Not Employed 37 Hours or Employed 41?
– A CGE Analysis for Germany

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Abstract

In the 1980ies the myth of work-sharing has led policy makers to believe that reduced working time will reduce unemployment. Faced with a record level of unemployment, the present debate in Germany is to extend the weekly hours of work. The open question is whether this extension is a serious option towards more employment or only a fallacy, profitable for the firms. In this paper we quantify the employment effects of an increase in weekly normal hours in German manufacturing on the basis of a CGE model using an input-output framework for all sectors of the economy. As the work-sharing reforms in Germany and France in the 80ies included persistent hourly wage hikes as income compensation for workers and no alleviation for firms, a negative outcome was not too surprising. Whether an increase in standard hours with a constant weekly payroll will lead to more or less unemployment is from the perspective of economic theory again an unsettled issue. The outcome is in general ambiguous. On the one hand, as the increase in working time (37.4 to 41.5 standard weekly hours) raises labour productivity by about 10 percent, conditional demand for labour will increase (substitution effect) and conditional demand for intermediate inputs will decline. Since, on the other hand, workers do have a longer working time anyway, no positive effect on the number of persons employed can be expected. However, output of the manufacturing industry, and thus unconditional demand for labour, capital and intermediate goods, will increase (output effect). In order to sell the additional output, firms have to lower prices. Depending on the price elasticities, revenues and hence profits will change.

The objective of our CGE analysis is to find out whether an increase in working time can be considered an adequate policy to reduce unemployment. Our simulation results support the argument of the opponents of longer working time that not more jobs will be created. However, when we recycled the higher tax revenues from GDP growth to lower the contribution to social security, then we have been able to support the claim of the proponents that more jobs will be created.

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1. Introduction

Recently, the number of hours people work has become an issue in some European countries, especially in Germany, where unemployment remains stubbornly high. Since years labour costs are uncompetitive, especially in comparison to its East European neighbours. Many of them became members of the EU and can compete in the international market at wage rates one sixth or less of those in Germany. The long-term trend in the past had been one of reducing the working time. In Germany, it fell from 1,939 hours per full time employee in 1970 to 1,641 hours at the end of 1990 and to 1,636 hours in 2002 (see Figure 1 in the Appendix). This decline in annual hours has stopped, however, or even been reversed in several OECD countries. In Germany, too, economists and politicians argue that raising the working time or canceling holidays is an appropriate measure to reduce unemployment since longer hours at equal pay are one way of reducing labour costs. As Figure 2 in the Appendix shows the number of hours worked per week varies widely between countries. One reason for the national differences are differences in productivity. Hours per worker are highest in those countries like Korea or Greece where output per worker is lowest. But there are also substantial differences in hours worked between the United States and European countries with similar levels of productivity.

The open question is how can more jobs be created if people work more hours for the same pay (see Sinn 2004). Firms will then decide to do the same amount of work with fewer people and dismiss the unneeded workers, claim the trade unions. Economic theory can not give an unambiguous answer on whether employment will increase. With longer working hours, the productivity of individual employees rises. Since per-capita labour costs do not increase, it is profitable for firms to employ more people. Unfortunately, it is not so simple. As usual in economics, the answer is “it depends”. On the one hand, the extension of working hours without wage compensation will lead to lower labour costs per hour. This increases firms’ demand for man-hours. On the other hand, more hours are being supplied by those already employed. It can not be concluded, however, that the additional demand for hours exceeds the supply. The open question is what happens on the goods market. Unpaid over-time working raises productivity per worker and has the same effect as technological progress. More goods can be produced with the same number of people at the same wage bill. For demand to increase, prices should fall. It will depend on domestic price elasticities of demand, of exports and imports whether consumers buy at least the additional output. Furthermore, the additional supply of products in itself creates demand. Due to the input-output inter-industry transactions, a firm which supplies something is at the same time a

demander of something else. If profits increase, firms will have an increased demand for other goods and services. In principle, demand from an extension of working hours should rise by the same amount as supply. But that is not enough because the advocates of this policy wish to reduce unemployment. More support is needed for the success of this policy like the increase in machine running times, the strengthening of the international competitiveness, and the attractiveness of Germany as a location of a firm because of the higher productivity per worker.

Our discussion has shown that a computable general equilibrium analysis is required to answer all those questions in quantitative terms. In the next section we give a short review of the related literature. In section 3 we present a simple microeconomic analysis of the factors at work by using a graphical explanation. Section 4 describes the labour market in the GEM-E3 model and section 5 presents the quantitative results from a ten percent increase in working hours in all firms simultaneously. Section 6 concludes.

2. Related Literature

Since many years a rough consensus amongst economists emerged that high unemployment in Europe is due to labour market rigidities. Saint-Paul (2004) discusses the potential obstacles to labour market flexibility and offers some perspectives to explain why some countries have reformed their labour markets and others have not. There has been a widespread popular belief that unemployment can be reduced by reducing the number of hours worked per person. Starting in 1985, (West) German unions began to reduce standard hours on an industry-by-industry basis, in an attempt to raise employment. Similarly to the current debate of extending hours per week, the literature was theoretically ambiguous whether this “work-sharing” will work. Hunt (1999) exploited the cross-industry variation in standard hours reductions to examine their impact on actual hours worked, wages, and employment. Her finding was that “work-sharing” may have reduced employment in the period 1984-1994. Using individual data from the German Socio-Economic Panel, she substantiates the union claim of “full wage compensation”: the hourly wage rose enough to offset the decline in actual hours worked. Those who remained employed enjoyed lower hours at a higher hourly wage, but at the price of lower overall employment. In that case the current debate can not be seen in a laterally reversed sense because wage compensation for the longer work week is not considered. Studies finding also falling employment or no effect include Brunello (1989), König and Pohlmeier (1989), Lehment (1991) and Steiner and Peters (2000). Hart (1987) and Hart and

Wilson (1988) use cross-section variation in hours, and found no effect. Wage restraint is implied by the results of Lehment (1991), while the results of Franz and Smolny (1994) conclude that hourly wages increased as a result of hours reduction. Papers finding that employment rises when hours are cut include Hart and Sharot (1978), Faini and Schiantarelli (1985) and Franz and König (1986). An important aspect in many of those papers is overtime work. 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. In our paper we will not measure the effect that extending hours per week will reduce overtime and hence will lower wage income. To conclude, it is in general not clear how a reduction in working time affects the wage per unit of time and employment. There are a number of forces working in different direction.[1]

3. A Microeconomic Analysis of an Extended Weekly Working Time

Computable general equilibrium (CGE) models have become the standard tool for the analysis of the economy-wide impact of policies on resource allocation and the associated implications for incomes of economic agents since they provide a comprehensive micro-consistent representation of price-dependent market interactions. Most CGE modelers begin their paper by referring to the full microeconomic foundation of their model listed in an appendix. We will begin by presenting some basic textbook figures in order to show the economic effects of a longer working week. These effects sometimes offset each other which then requires a CGE model to see which are the dominating ones. Figure 1 illustrates the partial equilibrium labour market effects in case of an increase in labour hours by 10 percent (from 37.4 to 41.5 hours a week),[2] with an exogenous wage rigidity. In Figure 1 $\overline{w}$ is a horizontal wage setting line and $L_0 = 37.4 \cdot n_0$ where 37.4 is assumed to be the weekly hours worked and n_0 is the number of employed persons. U_0 is unemployment, measured as $37.4(n_s - n_0)$, where n_s is the number of people supplying work. L^D is the aggregated labour demand curve and L^S the labour supply curve. L_0 at $\overline{w}$ is $L_0(n_0, 37.4, \overline{w})$ and L_1 at $0.9 \cdot \overline{w}$ is $L_1(n_1, 41.5, 0.9 \cdot \overline{w})$. Three cases are possible for n_1 as the number of employed persons under the wage $0.9 \cdot \overline{w}$:

[1] See also Calmforce (1985) and Franz (1984) on that debate.
[2] 37.4 is the average workweek for Germany as given in Figure 2 in the Appendix.

(1) If $L_1\left(n_1, 41.5, 0.9\cdot\overline{w}\right) < 41.5\cdot n_0$, then $n_1 < n_0$.

Demand for labour in hours is less than the hours worked by the current number of workers at 41.5 hours/week. Hence the number of unemployed persons will increase.

(2) If $L_1\left(n_1, 41.5, 0.9\cdot\overline{w}\right) = 41.5\cdot n_0$, then $n_1 = n_0$.

The same number of people will be employed but now they work 41.5 hours/week. Their wage income will be unchanged ($\overline{w}\cdot L_0 = 0.9\cdot\overline{w}\cdot L_1$ because $\overline{w}\cdot 37.4\cdot n_0 = 0.9\cdot\overline{w}\cdot 41.5\cdot n_0$).

(3) If $L_1\left(n_1, 41.5, 0.9\cdot\overline{w}\right) > 41.5\cdot n_0$, then $n_1 > n_0$.

In this case the number of employed persons will increase and total wage income will be higher than before ($\overline{w}\cdot 37.4\cdot n_0 < n_1\cdot 41.5\cdot 0.9\cdot\overline{w}$).

L_0 is based on marginal productivity of labour $MP_L(37.4)$ of n_0 workers working 37.4 hours, but L_1 is based on $MP_L(41.5)$ of n_1 people working 41.5 hours. Figure 1 shows the usual effect that four more hours lower MP_L and hence average productivity. It does not consider an exogenous, psychological effect like demotivation of workers if they have to work longer. This might affect MP_L for all hours worked. Such an effect implies in our figure that L^D has to be turned somewhat to the left, beginning at the point $\left(L_0, \overline{w}\right)$. This, of course, would lower the demand for labour.

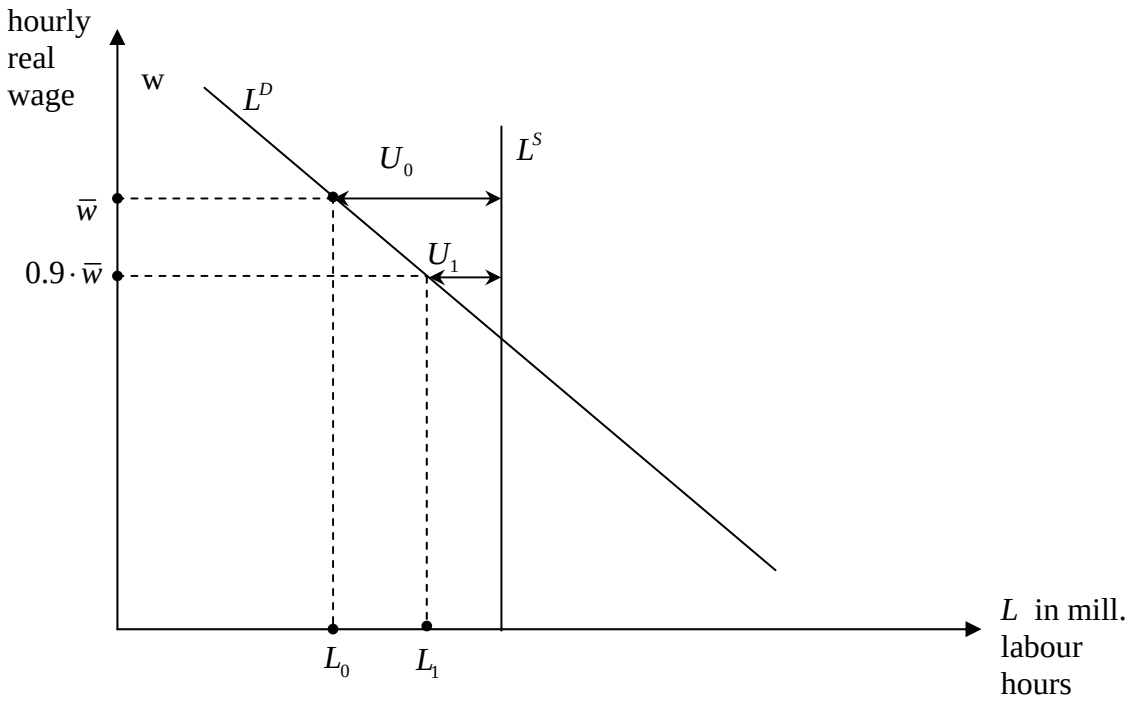

Figure 1: Effects of an extension of working time on labour demand

Till now our analysis of the labour market effect of an increase of hours worked is based on the assumption that the number of firms has not changed and prices of goods are also unchanged. However, since output will rise due to more hours worked, prices will decline, raising demand. Figure 2 shows the output decision of a representative firm and Figure 3 the aggregate market of the industry (e.g. manufacturing) with S_x^0 as the supply curve before the labour market policy. Since the reduction of the producer wage lowers *MC* (from MC_0 to MC_1 in Figure 2), the representative firm will produce more (x_1). On the labour market this implies that the aggregate demand curve for labour will shift to the right because of capacity extension or full use of capacity of the existing firms. This shift of L^D is supported by the substitution and the output effect demonstrated in the textbook approach to cost-minimizing input combinations (see Figure 4). The new equilibrium will be E_1, due to the substitution effect. Labour demand of the firm will increase from l_0 to l_1. Since output has increased from x_0 to x_1 (see Figure 2), the new equilibrium is E_2 with $l_2 > l_1$. The Figure 4 shows an unchanged demand for capital which could reflect the fact that a longer work week will permit a better utilization of the existing capital stock. The new demand curve for labour in Figure 1 will shift to the right, raising the demand for labour. Since average costs (AC_0) have fallen to AC_1 in Figure 2, firms make profits at the present price level p_0. New firms enter the market and labour demand shifts to the right. Finally, since *MC* has shifted to the

right, supply S_x on the product market will also shift to the right which implies a drop in the price from p_0 to p_1 (see Figure 3). This price decrease, in turn, will raise the hourly real wage rate. Labour demand will in addition be affected by the revised output decision of the firm as *p* has dropped from p_0 to p_1 (see x_2 in Figure 2).

It is obvious after this analysis that a CGE approach that concerns the interaction of consumers and producers in markets is necessary in order to find out the impact on the labour market under so many off-setting effects.

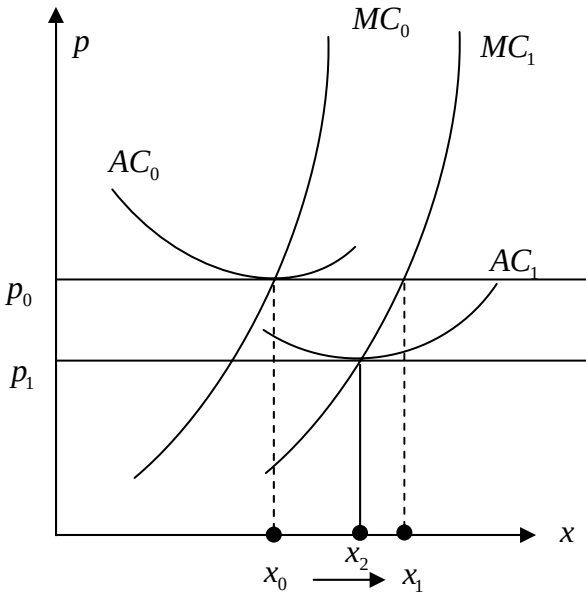

Figure 2: Effect of a lower producer wage on MC and a firm's output decision

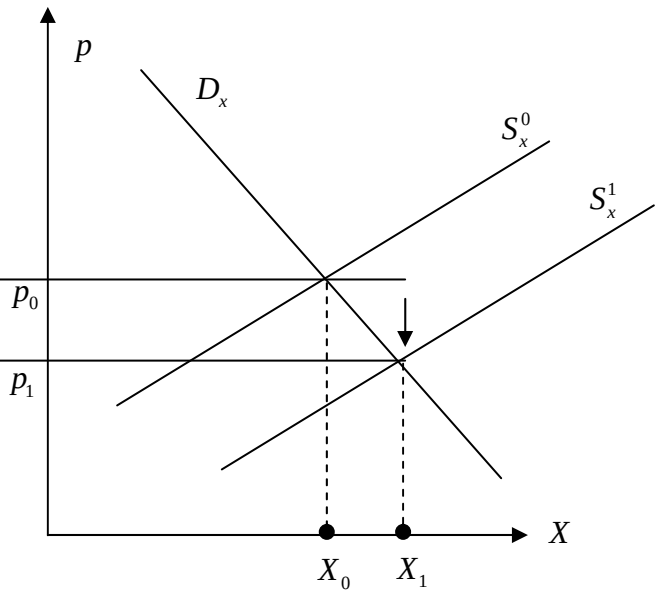

Figure 3: Effect of a lower producer wage on the aggregate supply curve of the industry

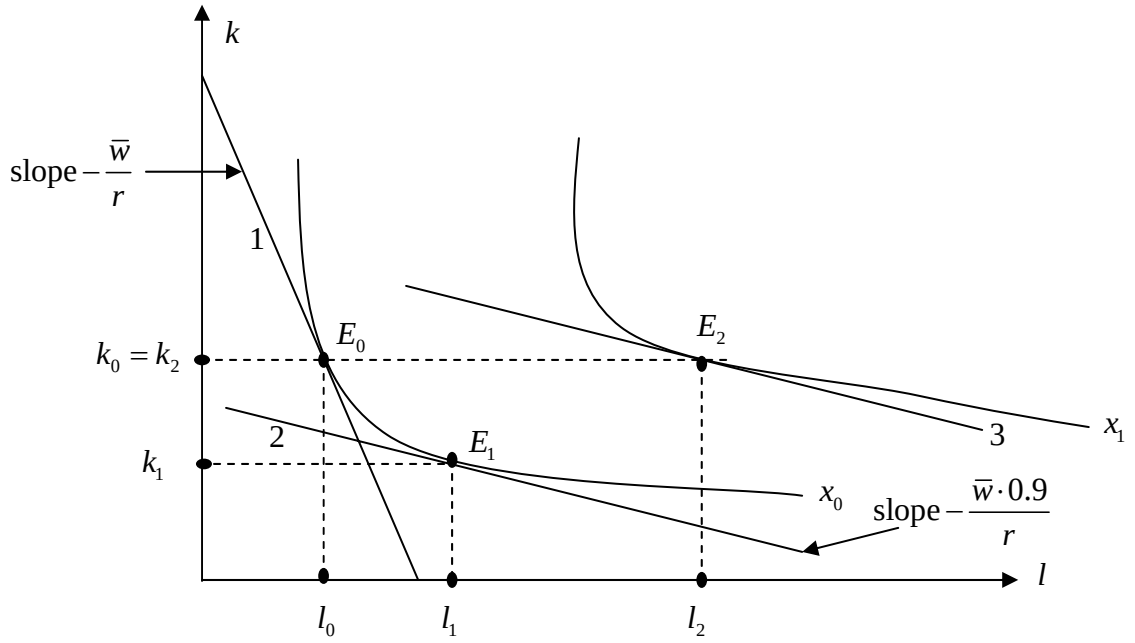

Figure 4: The cost-minimizing input combination of a representative firm

k-capital, *l*-labour demand of the firm, *r*-price of capital. 1-initial isocost line, E_0-initial equilibrium, 2-isocost line under a lower real wage, 3-new isocost line for $x_1 > x_0$.

4. Labour Market Effects in the GEM-E3 Model

In this section the quantitative labour market effects of an increase in labour hours without pay compensation in Germany are evaluated. To this end, we apply the single-country version of the computable general equilibrium model GEM-E3 for Germany with exogenously given real wage rigidities and involuntary unemployment in the initial equilibrium. In the literature, there are different theoretical microeconomic models to explain wage rigidities and involuntary unemployment. All models explain why the actual consumer wage is marked up over the reservation wage or outside option of employees, but they differ in the variables that affect this mark up. In the context of the German labour market, the most important labour market institutions are trade unions, i.e. wages are the outcome of collective bargaining.[3]

The simulations in section 5 are based on a simplified ad hoc specification of a minimum wage model which can give insights into the labour market effects of an extension of working time and into the sensitivity of model results to wage formation. An increase in working time at unchanged pay provides the opportunity to cut the hourly wage even if real wages are rigid downwards.[4]

[3] See Koschel (2001) for an application of a monopoly union model within a CGE framework for Germany.
[4] Moreover, given a fall in the hourly wage, it can be argued that longer working hours which can keep the living standard of employees are compatible with trade union's interest (see EEAG 2005:58ff.).

We assume that there is only one type of labour and that labour is mobile between sectors, but immobile between countries. In the model, the (neoclassical) equilibrium condition for the real wage rate is replaced by a wage equation that fixes the real wage level, i.e. labour supply is de facto infinitely elastic. The equilibrium employment level is determined by labour demand at the fixed real wage while equilibrium involuntary unemployment is calculated as a residuum resulting from the difference between individual labour supply and labour demand. The unemployment rate in the base run is around 10% in 2005. In all simulations, we assume that individual labour supply (representing labour supply in the absence of labour market institutions) is endogenous and depends on both the real consumer wage and non-wage income. Labour supply is computed as the difference between exogenous time resources and endogenous demand for voluntary leisure.[5]

Figure 5 illustrates the partial equilibrium labour market effects in the GEM-E3 model in the case of an increase in labour hours by around 10% without pay compensation with exogenous real wage rigidities. The wage-setting curve (*WS*) is a horizontal line, representing exogenously given real wage rigidities. For reasons of simplicity, we assume in Figure 5 that there is no tax wedge between real producer and consumer wage.[6] In the initial period, unemployment is given by U_0 (individual labour supply L^S minus labour demand L^D at $\overline{w}$) while voluntary leisure VL_0 is calculated as the difference between total time resources *TT* and individual labour supply L^S. Now we assume an economy-wide increase in the regular working time without pay compensation. The extension of working time reduces the hourly (real) consumer wage by 10% (while the pay per employee remains constant), i.e. the *WS* curve moves downwards to WS^1. The hourly (real) producer wage decreases by 10% as well. Both employers and employees take into account the wage rate reduction per hour and revise their labour demand and individual labour supply decisions.[7] Because of substitution

[5] Concerning the unemployment benefit regime it is assumed that the benefit replacement ratio, i.e. the ratio of unemployment benefits to the net wage, is fixed and independent of a change in working hours per employee. Unemployment benefits are indexed to the nominal after-tax wage, while the benefit replacement ratio is fixed at a 50% level for Germany, i.e. nominal unemployment benefits which are paid within a period to the involuntarily unemployed people are calculated as a fixed share of the (equilibrium) nominal net wage of the same period. A replacement ratio of 50% is close to reality. Nickell and Layard (1999:3045) estimate an average benefit replacement ratio of 63% over the period 1989-1994. Using a data sample of pooled cross sections and time series over 1978-89 and eight EU countries Brunello (1996) estimates a replacement ratio of 54% in Germany.

[6] The tax wedge is defined as the difference between the real producer wage and the real net wage which can be attributed to all commodity and factor taxes that are borne by labour (Steiner 1998:317).

[7] Note that in the case of a non-zero labour supply elasticity (i.e. labour supply rises with the real net wage) an extension of working time without wage adjustment influences the labour-leisure choice of the representative household. In the GEM-E3 model the labour supply elasticity with respect to the net wage is around 0.1. Since the substitution effect exceeds the income effect, a fall in the hourly wage reduces the desired amount of individually supplied labour hours – in return, the demand of voluntary leisure rises (see Section5). Concerning labour demand it is assumed that the total demand of labour hours is independent of the working time per employee, i.e. working hours and workers are perfect substitutes (see also EEAG 2005:59).

processes in production, labour demand rises (for given output and labour productivity) from L_0 to L_1 while individual labour supply decreases. The new unemployment level (in hours) is U_1.

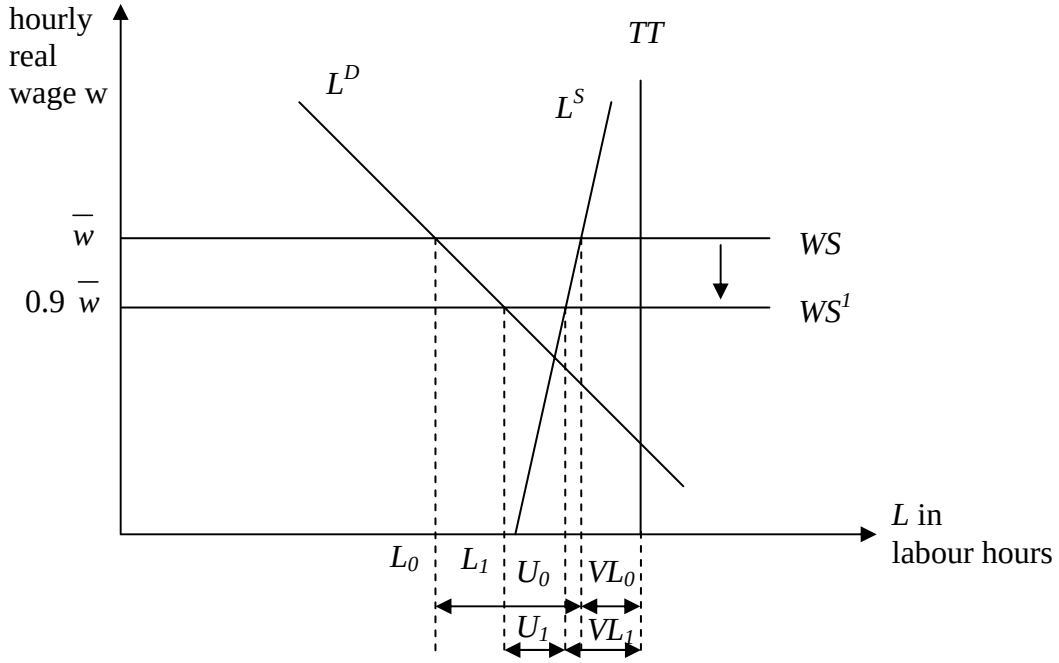

Figure 5: Effects of an extension of working time by around 10% in the presence of exogenous real wage rigidities

In a general equilibrium analysis, however, price and output effects have to be taken into account (see section 5).[8] An additional effect on labour demand and supply can occur if the public deficit per GDP is kept constant during the simulation and the tax wedge between producer and consumer wage is affected. This is, for example, the case if a budget surplus is used to reduce the social security contribution rate of employees and employers. The reduction in existing labour market distortions will lead to an additional positive labour market effect. In this context the degree of real wage resistance, and thus the definition of the wage setting rule, are important issues. Real wage resistance exists if the real wage partially or fully resists the change in the labour tax rate (or rate of social security contributions, respectively). If the wage setting rule allows for real wage resistance, then a reduction in the tax wedge will benefit not only employees but also employers leading to higher labour demand.

[8] Since empirical evidence is weak, we ignore effects of a working time extension on the productivity of labour hour.

In order to test for the sensitivity of model results to wage formation we apply two different wage setting (WS) rules:

WS rule I assumes that the actual nominal gross wage per hour (W_1^{gross}), i.e. the hourly nominal net (after-tax) wage (W^{net}) plus labour income taxes (t^{dir}) and employees' social security contributions (ss), is exogenously fixed at the base year (0) level:[9]

$$W_1^{gross} = \alpha \cdot W_0^{gross} = \alpha \cdot \frac{W_0^{net}}{(1-ss_0)(1-t_0^{dir})} ,$$

where α represents a "working-time factor" which is 1 in the reference run and 0.9 in the scenario run (reflecting a cut in hourly wages by 10%). Obviously, a change in the employees' social security contribution rate or in the consumer price index will have no impact on the actual nominal gross wage W_1^{gross}. An exogenous increase in working time per employee is represented by an equivalent fall in the hourly nominal gross wage.

WS rule II assumes that the hourly real net (after-tax) wage is exogenously fixed at the base year level according to:

$$\frac{W_1^{net}}{PC_1} = \frac{W_1^{gross}}{PC_1} \cdot (1-ss_1)(1-t_1^{dir}) = \alpha \cdot \frac{W_0^{net}}{PC_0} ,$$

where PC represents the consumer price index. Obviously, WS rule II assumes that employees can keep their real consumption standard. An exogenous increase in working time per employee without pay compensation, however, leads to an equivalent fall in the hourly real net wage ($\alpha = 0.9$). In contrast to WS rule I, changes in the employees' social security contribution rate and the consumer price index affect the actual nominal gross wage W_1^{gross} either positively or negatively. A cut in the social security contribution rate and a decrease in the consumer price index (resulting from output expansion due to working time expansion) lead to additional wage moderation.

[9] The gross wage plus the employers' social security contributions then yield the producer wage, i.e. labour costs.

5. Simulation Results

Table 1 depicts the simulation results for different scenarios of an increase in working hours. Since in all simulations the sectoral capital stock is quasi-fixed and internationally immobile, the results reflect rather short-term effects.[10]

In *Scenario 1* we assume that the nominal consumer and producer wage rate decrease by exactly -10% (WS rule I). Trade unions fully accept the increase in labour hours and the corresponding reduction in the hourly wage. Since the consumer price index decreases by -1.90%, employees take a loss in the real consumer wage by "only" -8.26% (the wage setting equation does not include the consumer price index). The public deficit per GDP is variable.

In contrast to *Scenario 1*, *Scenario 2* assumes that the ratio of public deficit to GDP is fixed (at the reference level); a budget surplus is used to reduce the VAT rate. Concerning wage formation we apply again WS rule I. The intuition behind this is, for example, that trade unions fully accept an increase in labour hours per person and the corresponding cut in nominal hourly wages by -10%. Since the consumer price index decreases by -3.72% – due to the drop in VAT, the price decrease is higher than in *Scenario 1* – employees take a loss in the real consumer wage by only -6.52%.

In *Scenario 3a* and *3b* the ratio of public deficit to GDP is fixed as well (at the reference level). The budget surplus is used to cut the rate of social security contributions of employers and employees equally. While in *Scenario 3a* a cut in the employees' share in social security contributions leads to a relatively higher real consumer wage (WS rule I), in *Scenario 3b* the cut in the employers' and employees' social security contributions favours the employers in terms of lower labour costs (WS rule II).

Let us turn to *Scenario 1*. Table 1 indicates that the reduction in the nominal and real producer wage of -10% and -6.34%, together with a positive effect on domestic production (2.26%), leads to a higher demand for labour hours by 5.16% compared to the reference case without labour market policy. Output and substitution effects, however, are not strong enough to compensate for the negative effect of an increase in labour hours on the employment level in terms of employees: The number of employed persons drops by -4.40%. The overall drop in prices of consumption, production and labour leads to higher domestic demand (0.49%) and exports (6.85%). Exports rise since foreign export demand for German products is price elastic. Imports increase as well (by 1.45%) due to a rise in domestic production (obviously,

[10] An increase in labour input (hours) leads to a higher ex-post price for capital and thus to a higher real capital income (see Appendix). Since above all the real net wage per hour drops, voluntary leisure (in hours) increases. Note that the nominal wage income per employee remains constant (a lower nominal wage by 10% is compensated by an equivalent increase in hours worked).

negative price effects on Germany's import demand are outweighed by positive output effects). The relatively higher increase in labour hours compared to domestic production is responsible for the decrease in labour productivity per hour by -2.76% while labour productivity per worker increases by 6.96%. The public deficit is kept variable. The reduction in the public deficit per GDP by 1.25 percentage points has no feedback effects on the economy (this assumption is feasible particularly in the short and medium term).

Table 1: Macroeconomic effects of an increase in working hours by around 10% in Germany in 2005 *(numbers indicate percent changes from baseline)*

	Increase in working hours by around 10% in 2005			
	Scenario 1	*Scenario 2*	*Scenario 3a*	*Scenario 3b*
Gross domestic product	**2.46%**	**2.58%**	**3.16%**	**4.34%**
Employment (number of employed persons)	**-4.40%**	**-3.68%**	**-2.47%**	**1.05%**
Employment (hours)	**5.16%**	**5.95%**	**7.28%**	**11.15%**
Voluntary leisure (hours)	**1.28%**	**1.66%**	**1.24%**	**2.64%**
Labour productivity (output/employed persons)	**6.96%**	**6.16%**	**5.38%**	**2.71%**
Labour productivity (output/labour hours)	**-2.76%**	**-3.49%**	**-4.20%**	**-6.62%**
Nominal producer wage/hour	**-10.00%**	**-10.00%**	**-12.24%**	**-17.76%**
Nominal consumer wage/hour	**-10.00%**	**-10.00%**	**-6.49%**	**-10.81%**
Real producer wage (deflated by GDP deflator)	**-6.34%**	**-7.91%**	**-9.48%**	**-14.40%**
Real consumer wage (deflated by consumer price index)	**-8.26%**	**-6.52%**	**-5.60%**	**-10.00%**
Consumers' price index	**-1.90%**	**-3.72%**	**-0.95%**	**-0.90%**
GDP deflator in factor prices	**-3.91%**	**-2.27%**	**-3.05%**	**-3.93%**
Domestic production	**2.26%**	**2.25%**	**2.78%**	**3.79%**
Private investment	**0.81%**	**1.32%**	**1.32%**	**1.71%**
Private consumption	**-1.52%**	**0.80%**	**0.66%**	**0.58%**
Domestic demand	**0.49%**	**1.26%**	**1.41%**	**1.83%**
Exports in volume	**6.85%**	**4.77%**	**6.25%**	**8.07%**
Imports in volume	**1.45%**	**1.72%**	**2.08%**	**3.05%**
Public deficit as % of GDP *	**0.0125**	**0.0000**	**0.0000**	**0.0000**

* absolute difference from baseline

If the public deficit per GDP is fixed and the VAT rate is endogenous (*Scenario 2*), employment effects of an increase in labour hours are slightly higher. Labour demand in hours increases by 5.95% while employment in persons falls by only -3.68%. The VAT rate reduction leads to a relatively higher fall in the consumer price index (by -3.72%) and a higher real consumer wage. Domestic and import demand are higher than in *Scenario 1* while export demand is lower since the GDP deflator in factor prices declines less than in *Scenario 1*.

In *Scenario 3a* the real labour costs decrease by -9.48%. Labour demand in hours rises by 7.28% while employment in persons falls by -2.47%. In *Scenario 3b* the real producer wage is reduced by -14.40% while the real consumer wage is at a relatively low level (-10%).

Scenario 3b assumes that trade unions accept the wage decrease due to the extension of working time and moreover take into account that the consumer price index and the employees' rate of social security contributions have fallen. This additional wage moderation allows for a rise of both employment in hours (11.15%) and persons (1.05%).

Obviously, the employment effects of longer working hours are sensitive to the way how a budget surplus is recycled and to the wage fixing rule. If the nominal wage falls enough (since wage pressure is even further reduced), real labour costs can decrease at a sufficient rate and the incentives for additional labour demand are strong enough. The smaller the reduction in labour costs is, the smaller are the production, domestic demand and labour demand levels and the higher are the price levels and the loss in employment (in persons).

6. Conclusion

Our simulation results have shown that the increase in working time without pay compensation will not solve the problem of high unemployment in Germany in the short run. They could be interpreted only as a step in the right direction to encourage entrepreneurs not to outsource production to lower-cost facilities abroad or to revise decisions to closing down production facilities. The new labour market policy will have a psychological effect and should be seen as a signal that the society is willing to sacrifice leisure time as a response to international competitive pressures from globalisation which has raised capital mobility. Our simulation results support the argument of the opponents of longer working time that not more jobs will be created, however, when we recycled the higher tax revenues from GDP growth to lower the contribution to social security, then we have been able to support the claim of the proponents that more jobs will be created.

Many aspects of a transition to longer working time have been neglected in our analysis. We retained from specifying a model of collective bargaining which is standard for analysing wage setting in theoretical models. We also neglected the fact that due to paid overtime the actual working time exceeds standard working time implying a lower income for those workers and lower labour costs for some firms if 41.5 hours/week become standard working time. But more important, we have not addressed the issue of working time and the utilization of capital stock.[11] This means that longer working time for employees will not increase the operating time of capital. This effect can obviously make a positive employment

[11] See Box 3.1 in the EEAG Report which lists some formulas for the short-run employment effects of longer working hours at unchanged pay per worker.

effect more likely. In any case, in the short-run employment effects are likely to be negative. In the long-run, economic forces need support from psychological factors.

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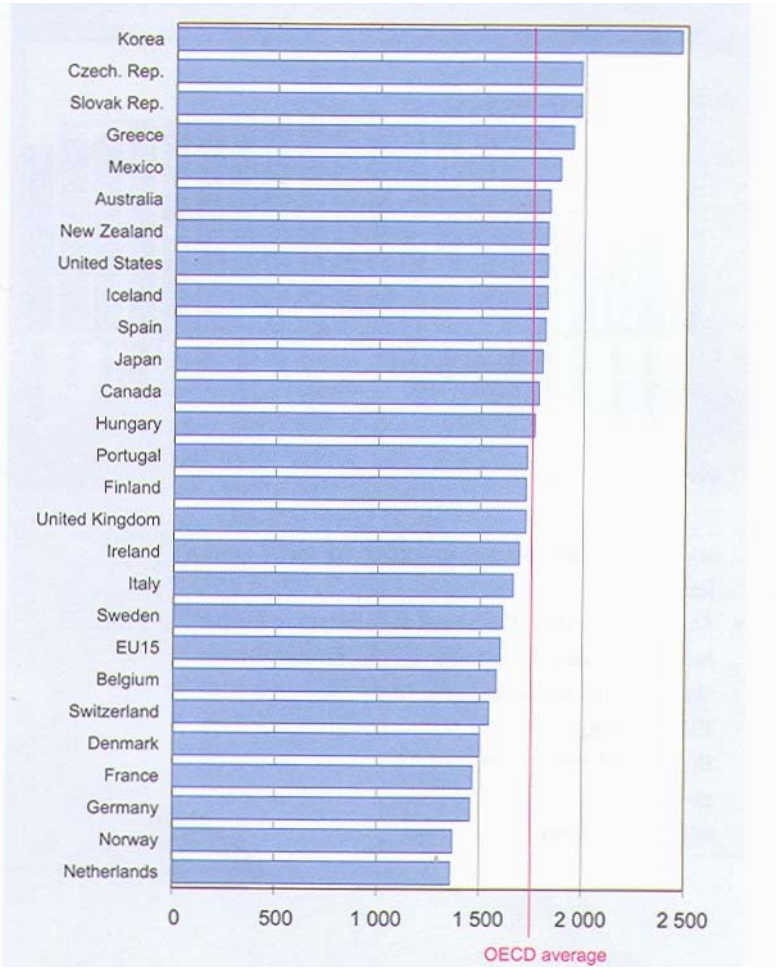
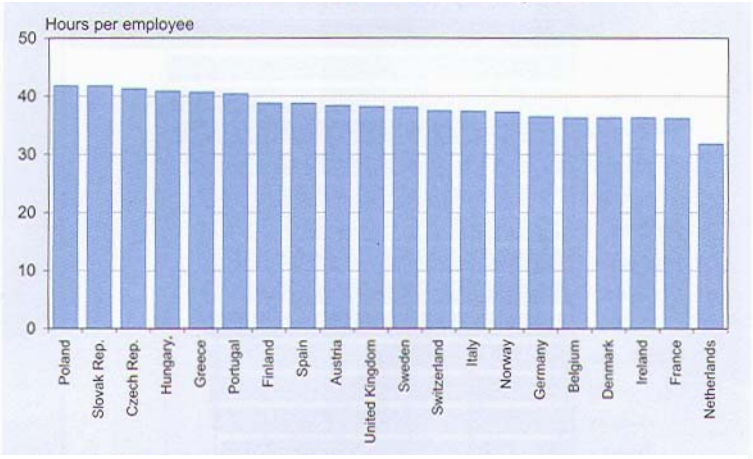
Appendix



Source: OECD (2004)

Figure 1: Annual hours worked per worker in 2002



Source: OECD (2004)

Figure 2: Average workweek in Europe in 2002

Appendix: The GEM-E3 model

GEM-E3 is a multi-country computable general equilibrium model that was developed on behalf of the European Commission, Directorate-General for Research.[12]

In the single-country version for Germany 18 production sectors are included which are characterised by four-level nested CES production functions with labour, capital, and 18 intermediate inputs, including electricity, an input aggregate of three fossil fuel components (coal, oil, and gas), and an input aggregate of 14 nonenergy material components. Profit maximisation under constant returns to scale (in the long run) implies marginal revenues equal marginal costs, which explains the output price of domestic production in terms of a CES unit cost function.

Labour is immobile across countries but mobile between sectors. The sectoral capital stock is quasi fixed for the current year at a level reached at the end of the previous year. Hence the demand function for capital is used to determine an endogenous *ex post* price of capital which clears the market for the fixed capital stock. It is used to calculate capital income, which is distributed among households (in form of interest payments from assets, dissemination of firms profits, entrepreneurs' salary), firms, and the government. Given the *ex ante* price of capital, which depends on the price of investment goods, the rate of return on risk-free government bonds, and the rate of replacement, the factor demand function for capital can be employed to determine the desired stock of capital. The difference between the desired capital stock and fixed capital stock defines net investment.

The behaviour of the representative household is assumed to perform a two-stage budgeting procedure: an intertemporal allocation of lifetime wealth endowment between present and future consumption of goods and leisure and an intratemporal allocation of total consumption of goods between durable and non-durable goods. The representative household determines an allocation of its resources between present and future consumption by maximising an intertemporal utility function subject to an intertemporal budget constraint: Under myopic expectations and the assumption of constant and equal growth rates for both inflation and the nominal wage rate the Fisher relation can be used to derive demand functions for consumption and leisure. Labour supply is given by the residual between total time resources and leisure demand.

In the standard version of the GEM-E3 model with a neo-classical labour market, the wage rate serves to balance labour demand of firms and leisure demand of households. The savings of households are determined by the difference of disposable income and

[12] For a more detailed presentation of the model structure and the empirical data basis see Capros et al. (1997) and Schmidt (1999).

consumption expenditures. In the version which is used in this paper, the real net wage rate is exogenously fixed which leads to involuntary unemployment in equilibrium. Labour demand at the fixed wage rate determines employment. Involuntary unemployment is calculated as the difference between exogenously given time resources minus voluntary leisure minus labour demand.

The model distinguishes between two types of consumption expenditure: expenditure for non-linked, non-durable goods, which are allocated on the second stage of the consumer decision problem, and expenditure associated with the use of durable goods – covering capital user costs and demand for linked non-durable goods.

The government's expenditure is exogenous in large parts while revenues are endogenous. Revenue categories are for example direct and indirect taxes, VAT, employers' and employees' social security contributions, export and production subsidies, or import duties.

The specification of Germany's import demand for tradable commodities is based on the Armington model of national product differentiation. Expenditure is allocated between domestic demand of domestically produced goods and imports from the rest of the world. Thus, import demand is price elastic. Domestically produced goods sold on the German market, however, are perfect substitutes for goods that are sold on foreign export markets.
The rest of the world's production and consumption behaviour is exogenous. The rest of the world supplies exports at fixed world market prices. The foreign import demand function is modelled in complete analogy to Germany's import demand function (Armington) and thus entails a certain degree of price elasticity as well.

Since the demand system determines consumption goods by categories and the system of investment functions determines investment demand by destination, transition matrices are required to transform demand into deliveries from the industries. Therefore, the final demand is the result of the transition matrix of the type (branches × categories) multiplied by the consumption categories. Similar to the matching of consumption categories to products, an investment matrix with fixed technical coefficients is used to calculate investment demand by origin (products) from investment demand by destination (branches).

The national accounting identity, which expresses that the private gross domestic production from both the flow of cost approach and the flow of product approach should be equal, is satisfied if and only if total saving, involving income distribution and fiscal policy relationships, equals total investment. Following Walras' Law, this market is in equilibrium if an equilibrium price vector is found for the other markets (supposing that the demand, supply

and price functions are specified according to the needs of an Arrow-Debreu economy). Therefore, the saving-investment identity and the corresponding global shadow price of capital (mobility of (new) capital between sectors but not across countries is assumed) is automatically given.