EU-15 average of 38.1.

company rather than the sectoral level. At the time, many commentators interpreted these changes as arising from increasingly powerful firms in firm–union negotiations and/or firms responding to increasing competition because of globalization. There was less consensus as to whether employment and output would increase.[4] Moreover, to date there has been no econometric evidence.[5]

Our article is the first that estimates the effect of this increase in standard hours on employment. We analyse a sample of German plants from 2001 to 2006, and we use both standard regression and propensity score matching in a difference-in-differences (DiD) framework. We compare those plants that increased standard hours between 2002 and 2004 (the treatment group) with plants for whom standard hours did not change between 2001 and 2006 (the control group). The data are an annual panel of plants collected by the Institut für Arbeitsmarkt– und Berufsforschung, and cover 1% of all plants in Germany (the IAB Establishment Panel).

To interpret our results as a causal impact of standard hours on employment, two standard key identifying assumptions are required (see, for example, Angrist and Pischke, 2009, ch. 5). The first is that plants do not respond to a demand shock by immediately increasing standard hours; if they did, then the covariate of interest, the treatment dummy, would be correlated with part of the regression error, the unobserved demand shock. We argue that the first assumption is valid because changes in standard hours typically require negotiation with workers or their representatives, and this takes time. Instead, the short-term response to changes in demand is to change employment or overtime. Note that pre-existing differences in demand between plants that increase their standard hours are unproblematic because of the DiD methodology we use. In addition, temporary shocks to demand are also unproblematic because even if plants did adjust standard hours in response (which we do not believe for reasons already given), this adjustment would be reversed once the temporary shock ends. This is because our definition of treated plants excludes plants that make temporary changes to standard hours. The second assumption is that employment trends would have been the same in both treated and control plants in the absence of treatment. To test this assumption we compare employment trends in treated and control plants before increases in standard hours occur.

[4]In summarizing the extensive public debate, the EEAG notes that it diverges 'fundamentally' between those who believe that increased working hours will increase employment (e.g. Sinn, 2003) and those who believe the opposite. Furthermore, Dustmann et al. (2014) attribute much of Germany's improved macro performance since the early 2000s to the unprecedented decentralization of the wage-setting process from the industry level to the firm level.

[5]Using the growing empirical literature on work sharing is not directly relevant here, because, as already noted, we cannot assume symmetry. This literature examines the effects of cutting standard hours on employment and wages, using firm, worker, and industry data for France, Germany, Portugal, and Canada. We note that there is very little evidence for positive employment effects and most studies find evidence of wage compensation. See Hunt (1999), Crépon and Kramarz (2002), Andrews et al. (2005), Schank (2006), Skuterud (2007), Estevão and Sá(2008), Chemin and Wasmer (2009), and Raposo and van Ours (2010).

As outlined already, the standard theory of the firm suggests that the response of plants to a change in standard hours will differ between those that offer overtime and those that do not. We therefore stratify our sample accordingly. It is important to note that in some cases plants that increased standard hours offered 'employment guarantees' to their existing workforce. It is therefore useful to consider both the hiring and separation response to changes in standard hours, since firms who offered employment guarantees, and who wanted to reduce employment, could still reduce hiring. Finally, we run the same DiD regressions, but with the plant's per worker labour costs as the dependent variable, so we can examine whether concessions in the hourly wage rate occurred.

In Section 2, we provide more details on the institutional background. In Section 3, we outline an established theoretical model for assessing whether more employment follows from increases in standard hours and whether wage concessions occur. In Section 4, we describe the data; in Section 5 we discuss our DiD methodology; and in Section 6 we discuss our results. Section 7 concludes.

2. Institutional background

Figure 1 illustrates the decline in standard hours in Germany in the 1980s and 1990s and suggests that standard hours have remained roughly constant in Western Germany since 1998 and in Eastern Germany since 2002.[6] However, Fig. 1 refers only to standard hours covered by bargaining agreements. Figure 2 uses the IAB establishment panel to show the trend in standard hours for all plants, not just those with bargaining agreements.[7] Figure 2 shows that the majority of plants do not have bargaining agreements, and since the turn of the century, standard hours have been increasing in Western German plants, and in particular in those plants which have no bargaining agreements. The workweek is about 1 hour longer in Western Germany and about 30 minutes longer in Eastern Germany when standard hours are not determined by collective bargaining.

The key features of the increase in working time in the early 2000s are as follows.[8] It is argued that agreements to lengthen standard hours were an attempt to reduce labour costs in the face of increased competition and came about at the company rather than sectoral level.[9] In addition to Siemens, Daimler-Chrysler, and Volkswagen, other well-publicized agreements were negotiated at Deutsche Bahn, MAN, Thomas Cook, Lufthansa, and many other small and medium-sized firms. In addition, state governments increased working time for civil servants in Bavaria and

[6] Source: Tarifregister of the Bundesministerium für Wirtschaft und Arbeit. Received on personal request from the German Federal Ministry of Labour and Social Affairs (BMAS).

[7] In this section, we refer to both firms and plants, because the IAB Establishment Panel is not a firm-level data set. In Section 3 we refer only to firms.

[8] See Section 2 of the European Economic Advisory Group (2005) for fuller details.

[9] According to European Economic Advisory Group (2005, p.56), employees were 'exposed to credible threats from employers that production sites will be closed down and jobs outsourced abroad'.

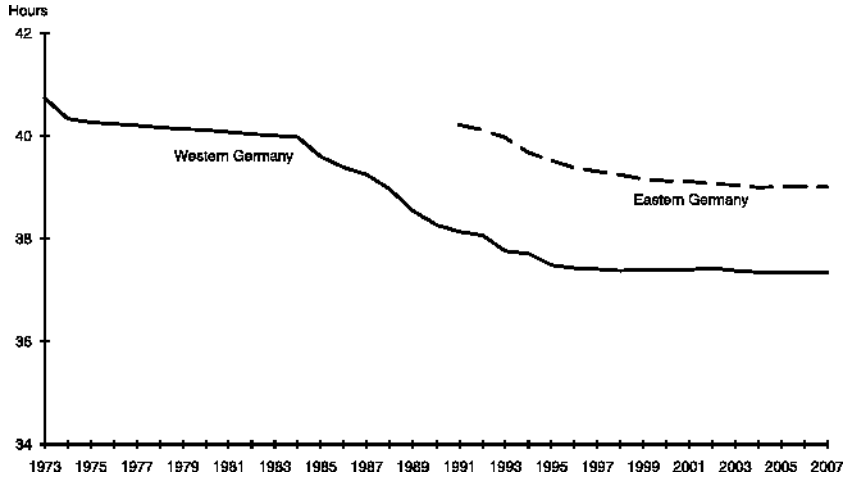

Fig. 1 Standard hours determined by collective bargaining. *Source*: Tarifregister of the Bundesministerium für Wirtschaft und Arbeit.

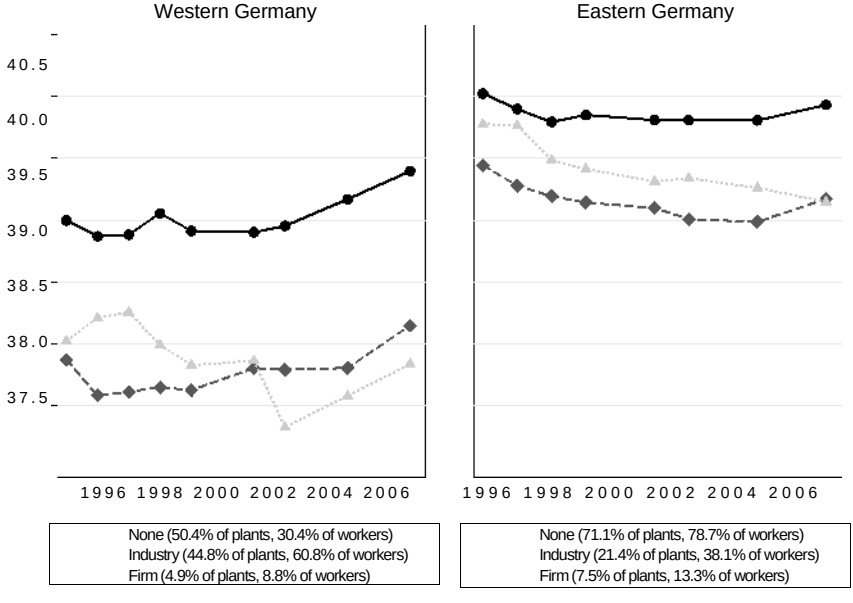

Fig. 2 Standard hours at the plant level, by bargaining agreement, weighted *Source:* IAB Establishment Panel.

Hessen. In some notable cases—for example, Siemens, Daimler-Chrysler, and Volkswagen—some form of employment guarantee from the employer was agreed.

For those plants involved in sectoral bargaining, so-called opening clauses in bargaining agreements allowed plants to deviate from the standard hours originally negotiated. In the 2005 Wave of the IAB Establishment Panel, 13% of

plants had such opening clauses, and of these, 52% actually made use of them. Opening clauses were used mostly for making standard hours adjustments. Furthermore, many of the agreements did not involve any compensation in weekly pay, thereby lowering pay per hour.

The employment guarantees mentioned above are a reason employment reductions in response to increased standard hours might not be observed in the short run. However, employment guarantees to existing employees do not prevent firms lowering employment, since firms are still able to reduce hiring (Abowd *et al.*, 1999).

3. Theoretical considerations

We start with the neoclassical demand for hours model to illustrate whether an increase in standard hours leads to lower employment. We extend such a model of labour demand by modelling the firm's choice of overtime regime. This draws heavily on Leslie (1984), Hart (1987), Calmfors and Hoel (1988), as well as Andrews *et al.* (2005) and references within. We then discuss what happens when we extend the model to a union-firm bargaining framework.

3.1 The theory of the firm

Consider a firm free to choose both the level of employment, N, and weekly hours, H, per employee. All workers work the same number of hours. The firm's cost function is given by

$$C = N(wH \pm z) \quad \text{if } H = H; \tag{1}$$

$$C = N[wH \pm {}_{y}w(H - H) \pm z] \text{ if } H > H. \tag{2}$$

We assume that the firm does not offer its employees hours of work lower than the standard workweek, because short-time working is not observed very often in the sample period (part-time working is usually seen as a supply-side phenomenon).

Weekly hours may be greater than the standard workweek, in which case overtime hours $V . H - H$ are strictly positive. Each hour up to H is paid w; overtime hours are paid at premium rate ${}_{y}w$, where ${}_{y} > 1$. z represents quasi-fixed labour costs, in other words those fringe costs that are independent of hours worked, imputed on a per period basis (typically they represent hiring and firing costs).

The isocost contour in (N, H) space comprises two convex segments which form a kink at $H = H$, for example ${}_{A0B0D0}$ in Fig. 3. The firm's strictly concave revenue function is denoted by ${}_{O}R(H, N)$, where ${}_{O}$ is a demand shock.

The firm chooses H and N to maximize $\Pi . {}_{O}R(H, N) - C$, where C is given by (1) if $H = H$ and (2) if $H > H$. In general, the profit-maximizing solutions are written:

$$\begin{aligned} N &= N_1(w/{}_{O}, H, z/{}_{O}) \\ H &= H \end{aligned} \quad \text{if } H = H \tag{3}$$

$$N = N_2(w=\sim;\ H;\ z=) \qquad \text{if } H > H: \qquad (4)$$

If $H_2(w=0;\ H;\ z=0) = H$, then the firm operates on the kink and all its employees work the standard workweek. Firms with $H = H$ are hereafter labelled 'standard-time firms'. Otherwise, if

$$H_2(w=^{\circ};\ H;\ z=0) > H; \qquad (5)$$

then the firm operates on the upper segment and all its employees work overtime. These firms are hereafter labelled 'overtime firms'. The two possible solutions (or 'working-time regimes') are drawn in Fig. 3. Consider the kinked solid isocost curve $_{A0B0D0.}$ There are two possible iso-revenue maps, and we draw just one iso-revenue curve for each map and hence illustrate the profit-maximizing outcome for the two regimes. These are points B_0 for standard-time firms and C_0 for overtime firms, respectively. The dotted lines illustrate how the isocost schedule shifts as H increases. Even though $N_1(\ )$ and $N_2(\ )$ have the same arguments, they are different functions. In particular, the effect of standard hours on employment varies between overtime and standard-time firms.

3.1.1 *Overtime firms* For a firm to optimally offer overtime to all its employees, eq. (5) suggests that it must face relatively low standard hours. The demand for employment and hours functions are given by eq. (4), whose properties depend in part on the underlying technology generating the revenue function $0R(H;\ N)$.

Consider an increase in standard hours, H. In Fig. 3, this is from H_0 to H_1, and the new dotted isocost contour becomes $_{A1B1D1.}$ For given output, the marginal cost of an employee (the so-called extensive margin) falls but the marginal cost of an overtime hour (the intensive margin) remains constant, and so the firm substitutes away from hours towards employment (C_0 to C_1 in Fig. 3). Allowing output to vary, there is an additional scale effect, for example from C_1 to C_2, whereby the firm demands more hours and employees, because costs have fallen. Recall that this is exactly the motivation for German firms increasing standard hours in the early 2000s. The overall effect of a increase in standard hours on employment is unambiguously positive ($N_H > 0$). The firm reduces expensive overtime as the workweek is increased.

3.1.2 *Standard-time firms* If it is optimal for the firm to operate at the kink, effectively employment is chosen conditional on the exogenously determined workweek, $H = H$. The firm's problem can be more simply stated as

$$\max_N 0R(H;\ N) - (wH + z)N: \qquad (6)$$

This generates the labour demand eq. (3). The variables that enter are the same as for the overtime regime (see eq. 4); it is the comparative static effects that are different. It is clear from eq. (6) that H is a price of employment, in direct

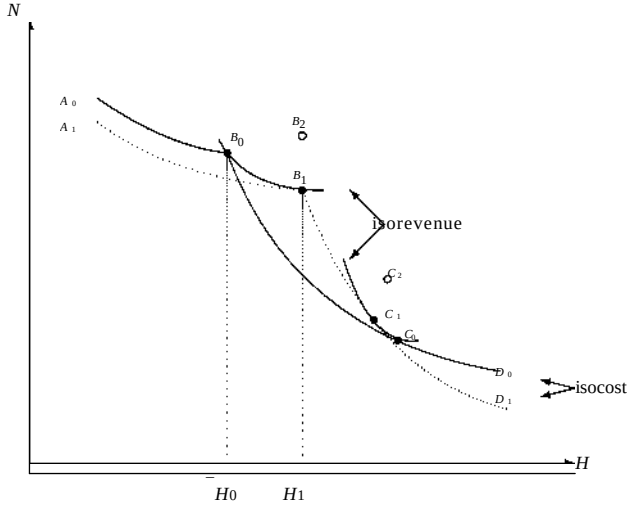

Fig. 3 Substitution and scale effects of an increase in standard hours. An increase in H moves the isocost line from $A0B0D0$ to $A1B1D1$. The substitution effect moves standard-time firms from B_0 to B_1 (along the same iso-revenue curve) and overtime firms from C_0 to C_1 (along the same iso-revenue curve). The scale effects are B_1 to B_2 and C_1 to C_2 and are positive for both types of firm.

contrast to the overtime model. Just like an increase in the wage, an increase in H increases the marginal cost of an extra employee. On its own this decreases employee demand. However an increase in H also affects marginal revenue; only if the cross-partial is sufficiently positive—in other words if marginal revenue increases by more than marginal cost—does employment actually increase.

Figure 3 illustrates the pure substitution effect of an increase in standard hours from H_0 to H_1, which moves standard-time firms from B_0 to B_1, reducing N. The scale effect moves the solution above B_1 (for example to B_2), which illustrates the ambiguity in the partial derivative. Overall, negative employment effects from increasing standard hours ($\partial N/\partial H < 0$) will be observed for standard-time firms providing the substitution effect dominates.

Whether increasing standard hours reduces employment therefore depends on the extent to which firms offer overtime. Clearly, it is essential to distinguish between firms that offer overtime and those that do not and examine whether $\partial N/\partial H$ varies with the firm's working-time regime. We discuss the prevalence of overtime firms in the context of our data in Section 4.

3.2 Negotiating over standard hours and wages

It is important to model employment and standard hours outcomes in the presence of bargaining, especially because the initial drive for longer standard hours

happened in larger well-known firms where workforces were unionized. To do this, there are well-developed union-firm bargaining models that analyse how standard hours are negotiated; see Booth (1995) and Andrews and Simmons (2001) and references within. These models are still relevant even when firms do not explicitly bargain with a union.

A key assumption in the literature is that standard hours and wage negotiations occur less frequently than changes in employment and hours. This is the assumption that firms 'retain the right-to-manage'. Once standard hours and the hourly wage have been determined in the outcome of a bargain, effectively both variables are 'exogenous' for employment and hours, which means that the traditional hours demand model is appropriate.

In a typical union-firm bargaining model, a Nash bargain is set up with both the firm's profit function and the union's utility function having standard hours H and the hourly wage rate w as the variables negotiated over. If the relative power of the firm increases, the outcome of the negotiation may involve a lower hourly wage w—so-called wage concession—as well as the increase in standard hours H being modelled here. To see the effect of possible wage concession on profits, first consider a standard-time firm. The effect of standard hours and the wage rate on profits π is given by

$$\pi = \pi(H, wH),$$

where $\pi_1 = R_H > 0$, $\pi_2 = -N < 0$ (Hotelling's lemma). If the worker's weekly income $Y = wH$ remains constant—because the fall in the hourly wage offsets the longer working week—than the firm is unambiguously better off (as $\pi_1 = R_H > 0$). This also means that per worker utility is unambiguously lower, because both weekly income is constant and leisure has fallen. This is because per worker utility is written $U(wH, -H)$, with both arguments having positive marginal effects.[10]

For workers in overtime firms, the effect of wage concessions is even stronger. In this case, a worker's weekly income (the same as the firm's per worker costs apart from z) is given by

$$Y = w[\gamma H(H, \ldots) - (\gamma - 1)H)]. \tag{7}$$

If $H_H < 0$, the expression inside [] falls when H increases which, in contrast to standard-time workers, reinforces the fall in per worker weekly income.

To summarize, the main focus of our empirical analysis is to examine whether employment does indeed increase, after stratifying by overtime and standard-time firms. However, this last section shows that we also need to examine what happens to per worker weekly labour costs in the same plants.

[10] If the negotiations involve trade unions, whose utility depends on adding up all its members utilities, there might be a partial offset in total union utility if there are more jobs.

4 Data description

There are two data sources. The first is the IAB Establishment Panel, an annual survey of approximately 10,000 plants located in the former West Germany and an additional 5,500 plants in the former East Germany. The survey started in 1993 and is ongoing. It covers 1% of all plants and 7% of all employment in Germany, and is therefore a sample weighted towards larger plants. Information is obtained by personal interviews with plant managers, and comprises about 80 questions per year, giving information on, for example, total employment, bargaining arrangements, standard hours, total sales, exports, investment, wage bill, location, industry, profit level, and nationality of ownership. A detailed description of the IAB Establishment Panel can be found in Fischer et al. (2009).

The second source of data is the employment statistics register of the German Federal Employment Agency; this so-called Beschaftigtenstatistik covers all workers or trainees registered by the social insurance system. The register covers about 80% of workers in Western Germany and about 85% in Eastern Germany. Information on workers includes basic demographics, start and end dates of employment spells, occupation and industry, earnings, qualifications (school and post-school), and a plant identification number. A detailed description of the employment data can be found in Bender et al. (2000).

From the IAB Establishment Panel, we construct a balanced panel of private-sector plants, indexed j, observed annually on 30 June for 2001,. . . , 2006 (hereafter $t = 1,.. ., 6$). By using the plant identification number in the Beschaftigtenstatistik, we link each worker to a plant in the panel, selecting all workers who were employed by the surveyed plants on 30 June each year. Because almost all workers in the private sector are covered by the social insurance system, the data cover nearly 100% of workers. From this, we compute the stock of employees N_{jt}. We can also compute hires h_{jt} and separations s_{jt} for plant j between 30 June in year t – 1 and 30 June year t.[11] When normalized by $N_{jt} \sim \delta N_{j,t\_1} \flat N_{jt}Þ/2$, these three variables are linked as follows:

$$\frac{\sim N_{jt}}{N_{jt}} 1/4 \frac{h_{jt}}{N_{jt}} \quad \frac{s_{jt}}{N_{jt}} \qquad t 1/42, \ldots, 6.$$

Thus we are able to estimate models for employment, the employment growth rate, the hiring rate, and the separation rate. The fact that the increase in standard hours often included employment guarantees means that plants may adjust employment on the hiring rather than the separation margin. Finally, we construct two measures of each plant's labour costs. The first is the plant's per worker total wage bill and proxies the variable Y in Section 3.2. The second is the same, but averaged over all full-time employees in the plant in 2001 and who

11 To be precise, h_{jt} is the sum of all workers who were not employed by plant j in t – 1, but were employed by plant j in t. Conversely, s_{jt} is the sum of all workers who were employed by plant j in t – 1, but were not employed by plant j in t.

remain in the plant for the rest of the sample period. These employees are labelled 'incumbents'.

The definition of standard hours H_{jt} in the JAB Establishment Panel is "How long is the agreed average standard working time for full-time workers in your plant?"and the variable is observed in 2001, 2002, 2004, and 2006.[12] The question was not asked in 2003 and 2005. There are large variations in standard hours across plants in Western Germany. Using employment weights from the JAB Establishment Panel, we find that for 10% of plants, standard hours are less than 35; for 45% of plants, they are between 37.5 and 38.5 hours; and for the remaining 25%, standard hours exceed 40. There is less dispersion in Eastern Germany. To identify the models we estimate, it is not variations in standard hours that we need but variations in its change. Standard hours for some plants have changed: of 11,898 plants in the JAB Establishment Panel in 2004, 1,066 increased their standard hours between 2002 and 2004. A subset of these plants form the control and treatment groups we use in the subsequent analysis. The control group ($T_j = 0$) consists of all plants where H is constant in 2001, 2002, 2004, and 2006. The treatment group ($T_j = 1$) consists of all plants where standard hours are constant in 2001 and 2002; go up between 2002 and 2004; and are constant again in 2004 and 2006.

We use a balanced panel because we need to observe hours of work in 2001, 2002, 2004, and 2006. Although this reduces the sample to 603 treated plants, this restriction greatly reduces the possibility that the observed increase in standard hours is due to measurement error. However, there is a possible selection bias in that plants who are included in the balanced panel are less likely to have suffered large, negative idiosyncratic shocks. This is discussed later. We then exclude plants for which we do not have complete information in each year. This reduces the treated sample to 111 plants. The control group comprises 1,908 plants which have constant standard hours for all years. Figure 4 illustrates, where the averages for H are computed from the regression sample. We label 2001 and 2002 as 'before' and 2005 and 2006 as 'after'. We chose this six-year period because most increases in standard hours took place in 2003 and 2004.[13]

The dummy variable V_{jt} records whether a plant used overtime in a given year. The data actually record whether overtime is (a) 'paid for'; (b) 'partly paid for, partly compensated by time off'; (c) 'only compensated by time off'; or (d) 'neither paid for nor compensated by time off', and is observed in 2001, 2002, and 2006.[14] Because the crucial aspect of an overtime hour is whether it is paid a premium

12 The word 'average' allows for some short-run variations in standard hours allowed for in some bargaining agreements providing the annual average matches that agreed.

13 Note that plants in the control group have higher standard hours on average than the treated plants before treatment. This is probably because it is easier for employers to increase standard hours when they have been lower than the current average level.

14 The question asked in 2004 is not consistent with those in 2001, 2002, and 2006 and cannot be used.

Fig. 4 Average standard hours for plants in the treatment group (T_j= 1) and control group (T_j = 0). There are 111 plants in the treatment group that have constant hours between 2001 and 2002 (average = 37.7 and between 2004 and 2006 (average = 39.4) and increase hours between 2002 and 2004. There are 1,908 plants in the control group that have constant hours between 2001 and 2006 (average = 39.1). Standard hours are not observed in 2003 and 2005.

(the theory relies on $\gamma > 1$), we define V_{jt} = 1 only if (a) or (b) apply.[15] It is fixed at its 2001 value, but we examine what happens to the subset of plants where V changes in 2006 by dropping them from our basic model, to examine whether our results are robust to this change. The theory outlined in Section 3 suggests that as standard hours increase, some plants will no longer offer overtime.[16] Throughout we stratify by the dummy variable $v_{j1,}$ creating sub-samples of standard time and overtime plants.

5. Econometric methodology

Our methodology is a standard application of the DiD estimator for treatment effects, using both regression and propensity score matching. The DiD framework allows for the fact that plants that expanded their standard hours are unobservably different from plants that did not, provided these differences already existed before

15 Only 15% of workers in Germany were paid overtime in 2006 (IAB Establishment Panel), and 16.1% of (weighted) plants are 'overtime plants' in the same year.

16 Of 414 plants that changed their overtime status, 240 changed from standard-time to overtime and 174 went the other way.

2002 and are permanent. We explained in the introduction that there are two key identifying assumptions that allow us to interpret our results as a causal impact of standard hours on employment. First, that unobserved demand shocks are not correlated with T_j, and second that employment trends would have been the same in $T_j = 1$ and $T_j = 0$ plants in the absence of treatment.

Our basic estimating equation for employment is as follows:

$$\log N_{jt} = \gamma_0 + \sum_{k=2}^{6} \sigma_k D^k_t + \sum_{k=2}^{6} \gamma_k D^k_t T_j + \mathbf{x}_j \beta + \lambda T_j + \alpha + u_{jt}, \quad t = 1, \ldots, 6. \tag{8}$$

T_j is the treatment dummy, D^k_t is a time-dummy for year k, and $\mathbf{x}_j$ is a vector of observed covariates, held constant at their 2001 values. The selection effect is A, which captures any differences in employment outcomes between treated and control plants before the treatment takes place, including any permanent difference in demand between the two groups. One can either estimate eq.(8) by OLS, or one can allow for plant-specific fixed effects α_j, in which case the estimating equation is

$$\log N_{jt} = \gamma_0 + \sum_{k=2}^{6} \sigma_k D^k_t + \sum_{k=2}^{6} \gamma_k D^k_t T_j + \alpha_j + u_{jt}, \quad t = 1, \ldots, 6. \tag{9}$$

The α_j can be removed with either fixed effects (FE) or first differenced (FD) estimators. With time-invariant covariates, as here, the estimates of γ_k are identical.[17] We report plant-level cluster-robust standard errors, which takes account of any serial correlation in the u_{jt} for a given plant as well as heteroskedsticity in the u_{jt} across plants. The number of plants/clusters is sufficiently large, there being roughly 1,000 plants in the overtime and standard time sub-samples. The same basic DiD framework is used when analysing per worker weekly labour costs. Within the same DiD framework, an alternative approach to control for observable differences between the treated and control plants is to assess whether there are any pre-existing differences in $\mathbf{x}_j$ between the treated and control plants and then explicitly match on values of $\mathbf{x}_j$. When interpreting the parameters, first consider the OLS estimate of γ_2 in the absence of covariates:

$$\gamma_2 = (\log N^T_2 - \log N^T_1) - (\log N^C_2 - \log N^C_1).$$

The superscript T denotes 'treated' and C denotes 'control'. γ_2 should be 0 if the common trends assumption holds, because periods 1 and 2 are before the treatment occurs. Next, γ_5 and γ_6 are the two treatment effects (DiD) of interest, corresponding to 2005 and 2006, the two years in the data after the change in H. It is clear that

$$\gamma_6 = (\log N^T_6 - \log N^T_1) - (\log N^C_6 - \log N^C_1)$$

17 We include $\mathbf{x}_j$ in eq. (8) because this may improve the precision of the estimates.

compares 2006 with 2001. However, under common trends, $\hat{\gamma}_6$ also compares 2006 with 2002. The same argument applies to $\hat{\gamma}_5$. Finally, we can also write

$$\sum_{t=2}^{6}\hat{\gamma}_t = \sum_{t=2}^{6}\left[(\log N^T_t - \log N^T_{t-1}) - (\log N^C_t - \log N^C_{t-1})\right] \approx \sum_{t=2}^{6}\left[(\Delta N_t/N_t)^T - (\Delta N_t/N_t)^C\right].$$

Thus, this particular DiD is written as the approximate sum of five differentials—between treated and control plants—in the employment growth rates. Because we need to control for observables, these are actually estimated from:

$$\frac{\Delta N_{jt}}{N_{jt}} = \sum_{k=2}^{6}\alpha_k D_{kt} + \sum_{k=2}^{6}\gamma_k D_{kt} T_j + x_j'\beta + e_{jt} \quad t = 2, \ldots, 6. \qquad (10)$$

The five differentials are $\gamma_2, \ldots, \gamma_6$.

There are analogous regression models for s_{jt}/N_{jt} and h_{jt}/N_{jt}. From these, we can decompose the differentials in the employment growth rates into differentials for hires and separations:

$$\sum_{t=2}^{6}\hat{\gamma}_t \approx \sum_{t=2}^{6}\left[(h_t/N_t)^T - (h_t/N_t)^C\right] - \sum_{t=2}^{6}\left[(s_t/N_t)^T - (s_t/N_t)^C\right]. \qquad (11)$$

Finally, we examine the potential selection issues that arise because plants are necessarily observed six times. Plants who are included in the balanced panel are less likely to have suffered large, negative idiosyncratic shocks. We follow Wooldridge (2010, Section 19.9.1) and examine the larger data set (i.e. the IAB Establishment Panel) from which the balanced panel was constructed. We define a dummy $s_j = 1$ if a plant is in the balanced panel and $s_j = 0$ otherwise. We then estimate the following model using fixed effects:

$$\log N_{jt} = \gamma_0 + \sum_{k=2}^{6}\alpha_k D_{kt} + \sum_{k=1}^{6}\rho_k D_{kt} s_j + a_j + u_{jt}, \quad t = 1, \ldots, 6.$$

We normalize $\rho_2 = 0$ (2002) and then test $H_0: \rho_5 = \rho_6 = 0$. If either ρ_5 or ρ_6 were positive, it means that the growth of employment between 2002 and 2005/6, conditional on unobserved characteristics, is higher in the plants that have been included in the estimation sample compared with those that were not. It turns out that this test is not rejected, for both standard-time plants and overtime plants. The estimate for 2005 is 0.0221 (0.0131) and for 2006 it is 0.0092 (0.0145) for standard time plants (joint test p-value = 0.111). For overtime plants, the corresponding estimates are 0.0112 (0.0124) and −0.0003 (0.0148), with a joint test p-value = 0.504.[18] This confirms that we do not have such selection issues in our data.

18 If one adds standard hours to the estimation, one loses the estimates for 2003 and 2005. It turns out that nothing changes when we do this.

6. Results

Our basic employment estimates and their decomposition into hires and separations are presented in the first section below, followed by various departures from the basic results in second subsection. Finally, we analyse per worker weekly labour costs.

6.1 Employment

The sample comprises a balanced panel of 1,112 standard-time plants (68 treated and 1,044 control) and 907 overtime plants (43 treated and 864 control), making a total sample size of 2,019 plants.

For propensity score matching, we need to assess whether there is overlap between the treated and control plants. We follow Imbens and Rubin (2014), who suggest computing the following normalized difference in sample means for any covariate x:

$$z = \frac{\bar{x}^T - \bar{x}^C}{\sqrt{S_{2,T} + S_{2,C_x}}}, \quad (12)$$

where x^w is the sample average of the covariate of interest for group w, and S_{wx} is the sample standard deviation, with $we\{T, C\}$. Imbens and Rubin suggest that if the difference in means is bigger than 0.25 standard deviations ($|z| > 0.25$), then linear regression methods may be problematic.

Table 1 shows that there are some significant differences in sample means between treated and control plants. The most important of these is that treated plants are less likely to be in Eastern Germany: for standard-time plants, 63% of control plants—but only 25% of treated plants—are in Eastern Germany. There is a similar difference (47% and 12%, respectively) in overtime plants. For the same reason, the regional unemployment rate is significantly higher in control plants. Given the earlier discussion on whether firms bargain with unions, and whether this has an impact on whether a plant is treated, note that amongst standard-time plants, a significantly larger share of treated plants had some collective bargaining (43% of treated compared to 62% of control plants had no collective agreement). The difference for overtime plants is very small ($z = 0.027$).

Overall there are only a few significant differences, and therefore it is not surprising that it makes no difference to our results below whether we use standard linear regression or propensity score matching. In what follows, we report and discuss the regression results; the propensity score matching results are reported in the Online Appendix.

Our results for employment are reported in Table 2. The raw DiDs are given in the third column, which are exactly the same when covariates are added, reported in the fourth column. (These are all the variables listed in Table 1 plus sector dummies.) For standard-time plants, the DiD for 2005 is —0.030 (0.052), and for 2006 it is 0.009 (0.059). For overtime plants, these estimates are much bigger: 0.113 (0.064) for 2005 and 0.158 (0.070) for 2006.

Table 1 Unweighted sample means, pre-treatment (2001)

Variable	Standard-time plants "$H > 0$?			Overtime plants "$H > 0$?		
	yes	no	z	yes	no	z
Employment (N)	43.03	62.60	-0.09	1414	254.05	0.14
Standard-time (H)	37.79	39.47	-0.81	37.44	38.67	-0.46
Hiring rate	0.126	0.179	-0.20	0.158	0.148	0.04
Separation rate	0.188	0.187	0.00	0.128	0.153	-0.14
Share of female employees	0.429	0.415	0.03	0.265	0.304	-0.12
Share of part-time employees	0.213	0.167	0.15	0.091	0.108	-0.08
Share of vacancies	0.007	0.018	-0.06	0.011	0.011	-0.00
Export share in total sales	0.023	0.046	-0.14	0.166	0.138	0.08
Very good or good profitability	0.324	0.324	-0.00	0.349	0.384	-0.05
No collective agreement	0.426	0.620	-0.28	0.442	0.422	0.03
Sector-level bargaining	0.500	0.327	0.25	0.442	0.465	-0.03
Firm-level bargaining	0.074	0.054	0.08	0.116	0.112	0.01
Works council	0.206	0.152	0.10	0.442	0.466	-0.03
Located Eastern Germany	0.250	0.629	-0.58	0.116	0.468	-0.59
Regional unemployment rate	0.106	0.134	-0.41	0.086	0.122	-0.55
Number of observations	68	1,044		43	864	

Notes: The sample is exactly that used in the regressions. The z-statistic for testing equality of means is defined in eq. (12).

Figure 5 plots these estimated conditional differentials for hires, separations, employment growth, and employment for both plant types. A comparison of the fourth panel in Fig. 5 between standard-time and overtime plants shows that for overtime plants, employment increases for the treatment group and reduces slightly for the control group, whilst for standard-time plants employment reduces for both groups.

The 'post-treatment' period is defined to be 2005 and 2006. However, the estimate of γ_4 for 2004 in the bottom panel of Table 2 is also positive and significant (0.102 with a standard error of 0.053). This is also clear from Fig. 5, which shows an increase in employment in overtime plants occurring in 2004. But in fact, this is perfectly consistent with our results for 2005 and 2006, because some plants will have changed standard hours at some point between 30 June 2002 and 30 June 30t 2004—we do not observe when—and the subsequent increase in employment will have occurred between these two dates. For similar reasons, the same will have happened between 30 June 2002 and 30 June 2003, but the number of plants doing this will be smaller.

As already discussed, testing the common trends assumption amounts to seeing whether the DiD estimates for 2002 in both regressions are insignificant, which they are (t-statistics of 0.3 and 0.3, respectively.) This is also seen when comparing the fourth panels in Fig. 5. Employment in standard-time plants fell at the same rate over the whole sample period, including the pre-treatment period. Employment in

Table 2 Difference-in-difference employment estimates, standard-time and overtime plants separately

	Raw differential			Conditional differential			
	$\log N_t^C$	$\log N_t^T$	DiD[a]	$\log N^b$	$\frac{\Delta N_{jt}^c}{N_{jt}}$	h_{jt}	s_{jt}
A: 1,112 standard-time plants (68 treated)							
2001	2.667	2.491					
2002	2.643	2.473	0.006	0.006	0.014	–0.018	–0.031
			(0.023)	(0.023)	(0.023)	(0.025)	(0.024)
2003	2.635	2.410	–0.048	–0.048	–0.046	–0.051	–0.005
			(0.032)	(0.032)	(0.028)	(0.020)	(0.026)
2004	2.628	2.432	–0.020	–0.020	0.030	0.069	0.039
			(0.048)	(0.048)	(0.037)	(0.033)	(0.028)
2005	2.594	2.389	–0.030	–0.030	0.007	–0.001	–0.007
			(0.052)	(0.052)	(0.036)	(0.021)	(0.032)
2006	2.546	2.380	0.009	0.009	0.042	0.003	–0.039
			(0.059)	(0.059)	(0.034)	(0.027)	(0.026)
Sum[d]					0.047	0.002	–0.043
No. obs.	6,672	6,672	6,672	6,672	5,560	5,560	5,560
B: 907 overtime plants (43 treated)							
2001	4.205	4.409					
2002	4.185	4.398	0.009	0.009	0.010	0.018	0.009
			(0.035)	(0.035)	(0.033)	(0.022)	(0.022)
2003	4.180	4.429	0.046	0.046	0.035	0.011	–0.023
			(0.043)	(0.043)	(0.026)	(0.022)	(0.014)
2004	4.173	4.479	0.102	0.102	0.055	0.044	–0.011
			(0.053)	(0.053)	(0.029)	(0.027)	(0.017)
2005	4.141	4.458	0.113	0.113	0.010	0.030	0.020
			(0.064)	(0.064)	(0.034)	(0.023)	(0.026)
2006	4.096	4.457	0.158	0.158	0.038	0.009	–0.029
			(0.070)	(0.070)	(0.024)	(0.017)	(0.017)
Sum[d]					0.148	0.112	–0.034
No. obs.	5,442	5,442	5,442	5,442	4,535	4,535	4,535

[a]Raw DiD differential is defined as $(\log N_{T_t} - \log N_{T_1}) - (\log N_{C_t} - \log N_{C_1})$.
[b]Conditional DiD differential for $\log N$ is given by γ_k in eq. (9).
[c]Differential on $\Delta N_{jt}/N_{jt}$ is given by γ_{0k} in eq. (10), which decomposes into hires and separations. [d]Sum of employment change over 2002.. .2006; see eq. (11).

overtime plants has the same trend for both groups in the pre-treatment period; treatment plants did not increase employment until after 2002.

Our identifying assumptions (no correlation of unobserved demand shocks with the treatment; common trends) allow us to interpret our estimates as causal, and the results match the theory exactly. Those overtime plants who increase standard hours increase their employment more than observably similar plants who did not increase standard hours. This does not happen in standard-time plants. For standard-time plants, the zero estimate implies that the scale and substitution effects cancel each other out; for overtime plants, both scale and substitution effects mean higher employment. See Fig. 3.

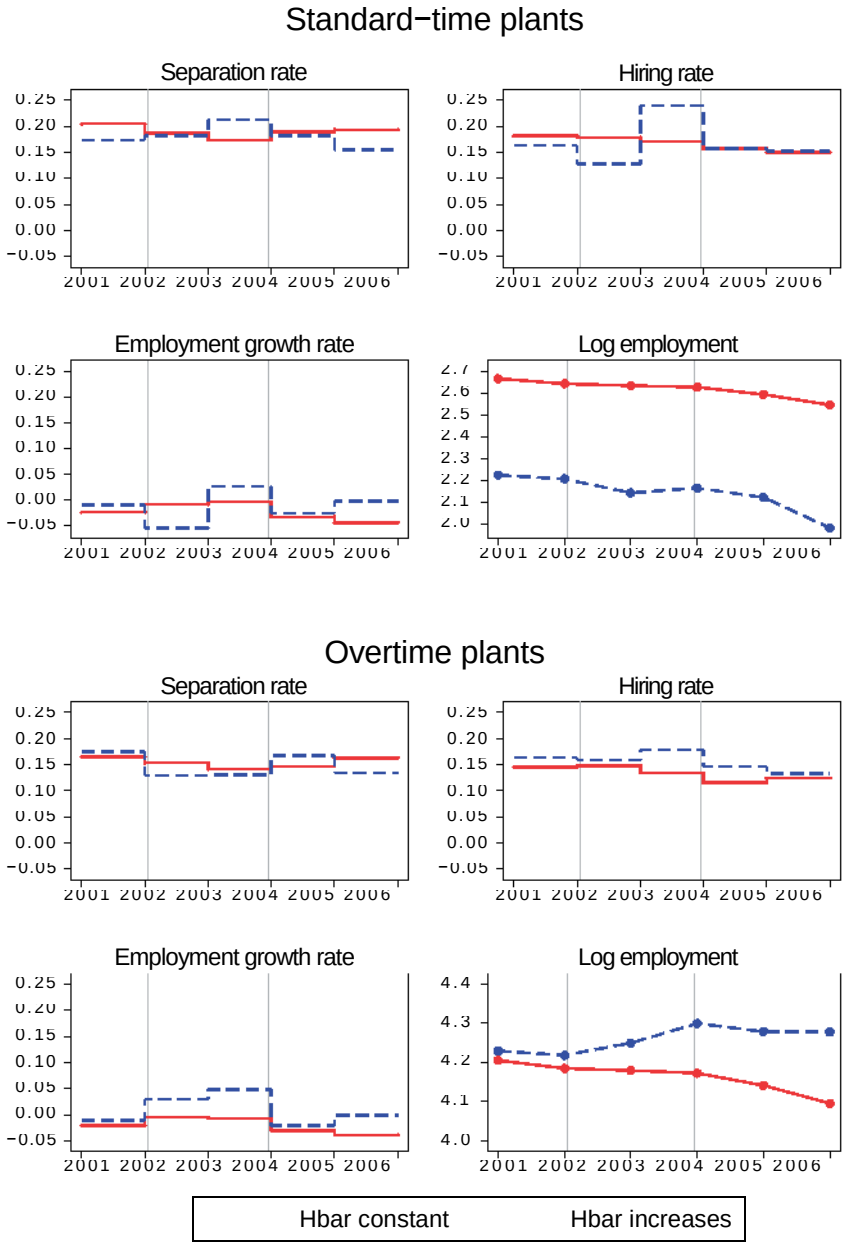

Fig. 5 Employment, hiring, and separation effects of an increase in standard hours for standard-time and overtime plants separately. Estimates are from the conditional DiD model reported in Table 2.

For overtime plants, the effect is economically significant. An increase of H by 1.57 hours (see Fig. 4) represents a 4.17% increase (1.57 / 37.66 = 4.17%), which leads to a 0.113 log-point increase in employment: an elasticity of 0.113 / 4.17 = 2.7. Alternatively, if we define the DiD as (0.113 + 0.158) / 2 = 0.136, then the estimates are slightly bigger. Whilst these treatment effects are large, the 95% confidence interval obviously contains smaller (perhaps more plausible) elasticities.

We noted in Section 2 that some agreements to increase standard hours included employment guarantees for existing workers, meaning that reductions in employment could only be implemented by hiring fewer workers. As our results show that the employment effect of increasing standard hours was zero in standard-time plants and positive in overtime plants, this is no longer an issue. Nonetheless, it is interesting to examine what happens to hires and separations. The final three columns of Table 2 report the employment growth rate($\sim_{Njt}^{Njt}$) and its component hiring and separation rates. Recall that, from eq. (11), the DiD estimate of Υ_t is approximately equal to the sum of employment growth between year t and 2001, which itself is equal to the sum of the difference between hiring and separation rates. These rates are also plotted in the first three panels of Fig. 5 for both standard-time and overtime plants. For standard-time plants, the difference in employment growth rates between treated and untreated plants is close to zero, and there is no additional differential effects for either hires or separations.

For overtime plants, the differential in employment growth rates between treated and control plants is 0.148. As one can see from eq. (11), this is approximately the same as the estimate of Υ_6 1/4 0.158 in the preceding column. The sum of employment growth (0.148) decomposes into 0.112 for hires and —0.034 for separations. Thus, for overtime plants, the increased employment in treated relative to control plants is due to increased hires rather than fewer separations. This is exactly what would be expected in plants that are expanding (Bellmann *et al.*, 2011).[19]

Finally, it is interesting to compare the effect on the separation rate with that of the earlier studies that examined the effects of work sharing (reductions in standard hours), although, as we have noted, there is no reason to assume symmetry. For example, when looking at state-mandated cuts in standard hours in France in 1981, Crépon and Kramarz (2002), who used the French Labour Force Survey, found that the separation rate increased by 2 to 4 percentage points in response to a cut in hours from 40 to 39 in 1981. The 95% CI for our estimate, (—0.054, —0.014), is similar. In our analysis, the average increase in standard hours is 1.5 hours, and it is the hiring rate that changes, not the separation rate, something studies using worker-level data cannot infer. This demonstrates a key advantage of using plant-level rather than worker-level data.

[19] Recall that the definition of whether a plant is standard-time or overtime is fixed at its 2001 value, because we need a balanced panel for estimating DiD effects. Our results are robust to the exclusion of plants whose overtime status changes in 2006; again, we find a zero-employment effect for standard-time plants and a positive effect for overtime plants (where the average DiD effect for 2005/6 is equal to 0.111 (0.046)). Results are available on request.

6.2 Departures

In this section, we examine what happens to our basic DiD estimate when we stratify its effect in various directions. By way of example, it is interesting to see whether it makes a difference whether the plant is located in Western or Eastern Germany. We also stratify by whether there is a bargaining agreement and possible employment guarantee in the plant, we examine the effects of whether overtime plants have a small or large proportion of overtime workers, and we examine the effect of temporary contracts.

Our results are reported in Table 3. The first row simply summarizes our earlier results from Table 2, where for simplicity we focus on 2006 only.

In the next row, we run separate regressions for Western and Eastern Germany. If we look at overtime plants, the 'basic' result above of 0.158 splits out into 0.126 for Western German plants and 0.452 for Eastern German plants. The latter is very imprecisely estimated because there are only five treated plants, so the difference between 0.126 and 0.452 is insignificant.

However, when we stratify plants by whether there is a bargaining agreement in place, for overtime plants, the positive effect of 0.158 comes solely from the plants that apply a bargaining agreement, that is, 0.275. This does seem somewhat at odds with the view that increasingly powerful firms drive the increase in standard hours, but of course, unions are better off if there are more jobs for their members. The change in employment comes about through more hires and fewer separations. There is no effect for standard time plants. The data also record whether a plant has an employment guarantee (or 'Bündnisse für Arbeit'; see Section 2). However, these total just six treated plants (three of each type), so we do not learn anything from stratifying the regressions accordingly (which are therefore not reported in the table).

We now examine whether plants with proportionally more workers on temporary contracts are more easily able to increase employment compared with plants with proportionally more permanent workers. We stratify the sample into plants with some workers on fixed-term contracts and those with none. The results go in opposite directions, with standard-time plants being more flexible with more temporary workers (as expected). It is the opposite for overtime plants. However, in both cases, the differences are insignificant.

Finally, we examine whether the proportion of workers doing overtime within a plant has the same effect on employment as comparing overtime between plants. By construction, we can only do this for overtime plants. It turns out that the (positive) employment effect is bigger if the firm has fewer employees working overtime: the 'basic' result of 0.158 splits out to 0.235 if the share of overtime workers is less than one-half and 0.075 otherwise. Again, the difference is not significant.

To conclude this section, the number of treated plants is relatively small, which means that stratifying the data again delivers imprecise estimates. The one strong finding is that it is overtime plants with bargaining agreements where jobs are created.

Table 3 Departures

	Standard-time plants						Overtime plants					
	Treated						Treated					
	Yes	No	DiD	$\frac{N_{jt}}{N_j}$	$\frac{h_{jt}}{N_{jt}}$	$\frac{s_{jt}}{N_{jt}}$	Yes	No	DiD	$\frac{N_{jt}}{N_j}$	$\frac{h_{jt}}{N_{jt}}$	$\frac{s_{jt}}{N_{jt}}$
Original results[a]	68	1044	0.009	0.042	0.003	-0.039	43	864	0.158	0.038	0.009	-0.029
			(0.059)	(0.034)	(0.027)	(0.026)			(0.070)	(0.024)	(0.017)	(0.017)
Western Germany	51	387	-0.017	0.042	-0.057	-0.099	38	460	0.126	0.086	0.058	-0.028
			(0.077)	(0.075)	(0.086)	(0.081)			(0.065)	(0.062)	(0.069)	(0.058)
East Germany	17	657	0.023	0.057	0.166	0.109	5	404	0.452	0.565	0.490	-0.075
			(0.078)	(0.088)	(0.228)	(0.210)			(0.333)	(0.319)	(0.250)	(0.087)
Difference			0.041	0.015	0.223	0.208			0.326	0.480	0.432	-0.047
			(0.110)	(0.110)	(0.245)	(0.223)			(0.339)	(0.324)	(0.259)	(0.104)
No bargaining agreement	29	647	0.013	0.027	-0.091	-0.118	19	365	0.004	0.015	0.036	0.051
			(0.085)	(0.084)	(0.105)	(0.090)			(0.106)	(0.097)	(0.111)	(0.095)
Bargaining agreement	39	397	0.011	0.060	0.072	0.011	24	499	0.275	0.267	0.169	-0.098
			(0.083)	(0.079)	(0.129)	(0.122)			(0.092)	(0.091)	(0.089)	(0.051)
Difference			0.011	0.033	0.162	0.130			0.271	(0.282)	0.133	-0.149
			(0.083)	(0.108)	(0.166)	(0.144)			(0.140)	(0.129)	(0.138)	(0.106)
No fixed-term employees	52	809	-0.027	-0.013	-0.052	-0.039	22	449	0.229	0.222	0.112	-0.110
			(0.070)	(0.070)	(0.080)	(0.077)			(0.114)	(0.115)	(0.109)	(0.057)
Some fixed-term employees	16	234	0.130	0.218	0.188	-0.029	21	413	0.084	0.068	0.114	0.046
			(0.107)	(0.110)	(0.247)	(0.229)			(0.075)	(0.075)	(0.090)	(0.082)
Difference			0.157	0.231	0.240	0.009			-0.145	-0.154	0.002	0.156
			(0.128)	(0.126)	(0.260)	(0.238)			(0.137)	(0.135)	(0.139)	(0.100)
0 < overtime workers ~ 50%	0	0					21	502	0.235	0.211	0.181	-0.030
									(0.075)	(0.080)	(0.030)	(0.049)
> 50% overtime workers	0	0					22	355	0.075	0.080	0.030	-0.049
Difference									-0.160	-0.131	-0.150	-0.019
									(0.075)	(0.080)	(0.030)	(0.049)

[a]See the 2006 rows of Table 2.

6.3 Labour costs

In this subsection, we report what happens when we repeat our DiD estimations, but with the plant's labour costs as the dependent variable. We construct two versions: (i) the weekly cost of employing each full-time worker, averaged for each plant, and (ii) the same, but only averaging across full-time workers who remain in the plants throughout the six years. The latter we label as 'incumbents' in Table 4. We do this to control for hires and separations over the six years and to control for any compositional changes in a plant's workforce—such as gender composition, whether full-time or part-time, and so on—so that we get a cleaner measure of the cost of employing each worker.

The results show very clear evidence of wage concession. Irrespective of which method or plant type, weekly labour costs are unaffected by whether they are treated. Because standard hours H have increased for treated standard-time plants, this means that the hourly wage rate w must have fallen in these plants.

To see whether the wage rate has gone up or down in overtime plants, differentiate eq. (7) and set $dY = 0$, giving:

$$\frac{dw}{dH} = -\text{sgn}\ \gamma H_H - (\gamma - 1)]. \quad [$$

Empirical evidence convincingly suggests that H_H 0.8 (Andrews and Simmons, 2001) and γ is often said to be 1.5 (so-called time-and-half), and so $\frac{dw}{dH} < 0$. In other words, our regressions imply that there is wage concession in overtime plants as well standard-time plants.

In terms of the theory, for standard-time plants and their workers, the outcome is clear (Section 3.2). wH is the same for both treated and untreated plants, so profits for treated plants must have increased and at the same time per worker utility fell for their employees. This is perfectly consistent with the idea that German firms became more powerful in the sample period. The same basic story happens in overtime plants, but it is a bit more complicated as plants choose hours as well as employment. However, in these plants, we know that more union members have jobs, which partially offsets the fall in per worker utility.

7. Conclusion

In this article we estimate the effect of increasing standard hours on employment in Germany in the early 2000s. During this period many firms were able to negotiate increases in standard hours, including several prominent examples. This was and remains a contentious policy issue. Proponents of increased working time argue that it allows firms to increase competitiveness and hence protect jobs. Others disagree and argue that firms will substitute hours for jobs. This article is the first to provide econometric evidence on the employment effects of increasing standard hours. The increase in standard hours reversed earlier trends of working time reductions in Germany and elsewhere in Europe (so-called work sharing). We argue that the policies of increasing and reducing standard working time are not necessarily

Table 4 Difference-in-difference estimates of plant-averaged per worker weekly labour costs, standard-time and overtime plants separately

	Incumbents only			All		
	$\log Y^{C}_{t}$	$\log Y^{T}_{t}$	DiD[a]	$\log Y^{C}_{t}$	$\log Y^{T}_{t}$	DiD[a]
A: 940 standard-time plants (58 treated)						
2001	4.018	4.108		3.595	3.576	
2002	4.042	4.129	–0.004	3.602	3.593	0.007
			(0.006)			(0.021)
2003	4.059	4.141	–0.010	3.609	3.622	0.026
			(0.015)			(0.036)
2004	4.062	4.147	–0.006	3.575	3.578	0.023
			(0.019)			(0.051)
2005	4.064	4.145	–0.010	3.566	3.579	0.029
			(0.021)			(0.048)
2006	4.073	4.156	–0.007	3.566	3.581	0.038
			(0.022)			(0.049)
No. obs.	5.634	348	5,982	6,264	408	6,672
B: 847 overtime plants (43 treated)						
2001	4.281	4.444		3.988	4.163	
2002	4.305	4.472	0.003	4.007	4.218	0.029
			(0.008)			(0.023)
2003	4.328	4.507	0.015	4.018	4.199	0.000
			(0.010)			(0.033)
2004	4.337	4.517	0.017	4.018	4.191	–0.007
			(0.010)			(0.037)
2005	4.347	4.505	–0.007	4.018	4.184	–0.008
			(0.016)			(0.035)
2006	4.362	4.523	–0.003	4.038	4.198	–0.013
			(0.017)			(0.037)
No. obs.	5,082	258	5,340	5,184	258	5,442

Notes: See Table 2, notes a and b. DiDs are conditional, with same covariates as for employment regressions. 'Incumbents only' means that plant averaging only includes those full-time workers employed in all six years.

symmetric. Thus, earlier evidence on the effects of work sharing—which generally concluded that work sharing does not lead to employment increases and may even reduce employment—cannot necessarily be used to infer the employment effects of increased hours. This asymmetry is most likely to be relevant if negotiations over working time also include—in the case of working time reductions—wage compensation or—in the case of working time extensions—wage concessions.

Using a panel of German plants observed between 2001 and 2006, we investigate whether there was any significant change in employment for those plants where standard hours increased between 2002 and 2004, relative to a control group of plants that did not increase standard hours. We link this panel of plants to worker-level information, which enables us to examine whether workers in the treatment group experienced falls in hourly wages as their hours were increased. The use of

worker-level information also allows us to decompose changes in employment into hires and separations. This sheds light on whether negotiations over hours included employment guarantees which precluded layoffs.

We outline an established theoretical model which shows that we should expect a different impact on employment in plants that offer overtime and those that do not. Our results are consistent with the predictions of this model. Overtime plants that increased standard hours increased their employment significantly more than overtime plants that did not change standard hours. The effect is economically significant, with an elasticity of about 2.5. The increased employment in treated (relative to control) plants comes about due to increased hires rather than reduced separations, suggesting that the employment response was not merely the result of employment guarantees negotiated with the increased hours. For standard-time plants, there is no difference at all between plants that increase standard hours and those that did not. These results, for both types of plant, match the theory exactly, because for overtime plants scale and substitution effects of an increase in standard hours work in the same direction, whilst for standard-time plants they work in opposite directions.

We then test whether the positive employment effect is at least partly the result of wage concessions. Our results show clear evidence of wage concessions, because there is no significant effect of the treatment on weekly labour costs, so hourly labour costs must have fallen in the treated plants relative to the control plants.

The key issue in the interpretation of our results is that we identify the employment response from a change in standard hours which is negotiated by firms (as in Hunt, 1999) rather than imposed exogenously as a policy (as in Crépon and Kramarz, 2002). For our estimates to be interpreted as the causal impact of standard hours on employment, we require that plants do not respond to demand shocks by immediately increasing standard hours. This is likely to be the case because changes in standard hours typically require negotiation with workers or their representatives. Instead, the short-term response to changes in demand is to change employment or overtime. We also require that the employment trends of treated and control firms would have been the same in the absence of the change in hours. A comparison of pre-treatment trends supports this assumption.

Supplementary material

Supplementary material is available online at the OUP website.

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