Hans Herrmann Blauw

Working time and unemployment – From weakness in sales to economic crisis

Optimal and factual working time
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Preface

In view of the huge rise of production with a thirty-fold increase of labour productivity and a decrease to half the working time per employee since the beginning of industrialisation, this book investigates why the working time per employee just decreased to the degree it did, and which working time is optimal for the household and for the company.

It is obvious that unemployment has something to do with working time. But all the explanatory approaches to explain unemployment have in common that they do not take into account the quantity of work per employee as desired by suppliers and demanders, and therefore say little that is convincing about the reduction of working time. This book derives how the unemployment rate is connected with the working time per employee.

Independent of cyclical fluctuations, the key problem of industry has almost always been the sale of its output. This results in overproduction over and over again. If, in addition, big income differences per person exist, savings can become so high that not enough profitable or at least amortisable investments in newly produced goods are possible, and the economic circuit can then slacken off even to the extent of an economic crisis. Possible measures for remedy are discussed. The economic crisis from 2007 is compared with that from 1929 and with later recessions. Because of the higher debt, today's crisis has a larger potential than that from 1929.

I obtained the following new results: The optimal working time of the employee decreases with increasing wage rate and with worsening of working conditions. If the factual working time is longer than optimal, consumption does not keep pace with production and unemployment results. If working time is not reduced in line with increasing productivity, the national income eventually stagnates. If savings are much larger than investment in real goods an economic crisis can develop. It can be resolved without inflation and government debt by taxing away the surplus savings and investing or consuming them via the state, and by reducing working time per employee.

In Western industrialised countries the economic crisis is combated predominantly by government loans to the financial industry. But it is first and foremost a sales crisis and cannot be remedied like that. States which invest additionally in public goods, where need exists, for example of infrastructure or conservation, are on a better track.

The book consists of three largely independent chapters dealing with working time, unemployment and economic crises. The problems are investigated theoretically and the results tested empirically for the USA, Japan and Germany.

I stumbled upon the problem of productivity, working time and employment years ago as a business planner with an industrial group. Since then I have dealt with the topic in detail, in contact with experts, also of universities and institutes at home and abroad, alongside my job as a managing director in industrial companies. My repeated confrontation with the problem of sale of goods motivated me to investigate its causes and effects. As eventually the crisis from 2007 came and stayed, it was not difficult to explain it with the approach described here. This meant I could deal with the topic of working time, unemployment and economic circuit in context.

H. H. B.

Chapter 1
Optimal and factual working time

The chief business of the Stywards - in fact, practically their only business - is to see that nobody sits around doing nothing, but that everyone gets on with his job. They don't wear people out, though, by keeping them hard at work from early morning till late at night, like cart-horses. That's just slavery - and yet that's what life is like for the working classes nearly everywhere else in the world. In Utopia they have a six-hour working day...

With everybody doing useful work, and with such work reduced to a minimum, they build up such large reserves of everything that from time to time they can release a huge labour force to mend any roads which are in bad condition. And quite often, if there's nothing of that sort to be done, the authorities announce a shorter working day. They never force people to work unnecessarily...

Thomas More, Utopia, 1516 (1965 p. 75-76, 79)

Abstract

The optimal working time of the household decreases with increasing wage rate or non-work income. With longer working time a higher proportion of the income is saved. From the point of view of the company the optimal working time is longer than that of the employee household. The factual working time is longer than desired by the employees. For the time from 1850 on, the working time in the USA, Japan and Germany are in line with the optimal working time for the employee as a function of the wage rate.

JEL code and keywords

J22, J23

company, employee household, historical, labour supply curve, saving, utility, wage rate, working time

The course of argumentation can also be pursued without the parts written in italics.

1. Initial position

In today‘s industrialised countries, labour productivity per working person and hour rose to about 27 fold between the years 1800 and 2000 (Maddison 1995 p. 46). In Germany, labour productivity in mining rose to about 10 fold, in agriculture 15 fold, in production up to 100 fold and more, and in services 3 fold (Katalyse 1981 p. 10). Between 1820 and 2000 the gross domestic product per person in real terms rose to about 20 fold, in the preceding 200 years only to about 1.5 fold (Maddison 2003 p. 262). In Germany since 1800 the conversion of non-renewable raw materials rose to more than 10-fold (Katalyse 1981 p. 13). On average, the population of Western Europe and Japan rose on average to 3.2 fold (Maddison 2003 p. 256). In the USA, the gross wages and salaries in real terms increased to 12-fold and in Germany to 30-fold per working hour (section 8 figure 7). The annual earning working time per employee was reduced to half or even less (Maddison 2001 p. 347), slavery was banned in 1865 or earlier (Brockhaus 1993 vol.20 p. 359) and child labour in 1973 or earlier (Brockhaus 1990 vol.11 p. 683).

These dimensions of the changes will make it revealing to investigate, why the working time per employee just decreased to the degree as it did, or how the working time depends on the wage rate, and which working time is optimal for the household and for the company. To clarify this, in the first place the utility of the household depending on the consumption is described. Then it is considered, that the means for the consumption are acquired with work or non-work income, and then the optimal working time for the household is determined. Next the optimal working time of the employee from the point of view of the company is discussed. Finally the desired and the factual working time are compared, and the historical development of working time and wage rate shown.

2. Utility and consumption

A key question in this study is the optimal amount of work or its corresponding optimal working time from the view of the working person. It can be seen as working time, with which the utility of a person or its household has its maximum. Utility can be understood as the standard of living or well-being. In order to achieve this, goods are consumed or used. To buy them money has to be spent. Hence the optimum working time can be determined if the dependence of utility on consumption and working time is known. For this there are several approaches.

In 1738, Daniel Bernoulli postulates for the calculation of the values of strokes of luck, that an increase in the quantity of goods creates an increase in utility, which is inversely proportional to the already available quantity of goods. For instance, if the quantity of goods is three times as large, utility grows only by a third with the same increase of the quantity of goods.So utility changes with the logarithm of the quantity of goods (Bernoulli 1954 p. 25, 27). In 1728, for this case Gabriel Cramer uses the hypothesis that utility grows with the square root of the quantity of goods, thus utility is a power function of the quantity of goods (Bernoulli 1954 p. 34).

The psycho-physical relation by Weber and Fechner from the year 1860 shows that the strength of perception of a sensory stimulus grows with the logarithm of the strength of the sensory stimulus (Schmidt... 2000 p. 210-211). It can be written as $y = a \ln x + b$*, with the strength of perception* y*, the strength of stimulus* x *and constants* a *and* b*. This relation is valid for an average segment of the strength of sensory stimuli. According to Plateau and Stevens in 1959, in many cases the strength of perception grows with a power of with the strength of the sensory stimuli (Schmidt... 2000 p. 211-212),. The exponent* n *is for example 0.21 for intensity of white light, 0.35 for loudness and 0,79 for force (Klinke... 1996 p. 628). Over a large range, the logarithmical function is a good approximation for the power function. The sound pressure is*

defined as $L = 20\lg(p_1 / p_0)$ *with* p_1 *= effective sound pressure and* p_0 *= 2 x* 10^{-5} *N/m*^{2} *scale basis (Hütte vol.1 1955 p. 624).*

From economics comes Turgot's law of diminishing returns as well as Gossen's first law, that the increase of utility diminishes with growing input of goods. In the report on human development by the United Nations Development Programme (UNDP) a human development index (HDI) is used, in which parameters for life expectancy, education, and standard of living that can assume the same values, are added (United... 2003 p. 341). In the definition of 2003 is:

Human Development Index = 1/3 of the index of life expectancy + 1/3 of the index of education + 1/3 of the index for standard of living.

Index for the standard of living = ((lg (real gross domestic product per inhabitant) - lg (fictitious minimum value of GDP per inhabitant)) / ((lg (fictitious maximum value of GDP per inhabitant) - lg (fictitious minimum value of GDP per inhabitant).

The fictitious minimum and maximum values are values that are reached by different groups of persons all over the world, or they are plausible limits.

Since the fictitious minimum value, the fictitious maximum value, and the conversion factor of $\lg$ *to* $\ln$ *are constants, the index of the standard of living can again be expressed by the formula* $y = a \ln x + b$ *, with the standard of living* y*, the real gross domestic product per person* x *and constants* a *and* b*.*

However, in social psychology this degressive relation is only confirmed for needs with a strong physiological link. At “goods” such as wealth, performance and power utility is said to increase progressively with increasing “consumption” (Fischer/Wiswede 2002 p. 109). But this is only relevant at a higher income.

For the facts discussed here, only the difference between various utilities is important. Then the constant b is not needed. The constant a can be combined with the numerus of the logarithm. Then utility is

$$u = \ln gc \qquad (1)$$

where u is the average utility of a person at each moment of their active life time of a time period, c the consumption of the person in this period, expressed in money value, and g is a scale factor.

The scale factor can be chosen in any way. In this study, its size is determined in such a way that utility has its maximum with the desired working time of the earning working person and the selected currency. See below. Its dimension Pa/$ (person multiplied with year, divided by US-$) is the inverse value of the dimension of consumption $/Pa. The utility function is shown in figure 1, and also a power function, whose values are approximately the same in the range examined here.

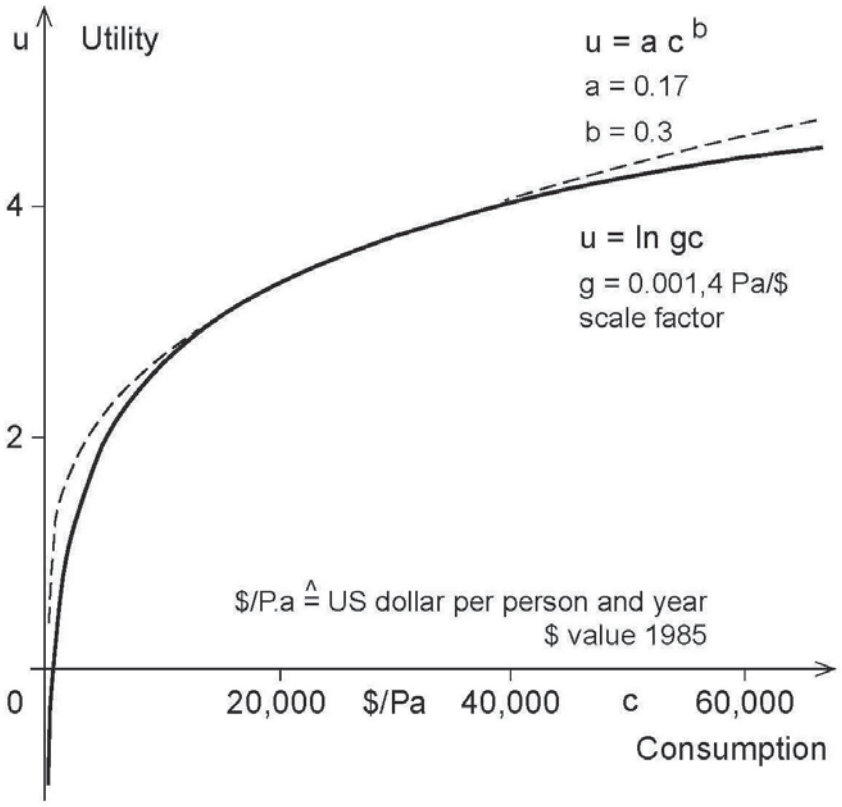

Figure 1

Consumption and utility

3. Work and utility

In order to develop a utility function, if the means for the consumption are obtained through work, reference is made to the explanations of Seitz (1965) and Becker (1965), in which it is shown that the

consumption of goods requires time, which is then not available for work. Other authors describe this using *a* Cobb-Douglas function, for example $u = \alpha \ln c + (1-a) \ln q$, where u is the utility, c the consumption, q the leisure time and α a parameter (for example Leuthold 1968 p. 314, Romer 2001 p. 177). But this term does not, among other things, express that the consumption mainly occurs during leisure time. In this article a function which considers this is derived from elemental relations. The leisure time which is used for the consumption of goods is not linked with these goods to new commodities, and leisure time is also not subdivided according to the nature of goods consumed. A differentiation is only made between working time and leisure time.

If one works in order to acquire means for consumption, this requires effort to an extent that reduces the utility. To consider this, the current utility during working time and leisure time are determined separately and then added to an entire utility. As postulated in 1916 by Gilbreth/Gilbreth (1919 p. 158) fatigue caused by work should be eliminated. According to the present general opinion in ergonomics, work should be organised in such a way that the degree of fatigue during working time after an initial rise remains constant (Rohmert/Rutenfranz (1983). Praktische Arbeitsphysiologie 1983 p. 87, 356) and that the fatigue totally disappeared after the next sleep (Rohmert/Rutenfranz 1983 p. 102). Here it is assumed that this is true in reality, and the additional fatigue caused by work is disregarded.

To be able to calculate the average utility from the utility during working time and leisure time, active life time is set as half of the calendar time, and it is assumed that the active life time of earning working persons consists exclusively of earning working time and leisure time, and that the average utility is the timely weighted arithmetical average of the utility in different time periods. That means that in life processes such as saturation by intake of food, satisfaction through having pleasant experience or fatigue caused by activity, in a wide field, ‘intensive and short lasting’ has the same effect as ‘weak and long lasting’. Contrary to

utility as a function of consumption there is no degression in average utility as a function of the varyingly utility at different time periods.

Similarly, with intertemporal utility the future utilities in successsive time periods are discounted and added up to a total utility (for example Mas-Colell/Whinston/Green 1995 p. 733-734). Here the discount can be disregarded since the periods of working time and leisure time are short. An average utility can be determined by adding the current utility multiplied by the associated time periods together and dividing it by the total number of time periods. In health economics health conditions are similarly assessed in this way. The measure QALY (quality-adjusted life years) used by the World Health Organisation (WHO) and World Bank likewise does not include a discount. It is the product of the time period multiplied by an index for health quality or, if this index shows different values at different times, the sum of these products (Dolan 2000 p. 1731).

The average utility thus calculated increases with the utility during working time, with the wage rate, and up to a certain value with the working time. It does not reach its maximum value at the maximum working time but at a shorter time, the optimal working time. See figure 2. If the increased fatigue after longer working time were taken into account, the optimal working time would be even shorter. The decreasing utility at longer working times is the result of two contrary effects. With longer working times, income and consumption increase, but related to a shorter leisure time they increase even more than when related to the total active life time. However, utility increases underproportionally with consumption, and average utility increases less with increasing working time. With long working times the decrease of utility by taking the average dominates the increase of utility in leisure time by higher wage rate and shorter leisure time.

The optimal working time as a function of the wage rate is deduced as follows. As argued above the utility of a person during working time u_l *first of all depends on the working conditions in a certain occupation, not on the working time,*

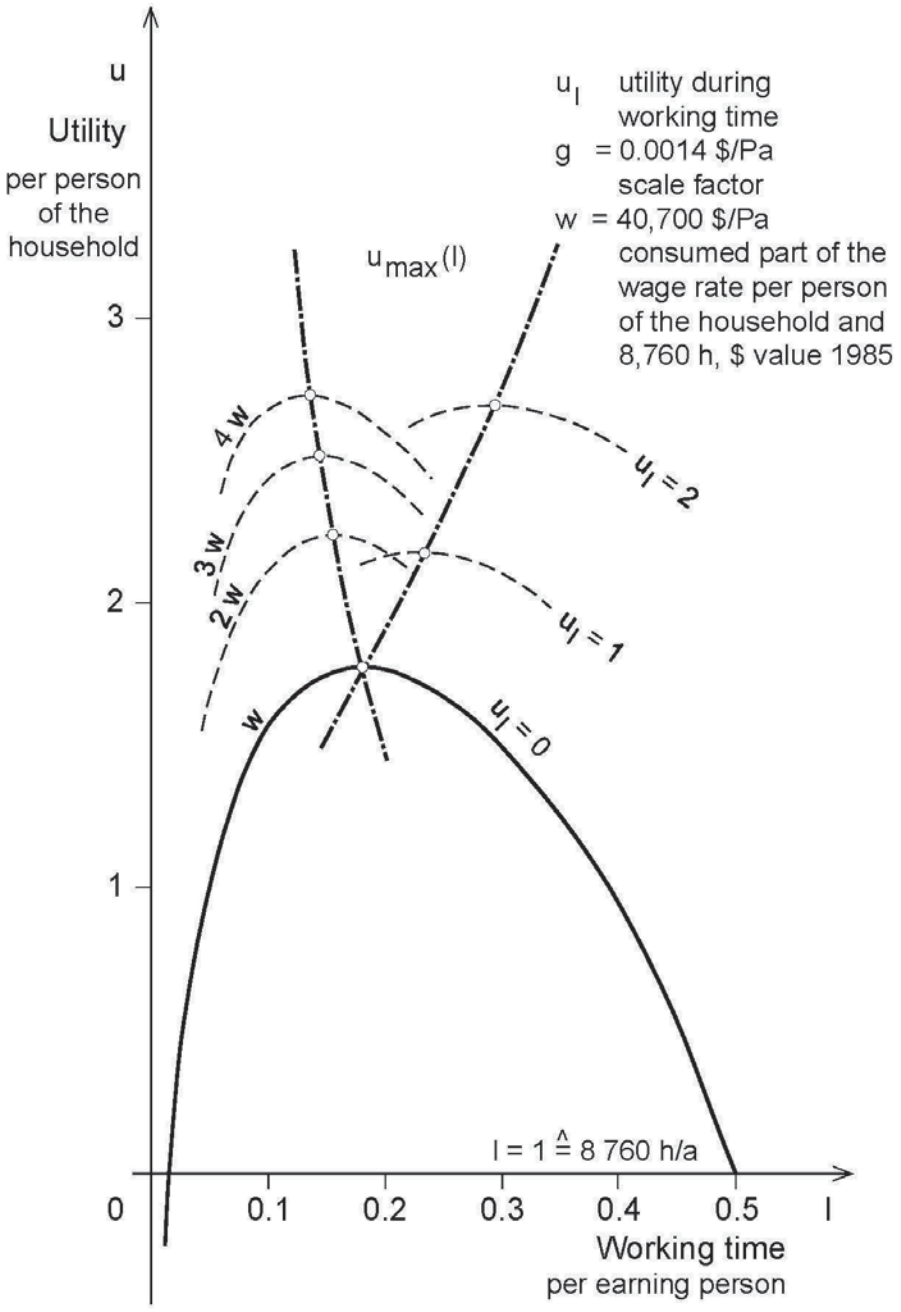

Figure 2
Utility in relation to working time

u_l = f (occupation, working conditions, ...). (2)

Utility during leisure time u_q depends on the goods consumed (inclusive worn out) during this time, and hence also on the means expended for it, as shown in equation (1). The case that only work income is achieved is

treated first. The disposable work income per person of the household and time period y_w *is*

$$y_w = w_d l \tag{3}$$

with the disposable part of the wage or pay rate (less direct taxes and social contributions), per person of the household w_d *and the earning working time per earning person* l *. Here the working time is set as a proportion of the active life time, which is set as half of the calendar time, so the maximal working time is then 1/2. The time period is set as one year. So the wage (or pay) rate is the income from 8,760 working hours. The wage rate is used as an average per person of the household,*

$$w_d = w_{ge} t_w p_e \tag{4}$$

with the gross wage rate per employee in the household w_{ge}*, the reduction factor for direct taxes, social contributions, balance of transfers) for the wage rate* t_w *and the activity rate* p_e *(the share of earning working persons out of all persons). So the non-earning persons in the household are taken into account in the work income, but not in the paid working time. Consumption per person of the household and time period* c *is disposable work income* y_w *minus saving* s_w*, therefore*

$$c = y_w - s_w = w_d l - s_w = wl \,. \tag{5}$$

w *is the consumed part of the wage rate per person of the household. The active life time is half the calendar time, with earning persons it consists solely of working time* l *and leisure time* $q = 1/2 - l$*, and they only consume during their leisure time. Therefore consumption related to leisure time is higher with the factor*

$$\frac{q+l}{q} = \frac{\frac{1}{2}}{\frac{1}{2}-l} = \frac{1}{1-2l}$$

than when related to working time plus leisure time. Utility of the earning persons during leisure time u_q *is with equation (1) and this factor*

$$u_q = \ln \frac{gc}{1-2l}. \qquad (6)$$

After inserting the term for c from equation (5) results

$$u_q = \ln \frac{gw}{\frac{1}{l}-2}. \qquad (7)$$

Utility for the earning person is determined as the timely weighted arithmetical average of utility during working and leisure time

$$u = \frac{u_l l + u_q\left(\frac{1}{2}-l\right)}{\frac{1}{2}}$$

or

$$u = 2lu_l + (1-2l)u_q. \qquad (8)$$

After inserting the term for u_q from equation (7) results

$$u = 2lu_l + (1-2l)\ln \frac{gw}{\frac{1}{l}-2}. \qquad (9)$$

The average utility u increases thus with the utility during working time and with the wage rate. With constant wage rate and variable working time utility does not have its maximum at the maximal working time, but at a shorter time. See figure 2. Therefore this optimal working time is shorter than the maximal one. It results from the rules of extremes with

$$\frac{\partial u}{\partial l} = \frac{1}{2l} + \ln\left(\frac{1}{l}-2\right) + u_l - \ln gw = 0 \qquad (10)$$

set, and with

$$\frac{\partial^2 u}{\partial l^2} = -\frac{1}{2l^2(1-2l)} < 0 \qquad \text{for } 0 < l < \frac{1}{2} \qquad (11)$$

from equation (10) to

$$\left(\frac{1}{l_*}-2\right)e^{\frac{1}{2l_*}} = \frac{gw}{e^{u_l}}.$$

Using l_* instead of l is to express that this relation is valid only for the maximum of u. $l_* = f(w)$ can only be determined numerically with this

relation. However, an explicit solution is obtained for the inverse function $w = f_1(l_*)$

$$w = \frac{1}{g}\left(\frac{1}{l_*} - 2\right) e^{\frac{1}{2l_*} + u_l} \quad . \qquad (12)$$

w *is the consumed part of the wage (or pay) rate per person of the household and time period,* g *a scale factor,* l_* *the optimal working time per earning person and* u_l *the utility during working time. Thus, the optimal working time is determined by the wage rate and utility during working time. The term* e^{u_l} / g *can be combined and then there is only one parameter in the equation.*

For utility during working time u_l*, which is not ascertained here, one can distinguish two extremes,* u_l *= 0 und* $u_l \geq u_q$*. In the first case, termed here functional work, no utility (in the sense of current well-being) during working time is achieved. Then the utility from equation (9) results in*

$$u_f = (1 - 2l) \ln \frac{gw}{\frac{1}{l} - 2}$$

and the wage rate from equation (12) in

$$w_f = \frac{1}{g}\left(\frac{1}{l_0} - 2\right) e^{\frac{1}{2l_0}} .$$

With $u_l = 0$*, the wage rate with the factor* e^{-u_l} *is smaller than for* $u_l > 0$*, if the same working time should be optimal. Conversely, with the same wage rate, the optimal working time with* $u_l > 0$ *is longer than for* $u_l = 0$*, also see figure 2, and smaller for* $u_l < 0$*. In the second case, with* $u_l \geq u_q$*, referred to here ideal work, working time is at least as pleasant as the leisure time. Then the optimal working time is equal to the maximum,* l_{0i} *= 1/2.*

To calculate the optimal working time, the scale factor for utility g *is necessary. It is determined with equation (19) for West Germany in 1985 with following data. For the conversion of DM into US-$ for 1985 with an*

exchange rate of 2.94 DM / US-$ and a purchasing power parity of 1.97 DM / US-$ (Statistisches... 1988 p. 722) following the German scheme 1 DM = 0.5 US-$ is used. The components of the income of the employee household are taken from the national accounts. See table 1.

From this the factors for the indirect taxes and the social contributions related to the income are calculated. With that the disposable amounts of the components of the income result. The disposable current transfers received are determined from the disposable income minus the disposable amounts of the components of income. The number of persons in the employee household is 2.69 (Statistisches... 1994 Sep b p. 14). The number of employees per household is 1.62, calculated from the gross wage and salary per employee household and year of 28,600 $/Ha (Statistisches... 1994 Sep a p. 5) divided by 17,700 $\$/P_e a$ *per employee and year (Statistisches... 1999), so the activity rate is 1.62 / 2.69 =0.60. The factual working time per employee is 1,580 h/a (Statistisches... 2003, Tafel 1.1.12) or* l *= 0.180. The average gross wage and salary rate is thus 11.20* $\$/P_e a$*, the average net wage and salary rate is about 7.73* $\$/P_e a$*. After removing the unemployed from the employee households (chapter 2 table 3) the number of persons per household is lower, their incomes are higher, and the current transfers received are lower. The saving ratio of the employee household is calculated to 12.1 % as the weighted average of all civil servant, white collar and blue collar employee households related to the income which can be spent, found out in the income and consumption random sample survey in 1983. The saving ratio of all two-person households with the average income which can be spent of 8,750 $/Pa, adjusted for inflation to 8,370 $/Pa in 1983, is 6.6 %. See section 5, figure 6. (The income which can be spent is approximately equal to the disposable income.) The saving ratio of the private households in 1983 was 10.8 % of the disposable income, in 1985 it was 11.4 %. From this the saving ratio of 10 % of the employee households with a disposable income of 8,750 $/Pa in 1985 is estimated. Wages and salaries count as work income while industrialist income, property income and current transfers received count as non-work income. With saving it is assumed that it*

Table 1
Disposable income, consumption and scale factor for the utility
(Employees, West Germany 1985, 1 DM = 0.5 US-$)

Persons per household (P)			2.69	2.54*				
Item			*Amount ($/Pa)***	*Reduction factor (1)*	*Share disposable work income ($/Pa)***	*Share non-work income ($/Pa)***	*Share disp. income ($/Pa)***	
Gross wage and salary income			*13,080*					
Gross wage and salary			*(10,630)*	*0.69*	*7,340*	*7,776**		
Employer's contribution			*(2,450)*					
Gross income from entrepreneurial activity without unwithdrawn profits			*470*	*0.85*			*390*	*413**
Gross property income less interests for capital credits			*430*	*0.85*			*370*	*394**
Current transfers received			*1,060*				*440*	*173**
Current transfers made			*-6,500*					
Social contributions			*(4,070)*					
Employee social contributions			*(1,620)*					
Disposable income without unwithdrawn profits			*8,540*	*8,756**		*7,776**		*980**
Saving			*(10 %)*	*-876**	*(5 %)*	*-438**	*(5 %)*	*-438**
Consumption						*7,338**		*542**
Working time	l	*(1)*	*0.18*					
Consumed part of the wage rate	w	*($/Pa)*	*40,700**					
Ratio of consumed non-work income to consumed part of the wage rate	v/w	*(1)*	*0.013**					
Optimal working time	l_*	*(1)*	*0.18*					
Scale factor for utility	g	*(Pa/$)*	*0.0014**					

**) Figures for the employee households after subtraction of the unemployed and their relatives*
***) $/Pa ≙ US-$ per person and year*

Sources: Statistisches... (1994 Sep a), Statistisches... (1994 Sep b), Statistisches... (1997) Tafel 2.4.2, Statistisches... (1984).

depends half on the work income, and half on the non-work income. With the working time it is assumed that in West Germany in 1985 the factual working time was 5 % longer than the optimal working time for the employee household. This is about half so much as results from the average for the desired working time from random surveys. See section 7, tables 2 and 3. With that the optimal working time is l_* *= 0.172 or 1,505 h/a. Utility during working time is set to* $= 0$*. The other parameters according to equation (19) are* w *= 40,700 $/Pa,* v/w *= 0.013, and thus ,* g *according to equation (19)* $= 0.0014$*. If the scale factor is determined for the gross wage rate per employee and working hour* w_{ge} *= 11.20* $\$/P_e a$*, the working time* l_* *= 1,505 h/a and the ratio of consumed non-work income to consumed part of the wage rate* v/w *= 0, so* g_{ge} *= 6.26 results. With this value the left curve of the gross wage and salary rate depending of the optimal working time for the employee* $w_{ge}(l_*)$ *is obtained. See section 8, figure 7.*

The elasticity of the optimal working time related to the consumed part of the wage rate

$$\eta_{l_* w} = \frac{\partial l_*}{\partial w}\frac{w}{l_*}$$

can be determined by deriving the equation (12) and inserting the term for w

$$\frac{\partial l_*}{\partial w}\frac{w}{l_*} = \frac{1}{\frac{\partial w}{\partial l_*}}\frac{w}{l_*}, \qquad \frac{\partial w}{\partial l_*} = -\frac{w}{l_*}\left(\frac{1}{1-2l_*}+\frac{1}{2l_*}\right),$$

$$\eta_{l_* w} = -2l_*(1-2l_*). \tag{13}$$

This function is drawn as a thick curve in figure 3. The elasticity does not depend on utility during working time and on wage rate, but only on the optimal working time. It is smaller than 0 and has a minimum of $\eta_{l_* w} = -1/4$ *at* $l_* = 1/4$ *(= 2,180 hours per year).*

In figure 2 further utility curves are drawn for different utilities during working time and for different wage rates, and their maxima are

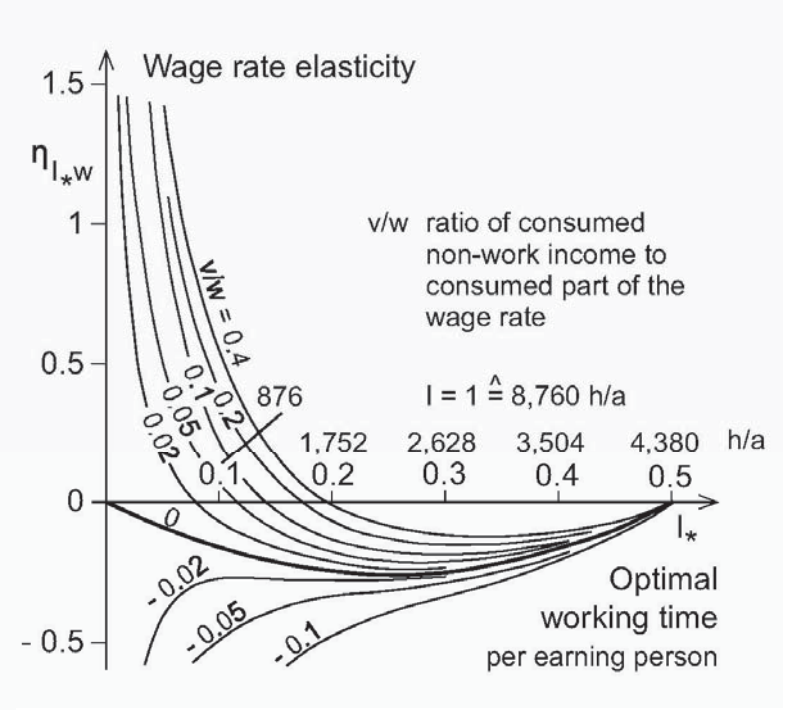

Figure 3
Wage rate elasticity of optimal working time

connected. The curve of maxima for different utilities during working time with a constant wage rate shows the optimal working time as a function of this utility. The curve of maxima for different wage rates with a constant utility during working time shows the optimal working time as a function of the wage rate. The optimal working time gets shorter with increasing wage rate. If in the diagram on the vertical axis instead of utility u the wage rate w is given, the curve of $w(l_*)$ instead of maximal $u(l_*)$ is slightly extended upwards. It is usually called the labour supply curve. This curve is drawn in section 8, figure 7, on the left. If the utility during working time u_l is constant (or rises only little or falls with rising wage rate), the curve inclines downwards to the right, bent concavely to the origin. It therefore confirms the negative sloping or 'backward-bending' labour supply curve.

This has already been a well-known theory in mercantilism and a common argument for a low-wage policy (Ekelund/Hebert 1975 p. 38-39). With general considerations Pigou (1920 p. 593) and Knight (1921 p. 117) came to the conclusion that with an increasing wage rate the offered working time becomes shorter, because the utility increases degressively with a rising income. Pigou (1920 p. 593) thought about how an income tax influences the working time: „Since a part of his income is taken away, the last unit of income that is left to him will be

more urgently than the last unit of income that would have been left to him if there had been no taxation. But the last unit of energy that he devotes to work will not affect him differently from what it did. Consequently, there will be a tendency for him to work a little harder ... than he would have done otherwise." Knight (1921 p. 117) states: "... they will at a higher rate divide their time between wage-earning and non-industrial uses in such a way as to earn more money, indeed, but to work fewer hours." This opinion is also confirmed by the following consideration. If the shopping basket and leisure time are normal goods (demand increases with income), the demand for both of them increases with rising income, thus the supply of paid work decreases (Wagner... 1997 p. 15). Because if the wage rate increases, and leisure time increases however so little that the wage rate increases much more, there is a stronger demand for normal goods, including leisure time.

In animal experiments from different authors "labour supply curves" with a positive gradient with low "wage rates" and with a negative gradient with high wage rates or with negative gradient over the whole range were found (Battalio... 1981 p. 622, 623, 628 table 3). For example in the case of pigeons, which had to peck corn, it was also possible to separate the income and substitution effect. In the range with negative gradient of the labour supply curve with increasing wage rate the income effect and the substitution effect in absolute values decreased, and the substitution effect declined stronger in relation to the income effect. (Battalio... 1981 p. 629).

With the relations of the elasticity of the optimal working time related to the consumed part of the wage rate values of -0.21 to -0.25 result, if the utility during working time is zero and working times per employee are 0.15 to 0.24 (1,300 to 2,100 h/a). The wage rate increases 4 to 5 times as much as the working time falls. The wage rate elasticity of the optimal working time is comparable to the uncompensated wage rate elasticity of the supply of working time. Many very different values were found in the numerous available empirical studies. Most values for men lie in the range between -0.27 and 0.14 with an accumulation around -0.08, for

women from -0.17 to 2.4 with an average approximately of 0.2 (Killingsworth 1983). Pindyck/Rubinfeld state the elasticities from studies for several types of households as being from -0.11 to 0.03 for men and from -0.09 to 0.11 for women (2009 p. 533-534). The higher values, which are in contrast to the results deducted here, may result from the fact that the surveys mostly refer to households with a low income. Then, as shown in the following section 4, the wage rate elasticity of the optimal working time increases with shorter working time and additional non-work income. However, the deducted values above can be confirmed well from the secular development of economy; since 1850 the wage rate has increased 4 to 5 times as much as the working time has fallen. See section 8, figure 7.

4. Non-work income

If besides work income another income is obtained or the income is not consumed completely, consumption and utility change. As non-work income the disposable income from entrepreneurship and capital, transfers, dissaving and borrowing is calculated, if it is obtained independently from working time. Consumption is calculated as work income plus non-work income minus saving. A direct utility of saving is not mentioned here. The course of utility over working time is shown in figure 4 for different (consumed parts of the) wage rates and non-work incomes. If, for example, the consumed non-work income is 5 % of the consumed wage income with maximum working time, this is 25 % of the consumed work income with a working time per employee of 0.2 (1,750 h/a). If the consumed non-work income is zero, the utility and the optimal working time are the same as in section 3, figure 2. If it is higher, the optimal working time is shorter, and from a certain amount upwards it is zero. In this case a higher utility is obtained, if the whole active life time is used for consumption instead of additionally working for money.

The wage rate as a function of the optimal working time is deduced as follows. If non-work income is obtained, consumption per person and time period is

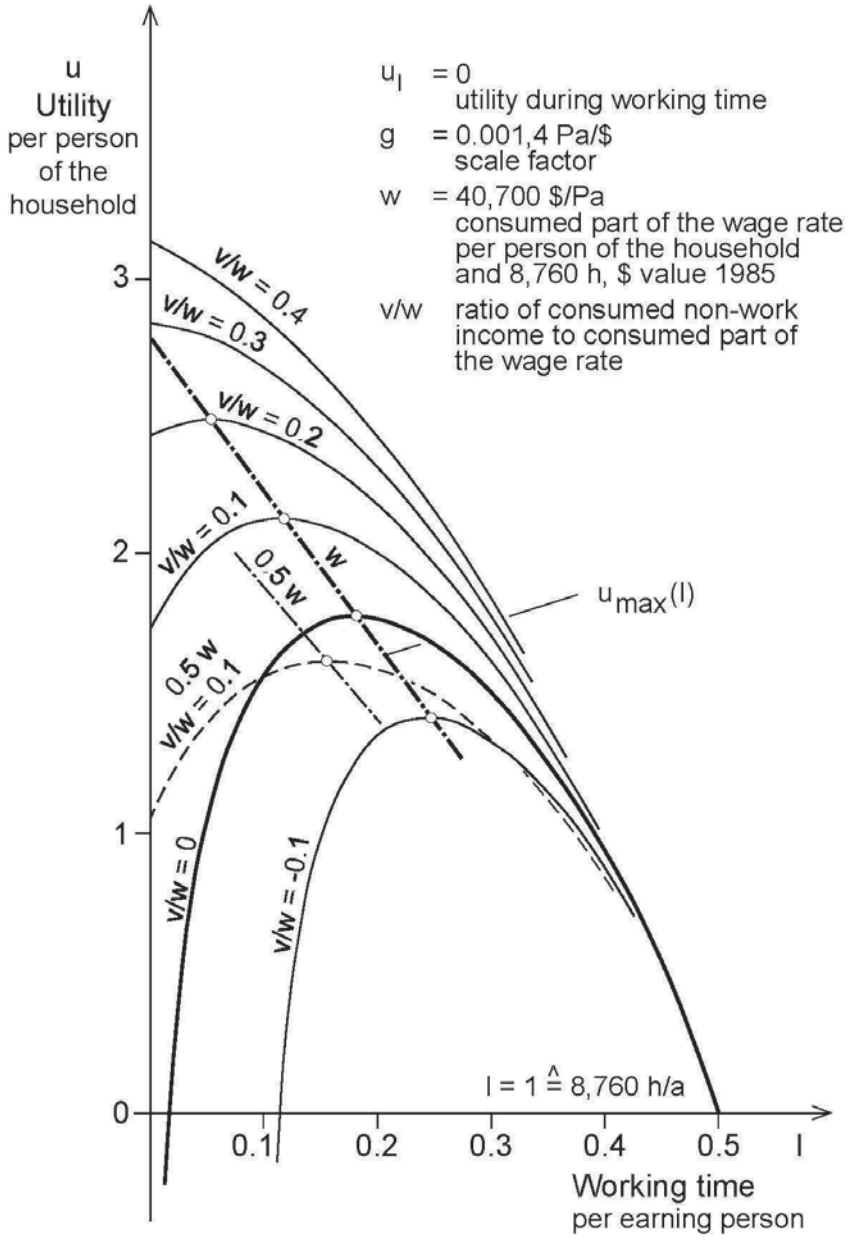

Figure 4
Utility as a function of work and non-working income

$$c = y - s = wl + y_v - s_v = wl + v\,, \qquad (14)$$

with the disposable non-work income y_v, the saving of non-work income s_v and the consumed non-work income v. The latter is the disposable non-work income minus the dependent saving per person of the household and time period,

$$v = y_v - s_v\,. \qquad (15)$$

Hence utility is

$$u = 2lu_l + (1-2l)\ln g\,\frac{wl+v}{1-2l}\,. \tag{16}$$

For the maximum of utility the following equations are valid,

$$\frac{\partial u}{\partial l} = 2\left[\frac{\frac{1}{2}+\frac{v}{w}}{l+\frac{v}{w}} - \ln\left(l+\frac{v}{w}\right) + \ln(1-2l) - \ln w + u_l - \ln g\right] = 0 \tag{17}$$

and

$$\frac{\partial^2 u}{\partial l^2} = -\frac{2}{\frac{1}{2}-l}\left(\frac{\frac{1}{2}+\frac{v}{w}}{l+\frac{v}{w}}\right)^2 < 0 \quad \text{for } 0 < l < \frac{1}{2}. \tag{18}$$

From the first derivation one gets for the wage rate

$$w = \frac{\frac{1}{g}(1-2l_*)e^{\frac{\frac{1}{2}+\frac{v}{w}}{l_*+\frac{v}{w}}+u_l}}{l_*+\frac{v}{w}} \tag{19}$$

v *is the consumed non-work income per person of the household and time period, the other terms have the same meaning as in equation (12) in section 3. The (consumed part of the) wage (or pay) rate can again be determined explicitly from the optimal working time, or the optimal working time numerically from the wage rate. With this relation it is possible to take into account several earning persons in the household with different working times, wage rates, non-work incomes, savings, and granted utility. For that, real or fictitious amounts of income are transferred to other members of the household.*

By partial derivation of the implicit function from equation (17)

$$F(w,v,l) = \left[\frac{\frac{1}{2}+\frac{v}{w}}{l+\frac{v}{w}} - \ln\left(l+\frac{v}{w}\right) + \ln(1-2l) - \ln w + u_l - \ln g\right] = 0$$

results for the elasticity of the optimal working time related to the consumed part of the wage rate

$$\eta_{l_* w} = \frac{\partial l_*}{\partial w}\frac{w}{l_*} = -\frac{\frac{\partial F}{\partial w}}{\frac{\partial F}{\partial l_*}}\frac{w}{l_*} = -\frac{w}{l_*}\frac{\frac{\frac{v}{w}\left(\frac{1}{2}-2l_*\right)-l_*^{\,2}}{w\left(l_*+\frac{v}{w}\right)^2}}{-\frac{\left(\frac{1}{2}+\frac{v}{w}\right)^2}{\frac{1}{2}(1-2l_*)\left(l_*+\frac{v}{w}\right)^2}},$$

so

$$\eta_{l_0 w} = -\left(\frac{1}{l_*}-2\right)\frac{l_*^{\,2}-\frac{v}{w}\left(\frac{1}{2}-2l_*\right)}{2\left(\frac{1}{2}+\frac{v}{w}\right)^2}, \qquad (20)$$

and for the elasticity of the optimal working time related to the consumed non-work income

$$\eta_{l_* v} = \frac{\partial l_*}{\partial v}\frac{v}{l_*} = -\frac{\frac{\partial F}{\partial v}}{\frac{\partial F}{\partial l_*}}\frac{v}{l_*} = -\frac{v}{l_*}\frac{-\frac{1}{w}\frac{\frac{1}{2}+\frac{v}{w}}{\left(l_*+\frac{v}{w}\right)^2}}{-\frac{\left(\frac{1}{2}+\frac{v}{w}\right)^2}{\frac{1}{2}(1-2l_*)\left(l_*+\frac{v}{w}\right)^2}},$$

so

$$\eta_{l_* v} = -\frac{\frac{1}{l_*}-2}{\frac{1}{\frac{v}{w}}+2}. \qquad (21)$$

In the same way for the elasticity of the optimal working time related to the non-work income, with the disposable non-work income $y_v = v + s_v$

$$\eta_{l_*, v+s_v} = -\frac{\frac{1}{l_*}-2}{\frac{1}{\frac{v+s_v}{w}}+2\left(1-\frac{s_v}{v+s_v}\right)} \qquad (22)$$

is obtained. Again, these elasticities do not depend on utility during working time and on the wage rate, but they depend only on the optimal working time and on the proportion of the consumed non-work income to the consumed part of the wage rate. See figure 5.

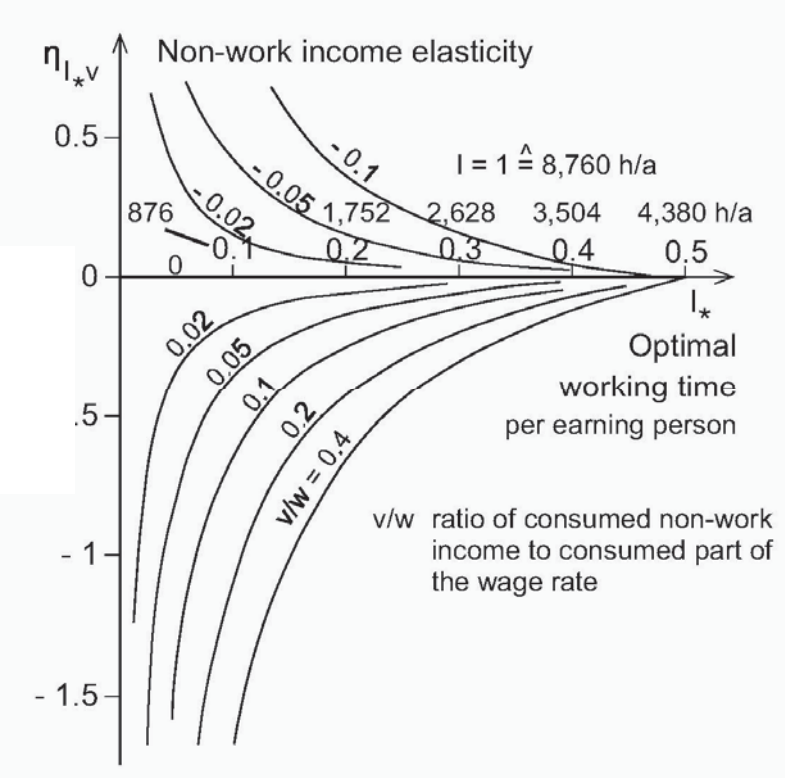

Figure 5
Non-work income elasticity of optimal working time

The elasticity of the optimal working time related to the consumed non-work income varies with a relation from non-work income minus savings to wage rate from 0 to 0.2 and an optimal working time per earning person from 0.15 (1,300 h/a) from 0 to -0.7, with 0.24 (2,100 h/a) from 0 to -0.3. In empirical studies for the comparable non-work income elasticity of working time supply or property income elasticity most values lie in the range from -0.8 to 0 with an accumulation around -0.15 (Killingsworth 1983). The empirically determined non-work income elasticity conforms better with the hereby deducted relation than with the wage rate elasticity. The differences in the empirical results can result from different high non-work incomes and savings in the individual studies or from the fact that from non-work income also incomes are included, which however do not result from work but nevertheless are obtained dependent on work income or working time. The latter may be

the case both with income from property as well as income from social benefits.

For work income and non-work income the following results: The optimal working time is determined by the wage rate, the non-work income and utility during working time. The higher the wage rate and the non-work income and the lower the utility during working time, the shorter the optimal working time and vice versa. In the case of non-earning working persons, their optimal working time (in the household) is longer, if the wage rate taken into account is lower. And if, for example, the self-employed have a higher utility during working time, their optimal working time is likewise longer. If further earning persons are members of the household, the costs of the housework can be assigned to them proportionately to determine their optimal working times.

5. Working and saving

Saving (in the sense of not spending money or not consuming or using goods respectively) has been treated here so far implicitly as reducing the consumed income. This leads to a smaller utility and a longer optimal working time, as on the other hand dissaving has the opposite effect. Saving and dissaving can increase the average utility, if therewith fluctuations in income and expenses are balanced. This is also because of the degressive increase of utility with consumption. In the same way temporary saving can increase the average utility based on a longer time period or the life span, if the return thus gained leads later to higher consumption or if more time is then available for consumption.

No theoretical or empirical results were found here for consumption or saving as a function of wage rate and working time. However, for consumption depending on income and type of household data are available, for example for West Germany from the income and consumption random test (Statistisches... 1984). They are shown for 1983 in figure 6. The two-person household was chosen because the average household consisted of 2.3 persons. The income up to a minimum value is fully consumed. Above the minimum value, a part is

saved in monetary or real capital. The higher the income, the higher the share of monetary capital. The total saving, real plus monetary share, is approximately proportional to the income above the minimum value. This trend also can be found in many other analyses. It corresponds to the consumption function according to Keynes. However, the income hypotheses by Duesenberry and Friedman determine this trend only for short-term fluctuations in income.

It has been confirmed empirically that saving rises not only with income, but also with wealth, inflation, age and education; the influence of the interest rate is rather low (Lea/Tarpy/Webley 1987 p. 230-240). In psychology, *as* motives for saving are considered provision, power, yield and appreciation. Provision is the most important motive. It acts mainly to secure the accustomed standard of living and it can be further intensified by indications of negative perspectives, for example a low old-age pension with a long life expectancy, high education costs for the children and threatening unemployment (Wiswede 2000 p. 163-169).

According to Böhm-Bawerk, present goods and income are preferred to future ones due to impatience, and this even more the lower the present income is (Fisher 1930, 1965 p. 61-68, 378-379). The preference for future goods might also be stronger with longer working time, because one then hopes to have more time in the future to enjoy consumption (or to invest the savings in real capital). If the factual working time is longer than optimal, on less consuming the working time is also closer to its optimum. Since persons with a higher wage mostly have longer working times than they desire, see section 7, table 2 and 4, one can conclude, that in general saving increases with the difference between factual and optimal working time. Then with the same work income but longer working time per person a higher proportion of the income is saved. But even if the utility during working time becomes larger and therefore the optimal working time longer, maybe even longer than the factual working time, the consumption will increase less than the earned income as a result of the leisure time becoming shorter.

For the calculation of the consumed income the saving ratio s/y *according to figure 6 is linearised as follows: Employee household with* s/y *= 10 % with* y_L *= 8,755 $/Pa (see section 4) and -6 % with 0 $/Pa, is* s_L/y_L *= 0.0000183* y_L *- 0.06; industrialist household with 40 % at 45,000 $/Pa and 8 % at 0 $/Pa, is* s_I/y_I *= 0.00000711* y_I *+ 0.08.*

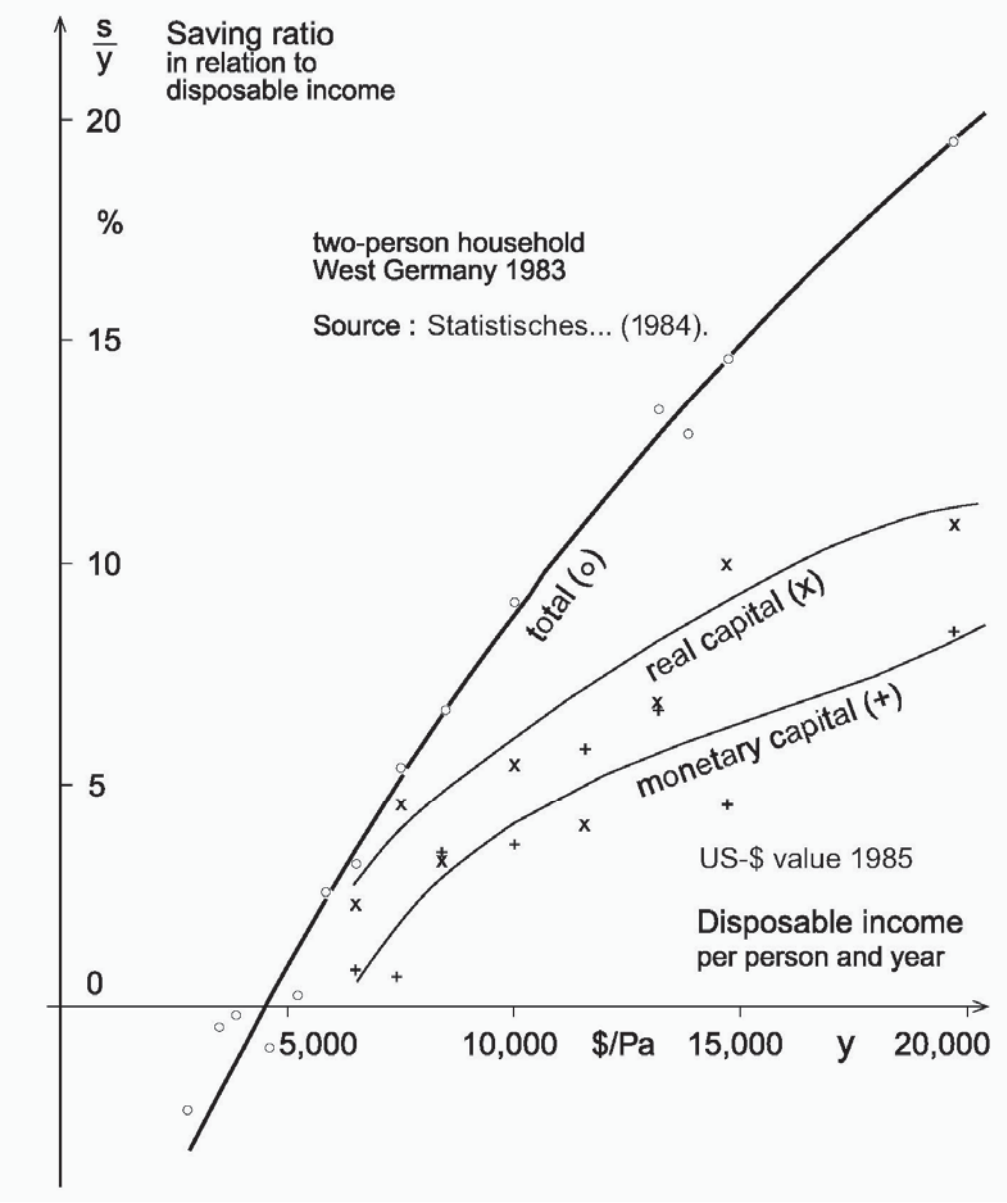

Figure 6 Income and saving

6. Optimal working time from the view of the company

Similarly to utility in a household, profit in a company can be regarded as the objective. Just as for a household, for a company an optimal working

time of the employees exists, at which profit has its maximum. The profit is the result of the price of goods multiplied with output volume minus production costs. The production costs per unit have a minimum with an average working time per employee, due to a lower labour productivity with a very short or a very long working time, higher capital requirements and administrative expenditures for more employees with shorter working time (for example Contensou/Vranceanu 1998), and sometimes a higher wage rate in case of a very short or very long working time. This optimal working time of the employee for the company can be calculated, if the production costs depending on working time are known. For this purpose one can determine the production costs for different working times per employee, the optimal working time belongs to the minimal production costs.

For empirical values of the wage rate elasticity of the optimal working time for the company there are far less results available as for the employee household. They lie in the range between –0.25 to –0.01 with a mean of –0.13 (Hamermesh 1993 p. 85, 86, König/Pohlmeier 1988 p. 567), and they are thus negative as well, but higher than the value for the factual and the optimal working time for the employee. So if the wage rate increases, the optimal working time for the company decreases, but not as strongly as the optimal working time for the employee; they drift apart.

7. Factual and optimal working time

The result of numerous empirical studies in industrialised countries is that a huge majority of the employees desires slightly shorter working times as is fixed for full-time jobs. Detailed data are available for West Germany. In the years 1978/80 it was found out in a representative survey among employees, whether shorter or longer working times with corresponding lower or higher income are desired. The factual and the desired working times according to occupation of the groups are shown in table 2. If the occupational activity of the partner is taken into consideration, the employees with a lower income had to work longer

Table 2
Average factual and desired working time according to occupational categories (West Germany 1979/1980)

Category	Weighting* estimated (1)	Factual working** time (h/week)	Desired working** time (h/week)	Undesired working** time*** (%)	Partner working** about° (%)
Unskilled and semi-skilled blue collar workers	0.27	36.2	34.9	3.7	61
Unskilled and semi-skilled white collar workers	0.25	37.2	34.3	8.5	65
Skilled workers	0.21	41.7	38.8	7.5	38
Qualified salaried employees and executives	0.17	41.5	37.0	12.2	41
Civil servants	0.10	40.2	36.9	8.9	41
Weighted average	1	38.9	36.1	7.8	52
Unemployment rate (%)				3.8	

*) Number of employees in the occupational group / total number of employees
**) earning working
***) (factual – desired working time / desired working time) x 100
°) (number of interviewed with working partner / number of interviewed with partner) x 100

Sources:
Schöppner KP, Selbmann M (1980) Tabellenband A, B, C, Tafel 1.2, 31.2, 39.2.. Bielefeld: Emnid.
Unemployment rate: Statistisches... (2004).

and wished a smaller reduction. On an average the factual working time was 7.8 % longer than desired, and its distribution as well did not fit in with the wishes of the employees. The unemployment rate (related to the employees plus the unemployed) was 3.8 %. In the socio-economic

Table 3
Factual and desired working time according to age and sex (West Germany 1990)

Working time (h/week)	Estimated average (h/week)	Men (%)	Women (%)
Factual			
up to 20	18	4	21
21 to 35	28	2	18
more than 35	40	94	61
Desired			
up to 20	18	3	32
21 to 35	28	27	34
more than 35	40	70	34
Undesired working time, average ((factual - desired working time / desired working time) x 100)		7.7	17.1
Weighting, estimated (1)		0.58	0.42
Undesired working time, average, weighted (%)		11.7	
Unemployment rate (%)		7.2	

Sources:
Weick S (1993 July) 10:9-13, p. 11.
Unemployment rate: Statistisches... (2004).

panel for West Germany in 1990 it was asked under the condition that the income is orientated according to the working time. The results were similar, see table 3. On an average, the factual working time was 11.7% longer than desired, the unemployment rate was 7.2%.In 1994, a study by the European Commission showed that in the European Union on average 35 working hours per week had been agreed upon, and that 33 hours per week had been desired by the employees. In the next wage round 36 % of the employees would have preferred a working time reduction with constant wage rate, and 56 % Would have preferred a wage rise with unchanged working time (European... 1995 p. 18,19). In a

Table 4
Average factual and desired working time according to occupational groups (Western Europe 1998)

Occupational group	Factual working time (h/week)	Desired working time (h/week)	Undesired working time* (%)
Self-employed	48.2	38.4	25.5
Employees			
Primary or secondary level I	37.3	34.5	8.1
Secondary level II	37.5	33.8	10.9
University/ college	38.7	33.6	15.1
Total	37.7	34.0	10.9
Unemployment rate			9.3

*) (factual – desired working time / desired working time) x 100

Sources:
Bielenski H, Bosch G, Wagner A (2002) p. 26, 57, 93, 171.
Unemployment rate: Eurostat... (2004 Nov 15).

survey in 15 countries of the European Union and in Norway in 1998 (Bielenski/Bosch/Wagner 2002) under the condition: "... and please also remember that money has to be earned of moneymaking" (... p. 26), the average working time of the employees in Germany was 11.3 % longer than desired (... p. 71), and the unemployment rate was 12.3% (Statistisches... 2004). In Western Europe the working time was 10.9% longer, and the unemployment rate was 9.3%. Even the self-employed wished for shorter working times too. See table 4. Because women have shorter working times and fewer women are self-employed, the difference between factual and desired working time with self-employed is even bigger, if it is only related to men (... p. 56). This shows that even the self-employed are not absolutely free in the choice of their working time and that their work conditions are not much better than that of the employees. The employees with higher qualification or in leading

position also have longer working times, and they wish for a little shorter working time than the rest of the employees. Older employees would like much shorter working times than the average, and women with a higher household income clearly want shorter working times (... p. 118). For the USA and Japan no data could be found, but according to economists a part of the full-time employees also wish to work less than demanded. This confirms that the factual working time of the employees and of the self-employed is on average longer than desired by them, and that the optimal working time decreases with increasing wage or pay rate.

No published data referring to the working times desired by the companies could be found. However, it is evident that they favour longer working times than the employees. "...employers are almost universally hostile towards proposals for major and systematic reductions of the workweek." (Hart 1987 p. 258). In the industrialised countries companies often pay supplements for overtime over a long time, but seldom pay bonuses for shorter than standard working times. In Germany factual working time per employee in non-tariff-bound companies is often from 5 to 10% longer than in the rest, and according to the estimation of owners and managers even longer working times would be optimal for the companies.

8. Historical development of wage rate and working time

It is revealing to compare the factual working time in the course of time with the optimal working time as a function of the changing wage rate and, thereby, possible to verify the relations deduced here. For that purpose the gross wage and salary rate as well as the factual working time per employee are determined for the USA from 1860, for Japan from 1950 and for Germany from 1850 on. The course of this rate over the factual and optimal working time for the employee is shown in figure 7. The curve of the wage rate over the optimal working time is adjusted with data of West Germany in 1985. See section 3.

The working time is shown per employee, for Germany and West Germany until the year 1970 also per full-time employee and year. The

consumed part of the wage rate per person of the employee household could only be found out for the last decades and for West Germany. Therefore the gross wage rate is taken into consideration. The difference in the run of the curves is little.

For the USA the working time is interpolated from the following time series. For 2000 back to 1950 average weekly hours of production workers on private nonfarm payrolls by major industry division, annual

Figure 7
Wage rate depending on factual working

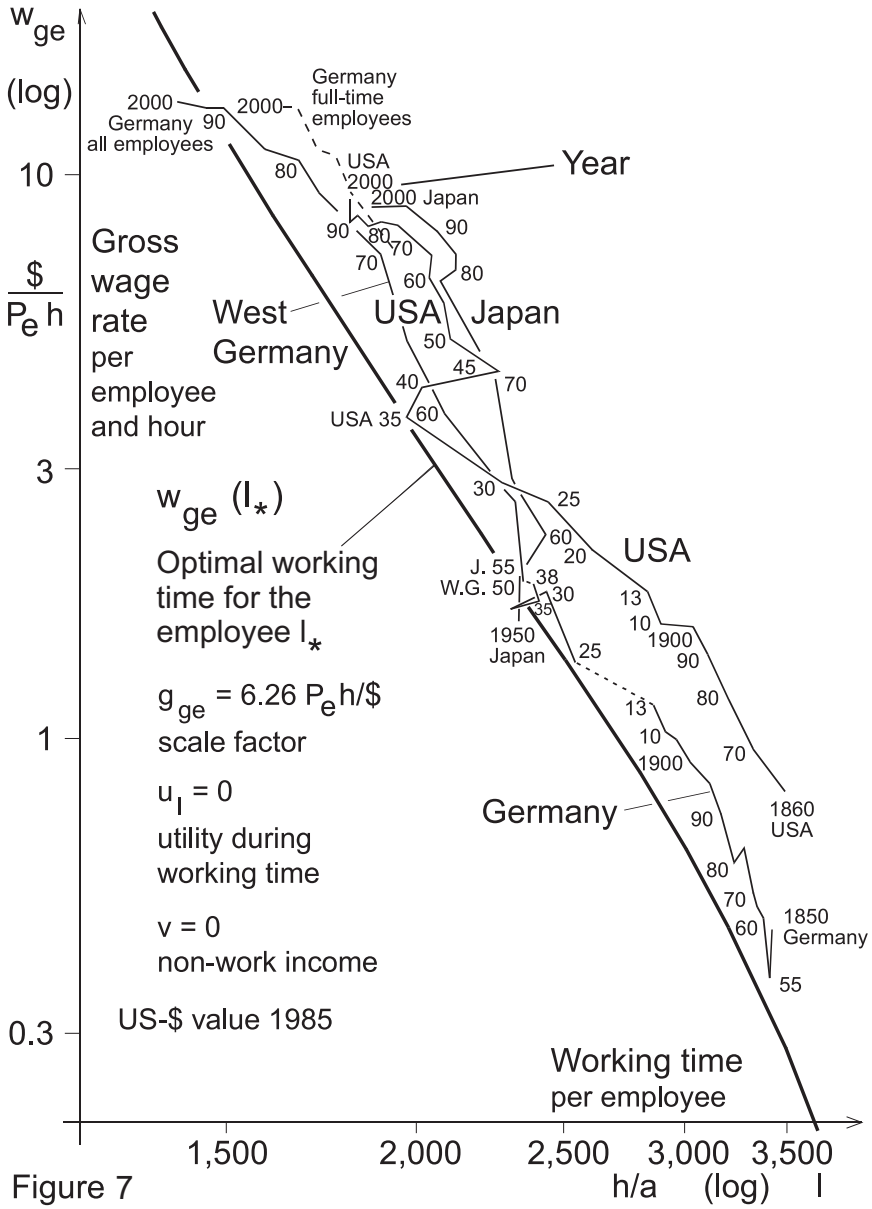

Figure 7
Wage rate depending on factual working time and optimal working time (labour supply curve)

averages (Report... 2001 p. 138), for 1970 back to 1909 weekly hours of production workers in manufacturing (Historical... 1975 p. 169, 170), for 1926 back to 1890 hours all industry (Historical... 1949 p. 67), for 1891 back to 1860 average hours per day all nonagricultural employments (Historical... 1949 p. 66) multiplied by 6 days per week multiplied by 46 to 46.5 factual weeks per year, these estimated with 1.5 weeks of public holidays, 1 week of vacation and 2.5 to 3 weeks of absence per year.

To take agriculture and the civil service into account, an estimated surcharge of 0.2 hours per week in 2000 up to 1 hour per week in 1860 is made. The associated wage rates are taken from the same sources (Report... 2001 p. 149, Historical... 1975 p. 169, 170, Historical... 1949 p. 67), for 1891 back to 1860 index of wage per day (Historical... 1949 p. 66). For the wage rate including agriculture and public services a reduction of 0.7 % for the year 2000 up to 8.9 % for 1910 is extrapolated from civilian labor force employed, agriculture to total (Historical... 1975 p. 127) and average annual earnings including farm labor to excluding farm labor (Historical... 1975 p. 168) 1926 to 1910. The wage rate is deflated with the price index for personal consumption expenditures from 2000 back to 1929 (U. S. Department of Commerce, 2004 p. 167-168), the gross national product (implicit price index) for the years from 1925 back to 1869 (Historical... 1975 p. 224) and the consumer price index for the years 1880 back to 1860 (Mitchell 2003 p. 708).

For Japan from 1950 upward the working time (Historical Statistics of Japan 1987 vol. 1 p. 415, Japan... 2004 p. 539) and the gross income (Historical Statistics of Japan 1987 vol. 4 p. 250, Japan... 2004 p. 520) in companies with 30 and more employees is taken and deflated with the consumer price index (Historical Statistics of Japan 1987 vol. 4 p. 352, Japan... 2004 p. 557). For the exchange rate in 1985 the purchasing power parity following the German scheme is used and rounded to 1,000 Yen = 8 DM = 4 US-$ (Statistisches... 1988 p. 722).

For Germany and West Germany the factual annual working time per employee from the year 1970 is proportionally extrapolated and it is taken from (Statistisches... 2003 Tafel 1.1.12), until the year 1960 with

values from (Institut... 1997), until the year 1950 with values from (Institut... 1984 Tafel 1) and for Germany until 1850 with values from (Hoffmann 1965 p. 19). The factual working time per full-time employee until 1991 is from Wanger and Bach (2005 p. 7) and until 1970 from Wanger (2003 p. 46-52). The gross wage rate is determined until 1950 from the gross wage and salary rates per employee and the factual working hours (Statistisches... 1999), and until 1850 it is proportionally extrapolated with the work incomes of the not self-employed (Hoffmann 1965 p. 483, 485), divided by the price index of the private consumption (Statistisches... 2002 Tafel 6; Hoffmann 1965 p. 599, 601). Currency parity 1 DM = 0.5 US-$ (Statistisches... 1988 p. 722).

The curves of the wage rate as a function of the factual working time in the USA, in Japan and Germany follow (except for the USA during the Great Depression) significantly the curve above the optimal working time. When the consumed non-work income is 0, the wage rate as a function of the optimal working time has only one parameter. Then the curve has only one degree of freedom with which it can be shifted towards above or below, but its course is not changed. Hence the dependence on the wage rate derived in section 3 is also confirmed by the historical development.

During the last decades the factual working time approaches slightly nearer to the here deduced optimal working time for the household. This is an effect of the grown share of part-time employees and of the higher non-work income. With the same wage rate the working time in the USA and in Japan in most years is longer than it is in West Germany and Germany, and much longer than optimal for the employee. A possible reason for this could be that in these countries labour intensity is lower. Then utility during working time is higher and a longer working time is optimal for the employee household. Reasons for the differences might also be that the share of illicit work is said to be 9 %, 11 % and 16 % of the gross domestic product in the USA, Japan and Germany, respectively (Schneider/IAW, 2002). Taxes and social security contributions might influence the regular working time also directly. In

the USA the marginal shares of them have been reduced considerably in the last decades, especially with two earners per household (Prescott 2004 p. 17). The higher taxes in Germany should have contributed to the shorter working times (Pissarides 2007 p. 32) and to more illicit work. Also the non-earning working time in the household, which has a similar range as the earning working time, influences the amount of the earning working time. In the USA the span between low and high incomes is bigger, there are more woman earning higher wages, and more paid work and less homework is being done. The sum of paid work plus housework in Germany is said to be as large as in the USA (Schettkat 2003 p. 15). For Japan, the long paid working time of men is explained by the facts, they work less in the household, the saving ratio is high, companies can stipulate the amount of overtime without a contract, and overtime premiums are low (Kawaguchi 1996 p. 265).

As explained in section 3, the optimal working time for the employee is a function of the wage rate, the non-work income and the utility during working time, which is primarily determined by the working conditions. According to section 5, the optimal working time for the company is particularly dependent on work productivity and quality that are lower with poorer working conditions or longer working time, and the costs for the jobs that are higher with shorter working time. In the last 150 years the optimal working time per employee has now become much shorter through the great increase in the wage rate. For the company the optimal working time per employee at first also decreased, because this led to an increase in the productivity and quality of the work. A maximum might have been reached by physiological causes (Hettinger/Kaminsky/Schmale 1980 p. 312-314) on average with the eight-hour day, as it had already been introduced by Ernst Abbe in 1900, Robert Bosch in 1906 and Henry Ford in 1914 in their enterprises. In the following time the administration costs per employee and the capital intensity (capital stock per earning working person) continued increasing, the latter for example in Germany since 1970 on average by more than 2 %/a in real terms (Institut der... 2004 p. 26). Therefore the fixed costs of working time per employee also continued to increase, and

the optimal working time for the company decreased less steeply than formerly. But as the working time continued to decrease, the relation of the optimal working time for the company to the optimal working time for the employee has increased.

9. Conclusions

It has been deduced theoretically and proved empirically, that with rising wage rate the optimal working time for the employee becomes shorter. That a question is answered which was for a long time open. Further it has been shown that the optimal working time for the company becomes longer with increasing costs per working place and for administration per employee. These costs are correlated with the wage rate. If the wage rate rises, the optimal working time for the employee becomes shorter, while for the company it decreases less or not at all. This also explains a permanent conflict between employers and employees.

Clear relationships were not found for some functional chains used here, for example saving depending on the working time. This also is a sign that in economics little attention is paid to the working time per employee. Therefore detours had to be made or imprecise information used. Despite that, one receives unambiguous and expressive results this way, unlike the analysis with the substitution and income effect (for example Varian 2007 p. 176). Further research should make simplification possible in the procedure developed here.

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Chapter 2
Working time and unemployment

If we glance at trade news, the newspapers, stories of travellers, we see everywhere proofs of that superabundance of production which exceeds consumption; of a manufacture that does not proportion itself at all to demand, but to capitals which seek employment... We have seen commodities of all kinds, but above all those from England, that great manufacturing power, abound in every Italian market, in amounts which so greatly exceeded demand that the merchants, in order to recoup a part of their capital, were obliged to give the goods away with a quarter or a third loss, instead of a profit. The torrent of trade, repulsed from Italy, has spilled over into Germany, Russia, Brazil, and soon has encountered the same difficulties there.

Jean-Charles-Léonard Simonde de Sismondi, New principles of political economy, or, Of wealth in its relation to population, 1819 (1991 p. 277)

Abstract

In the long term the supply of goods depends on working time and not on wage rate, and the demand for goods on consumed and invested income and not on price. If the factual working time is longer than optimal for the employee, too much is saved, and not the whole output is used. Then unemployed exist depending on the surplus. The unemployment rate and national income no longer change if working time per employee remains constant. If working time is reduced, stagnation is removed. An Okun factor for the long term is in the order of 1.

JEL code and keywords

J22, J23, J64
employee household, goods market, industrialist household, saving, stagnation, Okun's law, reduction in working time, unemployment, utility

The course of argumentation can also be pursued without the parts written in italics.

1. Arguments for a new perspective

In today‘s industrialised countries the gross domestic product per person in real terms rose 19-fold (chapter 1 section 1). Independent of cyclical fluctuations, the key problem of industry has almost always been the sale of its output. Expenditure on advertising, marketing, variation, and subsidy of goods has risen. The share of useless products and services and those with artificial obsolescence or wear and tear has increased. A portion of the employees and self-employed have very unproductive jobs, particularly with products and services being phased out. Even the state creates work by unnecessary activities. According to industrialists, up to a third of the output in industrialised countries is not covered by genuine demand. The result is an increasing difficulty and uncertainty in sales.

Unemployment, in the sense that part of the labour force is temporarily unemployed, began likewise only with industrialisation. With a decline in sales, the work intensity and working time per employee are reduced, and contrary to earler times the number of employees has also mostly diminished. However, in the USA during the Great Depression, the working time per employee was reduced on average by 22% (Historical 1975 p. 169-170), in Germany by 15% (Hoffmann 1965 p. 214), in Italy by about 15% (Mattesini/Quintieri 2006 p. 423), and many companies in the USA introduced a weekly working time of 30 hours for several years (Hunnicutt 1988 p. 148). The rate of the registered unemployed except during depressions was from 1 to 12% in the USA, from 0 to 5% in Japan, from 0 to 10% in Germany, and in countries with a planned economy it was zero. (Mitchell, The Americas 2003 p. 112, 114; Mitchell, Africa 2003 p. 108; U.S. Department... 2001 p. 195; Mitchell, Europe 2003 p. 164, 167, 169)

It can be said that with such a strong rise in the standard of living during the last 200 years it is negligible that not always every person willing to work is employed. Even illicit work is tolerated. Its ratio of the gross domestic product (Schneider/IAW 2002) in industrialised countries is of the same order as the unemployment rate. But if the unemployment rate

is distinctly above zero over a longer time period, important social objectives are missed and the national income can be lower than with full employment. Therefore unemployment is more than a blemish of the modern economy.

With Say's law the classical national economics denies the possibility of a general involuntary unemployment. In neo-classical theory and in monetarism unemployment is viewed as a consequence of too high wage rates, inflexible labour market and of not continuous economic policy. According to Keynes' theory unemployment is a consequence of lack of demand for goods. It can persist due to instabilities resulting from sudden changes in expectation in connection with the inadequately working price mechanisms. Then, with a high unemployment rate and a recessive economic development, the state by additional spending or tax reduction financed by borrowing is obliged to increase demand. However, with increasing productivity and unemployment an increasing percentage of the national income would have to be consumed artificially, and the deficits would be more difficult to finance.

Recent theories explain unemployment by obstacles on balancing labour supply and demand and by too high wages. Since in most industrialised countries during the last decades the rise in wages was clearly below the increase of productivity, unemployment should have sunk there; on average, however, it rose. See table 1. Furthermore, unemployment is often higher in countries or regions with a lower wage level. There were repeatedly attempts to justify a considerably lasting unemployment rate. Thus the modified short-term Phillips curve shows an equally directed coherence between the change in inflation rate and the unemployment rate. The „natural" unemployment rate according to Friedman is seen as a consequence of imperfect markets, stochastic changes in supply and demand, costs for provision of information, and immobility etc. and therefore can hardly be influenced. With the inflation stabilising rate of unemployment (NAIRU, non-accelerating inflation rate of unemployment), a development further of the Phillips curve, is to be shown that a certain unemployment rate is necessary to keep the inflation rate at the desired level. Differently expressed: "Recent

Table 1
Productivity, wage rate, unemployment rate, inflation rate

Average change in real labour productivity (gross domestic product per factual working hour) and in real gross or net wage and salary per factual working hour, average of several years

Year			1950...73		73...90		90...98	
USA	Labour productivity	%/a	3.1		1.5	(2.7*)	1.9	(3.4)
	Wage rate	%/a	2.9	(2.5)	0.8	(0.6)	1.0	(0.8)
Japan	Labour productivity	%/a	7.7	(10.0**)	2.9	(4.1)	2.1	(3.2)
	Wage rate	%/a	7.4	(7.4**)	2.2	(2.2)	1.9	(1.9)
West	Lab. prod.	%/a	5.9	(6.9)	3.4	(2.9)	1.4	(3.2)
Ger-	Wage rate	%/a	6.6	(7.0)	2.5	(3.3)	0.4	(2.0)
many	Wage rate***	%/a	4.9***		2.8***		0***	

*) from 1977 **) from 1955 ***) net wage and salary rate

Sources:
USA: Data for the business sector including the self-employed; wages and salaries including income tax and employer's social security contribution; Report... (2001) p.150. Data in brackets see below.
Japan: Labour productivity: Maddison (2001) p. 351. Wage rate: Report... (2001) p.196. Data in brackets see below.
West Germany: Labour productivity: Maddison (2001) p. 351, from 1973 Statistisches... (2003) Tafel 1.2.13. Wage rate: Statistisches... (2003) Table 1.1.8, 1.1.12, Statistisches... (2002), Statistisches... (1999), Institut... (1997), Institut... (1984). Data in brackets see below.
All countries, data in brackets: Manufacturing industry. Bureau... (2003) table 1 and 13.

Unemployment rate (unemployed / earning working persons), inflation rate (change in consumer price index), average of several years

Year			1950..73	74..83	84..93	94..98
USA	Unemployment rate	%	4.6	7.4	6.7	5.3
	Inflation rate	%/a	2.7	8.2	3.8	2.4
Japan	Unemployment rate	%	1.6	2.1	2.3	3.4
	Inflation rate	%/a	5.2	7.6	1.7	0.6
Ger-	Unemployment rate	%	2.5	4.1	6.2	9.0
many	Inflation rate	%/a	2.7	4.9	2.4	1.7

Source: Maddison (2001) p. 134.

developments in working-time theory rest on a host of generalizations of the neoclassical paradigm aiming at reconciling labor-market theory with the observed hard facts." (Contensou/Vranceanu 1998 p. 146).

Although the labour market became more flexible, social benefits were cut, the influence of trade unions decreased, the share of the capital side in national income increased and, last but not least, the inflation rate fell markedly, while the unemployment rate remained high. See table 1. Except for that, and independent of the unemployment rate, by means of money supply control the inflation rate was brought to this low level which has been desired since the 1970's.

All these explanatory approaches have in common that they do not take into account the quantity of work per employee as desired by suppliers and demanders, and therefore say little that is convincing about the obvious reduction in working time. This is a considerable gap, in view of the historically unique increase in labour productivity, which came along with the appearance of unemployment. However, in the discussion of social groups the reduction in working time per employee has always played an important role. For instance, in the USA from the employers' side after the First World War it was brought forward that this reduction would lead to criminality, radicalism, decline, etc. (Hunnicutt 1988 p. 40). Today it mostly points out that it increases labour costs and therefore reduces employment (for example Franz 2003 p. 179...180). On the other hand trade unions mention that with unemployed and their lower purchasing power employment is further more reduced. In a huge majority of contributions in the Internet the opinion is plead that a reduction in working time reduces unemployment. Journalism and science mostly contradict categorically; at most they concede that a reduction in working time can have little effect in the one or the other direction (for example Franz 2003, p. 180)

In this article relations are developed, which should help to describe the influence of the working time per employee on unemployment. Results on optimal working time dependent on wage rate of chapter 1 are used. The supply of and demand for goods are deduced including the working

time per employee and the unemployed. For equilibrium the unemployment rate and an Okun factor are determined.

2. Labour supply and demand

Compared to other markets, the labour market has some special features. The supplier has goods, which to a high scale he can also use for his own needs. The demander needs labour mostly only in the full or half of usual working time of the employee, so the supplier can then only vary the price and not the quantity. In many goods the factor labour determines largely the price. With labour many people obtain the major part of their income, social relations, self-esteem, and meaning of life. Hence the standard characteristics of a factor market are only to a limited extent given.

The customary idea of the labour market is, similarly to other markets, that with a rising wage rate the industrialists demand less labour, and the employees and the unemployed supply more. But the labour market consists of two markets, for workers and for working time per worker, with one price, the wage rate. That this brings both markets into equilibrium is pure chance (Pfaff 1987 p. 221-222). Therefore the quantity of one item of goods, normally the working time per employee, has to be laid down by a different agreement. The utility of the household, dependent on the working time, has a maximum, and the working time belonging to this maximum is optimal (chapter 1 section 3). For the employee household the maximum is mostly at a shorter working time of the employee than for the company and the industrialist household (chapter 1 section 7). It may be assumed that employee households are not less persistent in achieving their maximal utility than industrialist households. The common objective of both sides will at most be that their utilities are as little as possible below their maxima. Therefore in most cases the factual working time will be longer than the optimal working time for the employee household and shorter than the optimum for the company. See figure 1.

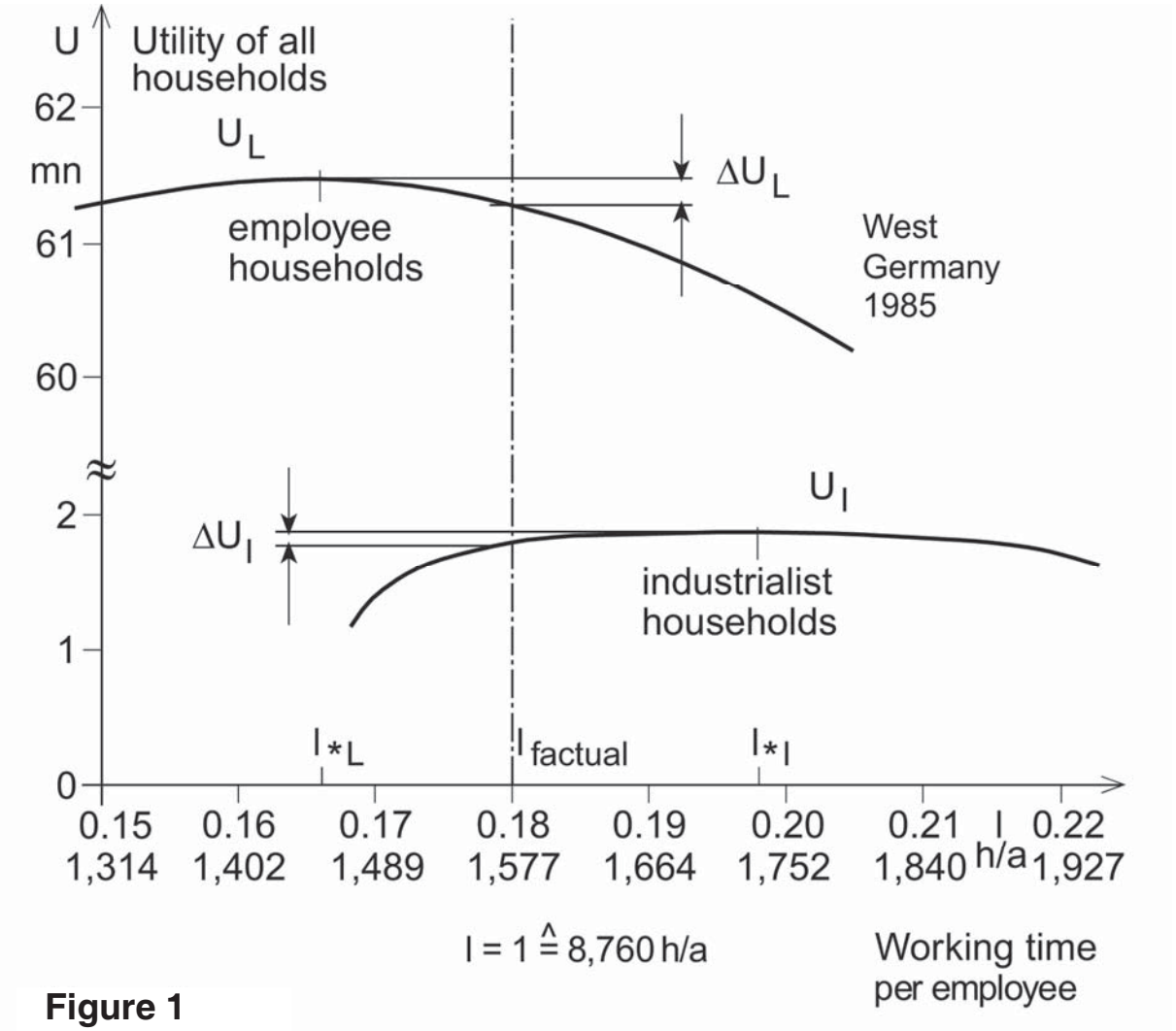

Figure 1
Utility of all households in relation of working time

This is derived as follows. Utility per person of the industrialist household is obtained from chapter 1, equation (1) or figure 1. Consumption depends on income, income depends on profit, and profit depends on production costs when property income is disregarded. Over working time it runs reciprocally to the expenses of the company depending on working time per employee and time period with constant output and constant number of employees. The utility of the industrialist households is calculated for West Germany, year 1985. The number of industrialists is estimated at 160,000 from the number of enterprises with at least 20 employees, and from the enterprises with at least 25,000 $ equity capital (Statistisches... 1990 p. 119, 122, 127). The number of persons in the industrialist household is taken with 3.12 as in the households of the

self-employed including industrialists (table 2), and this totals 500,000 persons. The disposable income per person of the industrialist household is estimated at 43,800 $/Pa, five times as high as the employee household – with all self-employed households it is nearly twice as high (table 2) It is earned with the factual working time of 0.18 per employee. The optimal working time per employee for the industrialist household is estimated 10% higher, that is 0.198. The income with other working times should decrease quadratic with the difference of the optimal to the factual working time. With a change in the working times of ± 10% the production costs are supposed to increase by 3% and with a profit of 8% with the optimal working time the income should then sink by 37.5%. Then the disposable income at the optimal working time of the employees for the industrialist household is 63,440 $/Pa. The saving ratio should change with the in-come according to the relation for the industrialist household (chapter 1 section 5). Utility per person of the industrialist household, according to equation (1) of chapter 1, with the factual working time 0.18 or 1,577 h/a and the utility of all industrialist households is 1.78 mn.

Utility per person of the employee's household is obtained from wage rate, working time, non-work income and saving according to equation (19) or figure 4 of chapter 1 with data from chapter 1, section 4. With equation (5) of chapter 1 the disposable part of the wage rate $w_d = w + s_w / y_w$ *for the factual state 0 of the economy is determined. It is assumed that it remains constant with a variable working time, and that the non-work income and therefore the gross income are proportional to the disposable work income. According to chapter 1, table 1* $s_w = s_v = 0{,}5s$ *and* $y_v = 0{,}126\, y_w$*. Furthermore* $y_L = y_w + y_v$*,* $w = w_d - s_w / y_w$ *and* $v = y_v - s_v$*. The saving ratio should vary with the income according to the equation for the employee household shown in section 5. With the factual working time the utility per person of the employee household is 1.821, for all employee households with 33.7 mn persons (table 2) it is 61.2 mn.*

The effect of working time on consumer behaviour can be shown by chapter 1, section 5. There it is described as plausible that working

Table 2
Number of persons and disposable incomes according to economic groups (West Germany 1985, 1 DM = 0.5 US-$)

, ≙ 1,000, ‘ ≙ mn, ‘‘ ≙ bn

Item	*Parameter*	*Unit*	*Self-empl.*	*Employees*	*Unemployed*	*Retirees°*	*State*	*Economy*
Households	N_H	*1*	*1’82*	*13’3*	*0’82*	*10’02*	*1’°°*	
Persons/ household	$n_{H...}$	*1*	*3.12*	*2.69*	*2.27*	*1.67*	*1*	
Persons	$N_{t...}$	*1*	*5’68*	*35’7*	*1’87*	*16’8*	*1’*	*61’0*
Employees	$N_{...}$	*1*	*3’12*	*24’4*	*2’30*			
Disposable income / household	$y_{H...}$	*DM/Ha*	*104,7*	*46,0*	*23,7*	*31,0*		
Disposable income	$Y_{...}$	*DM/a*	*191“*	*610“*	*19“5*	*310“*	*438“°°°*	*1.568“*
Disposable income / person	$y_{...}$	*DM/Pa*	*33,6*	*17,1*	*10,4*	*18,5*		
Adjustment of number of unemployed								
Change of employees, estimated	$\Delta N^*_{...}$	*1*	*-0’05*	*-0’9*	*1’5*	*-0’55*		
Change of persons, estimated	$\Delta N^*_{t...}$	*1*	*-0’11*	*-2’04*	*3’4*	*-1’25*		
Persons	$N^*_{t...}$	*1*	*5’57*	*33’7*	*5’27*	*15’5*		
Change of disposable income	$\Delta Y^*_{...}$	*DM/a*	*-1“15*	*-21“3*	*35“5*	*-13“1*		
Disposable income	$Y^*_{...}$	*DM/a*	*190“*	*589“*	*55“0*	*296“*	*438“°°*	*1.568“*
		$/a	*95“*	*294“5*	*27“5*	*148“*	*219“*	*784“*
Disposable income / pers.	y	*DM/Pa*	*34,1*	*17,5*	*10,4*	*19,1*	*7,18*	*25,7*
		$/Pa	*17,0*	*8,75*	*5,22*	*9,54*	*3,59*	*12,9*

°) Retirees, welfare recipients
°°) Residents of an institution
°°°) Residents of an institution and non-profit private organisations 40“4DM/a, enterprises -2“4 DM/a, state 400“ DM/a
Disposable incomes without unwithdrawn profits of enterprises without their own legal entity.
For further details see text.

Sources:
Statistisches... (1994 Sep a), Statistisches... (1994 Sep b), Statistisches... (2004 Aug 2), Statistisches... (1997) Tafel 2.4.

persons save more (spend less money) if their working time is longer. If the companies have shorter working times per employee than is optimal for the companies, only their costs are higher and the users have to pay higher prices. If the working time is shorter than the optimum for the employee households too, a larger part of the income is consumed or invested, and the companies have neither difficulties with the sales of goods, nor with the demand for working time. However, if it is longer, the corresponding work quantity, output, and work income are larger, but saving is even larger. Then the ratio of sales of goods to output is lower at first and higher expenditure is necessary to push through the working time. With that, the economic uncertainty for the industrialists and the self-employed is bigger and they will go easy on consumption and even more on investment (in goods). Since they react faster to the incentives of the market, their restraint comes faster than the employees‘, despite their higher incomes.

The surplus of output and excessive savings lead to an abundance of capital. In the total economy it is difficult to invest capital more than to a certain extent. There is a lack of investment opportunities, because the sum of profitable or at least amortisable investments is limited (for example Zinn 1978 p. 358-360). However, storing of output is also expensive and risky. An open economy can find a way out by exporting the surplus of capital and goods. But even this does not work unlimitedly, since repayment otherwise becomes uncertain. Therefore with a surplus in saving, particularly as monetary capital, production is adjusted after a short time to the lagging consumption and investment. If thereby the working time and work quantity per employee remain constant, a portion of the employees becomes unemployed.

3. Production, consumption and unemployment

To ascertain the influence of working time per employee on the number of the employees, one proceeds for example from the production function of the company and determines the production costs depending on the working time per employee. When, as is mostly the case, with a

shorter working time they are higher, one deduces that more overtime is done and the number of the employees is reduced (except in cases with unsteadiness in the functions - corner solutions) (Mattesini/Quintieri 2006 p. 414, 429; Calmfors/Hoel 1988 p. 52-54). However, this does not take into account that overtime is often hard to push through, that labour productivity can be smaller with undesired long working time, and that employees, even with a shorter working time, have a greater purchasing power than the unemployed.

Therefore a model which also considers the labour supply and the economic circulation has been developed here. It contains the supply of and the demand for goods, but not in the sense of a market mechanism, where the sellers take home the goods not sold. To describe the above mentioned processes of the labour and goods market in this model, elements of the theory of economic growth are fallen back on: the output of production is equal to the demand of goods and it is determined by a substitutional production function of progress factor, capital and labour (similar to Solow 1956 p. 66...68). Differing to that, in this study the demand of goods does not result from the output as a function of investment, but from the income of the households and the state. With the employees the income is wage rate multiplied by working time. The working time is the optimal working time for the employees, since there is no other way to offset supply and demand of goods in the long term. The optimal working time depends on the wage rate, and the wage rate predominantly on the (labour) productivity. The wage rate as a function of the optimal working time for the employees is the labour supply curve.

In a total economy almost the whole quantity of goods soon becomes consumed or invested, and what is not sold soon is no longer produced. Therefore the output is regarded as the supply of goods, and what is used as the demand for goods. The producers produce as much as they can sell at a sufficient price which they also achieve on average, and the users buy as much as they can pay, with a work income obtained in their optimal working time. The latter is the condition for the whole output being bought.

So the supply of goods is not the quantities offered at different prices, but rather the output as the result of the factor input. It therefore depends (among other things) on working time and not on the wage rate. The wage rate is only used as a measure to calculate the income. In the same way, the demand for goods is not the demanded quantity at different prices, but the sum of the consumed and invested income, and it therefore depends again (among other things) on the working time. The supply of and the demand for goods are even equal in the short term.

For a comprehensive survey at first this is shown in a very simplified manner. In the economy only employees and unemployed exist; their numbers are N_L and N_N. The supply of goods (the output) is

$$Y_{Su} = alN_L \tag{1}$$

where the „output rate“ is a, a factor for the productivity and the price of goods and l the working time per employee and time period. The demand for (the use of) goods is

$$Y_{De} = w_e l\left(N_L + bN_N\right), \tag{2}$$

where the wage rate is w_e and the ratio of unemployment benefits to working income b. The output rate and the wage rate, as well as the quantity of goods per time period, are based on the disposable income, that means after subtracting the consumption of fixed capital and so on. At equilibrium

$$Y_{Su*} = Y_{De*}$$

holds for the goods market. The unemployment rate is defined as

$$n = \frac{N_N}{N_L + N_N}. \tag{3}$$

Equating (2) and (1) and inserting N_L from (3) results in

$$n_* = \frac{a - w_e}{a - (1-b)w_e} \tag{4}$$

for the unemployment rate at equilibrium. The higher the production, compared to consumption by the employees, and the lower the unemployment benefit, the higher the unemployment rate. The surplus of output $\Delta Y = alN_L(a - w_e)$ is to be consumed by the unemployed. Unemployment exists, if the wage rate is lower than the output rate. If the wage rate or unemployment benefits increase, the unemployment rate falls, because the surplus of output falls. A certain amount of the unemployment rate could then continue to exist for a long time, if for example employees and unemployed considered the wage rate, unemployment benefits and the unemployment rate as suitable.

At a certain wage rate there is a working time with which the employee achieves his maximal utility. This optimal working time l_* is therefore a function of the wage rate, $l_*(w_e)$, or conversely, the "optimal" wage rate is a function of working time, $w_{e*}(l)$, the known (wage -) labour supply function. So the demand for goods of the employees $w_e l N_L$ according to (1) is determined by their labour supply. It is assumed that the optimal wage rate is proportional to the working time,

$$w_{e*} = ml + p\,. \qquad (5)$$

m is the increase of the wage rate with working time, the gradient of the (wage -) labour supply curve, p is the wage rate at $l = 0$. Hence for the unemployment rate after inserting (5) in (4) the relation is

$$n_* = \frac{a - (ml + p)}{a - (1 - b)(ml + p)}\,. \qquad (6)$$

In the case of a positive slope of the labour supply curve, $m > 0$, the unemployment rate decreases, if the working time increases. This is because the numerator and the denominator of (6) are positive and the numerator decreases more, if working time increases. If the slope is negative, as in reality (chapter 1 section 3 fig. 2 fig. 7), the unemployment rate increases at increasing working time. Then a rising working time is connected to a falling wage rate, by which the difference to the output rate rises. (With equation (4) the unemployment rate is determined, with (6) its change if working time changes.)

The supply of goods $Y_{Su}(l)$ and the demand for goods $Y_{De}(l)$ depend on the optimal working time, that means on the labour supply $w_{e*}(l)$, see (1) and (2). This can easily be seen if only employees and the unemployed exist. Then the employees only offer labour in the amount of their demand for goods plus the amount of unemployment benefits, and the unemployed are only able to consume to the extent of the unemployment benefits.

This mechanism does not change much, when the model includes additional properties such as the self-employed, the retired, and so on. The factor capital is also considered and non-linear functions for supply and demand of goods are used. To provide a better overview, also in the extended model, simplifications are made: The population is assumed as constant. The ratio of investment related to national disposable income on average changes slowly. Therefore in the supply and demand for goods, net values (investments subtracted) are used. The ratio of the self-employed to economically active persons also changes slowly, and therefore also the share of employees plus the unemployed, even with variable wage rates and variable working times per employee. Therefore these ratios are also seen as constant.

As profits mainly depend on sales, the incomes of the self-employed - including industrialists - depend mainly on the income of employees, as well as the income of the unemployed, retired, other private organisations, and the state. Therefore, the ratio of the income per person of the different household groups is also seen as constant. This view thoroughly reflects reality, as, independent of the economic and political system, social conditions with classes that achieve different incomes per person can endure for centuries. But even if the ratio of incomes of the other household groups to the group of employees were changed, their income would nevertheless be mainly dependent on the incomes of employees. This would only be invalid, if the self-employed and so on succeeded in squeezing out a far bigger share of the income than now and earlier. Saving as a part of the disposable income is taken into consideration merely for the calculation of the consumed income in

the employee household, as it influences the optimal working time for the employee. These simplifications have little influence on the statements of the model.

The incomes of the employees on the demander's side for goods result predominantly from optimal working time, to which a certain wage rate belongs. So the long-term demand for goods is dependent on optimal working time for employees. Prices play no role (in Solow 1956 p. 79). In the long term they are reflected in the incomes of the groups. The unemployed appear as receivers and consumers of social benefits and as unused in the work force, because they are not needed. In particular, no lower wage rate is intended for them if they become employed. Their influence on the economic circulation is not different to that of the other household groups. Therefore the situation with the unemployed is as stable as with for example the self-employed or retired. Instead of the simplifications made, endogenous or exogenous relationships might also be used for the parameters. The extended model is formulated as follows.

4. Unemployment rate

The supply and demand for goods are expressed as production and consumption of the total economy. Thereby, a distinction is made between the groups of the employees L, the unemployed N, the self-employed S, the retired R and their respective households, and other private organisations and the state G. For each group it is calculated using an average value per person.

The production of a total economy can be described like the production of a company. A Cobb-Douglas function with labour and capital is used here as the production function. As with Feldstein (1967 p. 375) the factor labour is given as the product of number of employees multiplied by working time per employee and time period, and similar to Nadiri and Rosen (1973 p. 14) the factor capital is given as the product of capital and its time degree of utilisation. The degression of output with high

values of working time and capital utilisation is taken into account by additional exponents. Then the output per time period X *is*

$$X = A\left(N_e l_e^{\lambda}\right)^{\nu}\left(N_e s_{se} k_e^{\kappa}\right)^{\sigma}, \qquad (7)$$

where the productivity parameter of the economy is A*, the number of employees* N_e*, working time per employee and time period* l_e*, capital per employee* s_{se}*, time utilisation of capital* k_e*, elasticities of output depending on the factors labour* ν *and capital* σ*, and elasticities for the degression of output at high values of working time* λ *and capital utilisation* κ*. The gross domestic product* Y_g *is*

$$Y_g = PX,$$

P *is the price factor (price per unit of output). With a factor for consumption of fixed capital and so on* t_d *the national disposable income*

$$Y = t_d Y_g,$$

results, and is summarised as

$$Y = t_d P A N_e^{\nu+\sigma} l_e^{\lambda\nu} s_{se}^{\sigma} k_e^{\kappa\sigma}. \qquad (8)$$

(For simplification it is not taken into account that k_e*,* s_{se} *and* t_d *also depend on* l_e*,* k_e *and* s_{se} *due to the larger expenditure and* t_d *due to the larger consumption of fixed capital with decreasing* l_e*.)*

A distinction is made between employees and self-employed, and for the working time of the self-employed

$$l_S = t_S l \qquad (9)$$

is set, with the working time factor of the self-employed t_S *and the working time per employee and time period* l*. The supply of goods* Y_{Su}*, based on the national disposable income, is then*

$$Y_{Su} = t_d\left(P_L A_L N_L^{\nu+\sigma} s_{sL}^{\sigma} k_L^{\kappa\sigma} + P_S A_S N_S^{\nu+\sigma} t_S^{\lambda\nu} s_{sS}^{\sigma} k_S^{\kappa\sigma}\right) l^{\lambda\nu}. \qquad (10)$$

This expression can be simplified, if only the number of employees and the working time is varied. Starting from a certain state of the economy 0, using the productivity parameter of the total economy, and assuming that the contributions of the employees and self-employed to the national disposable income are proportional to their disposable incomes, (10) can be simplified to

$$Y_{Su} = \frac{A}{A_0}\left[\left(\frac{N_L}{N_{L0}}\right)^{\nu+o}\frac{Y_{L0}}{Y_{L0}+Y_{S0}} + \frac{Y_{S0}}{Y_{L0}+Y_{S0}}\right]\left(\frac{l}{l_0}\right)^{\lambda\nu} Y_0\,, \qquad (11)$$

with l_0 as the factual working time and Y_0 as the national disposable income in this state.

On the other hand the national disposable income results from the shares of the households, the other private organisations and the state,

$$Y = Y_L + Y_N + Y_S + Y_R + Y_G\,. \qquad (12)$$

The number of persons of the population is

$$N_{tG} = N_{tL} + N_{tN} + N_{tS} + N_{tR}\,. \qquad (13)$$

The disposable income per person of the household and time period in the employee household is y_L, and y_N in the unemployed household. Thus one obtains

$$Y = y_L N_{tL} + y_N N_{tN} + Y_S + Y_R + Y_G\,. \qquad (14)$$

The incomes of the persons in the other household groups are thought to be proportional to the incomes in the employee households; the number of persons in the household groups besides those of the employees and unemployed are assumed to be constant; and the values should be related to a certain state of the total economy. Therefore (14) can be transformed to

$$Y = y_L\left(N_{tL} + \frac{y_{N0}}{y_{L0}}N_{tN} + \frac{Y_{S0}+Y_{R0}+Y_{G0}}{y_{L0}}\right). \qquad (15)$$

y_L results from the consumed part of the wage rate w, the working time l, the consumed non-work income v and the saving s per person of the household and time period,

$$y_L = wl + v + s\,. \tag{16}$$

The demand for goods in the long term results from the optimal working time for the employee l_* and the wage rate w, whereby the non-work income and the savings still have to be taken into account. The wage rate depends on the optimal working time, equation (12) or (19) in chapter 1. If in equation (16) l_* instead of l is used and w is determined from equation (19) in chapter 1, y_L is a function of l_*. It yields

$$wl_* = \frac{\frac{1}{g}(1-2l_*)e^{\frac{\frac{1}{2}+\frac{v}{w}}{l_*+\frac{v}{w}}+u_l}}{1+\frac{v}{wl_*}}, \qquad wl_* + v = \frac{1-2l_*}{g}e^{\frac{\frac{1}{2}+\frac{v}{w}}{l_*+\frac{v}{w}}+u_l}, \qquad y_{L^*} = \frac{1-2l_*}{g}e^{\frac{\frac{1}{2}+\frac{v}{w}}{l_*+\frac{v}{w}}+u_l} + s\,.$$

If the latter term is inserted in equation (15), the demand for goods, based on the national disposable income, is

$$Y_{De} = \left(\frac{1-2l_*}{g}e^{\frac{\frac{1}{2}+\frac{v}{w}}{l_*+\frac{v}{w}}+u_l} + s\right)\left(N_{tL} + \frac{y_{N0}}{y_{L0}}N_{tN} + \frac{Y_{S0}+Y_{R0}+Y_{G0}}{y_{L0}}\right). \tag{17}$$

g is a scale factor and u_l the utility during working time.

At equilibrium, $Y_{Su} = Y_{De} = Y$ is valid. Therefore two equations exist for Y and this parameter can be eliminated. If for example the term (11) is equated with (17) and N_L is expressed by N_N the result is an equation for the number of the unemployed. As the number of the employees plus the number of the unemployed remains constant,

$$N_L = N_{L0} + N_{N0} - N_N \tag{18}$$

and

$$\left(\frac{N_L}{N_{L0}}\right)^{\nu+\sigma} = \left(\frac{N_{L0}+N_{N0}-N_N}{N_{L0}}\right)^{\nu+\sigma}. \tag{19}$$

With equation (19) put in (11) and the abbreviations

$$H_0 = \frac{N_{L0}+N_{N0}}{N_{L0}} \tag{20}$$

$$I_0 = \frac{Y_{L0}}{Y_{L0}+Y_{S0}} \tag{21}$$

$$K_0 = \frac{Y_{S0}}{Y_{L0}+Y_{S0}} \tag{22}$$

$$Q = \left(\frac{l}{l_0}\right)^{\lambda\nu} Y_0 \tag{23}$$

results

$$Y_{Su} = \frac{A}{A_0}\left[\left(H_0 - \frac{N_N}{N_{L0}}\right)^{\nu+\sigma} I_0 + K_0\right] Q. \tag{24}$$

In the same way, with equation (17) and the terms

$$N_{tN} = \frac{N_{tN0}}{N_{N0}} N_N \tag{25}$$

and

$$N_{tL} = N_{tL0} + N_{tN0} - \frac{N_{tN0}}{N_{N0}} N_N \tag{26}$$

and the abbreviations

$$G_0 = \left(1 - \frac{y_{N0}}{y_{L0}}\right)\frac{N_{tN0}}{N_{N0}} \tag{27}$$

$$M_0 = N_{tL0} + N_{tN0} + \frac{Y_{S0}+Y_{R0}+Y_{G0}}{y_{L0}} \tag{28}$$

$$R = y_L = \frac{1-2l_*}{g} e^{\frac{\frac{1}{2}+\frac{v}{w}}{l_*+\frac{v}{w}}+u_l} + s \tag{29}$$

the function

$$Y_{De} = (M_0 - G_0 N_N) R. \tag{30}$$

results. The terms (24) and (30) are equated and resolved to N_N. *With the abbreviation*

$$L = \frac{Q}{R} \tag{31}$$

and $l = l_*$ *results for the number of unemployed at equilibrium*

$$N_{N*} = \frac{1}{G_0}\left\{M_0 - \frac{A}{A_0}\left[\left(H_0 - \frac{N_{N*}}{N_{L0}}\right)^{\nu+\sigma} I_0 + K_0\right]L\right\}$$

for $N_{N*} \geq 0$, otherwise $N_{N*} = 0$. (32)

The number of unemployed in the case of equilibrium is hence a function of the working time, the wage rate, the non-work income and the saving of the employee and other parameters, and it is designated as N_{N*}. *As it can not be negative in the usual definition, it is* $N_{N*} = 0$ *for the case of* $N_{N*} < 0$. G_0, H_0, I_0 *and* K_0 *are parameters,* L *is a variable as* l_*.

With the unemployment rate

$$n = \frac{N_N}{N_{L0} + N_{N0}} \tag{33}$$

the unemployment rate at equilibrium results from equation (32)

$$n_* = \frac{M_0 - \frac{A}{A_0}\left\{\left[H_0(1-n_*)\right]^{\nu+\sigma} I_0 + K_0\right\}L}{G_0\left(N_{L0} + N_{N0}\right)}$$

for $n_* \geq 0$, *otherwise* $n_* = 0$. *(34)*

The equations (32) and (34) can be solved numerically.

For a Cobb-Douglas production function with the exponent $\nu = 1 - \sigma$ *an explicit solution for the unemployment rate in the state of equilibrium is obtained from the equations (32) and (34),*

$$n_* = \frac{M_0 - \frac{A}{A_0}(H_0 I_0 + K_0)L}{H_0\left(G_0 N_{L0} - \frac{A}{A_0} I_0 L\right)}$$

for $\nu + \sigma = 1$*; and for* $n_* \geq 0$*, otherwise* $n_* = 0$*.* (35)

A working time elasticity of the unemployment rate at equilibrium can be defined as

$$\eta_{n_* l} = \frac{\partial n_*}{\partial l} \frac{l}{n_*}.$$

It can be calculated numerically for pairs of values of n_*, l*, for example from equation (34), which are close together,*

$$\eta_{nl} \approx \frac{\Delta n}{\Delta l} \frac{\bar{l}}{\bar{n}} \qquad (36)$$

where Δn *and* Δl *are the differences and* $\bar{l}$ *and* $\bar{n}$ *the means of the values.*

An explicit solution can be obtained for a Cobb-Douglas production function with the exponents $\nu + \sigma = 1$ *and if* $s = 0$ *(no saving is made),*

$$\eta_{n_* l} = \left[\frac{1}{1 - \frac{M_0}{\frac{A}{A_0}(H_0 I_0 + K_0)L}} - \frac{1}{1 - \frac{G_0 N_{L0}}{\frac{A}{A_0} I_0 L}}\right]\left[\frac{\lambda \nu}{l} + \frac{2}{1 - 2l} + \frac{\frac{1}{2} + \frac{\nu}{w}}{\left(l + \frac{\nu}{w}\right)^2}\right] l$$

for $\nu + \sigma = 1,\ s = 0$. (37)

If $s \neq 0$*, this equation gives an approximate solution with an error in the size of* $\frac{s}{y_L}$*.*

The working time elasticity of the unemployment rate at equilibrium is high and amounts, for example, to 72 for West Germany in 1985. This means, if the existing working time has been optimal for the employees

and has been 1 per cent longer, the unemployment rate would have been 6.2 percentage points higher. (If the incomes of the self-employed, the retirees and the state do not change when there is a change in the incomes of the employees and unemployed, the elasticity is 45.) In the normal range of parameters the unemployment rate rises a little less than proportionally (this means weakly degressively) to a rising difference from factual to optimal working time for the employee.

In 1985 in the West German metal industry working time was reduced on 1 April from 40 to 38.5 hours per week, wages and salaries per working hour were raised by 6% and net production increased in real terms by about 7%. The number of workers, which was 2,480,000, increased according to the analysis of an institute for economic research by about 50,000. The employers' association estimated half as many, the trade union twice as many (Deutsches... 1987 p. 274, 275, 279). With an arithmetic number of 234,000 unemployed in the metal industry at an unemployment rate of 8.6% in the total economy (Statistisches... 2003 Tafel. 1.1.2; 2004 Tafel Arbeitslose...) before and 184,000 after the reduction, the unemployment rate decreased in the metal industry to 6.8%. The working time elasticity of the unemployment rate according to equation (36) was

$\eta_{nl} \approx \frac{\Delta n}{\Delta l}\frac{\bar{l}}{\bar{n}} = \frac{-50000}{38.5-40}\frac{40+38.5}{234000+184000} = 6.3$. The Okun factor, see section 6, according to equation (41) was

$\omega \approx -\frac{\Delta Y}{\bar{Y}\Delta n} = -\frac{235-219}{(235+219)(-50000/2714000)} = 1.9$. In billion DM at 1980 prices, net production was 235 from the second quarter of 1985 to the first quarter of 1986 and 219 from second 1984 to first 1985 (Deutsches... 1987 p. 275). It is assumed that the number of unemployed decreased within six months by the 50,000 persons mentioned. Therefore the difference of the net production for six months was chosen. - The results are the empirical values. The theoretical ones are ascertained further below.

During the Great Depression a large scale experiment of reducing working time was performed in Italy to decrease the number of unemployed. From the end of 1934 the average weekly working time per employee was lowered by about 10% in a few months. In the next year the output increased by about 7 % and worker unemployment decreased from about 23% to 15% (Mattesini/Quintieri 2006 p. 416, 417, 423, 424). This results in a working time elasticity of the unemployment rate of 3.6 and an Okun factor of 0.9.

With the relations derived here the working time elasticity of the unemployment rate at equilibrium can be determined theoretically too. This is shown again for the West German metal industry, where sufficient data are available*. But the elasticity cannot be calculated with equation (37), because in this case the wage rate is set and the net export of the total economy should not be neglected. But the national disposable income* Y_{Su} *for supply and* Y_{De} *for demand can be determined for given unemployment rates. Unemployment is varied till the demand is equal to the supply. Then it has the value at equilibrium of supply and demand. On the day before the working time is shortened and the wage raised, the state of the economy is 0 with the data valid for this. They are calculated for six months later with the state #. Then the elasticity and the Okun factor are ascertained from the data for the two states as empirically determined above.*

For Y_{Su} equation (24) with $\nu + \sigma$ = 1 is used, for Y_{De} from (16), (17) and (30)

$$Y_{De} = (M_0 - G_0 N_N)(F_w w_0 l + v + s) + F_F Y_0 .$$

The terms are defined as in section 4. F_w *is the factor for the change of the wage rate,* w_0 *the mean wage rate (disposable part for 8,760 h and person of the household) in the total economy at state 0. At this state the net export is included in* Y_{De}*. The rise until state # has the same effect as, for example, a raised income of the state. It is calculated with the factor* F_F *at the national disposable income and added to the other components of* Y_{De}*. (For this it is assumed that the net export equals net*

saving minus net domestic investment.) A/A_0, F_w *and* F_F *are calculated again from the mean values of the second quarter of 1985 to the first quarter of 1986 and also 1984/1985. For* A/A_0 *and* F_F *half the growth rate per year is used corresponding to the six months between state 0 and #. For* F_w *the full growth rate is used, because the wage is raised immediately to the full value, and as it is given nominally, devalued at half of the yearly inflation rate. Since there are no data for* Y_F *from the metal industry, they are accepted from the total economy, likewise for* l_0 *and* w_0, *as these are used to derive the relations. Then the state 0 is also valid for the total economy on 31 March 1985. The numerical values are as follows:*

Parameter		State 0	Change	State #
l		0.18	- 3.75 %	0.17325
w_0		40,700 $/Pa		
$\frac{A}{A_0}$	(Deutsches... p. 275)	1	+ 4.4 % / 2	1.022
F_w	(Deutsches... p. 275)	1	+ 6.3 % - 1 %	1.053
	Inflation rate2 % / a $\approx$1% / 0.5 a (Statistisches... 2002)			
F_F		0	+ 1.4 % / 2	0.007
	(Statistisches... 2003 Tafel 1.1.5 Inflation; Statistisches... 1996 Tafel 24.2 p. 641 Gross domestic product)			
n		0.086		0.045
Y		784 bn $		810 bn $
η_{nl}	(empirically 6.3, see above)			16.6
ω	(empirically 1.9, see above)			0.79

The working time elasticity of the unemployment rate is considerably higher, and the Okun factor lower than the empirical value. This is because the theoretical values are valid for equilibrium, which does not exist at state 0, not all parameters and no delays of effects are considered, and the statistical data scatter. If for example in state # A/A_0 = 1.032, this is 1 percentage point higher than used, the theoretical values are n_* = 0.063, Y = 806 bn $, η_{n^*l} = 8.2 and ω_* = 1.19.

Other elasticities can also be determined in the same way, for example for the effect of changes in technology on employment. The productivity elasticity of the unemployment rate at equilibrium is

$$\eta_{n_*A} = \frac{\partial n_*}{\partial A}\frac{A}{n_*}.$$

It can be calculated with

$$\eta_{n_*A} \approx \frac{\Delta n_*}{\Delta A}\frac{A}{n_*}, \qquad (38)$$

and similar to equation (37) as

$$\eta_{n_*A} = \frac{1}{1-\dfrac{M_0}{\dfrac{A}{A_0}(H_0 I_0 + K_0)L}} - \frac{1}{1-\dfrac{G_0 N_{L0}}{\dfrac{A}{A_0} I_0 L}}$$

for $\nu + \sigma = 1,\ s = 0$. (39)

Technical progress increases the productivity parameter. The unemployment rate at equilibrium increases with the increasing productivity. For West Germany in the year 1985 one gets a productivity elasticity of the unemployment rate at equilibrium of 21. An increase of 1% in productivity with otherwise constant conditions, would have increased the unemployment rate by 1.8 percentage points to 10.4%.

If more variables than l and A should be considered for the theoretical determination of the elasticities and Okun factor, as in the example of the metal industry, Y_{Su} and Y_{De} can be calculated and n_* can be numerically determined for $Y_{Su} = Y_{De}$.

The model can be shown in a diagram. See figure 2. The curve of the demand for goods is equivalent to the curve of labour supply (chapter 1 figure 7). It is negatively sloped and concavely bent to the abscissa. The curve of the supply of goods, positively sloped and convexly bended to

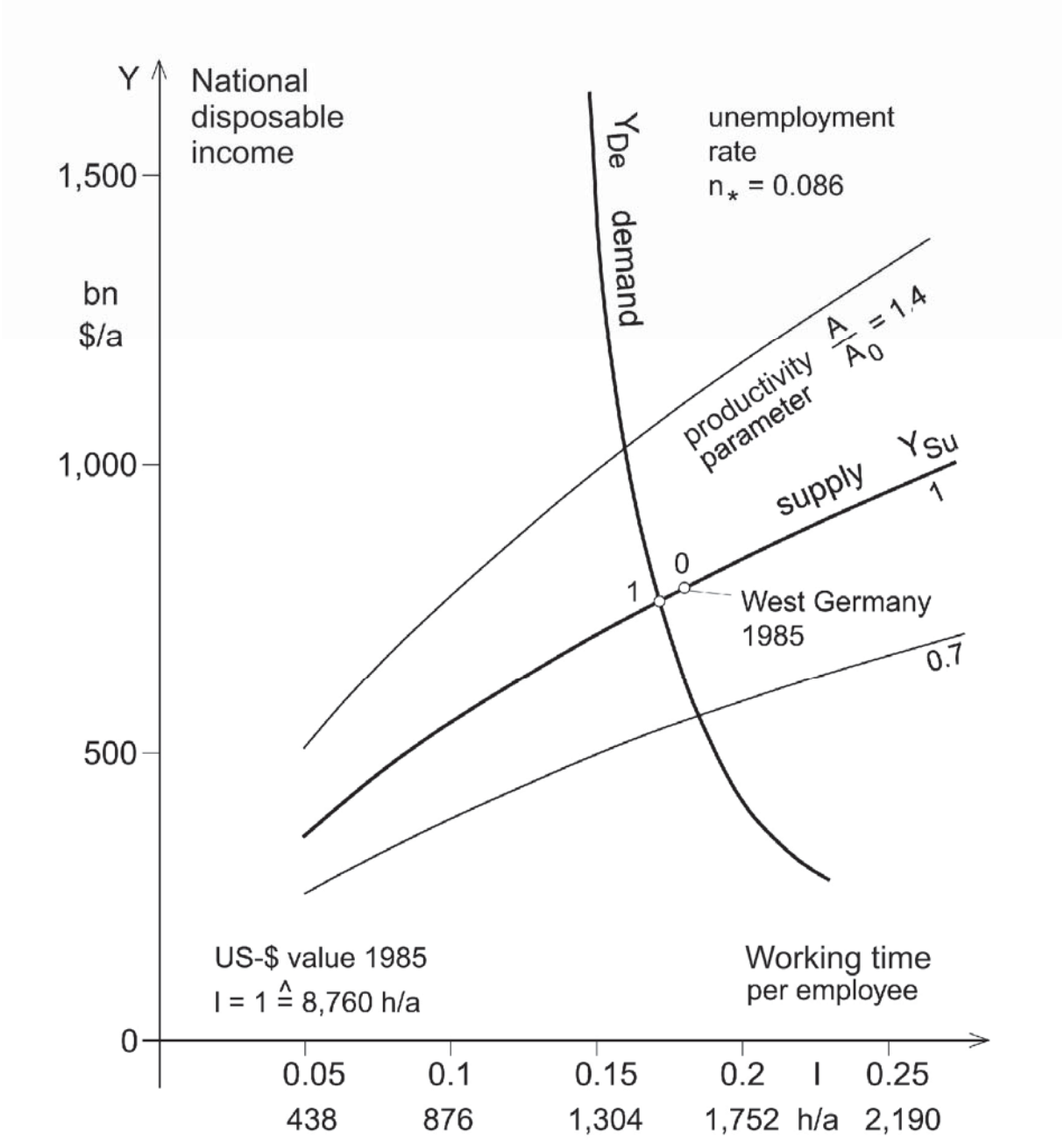

Figure 2
Supply and demand of goods as a function of working time and productivity

the abscissa, is the curve of output. Compared to the usual depiction of aggregate supply and demand, if the price is depicted on the abscissa and the quantity on the ordinate, the goods price is replaced through working time per employee.

If productivity in the total economy increases, the goods supply curve becomes steeper, but the goods demand curve remains the same. See figure 1. For different values of productivity there are then a family of supply curves, but only one demand curve exists (with constant amounts of unemployment rate, investment, utility during working time, number of employees and self-employed, ratio of income of their households and so on).

5. Unemployment

If unemployment is permitted, there is no restriction for working time caused by the economic circulation. Depending on the extent to which working time per employee and time period is reduced or extended, states of equilibrium with higher or lower wage rates and lower or higher unemployment result. The proceedings are shown in figure 3, which is an enlarged and extended detail of figure 2. The initial (factual) state of the total economy is 0, the state with optimal working time for the employee at the existing unemployment rate is 1; at full employment it is 2, if productivity has risen while working time has remained constant, it is 3, and at full employment with increased productivity it is 4. The unemployment rate is used here as a further variable and shown as a parameter. If there are unemployed, the supply curve is lower due to the smaller number of employees, and the demand curve is more to the left due to the lower incomes of the unemployed. For different unemployment rates, different pairs of supply and demand curves exist. With an unemployment rate of 0.086, the curves intersect at point 1, and with a rate 0 at point 2. The intersections of the curves of supply and demand with certain unemployment rates are the states of equilibrium of supply and demand. They lie on the equilibrium curve $(B)l$.

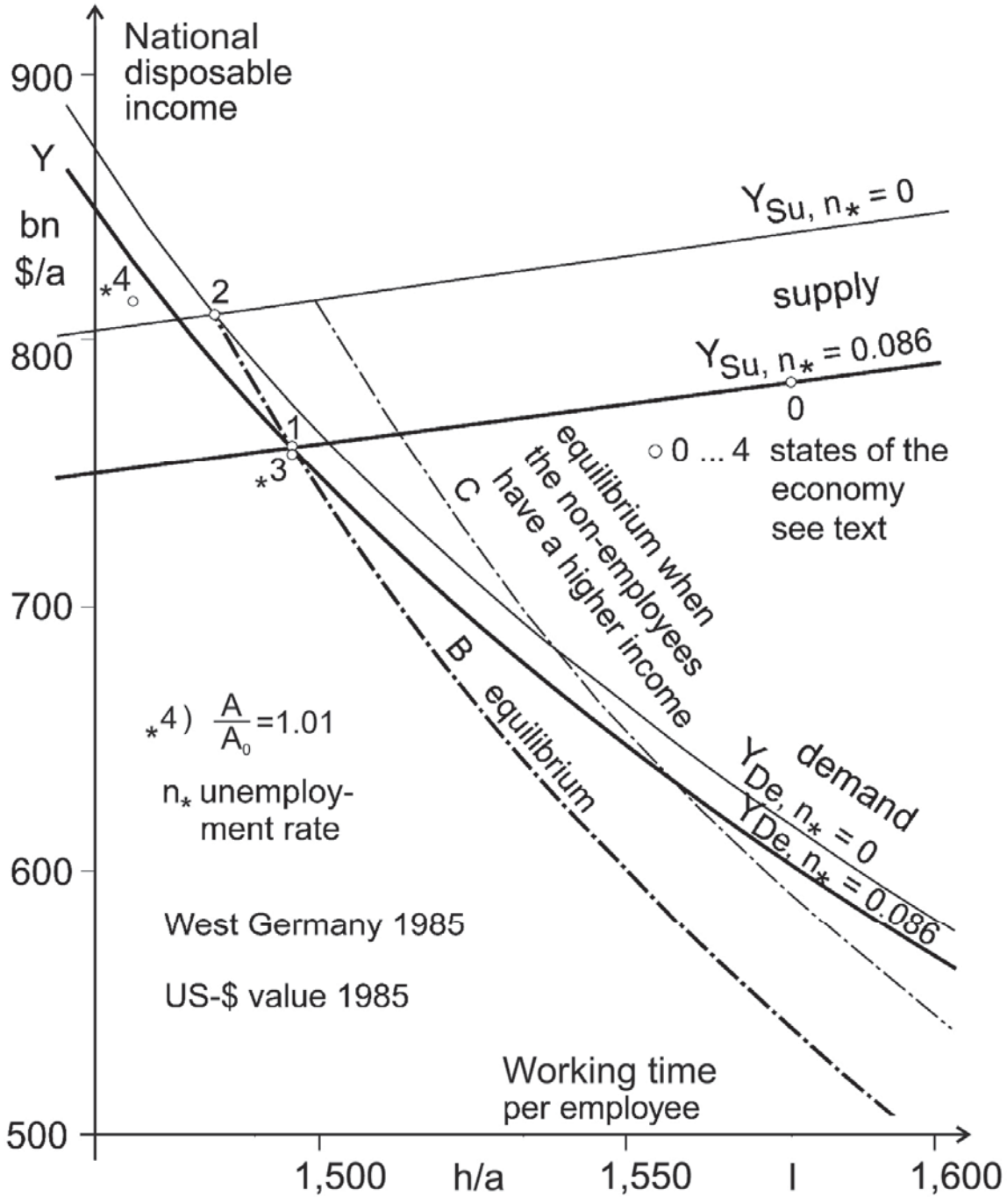

Figure 3
Working time, disposable income and unemployment rate

Unemployment and output are linked. For the short term (in the same business cycle), Okun's relation is valid: 1 additional percentage point of unemployment rate diminishes the gross domestic product by about 2 per cent (Dornbusch/Fischer/Startz 2004 p. 132, 145), the "Okun factor"

is about 2. For the long term an Okun factor can also be determined with the relations developed here. This is explained in more detail below.

6. Unemployment rate and national income

(A relation as Okun's law for the long term)

Okun's relation can be written as

$$\frac{Y_{gd2} - Y_{gd1}}{Y_{gd1}} = -\omega(n_2 - n_1)\,, \tag{40}$$

with the gross domestic product Y_{gd} *and the unemployment rate* n *for two states 1 and 2 of the economy within a business cycle; the Okun factor* $\omega \approx 2$ *(Dornbusch/Fischer/Startz 2004 p. 132, 145). An Okun factor at equilibrium (for the long term)* ω_* *can be defined similarly,*

$$\omega_* = -\frac{\Delta Y}{\bar{Y}\,\Delta n_*} \tag{41}$$

with the national disposable income Y *and the unemployment rate at equilibrium* n_**.* ΔY *and* Δn_* *are the differences and* $\bar{Y}$ *the means of the values of state 1 and 2. One can calculate* ω_* *numerically, for example from equations (10) or (11) and (34) or (35) with the differences of pairs of values of* Y_{Su}, n_* *for values of* l *, which are close together. For several states of the West German economy in 1985 these Okun factors are shown in table 3. If the unemployment rate decreases after shortening the working time per employee, it is about 0.7; if the unemployment rate rises because of increased productivity, it is about 0.3. The order of the Okun factor at equilibrium can be explained in a simple way: If the number of employees increases by a certain percentage, the output and national disposable income and national income increase by about the same percentage. The unemployment rate therefore decreases by about the same number of percentage points. Then the Okun factor at equilibrium is about 1. If the higher employment is achieved by a reduction in working time per employee or the ratio of the number of self-employed rises less than that of the employees, the national income*

increases less and the Okun factor at equilibrium becomes smaller. If productivity increases and working time is not reduced, the unemployment rate increases. But, because of higher productivity the national income falls less and the Okun factor becomes even smaller.

7. Paths to full employment

Usually there are unemployed, and the working time is longer than optimal for the employees, state 0 in figure 3. If the unemployment rate is only reduced by a reduction of working time and otherwise no interventions in the labour market are made, a transition to full employment runs in two phases. In the first the unemployment rate remains constant. The disposable income falls, but like production underproportionally to working time. The working time of the self-employed falls too, as it is set proportionally to the working time of the employees. Since the proportion of the incomes of the household groups is constant, the wage rate rises slightly with increasing productivity. If the working time of employees is optimal at the current wage rate, state 1 is achieved. If the working time is further reduced, persons so far unemployed are hired. Now the wage rate has to rise more strongly so that the shorter working time remains optimal for the employees. This is financed with the saved unemployment benefits and the further increase in productivity. The proportion of the incomes of the household groups remains constant. When all unemployed are employed, state 2 is achieved.

With other proportions of the incomes, other states of equilibrium arise. If, for instance, a bigger part of the income of the total economy is diverged from the self-employed households or from the state, lower unemployment can be achieved by a smaller reduction of working time per employee. But then the wage rate has fallen. This is the case in the usual elimination of unemployment. Thereby, the demand curve in figure 2 shifts to the right. The curve of equilibrium $B(l)$ also shifts, for example to curve $C(l)$, if the self-employed receive 50 % more income per person (and their number remains constant). Conversely, if the incomes of

groups except the employees are reduced, the demand and equilibrium curves shift to the left; and then the working time has to be reduced more to achieve the same reduction of unemployment.

If productivity increases and working time remains constant, then so many employees become unemployed until the supply of goods has sunk so far that it is in equilibrium with the demand of those still employed and the other groups. If the number of unemployed is to remain constant, working time has to be shortened accordingly because of a rise in productivity. If the productivity sinks, for example by shortage of raw materials or steps for environmental protection, the unemployment rate decreases and the national disposable income increases. As the national income, the gross domestic product and so on, change almost proportionally to the national disposable income, this all also applies to the national income.

Some economic data relating to the states given in figure 3 are specified in table 3 for West Germany in 1985. They are calculated using equations (11), (17) and (35), with (1), (5) and (19) of chapter 1, and with (41). In comparison to state 0, in state 2, the national disposable income is 3.3% higher, the working time 6.1% shorter, the unemployment rate declines from 8.6% to 0 and the Okun factor is 0.68. If the working time were reduced further than necessary for full employment, then incomes would fall. If the productivity is 1% higher than in state 1, the unemployment rate is 1.8 percentage points higher, and the national disposable income is 0.4% less, state 3. If at the higher productivity the working time is shortened by 1.9%, there is full employment, and the national income is 7.5% higher, state 4.

It is taken into account that non-work income and saving vary with the total income. In state 1 the working time is slightly shorter than 0.172, the estimated value of the optimal working time for the employee (which is also used for determining the scale factor g *). This is the effect of increasing productivity with decreasing working time per employee, which is surely not taken into consideration by those interviewed. By the way, here the unemployed are a little better-off than the employees, as*

far as the current utility is concerned. Returning to the utility curves in figure 1, the employee households in states 1 and 2 have the maximal utility, but not the industrialist households. Because the reduction of working time, but due to the condition that the ratio of the industrialist income to the employee income remains constant, both the utility curves have moved upward due to higher incomes, the utility of the industrialist household is also higher than it was before.

The factual state of the goods market is at point 0, in figure 3 to the right of the curve of the equilibrium points and of state 1. The difference results mainly from the fact that state 0 is out of equilibrium (if no interventions in the labour market are made). The surplus capital can be still invested without difficulties, in this case also in foreign countries, the net value was 2.7% of gross domestic product. In the years following the net lending to the foreign countries rose to 4.3% of the gross domestic product (Statistisches... 2003 Aug Tafel 1.1.5). With the usual interventions in the goods and labour market, a state can be maintained in the long term, too, which would otherwise be out of equilibrium. In 1985 for instance, in West Germany the labour market alone was influenced by public spending for labour agencies, training, youth, rehabilitation, employment, unemployment benefits and early retirement to the amount of 2.2% of the gross domestic product, and this rate had increased to 4.2% by 1993 (OECD Employment... 1989 p. 20, 1996 p. 207). Therefore it should be possible in figure 3 to get straight to state 2 from state 0 without going through state 1 and thus avoid a temporary decline in disposable incomes.

Using this mechanism a simple explanation is found for the „natural“ unemployment rate. The unemployment rate is not predominantly a result of incomplete information with the supply and demand of labour and so on, but above all because of a permanently too long working time per employee. This also applies to the quasi in equilibrium unemployment rate (QERU, quasi-equilibrium rate of unemployment) and the inflation stabilising unemployment rate (NAIRU).

Table 3
States and parameters of the economy (West Germany 1985)

0...4 State of the economy as in part 5, figure 2 and 3
l Working time
A/A_0 Productivity parameter, related to the parameter in state 0
n Unemployment rate
w Consumed part of the wage rate (for 8,760 working hours) per person of the household
y_L Disposable income per person of the employee household and year
u_L, u_I, u_N Utility per person of the employee, industrialist and unemployed household
Y National disposable income
η_{n*l} Working time elasticity of the unemployment rate in equilibrium
η_{n*A} Productivity elasticity of the unemployment rate in equilibrium
ω_{*l}, ω_{*A} Okun factor for the long term at varying working times or productivity parameters

State	Parameter: l	A/A_0	n	w	y_L	u_L	u_I	u_N	Y	η_{n*l}	η_{n*A}	ω_{*l}	ω_{*A}
Unit:	1	1	1	$/Pa	$/Pa	1	1	1	bn $/a	1	1	1	1
0	initial (factual working time)									(- = not in equilibrium)			
	0.180	1	0.0863	40,700	8,750	1.82	3.62	1.95	784	-	-	-	-
1	working time shortened to the optimum at the existing unemployment rate												
	0.171	1	0.0863	41,700	8,480	1.84	3.60	1.95	759	71.7	21.0	0.731	0.276
2	working time further shortened to achieve full employment												
	0.169	1	0	43,700	8,830	1.87	3.62	1.96	810	∞	∞	0.684	0.273
3	productivity increased, working time as in state 1												
	0.171	1.01	0.104	41,700	8,480	1.84	3.60	1.95	756	58.2	17.1	0.741	0.277
4	productivity increased, working time further shortened to achieve full employment												
	0.168	1.01	0	44,700	8,860	1.88	3.63	19.7	813	∞	∞	0.685	0.269

If working time remains constant (at constant proportions of incomes of the groups, constant productivity and so on), then, in the state of equilibrium, the wage rate also remains constant - otherwise the state would not be in equilibrium. So working time determines the national income. Secular stagnation may therefore also come about with the effects described here, but for other reasons than according to A. H. Hansen (1939 p. 3) following on from Keynes: not because no further expansion is possible and the technological progress has slowed down, but because a too long working time in proportion to the increased wage rate results in too little being consumed. But if working time per employee is reduced, stagnation (or decline) does not take place, and with increasing productivity the demand for goods and the national income also rises.

8. Conclusions for economic development

From the mechanism described here it can be seen that a very effective control variable for the unemployment rate exists: the working time which the employees have to do. If no unemployment is desired, the factual working time must be not longer than optimal for the employees, whose group is the main and leading consumer. If the optimal working time for the companies is longer, working time has to be set solely by the employees, just as they can also solely set their consumption.

Indeed, too high production in view of the propensity of consumption tendencies of the employees can be maintained by other means than higher consumption of the other household groups. Saving can be taxed, investment subsidised, working conditions improved, and consumption during working time made possible. The restrained consumption for fear of unemployment or of a cut in pensions can be reduced by statutory regulations that assure an appropriate distribution of the produced goods to all groups. An unconditional basic income may reduce the supply of earning work. Money can be spent in a nearly unlimited sum for not privately consumable goods such as investment in an improved infrastructure, development aid, research, armament and so on. But all

of this is only a cure for the symptoms and does not comply with the wishes of the employee households for more leisure time at a higher income. If the optimal working time for the company was stipulated as binding and the resulting unemployment accepted and remunerated by society, unemployment would no longer be a social problem. But for many jobs, workers could only be recruited by force or with the incentive of improved conditions, and the national income would be lower than if the employees, including those so far unemployed, worked slightly shorter. The solution to give employees the rights of the self-employed collides with the property rights of the owners and can only be implemented to a limited extent with the current company organisation and in smaller companies.

Since the incomes of the other economic groups in the great majority of cases increase with the national income and thereby in the first place with the work income of the employees, also the self-employed, the state, the retirees and the bound-to-lose unemployed superficially have an interest in longer working times. There are thus further motives apart from the optimal working time for the company and the power of the employer side, which lead to excessive working times. Even the term “industry”, from the Latin industria = diligence, designates the bourgeois counterpart of feudal idleness and luxury. Its promise relates in the first place to production, in the second to consumption and only in the third to the well-being of those whom it employs. Those responsible for this, the entrepreneurs, have either good working conditions and therefore longer optimal working times, or they are fighting for a good position in the market, and if they do not have a superior strategy, they attempt to compensate through greater work intensity and longer working time, for themselves and their employees. The self-employed often see themselves as entrepreneurs, even when they more resemble employees without a contract. The employed managers are recruited partly based on a longer presence time at the work place, due to lack of better criteria, and likewise the working time of the top officials from employers’ federations and unions, and of important politicians and scientists are often excessively long. The contracting parties in the

negotiations over working times and their assistants therefore do not have a great personal interest in shorter working times in general and hardly have a feeling for the optimal working times of people without particular ambitions. Finally, the conventional company organisation does not fully exhaust the productivity potential of shorter working times per employee. Many forces therefore come together which are directed against the adjustment of optimal working times for the employees.

Since unemployment (as far as it is caused by longer working time per employee) can be avoided with little additional cost in production, the reduction of working time is also an economically advantageous strategy. The additional income of the formerly unemployed raises the national income. The incomes of the other household groups can likewise rise. Full employment with shorter working time does not necessarily bring about economic disadvantages for any group. In this case, however, the overall sanctioning effect of unemployment is missing. But it is not needed for control inflation, and to discipline employees it is possible to choose individual sanction options. This would also lead to more justice. If in the future, for example for ecological or demographic reasons, longer working times are needed again, nothing would get in the way of this. In the USA, working time was reduced by more than a fifth in the years from 1929 to 1933, well more than was necessary for the elimination of long-term unemployment. Up to 1944 it was raised again to the amount before the Great Depression and higher (Historical... 1975 p. 169-170, Hunnicutt 1996 p. 96).

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Chapter 3
Weakness in sales and economic crisis

It is evident that the consuming power, which, if exercised, would keep tense the reins of production, is in part withheld, or in other words is “saved” and stored up for investment. All saving for investment does not imply slackness of production; quite the contrary. Saving is economically justified, from the social standpoint, when the capital in which it takes material shape finds full employment in helping to produce commodities which, when produced, will be consumed. It is saving in excess of this amount that causes mischief, taking shape in surplus capital which is not meeded to assist current consumption, and which either lies idle, or tries to oust existing capital from its employment, or else seeks speculative use abroad under the protection of the Government.

John Atkinson Hobson, Imperialism, a study, 1902 (1961 p. 82)

Abstract

Savings can accrue and above a certain level may not be invested profitably. They are then used increasingly to buy assets. Institutions and individuals, who have no savings, also buy assets on credit. Eventually they can no longer keep up the repayments. If the state then grants loans, the money is only partly used for newly produced goods. In spite of an increasing unemployment, savings can increase more and the crisis can intensify. A possible way to resolve such a situation is by taxing away the surplus savings and using them to buy goods as well as by shortening working time.

JEL code and keywords

J22, J23, J64

assets, course of the economy, debt, depression, economic circuit, economic crisis from 1929 and 2007, excess liquidity, investment,

overproduction, sales gap, speculative money, surplus, tax, underconsumption

1. Surplus savings and excess production

In a total economy savings can become so high that not enough profitable or at least amortisable investments in newly produced goods are possible (underconsumption). Then savings are left over, the production no longer flows fully into consumption and investment. Then exports are stepped up. This comes up against limits too - credits for financing, surplus in foreign trade. Then more assets are bought. Their sellers will also not consume or invest all the proceeds in new goods. This means a part of savings and new goods is left over. Even if their production is reduced, with a high propensity to save, a surplus can continue to exist. If the difference between savings and investment in the national economy is larger than zero, it is designated here as excess production. The excess production capacity can be called excess real liquidity, analogous to excess monetary liquidity, that is to say the money stock which is not needed for real economic transactions. Monetary liquidity is affected by real liquidity.

To make clear how the surplus arises, the flow of money, goods and assets is portrayed by a scheme of the economic circuit. See figure 1. In the factory F goods G are produced. One or more persons of household H_1 work in or for the factory and receive money for this. The household uses the money for consumption C or savings S. It buys goods G from the factory for consumption. It invests its saved money directly or via monetary capital M in new goods (referred to here as goods G), or in previously produced, old goods, land and things like that or in rights on such goods (referred to here as assets A). The household H_1 also obtains income from the investment and buys assets from household H_2 for consumption or investment. H_2 likewise consumes and saves, and again invests the savings in goods or assets. It buys the latter from household H_3 and so on. H_9 does business with H_1 and with F. If a household rather than the factory sells goods, they are no longer goods, but assets. In the end, if the proceeds of their sale are not fully

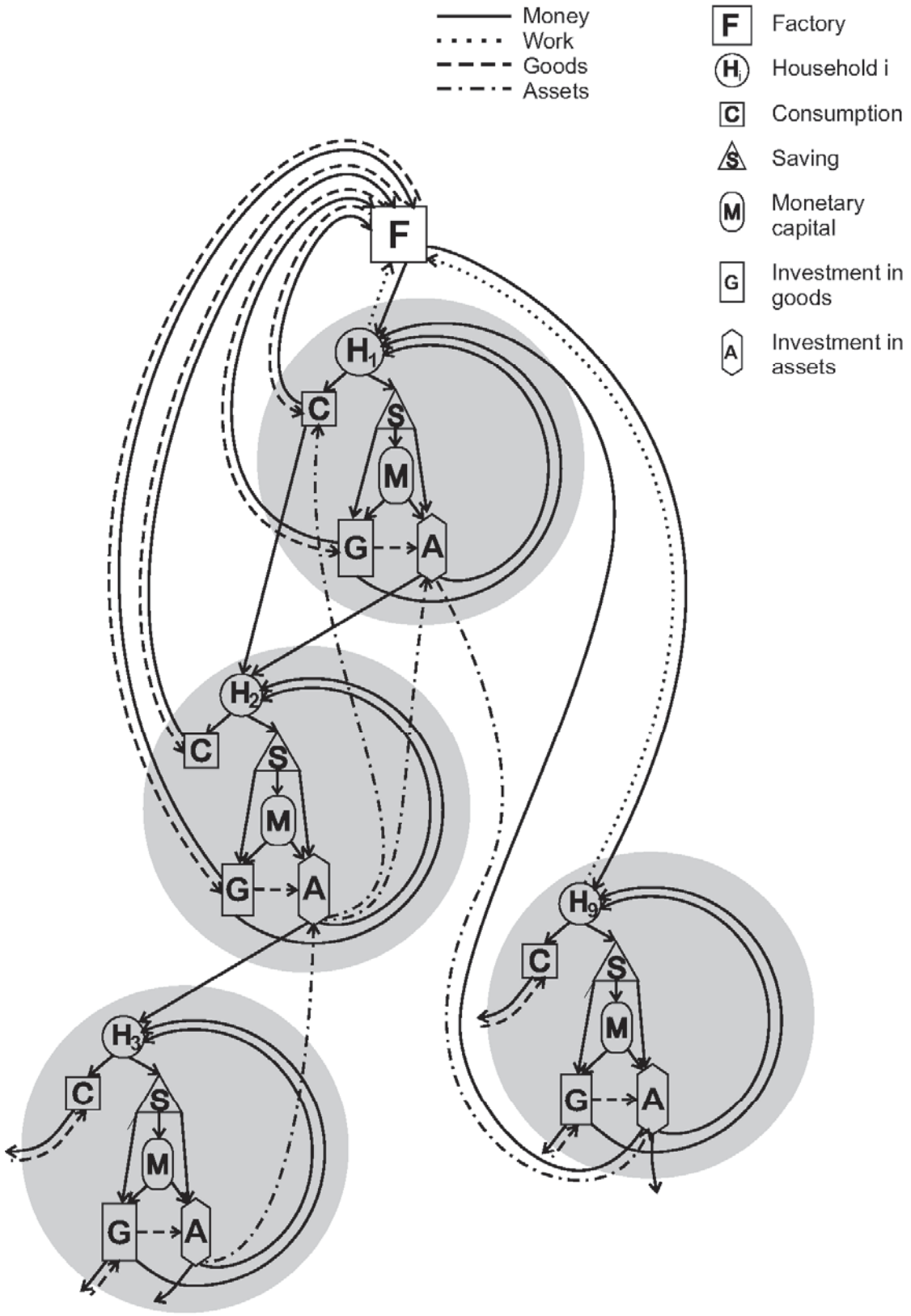


Figure 1
Economic circuit with goods and assets

consumed or invested in goods, some money obtained by working is left over.

2. Economic circuit in borrowing and repayment

The surplus money is attempted to be placed as loans at home or abroad. This is shown in figure 2. In the upper part, loans are paid out. The employee households H_E give, for example, 100 units of economic performance as work to the factories F and receive 80 units of money for it. They give these back to the factories and receive in return 80 units of consumer or investment goods. The industrialist households H_I receive 20 units of money from the factories and pay 17 units to the factories for goods. They lend the excess output of 3 units to the borrower households H_B. These buy goods with it at the factories F.

The repayment of the loans is shown in the lower part of figure 2. In the employee households nothing has changed. The industrialist households receive 20 units of money from the factories and 3 units back from the borrower households and buy goods for 23 units of money. If the borrower households are abroad, they offset their balances of trade by selling 3 units of goods to the trade departments of the domestic factories. These resell the goods to the employee and industrialist households. Domestic borrowers offset their money and goods flow by consuming 3 units less than they earn with work.

If a borrower wants to repay his debt without delivering goods for it, he can assign assets to his creditors. Their assets increase to the same extent as they decrease for the borrower.

If the government incurs debts, it consumes or invests goods in the value of its income from taxes plus the loans taken out. The households lend the government money from their savings, which means they buy fewer goods, or money from their assets.

If the government wants to pay off its debts, it can lower its expenditure, which means buy fewer goods, and give the money thus saved back to its creditors. The creditors then have to buy goods for the money returned. Or the government gives up its own assets to the households.

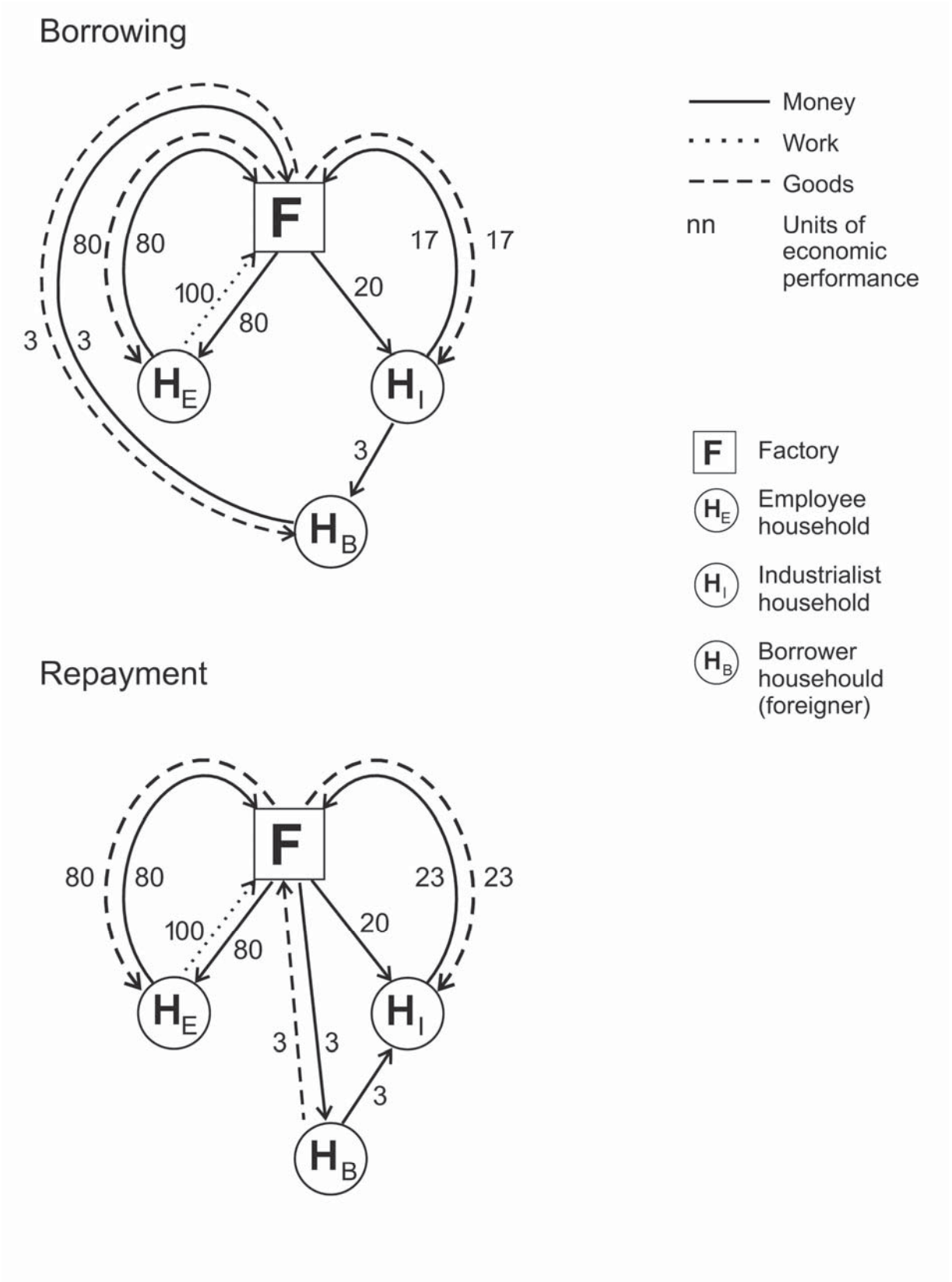


Figure 2
Borrowing and repayment in the long term

Then the flow of goods does not change. Instead the government can also raise taxes and this results in the households giving up assets to the government, if need be even by incurring debts. Conversely, the government can lower taxes and thereby raise its debts, which then go to the households as assets.

In all these cases the economic circuit is balanced; money and goods do not need to be hoarded.

As goods can only be stored in small quantities, and the money quantity should equal the value of the goods quantity, if one disregards financial capital and inflation, money flow largely corresponds to goods value flow. In the long term, money flow between households, governments and national economies is linked with goods value flow of the same magnitude. Lending can therefore only temporarily reduce excess production. If goods are given away without return, this acts like higher consumption by the givers, and the surplus goes down.

3. Causes of the weakness in sales

Some causes of overproduction and weakness in sales can be:

(A) If the productivity or income of the employees increases and their earning working time is not shortened enough, more is saved, but because of a lack of time, not fully invested in goods.

(B) If the uneven distribution of the incomes increases, the rich save more, but because of a lack of opportunity do not invest it all in goods. See chapter 1, figure 6.

(C) If the expenditure of the government or the awarding of loans goes down, the sale of goods also decreases.

(D) If loans or investment abroad rise more than exports, it is true that surplus money flows off, but the surplus goods remain at home.

Referring to (A):
In chapter 1 it is shown that the working time per employee, from the employee's perspective, is too long in most cases and therefore they mainly invest their savings as monetary capital. Because this is not

completely invested in goods, this leads to a weakness in sales and a decline in production. In addition, in chapter 2 it is explained, that this leads to an increase in unemployment and a decrease in national income.

Referring to (C):
If the expenditure of the government goes down, the gross domestic product decreases (sacrifice ratio). If increased loans are refused or called in, the money circuit can slacken off. This can happen, for example, in the case of high investments in assets. If these increase, they become more expensive, their yields sinks (Becker 2008 p. 8), and the interest rates can also go down. In the hope of further appreciation, institutions and individuals, who have no savings, now also buy assets on credit. Eventually they cannot or do not want to buy more assets or they can no longer pay back the loans. Then production goes down, and a recession can result.

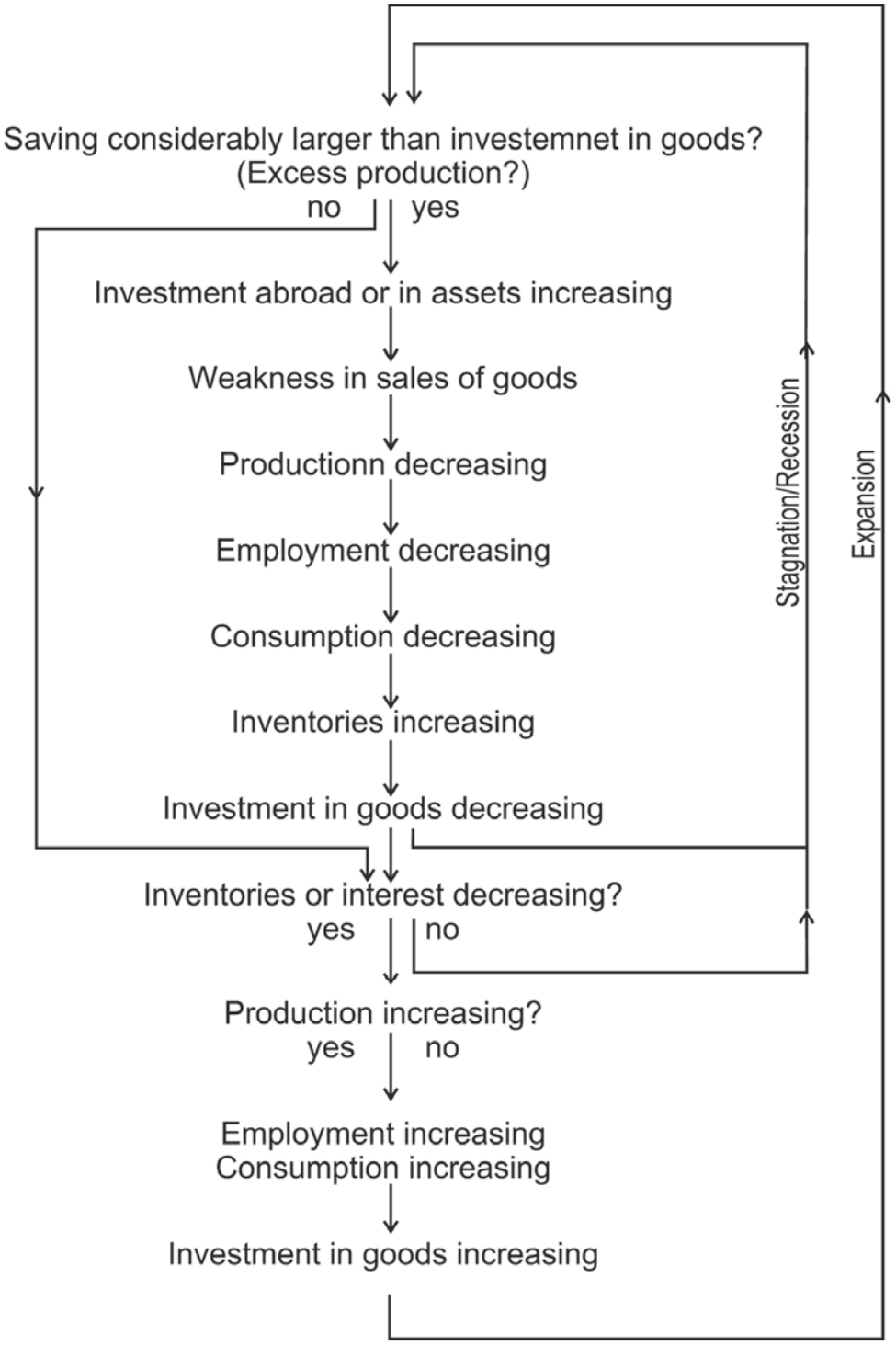
Referring to (D):
If foreign countries receive loans, domestic monetary liquidity sinks, and if they buy goods in the giver land, the surplus in goods is also reduced there.

If the loan is paid back and the trade balance at home and abroad is to be offset, the country has to buy goods abroad. But then fewer domestic goods are sold, and the former surplus of goods and weakness in sales returns.

If the country buys more home domestic goods with the repaid money, monetary liquidity does not increase in the country, more goods are produced and the total economy of the country expands. If there is no demand, the surplus rises again.

4. Course of the economy with excess production

The course of the economy in the case of savings being larger than investment, excess production, is now explained in more detail. See figure 3. The course is described as succession of striking events. Normally they take place one after the other from top to bottom. A vertical arrow downwards means that the following event takes place



The order of events can start at every question if the answer has changed.

Figure 3
Course of the economy with excess production

after a delay. After a yes-no-question the succession ramifies. The next event then follows either further below, or the previous course is repeated partly or completely, that means the flow chart of the course has a loop.

If savings are considerably larger than investment in goods, they are increasingly invested abroad or in assets. This results in a weakness in sales of goods and a decline in production. Employment and consumption fall off. Inventories increase initially and investment in goods decreases. This can continue until a recession occurs. If inventories or interest have fallen, production, employment and consumption increase. Subsequently the investment in goods also increases, and the economy expands. This is also true if savings are not considerably larger than investment in goods and production increases. The order of events can start at every question if the answer has changed.

5. Economic crisis from 1929 and 2007

A comparison of the situation since 2007 with the crisis from 1929 to 1937 in the USA using plausible criteria, results in the following picture.

The symbols (+) or (-) mean, that the items lessen or heighten the crisis of today compared with 1929 to 1937.

(+) Before and in the crisis from 2007, the share price rose and fell less: From 2000 to 2007 it increased by 33% in contrast to 250% from 1924 to 1930, from 2007 to 2009 it fell by 50% in contrast to 85% from 1930 to 1932 (Dow ... 2010).

(+) The inventories this time are not high and have already been going down in real terms for a longer time (Selected ... 2009 p. D-56).They increased from 1922 to 1929 moderately (League ... 1945 p. 67), and in the case of agricultural products and raw materials strongly (Kindleberger 1979 p. 89).

(+) The gross private domestic investment increased less: from a peak in 2000 by 13% up to 2006 (BEA 2010),from 1920 to 1927 by over 200% (and the output of producer's goods and business construction by about 350% (League... 1945 p. 56)). → Overinvestment.

(+) The personal consumption expenditure (BEA 2010 table 1.1.6) went down after 2007 by 2%. From 1929 to 1933 it diminished by 18%. → Underconsumption.

(-) The working time per employee decreased from 2000 to 2007 by 1% (production and nonsupervisory workers (BLS 2009)), from 1920 to 1929 by 2% (manufacturing wage earners, average weekly hours, both sexes (Historical... 2006 p. 3-121...3-123)).

(- -) The debt level of the households is much higher today: In 2007 it amounted to 95% of the annual gross domestic product; in 1929 to 40% (figure 4). → When private debts are paid back, this consumption decreases.

(- -) In 2007 the debt level of the financial sector was 10% higher than of the households, but in 1929 it was 35% lower. Before 2007 it had risen greatly, but before 1929 it had gone down slightly (figure 4).

(-) The government deficit is considerably higher this time. The net government saving / gross domestic product changed from -1.5% in 2007 to -8.7% in 2009, the net lending or net borrowing / gross domestic product changed from -2.8% to -11.8%. From 1929 to 1931 the net government saving / gross domestic product dropped from 2.5% to -1.4%, and in 1934 to -1.5% (BEA 2010 table 3.1., table 1.1.5), the federal surplus / gross domestic product was 0.7% in 1929, -0.6% in 1931 and -5.4% in 1934 (US Census Bureau 2003). → If debts are repaid, this curtails economic performance (sacrifice ratio).

Apart from that it is impressive even today, how the USA between 1930 and 1950 halved all their debt, related to the gross domestic product. See figure 4.

(-) The net saving is smaller than the net domestic investment. In the USA in 1929 and 1930, there was more saving than investment; from 1931 to 1936 more was invested, mean 0.7% of the gross domestic product (section 7 table 1 excess production). Therefore it increased more than if saving were equal to investment. The situation was similar from 1999 on, but the trend was increasingly to invest much more and save less. This could be seen as a beginning to tackle the 2007 crisis long before it started. But because at the same time the net import increased till 2006 (BEA 2011 table 1.1.5.), this did not benefit the country's own production and the gross domestic product.

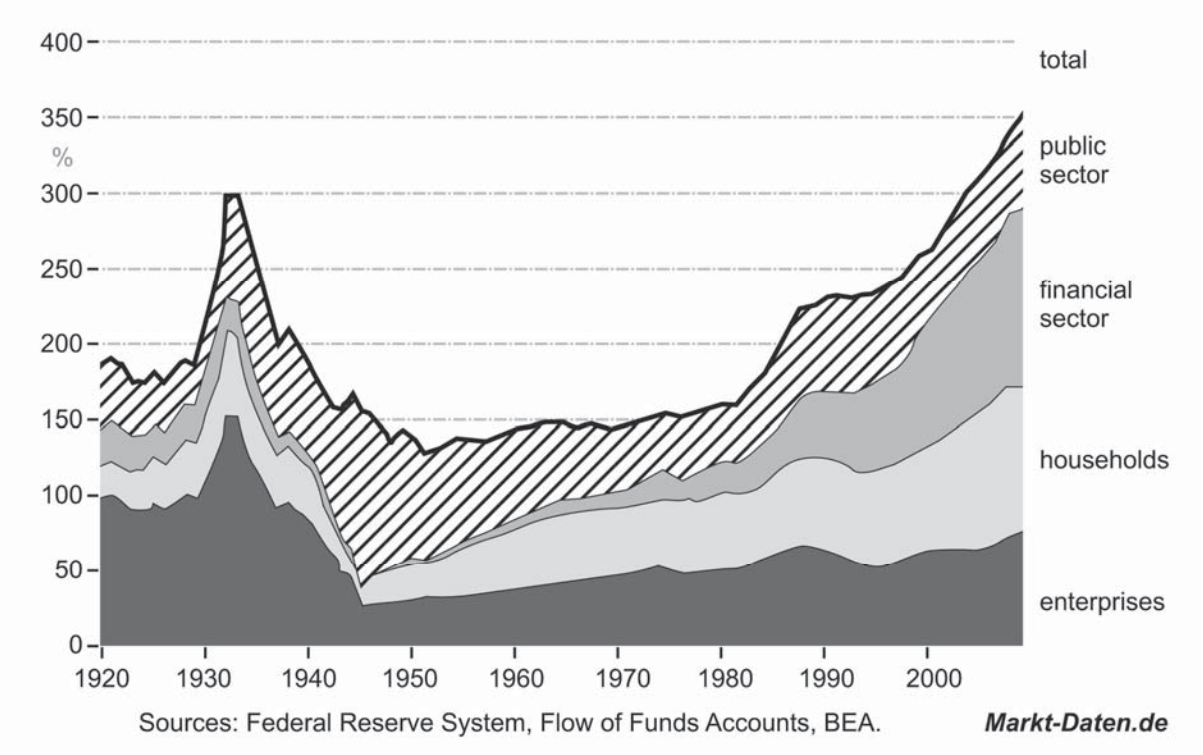


Figure 4
U.S. debt level as a percentage of gross domestic product 1920-2009

In China, Japan and Germany before the last crisis increasingly more was saved than invested at home. Until 2008 the USA absorbed a

considerable part of the surplus on money and goods and thus contributed global balance for a long period. Afterwards the economic performance of many countries decreased. Investment fell in the USA, and rose in China, Japan and Germany. All in all, ever since then excess saving has diminished slightly; a small self-healing effect of the crisis. See figure 5.

With overinvestment, high inventories and underconsumption the Great Depression was not only a financial and bank crisis, but primarily a sales crisis. With the high level of public debt in many states, which forced consumption up in advance, the present crisis is a sales crisis, too.

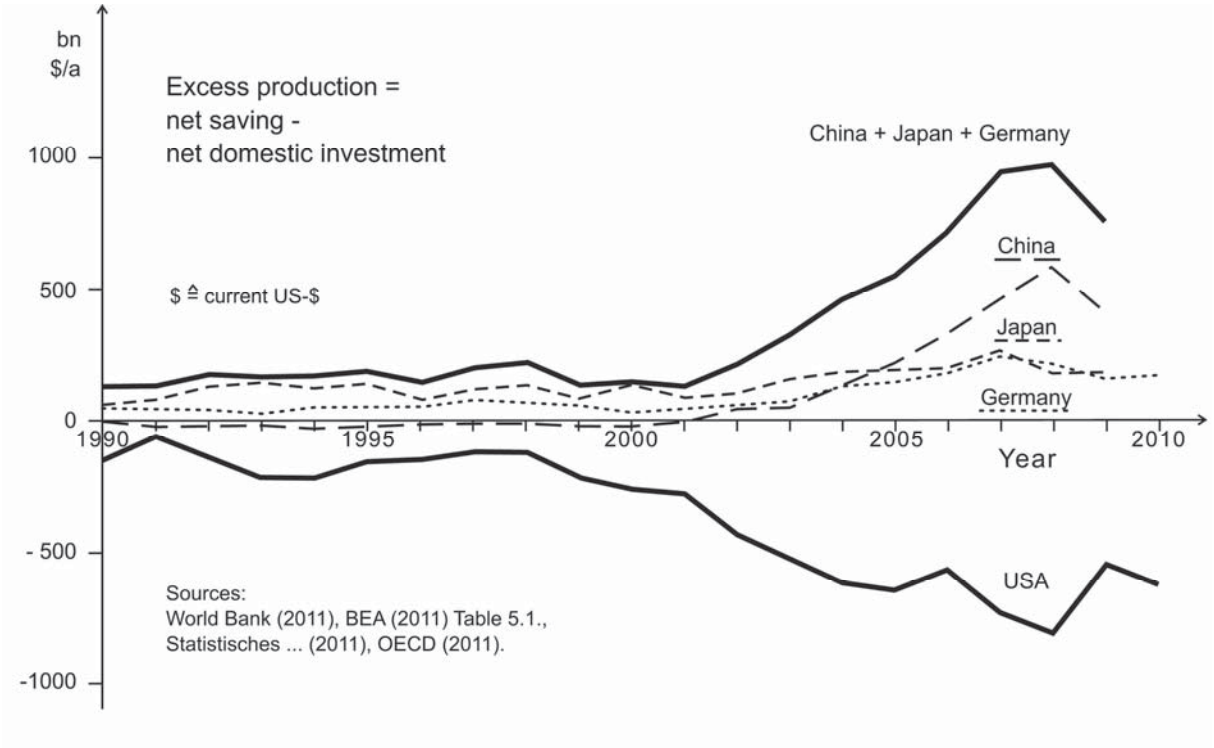


Figure 5
Excess production 1990 - 2010

6. Crisis from 2007 and recessions before

The symbols (+) or (-) mean that the items lessen or heighten the crisis of today compared with the recessions since 1954 in the USA.

(o/-) The working time per employee has been going down since 2000 on average, as formerly, by about 0.2% p. a., but between 1990 and 2000 it remained constant (production and nonsupervisory workers (BLS 2009)).

(-) The gross private domestic investment / gross national product was lower than after the end of the last recession before the down turn for the first time (Selected ... 2009 p. D-53). → Bad business prospects.

(-) The utilisation of production capacity has gone down on average since 1965, more so in the last decade, although in that time capacity has been increasing much more slowly than before. See figure 5. The expectation that investment in production capacity is worthwhile, has become increasingly disappointing. → Weakness in sales.

(--) The debts of the households are higher than ever before. The debt level increased from 2000 to 2007 from 70% to 95% of the annual gross domestic product (Markt-Daten 2010), the highest value and greatest rise ever.

(-) The government deficit is increasing as strongly as in 1974 (ratio of net government saving to gross domestic product (Selected... 2009 p. D-52)), but starting at a higher level. The public debt (Federal Government) increased from 1974 to 1976 from 23% to 27% of the gross domestic product and then sank again. It increased from 36% in 2007 to 52% in 2009 and is estimated at 60% in 2011 (Wikipedia 2010, figure: Debt as a fraction of gdp, table: Gross debt as % of gdp).

→ The last two points: If debts are paid back, economic performance is curtailed.

The present crisis therefore has a much higher handicap than previous recessions. Sinking utilisation despite the lower increase in production capacity and greatly growing debts of the households at low interest show again, that today a sales crisis also exists. Because of the preceding high sales by the households on credit and the high debts of the financial sector, in the USA it could require even greater efforts to resolve the crisis or this could last even longer than after 1929.

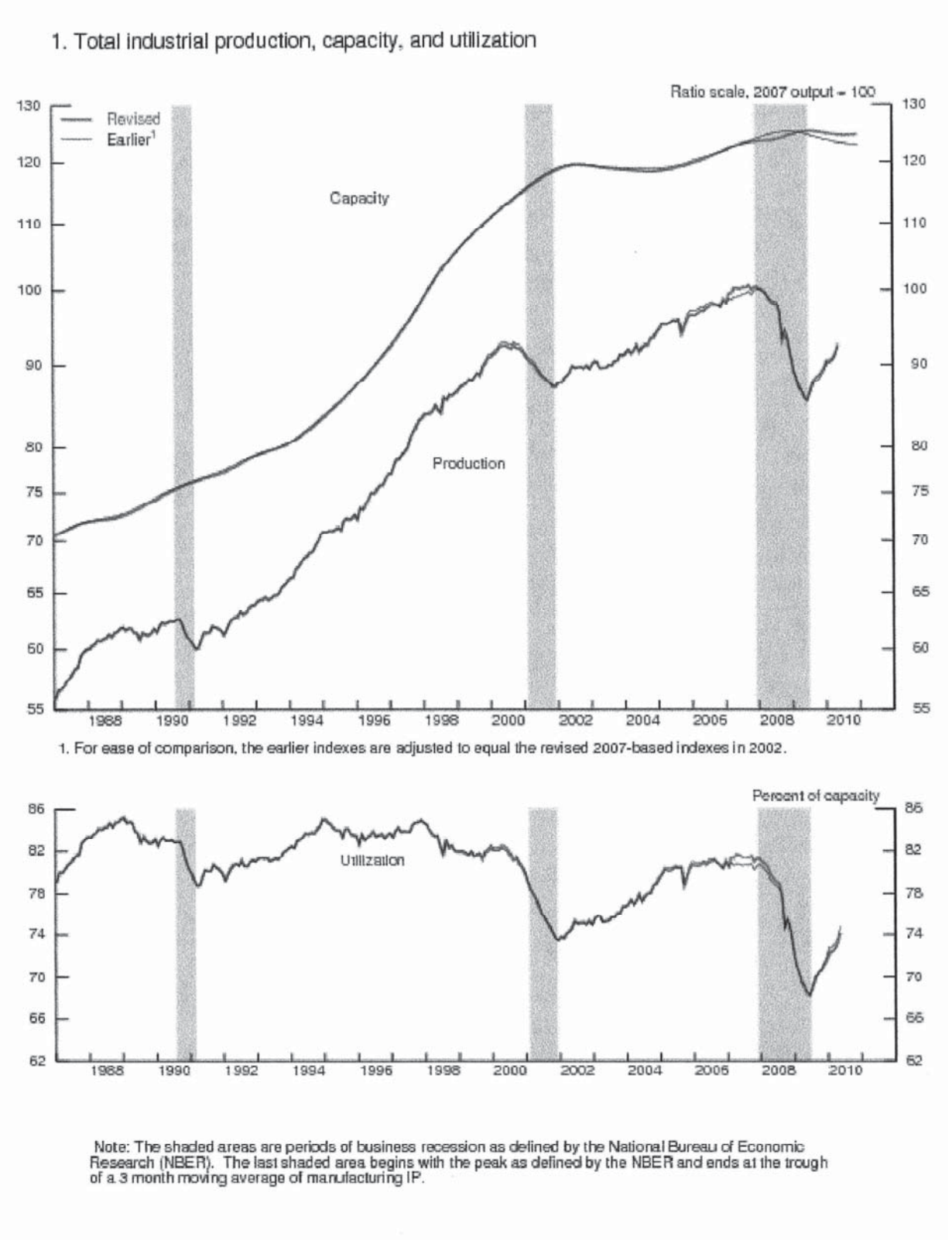


Figure 6
U.S. production, capacity and utilisation
1920-2009

7. Resolving the crisis

From the explanation so far, a series of measures to have an effect on an economic crisis can be derived.

If trade and industry or the state rush to the aid of the economy and provide loans from an existing surplus, the sale of goods rises and savings diminish. If the loans are not invested or consumed, but used for repaying debts, the sales gap is not closed.

If money surpluses are reduced or debts made and this money is spent on investment in goods or for consumption, it is true that the weakness in sales decreases. However, this is not boundlessly possible, but merely postpones the downturn.

Inflation raises the price of goods and assets and reduces the income of employees, the unemployed and retirees. However, it does not raise either consumption or investment in goods by the rich self-employed as a result of the diminishing demand of the other groups. Therefore it does not resolve the sales crisis.

Redistribution of income from high to low increases the sales of goods. Then in total fewer assets and more goods are purchased, because those with lower incomes invest more in goods. However, all in all savings remain the same or increase slightly because of the larger gradient of the saving ratio depending on the income in the case of low incomes. See chapter 1, figure 6.

A tax on the investment of money in assets can indeed lead to more investment in goods. But if little demand for goods exists, its yield is small.

However, if the state taxes away a large part of the savings which are not invested in goods from their owners and makes sure that they are consumed or invested in goods, the surplus of money and goods disappears.

Higher taxation of those with lower incomes lessens the surplus only slightly, and results in a small decrease of their saving ratio. However, as they previously invested more in goods, sales of these are reduced more

intensively. With the higher incomes this is the opposite. Because here more is invested in assets, the sale of goods decreases less. The higher the income, the higher the excess saving. According to current view this is used for financial transactions. As the high earners often profit from an economic crisis and are even partly responsible of causing it, it is not only more effective, but also just, if they are more strongly called upon to cover the costs of the crisis.

If additional state expenditure is no longer needed urgently, taxes can be lowered and working time and production appropriately reduced, so that savings continue to be fully spent on goods.

It is therefore possible to resolve the crisis and to further increase the performance of the economy, without debt and inflation. The most effective measures are

-1 additional investment or consumption, financed with taxes,

-2 higher incomes and speculative money assets have to be taxed at a higher rate,

-3 if this is not enough to achieve full sales of the production, working time per employee has to be shortened, with wage adjustment only in the case of very low income.

Point 1 can be considered as forced ”consumption“. With investment in better ecologically compatible products and processes, productivity is also decreased by higher expenditure in technology and reduced use of exhaustible raw materials. Higher consumption or lower productivity leads to higher employment. An unconditional basic income reduces the number of people seeking paid work.

Point 2 results in investment in assets being reduced, the stocks on assets going down, the speculative volume diminishing, and the state receiving more money.

Point 3 produces lower savings by employees, on account of the lower income and the longer leisure time. The redistribution of labour through the shorter working time raises the number of employees. Shorter working time and more employees with more consumption and

production raise the national income to a higher extent than it is reduced by the shorter working time. See chapter 2, section 7, table 2.

Besides this, it helps if the amount of illicit work by the small time or low-income self-employed is transformed into legal work, with low deductions, only for social security. This creates better terms for small businesses, relieves social security services, puts the perspectives straight in business and the state, and corrects the statistics.

8. Activities in the Great Depression

In a long learning process such measures were already successfully adopted in the Great Depression. See table 1 and 2.

In the USA, from 1929 on, in most years more was invested than saved, the excess production was negative. Except 1929 and 1937 the national budget had a deficit every year. Governments receipts related to the gross domestic product increased at first because the gross domestic product decreased and increased later by higher taxation. The maximal rate of income tax was raised from 24% to 79% and during the second world war even more; federal tax on company profits more than doubled from 14% (Krugman 2007 p. 47-48), and between 1932 and 1938 government spending on job creation amounted to a total of about 570 $, related to one unemployed person fewer. As in the case of the Tennessee Valley project, investments were made in the infrastructure, which still bear fruit. Working time was reduced by 22% in some companies to thirty hours per week for several years (Hunnicutt 1988 p. 148). The unemployment rate rose from 3% to 25% between 1929 and 1933 and fell by half in 1941.

On Japan the Great Depression had hardly any effect, industrial production went down by only 9 % (League... 1945 p. 89).

In Germany, the country most affected after the USA, the method of reviving the economy by increasing government debt was developed by Woytinski and others before Keynes (Kindleberger 1979 p. 261). However, only the National Socialists made use of it on a larger scale. They had also propagated this from 1932 on, as the only party. In 1933

Table 1

Great Depression in USA
Gross domestic product, excess production, government surplus or deficit, job creation, working time, unemployment rate

Year	Real gross domestic product bn $ 1996	Excess production* / GDP %	Government surplus or deficit (-) / GDP %	Government current receipts** / GDP %	Job creation total per unemployed person*** $/person	Weekly working time in manufacturing hours/week	Unemployment rate %
1927	764					45	3.3
1928	770					44.4	4.2
1929	**822**	0.1	1.0	9.7		44.2	3.2
1930	752	**1.1**	-0.3	10.4		42.1	8.7
1931	704	-0.8	**-2.9**	10.8		40.5	15.9
1932	612	-0.2	-1.8	13.3	)	38.3	23.6
1933	**603**	-1.2	-1.4	14.7	)	38.1	**24.9**
1934	668	0	-2.4	14.2	)	**34.6**	21.7
1935	728	-0.1	-2.0	13.8	) approx.	36.6	20.1
1936	823	**-1.6**	**-3.1**	**13.7**	) 570	**39.2**	16.9
1937	**866**	0.2	0.3	15.1	)	38.6	**14.3**
1938	**836**	**0.6**	-1.8	15.4	)	**35.6**	**19.0**
1939	904	-0.3	-2.2	15.1		37.7	17.2
1940	981	0.3	-0.7	16.0		38.1	14.6
1941	1,149	0.5	-3.8	18.4		40.6	9.9
1942	1,360	0.5	-31.4	19.0		43.1	4.7
1943	1,584	-0.2	-44.1	**23.7**		45.0	1.9
1944	1,714	-2.0	-51.8	22.1		45.2	**1.2**
1945	1,693	-2.2	-39.5	22.6		43.5	1.9
1946	1,506	12.1	5.4	22.4		40.3	3.9

*) (Net saving - net domestic investment) / gross domestic product
**) (Current tax receipts + contributions for government social insurance) / gross domestic product
***) Government expenses for job creation, related to one unemployed person fewer, in the specified time period: total amount in the time period / decrease of the number of unemployed in this period

Sources:

Histor. Stat. Mill. Edition (2006) Tab. Ca9-19, p. 3-25	BEA (2010) Tab. 5.1., Tab. 1.1.5.	Hist. Stat. (1975) Ser. F 552-565, p. 263	BEA (2010) Tab. 3.1., Tab. 1.1.5.	Henning (1979) p. 154	Historical Statistics (1975) Series D 802-810, p. 169-170	D 85-86, p.135

they abolished motor-vehicle tax, redistributed jobs to married men, forbade the Jews from reporting as unemployed, and awarded further loans for the creation of jobs, for the construction of motorways and the renovation of buildings. They lowered taxes for building construction and agriculture, expanded the labour service at a minimum wage, and took party officials into the civil service. In 1935 they introduced general conscription, and armed to a larger extent. The government deficit related to the gross domestic product was slightly larger than in the USA. Taxes were higher and increased steeply in the crisis. Government

Table 2
Great Depression in Germany
Gross domestic product, government surplus or deficit, job creation, working time, unemployment rate

Year	Real gross national income bn RM 1936	Government surplus or deficit (-) / GNI* %	Tax receipts total / GNI %	Job creation total per unemployed person** $/person	Weekly working time in industry hours/week	Unemployment rate %
1927	39.9	15.1			50.0	8.8
1928	41.7	15.0			49.0	8.4
1929	41.5		15.2		46.0	13.1
1930	41.0	-3.4	16.4		44.0	15.3
1931	37.8	-0.4	17.1		42.5	23.3
1932	35.0	-0.8	18.0		41.5	30.1
1933	37.1	-0.8	18.2	)	43.0	26.3
1934	40.4	-1.2	18.2	) approx.	44.5	14.9
1935	44.1	-2.2	18.2	) 2,500	44.5	11.6
1936	47.9	-2.0	19.1	)	46.5	8.3
1937	53.3	-2.0	20.5	)	47.5	4.6
1938	58.6	ca. -3.0	22.8		48.0	2.1
1939			26.6		48.5	
1940					50.0	
1941					50.0	
1942					49.0	
1943					48.0	
1944					48.5	
1945						
1946						

*) Rise in debt of the public administrative authority over previous year / gross national income
**) Government expenses for job creation including armament, related to one unemployed person fewer, in the specified time period, at an exchange rate of 1 RM = 0.33 US-$:
total amount in the time period / decrease of the number of unemployed in this period

Sources:

Statistisches Bundesamt (2004 Feb)	Statistisches Jahrbuch (1938) p. 635, (1941/42) p. 677, Bevölkerung (1972) p. 260	Bevölkerung... (1972) p. 233, 260	Henning (1979) p. 152, 154	Hoffmann (1965) p. 214	Mitchell, Europe (2003) p. 164, 166

spending on job creation including by armament was more than four times as high, related to one unemployed person fewer. Working time was shortened only by 10%. From 1932 to 1934, unemployment was halved, and in 1938 full employment was achieved.

In the USA and in Germany, the crisis was resolved only by armament and war. In the USA private debt was cut back to almost to zero, where government debt related to the gross domestic product increased by about 70% and total debt related to the gross domestic product between

1930 and 1950 decreased by 50% impressingly. See figure 4. In Germany the occupied territories were exploited and - as was also the case in the first world war - the currency completely devaluated after the war.

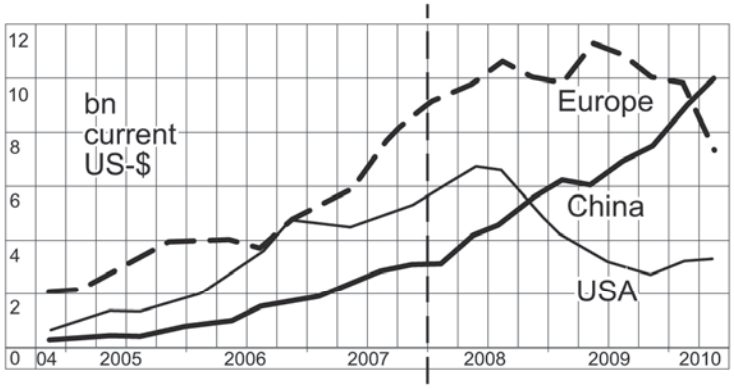
9. Tackling the current crisis

Attempts to overcome the current crisis, as of January 2011, include the following steps (Wikipedia 2011).

USA
Base rate lowered from 4.25% to 0 - 0.25% p. a..
About 7 trillion US$ provided or secured for banks and insurance companies.

Japan
Base rate lowered to 0.3% p. a..

Germany
About 400 billion € loans provided or secured for financial companies.
About 30 billion € provided for advanced investment in infrastructure and redevelopment, scrap bonus for old cars.
Tax reduction by 8.5 billion €.
Period of government subsidies for the cost of reduced working hours



Sources: Frankfurter Rundschau (2010 Aug 2) FR/Hegmaier, Bloomberg.

Figure 7
Investment in new ecological energy plants

extended to a maximum of 24 months.
National budget stressed till now by 100 billion €.

China
Apparently no banks were supported but
580 billion € were awarded for investment, above all in infrastructure. Compare figure 7, investment in ecological energy plants.

Through these measures a slump in consumption was avoided and the production returned to the level before the crisis, at the price of high new state debts. China was the country that did most to combat the weakness in sales.

The excess saving in China, Japan and Germany is larger than the lack in the USA (figure 5). The USA have announced an expansion of exports. If equilibrium should come, the export countries are also faced with regroupings. They have to strengthen the domestic investment and consumption, or curb production.

If, above all, investments are made in environmentally friendly technology and in saving exhaustible raw materials, the economy can also better cope with the ecological and demographic challenge than with the usual programmes to stimulate the economy. In the long term, diminishing yields in agriculture and in the exploitation of raw materials and, in the industrial countries, decreasing populations will lead to a higher demand on labour and so counteract further sales crises.

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Hans Peter Herrmann studied Mechanical Engineering with supplements in electrical engineering and economics at the Stuttgart Institute of Technology (Dipl. Ing.) and prepared a thesis on process measuring technology at the Technical University Berlin (Dr. Ing.). He led projects for development and planning of automation systems for oil and nuclear power stations at AEG, Berlin, of software for production in steelworks and rolling mills at Scientific Control Systems, Essen and for developing product divisions and strategic corporate planning as a manager at Fried. Krupp, Essen and Rheinhausen. He was a managing director at Franz Kessler, Bad Buchau, a manufacturer of electric machines, and subsequently, after the German reunification, of the Rothenberger Group at Forschungszentrum Maschinenbau, Chemnitz, a development centre for mechanical an electrical engineering, and was also involved in technology transfer for machine tools to China and Taiwan. Today he manages his own company for railway technology and economics. Considering his other occupation, for his work in economics he has always used the pseudonym Blauw, after his great-grandfather, a beer-brewer and Royal Württembergian economy councillor.

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