HAS WORK-SHARING WORKED IN GERMANY?*

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Starting in 1985, (West) German unions began to reduce standard hours on an industry-by-industry basis, in an attempt to raise employment. Whether this "work-sharing" works is theoretically ambiguous. I exploit the cross-industry variation in standard hours reductions to examine their impact on actual hours worked, wages, and employment. Analysis of industry-level data suggests that "work-sharing" may have reduced employment in the period 1984–1994. Using individual data from the German Socio-Economic Panel, I substantiate the union claim of "full wage compensation:" the hourly wage rose enough to offset the decline in actual hours worked.

There is a widespread popular belief that unemployment can be reduced by reducing the number of hours worked per person. The reasoning is usually based on the idea that labor input is fixed, and it is thought that if each worker works fewer hours, this work can be spread over more workers, and employment will rise. This is known as work-sharing. However, if restrictions on hours make labor less attractive to employers, they will substitute to other inputs, and there will also be a scale effect reducing use of all inputs.

Interest in work-sharing resurfaces periodically in different countries, and has been particularly high in Europe in recent years, following the rise in unemployment since the mid-1970s. The tool of choice in Europe for the reduction of working hours is a reduction in the standard workweek: that is, a reduction in the number of hours beyond which an overtime premium must be paid. In the 1980s the French government mandated reductions in the standard workweek, and the Belgian government created incentives for employers to cut hours, while German unions have achieved more far-reaching reductions on an industry-by-industry basis. In 1998 the French government presented plans to legislate a reduction in standard hours from 39 to 35, while

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similar moves were made in Italy. In the United States mandated overtime premiums have been preferred as an inducement to work-sharing (the 50 percent premium is higher than typical premiums in Europe). The use of standard hours as an hours-reducing tool introduces further ambiguity into the theoretical problem, however, since employers have the option of shifting to using more overtime.

Most studies of reductions in standard hours have relied on aggregate time series, where the effect of falling standard hours could be confounded with the effect of another variable trending down.[1] In this paper I take advantage of the industry-level variation in standard hours reductions in (West) Germany to identify the impact on employment and other variables. The reductions, negotiated between unions and employers, began with the metalworking and printing sectors in 1985, where standard hours fell in steps from 40 to 36 between 1984 and 1994. Most other sectors had a smaller reduction beginning later, commonly in 1989. Since many of the reductions were agreed to several years in advance, and could not be amended in response to unforeseen economic changes, they are taken to be exogenous.

There appears to be a consensus in Germany that this episode of reductions in standard hours translated largely into reductions in actual hours per worker, although this has not been examined using micro-data.[2] There is less consensus on the joint movement of wages and standard hours, however, which is critical to the final impact on employment. On the one hand, unions claim to have achieved standard hours reduction with "full wage compensation," that is, no reduction in monthly pay, which suggests that hourly wages may have risen in affected industries relative to those with no standard hours reductions. On the other hand, observers including union observers suggest that standard hours reductions caused "wage restraint."[3] It is generally believed that employment rose, despite an almost total absence of econometric

1. Papers finding that employment rises when hours are cut include Hart and Sharot [1978], Faini and Schiantarelli [1985], Franz and König [1986], Wadhwani [1987], and deRegt [1988]. Studies finding falling employment or no effect include Brunello [1989], König and Pohlmeier [1989], and Lehment [1991]. Hart [1987] and Hart and Wilson [1988] use cross-section variation in hours, and find no effect.

2. For example, Stille and Zwiener [1987] believe that in the metalworking industry overtime rose by one-third of an hour in response to a one-hour fall in standard hours. This overtime response is larger than that calculated by the union or employer think tanks or by the central statistical agency.

3. Wage restraint is implied by the results of Lehment [1991], while the results of Franz and Smolny [1994] suggest hourly wages increased as a result of hours reductions.

evidence. For example, in the metalworking industry the economists of both the union and the employers' federation agree that work-sharing raised employment; they disagree only about the magnitude.

The theory makes clear that the more fully standard hours reductions translate into actual hours reductions, the more likely employment is to rise. Using data from the German Socio-Economic Panel for the period 1984–1994, I establish that for full-time Arbeiter (workers paid hourly) in manufacturing, actual hours fell by 0.88–1 hour in response to a one-hour fall in standard hours. I then examine wages (for all full-time workers), and find that workers in sectors achieving reductions in standard hours bargained sufficient increases in the straight-time hourly wage that their monthly pay fell little relative to other workers.

I use data on 30 manufacturing industries to look at employment directly for 1984–1994. My results do not provide the positive assessment of the employment effects of work-sharing found by much of the existing literature. Although the relevant coefficient is not significant in all specifications, the results suggest that reductions in standard hours caused employment losses among men. Thus, the workers benefiting from lower hours and higher hourly wages did so at the expense of others denied employment.

I. Hours Reductions in Germany

Unions in Germany bargain at the industry level, and conditions of union contracts apply not only to members, but to almost all other workers as well. Overtime premiums are part of a union's long-term agreement, and the basic premium in most industries is 25 percent. Annual hours may be reduced either by increasing vacation time or by reducing standard weekly hours. By 1975 the prevailing conditions for full-time workers were 40 hours per week and 30 days annual leave, and by 1981 95 percent of workers had a standard working week of 40 hours.[4] The giant metalworkers' union, IG Metall, which along with the printing union IG Druck had spearheaded earlier reductions in weekly hours, struck unsuccessfully in 1978–1979 to reduce standard weekly hours below 40. Other unions, such as IG Chemie, the chemical union, focused on reducing lifetime hours by reducing

4. *European Industrial Relations Review* [November 1983].

the retirement age. IG Metall resumed its demands in 1982–1983, and was successful after a protracted strike in early 1984. The declared aim of the hours reductions was a reduction in unemployment through work-sharing. Hours in the metalworking sector (employing almost four million workers) were reduced to 38.5 in 1985.

A key element of the agreement, upon which agreements in many other sectors were modeled, was the concession to employers of greater flexibility in the use of standard hours. In particular, standard hours no longer had to be spread evenly over each day of the week, and could in fact vary from week to week as long as they averaged to the agreed-upon number over a certain number of months.[5] Also, standard hours could vary across employees as long as they averaged to the agreed-upon number. It is important to note that the implementation of flexibility is a matter to be negotiated at the plant level between the management and the works council, and surveys have found that the majority of plants, particularly small plants, have not taken advantage of the flexibility provisions [Bosch et al. 1988; Promberger 1994].

A further issue to be resolved by management and works councils is the method of implementation of the reduced standard week. Some firms reduced hours on Thursdays and Fridays, some reduced the hours of each weekday by an equal amount, while others reduced hours by awarding workers days off. Bosch [1990] reports that, initially, capital-intensive industries preferred days off, while labor-intensive industries reduced weekly or daily hours. As the standard workweek fell further, however, the number of days off to be allocated became too great to be efficient, and the move to a reduction in daily hours (or a mixture of reduction in hours and days off) became more generalized.

Finally, certain union agreements recommended caps on overtime (or the compensation of some overtime with days off) to prevent the substitution of overtime hours for standard hours. This is again something to be implemented at the plant level by the works council and management, and is obviously potentially important for work-sharing. The reductions in standard hours

5. Under the old system, a worker working more than eight hours in any given day was entitled to overtime, as has been the case in California. Generally in the United States the 40 weekly hours may be spread in any way across the week with no obligation to pay overtime, and the new German agreements allow for even longer windows.

negotiated did not apply to part-time workers (the vast majority of whom work 30 hours per week or less).[6]

The agreement in the metalworking sector and the simultaneous agreement in the printing sector were followed by more and more manufacturing and service industries over the subsequent years. IG Metall itself in two later agreements negotiated further stepwise reductions in standard hours, which culminated in October 1995 in the 35-hour week. Average standard hours worked fell from 40.0 in 1984 to 38.8 in 1989 to 37.7 in 1994 [IAB]. In 1990 actual annual hours per worker were 10 percent lower in Germany than in the United States [Bell and Freeman 1995].

The agreements reached concerning standard hours often extend over a period of several years, involving stepwise falls in hours, while (monthly) wages typically continue to be renegotiated each year. In most cases the unions announced that they had achieved their aim of "full wage compensation," which would appear to imply a rise in hourly wages. It is not clear how to measure the success of "full wage compensation," however. At a minimum it presumably means that nominal monthly earnings (without overtime) did not fall (and inflation was low in the 1980s). Survey evidence from 1989 shows only 10 percent of German workers desiring to work fewer hours and earn correspondingly less money [Bell and Freeman 1995]. Real wages were rising steadily, however, and monthly earnings, and hence possibly hourly wages, might have fallen relative to those in sectors without falls in standard hours.

II. Theory

The effect of standard hours on employment and actual hours is ambiguous, as may be demonstrated in a simple static labor demand model. Consider a firm taking standard hours (h_s), hourly wages (w), and the rental rate of capital (r) as given, and choosing actual hours per worker (h), employment (N), and capital (K) in the presence of fixed costs of employment (f), and an overtime premium (p):

$$(1) \qquad \max_{h,N,K} g(h,N,K) - whN - fN - pw(h - h_s)N - rK.$$

6. A large literature documents the implementation of standard hours reductions. See, for example, Bosch [1990], Bosch et al. [1988], Bosch and Lehndorff [n.d.], *European Industrial Relations Review* [various issues], Stille [1995], and *WSI-Mitteilungen* [various issues].

Assume that this firm chooses nonzero overtime hours ($h^* > h_s$), due to a high fixed cost of employment f. Consider now an exogenous reduction in standard hours, which due to the overtime premium increases labor costs. There will be a scale effect, tending to reduce employment and hours per week, and a substitution effect from labor services to capital. Worker-hours thus fall unambiguously. Substitution between hours per worker and workers is made clearer by considering the marginal cost of hiring an additional worker for h^* hours (MC_N) and the marginal cost of h^* additional hours work by existing workers (MC_h):

$$MC_N = wh^* + f + pw(h^* - h_s)$$
$$MC_h = (1 + p)wh^*. \tag{2}$$

Clearly, the marginal cost of additional overtime is unaffected by standard hours (and is determined only by the wage and the overtime premium), while the marginal cost of an additional worker is increased when standard hours are reduced, since more of this worker's wages must be paid at the overtime premium. Hence, the firm will substitute from workers to hours, an effect that obviously tends to decrease employment. Figure I shows the two marginal cost schedules for original standard hours h_s^0 and reduced standard hours h_s^1. This case is that of a firm originally having optimal hours such as h_*^a. Employment will therefore fall, and the effect on weekly hours depends upon whether the scale effect and substitution from labor to capital dominates the substitution from workers to hours. If firing costs make a rapid fall in employment expensive, this fall could take place gradually.

Figure I makes clear, however, that the original optimal hours (and the magnitude of the standard hours reduction) are critical for the response of the firm along the worker-hours margin. Consider a firm whose optimal hours are below even the new standard hours, at h_*^b. Assume that the law constrains hours to be at least standard hours: German firms can only put full-time staff on hours below standard hours ("short-time") temporarily, and after convincing a government office that they are experiencing a downturn. This firm will move its actual hours from the original kink point h_s^0 to the new kink point h_s^1. MC_h has thus not changed, while MC_N has fallen, and the firm will substitute from hours to workers, the opposite of the previous case. The scale effect and the capital-labor substitution effect will work to in-

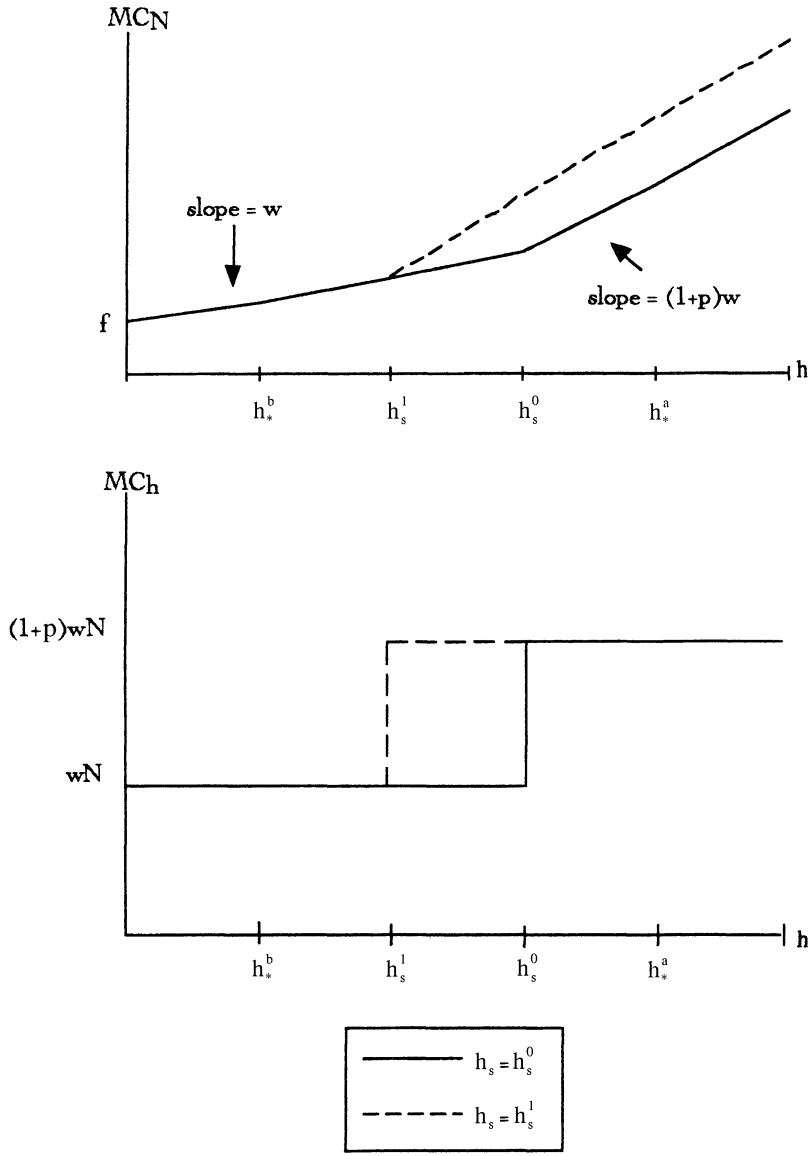

FIGURE I
Marginal Costs of an Additional Worker (MC_N) and of an Additional Hour of Work (MC_h) Plotted against Hours of Work (h)

crease employment. The overall effect is that hours will fall, while employment will rise.

There are a large number of other possible cases based on Figure I. Also, if the overtime premium rises with overtime, for example if overtime spills into the weekend when German overtime premiums are higher, the effects of standard hours reductions are ambiguous for a firm using overtime. It is clear that in general if employment is to rise, there must be a large substitution from hours to workers.[7]

Notice from equations (1) and (2) that if the fixed cost of a worker (f) is endogenous, firms may neutralize the effect of a standard hours reduction by reducing f. Since there were no reductions in benefits or other fixed costs of employment in Germany in the period of interest, this possibility is not considered.

Germany's standard hour reductions took place through union bargaining rather than through legislation, but adding a union to a model while keeping the wage exogenous does not change the intuition. What is more complicated is to endogenize the wage, as Calmfors [1985], Hoel [1987], and Houpis [1993] do in a monopoly union context.[8] If the reduction in hours brings hours closer to the workers' optimum, the value of the additional leisure may allow the wage to fall, although the result is ambiguous. (Forces working to raise the hourly wage include the fact that lower monthly income reduces the disutility of unemployment.) Calmfors [1985] is the only paper to consider an endogenous change in standard hours: if a recessionary shock shifts labor demand in, the effect on optimal wages and working time is ambiguous.

The effect of a wage increase alone is to cause a substitution from hours to workers due to the fixed cost of hiring a worker.[9] The net effect on hours per worker is therefore negative, and on employment is ambiguous, although we would usually expect the

7. See Hart [1987], König and Pohlmeier [1988], and Freeman [1998] for theoretical analysis of this type.

8. See also Booth and Ravallion [1993] and Booth and Schiantarelli [1987].

9. To see this, write the ratio of the marginal costs, and take the derivative of this with respect to the wage:

$$\frac{\partial(MC_N/MC_h)}{\partial w} = \frac{1}{(1+p)^2 w^2 N^2} \cdot ([h + p(h - h_s)](1+p)wN - [wH + f + pw(h - h_s)](1+p)N).$$

This is less than zero if $f > 0$.

scale effect and substitution to capital to predominate and lower employment. Worker-hours will fall.

It is important to bear in mind that the overt concession in exchange for shorter standard hours on the part of German unions was the introduction of greater flexibility. Presumably flexibility has a positive scale effect, but it may be complementary with capital, and its effect on the trade-off between workers and hours must be examined in a more complex model. Finally, it is possible that individuals are more productive when they work fewer hours. Lowering actual hours is thus equivalent to capital-saving technological progress. This has an ambiguous effect on the already ambiguous employment response, but should lead to a larger fall (or lower rise) in actual hours. Worker-hours fall.

III. Data

For analysis of actual hours and wages, the principal data used are the individual-level German Socio-Economic Panel (GSOEP) for the years 1984–1994, which include self-reported standard hours. Data aggregated to the industry level from the much larger Mikrozensus cross-section survey of individuals are used for analyzing employment effects. The two Mikrozensus samples used are a panel of 10 manufacturing industries for 1984–1994, and a panel of 30 manufacturing industries for 1982 and odd years from 1985 to 1993. Standard hours by very detailed industry (more than 200) are obtained from tables supplied by the WSI (Wirtschafts- und Sozialwissenschaftliches Institut des Deutschen Gewerkschaftbundes) [Hans-Böckler-Stiftung 1995].[10] Standard hours are not so easily computed for services as for manufacturing, due to the much larger number of contracts negotiated, which is the reason for the focus on manufacturing in the analysis of Mikrozensus data. Some additional data on wage indices and standard hours in manufacturing are obtained from the Statistisches Bundesamt.

To examine the response of actual hours per worker in the GSOEP, I take advantage of several questions pertaining to the respondent's main job, especially: "What are your collectively bargained weekly work hours without overtime?" and "What is on average your actual work time including any overtime [hours per

10. In certain industries where standard hours vary by region, the average across regions (weighted by employment) is computed.

week]?" In years other than 1984, 1985, and 1987, these questions were followed by the question: "In the last month: did you work overtime, and if so, how much [hours]?" Notice that in addition to asking about monthly rather than weekly hours, this question specifically asks about the previous month, rather than about what happens on average. Average overtime as reported on this question agrees closely with published aggregate data [IAB], while overtime as calculated by the difference between actual and standard hours (where positive) is considerably higher. The survey does not ask enough about short-time for the responses to be very useful. Respondents reporting actual hours below standard hours ("undertime") do not in most cases appear to be reporting compensated short-time, but may be reporting sick time, or uncompensated hours lost due to short-time work.

The fact that some workers receive their standard hours reduction or overtime compensation in the form of days off would not matter if they accurately reported actual hours from, for example, the survey week. Those workers with their days off in that week would average with those working more than standard hours in that week. Unfortunately, the question about actual hours refers to an "average" week, while the question about "last month" specifies overtime, rather than actual hours, and will obviously not elicit negative responses. Since workers may not think of a week with days off as an average week and since monthly overtime cannot be negative, it is possible that both reported actual hours and actual hours calculated as standard hours plus reported overtime are overestimates.[11] If the trend is toward more compensation with days off for those with falling standard hours, my result will be biased toward finding a shift to overtime and increased actual hours. (I do not see evidence of this in the data, however.) Since such a large proportion of salaried workers (Angestellten) get at least partial payment in days off (52 percent) or are unpaid (28 percent), I emphasize hourly-paid workers (Arbeiter) in my hours analysis. A large but falling majority of Arbeiter in manufacturing are (only) paid for overtime, while only about half of Arbeiter in services receive compensation exclusively in the form of monetary payment.

The GSOEP wage variable used is earnings on main job in the previous month, without bonuses (common bonuses are thirteenth month salary, holiday money, etc.). The only other wage

11. It is also unclear what workers who are on strike respond to the questions.

information available concerns monthly earnings in the previous year.

The sample of workers drawn from the GSOEP is as follows. I wish to focus on full-time workers, and hence drop respondents who said they had less than 35 standard hours. I also drop workers who said their standard hours were greater than 45, to remove the most obvious outliers (standard hours for all included industries were 40 or less throughout the sample period). I drop workers in fishing, agriculture, or private households, and the self-employed, for whom standard hours are not well-defined. I drop workers aged 55 or over, since during the period under consideration special agreements were reached in some industries to reduce the hours of older workers below those of others in the same industry or to allow early retirement. I also drop those doing apprenticeships and those under age 20, although they could arguably be included. Finally, I drop those with missing actual or standard (agreed-upon) hours, industry, firm size, job type (self-employed, salaried, etc.), or education. Note that in only 0.7 percent of the sample observations do individuals reporting standard hours above 35 claim to be other than full-time.

Means and standard deviations of the GSOEP variables used are shown in Appendix 1. Figure II shows the dramatic transformation in standard and actual hours for Arbeiter (hourly-paid workers) in manufacturing and construction in the sample, between 1984 and 1994.[12] In 1984 standard hours were almost universally 40 per week, while by 1994 less than 20 percent of workers had a standard 40-hour week. Actual hours also have a huge shift down from 40 hours.

The analysis of employment effects is completed with the industry-level data from the Mikrozensus. The Mikrozensus is taken in the spring each year, although unfortunately not always in the same month. Employment by sex for the nonself-employed is published annually for ten manufacturing industries. I have obtained more detailed data on employment and hours, but these data are not released for all years. The detailed data have employment by job type-sex-hours-industry cells. Examples of job type are hourly paid, salaried, and civil servant. There are 30 manufacturing industries available after four small industries for whom no standard hours contract was identified were dropped,

12. The sample weights are used to create the figures. The GSOEP oversamples foreigners, who work less overtime than Germans.

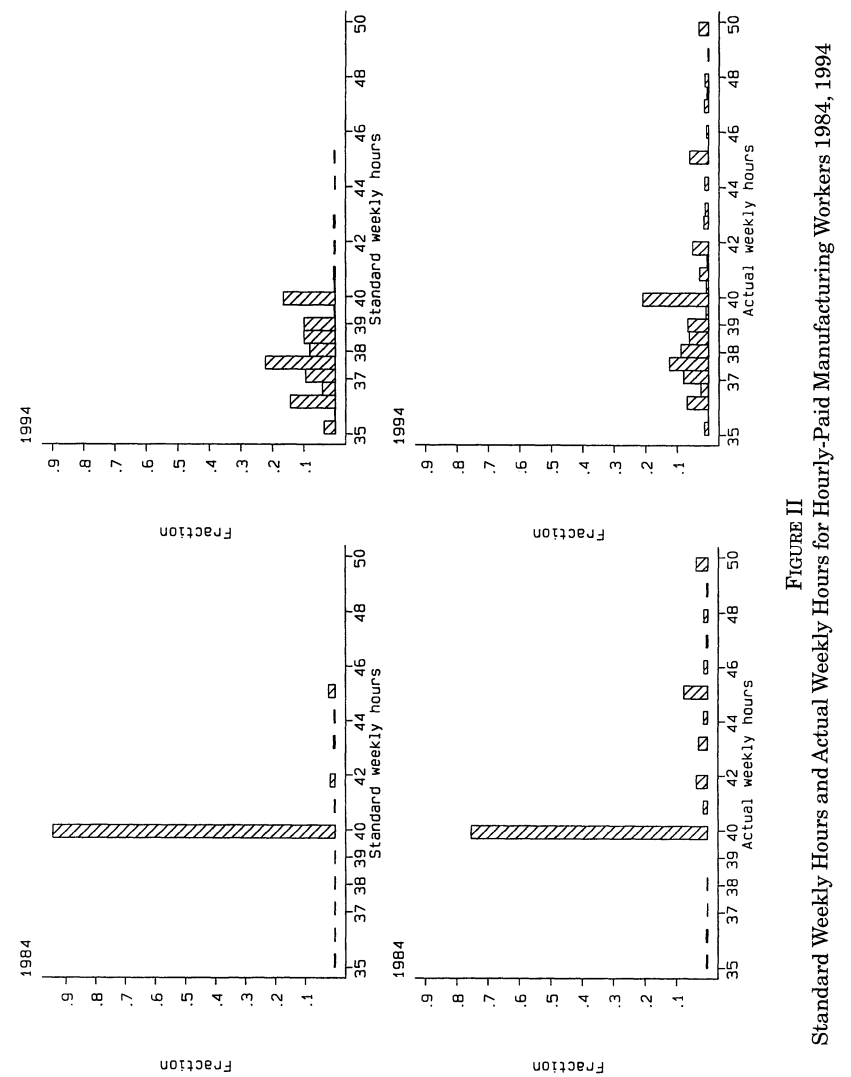

FIGURE II
Standard Weekly Hours and Actual Weekly Hours for Hourly-Paid Manufacturing Workers 1984, 1994

and a fifth small industry that was an outlier driving the unweighted regressions was also dropped.

Two weekly hours variables are available: one is actual hours worked in the survey week, but the results of this question have not been made available since 1987, which limits its usefulness. The second is "normal" weekly hours: respondents are directed to report deviations from standard hours caused by regular overtime or short-time, but not unusual deviations due to overtime or such reasons as vacation and sickness. The answers to these questions are made available in categories, which become more detailed as the years progress. I aggregate later categories to be compatible with the earlier ones, and assign either the midpoint of the category or the average hours reported by GSOEP respondents of that job type and year who reported actual hours in the relevant range. The categories relevant for full-time workers' normal weekly hours are 36–39, 40, 41–42, 43–45, etc.

The principal measure of standard hours used, obtained from the WSI tables, is averaged up to the level of the 30 industries, weighting by 1984 employment in the subindustries as given by Statistisches Bundesamt data.[13] I drop civil servants and the self-employed from the analysis, but include apprentices. The two other variables used from the Statistisches Bundesamt, standard hours and wage indices, have industry categories of a similar aggregation level to the Mikrozensus 30, and hence are matched with more error. The index of bargained monthly wages, rather than actual monthly wages, is used as a covariate, as it is more exogenous: firms can and do pay more than the bargained wage, but they cannot pay less. Also, actual wages are affected by hours worked, which is one of the outcomes of interest. I use the index for hourly-paid employees throughout, as it has a 0.99 correlation with the index for salaried employees in every industry.

Appendices 2 and 3 provide unweighted means and standard deviations for the two levels of aggregation used. They also report the median individual-level observations per industry (0.7 times the employment in hundreds). The data for the 30 industries have enough observations for men or hourly-paid workers to be exam-

13. An earlier version of this paper used the Statistisches Bundesamt data exclusively, since a larger number of industries are available. These data suffered from missing values, particularly in later years, and from the exclusion of workers at firms with less than twenty employees. I therefore decided to turn to the Mikrozensus data, and use the Statistisches Bundesamt data only in computing weighted averages of standard hours for the more aggregated Mikrozensus industry categories. The Mikrozensus results are much more robust to specification changes than the Statistisches Bundesamt results.

ined separately, but not enough for women or salaried workers to be examined separately with confidence, although some results are reported nonetheless.

IV. Hours Results from the GSOEP

Results were generally found to differ quite a bit between manufacturing and construction, on the one hand, and services on the other, so analysis is conducted separately for the two sectors. All regressions include year dummies, but industry dummies are not included in the fixed effects specifications, where these were generally jointly insignificant and never affected the coefficient of interest. The first set of results, for manufacturing and construction, is shown in the upper panel of Table I, where the dependent variable is actual hours worked on average in a week, and the main independent variable of interest is "agreed-upon" or standard hours per week as reported by the respondent. A coefficient of 1 on standard hours implies no shifting to overtime, while a coefficient of 0 implies full shifting to overtime. The regressions include year dummies, which control partially for the business cycle and for other trends in overtime.

The first two columns perform random and fixed effects (random effects allows for correlation of the error term within individuals, while fixed effects includes dummies for each individual). The coefficient on standard hours in the preferred fixed effects specification is 0.88 and significantly different from 1. As was discussed above, the use of days off as compensation for overtime when standard hours are reduced could bias the coefficient toward zero. Bias toward zero due to classical measurement error in standard hours may be remedied by instrumenting standard hours as reported by the respondent with standard hours for the industry in the month of the interview as obtained from published sources (WSI). Because the GSOEP aggregates industries (there are only twelve categories for manufacturing and construction), the published hours used to instrument are an average (weighted by employment from the Statistisches Bundesamt) of standard hours in the subindustries. The third (FE IV) column in Table I does this for fixed effects. The point estimate of the coefficient on standard hours rises to 1.14, but the standard error is very large (although the coefficient is significantly different from zero).

The correlation between the published and reported standard

TABLE I
ACTUAL HOURS EFFECTS OF STANDARD HOURS GSOEP DATA 1984–1994
(STANDARD ERRORS ARE IN PARENTHESES.)

	Reported actual hours			$P(OT > 0)$	$P(UT > 0)$	OT
	RE	FE	FE IV	FE (OLS)	FE (OLS)	FF
A. Manufacturing and construction						
Standard hours h_s	0.96	0.88	1.14	−0.029	0.006	0.08
	(0.04)	(0.05)	(0.31)	(0.004)	(0.001)	(0.08)
Year dummies?	yes	yes	yes	yes	yes	yes
Other covariates?	yes	no	no	no	no	no
Hausman (p-value)	0.00					0.11
Observations			14947			4867
Individuals			3261			1818
B. Services						
Standard hours h_s	0.91	0.74	0.87	−0.017	0.004	−0.38
	(0.09)	(0.11)	(0.34)	(0.007)	(0.003)	(0.16)
Year dummies?	yes	yes	yes	yes	yes	yes
Other covariates?	yes	no	no	no	no	no
Hausman (p-value)	0.00					0.02
Observations			3243			1154
Individuals			1125			535

a. Workers paid hourly (Arbeiter).
b. Overtime OT = reported actual hours-standard hours if positive, zero otherwise.
c. Undertime UT = standard hours-reported actual hours if positive, zero otherwise.
d. RE refers to random effects; FE to fixed effects.
e. Excluded instrument for IV is published standard hours in industry and month of interview (for manufacturing) and average response of Arbeiter in that industry and year (services).
f. Random effects specifications include controls for education, nationality, gender, age, firm size, and industry.
g. The p-value is reported for the Hausman test of the null hypothesis that the individual effects are uncorrelated with the covariates (i.e., that random effects is appropriate).

hours is only 0.52. Reasons for differences in addition to measurement error in the respondent variable include the following: the fact that in some industries standard hours only have to average to the agreed-upon standard hours across employees, that I have imputed some interview months, that the aggregation of industries in the GSOEP means published hours is a weighted average of sometimes different standard hours, and that there is considerable noise in the GSOEP industry variable. More generally, standard hours reported in the GSOEP appear to lag behind the published hours, which might indicate delay in implementing the

agreements at the firm level. German observers believe such delays have been occurring.[14] If published hours are entered directly instead of as an instrument, the coefficient is only 0.55, but if the lag of published hours is added, the sum of the two coefficients is close to one (these results are not shown). This suggests that the lag should be included in the industry-level analysis below.

The remaining columns of Table I analyze directly the incidence and length of overtime and undertime (actual hours below standard hours). The fourth column—$P(OT > 0)$—uses a linear probability regression to examine the probability of a respondent reporting actual hours greater than standard hours. The coefficient on standard hours is significant and negative, indicating a shift toward overtime use when standard hours are reduced. The magnitude of the coefficient implies that a one-hour fall in standard hours raises the probability of overtime by 3 percent.[15] The column headed "OT" indicates that standard hours do not significantly affect the length of overtime, conditional on overtime being positive. The coefficient of 0.006 in the $P(UT > 0)$ column implies that a one-hour reduction in standard hours would reduce the probability of reported actual hours being lower than standard hours by 0.6 percent. In regressions not reported, the length of undertime conditional on undertime being nonzero was not significantly affected by standard hours.

The lower panel of Table I analyzes the service sector. The coefficient on standard hours in the fixed effects specification is 0.74, lower than for manufacturing, and possibly due to greater measurement error (as inspection of the data suggests). The third column of this panel instruments standard hours with the average response of hourly-paid respondents in the same industry and year (the correlation is 0.3). Again the main effect of instrumenting is to increase the standard error. The problem with this instrument may be that the large number of service categories means some have very few workers in them in a given year, and hence averaging does not reduce measurement error much.[16] The

14. Personal communication with Gerhart Bosch, 1997.

15. An earlier version of the paper used a fixed-effects conditional logit for 1984–1989 data and found very similar results.

16. The alternative obviously is to instrument as for manufacturing with (WSI) published standard hours. The difficulty is that the bargaining units in services are much smaller, and have a greater tendency to bargain separately by region, so it is difficult to match published hours with the individual data. The Statistisches Bundesamt data on standard hours covers only manufacturing.

columns examining overtime and undertime directly suggest more frequent use of shorter overtime spells, and no effect on undertime. In results not reported, if the sample was enlarged to include those reporting standard hours above 45 hours, the fixed effects coefficient on standard hours in the actual hours equation fell by 0.1 for manufacturing and 0.2 for services (which has two-thirds of the outliers). I attribute this to the addition of measurement error.

The results of Table I may be checked by using the responses to the direct question about monthly overtime. A second measure of actual weekly hours is constructed by adding standard hours and reported overtime hours in the previous month divided by 4.33. The bias on the uninstrumented coefficient on standard hours in this case is unclear: classical measurement error in this case biases the coefficient toward one, since the measurement error is also added to the independent variable. However, the fact that the overtime variable has no negative responses may introduce a bias toward zero as discussed above. Table II presents results for manufacturing of regressions run for the years 1986 and 1988–1994, the years for which monthly overtime is available. The top panel of the table reruns the regressions of Table I using reported actual hours for the subset of years, as a basis for comparison, while the lower panel reports results for these regressions using the actual hours variable constructed from monthly overtime. The results of the top panel are similar to those found for all years in Table I.

The uninstrumented fixed and random effects results in the lower panel indicate coefficients very close to one, possibly due to the upward bias of the classical measurement error (although these coefficients are not significantly different from those in the upper panel). Instrumenting in the following column lowers the point estimate, but the large standard error means it is still not significantly different from one. The linear probability regression for the probability of reporting overtime yields an insignificant coefficient on standard hours, and likewise for fixed effects estimation of the length of overtime (conditional on overtime being positive) in the final column. Thus, the results of this panel do not point to any shift to overtime, unlike the results of Table I. The equivalent regressions have all been run for services, and again there is no evidence of shifting toward overtime (these results are available from the author).

TABLE II
ACTUAL HOURS EFFECTS OF STANDARD HOURS IN MANUFACTURING AND CONSTRUCTION GSOEP DATA 1986, 1988–1994
(STANDARD ERRORS ARE ARE IN PARENTHESES.)

A. Analysis based on reported actual hours

	Reported actual hours			$P(OT > 0)$	OT
	RE[f]	FE	FE IV	FE (OLS)	FE
Standard hours h_s	0.93	0.84	1.08	−0.033	0.00
	(0.04)	(0.05)	(0.54)	(0.004)	(0.09)
Hausman (p-value)	0.00				0.00
Observations	10275				3682
Individuals	2609				1524

B. Analysis based on monthly overtime (OT^M)

	Constructed actual hours			$P(OT^M > 0)$	$OT^M/4.33$
	RE	*FE*	*FE IV*	*FE* logit	*FE*
Standard hours h_s	1.02	0.98	0.65	−0.002	−0.06
	(0.02)	(0.03)	(0.32)	(0.004)	(0.07)
Hausman (p-value)	0.00				0.10
Observations	10275				336
Individuals	2609				1447

a. Workers paid hourly (Arbeiter).
b. Overtime OT = reported actual hours-standard hours if positive, zero otherwise.
c. Constructed actual hours = standard hours + reported monthly overtime/4.33.
d. RE refers to random effects; FE to fixed effects.
e. Excluded instrument for IV is published standard hours in industry and month of interview.
f. Random effects specifications include controls for education, nationality, gender, age, firm size, and industry. All specifications include year dummies.
g. The p-value is reported for the Hausman test of the null hypothesis that the individual effects are uncorrelated with the covariates (i.e., that random effects is appropriate).

The analysis has yielded qualitatively different results for manufacturing depending upon whether it was based on reported actual hours, which indicated shifting to overtime and from undertime, or reported overtime in the previous month, which showed no shifting, but quantitatively the difference is not large: a one-hour reduction in standard hours reduces actual hours by between 0.88 and 1 hour. Unreported analysis of men and women separately yields results that are not statistically different, but the point estimates are larger for women in both manufacturing

and services, as would be expected given that women work less overtime.

The results for salaried workers (Angestellten) are not reported, as the hours variables are considered too unreliable, but for manufacturing the fixed and random effects regressions suggest more shifting toward overtime than for hourly-paid workers (Arbeiter), when analysis is based on reported actual hours. Otherwise, results are similar to those for hourly-paid workers. For a sample of hourly-paid workers with weekly hours below 35, published industry standard hours have an insignificant effect on reported actual hours, as expected (these results are not shown).

V. Wage Results from the GSOEP

If a measure of hourly straight-time wages were available, the approach would simply be to add standard hours as a regressor to fixed and random effects wage regressions. This approach does oversimplify the problem: while in some years standard hours are predetermined and only wages are endogenous, in many years wages and hours are jointly determined, and furthermore there may be timing issues involved, such as the wage bargaining anticipating future reductions in standard hours. Nevertheless, such an approach will pick up the broad correlation between changes in wages and changes in standard hours even if causality is not implied and fine details of timing are overlooked.

The difficulty addressed here is therefore simply that the wage measure available is monthly and includes possible overtime (OT_M) and undertime (UT_M). Denote w as the straight-time hourly wage, and w_M as the monthly wage including overtime and undertime. p is the overtime premium, and h_s is the weekly standard hours. The straight-time hourly wage is modeled as

$$\log(w) = \alpha + \beta X + \gamma h_s + \epsilon \tag{3}$$

(with i,t subscripts and modeling of the error suppressed for simplicity), while the monthly wage is defined as

$$w_M = w(4.33h_s + (1 + p)OT_M - UT_M). \tag{4}$$

The log of the monthly wage may thus be written as

$$
\begin{aligned}
(5) \qquad \log(w_M) &= \alpha + \beta X + \gamma h_s + \epsilon \\
&\quad + \log(4.33h_s) + (1+p)OT_M - UT_M) \\
&= \alpha + \beta X + \gamma h_s + \epsilon + \log(4.33h_s) \\
&\quad + \log\left(1 + \frac{(1+p)OT_M}{4.33h_s} - \frac{UT_M}{4.33h_s}\right) \\
&\approx \alpha' + \beta X + \gamma h_s + \log(h_s) + \frac{1+p}{4.33}\frac{OT_M}{h_s} \\
&\quad - \frac{1}{4.33}\frac{UT_M}{h_s} + \epsilon,
\end{aligned}
$$

where the approximation $\log(1+x) \approx x$ for small x has been used, which assumes that monthly overtime and undertime are small compared with monthly standard hours.

The coefficient of interest is of course γ. Although we know monthly overtime for most years, we do not have a corresponding measure of monthly undertime. One possibility is to estimate equation (5) without the term for undertime, hoping that its omission does not bias γ. A second possibility is to use the weekly measures of overtime and undertime (based on reported actual hours) and assume that multiplying by 4.33 yields monthly overtime and undertime (which is likely to overstate both). The coefficients on $\log(h_s)$ and (where included) UT/h_s are restricted to be 1 and -1, respectively. p is restricted to be 0.25, the most common overtime premium, but imposing this restriction hardly affects γ. Year, industry, and firm size dummies are also included as covariates.

Table III presents results using the monthly measure of overtime, omitting any measure of undertime. There are fewer observations than in the corresponding regressions in the hours section due to missing values in the wage variable. The results for fixed effects are presented: random effects produced extremely similar coefficients on standard hours, and were rejected by the Hausman tests. The results show that a one-hour fall in standard hours was associated with a significant relative rise in the straight-time hourly wage of between 2 percent and 2.4 percent.

Table IV, where overtime and undertime are based on reported actual hours, show significant negative coefficients of smaller magnitude. Imposing a coefficient of -1 on the undertime

TABLE III
WAGE EFFECTS OF ACTUAL HOURS BASED ON REPORTED MONTHLY OVERTIME (OT^M)
GSOEP DATA 1986, 1988–1994

	Arbeiter (paid hourly)		Angestellten (salaried)	
	Manufacturing	Services	Manufacturing	Services
Standard hours h_s	−0.022	−0.024	−0.020	−0.020
	(0.002)	(0.004)	(0.003)	(0.003)
log (h_s)	1	1	1	1
$OT^M/(4.33*h_s)$	1.25	1.25	1.25	1.25
$UT^M/(4.33*h_s)$	—	—	—	—
Year, industry, and firm size dummies?	yes	yes	yes	yes
Industry dummies zero? (p-value)	0.02	0.21	0.00	0.00
Hausman (p-value)	0.00	0.00	0.00	0.00
Observations	9579	2009	2975	5446
Individuals	2522	798	933	1742

a. The dependent variable is log of gross earnings in the previous month on main job.
b. Estimation is by fixed effects.
c. Manufacturing includes construction.
d. If no standard error is reported, the value of the coefficient has been imposed.
e. The Hausman test refers to a random effects specification including all those covariates included in random effects regressions in earlier tables.

ratio variable has an important effect on the coefficient on standard hours: when the overtime and undertime ratio variables are left unrestricted, the undertime ratio is insignificant, and the coefficients and standard errors on standard hours are very similar to those in Table III. Undertime therefore does not seem to capture what was intended, and the results of Table III are preferred.

These results agree with those found by Franz and Smolny [1994] in their industry-by-industry time-series, and accord with the claims of the unions. A one-hour fall in standard hours from 39 or 38 hours represents a 2.6 percent fall, while Table III suggests straight-time hourly wages rose 2–2.4 percent. So monthly pay for an individual not working overtime remained close to the same after a reduction in hours, compared with individuals in industries with constant hours. Results not reported provide further support: log monthly wages are regressed on standard hours and year dummies for 1984–1994, without attempting to adjust for hours and overtime. As expected, the coefficients on standard

TABLE IV
WAGE EFFECTS OF STANDARD HOURS WITH OVERTIME FROM REPORTED ACTUAL HOURS GSOEP DATA 1984–1994
(STANDARD ERRORS ARE IN PARENTHESES.)

	Arbeiter (paid hourly)		Angestellten (salaried)	
	Manufacturing	Services	Manufacturing	Services
Standard hours h_s	−0.018	−0.012	−0.013	−0.020
	(0.002)	(0.005)	(0.004)	(0.003)
log (h_s)	1	1	1	1
OT/h_s	1.25	1.25	1.25	1.25
UT/h_s	−1	−1	−1	−1
Year, industry, and firm size dummies?	yes	yes	yes	yes
Industry dummies zero? (p-value)	0.03	0.07	0.00	0.00
Hausman (p-value)	0.00	0.00	0.00	0.00
Observations	13858	3009	4103	7457
Individuals	3162	1066	1119	2060

a. The dependent variable is log of gross earnings in the previous month on main job.
b. Estimation is by fixed effects.
c. Manufacturing includes construction.
d. Overtime OT = reported actual hours-standard hours if positive, zero otherwise.
e. Undertime UT = standard hours-reported actual hours if positive, zero otherwise.
f. If no standard error is reported, the value of the coefficient has been imposed.
g. The Hausman test refers to a random effects specification including all those covariates included in random effects regressions in earlier tables.

hours are small (between −0.004 and 0.002) and insignificant, indicating that monthly pay was little affected by standard hours.

VI. EMPLOYMENT AND HOURS RESULTS FROM INDUSTRY DATA

I used a fixed-effects estimation approach to assess the effect of standard hours on employment or normal hours. The specification with the most covariates has the form,

$$(6)\quad \ln y_{it} = u_i + \nu_t + \beta_{1i}t + \beta_2 h_{s_{it}} + \beta_3 h_{s_{it-1}} + \beta_4 \ln w_{it-1} + \epsilon_{it},$$

where i indexes industry and y indicates employment or normal weekly hours. The equation thus includes industry fixed effects (u_i), year dummies (ν_t), industry-specific trends (t), standard hours from the WSI tables (h_s) and its one-year lag, and the log of the nominal bargained wage lagged one quarter ($\ln w_{it-1}$). Since there is likely to be some measurement error in my matching of the union contracts with industries, I also present regressions

where the WSI standard hours and its lag are instrumented with the measure in the Statistisches Bundesamt data and its lag, to avoid bias. The two measures are highly correlated. There is evidence of heteroskedasticity in the regressions, so in some specifications I weight using industry employment. For unweighted regressions I report robust standard errors.

My preferred specification does not include the wage, since the determination of the wage is part of the work-sharing outcome that we are studying. Since wages increased, controlling for the wage should make work-sharing appear more beneficial, and in principle allow analysis of what the effects of work-sharing would have been if wages had remained the same.

The aggregated (ten-industry) data on employment are published for men and women separately, and since the results differ somewhat by sex, men and women are analyzed separately as well as together. Since men and women work in very different occupations, this difference is not implausible. Table V presents the results for men and women together, beginning in column (1) with a specification including only standard hours, year dummies, and industry fixed effects. The sum of the coefficients on standard hours suggests that in steady state, reducing standard hours by one hour decreases employment by 3.8 percent, but this is not significant. Including industry-specific trends in column (2) reduces the standard error, but the coefficient remains insignificant. Instrumenting in column (3) changes little, while weighting in column (4) reduces the coefficient sum. The addition of the wage to the covariates in column (5) reduces the coefficient sum, as expected.

Table VI presents the instrumental variables results for men and women separately. For the men the unweighted specification (column (1)) indicates that a one-hour reduction in standard hours reduces employment by a statistically significant 6.1 percent. Weighting (column (2)) reduces the point estimate so it becomes insignificant, however. These two point estimates are rather too large to be plausible, although the coefficients are not measured precisely. Adding the wage to the covariates (column (3)) further reduces the sum of the coefficients. The coefficient sums for women (columns (4)–(6)) are all insignificant. It is worth noting, however, that weighting flips the sign from positive to negative.

I turn now to analysis of the panel of 30 more detailed industries. Although the number of industries is three times as large here, the number of years has been halved. I first check

TABLE V
EMPLOYMENT EFFECTS OF STANDARD HOURS
AGGREGATE MIKROZENSUS DATA (TEN INDUSTRIES)
(STANDARD ERRORS ARE IN PARENTHESES.)

	(1) OLS	(2) OLS	(3) IV	(4) IV weight	(5) IV weight
Standard hours$_t$	0.054	0.007	0.051	0.056	0.048
	(0.046)	(0.029)	(0.039)	(0.036)	(0.035)
Standard hours$_{t-1}$	−0.016	0.029	−0.011	−0.037	−0.043
	(0.033)	(0.029)	(0.033)	(0.033)	(0.033)
Wage (log)	—	—	—	—	−1.72
					(0.99)
Year dummies, industry dummies?	yes	yes	yes	yes	yes
Industry-specific trends?	no	yes	yes	yes	yes
Trends jointly zero? (p-value)	—	0.00	0.00	0.00	0.00
Sum of standard hours coefficients	0.038	0.036	0.040	0.019	0.005
	(0.036)	(0.030)	(0.032)	(0.027)	(0.027)

a. The dependent variable is the log of employment.
b. Estimation is by fixed effects for 1984–1994 for ten industries (110 observations).
c. In columns (3)–(5) standard hours and its lag are instrumented with a measure of standard hours from a second source, and its lag (see text).
d. In columns (4)–(5) estimates are weighted by employment in the industry.
e. Robust standard errors are reported for unweighted estimates.

whether the GSOEP results concerning actual hours worked are replicated in these data. The underlying sample sizes for women when spread over 30 industries are rather too small to allow reliable estimation. Nevertheless, since employment results have been presented for women, it is of interest to check as well as possible what their hours response has been. Instrumental variables results using the log of the first normal hours measure (where I assign category midpoints) are shown in Table VII. A one-hour reduction from 40 hours is 2.5 percent, so a coefficient of 0.025 on the (sum of) standard hours coefficients would indicate a one-for-one reduction. The first three columns for men and women together show a coefficient sum of 0.024, and hence close to a one-for-one reduction, as was found in the GSOEP data. Standard errors are small, and the wage does not affect normal weekly hours. When men and women are separated, the weighted specifications of columns (4) and (5) show that the point estimate for women is larger, as was found in the GSOEP data. The unreported

TABLE VI
EMPLOYMENT EFFECTS OF STANDARD HOURS BY GENDER
AGGREGATE MIKROZENSUS DATA (TEN INDUSTRIES)
(STANDARD ERRORS ARE IN PARENTHESES.)

	Men			Women		
	(1) IV	(2) IV weight	(3) IV weight	(4) IV	(5) IV weight	(6) IV weight
Standard hours$_t$	0.069	0.079	0.068	0.038	0.026	0.023
	(0.036)	(0.038)	(0.036)	(0.055)	(0.038)	(0.038)
Standard hours$_{t-1}$	−0.008	−0.033	−0.038	−0.014	−0.064	−0.071
	(0.031)	(0.035)	(0.034)	(0.047)	(0.036)	(0.037)
Wage (log)	—	—	−1.80	—	—	−1.57
			(0.95)			(1.29)
Year dummies, industry dummies?	yes	yes	yes	yes	yes	yes
Industry-specific trends?	yes	yes	yes	yes	yes	yes
Trends jointly zero? (p-value)	0.00	0.00	0.00	0.00	0.00	0.00
Sum of standard hours coefficients	0.061	0.046	0.030	0.024	−0.038	−0.048
	(0.029)	(0.028)	(0.028)	(0.047)	(0.028)	(0.029)

a. The dependent variable is the log of male or female employment.
b. Estimation is by fixed effects for 1984–1994 for ten industries (110 observations).
c. Standard hours and its lag are instrumented with a measure of standard hours from a second source, and its lag (see text).
d. In columns (2), (3), (5), and (6) estimates are weighted by male or female employment in the industry.
e. Robust standard errors are reported for unweighted estimates.

unweighted specification yields an equal coefficient sum for men and women (0.019). Although too much should not be made of differences that are insignificant, the fact that weighting raises the coefficient sum for women in the hours regression is consistent with the fact that weighting changed the sign of the coefficient sum for women in the employment regression: the weighting appears to weight industries where women's actual hours were more effectively reduced (possibly due to lower overtime) and hence where their employment may have been able to rise.

I have experimented with using the second measure of normal hours (where I assign the mean hours of GSOEP respondents in the category), the log of actual hours for the survey week (available for the first three years), and the more detailed normal hours categories (available for the last three years), and find very similar results which I do not report. Making the Mikrozensus sample more similar to the GSOEP sample by dropping appren-

TABLE VII
ACTUAL HOURS EFFECTS OF STANDARD HOURS
DETAILED MIKROZENSUS DATA (THIRTY INDUSTRIES)
(STANDARD ERRORS ARE IN PARENTHESES.)

	Men and Women			Men	Women
	(1)	(2)	(3)	(4)	(5)
	IV	IV weight	IV weight	IV weight	IV weight
Standard hours$_t$	0.009	0.013	0.013	0.013	0.009
	(0.004)	(0.002)	(0.002)	(0.002)	(0.004)
Standard hours$_{t-1}$	0.014	0.011	0.011	0.006	0.013
	(0.004)	(0.003)	(0.003)	(0.002)	(0.005)
Wage (log)	—	—	0.002	—	—
			(0.121)		
Year dummies, industry dummies?	yes	yes	yes	yes	yes
Industry-specific trends?	yes	yes	yes	yes	yes
Trends jointly zero? (p-value)	0.00	0.00	0.00	0.00	0.00
Sum of standard hours coefficients	0.024	0.024	0.024	0.019	0.023
	(0.004)	(0.003)	(0.003)	(0.002)	(0.005)

a. The dependent variable is the log of average "normal" weekly hours.
b. Estimation is by fixed effects for 1982, 1985, 1987, 1989, 1991, and 1993 for 30 industries (180 observations).
c. Standard hours and its lag are instrumented with a measure of standard hours from a second source, and its lag (see text).
d. In columns (2), (3), (5), and (6) estimates are weighted by employment of the relevant group in the industry.
e. Robust standard errors are reported for unweighted estimates.

tices and workers reporting normal hours under 36 per week reduces the standard errors for women, but otherwise changes little (these results are also not reported).

Table VIII presents results for employment using the 30-industry sample. The standard errors are larger than in the ten-industry regressions, and the point estimates are smaller and hence insignificant. The point estimates for the sum of standard hours coefficients are positive for men when the wage is not included as a covariate (columns (4) and (5)), confirming the results of the ten-industry sample. For men and women together the point estimates are zero or negative, however. As with the ten-industry sample, controlling for the wage makes standard hours reductions appear more beneficial. The analysis of the

TABLE VIII
EMPLOYMENT EFFECTS OF STANDARD HOURS
DETAILED MIKROZENSUS DATA (THIRTY INDUSTRIES)
(STANDARD ERRORS ARE IN PARENTHESES.)

	Men and Women			Men		
	(1) IV	(2) IV weight	(3) IV weight	(4) IV	(5) IV weight	(6) IV weight
Standard hours$_t$	−0.011	0.007	0.007	−0.004	0.018	0.016
	(0.032)	(0.024)	(0.023)	(0.031)	(0.025)	(0.024)
Standard hours$_{t-1}$	0.009	−0.020	−0.045	0.033	−0.006	−0.024
	(0.040)	(0.030)	(0.035)	(0.039)	(0.032)	(0.037)
Wage (log)	—	—	−1.73	—	—	−1.21
			(1.31)			(1.30)
Year dummies, industry dummies?	yes	yes	yes	yes	yes	yes
Industry-specific trends?	yes	yes	yes	yes	yes	yes
Trends jointly zero? (p-value)	0.00	0.00	0.00	0.00	0.00	0.00
Sum of standard hours coefficients	−0.002	−0.013	−0.038	0.029	0.012	−0.008
	(0.044)	(0.029)	(0.034)	(0.042)	(0.031)	(0.036)

a. The dependent variable is the log of employment.
b. Estimation is by fixed effects for 1982, 1985, 1987, 1989, 1991, and 1993 for 30 industries (180 observations).
c. Standard hours and its lag are instrumented with a measure of standard hours from a second source, and its lag (see text).
d. In columns (2), (3), (5), and (6) estimates are weighted by employment in the industry.
e. Robust standard errors are reported for unweighted estimates.

30-industry sample has been repeated for hourly-paid workers, yielding results similar to those reported for men (these results are not shown).

Table IX reproduces the weighted instrumental variables employment results from the 10- and 30-industry samples for men and women together (columns (1) and (3)). Columns (2) and (4) analyze the wage bill (the product of normal weekly hours and the index of monthly actual—not negotiated—wages), while column (5) analyzes worker hours (the product of normal weekly hours and employment). The sums of the coefficients on standard hours are insignificant in all cases.

The industry data thus lead to imprecise estimates of employment effects of work-sharing, but seem to indicate falls in employment for men when standard hours are cut in manufacturing. Comparison of regressions including and excluding the wage

TABLE IX
EFFECTS OF STANDARD HOURS ON EMPLOYMENT, WORKER HOURS AND WAGE BILL
MIKROZENSUS DATA
(STANDARD ERRORS ARE IN PARENTHESES.)

	10-industry sample		30-industry sample		
	(1) Employment	(2) Wage bill	(3) Employment	(4) Wage bill	(5) Worker hours
Standard hours$_t$	0.056	0.067	0.007	0.017	0.020
	(0.036)	(0.038)	(0.024)	(0.025)	(0.023)
Standard hours$_{t-1}$	−0.037	−0.051	−0.020	−0.033	−0.009
	(0.033)	(0.035)	(0.030)	(0.031)	(0.030)
Year dummies, industry dummies?	yes	yes	yes	yes	yes
Industry-specific trends?	yes	yes	yes	yes	yes
Trends jointly zero? (p-value)	0.00	0.00	0.00	0.00	0.00
Sum of standard hours coefficients	0.019	0.016	−0.013	−0.016	0.011
	(0.027)	(0.028)	(0.029)	(0.030)	(0.028)

a. The dependent variable is the log of the variable indicated at the top of each column.
b. The wage bill is the product of the monthly actual wage index and employment.
c. Worker hours are the product of "normal" weekly hours and employment.
c. Estimation is by fixed effects weighted by employment in the industry.
d. Standard hours and its lag are instrumented with a measure of standard hours from a second source, and its lag (see text).
e. Columns (1), and (2) are for 1984–1994 for ten industries (110 observations).
f. Columns (3)–(5), are for 1982, 1985, 1987, 1989, 1991, and 1993 for 30 industries (180 observations).

confirms the hypothesis that the effect of wage compensation was to reduce employment.

VII. CONCLUSIONS

My analysis of the German Socio-Economic Panel (GSOEP) data for 1984–1994 indicates that for Arbeiter (hourly-paid workers) in manufacturing, a one-hour fall in standard hours led to a fall in actual hours of between 0.88 and 1 hour. The GSOEP data indicate further that a one-hour reduction in standard hours was associated with a 2–2.4 percent increase in the straight-time hourly wage, relative to sectors with no standard hours reductions. This hourly increase is close to enough to offset the fall in hours worked, substantiating the union claim that standard hours reductions were achieved with "full wage compensation." These results are incompatible with the notion that reductions in standard hours were accompanied by "wage restraint."

The wage rise would appear to make unlikely the possibility of an employment rise in response to reduced standard hours, the ostensible goal of the exercise. Regressions designed to examine this with industry data for 1984–1994 yield imprecisely estimated coefficients. Nevertheless, the point estimates for male employment indicate employment falls, and these coefficients are significant in some cases. Germany's work-sharing experiment has thus allowed those who remained employed to enjoy lower hours at a higher hourly wage, but likely at the price of lower overall employment.

APPENDIX 1: MEANS OF VARIABLES IN GSOEP DATA
(STANDARD DEVIATIONS ARE IN PARENTHESES.)

	Arbeiter (hourly-paid)		Angestellten (salaried)	
	Manufacturing/ construction	Services	Manufacturing/ construction	Services
Standard hours	39.0	39.4	38.9	39.2
	(1.5)	(1.4)	(1.5)	(1.3)
Reported actual hours	40.5	41.5	42.5	41.9
	(5.9)	(8.0)	(7.2)	(6.6)
Actual > standard?	0.33	0.36	0.64	0.49
	(0.47)	(0.48)	(0.48)	(0.50)
Actual < standard?	0.02	0.02	0.02	0.02
	(0.15)	(0.15)	(0.16)	(0.14)
Observations (total)	14947	3243	4446	7898
Observations (cross-section)	3261	1125	1174	2146
Log (wage)	7.92	7.82	8.25	8.02
	(0.29)	(0.36)	(0.40)	(0.40)
Observations (total)	13858	3009	4103	7457
Observations (cross-section)	3162	1066	1119	2060
Years	1984–1994	1984–1994	1984–1994	1984–1994
Constructed actual hours	40.0	40.9	41.5	41.1
	(3.4)	(3.9)	(4.2)	(3.7)
Monthly overtime > 0?	0.32	0.37	0.62	0.50
	(0.47)	(0.48)	(0.49)	(0.50)
Observations (total)	10275	2182	3184	5718
Observations (cross-section)	2609	851	978	1808
Years	1986, 1988–1994	1986, 1988–1994	1986, 1988–1994	1986, 1988–1994

APPENDIX 2: MEANS OF AGGREGATE MIKOZENSUS DATA
(TEN INDUSTRIES)
(STANDARD ERRORS ARE IN PARENTHESES.)

	Men		Women	
	1985	1993	1985	1993
Log employment	8.42	8.41	7.36	7.42
	(0.78)	(0.87)	(1.14)	(1.12)
Standard hours (1)	39.6	37.2	39.6	37.3
	(0.6)	(0.8)	(0.6)	(0.8)
Standard hours (2)	39.5	37.4	39.5	37.4
	(0.7)	(1.1)	(0.7)	(1.1)
Log wage	6.89	7.25	6.89	7.25
	(0.01)	(0.04)	(0.01)	(0.04)
Underlying sample size (median)	3171	3195	1407	1687

a. Employment is measured in hundreds.
b. The source of standard hours (1) is the WSI. The source of standard hours (2) is the Statistisches Bundesamt. See text for more details.
c. The wage is the nominal bargained monthly wage.
d. The underlying sample size is the number of observations per industry in the underlying individual level data.

APPENDIX 3: MEANS OF DETAILED MIKROZENSUS DATA
(THIRTY INDUSTRIES)
(STANDARD ERRORS ARE IN PARENTHESES.)

	Men		All	
	1985	1993	1985	1993
Log employment	6.68	6.57	7.11	7.00
	(1.33)	(1.45)	(1.26)	(1.41)
Log normal Hours	3.69	3.66	3.65	3.61
	(0.02)	(0.02)	(0.03)	(0.04)
Normal hours	40.2	39.0	38.7	37.0
	(0.8)	(0.8)	(1.1)	(1.3)
Standard hours (1)	39.5	37.4	39.5	37.4
	(0.7)	(1.0)	(0.7)	(1.0)
Standard hours (2)	39.5	37.4	39.5	37.5
	(0.7)	(1.0)	(0.7)	(1.0)
Log wage	6.89	7.25	6.89	7.25
	(0.01)	(0.03)	(0.01)	(0.03)
Fraction female	0	0	0.31	0.32
			(0.19)	(0.18)
Fraction salaried	0.30	0.34	0.32	0.37
	(0.14)	(0.15)	(0.13)	(0.13)
Fraction part-time	0.01	0.02	0.09	0.11
	(0.01)	(0.01)	(0.05)	(0.06)
Underlying sample size (median)	530	437	847	734

a. Employment is measured in hundreds.
b. The source of standard hours (1) is the WSI. The source of standard hours (2) is the Statistisches Bundesamt. See text for more details.
c. The wage is the nominal bargained monthly wage.
d. The underlying sample size is the number of observations per industry in the underlying individual level data.
e. Part-time is defined as fewer than 36 hours per week.

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