

## Is there a Cause-Effect Relationship Between Unemployment and Taxation Level?

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### Abstract

The debate on the causes of present high and apparently staying unemployment is just starting to get the grand picture together.

A preliminary investigation of a two-sector economic model is presented. Its focus is the interaction between wages in the productive sector and rents and subsidies in the non-productive sector.

Aging population, late entry into the labor market, a growing administration headcount and widespread subsidizing add up to taxes and other fiscal measures. Their driving force is modelled to be the recompensation expected relative to the wages before tax of the productive sector.

There are three different behaviour-modes identified:

- **full employment policy** will result in a stable employment inverse to the expected recompensation of the Non-Producing sector.
- **hire and fire policy** will get a stable mean taxation level, but with oscillations of some twenty years duration at least.
- **preventative hire and fire** will induce catastrophic changes of employment and tax-income.

A weak interaction composite model of this two-sector model into an available longwave model further reinforces, that a high rent-and-subsidizing expectation kills employment and reduces the so called self-ordering of capital production in the longwave model context, except for businesses with high profits. Also the longwave period is influenced strongly in this composite experiment.

The context for interpretation of the results is proposed to be the national economies with their taxation in global competition.

## Is There a Cause-Effect Relationship between Unemployment and Taxation Level ?

### 1. Framework of the model "employment & tax"

In the actual debate how to fight widespread and chronic unemployment on the European continent good arguments often appear, but usually in different places, time and context. Statistics show an almost strict correlation between taxation and subsidizing level on one side and unemployment on the other for different national economies. With a very simplified simulation-model of the interaction of taxation and employment a preliminary confirmation and some insight into this observed correlation has been attained.

The model comprises two different economic sectors interacting. A Productive Sector is the tax base. If profits after tax are positive, business will expand and hire people. Hiring reduces the population in the Non-Producing Sector, which consumes rents and subsidies paid for by taxes. Hiring increases the wage level of the Producing Sector and so increases after a while the expected rent or subsidy for the Non-Producing Sector. With the time-delay of taxation legislation such an expected rent is transmitted as increased tax back to business.

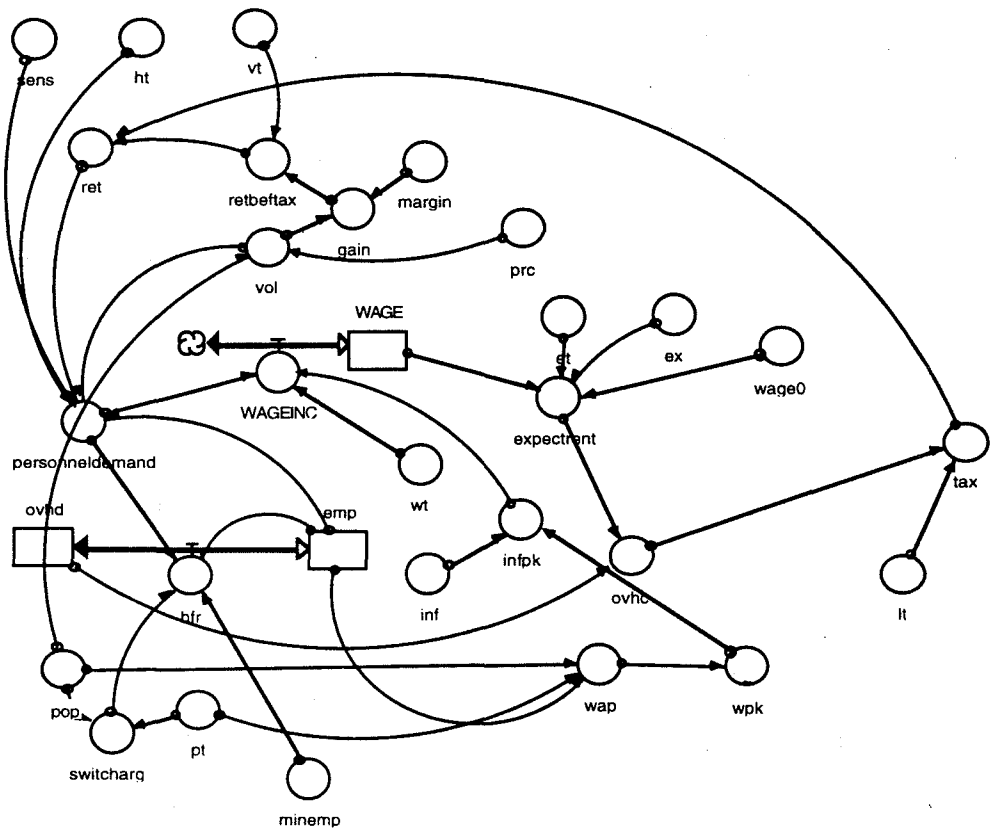


Fig.1 Causal loop diagramm of the model used.

With typical time constants oscillations have periods of some 10 to 30 years.

The two most dominant parameters for employment are:

EX, the expectation relative to the wages

SENS, the sensitivity how hire-and-fire is dependent on actual business profit after tax

The result of the simulations can be summarized as follows:

SENS	EX	
	0.5	1.5
0.1	A: slow increase of wages followed by tax with asymptotic behaviour to high employment	D: continuous increase into high wage-high tax context with low employment
0.3	B: oscillation about mean values	E: pronounced oscillations
0.5	C: very pronounced oscillations into the limits	F: catastrophic behavior

The simulations reflect the assumed interactions of the two sectors :

- employment is controlled by hire-and-fire only
- expansion is dependent on profit after tax
- taxes are defined by past wages, the size of Non-Productive Sector and its expectance level EX
- business can only reduce employment to balance the tax impact

As shown by the table and partially by Fig. 2 there are three different behaviour modes:

SENS = 0.1: **full employment policy** which results in a slow and steady increase of wages followed by taxes. Employment develops to asymptotic values inverse to expectations of Non-Producing sector. for high expectance values this leads to a context of very high wages and taxes. (the so called cooked frog story)

SENS = 0.3: **hire-and-fire policy**. Employment is adjusted to taxes as you go. The result is an oscillation around reasonable and globally competitive mean values, but with periods easly greater than some 20 years. (no quick fix of unemployment problem)

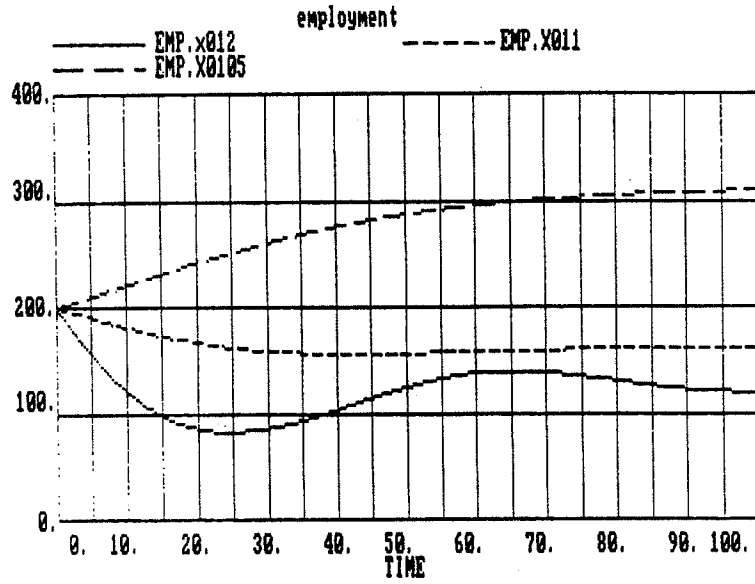
SENS = 0.5: **preventative hire-and-fire policy**. Employment is adjusted in a preemptive overreaction, which tends to cause catastrophic changes of the whole two-sector system. (potentially a quick fix for the problem, but with very unpredictable results)

**2. weak interaction composite model**

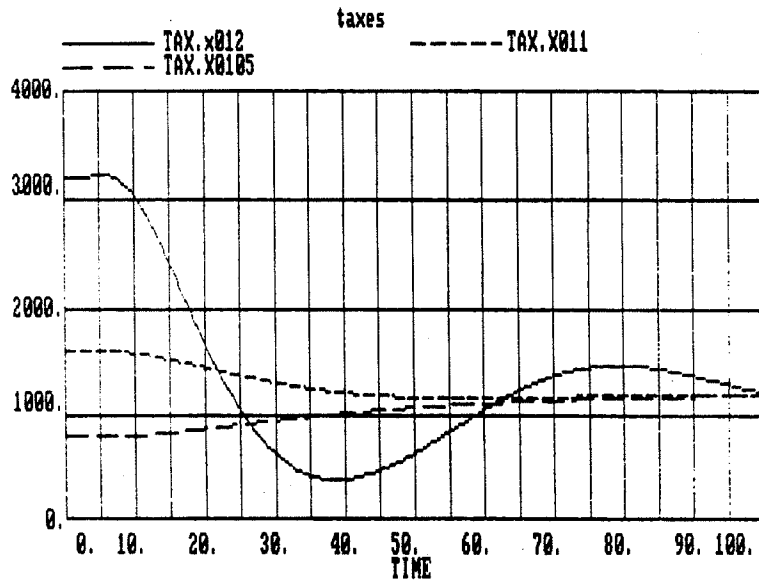
A second simulation experiment was done by integration into the simple longwave model available in [1].  
The coupling was implemented with the following parameter equivalence:

two-sector model	longwave-model
VOL business volume	KPR capital production rate
HFR hire-fire rate	KSSO modified self-ordering switch

The simulation confirms, that increasing expectations of the Non-Productive Sector reduces employment progressively and even lets the self-ordering of the capital sector almost vanish. High expectation levels result in employment with high profit levels of business only. As illustrated by Fig. 3 high expectation levels also distort the periods of the so called longwave Kondratieff-Cycle.



**Fig. 2-1 Full-Employment-Policy with different expectation**  
 The asymptotically reached employment is inversely to the recompensation expectation of the Non-Producing Sector



**Fig.2-2 With Full-Employment policy the integral tax-levels**  
 tend to stabilize in the long run at about the same levels,  
 irrespective of expectation levels of the Non-Producing, rent-  
 consuming sector

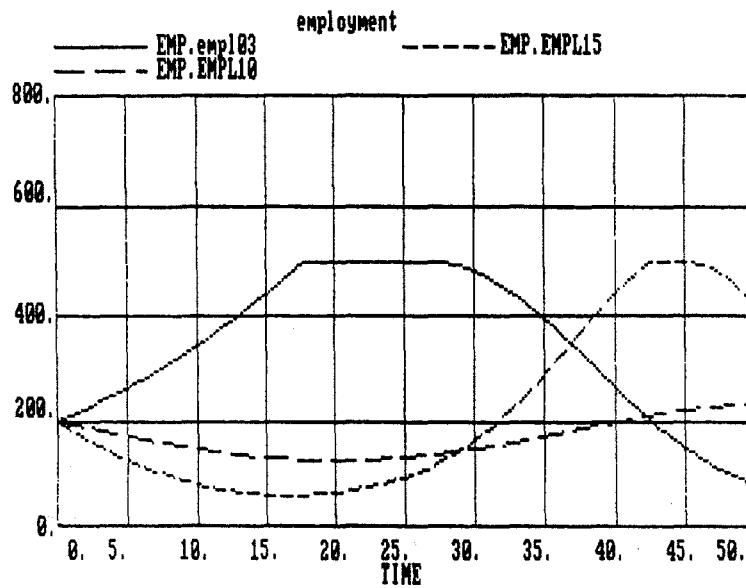


Fig. 2-3 Employment with **Hire-and-Fire Policy**. parameter is the expectation level of recompensation of the Non-Producing sector in fractions of wage of the Producing sector.0.3, 1.0, 1.5. for low expectations employment overshoots first and for high expectations it tax levels that overshoot first.

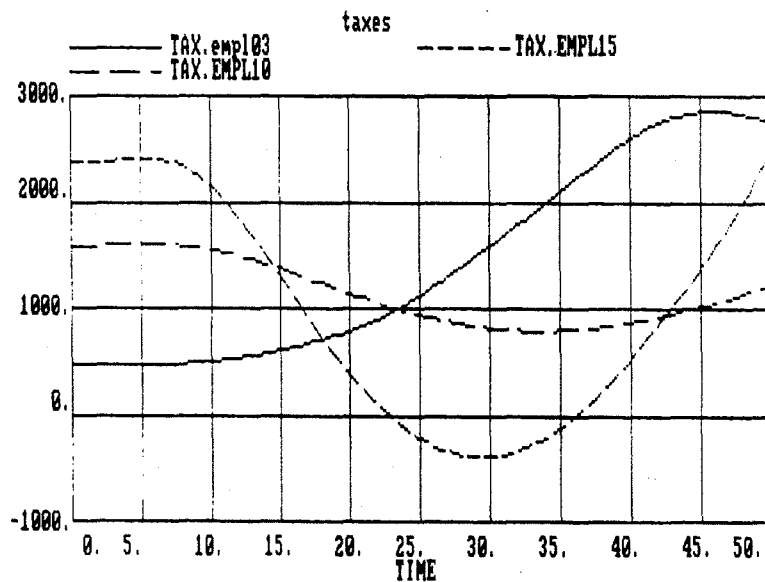
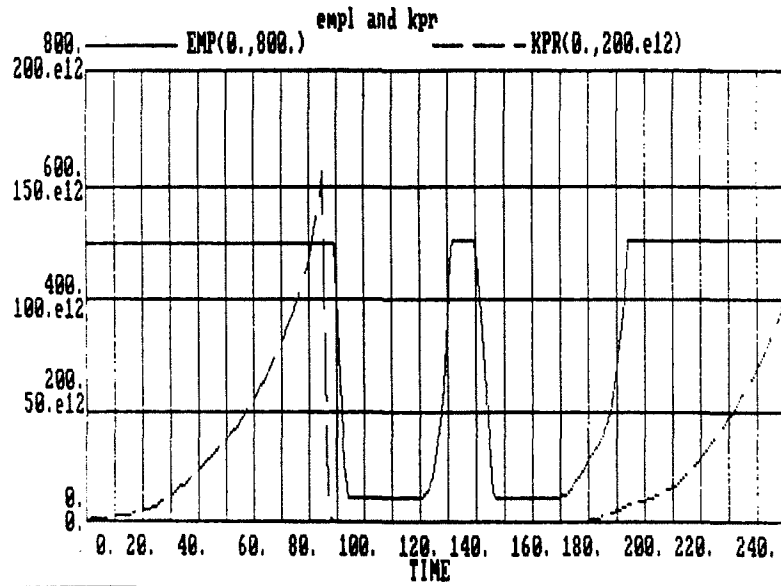
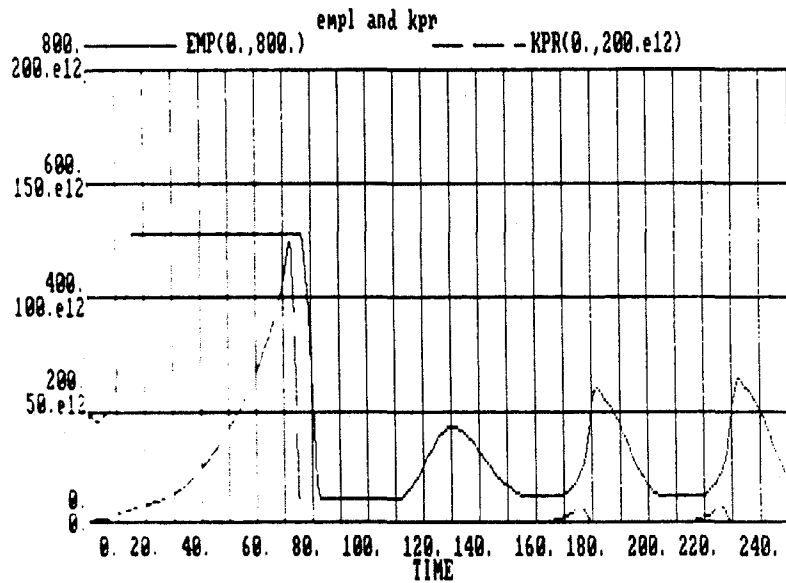


Fig.2-4 Tax behaviour for **Hire-and Fire policy**. Comparison with employment shows the disastrous phase lag of taxes behind employment, which represents the tax-income-base.



**Fig. 3-1 Hire-Fire Policy with a high expectation level  $EX = 1.5$  results in a spurious longwave cycle. Capital production KPR and employment EMPL do reach acceptable levels with high business margins  $GF = .8$  only.**



**Fig.3-2 Hire-Fire Policy with an expectation level  $EX = 1.0$  and employment not at maximum at start results in depressed employment and capital production, even as the business profitability is still at  $GF = .7$**

## References

- [1] J. D. Sterman, simple model of the economic long wave,  
ILP-Report 6-69-83 MIT
- [2] J. D. Sterman, The economic Long Wave: Theory and Evidence,  
WP-1656-85 MIT
- [3] H. E. Figgie, bankruptcy 1995, Little, Brown & Co. 1992,  
ISBN 3-550-06831-X

## 4. Appendix

Dynamo model source code of "employment and tax" and coupling equations to longwave model  
Ref. [1]

\*simple employment-model with two sectors 26feb94 © Dr. U. La Roche 94

insert zero.dyn

note company sector

a vol.k=pop.k\*(wage0) selling dependent basic volume

a gain.k=vol.k\*gf

a ret.k=delay3(gain.k,vt)-tax.k

r hfr.kl=(smooth(ret.k,ht)/vol.k)\*emp.k\*sens hire/fire to adjust to taxes

c sens=.3

note variabler lohnanteil

l wage.k=wage.j+dt\*(smooth(hfr.jk,wt)\*infp.k\*dt) variabler lohnanteil

c inf=.3

a infp.k=inf\*wpk.k

a wpk.k=table(wap.emp.k/(pop\*pt),0,1,.1)

t wap=.3/.3/.32/.35/.4/.45/.55/.7/.85/.93/1

c prc0=2

c vt=1

c gf=.3

c ht=1

c wt=3

n wage=0

c wage0=4

note employment sector

l emp.k=emp.j+dt\*hfr.jk^

\*clip(clip(0,1,emp,pop\*pt),clip(1,0,emp.k,minemp),hfr,0)

c minemp=50

a ovhd.k=pop-emp.k

a expk.k=delay3((wage.k+wage0)\*ex,et)

a ovhc.k=ovhd.k\*expk.k

a tax.k=delay3(ovhc,lt)

n tax=ovhd.k\*wage0\*ex

c pop=1000

c pt=.5

c et=5

c ex=1

c lt=5

n emp=emp0 pop\*(1-gf/(ex+.01))

c emp0=250

spec dt=.125/length=100/savper=1

save wage,gain,hfr,ret,emp,tax,ovhc,ovhd,expk,vol

A simple composite model of the economic long wave 83 by J.D. Sterman with the employment model U. La Roche 28.2.94, coupling equations only, see the complete longwave model in Ref. [1]

note voln in place of vol for coupling kpr-volume to model employment

a  $\text{voln.k} = \text{vol.k} * (\max(\text{kpr.k}/\text{kpr0}, 1))$

note in composite model wage-deviations do dampen out

l  $\text{wage.k} = \text{wage.j} + \text{dt} * (\text{smooth}(\text{hfr.jk}, \text{wt}) * \text{infp.k} * \text{dt} - \text{wage.k} / \text{delwage})$

c  $\text{delwage} = 10$

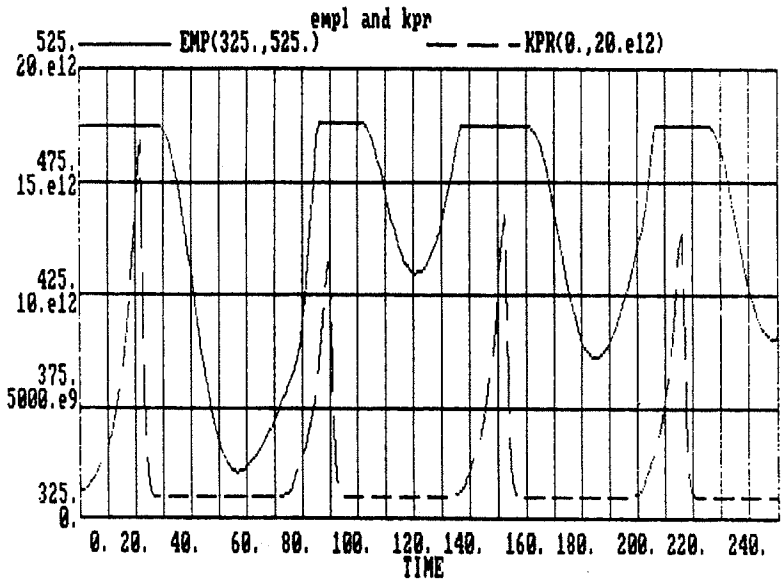
note ksson instead of kss0 for coupling with hfr to model employment

l  $\text{ksson.k} = \text{ksson.j} + \text{dt} * ((\text{kss0} + \text{hfr.k} * \text{kfak} / \text{pop}) - \text{ksson.j}) / \text{dt}$

n  $\text{ksson} = \text{kss0}$

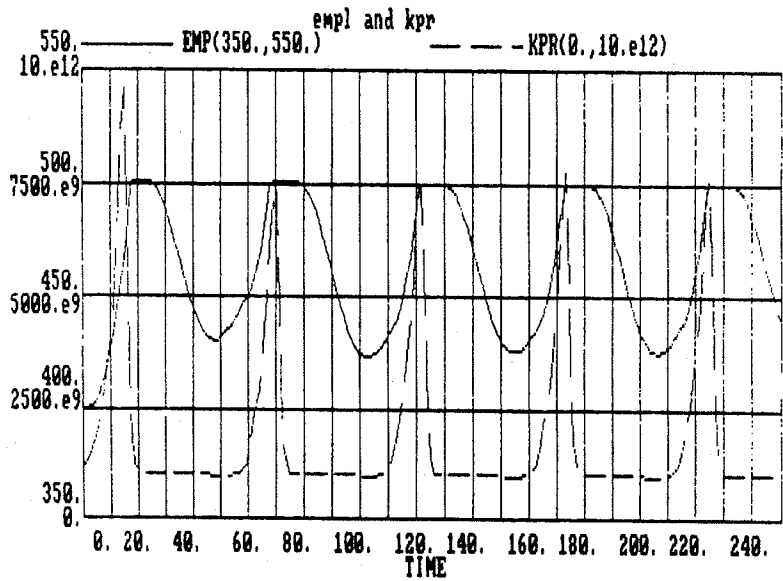
c  $\text{kfak} = 10$



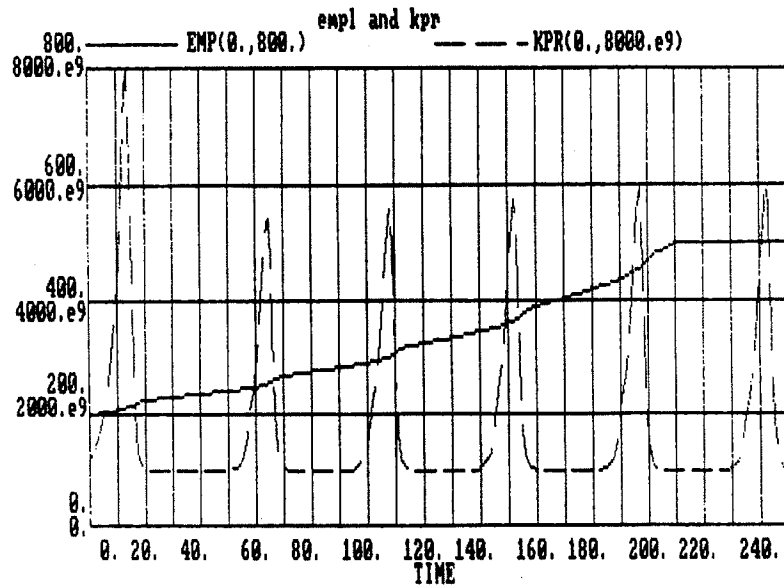


**Fig. 3-3 Full-Employment-Policy** is successful only with high profitability businesses for all employed: EX = 1.0; SENS = .1; GF = .7

Note that the capital production cycle has a period increased to 60+ years



**Fig.3-4 With Full-Employment policy** and reduced Expectation level EX = .5 almost optimum employment results with a medium business profitability of GF = .3



**Fig. 3-5 Full-Employment-Policy with an extremely low expectation level  $EX = .1$  results in real full employment with a low business profitability of  $GF = .1$  The longwave capital production cycle is not influenced any more.**

### 3. Conclusions

The very preliminary experiments with a simplified two-sector model confirm the interdependence of employment and the sum of taxations and subsidies. The timewise behaviour of the model does show in general oscillations with periods of up to 50 years.

The context of the so called double dip recessions observed today does exhibit traits identified also in the model simulations, e.g.

**only high profit business survives** the taxation levels caused by high expectation of the Non-Productive Sector

**High employment with moderate taxation levels** is possible only with rather low expectation levels of the Non-Productive Sector.

With high expectation levels the so called full-employment-policy does result in stable small employment with a tax level about equal the case of low expectation and high employment but essentially the same total tax level. The cooked frog story is invoked for the latter case, where we end up in a high per capita tax-load on the employed population.

**The global competition context of different national economies** with different tax levels lets businesses with low to moderate profit survive in low expectation levels of the respective Non-Productive Sectors only.

**No easy quick-solution to unemployment exist**, unless the expectatons of the Non-Productive Sector can be lowered other than just as a consequence of lower wages in the Productive Sector.

The purpose of the simulation exercize was to bring the consequences of the high weigth of the Non-Productive Sector of some industrialized nations into focus, see for a good story from a financing view [3].

Limits on capacity and time for the study presented have reduced it to a hopefully provocative poster format for further study.