REDUCTION OF WORKING TIME: DOES IT DECREASE UNEMPLOYMENT?

Axel Börsch-Supan

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mea – Mannheimer Forschungsinstitut Ökonomie und Demographischer Wandel
Gebäude L 13, 17_D-68131 Mannheim_Sekretariat +49 621 181-2773/1862_Telefax +49 621 181-1863_www.mea.uni-mannheim.de

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Axel Börsch-Supan

MEA, Department of Economics, University of Mannheim, Germany
Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim
Center for Economic Policy Research (CEPR), London, UK
National Bureau of Economic Research (NBER), Cambridge, Massachusetts

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ABSTRACT

Over and again, the reduction of working time is praised as *the* instrument against unemployment in Europe. While the first round argument appears obvious – less work for some will create more work for others – second round repercussions, such as consequential labor cost increases, put doubt on the validity of the argument. As frequently, empirical evidence would be helpful to shed light on this important debate.

This paper reviews the theoretical arguments and the empirical evidence on the effects of reduced weekly working time on unemployment. Given the prominence in the European popular discussion, the scientific literature is astoundingly thin on the topic.

The main findings can be summarized as follows: There are theoretical arguments that can form the basis for a positive effect on employment in response to a reduction in working time. However, they rest on strong assumptions that appear counterfactual. Econometric studies show little or negative effects on employment in Germany. Only a set of simulation studies predicts a positive employment effect – but again, they appear to rest on counterfactual assumptions. Hence, while the reduction of work hours may have increased workers' utility – a legitimate goal of the unions – it does not appear to be justified as a cure against unemployment.

ADDRESS:
MEA, Department of Economics
University of Mannheim
D-68131 Mannheim, Germany
Fax: +49-621-292-5426
E-Mail: axel@econ.uni-mannheim.de

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by Axel Börsch-Supan[1]

1. Introduction

Over and again, the reduction of working time is praised as *the* instrument against unemployment in Europe. It is an old debate with equally old arguments. Franz (1984) quotes the military in 1817, Bismarck in the 1880s, and Lemmer (1930) with a paper that has exactly the same title as this one. Why hasn't this issue been settled?

The issue – as it concerns Germany – came to a climax in the mid 1980s when the labor union in the metal industry enforced a reduction in working time by wide-spread strikes that ultimately reduced weekly work hours from 40 to 35 hours. In fact, working time has been secularly reduced since the industrial revolution. Even since 1960, both contract and effective hours have been reduced dramatically, see Table 1, by almost a quarter. This reduction in annual working hours was accompanied by an equally dramatic reduction in working time over the life span, see Figure 1. While the labor force participation of men aged 60-64 was about 70 percent in the 1960s, less than a third were employed 30 years later. This trend was shared all over Europe, with the exception of Sweden.

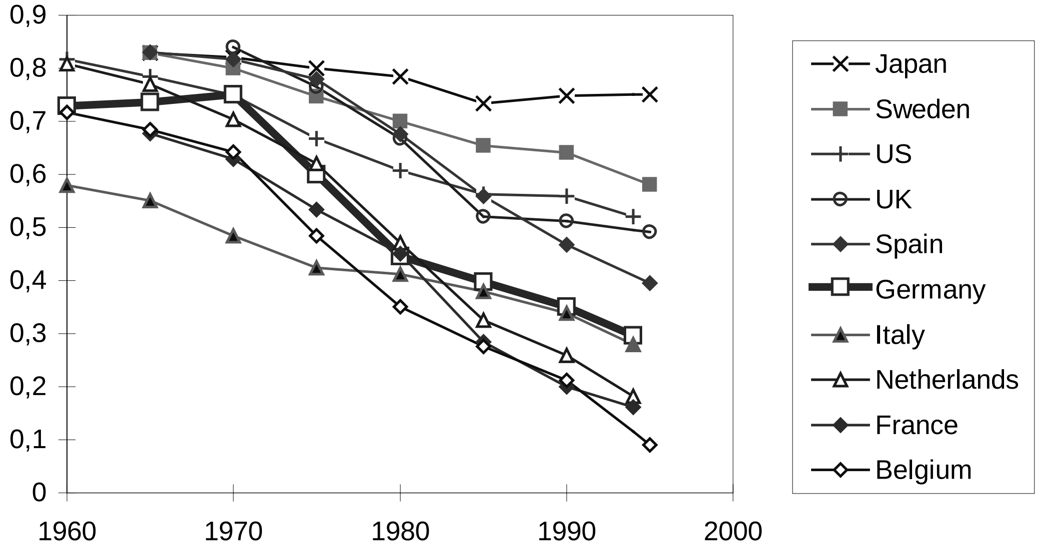
Table 1: Working Time per Full-Time Employee

	1960	1970	1974	1980	1984	1990	1994
Weekly hours	44.6	41.5	40.8	40.1	40.0	38.5	37.8
Vacation days p.a.	15.5	21.2	23.7	27.3	29.9	30.7	31.0
Contract hours p.a.	2124	1898	1832	1789	1761	1676	1661
Actual hours p.a.	2101	1930	1829	1751	1729	1649	1621
Overtime (% contract)	4.5	8.3	6.3	4.5	3.7	4.2	3.7
Sick leave (% contract)	5.3	5.7	5.8	6.1	4.8	5.5	5.2

Notes: West Germany only. ***Source***: Stille and Zwiener (1997), Tabelle 1/1.

[1] I wish to thank Lothar Essig for his assistance, Joachim Winter for helpful discussions, and Gilbert Cette and Michael Wiedemeyer for their comments at the Paris conference.

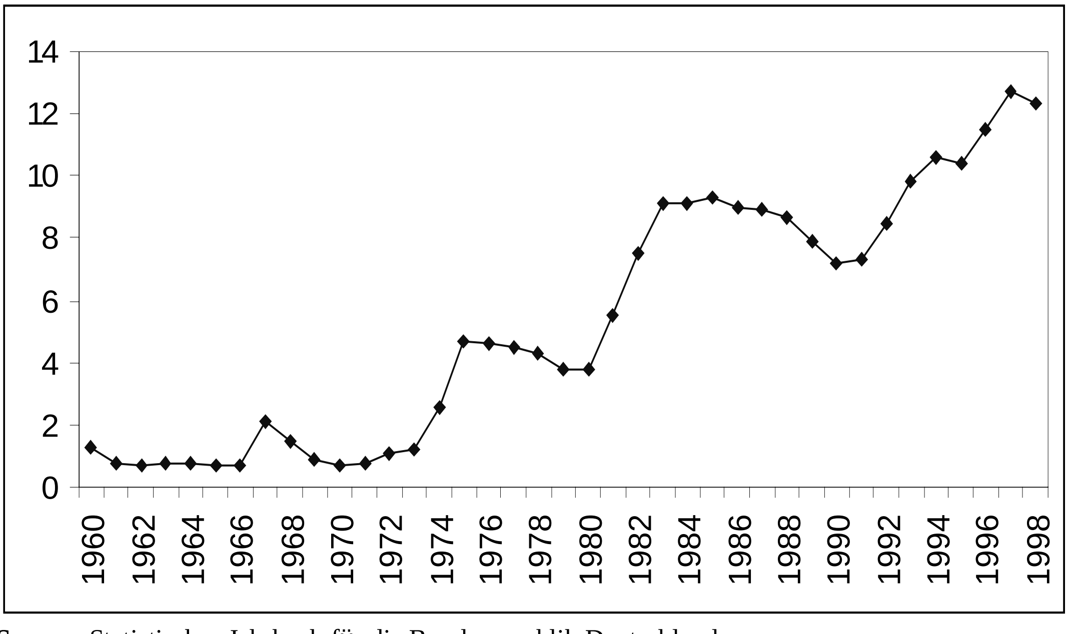
Figure 1: Old Age Labor Force Participation in Europe, U.S. and Japan, 1960-1995



***Note*:** Labor force participation rates of men aged 60-64. ***Source*:** Gruber and Wise (1999).

It is tempting to correlate these trends with the evolution of the unemployment rate. As Figure 2 shows, the prima facie evidence for a positive effect on employment in response to this dramatic reduction in work hours is not very convincing.

Figure 2: Unemployment Rate, Germany, 1960-1998



Source: Statistisches Jahrbuch für die Bundesrepublik Deutschland

As Figure 2 shows, unemployment has steadily risen, and the business cycle upturn in the mid 1980s has not produced a different pattern in the unemployment rate (quickly rising, slowly falling) than the corresponding upturn in the late 1970s, although the former was accompanied with a reduction in work hours.

The opposite apparent conclusion could be drawn from the Blum experiment in France around the year 1936. His reduction in weekly working time from 40 to 48 hours was accompanied by a strong decline in unemployment from 2,2% to an excess demand for labor. However, Léon Blum also started a large fiscal expansion which might have overcompensated an actually negative employment effect of the hours reduction. Thus, more subtle analysis is required to separate causes and effects in both historical examples.

Similarly tempting, the prima facie theoretical arguments appear “obvious”. If prices are fixed, workers’ and employers’ behavior remains unchanged, less work for some must create almost tautologically more work for others.[2] On the other hand, if prices and quantities are flexible, any reduction in work hours that raises unit labor costs must decrease employment. Again, more subtle analysis is required to understand the second round repercussions, such as consequential labor cost increases, price and wage effects, and general equilibrium feedback on product demand.

The issue has not been settled because prima facie arguments are so seemingly obvious and politically tempting while the countervailing arguments are substantially more subtle and complicated. Given the prominence in the European popular discussion, the scientific literature is astoundingly thin on the topic. This paper reviews the theoretical arguments and critically evaluates the empirical studies that have been conducted in Germany. The paper concentrates on weekly hour reductions. Other changes in working time are the increase in yearly vacation days, see Table 1, and the prevalence of early retirement, see Figure 1. The latter is discussed in length in Börsch-Supan and Schnabel (1998, 1999).

The main findings can be summarized as follows: There are theoretical arguments that can form the basis for a positive effect on employment in response to a reduction in working time. However, they rest on strong assumptions that appear counterfactual. The econometric studies show little or negative effects on employment in Germany. Only a set of simulation

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[2] Toedter (1988), p.1320.

studies predicts a positive employment effect – however, also they appear to rest on counterfactual assumptions.

The reduction of working time has provided German workers with more leisure during, and a longer retirement after, working life. There are also no signs that German workers have suffered from income losses due to reduced work hours, *given output*. This is an important social achievement and has made life much more pleasant for the workers. However, there is little evidence that a reduction in working time has reduced unemployment, while there is some evidence that is has reduced output and thus macroeconomic growth. We have no reasons to believe that the underlying assumptions will change in a way that will make these conclusions less relevant in the future.

The remainder of the paper is structured as follows. In the following section, I set out the theoretical background of the debate in order to isolate the main mechanisms that might create (or inhibit) positive employment effects in response to an hours reduction. The next four sections collect circumstantial evidence on these mechanisms: evidence on wages, productivity, desired hours, and macroeconomic feedbacks. Section 7 continues with a review of the direct evidence of employment effects. In addition to the econometric evidence, Section 8 summarizes the results and mechanisms of two major simulation models, and Section 9 reports on the famous VW experiment. Section 10 concludes.

2. The theoretical background of the debate

While the often-voiced first-round theoretical argument – less work for some must create more work for others – appears "obvious" in favor of a positive employment effect, it has several major flaws.[3] First, the amount of labor is not given as a fixed lump which can only be redistributed. The total amount of labor demanded and supplied changes as the economy evolves, and a reduction of working time may affect this total amount of labor. Thus, partial analysis of the labor market needs to be supplemented by a general equilibrium analysis of total demand in the economy. This leads to the second flaw in the argument: Labor can be substituted by capital, and the demand for labor depends on the relative price of capital and labor. If labor costs change in the wake of an hours reduction, labor demand will also change. Thus, we need to study how unit labor costs evolve after an hours reduction

[3] See Franz (1984).

which requires an analysis of wage and productivity adjustments. The third fundamental flaw in the argument suggests that labor is homogenous, and that the currently unemployed are good substitutes for labor which has been "freed" by the reduction of working hours. Thus, a supplemental analysis of the qualification structure of the work force is required.

Furthermore, the semantics of the debate obscure an important distinction among working time (measured in hours), employment (measured in persons employed), and the product of the two, the total quantity of labor demanded (measured in man hours, or politically more correct, in person hours). Franz (1984) and Toedter (1988) carefully distinguish these variables. Taking hours ($\boldsymbol{h}$) and persons ($\boldsymbol{n}$) as separate production factors besides capital, and ignoring capital-labor-substitution, a reduction in hours ($d\boldsymbol{h}/\boldsymbol{h}<0$) will create the following response in the demand for workers ($d\boldsymbol{n}/\boldsymbol{n}$):

$$\textbf{(1)} \qquad d\boldsymbol{n}/\boldsymbol{n} = \eta_n \, [\, d\boldsymbol{w}/\boldsymbol{w} - d\boldsymbol{p}/\boldsymbol{p} + (1-\boldsymbol{a}_h)\, d\boldsymbol{h}/\boldsymbol{h} \,]$$

which depends on the wage response ($d\boldsymbol{w}/\boldsymbol{w}$), the price response ($d\boldsymbol{p}/\boldsymbol{p}$), and several demand and production parameters to be explained below. Hours supply is treated as passive: it accommodates demand.

In the best of the Keynesian worlds, wages and prices are sticky. In this case, an hours reduction leads to a proportional increase in employment,[4] and total worker-hours remain constant. This result appears to underlie arguments that are often voiced by trade unions.

However, if prices and wages respond to the hours change, results are more complicated. In this case, we need to look at the demand and production parameters more carefully. Among those, γ will denote the demand elasticity of the product ($d\boldsymbol{y}/\boldsymbol{y}$ divided by $d\boldsymbol{p}/\boldsymbol{p}$), η_h and η_n denote the elasticities of the employers' demand for hours and workers with respect to the wage ($d\boldsymbol{n}/\boldsymbol{n}$ and $d\boldsymbol{h}/\boldsymbol{h}$, respectively, divided by $d\boldsymbol{w}/\boldsymbol{w}$), while $\boldsymbol{a}_h$ and $\boldsymbol{a}_n$ denote the scale elasticities of hours and workers in production ($d\boldsymbol{y}/\boldsymbol{y}$ divided by $d\boldsymbol{h}/\boldsymbol{h}$ and $d\boldsymbol{n}/\boldsymbol{n}$, respectively). Using these parameters, equation (1) becomes

$$\textbf{(2)} \qquad d\boldsymbol{n}/\boldsymbol{n} = [\, \eta_n / (\eta_n \cdot \boldsymbol{a}_n + \gamma) \,] \cdot [\, (1 + 1/\eta_h) - \boldsymbol{a}_h\, (1 + 1/\gamma) \,] \cdot d\boldsymbol{h}/\boldsymbol{h}$$

[4] The factor proportionality is $\eta_n(1-a_h) < 0$.

If the hours reduction is fully compensated by a corresponding increase in wages (η_h = -1) and prices fully adjust to a quantity reduction in output (γ = -1), the hours reduction has no effect on employment at all. In this case, total worker-hours and output decrease. Workers' wage bill remains constant, and their utility may increase or decrease, depending on whether they appreciate the added leisure. The same holds, if a_h = 0, i.e., if the organization of labor by working hours makes no difference in the production process.

We now have shown that an hours reduction can have a positive and a neutral effect on employment. However, it can have a negative effect as well. If the organization of labor by working hours matters in the production process (a_h > 0), the product is moderately price elastic (0< $-\gamma$ <1), and the hours reduction is fully compensated by a corresponding increase in wages (η_h = -1), then not only output and worker-hours but also employment will fall in response to an hours change. Moreover, real wages will fall because prices will rise. In this third case, the policy will be counteracting its purposes.

The theoretical analysis of labor demand therefore provides three important insights:

First, depending on parameter assumption such as wage and price responses, an hours reduction can lower, keep neutral, or increase employment. All sides of the debate can be accommodated. As a rule, positive employment effects are the more likely, the less workers, employers and customers can respond to the hours change. If in turn workers shift into overtime, employers substitute labor by capital, and customers demand less of a more expensive product, the employment effect will be negative (Toedter, 1988).

Second, employment will unambiguously decrease in response to an hours reduction if the *real* wage bill is to remain constant. This is an important result which contradicts some arguments in the public debate. It is strengthened by general equilibrium effects, see Franz (1984) and Toedter (1988).[5]

Third, the analysis provides us with a check list of items that helps to clarify where the fault lines are in the public debate. Although the items are highly interrelated, it will also structure our review of the empirical evidence for Germany which follows in the next section.

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[5] Some argue that this proposition is weakened if the hours reduction precipitates a productivity increase over and above the one implied by a fixed production technology, for instance by fostering a higher degree of labor flexibility. While this is correct, higher flexibility could also be achieved without an hours reduction. This line of reasoning therefore confounds two distinct labor market policies. In this paper, we want to concentrate on the effect of an hours reduction *per se*.

Box 1: Check list for empirical analysis

- **Are hourly wages fixed?**
  - Will the hours reduction be combined with an increase in the hourly wages in order to keep the nominal wage bill constant (full compensation)?
  - Will wages respond to productivity changes?
- **Will productivity change?**
  - Change in capital intensity?
  - Better work organization/more labor flexibility?
  - Better work conditions, lowering quit rates and exhaustion?
- **Is the capital stock exogenously fixed?**
  - Will labor be substituted by capital? (Short run vs. long run)
- **Is effective working time exogenous?**
  - What is the current labor-leisure tradeoff? Are workers constraint by current hours, will they be constraint by lower hours? Will the hours change precipitate more over-time and/or black-market activities?
  - Are employers at their optimal allocation of work hours, given capital utilization?
- **Are prices fixed?**
  - Can employers shift higher labor costs to consumers?
  - Will lower/higher prices increase/decrease product demand?
- **Is output fixed?**
  - Partial against equilibrium analysis: Will output via the transmission channels (real wages and prices) be reduced or increased?

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3. Evidence on hourly wages

A first item in our list of circumstantial evidence is whether hourly wages respond to a change in weekly work hours. This is at first sight a purely contractual matter as a reduction in work hours can be negotiated with or without full compensation of the contractual monthly pay. However, even if there were no changes in hourly *contract* wages, there are several reasons why an increase in *effective* labor costs is likely in response to a shorter work week. First, a reduction in contract hours may increase the demand for, and the supply, of overtime which is commonly remunerated at higher hourly wages. Section 5 will show that there is no homogenous answer to this question. A majority of the workers, however, does not want to decrease hours and is therefore likely to supply overtime. Second, there are typically fixed cost of labor that are independent of hours worked. A prominent example are training costs, another the startup time required to obtain the usual routine (Dichmann, 1996). McKinsey (1994) estimates these costs at 10% of total labor costs, not counting management and similar overhead. Third, a reduction in hours may lead to investment in capital (such as automated teller machines in the banking industry) and thus raises total production costs. Moreover, it raises productivity and thereby, potentially with a lag, wages, see below. Of course, all effects are amplified if the reduction in work hours is negotiated with a full compensation of the former total salary.

Because of the multitude of mechanisms, an assessment of whether hourly wages respond to a reduction in hours requires an econometric study. Hunt (1996) provides an extended empirical analysis of wage changes between 1985 and 1995, using the German Socio-Economic Panel (GSOEP). Her careful econometric study differentiates between industries that mandated hours reductions and those which did not. This is important since national time-series studies will not be able to isolate the effects of hours reductions from other concomitant changes.[6] She finds that a one hour reduction in contractual working time was accompanied by a hourly wage increase of 2-3 percent, relative to industries with unchanged hours. Since a one hour fall from a 40-hours week corresponds to a 2.5% decrease, this implies close to full compensation. Thus, the assumption of unchanged hourly wages, an important ingredient to generate positive total employment effects, appears counterfactual.[7]

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[6] Such confounding effects are the wage freeze in France in the early 1980s.

[7] Note that constant real wages are neither necessary nor sufficient for positive employment effects.

4. Evidence on productivity changes and capital utilization

An increase in hourly wages may be accompanied by an increase in productivity. First, hours might, just as workers, scale effects in production. Reducing hours may thus increase productivity. In addition, there may be secondary effects due to better work organization or less exhaustion, e.g., because workers are better rested, an important argument in the 19th century literature on hours reduction. If productivity rises due to lower work hours, the increase in unit labor costs due to rising effective hourly wages is dampened, and the effect of an hours reduction on *unit* labor costs may become ambiguous.

Indeed, here is a handle for positive total employment effects (measured in worker-hours) if productivity increases more than proportionally to the hours reduction. In this case, unit labor costs decline, labor demand increases, and unemployment could be reduced if the unemployment pool provides the qualifications needed. Thus, an engine for positive employment effects can be hidden in production inefficiencies due to overly long work hours or other bad practices in work organization. Interestingly, McKinsey (1994) provides a long list of such examples and claims that productivity could be raised by between 10 and 30 percent even if daily work hours are reduced from 8 to 6 hours. The main instrument to achieve this productivity gain is flexible shift time that permits an optimal utilization of capital.

There are two problems with this argument. First, many of the effects could be achieved without an hours reduction. This line of reasoning therefore confounds two distinct labor market policies. In this paper, we want to concentrate on the effect of an hours reduction per se. The second problem is, that this well of productivity has not been tapped into. Why? It least one reason appears to be that worker do not like flexible shift work, see Section 5.

Unfortunately, there are no recent econometric studies that link labor productivity to hours reduction. The German Council of Economic Advisors (1983) presents estimates that relate a 2.5% decrease in hours with a productivity increase of 1.0-1.8%. It appears unlikely that genuine productivity changes can be the *deus ex machina* that creates higher demand for labor when hours are reduced.

5. Evidence on desired work hours

Any effect on employment (i.e., workers) will be mitigated when reduction in standard work hours are compensated by an increase in over time supplied by the existing workers. This is an area where we actually have considerable empirical evidence. DIW (1997) and Hunt (1998) evaluate the GSOEP data and arrive at similar conclusions as a series of polls conducted by the German employers' association (EMNID, 1997), see Tables 2 and 3.

Table 2: Desired hours by actual hours, 1985 and 1994

		Percentage desiring .... weekly hours:			
Actual hours worked	**Year**	**More**	**Same**	**Less**	**Sample size**
Less than 40	1985	64.2	14.1	21.8	187
	1994	28.8	39.0	32.2	517
Exactly 40	1985	6.0	69.7	24.3	749
	1994	3.7	55.5	40.9	227
More than 40	1985	7.4	6.1	86.5	428
	1994	6.2	8.2	85.6	200

Source: Hunt (1998) using data from the German Socio-Economic Panel (GSOEP).

Table 3: Desired hours, 1997

Desired weekly work hours	**All**	**West**	**East**	**Men**	**Women**	**Union members**
Less than 10	7.3	7.8	5.3	5.8	8.9	4.3
10 – 25	9.5	10.8	4.6	2.5	17.2	4.6
25 – 35	16.5	17.2	14.0	8.5	25.4	14.1
35 – 38	17.0	18.1	13.0	19.5	14.2	24.1
38 – 40	13.7	13.9	13.0	13.1	14.4	17.8
40 – 45	25.5	22.8	35.7	34.6	15.6	24.8
45 – 50	3.7	2.7	7.3	5.7	1.5	3.6
More than 50	6.8	6.8	7.0	10.4	2.8	6.7

Source: EMNID poll with a sample of 1.074 workers, Juli 1997, for the *Institut der deutschen Wirtschaft*.

Both GSOEP and EMNID asked about desired hours under the (counterfactual) assumption of no wage compensation ("if total pay is adjusted accordingly"). Under this presumption, workers appear to have a rather strong consensus on a 40-hour week. Workers with fewer hours want to work more while workers with more hours want to work less.

Responses of intend to polls and survey questions are notoriously unstable. Small changes in the wording, in particular concerning the compensation agreements accompanying the hours reduction, can change responses due to framing effects. Thus, the agreement between the sources is remarkable. Nevertheless, ex post data may be a more reliable indication of workers' preferences than ex ante statements of intends. Thus, it is interesting to combine the responses in Tables 2 and 3 with experiences that workers have actually made with hours reductions, see Table 4.

Table 4: Personal Experiences with Reductions in Weekly Hours

	Percent of workers who experienced ...		
	More strain	**More overtime**	**New hirings**
All	52.9	52.6	13.0
West	56.3	54.8	12.4
East	35.0	40.9	15.8
Men	56.2	52.5	14.4
Women	47.6	52.6	10.7
Union members	63.5	54.5	13.1

Source: EMNID poll with a sample of 1.074 workers, Juli 1997, for the *Institut der deutschen Wirtschaft*.

52.6% of the workers say that they experienced an increase in overtime in their company as a response to an hours reduction (EMNID, 1997). This is in line with estimates by Hunt (1996) who reports that actual hours responded less than one-to-one to contract hours. On an aggregate level, second jobs have increased from 1987, when 2.6% of workers moonlighted, to 3.7% in 1994. Overtime as a percentage of total actual working time responds closely to the business cycle and does not show a secular trend. Correcting for cyclicality, König and Pohlmeier (1988) show that overtime responds much stronger to an hours reduction than actual hours. The coefficient is compatible with Hunt's less than one-to-one relation between actual and contract hours.

A recent study by the research institute of the German labor unions reports similar findings. While workers appreciate the leisure brought about by a forced reduction in work hours, most also complain about initially lower incomes (Herrmann et al., 1999, p.75). Polls accompanying the VW experiment in Wolfsburg, described in Section 9, produce identical results (Klenner et al., 1996, p.120).

Summing up, an hours reduction at constant hourly wages is likely to create significant effort by the workers to compensate the loss of income at least partially by taking overtime and/or moonlighting. There is anecdotal evidence that this happened in Wolfsburg to a large extent when VW reduced quite dramatically reduced the work week to 28.8 hours. We will come back to this issue in Section 9.

6. Evidence on prices and output

Turning to general equilibrium issues, an important consideration are product prices because they affect product demand which in turn determines labor demand. This is the last of the items in our list of circumstantial evidence, and the item we know least of.

First, the ability to shift increased labor costs in the form of higher prices is a mechanism frequently quoted in the literature. Even if unit labor costs rise, demand for labor may increase in the wake of an hours reduction if product prices can be raised to an extent that increases total revenues. Obviously, this requires rather low price elasticities. Empirical evidence provides a heterogeneous picture by type of commodity. Almost all price elasticities are between 0 and –1, and most are close to -0.5.[8] In addition, this mechanism is on shaky theoretical grounds as it requires market power vis-à-vis (international) competition with longer working hours. However, a monopoly would not produce at a point featuring such a low elasticity.

Second, and on the other hand, Keynesian models rest on the assumption that prices are sticky. This assumption is an important ingredient in order to stop feedback mechanisms due to hours reductions. The microeconomic evidence on short-term price adjustments is still in its infancy. Blinder (1994) and Kashyap (1995) are seminal studies. They agree that price changes are infrequent, irregular, and that intervals between price changes in consumer goods are about one year. Köhler (1996) investigates price adjustments in Germany and finds

[8] In the UK, the major consumption groups and their own price elasticities were: food (-0.51), clothing (-0.38), housing (-0.39), utilities (-0.67), transportation (-0.47), and out-of-pocket medical care (-0.67) (Blanciforti, Green and King (1986).

similar lags. This implies, in turn, that prices will adjust to changes in the economic environment – for instance reduced work hours – with a lag of about one year.

Price changes provide an important general equilibrium mechanism that will reduce output in response to an hours reduction, in addition to any straight-forward reductions in output due to lower labor input measured in worker-hours. We do not have good econometric evidence on the output reaction to the hours reduction. The gap in GDP per capita between Germany and the U.S. widened in the early and mid 1980s, but narrowed in the late 1980s. However, such aggregate evidence is hardly indicative of cause and effect.

7. Evidence on employment

Collecting the results of sections 3 through 7, there is little encouragement to believe that employment will increase in response to an hours reduction. Hourly wages have increased rather than remained constant. Productivity has adjusted less than one-by-one until the mid 1990s, increasing unit labor costs even more.[9] Although those, who work a lot, would like to decrease their work hours, there is little evidence that workers are constraint to work at hours that are substantially lower than the current hours. Finally, absolute price elasticities are larger than zero in most industries, alleviating a feedback to labor demand via a decrease in product demand, at least with a delay of about a year.

In addition to the circumstantial evidence that these transmission mechanisms render a positive effect of an hours reduction on employment quite unlikely, there is also direct econometric evidence of that an hours reduction will have no effect, or even a negative effect, on employment.

In a series of articles, König and Pohlmeier (1988, 1989, and 1992 together with Entorf) develop an econometric framework and estimate production functions in which labor enters separately as hours and workers, with a nonlinear relation between the two. These estimates can be used to compute the elasticities involved in equation (2), and therefore also to predict the employment reaction to an hours reduction.

Their main result is that there is very little substitution between hours and workers, much less than between labor and capital. "A reduction in standard working hours will result

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[9] It appears that unit labor costs have fallen after the mid 1990s. Since the measurement of unit labor costs is difficult, the jury is still out.

in a [small][10] decrease in the number of employees but an increase in overtime work and induce substitution in favor of capital” (König and Pohlmeier, 1989, p.569). These results were based on industry data 1964 to 1983. König, Pohlmeier and Entorf (1992) use a longer sample period (1962-1986) to arrive at the same conclusions: A reduction of standard hours worked by 6.25% (from 40 to 37.5 hours per week) leads to a very small *reduction* in total employment of 0.2%.

Kraft (1993) uses a different econometric approach. He essentially uses a reduced form to regress employment on contract working hours, lagged values and a number of other covariates that correct for business cycle effects. His findings indicate a small negative, but insignificant effect of an hours reduction on employment. His conclusion is, that “it is appropriate to consider the effect of an employment reduction on employment as neutral, as long as the hourly wage stays constant” (Kraft, 1993, p.24).

Hunt (1998) is the only econometric study based on micro data. Using disaggregate data permits the correction of many confounding effects (such as changes in the composition of the work force) as well as individual heterogeneity (such as differences in qualification). She arrives at a similar conclusions as the other econometric studies and finds that her “results suggest that reductions in standard hours were associated with employment declines, although the magnitudes of these decreases are imprecisely estimated” (Hunt, 1998, p.356).

The agreement among these studies is remarkable because the samples are so different. While König et al. (1988, 1989) and Kraft (1993) use industry data before the mid 1980s, Hunt’s study relies on micro data and spans the actual “natural experiment” during the second half of the 1980s when work hours were significantly reduced.

8. Simulation studies

Simulation with a structural macroeconomic model is another methodology to predict the effect of an hours reduction on unemployment. Such simulation studies are hard to compare to actual ex post analyses because their calibrated parameters do not rest on an internally consistent data set. Thus, it is rather difficult to isolate specific model features that are built in to produce certain results. Nevertheless, such models attempt to reproduce general equilibrium effects and are powerful instruments if the underlying behavioral assumptions are

[10] Added by the author.

correct. The methodology is to estimate a set of equations on actual data (in this case, spanning the end 1980s reduction in working hours), and then create a counterfactual (in this case, how employment, wages, and the entire set of macroeconomic aggregates would have behaved if working hours had stayed constant).

In this section, we report on two simulation studies which have received widespread attention in Germany. The first study was conducted by DIW, the German Institute for Economic Research in Berlin, the other by IAB, the research institute attached to the German Labor Administration. We will present the main results and then look at the internal and external plausibility of the involved mechanisms.

Stille and Zwiener (1996) present an application of the DIW-macroeconomic model to the hours reduction that took place between 1984 and 1990. The DIW model is a Keynesian business cycle model with limited contemporaneous adjustments of prices and wages to exogenous shocks. The original DIW model was adapted to accommodate exogenous changes in the standard working time. Additional equations – relating wages and employment to standard working time – were estimated on the basis of quarterly national accounting data (Stille and Zwiener, p.148). Note that using nation-wide aggregate data is problematic insofar as changes in working time were industry specific. Thus, aggregate data may not properly identify the effects of changes in the standard working time on wages and employment.

As in any simulation model, the predictions rest on a set of strategic assumptions. In this case, productivity increases are assumed to offset 50% of the reduced standard working hours. The relation between hourly wages and standard working hours (full versus no compensation) results from the regression equation mentioned above. Since all other structural changes between hours and wages in the 1980s affect this equation as well, but are left out in this equation, corresponding biases are carried forward in the simulation.

Table 5 summarizes the main results. All figures represent deviations between the actual reduction of working hours 1985 to 1990 from a counterfactual that left the 1984 standard working hours constant. The simulation predicts a relative employment increase of 2.9% over these 6 years. This corresponds to 700.000 workers. This is enormous number that flatly contradicts the neutral effects measured by the econometric analysis reviewed in the previous section. At the same time, GDP increases relative to the path of the economy that would have prevailed if hours had remained constant.

Table 5: DIW Simulation Results (Percentage differences relative to baseline)

	1985	1986	1987	1988	1989	1990
Weekly work hours	-0.8	-1.6	-2.5	-2.9	-3.7	-5.8
Induced productivity	+0.4	+0.8	+1.3	+1.5	+1.9	+2.9
Employment	0.4	0.9	1.5	1.7	2.0	2.9
Real GDP	0.1	0.1	0.3	0.5	0.6	0.8
GDP Price level	-0.0	-0.2	-0.4	-0.7	-1.0	-1.3
Contract wages	0.0	0.0	0.1	0.5	0.8	1.2
Unit labor costs	-0.1	-0.4	-0.6	-0.7	-0.9	-1.2

Source: Stille and Zwiener (1997), Table 5/2.

How do these predictions come about? It helps to look at the other aggregates predicted by the DIW model. The main point is that productivity increases by 2.9% by assumption (50% of the hours decline) while hourly wages increase by only 1.2%. Thus, unit labor costs decrease by 1.2%, making labor cheaper than without the hours reduction. Lower labor costs increase labor demand and create the rising employment. At the same time, prices fall and increase product demand, thus GDP, the latter by 0.8% relative to the baseline scenario.

Results for a smaller and larger productivity increase (offsetting 25% and 75% of reduced working hours) are as expected: smaller productivity increases dampen, while higher ones amplify, these effects. Main point is that in all model variants productivity effects are not translated into corresponding hourly wage increases. The main engine for the increase in employment is therefore lower unit labor costs.

Are these predictions credible? Actual data shows that with the exception of 1988, unit labor costs have risen by about 2% on average between 1985 and 1990. Using the DIW estimates, unit labor costs would have risen by 2.2% on average if work hours had stayed constant. These are small differences, and there is no reason to believe that these numbers are implausible. However, this is not the case with some of the strategic links in the model. Remember that we found in Section 3 that the hours reduction in the 1980s were about fully compensated by wage increases (Hunt, 1996). This is not the case in the DIW results. To the contrary, real contract wages fall.[11] This is particularly astounding as productivity is assumed to increase substantially vis-à-vis the baseline scenario. The implausible decoupling of wages from productivity appears to be a major reason for the difference between the simulation exercise to the ex post econometric studies summarized in the previous section.

A second large-scale simulation exercise was performed by the IAB and is reported in Klauder, Schnur and Zika (1996), summarized in Barth and Zika (1996). IAB modifies the SYSIFO model originally designed by Westphal (1988). The SYSIFO model is another Keynesian-type macro model, featuring complicated lag structures which emphasize dynamic adaptations to exogenous shocks. The IAB model exchanges the role of productivity and wage reactions. While in the DIW model productivity reactions are set and wage reactions to standard hours estimated, the IAB model estimates how productivity correlates with working time and exogenously sets how wages are adjusted when hours are reduced.

Table 6 summarizes the main results. It reports differences in growth rates between the baseline scenario (only very slightly reduced work hours between 1996 and 2005) and an assumed reduction from 37.5 to 34 weekly hours. Employment changes are reported as absolute change (in million workers).

Table 6: IAB Simulation Results (Percentage growth differences relative to baseline)

	1996/2000	**2000/2005**	**1996/2005**
Weekly work hours	-1.1	-0.3	-0.6
Employment*	0.7	-0.1	0.3
Real GDP	-0.1	-0.2	-0.2
Labor productivity	0.3	0.2	0.2
Contract wages	0.5	0.9	0.7
Unit labor costs	0.1	0.7	0.4
GDP Inflation	0.2	0.5	0.3
Disposable income	-0.2	-0.4	-0.3

Note: * Absolute difference in million workers. ***Source***: Klauder, Schnur and Zika (1996), p.14, Table 2, Column 1.6.

[11] Nominal contract wages (Table 5) minus CPI which falls slightly more than the GDP deflator reported in Table 5.

While the first round employment effect appears to be astoundingly close to the DIW result, the simulation in fact rests on very different mechanisms. Table 6 shows that the IAB simulation represents a tough medicine. Real GDP falls, and even more so disposable income. Inflation increases, and productivity gains are modest. As Barth and Zika (1996) summarize, the "gain in employment is paid for with welfare losses" (Barth and Zika, 1996, p.179). This is in stark contrast to the DIW simulation in which prices fall and GDP increases. While the DIW-model's engine of growth in employment is a productivity increase that is not absorbed by corresponding increases in the real wage, the IAB-model's engine of employment growth are higher product prices that depress output more than labor demand.

Whether the gloomy picture painted by the IAB is more credible than the DIW model is unclear. GDP per capita relative to the U.S. has stagnated but it has increased relative to most other EU countries. Inflation has remained low. Thus, many of the predicted effects appear counterfactual.

There are other important reasons to be skeptical about predictions made by aggregate simulation models. Most importantly, neither the DIW nor the IAB model have labor markets that are disaggregated by qualification. Labor is assumed to be homogenous, and the unemployed can substitute for any of the reduced hours, disregarding differences in qualification and work experience. This is different from the econometric analyses. While these studies do not explicitly model mismatches in qualification, they indirectly capture such effects because they are based on micro data that corrects for individual qualification heterogeneity (Hunt, 1996) or on industry data (König and Pohlmeier, 1989; Entorf, König and Pohlmeier, 1992; Kraft, 1993) which at least capture inter-industry differences in qualification.

9. The Volkswagen and Ruhrkohle experiments

The cleanest way to find out about the effects of policy changes on the economy is when large scale experiments take place which are precipitated by exogenous changes in policy. In many respects, the decision by Volkswagen to decrease working hours from 36 to 28.8 hours per week was such an experiment. VW had a fairly strict agreement with its workers when it entered a period of a swift demand decline when the unification boom ended in 1993. Demand declined by about 20%. Firing was as expensive as was short-time because

VW had agreed to very high severance payments and to labor contracts that forced VW to keep paying up to 90% of the wage bill in case of short time (Stille and Zwiener, 1997). In many respects, VW had no choice but to reduce work hours in response to the (exogenous) decrease in demand.

The reduction in working hours of 20% was accompanied by only a 4% increase in hourly wages, resulting in a gross income loss of 16%, and a somewhat smaller net income loss due to the progressive German tax schedule (11-12% according to Stille and Zwiener, 1997). In turn, VW promised a moratorium on firings until 1997. Details of the VW-Plan can be found in Hartz (1994). Unfortunately, there is no comprehensive study yet on the overall effects of this experiment on the Wolfsburg economy. VW company reported a massive productivity increased by 10-20% in the three years between 1992 and 1995. There were no new hirings – but also no firings in spite of the drop in demand. Promberger et al. (1996) present a comprehensive report on workers' view of the VW experiment, see Table 7:

Table 7: Workers' satisfaction with the VW experiment (Percentages)

General satisfaction with 28.8 hour week	**(Very) Satisfied** 49	**Indifferent** 35	**(Very) dissatisfied** 16
Actual change in household income	**Increase** 2	**Same** 12	**Decrease** 87
Coping with income decrease	**(Very) hard** 43	**So so** 51	**(Very) easy** 6
Reasons for income stability or increase	**Other HH member** 40	**Overtime** 45	**Other Sources** 32
Desired changes in employment contract	**More pay/more hours** 46	**Leave as is** 53	**Less pay/less hours** 1

Source: Assembled from Promberger et al. (1996).

The picture is an ambivalent one. On the one hand, almost half of the workers are satisfied or very satisfied with the experiment. The other half is indifferent or against it. On other hand, 87% report an income decrease, and 43% state that they have problems in coping with this income decrease. Asked whether they would prefer changing the deal, a slight majority (53%) wants to leave the VW employment contract as it is. However, 46% prefer changing the contract to either more hours or more pay.

It is interesting how those workers coped who kept or even increased their total income. Overtime was frequent, as was additional work by other household members. Unfortunately, the survey missed it to ask about moonlighting. As mentioned before, there is ample but anecdotal evidence that moonlighting increased, and that overall demand for goods and services declined in the Wolfsburg region. Further work has to look at the entire regional economy, not only at VW.

The VW experiment has really not found emulators. The union-associated institute for economic research (WSI) blames this on the negative impact on take-home pay (Klenner et al., 1996, p.120). It appears that the VW experiment was born because of the special circumstances – mainly the specific labor contracts with their expensive social plans and short-time regulations – of the VW company. The closest other experiment is that of the Ruhrkohle AG, a large mining conglomerate in the Ruhr area. This company reduced working hours by introducing additional free shifts, i.e., annual working time rather than weekly working time. The reduction was much smaller than at VW, about 6%. However, pay losses were strictly proportional keeping hourly wages constant. Promberger et al. (1996) compare some of the workers' sentiments with that of the VW workers, see Table 8:

Table 8: Workers' satisfaction with the Ruhrkohle AG experiment (Percentages)

General satisfaction with reduction in annual work time	**(Very) Satisfied** 35	**Indifferent** 43	**(Very) dissatisfied** 22
Actual change in household income	**Increase** 7	**Same** 28	**Decrease** 66
Coping with income decrease	**(Very) hard** 53	**So so** 40	**(Very) easy** 8
Reasons for income stability or increase	**Other HH member** 36	**Overtime** 60	**Moonlighting** 28
Desired changes in employment contract	**More pay/more hours** 60	**Leave as is** 38	**Less pay/less hours** 2

Source: Assembled from Promberger et al. (1996).

Although the pay cut was lower than at VW, 53% rather than 43% found the loss in income hard to bear, and only 38% rather than 53% wanted to keep the deal as is, while 60%

asked for either more pay or more hours rather than 46% in Wolfsburg. Most interesting are the mechanisms to offset the income losses: Almost a third of the workers started moonlighting, and 60% worked on overtime.

In summary, workers appreciate the additional leisure but frown about the lost income. The supply of overtime and moonlighting work indicated in the surveys sheds considerable doubt on the hypothesis that the workers optimal labor-leisure tradeoff is on such low working hours as they were targeted in the VW and the Ruhrkohle experiments.

10. Conclusions

This review paper collected the theoretical arguments and the empirical evidence on the effects of reduced working time on employment in Germany.

As often with such a complex matter, theory yields a wide variety of predictions, depending on the structure of the economy. As a rule, positive employment effects are the more likely, the less workers, employers and customers can respond to the hours change. If in turn workers shift into overtime, employers substitute labor by capital, and customers demand less of a more expensive product, the employment effect will be negative.

In spite of the ambiguity, theory helps to structure the problem and to isolate the main transmission mechanisms. Collecting the evidence on the main links, it appears that those assumptions that would give rise to positive employment effects are counterfactual. Hourly wages have increased rather than remained constant. Productivity has adjusted less than one-by-one until the mid 1990s, increasing unit labor costs even more.[12] Although those who work a lot would like to decrease their work hours, there is little evidence that workers are constraint to work at hours that are substantially lower than the current hours. Finally, absolute price elasticities are larger than zero in most industries, enabling a feedback to labor demand via a decrease in product demand.

We then resorted to direct evidence. None of the few existing econometric studies could find a significant effect over various time periods and different degrees of aggregation. All studies use inter-industry differences in working hours as identifying instruments. The

[12] It appears that unit labor costs have fallen after the mid 1990s. Since the measurement of unit labor costs is difficult, the jury is still out.

econometric evidence rather unambiguously rejects the idea that reducing work hours will help decrease the unemployment problem.

Only two simulation studies predict a positive employment effect. One uses a unit labor cost decrease as an engine to create employment (productivity increases faster than hourly wages), the other pays a high price for employment increases in the form of a GDP decline and an inflation increase. Both models rest on counterfactual mechanisms in detail.

In summary – and this may come as a surprise given the subtlety of the issue, once the arena of prima facie arguments has been left behind – this old debate with equally old arguments has quite an unambiguous answer: the German experience provides no convincing evidence that reduced work hours will increase employment. Reduced work hours probably have increased workers' utility by providing them with more leisure at only slightly reduced income. This is not a small achievement which labor unions can be proud of. But there is simply no evidence that it can work as an instrument for the solution of the unemployment problem.

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