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THE REDUCTION OF THE WORK WEEK: AN INTERNATIONAL COMPARISON OF MACRO-ECONOMIC MODEL SIMULATIONS*)

(Simulation results of twelve macro-economic models for six Western European countries)

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Introduction

In the face of high and persistent level of unemployment in the industrial countries since the first oil crisis which induced a world recession in 1974/75, reduction of working time has been proposed as a measure to reduce unemployment.

Most European trade unions are pushing for a reduction of the normal working week from 40 to 35 hours, for a reduction of overtime and for several forms of early retirement (life time rules). The normal working week in most countries is at present 40 hours.[1)] In some countries the norm is higher (e. g., Switzerland 45 hours, Spain 42 hours, Japan 48 hours, USA for full-time workers 42.5 hours) and in some countries lower (e. g., France since January 1982 39 hours, also Belgium and United Kingdom to a degree).
In Germany, after heavy strikes for the 35-work-week in the metal and printing industries, a compromise ("Leber-Plan") was reached in July 1984 which provides a general reduction of the working week to 38.5 hours in both industries, beginning with April 1, 1985 with full wage compensation (flexible working time rules have to be settled at the firm level).

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1) For a description of the status quo; see OECD (1983) and BWSF (1984).

This study analyses only the impact of a reduced work week on employment and other macroeconomic variables.[1] Not treated are the effects of other forms of working time reductions. This paper compares the simulation results of twelve macro-economic models for six Western European countries.[2]

The advantage of macro-economic models is their ability not only to estimate the "direct" employment effects of the reduction of the work week, but also the "indirect" employment effects (such as inflation, the balance of payments, investment, aggregate demand, output and government budget).

The weakness of macro-economic models is that they are usually only able to cope with marginal changes. In several simulations, however, the work week is reduced abruptly from 40 to 35 hours. Such jumps may cause fundamental changes in consumption behaviour, for example, (effect of more free time on consumption). A further weakness is that behavioural equations are based on past observations, reflecting hence "average" behaviour even though the patterns in recessions and booms may differ.[3] One of the most striking weaknesses of these model outcomes is that they only look at the effects within one isolated country and ignore the

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1) Under several hypotheses of early retirement rules in Austria, the BWSF (1984), pp. 70 ff. has estimated an employment effect of some 11 000 to 33 000 new jobs (assumption: 60 % of the early pensioners will be substitued by additional workers).
In Germany the reduction of the pensioners age to 60 years for men and to 58 years for women would lead to a reduction in the number of wokers by less than 200 000. The effects on economic growth and inflation would be insignificant. See: KRUMPER et. al. (1983), pp. 19, 20. According to DIW (1984) the so-called "Vorruhestandsregelung" (early retirement rules) would unburden the labour market by some 480 000 workers until 1988. The unemployment effect (creation of new jobs) would amount to some 240 000 and 350 000 people. The other economic effects (growth, inflation) are also insignificant.
2) This paper is based on a study by GINNEKEN (1984), who compared seven models for five European countries. In our study new simulation results for the Federal Republic of Germany and Austria are added.
3) See SCHWÖDIAUER (1984) in support of such arguments.

possible effects of one country's working time reduction on another (e. g., full wage compensation in one country may stimulate employment in another), or the effects of the simultaneous introduction of a reduced work week in all European countries. The possible implications of such assumptions are discussed at the end of this paper.

The simulation results of the following models are discussed:

Country	Model
France	DMS model[1)]
France	METRIC model[1)]
United Kingdom	TREASURY model[2)]
Federal Republic of Germany (F.R.G.)	HENIZE model[3)]
F.R.G.	DIW model[4)]
F.R.G.	IFO (quarterly and IP) model[5)]
F.R.G.	RWI model[6)]
Belgium	MARIBEL model[7)]
Netherlands	VINTAF model[8)]
Netherlands	FREIA model[9)]
Austria	WIFO (JMX) model[10)]
Austria	IHS (LIMA) model[11)]

1) OUDIZ, RAOUL, STERDYNIAK (1979).
2) ALLEN (1980).
3) HENIZE (1981).
4) STILLE, ZWIENER (1983). The DIW model is an adapted version of the economcetric business cycle (quarterly) model of the German economic research institutes. For a description of the model, see: ZWIENER (1984).
5) KRUMPER et. al. (1983). The "quarterly" model is an adapted version of the econometric business cycle model of the German economic research institutes. The IP-model is an annual model (IP = integriertes Prognosemodell).
6) HEILEMANN (1983).
7) Bureau du Plan (1982).
8) CPB (1979).
9) Sociaal-Economische Raad (1982).
10) SCHEBECK (1983). JMX is an annual model.
11) MAURER, PICHELMANN (1983) = IHS/I (annual model) and MAURER, PICHELMANN (1984) = IHS/II (inclusive adaptations for the effects of a work week reduction in the public sector; see: BUSCH (1984)).

Simulation results

1. Employment effects

The results had to be presented in two sets of tables, because some models consider a working time reduction of four or five hours a week (35-hours-week: tables 1a, 1b), while others look at reduction of one or two hours a week (38-hours-week: tables 2a, 2b).

The tables show the effects on both employment and unemployment. The latter effects are usually lower because increasing employment stimulates the participation rate of the so-called discouraged workers.[1)] Employment estimates are made for different sets of hypothesis. The most frequently used alternative hypotheses are reduction of working time with a corresponding reduction in wages (no compensation case = NC case) or without a corresponding reduction in wages (full compensation case = FC case). The FC case implies that wages per normal work week are maintained.[2)] Some models make explicit assumptions concerning production capacity. A reduction of the work week normally reduces production capacity (potential output) by the same amount because operating time will be reduced at the same rate. This leads to higher capital cost per unit of production. Only if workers accept a shift or rotation system, can the original production capacity be maintained, and capital costs will not increase.

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1) HEILEMANN (1983) assumes for Germany that 2/3 of an increase in employment stems from the unemployed and 1/3 from discouraged labour force.
Only in models with an unsophisticated labour market, like in the WIFO model (table 1b), the effects are of the same magnitude.

2) In former ILO documents the FC case implies that real wages per normal work week are maintained. See the Reduction of Hours of Work Recommendation, 1962 (No. 116), Paras. 4 and 5; and the Employment Policy Recommendation, 1964 (No. 122), Para. 20. The Forty-Hour Week Convention, 1935 (No. 47), provides in Article 1 (a) that the application of the 40-hour week must not entail decreased levels of living for the workers. (Quotation from GINNEKEN (1984), p. 52).

Table 1a Impact of the reduction of working time (more than 8 per cent) on employment and unemployment (deviation from base projection, selected years of impact)

Model	Type of reduction	Hypothesis	Year of impact	Change in employment			Change in unemployment	
				No. ('000)	% of total	following 1 % work week reduction (elasticity)	No. ('000)	% of labour force
VINTAF (Netherlands)	2.5 % a year, 1979-83 [1]	1. Wage reduction; capacity reduction	1983	40	0.8	0.067	-25	-0.4
			1988	100	2.0	0.168	-65	-1.1
		2. Wage compensation; capacity reduction	1983	-80	-1.6	-0.135	55	1.0
			1988	-115	-2.3	-0.193	75	1.2
		3. Wage reduction; same capacity	1983	70	1.4	0.118	-45	-0.8
			1988	115	2.3	0.193	-75	-1.2
		4. Wage compensation; same capacity	1983	-50	-1.0	-0.084	35	0.6
			1988	-105	-2.1	-0.177	70	1.1
FREIA (Netherlands)	2.5 % a year, 1983-86 [2]	1. Wage reduction; capacity reduction	1986	60[3]	1.2	0.125	-45	-0.8
		2. Wage reduction; same capacity	1986	240[3]	4.7	0.488	-240	-4.0
MARIBEL (Belgium)	2 % a year, 1983-86 [1] (on top of 1 % trend reduction)	1. Wage reduction; no hypothesis regarding production capacity	1986	93	2.7	0.348	-93	-2.3
DMS (France)	2.5 % per year 1982-86 [4] (on top of trend reduction)	1. Wage reduction; same capacity	1986	1 200	5.6	0.582	-550	-2.2
		2. Wage compensation; same capacity	1986	1 300	6.1	0.633	-550	-2.0

1) All workers in the market sector. 2) All workers. 3) Private sector only. 4) All workers except those in agriculture, commerce, real estate, finance and non-market services.

Source: GINNEKEN (1984, p. 38)

Table 1b Impact of the reduction of working time (more than 8 per cent) on employment and unemployment (deviation from base projection, selected years of impact)

Model	Type of reduction	Hypothesis	Year of impact	Change in employment			Change in unemployment	
				No. ('000)	% of total	following 1 % work week reduction (elasticity)	No. ('000)	% of labour force
DIW (Federal Republic of Germany)	2.6 % a year (40 to 35; 1 hour per year) 1980-84	1. Wage reduction[1] (Variant I)	1984	1 140	-	-	-670	-
		Private sector		740	-	-	-	-
		Public sector		400	-	-	-	-
		2. Full wage compensation[2] (Variant III)	1984	700	-	-	-410	-
		Private sector		300	-	-	-	-
		Public sector		400	-	-	-	-
		3. Wage compensation (Variant II) with high productivity increase[3]	1984	880	3.9	0.312	-520	-
		Private sector		480	-	-	-	-
		Public sector		400	-	-	-	-
		4. Wage compensation (Variant II) with low productivity increase[3]	1984	1 340	5.8	0.464	-790	-
		Private sector		940	-	-	-	-
		Public sector		400	-	-	-	-
WIFO (Austria)	Five hours a week (40 to 35 = 12.5 %) 1978-81 (All workers)	1. No wage compensation	1981	188	6.7	0.536	-188	-6.5
		2. Full wage compensation	1981	155	5.5	0.448	-155	-5.4
IHS/II (Austria)	Five hours a week (40 to 35 = 12.5 %) in 3 steps: 1983: -2 hours 1985: -1 hour 1988: -2 hours 1983-91 (All workers)	1. Productivity oriented wage compensation (no wage compensation for working time reduction)	1985	-	4.1	0.547	-	-2.3
			1988	-	7.9	0.632	-	-4.4
			1991	250	9.7	0.772	-	-4.8
		2. Full wage compensation (70 % of working hours reduction)	1985	-	2.2	0.293	-	-1.5
			1988	-	3.9	0.312	-	-2.7
			1991	125	4.8	0.384	-	-3.3
		3. Full wage compensation (70 % of working hours reduction; without induced productivity increase)	1985	-	3.0	0.400	-	-1.9
			1988	-	5.4	0.432	-	-3.4
			1991	200	7.6	0.608	-	-4.7

1) Variant I: hourly wage rates are not changed after a work week reduction; this implies a reduction of the monthly wages by the same percentage points as the work week reduction. 2) Variant III: nominal monthly wages are not changed after a work week reduction; this implies an increase of the hourly wage rates by the same percentage points as the work week reduction. 3) Variant II: productivity oriented wage compensation rule: hourly wage rates ($\dot{w}_t$) are increased to the extent of productivity increase induced by the working time reduction ($\dot{p}r_{t-1}$) and price increase ($\dot{p}_{t-1}$), lagged by one year: $\dot{w}_t = \dot{p}r_{t-1} + \dot{p}_{t-1}$. This variant implies cost neutrality: the monthly wage increase is lower than in a situation without work week reduction, but higher than in variant I.

Table 2a Impact of the reduction of working time (less than 5 per cent) on employment and unemployment (deviation from base projection, third year of impact (1981))

Model	Type of reduction	Hypothesis	Change in employment			Change in unemployment	
			No. ('000)	% of total	following 1 % work week reduction (elasticity)	No. ('000)	% of labour force
TREASURY (United Kingdom)	Two hours a week 1)	1. Wage compensation; accommodative monetary policy	200	0.8	0.160	-150	-0.6
		2. Wage compensation; strict monetary policy	60	0.2	0.048	-40	-0.2
		3. Wage reduction; accommodative monetary policy	350	1.4	0.280	-260	-1.0
HENIZE (Federal Republic of Germany)	Two hours a week 1) (on top of 1 % trend reduction)	1. No wage compensation	908	3.4	0.680	-	-
		2. Employers compensate for productivity increase	828	3.1	0.620	-	-
		3. Government compensates for increased revenues	1 007	3.8	0.760	-	-
		4. Full wage compensation (in reduced taxes)	1 126	4.2	0.840	-	-
OMS (France)	One hour a week 2)	1. Wage reduction; same capacity	248	1.1	0.451	-108	-0.5
		2. Wage reduction; capacity reduction	179	0.8	0.325	-74	-0.3
		3. Wage compensation; same capacity	216	1.1	0.393	-84	-0.4
METRIC (France)	One hour a week 2)	1. Wage compensation; same capacity	326	1.5	0.593	-143	-0.6

1) All workers. 2) Non-financial and non-agricultural enterprises.

Source: GINNEKEN (1984, p. 39)

Table 2b Impact of the reduction of working time (less than 5 per cent) on employment and unemployment (deviation from base projection, short and long term impact)

Model	Type of reduction	Hypothesis	Year of impact	Change in employment			Change in unemployment	
				No. ('000)	% of total	following 1 % work week reduction (elasticity)	No. ('000)	% of labour force
IFO (Federal Republic of Germany)	Two hours a week (40 to 38 = 5 %) starting in 1984 (All workers)	1. No wage compensation						
		Short term effect in	1986	510 (Quarterly model)			-	-
				290 (Annual IP-model)			-	-
		Long term effect in	1986/90	340 (Annual IP-model)			-	-
		2. Partial wage compensation (less than 5 %)						
		Short term effect in	1986	440 (Quarterly model)			-	-
				300 (Annual IP-model)			-	-
		Long term effect in	1986/90	370 (Annual IP-model)			-	-
		3. Full wage compensation (5 %)						
		Short term effect in	1986	160 (Quarterly model)			-	-
				280 (Annual IP-model)			-	-
		Long term effect in	1986/90	350 (Annual IP-model)			-	-
RWI (Federal Republic of Germany)	One hour a week (40 to 39 = 2.5 %) 1983-84 (All workers)	1. No wage compensation 1)	1983	494	2.2	-	-371	-
			1984	457	2.0	-	-343	-
		2. Full wage compensation 1)	1983	478	2.1	-	-359	-
			1984	360	1.6	-	-270	-
WIFO (Austria)	Two hours a week (40 to 38 = 5 %) starting in 1978 (All workers)	1. No wage compensation (Alternative assumptions for productivity reaction on working hours reduction)	1981	72	2.6	0.520	-72	-2.5
			1981	(23 to 99)	(0.8 to 3.6)	(0.16 to 0.72)	(-23 to -99)	(-0.8 to -3.5)
		2. No wage compensation 2)	1981	93	3.3	0.660	-93	-3.2
		3. No wage compensation 3)	1981	20	0.7	0.140	-20	-0.7
		4. Full wage compensation (Alternative assumptions for productivity reaction on working hours reduction)	1981	(11 to 88)	(0.4 to 3.2)	(0.08 to 0.64)	(-11 to -88)	(-0.4 to -3.1)
		5. Full wage compensation 2)	1981	67	2.4	0.480	-67	-2.3
		6. Full wage compensation 3)	1981	-1	-0.0	-0.000	0	0.0
IHS/I (Austria)	Two hours a week (40 to 38 = 5 %) starting in 1983 (All workers) 2)	1. Productivity oriented wage compensation (no wage compensation for working time reduction)	1987	110	4.0	0.800	-110	-
		2. Full wage compensation (70 % of working hours reduction)	1987	60	2.1	0.420	-60	-

1) Assumption: a fictitious primary employment effect of 500 000 additional workers. 2) Real wage growth is an explanatory variable in the employment equation. 3) Instantaneous price reaction concerning private consumption, investment and total demand.

Not all models use the same definition of the labour market. Some models analyse only the effects on employment in the private (market) sector, others simulate a reduction of working time for all workers.[1)]

The large variety of models gives also a broad spectrum of results. The work week reduction employment elasticities vary between models for the same country and of course between alternative wage hypotheses. These elasticities range from -0.2 (VINTAF model for the Netherlands) to +0.8 (HENIZE model for Germany and IHS/I model for Austria). In general simulations find that the employment effect in the NC case is considerably higher than in the FC case. Exceptions are the French models, the HENIZE model and the IFO (IP) model for Germany. A drop in employment as a result of working time reduction is found by the VINTAF model for the Netherlands in the FC case and by the WIFO model for Austria (when special price reactions are assumed).

Some countries treat the employment effect in the public sector explicitly. DIW estimates (table 1b), for example, show that the employment effects in the public sector are, compared to those in the private sector, very high. Estimates for Austria also imply a higher employment effect in the public sector in the long run (the elasticity of the working time reduction is of the order of 0.7 to 0.82) than in the private sector (elasticity: 0.6 to 0.65).[2)]

Only in the case of France can the simulation results be tested against reality. In January 1982 the French Government reduced the statutory work week from 40 to 39 hours. A study carried out by the National Institute of Statistics and Economic Studies (INSEE)[3)] found that this led to an almost immediate reduction by one hour during the first

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1) Sometimes special assumptions concerning the public sector are made. E. g. for Germany (DIW, IFO) and for Austria (WIFO, IHS).
2) BWSF (1984), p. 62.
3) MARCHAND, RAULT, TURPIN (1983).

three months of 1982 and that enterprises paid full wage compensation. The study estimates that by September 1982 the reduction of working time resulted in 10 000 to 20 000 new jobs in the manufacturing industry and 4 000 to 8 000 new (mainly part-time) jobs in commerce. The simulation of the DMS model, assuming full wage compensation and the same production capacity, estimates the employment effect after one year at 143 000 new jobs, or five to ten times as high. GINNEKEN (1984, pp. 48, 49) explains this discrepancy partly by the difference in coverage of the labour market: the INSEE survey covers only industrial and commercial enterprises, while the DMS model includes all non-agricultural and non-financial enterprises. The survey asked enterprises to report only on the creation of new jobs. It did not ask whether as a result of the reduced work week they kept workers they would otherwise have dismissed. Taking these effects into account, one would arrive at an employment effect of about 65 000 jobs, which is still less than half of what was estimated by the DMS model. GINNEKEN's (1984) explanantion, referring to the INSEE study, is that large enterprises cope with the working time reduction in a different way from small enterprises. There are three types of response in the INSEE study. The first is structural adaptation, either through new investments or through (increased) shift work. Large enterprises which already work with a shift system are most likely to employ new people. The second response is stricter time management (increased work pace, reduction of slack time, seasonal fluctuation of working hours) - which hardly leads to the creation of new jobs - and more subcontracting - which leads to the creation of some employment in ohter enterprises. The third response, adopted mainly by small enterprises, is to reduce production and production capacity.

Macro-economic model simulations are not the only source of information. In some countries, enterprises have been surveyed for reactions to a working time reduction. Such surveys have been carried out, for example, by the IFO institute for Germany[1] and by the IFES institute for Austria[2]. One has to take into consideration that the answers from entrepreneurs concern only the "direct" employment effects. The main response to working time reductions are rationalization, more overtime, better time management and only to a small part the creation of new jobs.

According to the IFO interpretations of the survey results[3] of 1983 (in the case of a partial wage compensation), the employment effect in industry would equal only 14 % of the cut in the volume of working hours due to a reduction in the work week to 38 hours, amounting to a creation of 50 000 new jobs (which is some 0.7 % of total labour force in this sector). In the construction sector some 10 000 new jobs would be created according to the survey results (which is 1.2 % of total labour force in this sector). In comparison with a similar survey made by IFO in 1977 (for the case of no wage compensation), this signifies a lower employment effect. Taking into account the potential cases of dismissed workers if a working time reduction hat not been introduced in a recessionary phase, IFO estimates that the net employment effect is much higher than 65 000 (possibly twice as much). The survey covers only 1/3 of the total labour force. Therefore, IFO concludes that the survey results would correspond well with the model simulation results concerning the employment effect.

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1) GÜRTLER, NERB (1983) and KRUMPER et. al. (1983) and IFO-Studien, Band 3/II (1983).
2) IFES (1984) and BWSF (1984).
3) KRUMPER et. al. (1984), p. 23.

The contradictionary empirical results of model simulations are a reflected image of similar conflicting theoretical results concerning the employment effects of a working time reduction. GÖRRES (1982) sees the employment effect as a result of the sum of three effects: the (always positive) volume effects[1] and negative wage compensation effects (inclusive price effects) and substitution effects (productivity and negative economic growth) effects. In contrast to this optimistic view, a more "supply side" oriented position (taking into account an explicit neoclassical production function) expects the number of workers to drop when a reduction of working time is accompanied by full (real) wage compensation.[2]

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1) The volume effect of a working time reduction on employment can be derived according to the following formula (see GÖRRES, 1982, p. 340):

$$\frac{dE}{E} = (1 - c\,|\eta_{E,w}|)\frac{-dH}{H}$$

E = number of workers; H = working time per worker; c = degree of wage compensation: full compensation = 1, no compensation = 0.
$\eta_{E,w}$ = (negative) demand elasticity of employment with respect to wage rates.
Because of a low short run substitutability between capital and labour, $\eta_{E,w} < 0$. GÖRRES (1982, p. 347) reports values for $\eta_{E,w}$ in the range of -0.1 to -0.5. Therefore, according to GÖRRES's formula, dE/E is always positive, when working time is reduced.

2) This result is derived by LINDE (1983, p. 434) according to the following formula:

$$\frac{dE}{E} = +|\eta_{E,w}|\,\alpha_H\,\frac{dH}{H}$$

α_H = production elasticity of working time (derived from a neoaclassical production function: $X = g(H).f(E,K)$; $\alpha_H > 0$
X = output, K = capital, E = number of workers. H = working time per worker.
The above result implies the full wage compensation hypothesis:
$\dot{w} = \dot{p} - \dot{H}$ ($\dot{p}$ = relative change of prices; $\dot{w}$ = relative change of wages; $\dot{H}$ = relative change of working time.
$\eta_{E,w}$ = (negative) demand elasticity of employment with respect to wage rates.

2. Productivity

The variety of results in the model simulations concerning the employment effects are partly due to differences in the model structure and partly the result of special assumptions concerning the direct induced productivity effects following a reduction in the work week.

A large part of the employment that might have been generated in the short run by the reduction of working time is offset in higher productivity and more overtime. GINNEKEN (1984, p. 41) reports that the direct or first-round employment effects according to the HENIZE model for Germany are higher (50 %; 30 % higher productivity and 20 % more overtime) than those according to the TREASURY model for the United Kingdom (30 %; 30 % more productivity and 40 % more overtime). For the medium term the difference is even more marked (65 % versus less than 30 % employment effect). Similar assumptions as in the HENIZE model are made in the DIW and IFO simulations for Germany and in the WIFO and IHS estimates for Austria. The two Netherlands models make different assumptions about productivity effects. In the VINTAF model the short run employment effect of the reduction in working time is 50 %, FREIA implies a higher employment effect (87.5 %). Other models, such as DMS, MARIBEL and METRIC, are more sophisticated and derive productivity gains endogeneously (via estimations of optimal employment in order to produce an anticipated output).[1)]

As a result of all simulations total labour productivity per hour increases and total labour productivity per capita decreases (exceptions are those cases in which the employment effect is low or negative).

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1) See GINNEKEN (1984), pp. 40, 41.

3. Wages and labour costs

The simulation results concerning the other economic effects of a reduction of the work week can be seen from tables 3a, 3b (for the 35-hours-week) and in tables 4a, 4b (for the 38-hours-week). The real (hourly) labour costs almost always increase faster than in the base run. An exception are the DIW simulations for Germany for the main variant II (table 3b). Due to the special wage compensation rule (hourly wages increase with a one year lag on productivity and price increases induced by the work week reduction = variant II)[1], real hourly labour costs remain unchanged (on average between 1980 and 1984) whereas real unit labour costs decline very sharply. According to the DIW simulations (variant II) a work week reduction has also positive (!) implications for inflation, profits and foreign balance.[2]

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1) Although the IHS/I model implies a similar wage formation rule, the results concerning real hourly labour costs are not as "perverse" as in the DIW simulations. One reason for the DIW results is the cumulative decrease in working time reduction from 2.5 % in the first year to 12.5 % in the fifth year. This generates mechanically cumulative productivity and via the wage compensation rule of variant II asymmetric hourly wage increases (because of the one year lag) which result in mechanical labour cost decreases after a full wage compensated working time reduction.
As a possible consequence of these calculations, the employment effects could well be overestimated. See STILLE, ZWIENER (1983), p. 390.
The wage formation rule of IHS/I is:

a) in the FC case: $\dot{w}_t = \dot{p}_t + \dot{pr}_{t-1} - 0.70*\dot{H}_t$

b) in the NC case: $\dot{w}_t = \dot{p}_t + \dot{pr}_{t-1}$

$\dot{w}_t$ = relative change in nominal hourly wages; $\dot{p}_t$ = relative price change; $\dot{pr}_{t-1}$ = relative change in total productivity per hour, lagged by one year; $\dot{H}_t$ = relative change in normal working time per week. See MAURER, PICHELMANN (1983).
A similar wage formation rule is used in IHS/II. Here one differentiates between normal productivity increase and productivity increase induced by the work week reduction. See MAURER, PICHELMANN (1984).

2) See STILLE, ZWIENER (1983), comments on pp. 391 and 393.

Table 3a Impact of the reduction of working time (more than 8 per cent) on some main macro-economic variables (deviation from base projection) (in average annual percentages at selected years of impact)

Model	Type of reduction	Hypothesis	Year of impact	Final demand (in volume)				Wages		Consumer prices	Account position (in % of GDP)	
				Private consumption	Investment	Exports	Production (GDP)	Real hourly labour costs	Real income per wage earner		Balance of payments	Gov. 7)
VINTAF (Netherlands)	2.5 % a year, 1979-83 2)	1. Wage reduction; capacity reduction	1983	-1.8	-	-1.6	-1.9	0.1	-2.0	0.9	1.6[1)]	0.0[1)]
			1988	-1.2	-	-1.1	-1.1	-0.2	-1.3	0.4	2.0[1)]	1.0[1)]
		2. Wage compensation; capacity reduction	1983	-0.8	-	-2.8	-2.3	0.9	-0.5	1.9	-0.7[1)]	-1.5[1)]
			1988	-0.6	-	-2.0	-1.5	0.2	-0.5	1.1	-1.4[1)]	-2.6[1)]
		3. Wage reduction; same capacity	1983	-1.7	-	-1.4	-1.7	0.2	-2.0	0.7	1.5[1)]	0.0[1)]
			1988	-1.1	-	-1.0	-1.0	-0.1	-1.3	0.4	2.1[1)]	0.9[1)]
		4. Wage compensation; same capacity	1983	-0.7	-	-2.6	-2.1	1.0	-0.5	1.8	-0.8[1)]	-1.5[1)]
			1988	-0.6	-	-1.9	-1.4	0.2	-0.4	1.0	-1.4	-2.8[1)]
FREIA (Netherlands)	2.5 % a year, 1983-86 3)	1. Wage reduction; capacity reduction	1986	-1.0	-1.0	-1.0	-1.5	0.5	-1.5	1.5	0.7[1)]	0.3[1)]
		2. Wage reduction; same capacity	1986	-0.7	-1.0	-0.3	-0.5	0.7	-0.5	0.0	1.0[1)]	0.5[1)]
MARIBEL (Belgium)	2 % a year, 1983-86 2) (on top of 1 % trend reduction)	1. Wage reduction; no hypothesis regarding production capacity	1986	-0.2	0.0	-0.2	-0.2[4)]	1.2	-1.1	0.3	-	-0.4
DMS (France)	2.5 % a year, 1982-86 5) (on top of trend reduction)	1. Wage reduction; same capacity	1986	-1.5	0.0	0.6	-0.2	0.2	-1.6	-0.2[6)]	2.7	1.8
		2. Wage compensation; same capacity	1986	-0.1	-2.5	-0.5	-0.3	1.8	-0.4	1.7[6)]	2.0	1.2

1) As a percentage of net national income. 2) All workers in the market sector. 3) All workers. 4) Value added of enterprises. 5) All workers except those in agriculture, commere, real estate, finance and non-market services. 6) Producer prices. 7) -/+ = increase/decrease of the deficit.

Source: GINNEKEN (1984, p. 44)

Table 3b Impact of the reduction of working time (more than 8 per cent) on some main macro-economic variables (deviation from base projection) (in average annual percentages at selected years of impact)

Model	Type of reduction	Hypothesis	Year of impact	Final demand (in volume)				Wages		Consumer-prices	Account position (in % of GDP)	
				Private consumption	Investment	Exports	Production (GDP)	Real hourly labour costs	Real income per wage earner		Balance of payments	Gov. 10
DIW (Federal Republic of Germany)	2.6 % a year (40 to 35; 1 hour per year) 1980-84 (All workers)	1. Wage reduction (Variant I) 1)	Ø(1980-1984)	-1.2	-	-	-0.4	-2.1* / -3.5**	-	-0.5[4]	-	-0.7[5]
		2. Full wage compensation 2) (Variant III)	Ø(1980-1984)	-0.3	-	-	-0.2	2.3* / 0.6**	-	0.9[4]	-	-2.1[5]
		3. Wage compensation 3) (Variant II) with high productivity increase	Ø(1980-1984)	-0.9	0.1	-	-0.4	-0.4* / -2.0**	-	0.1[4]	6.4[6]	1.7[5]
			1984	-2.3	-1.2	-	-1.2	6.3* / -2.4**	-	0.3	18.5[6]	5.6[5]
		4. Wage compensation 3) (Variant II) with low productivity increase	Ø(1980-1984)	-1.3	-0.7	-	-1.3	0.2* / -1.4**	-	-0.0[4]	4.6[6]	7.2[5]
			1984	-1.1	-1.4	-	-1.1	4.9* / -1.7*	-	0.2	16.8[6]	11.8[5]
WIFO (Austria)	Five hours a week (40 to 35 = 12.5 %) 1978-81 (All workers)	1. No wage compensation	1981	-1.8	-0.1	0.6	0.2	5.5* / 0.2**	-6.6	-1.7	6.4[7]	8.3[8]
		2. Full wage compensation	1981	5.1	-4.5	-4.4	-2.4	19.2* / 14.5**	6.3	8.5	-17.0[7]	-1.9[8]
IHS/II (Austria)	Five hours a week (40 to 35 = 12.5 %) in 3 steps: 1983: -2 hours 1985: -1 hour 1988: -2 hours 1983-91 (All workers)	1. Productivity oriented wage compensation (no wage compensation for working time reduction)	1985	-	-	-	0.0	2.7* / -0.7**	-5.8	-0.5	-0.4[9]	-
			1988	-	-	-	-0.5	1.7* / -2.6**	-12.3	-0.9	27.0[9]	-
			1991	-	-	-	-1.0	3.6* / 0.5**	-9.1	0.2	11.5[9]	-
		2. Full wage compensation (70 % of working hours reduction)	1985	-	-	-	-0.8	9.5* / 4.8**	1.8	2.1	-19.6[9]	-
			1988	-	-	-	-1.8	15.1* / 7.4**	1.5	4.2	-13.3[9]	-
			1991	-	-	-	-3.2	18.3* / 10.6**	2.1	6.7	-7.2[9]	-
		3. Full wage compensation (70 % of working hours reduction; without induced productivity increase)	1985	-	-	-	-0.4	6.0* / 2.1**	-1.3	0.9	-4.1[9]	-
			1988	-	-	-	-1.3	10.7* / 4.7**	-2.1	2.4	-8.7[9]	-
			1991	-	-	-	-2.3	10.9* / 6.0**	-3.9	3.8	-0.3[9]	-

1) Variant I, 2) Variant III, 3) Variant II, see explanation on table 1b. 4) GDP-deflator. 5) Net lending (bill. DM) at current prices. 6) Foreign balance (bill. DM) at 1976 prices. 7) Current balance (bill. AS) at current prices (averages 1978-81). 8) Net lending (bill. AS) at current prices (end of simulation period). 9) Current balance (bill. AS) at current prices (end of impact year). 10) -/+ = increase/decrease of the deficit.
*) Real hourly labour costs = hourly wage divided by consumer prices. **) Real unit labour costs (ULC) = real hourly wage divided by productivity per hour.

Table 4a Impact of the reduction of working time (less than 5 per cent) on some main macro-economic variables (deviation from base projection) (in average percentages at third year of impact (1981))

Model	Type of reduction	Hypothesis	Final demand (in volume)				Wages		Consumer-prices	Account position (in % of GDP)	
			Private consumption	Investment	Exports	Production (GDP)	Real hourly labour costs	Real income per wage earner		Balance of payments	Gov. 4)
TREASURY (United Kingdom)	Two hours a week 1)	1. Wage compensation; accommodative monetary policy	-	-	-	-0.3	-	0.9	2.6	0.1	-0.4
		2. Wage compensation; strict monetary policy	-	-	-	-0.6	-	0.7	2.4	-0.1	-0.9
		3. Wage reduction; accommodative monetary policy	-	-	-	0.3	-	-0.4	-0.3	-0.1	0.1
DMS (France)	One hour a week 2)	1. Wage reduction; same capacity	0.0	0.1	-0.1	0.0	0.4 3)	-0.4	-0.1	0.0	-
		2. Wage reduction; capacity reduction	-0.2	-0.2	-0.5	-0.3	0.4 3)	-0.4	0.1	-0.1	-
		3. Wage compensation; same capacity	0.1	-1.0	-0.7	-0.2	1.0 3)	0.1	0.6	-0.1	-
METRIC (France)	One hour a week 2)	1. Wage compensation; same capacity	0.5	0.7	-0.6	0.3	1.1	0.2	0.3	-0.3	-

1) All employees. 2) Non-financial and non-agricultural enterprises. 3) Defined as average hourly wage divided by consumer prices. 4) -/+ = increase/decrease of the deficit.

Source: GINNEKEN (1984, p. 45)

Table 4b Impact of the reduction of working time (less than 5 per cent) on some main macro-economic variables (deviation from base projection) (in average annual percentages; short and log term impact)

Model	Type of reduction	Hypothesis	Year of impact	Final demand (in volume)				Wages		Consumer-prices	Account position (in % of GDP)	
				Private consumption	Investment	Exports	Production (GDP)	Real hourly labour costs	Real income per wage earner		Balance of payments	Gov. 12)
IFO (Federal Republic of Germany)	Two hours a week (40 to 38 = 5 %) starting in 1984 (All workers)	1. No wage compensation										
		Short term effect in	1986	(Quarterly model)		-	(-0.4 to -0.9)	-	-	(0.3 to 0.8)	-	-13 1)
			1986	(Annual IP-model)		-	-1.8	-	-	0.0	-	9 1)
		Long term effect in	1986/90	(Annual IP-model)		-	-3.0	-	-	0.0	-	11 1)
		2. Partial wage compensation (less than 5 %)										
		Short term effect in	1986	(Quarterly model)		-	(-0.4 to -0.9)	-	-	(0.6 to 1.2)	-	-13 1)
			1986	(Annual IP-model)		-	-1.3	-	-	0.0	-	6 1)
		Long term effect in	1986/90	(Annual IP-model)		-	-2.7	-	-	0.0	-	4 1)
		3. Full wage compensation (5 %)										
		Short term effect in	1986	(Quarterly model)		-	(-0.5 to -0.9)	-	-	(2.3 to 3.4)	-	-14 1)
			1986	(Annual IP-model)			-1.0	-	-	0.2	-	5 1)
		Long term effect in	1986/90	(Annual IP-model)		-	-2.0	-	-	0.2	-	2 1)
RWI (Federal Republic of Germany)	One hour a week (40 to 39 = 2.5 %) 1983-84 (All workers)	1. No wage compensation 2)										
		Effect in	1983	-1.4 3)	-0.3 3)	-0.0 3)	-1.4 3)	-	-380 4)	-0.0	0.7 5)	3.2 6)
		Effect in	1984	-3.3 3)	-2.1 3)	0.1 3)	-3.9 3)	-	-354 4)	-0.0	2.3 5)	2.3 6)
		2. Full wage compensation 2)										
		Effect in	1983	3.6 3)	0.4 3)	-2.0 3)	1.7 3)	-	-45 4)	0.1	-1.3 5)	7.4 6)
		Effect in	1984	3.0 3)	-1.5 3)	-3.2 3)	-1.3 3)	-	-104 4)	0.6	-2.2 5)	3.2 6)
WIFO (Austria)	Two hours a week (40 to 38 = 5 %) starting in 1978 (All workers)	1. No wage compensation . (Alternative assumptions for productivity reaction on working hours reduction)	1981	-0.6	0.0	0.2	0.1	2.2* / 0.2**	-2.5	-0.6	2.2 7)	3.0 8)
			1981	(0.4 to -0.8)	(0.7 to -1.2)	(0.0 to 0.2)	(0.6 to -0.3)	(5.2 to 0.7)* / (0.2 to 0.4)**	(0.7 to -4.1)	(-0.3 to -0.5)	(0.1 to 2.5) 7)	(-0.6 to 5.0) 8)
		2. No wage compensation 9)	1981	-0.6	-0.2	0.1	0.0	2.5* / 0.8**	-2.8	-3.0	2.6 7)	4.3 8)
		3. No wage compensation 10)	1981	0.4	-0.1	-0.1	0.3	5.1* / 0.3**	0.5	0.1	-0.4 7)	-1.5 8)
		4. Full wage compensation (Alternative assumptions for productivity reaction on working hours reduction)	1981	1.9	-1.8	-1.7	-1.0	7.0* / 5.6**	2.3	3.2	-5.0 7)	-0.5 8)
			1981	(2.9 to 1.6)	(-1.1 to -3.0)	(-1.9 to -1.8)	(-0.5 to -1.4)	(10.1 to 5.4)* / (5.8 to 5.8)**	(5.6 to 1.6)	(3.6 to 3.3)	(-8.3 to -5.9) 7)	(-4.2 to 1.6) 8)
		5. Full wage compensation 9)	1981	1.0	-1.0	-1.0	-0.5	6.0* / 3.6**	0.5	1.6	-2.6 7)	1.1 8)
		6. Full wage compensation 10)	1981	1.6	-2.8	-2.3	-1.5	9.3* / 5.7**	4.7	4.9	-5.1 7)	-7.2 8)
IHS/I (Austria)	Two hours a week (40 to 38 = 5 %) starting in 1983 (All workers) 9)	1. Productivity oriented wage compensation (no wage compensation for working time reduction)	1987	-0.7 11)	-	-	-0.5	1.1* / 0.3**	-4.1	0.2	2.5 7)	-
		2. Full wage compensation (70 % of working hours reduction)	1987	-0.5 11)	-	-	-1.0	6.4* / 4.1**	0.8	2.0	-6.8 7)	-

1) Net lending (bill. DM) at current prices. 2) Assumption: a fictitious primary employment effect of 500 000 additional workers. 3) Deviation from base projection in bill. DM at 1976 prices. 4) Real net income per employee in bill. DM at 1976 prices. 5) Foreign balance (bill. DM) at 1976 prices. 6) Net lending (bill. DM) at current prices. 7) Current balance (bill. AS) at current prices (averages 1978-81 and averages 1983-87). 8) Net lending (bill. AS) at current prices (end of simulation period). 9) Real wage growth is an explanatory variable in the employment equation. 10) Instantaneous price reaction concerning private consumption, investment and total demand. 11) Final domestic demand. 12) -/+ = increase/decrease of the deficit.

*) Real hourly labour costs = hourly wage divided by consumer prices. **) Real unit labour costs (ULC) = real hourly wage divided by productivity per hour.

Another result is that mainly because of inflation, real income per wage earner is usually lower than in the base run, even in the FC case. Exceptions are here the WIFO and IHS/II simulations for Austria in the case of full wage compensation.

In most models, nominal hourly wages are a function of consumer prices, pressure on the labour market (represented by the unemployment rate or the ratio between vacancies and unemployment, i. e., a kind of a Phillips-curve) and the "capacity to pay" (a proxy for which is "productivity" growth).[1)]
In the IHS/I and IHS/II models the wage function is represented by a "real wage" behavioural equation. Real hourly wages are a function of the normal working time (negative coefficient) and the productivity change, lagged by one year. This specification has been criticized for not representing the actual wage formation process in Austria. Furthermore, this "real wage" equation could lead to an underestimation of the price effects of working time reductions and consequently to an overestimation of the employment effects in the long run.[2)]

4. Economic growth, inflation and the balance of payments

Tables 3a, 3b and 4a, 4b show that in almost all cases the volume of production and/or GDP grows more slowly than in the base run. The French, United Kingdom, German, Belgian and some Austrian (WIFO, IHS/I and IHS/II) estimates are - especially in the NC case - somewhat less pessimistic than

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1) The "average" wage function has therefore the general form: $\dot{w}_t = f(\dot{p}_t, u_t, \dot{pr}_{t-1})$; u = unemployment rate; the other variables are defined as in footnote 1) on page 10.
2) See POLLAN (1984).

the estimates for other countries (VINTAF for the Netherlands; IFO (IP) model for Germany). As GINNEKEN (1984, p. 46) has emphasized, nearly all models make it clear that there is a trade-off between economic growth and employment, if the work week is reduced.
The reason behind this trade-off is the relationship between inflation and economic growth. All models show a significant increase in inflation, particularly when wages are fully compensated. An exception is again DIW, where also in variant II inflationary effects are nil or even negative.[1)] And in the IFO (IP) model the long term inflation effects for all wage compensation hypotheses are also nil.
Inflation also tends to be higher when production capacity is reduced, because this increases the cost of capital.

Full wage compensation increases real (disposable) income and tends to boost domestic private expenditure (consumption, investment) at the expense of exports. Exceptions to this general reaction pattern (i. e. in the FC case the foreign balance or current account position is always worse than in the NC case) are again the simulations for Germany by DIW and by IFO. This could, as mentioned, be due to the perverse development of real (hourly) labour (unit) costs after a working time reduction according to the productivity oriented wage compensation rule (DIW: variant II). This implies - contrary to all other model simulation results - that in the FC case the competitive position of German exports is not deteriorating. In the DIW simulations (table 3b), the positive (real) foreign balance increases over time (variant II) parallel to the reduction of working time from 2.5 % to 12.5 % in the fifth year. This is partly due to an import decrease and partly to an improved competitive position. Comments to the IFO simulations[2)] state that a

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1) This is the mechanical consequence of the negative unit labour cost effects.
2) KRUMPER et. al. (1983), pp. 17, 18.

working time reduction with full wage compensation does not deteriorate the external balance as badly as expected (in the IP model the real foreign balance becomes even positive, as in the DIW estimates).

In most models, exports are a function of (exogeneous given) world demand and some relative price term, in which labour cost variations play (indirectly via export price determination) a determinant role. In models where exports are exogeneous (e. g., in the WIFO and IHS models for Austria), the foreign balance position is modelled solely as a reaction of import demand to changes in domestic demand resulting from working time reductions. A further weakness in almost all model simulations is the general assumption of fixed exchange rates or no change in the exchange rate policy stance.

5. Government deficits

The models for the Netherlands, the United Kingdom, Germany (only the RWI model) and Austria find that a reduction in working time with proportional wage reduction (nearly) always leads to improved government finances. The resulting drop in unemployment leads to a reduction in social security benefits. An exception is the MARIBEL model for Belgium, where also in the NC case government finances deteriorate (table 3a). In the FC case the government position deteriorates in the same countries. The German models give different results. According to the RWI model the deficit is reduced in both wage compensation cases, but more in the FC case. The DIW model leads to an improvement in government finances according to variant II and results in a deterioration according to the other variants, more in the FC case than in the NC case. The net lending position of the general government (government plus social security system) deteriorates in the first year, then it improves steadily (variant II), although the financial

position of the government deteriorates continuously. In the IFO simulations the two models used (quarterly and IP model) show contradictory effects regarding the public deficits; the results for the general government differ also from those of the social security institutions (in the IP model). The budget position of the government (general government excluding the social security system) improves in any case when working time is reduced, but more in the NC case than in the FC case. On the contrary, the social security deficits increase more strongly in the NC case than in the FC case. In balance, the general government deficit is always positive (according to the IP model). But in the quarterly model, general government deficits almost always increase by the same amount compared with the base run, independent of the wage compensation assumption.[1)]
In Austria a stepwise reduction of working time to 38, and then to 35 hours a week would lead to a deficit of AS 5 billion in the consolidated general government (public sector) budget after the 2 hour reduction and to an further increase of AS 10 billion (per year) after the 5 hour reduction.[2)]

In the FREIA and TREASURY models, the drop in unemployment after a reduction in working time (in the NC case) also lowers interest rates, which make the repayment of government debts less expensive. Although in this case the government also receives less income because income tax and social security contributions decrease in comparison with the base run, this reduction in revenue is smaller than the reduction in expenditure. When wages are fully compensated, government finances deteriorate.
The simulations with the DMS model always show improved government finances.

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1) KRUMPER et. al. (1983), p. 18.
2) BUSCH (1984) and BWSF (1984), p. 64.

The improvement in government finances in some model simulations after a working time reduction is also partly due to the assumption of unchanged income tax rates, implying (via higher inflation) an increase in fiscal drag.

In a number of models, such as VINTAF, DMS, METRIC, HENIZE, RWI, IFO[1)] and in the Austrian models, no relationship is shown between government deficits and the interest rate, nor is there a link provided between the monetary and the "real" sector. In situations where high interest rates and monetary policy play an important role, this could seriously bias the results.

Instead of a conclusion: What bias is introduced by isolated simulations?

As mentioned in the introduction, all models make isolated simulations. They only look at the effects of a working time reduction whithin one particular country.

There are two cases which demonstrate possible interactions between countries after a working time reduction:
First, one assumes that only one country in Europe reduces working time (as in the case of France in 1982) and analyses the possible influences on the other countries, which do not (or only later) introduce a working time reduction.
Full wage compensation in that country for example could stimulate employment in another, when domestic demand increases in that country. However, when one looks at the tables 3a to 4b, one rarely finds an increase in domestic demand after a working time reduction, even when wages are fully compensated. On the contrary, domestic demand in almost all model simulations falls short of the base run. This means

1) KRUMPER et. al. (1983). The IFO quarterly model works alternatively with and without interest rate adaptations.

less export demand and therefore possible negative employment effects for the other countries.
In the case of a single country it is of course important whether this country is large or small. As can be easily seen from multiplier analysis by the INTERLINK model of the OECD,[1] an expansion (contraction) of domestic autonomous expenditure by 1 % of a large country (e. g., Germany) results in an incremental (negative) effect on annual GDP (in one year) in the EEC by 0.57 percentage points. The multipliers for other large European countries are the following: France 0.45, United Kingdom 0.28, Italy 0.22 (USA 0.22, Japan 0.05, Canada 0.03). The multipliers for every small European country lie around and below 0.05 (exceptions are: Belgium-Luxembourg 0.10, Netherlands 0.09). According to these results concerning the international transmission of demand, one may conclude that only when a large country reduces working time in isolation, is it of consequence to other countries.
Associated with each simulated change in a country's GDP is a simulated change in its own foreign balance and, via the international transmission of demand, a change in the foreign balance of other countries. Again, the increase (decrease) of a large country's GDP by 1 percentage point leads to a deterioration (improvement) in the foreign balance in the EEC countries of US-$ 1 to 1.5 billion, whereas the impuls from small countries lies below US-$ 0.5 billion (1978 prices and exchange rates).[2]

Second, one considers the introduction of a reduced work week in all (European) countries at the same time. GINNEKEN (1984, p. 52) reports of such simulations carried out by the European Community macro-economic model, COMET III, which includes all the economies of the member countries.
COMET III, however, produced unexpected results for the case of a simultaneous introduction of working time reduction in

1) OECD (1979), p. 20.
2) OECD (1979), p. 22

all member countries.[1] There was virtually no difference between the employment effect of individual national policies and those of concerted international policies towards the reduction of working time. GINNEKEN's (1984, p. 52) explanation appears to be that increased inflation as a result of reduced working time is exported from one country to another. This result is found irrespective of the assumptions made on wage compensation and production capacity. The models find, however, that the employment effects are highest when wages are not compensated and when the original production capacity is maintained.
In any case, a concerted action towards working time reduction in most European (EEC) countries would not affect the competitive position among its members. If the European Community were regarded as a closed economy, and if the work week were reduced simultaneously in all countries, some sort of wage compensation could have a more positive employment effect, because it would stimulate domestic demand without leading to a large increase in inflation. However, trade with countries outside Europe would still be affected.

1) Commission of the European Communities (1981).

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