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Working Paper European welfare state under the policy "make work pay" : Analysis with composite indicators

WSI-Diskussionspapier, No. 141

Provided in Cooperation with: The Institute of Economic and Social Research (WSI), Hans Böckler Foundation

Suggested Citation: Tangian, Andranik S. (2005) : European welfare state under the policy "make work pay" : Analysis with composite indicators, WSI-Diskussionspapier, No. 141, Hans-Böckler-Stiftung, Wirtschafts- und Sozialwissenschaftliches Institut (WSI), Düsseldorf

This Version is available at: https://hdl.handle.net/10419/21586

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European welfare state under the policy "make work pay": Analysis with composite indicators

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Diskussionspapier Nr. 141

December 2005

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WSI-Diskussionspapiere (Print) ISSN 1861-0625 WSI-Diskussionspapiere (Internet) ISSN 1861-0633

Abstract

The social security systems in 22 European countries are evaluated with a specially constructed indicator. It is based on a census-simulating model which combines both empirical (statistical) and normative (rule-based) approaches. The individual answers of unemployed on social security benefits are normatively derived from their personal situations with the OECD Tax-Benefit Models. The empirical data about personal situations are available from EuroStat. The goal is estimating the national average of net replacement rates (NRR) for unemployed persons. Such an indicator of social security shows the average degree with which social benefits compensate the loss of previous earnings.

Thus, the paper suggests:

- (Methodology) a model of *census simulation* combining statistical data on the population with individual answers computed with a rule-based model,
- (Indicator) an integral quantitative evaluation of social security in Europe, which reveals its total decline by 2004 contrary to institutional improvements,
- (Analysis) an explanation of the decline by a structural change of European labour markets with rapidly growing 'atypical' employment groups (= part-time, temporary, self-employed, etc.) with a lower eligibility to social benefits than normally employed (= permanently full-time),
- (Policy implications) a possible resolution of European policy contradictions by the "basic income model" with "flexinsurance".

Keywords: Composite indicators, social security, European welfare state, European Union, "make work pay" policy.

JEL Classification:

C43 — Index Numbers and Aggregation, C51 — Model Construction and Estimation, J32 - Nonwage Labor Costs and Benefits; Private Pensions, J38 - Public Policy.

Europäischer Wohlfahrtstaat und Politik "make work pay" (Abstrakt)

Die soziale Sicherheit in 22 europäischen Ländern wird mit einem Indikator evaluiert. Er basiert auf ein Zensus-simulierenden Modell, das institutionelle und empirische Ansätze kombiniert. Die individuellen Antworten der Arbeitslosen über die zustehenden sozialen Leistungen werden entsprechend der persönlichen Situationen mittels der OECD Steuer-Sozialleistungsmodelle regel-basiert berechnet. Die empirischen Daten über die persönlichen Situationen stellt EuroStat zur Verfügung. Das Ziel ist, die nationalen Durchschnitte der Nettoersatzquoten (NEQ) für Arbeitslose einzuschätzen. Solch ein Indikator zeigt den durchschnittlichen Prozentanteil, mit dem die sozialen Leistungen den Verlust der vorherigen Verdienste kompensieren.

Das Papier schlägt vor:

• (Methodologie) ein Modell der Zensus-Simulation, das statistische Bevölkerungsdaten mit individuellen Antworten kombiniert, die von einem regel-basierenden Modell berechnet werden,

- (Indikator) eine quantitative Evaluierung der europäischen sozialen Sicherheit, die trotz institutioneller Verbesserungen ihren totalen Rückgang im Jahr 2004 erlebt,
- (Analyse) eine Erklärung des Rückgangs durch eine strukturelle Änderung des europäischen Arbeitsmarktes mit wachsenden atypischen Beschäftigungsgruppen (Teilzeitbeschäftigte, Befristete, Selbstständige usw.), die geringere Sozialleistungen als die Dauervollzeitbeschäftigten beziehen,
- (Politische Implikationen) eine mögliche Auflösung der Widersprüche zwischen europäischen Politiken mittels Grundsicherungsmodell zusammen mit einer Flexinsurance (Flexibilisierungsversicherung).

Acknowledgement

The author is most grateful to Herwig Immervoll and Dominique Paturot (OECD, Paris) for the latest version of the OECD Tax-Benefit Models and for a kind help in their use. Special thanks deserves Michael Bergman (EuroStat, Luxembourg) who several times extracted the required cross-tabulations from the EuroStat data base. Odile Chagny (Commisariat Général du Plan, Paris) advised the OECD *Benefits and Wages* editions (former *Benefit Systems and Work Incentives*) as updatable reference sources. The author acknowledges the contribution of colleagues Hartmut Seifert, who suggested a number of improvements, Judith Aust who made data and literature research, Ingrid Kaiser who collected the annual currency exchange rates to express the average production wage (APW) in EUR, Wolfram Brehmer who made the OECD Tax-Benefit Models run under the STATA computer environment, and all others who participated in a fruitful seminar discussion on 23 November 2005, where the first version of the paper was presented. Mikhail Tangian gave valuable suggestions on the layout of the key graph of the article, Figure 7.

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1 Political background

In recent years the foundations of the European welfare state are being persistently reconsidered. The solidarity is getting to be restricted to those who are unable to receive a sufficient income, and the adherents of the economically more competitive and socially more "hard" Anglo-Saxon model are becoming more influential. Employers wish to share the competition burdens with employees, and politicians seek to shift the responsibility for employment from state to individuals.

The general flexibilization of employment relations is already adopted by the European Union as a means to enhance economic performance and to support sustainable development. It resulted in an increase of unemployment and in a disproportional growth of the number of atypically employed, like part-time, fixed-term, or self-employed (Euro-Stat 2005). The atypical employment is not only less secure but also provides less carrier prospects and training chances (OECD 2002b, p. 156–159). Besides, it often disqualifies workers from social benefits, since the eligibility of atypically employed is substantially lower than that of permanently employed (OECD 2002b, p. 131).

The flexibilization of employment relations resulted in a new labour market situation. In case of low wages or part-time jobs the "net incomes gained [are often] smaller than the loss of out-of-work benefits" (OECD 2004, p. 14). In other words, the Anglo-Saxon model transferred to the continental Europe turned out to discourage a significant fraction of labour force from active labour market participation.

To resolve this paradox, the policy "make work pay" has been launched. It is "characterized by a trade-off between income protection and maximizing the financial gain from work" (OECD 2004, p. 92). It is aimed at stimulating employment by different work incentives, in particular by reducing "the part of the in-work earning that is, upon entering employment, "taxed away" by the combined effect of higher taxes and lower benefits" (OECD 2004, p. 13). However, the efficiency of these measures remains questionable in the background of growing part-time, temporary, and low-paid employment.

The unambiguously consistent measure of the policy "make work pay" is penalizing low personal responsibility for being unemployed. Security benefits are reduced to those who do not participate in training programs and, generally, who are inactive in looking for a new job. The unemployed are thereby forced to accept unfavorable working conditions which puts in question collective agreements on wages, working hours and other key issues of bargaining of trade unions and employers.

These policies make a natural pressure on social security which generosity is an obstacle to make work pay. However, just the generosity of the social security guarantees that the unemployed will not accept any job offer and become "strike breakers" in the long-running trade union struggle for labour rights. Therefore, an adequate evaluation of the generosity of social security is more than just an academic question but rather a political argument in negotiations of trade unions with national governments.

2 Measuring social security

In spite of a visible roll-back of European welfare from the level of the 1980s, most empirical studies fail to detect a substantial decline in public support (Pettersen 1995, Taylor-Gooby 1998, Roller 1999, Van Oorschot 1999, and Mau 2001). The illusion that the social solidarity remains in force weakens the position of European welfarism, making an impression that minor improvements are sufficient to adjust social security to current needs. The focus made on governmental expenditures for social support (for references see Adema and Ladaique 2005) is rather misleading because it does not take into account increasing living costs and flexibilization of employment relations with longer periods of unemployment and lower specific payoffs per capita/months.

The variety and complexity of national social security systems complicate measuring their properties. A breakthrough in standardizing their structural descriptions is due to the OECD long-running project which progress is regularly reported in the book series *Benefits and Wages* (formerly *Benefit Systems and Work Incentives*) and in annual "Country chapters" downloadable from Internet (OECD 1998, 1999, 2002a, 2004, 2005).

This unifying approach paved the way for implementing national social security and taxation rules in the *OECD Tax-Benefit Models*, also available form the OECD web-page, which derives social security benefits, net incomes, and other parameters for 28 OECD countries. In particular, these models have been used to empirically estimate the efficiency of social security systems by their comparing with the statistics on houshold incomes in labour market transitions; see (Immervoll and O'Donoghue (2003) and Immervoll et al. (2005).

In continuation of these studies, the given paper suggests a *census-simulating* model which combines both empirical and normative (= rule-based) features. The idea is to use the OECD models to normatively derive individual answers of unemployed from their personal situations, which statistical distribution is empirically known (= demographic data in the terminology of EuroStat *Labour Force Survey*).

3 Census-simulating model

The census-simulating model is based on the following steps:

- 1. The unemployed are divided into demographically homogeneous groups with equal eligibility to social security benefits and with equal tax liability. Namely, we consider 103950 groups of unemployed resulting from their cross-tabulation by:
 - (a) 22 European countries
 - (b) seven control years: 1995, 1997, 1999, 2001–2004
 - (c) five age levels: 20 ± 5 , 30 ± 5 , 40 ± 5 , 50 ± 5 , 60 ± 5 years
 - (d) three types of family: single, one-earner couple, two-earner couple
 - (e) different number of children: 0–4
 - (f) six earnings levels: 40, 50, 67, 100, 150, and 200% of the national average production wage (the OECD reference)

(g) nine unemployment duration levels: just become unemployed, < 1 month, 1–2, 3–5, 6–11, 12–17, 18–23, 24–47, 48 months or longer (as in the DURUNE variable of the EuroStat Labour Force Survey)

see Annex 1 for some more details.

- 2. The social benefits, equal for all members of the group, are calculated according to the actual national rules. It is made with the OECD Tax-Benefit Models which input the data on personal situation and output the normative net social benefits. In the context of our study, the OECD Models replace individual interviews. Since the groups are homogeneous, it suffices "to interview one single representative", meaning that the results hold for the whole group. The social benefits taken into account by the OECD model include
 - (a) unemployment insurance
 - (b) unemployment assistance
 - (c) social assistance
 - (d) housing benefits
 - (e) family benefits
 - (f) lone-parent benefits
 - (g) employment conditional benefits
 - (h) childcare benefits
- 3. The social security coverage of each group of unemployed is characterized by the net replacement rate (NRR) which is the previous-to-current net income ratio. The OECD model computes the net income by adding earnings and social benefits and by subtracting taxes, depending on earnings and family status.

The national NRR is calculated as the weighted average of the NRRs of all the 103950 unemployment groups. Their sizes are given by the EuroStat cross-tabulation of the population. In other words, the EuroStat provides the statistics on individual interviews.

4. The national average NRR is used as an indicator of social security. It shows the average degree with which social benefits compensate the loss of preceding earnings.

4 Average production wage (APW)

The Average Production Wage (APW) is a measurement unit in many OECD studies. It is calculated on yearly basis for manufacturing workers in full-time employment. A summary of the calculation procedure can be found in OECD (2004, p. 131); for details see OECD (2003).

The use of the APW in a study on social security allows to express social benefits in terms of national standards which considerably vary all over Europe. The APW suggests a "normal" wage as a reference for "normal" social security benefits which generosity can be hardly expressed in absolute figures. Therefore the APW is useful in situations where money value and money amounts have different meaning. The dynamics of national APWs is shown in Figure 1. As one can see, the last decade exhibited a sustainable growth of wages in Europe with a few exceptions in last two years in Switzerland, Norway, United Kingdom, and Poland with an approximately equal decline in absolute figures. It should be emphasized that for Poland the decline means about 24%APW, whereas for the other countries it is much less significant (6, 11, and 8%, respectively).

Referring to the APW as a unit of wage measurement, it should be taken into account that its decrease implies a relative increase in social benefits. This is the case of Poland with the 24% wage reduction in 2002–2004. It implies that the social benefits, having remained untouched, begin to seem "more generous". This is exactly the same effect as after the national currency has been devaluated, imported goods appear to be more expensive.

5 Net replacement rate (NRR)

The goal of social security is to compensate the loss of earnings and to provide means of existence for those who do not work. The first phase of unemployment is therefore strongly conditioned by the previous earnings, but the longer the unemployment, the more the social benefits approach some fixed level conditioned rather by the family situation (spouse, income of spouse, number of children, etc.).

The generosity of social security for unemployed is defined to be the previous-to-current net income ratio, expressed in percent of previous net earnings, called *Net Replacement Rate* (NRR). The NRR tends to decrease with the duration of unemployment, but in some countries, like Denmark, can increase due to transition from unemployment insurance to a (surprisingly) more generous social assistance.

The dynamics of NRR depends on previous earnings, age, working record, and family situation. A sample example of the "most typical" case (one-earner couple with 2 children, 40 year-old earner, 22 years working record, earnings before unemployment 100% APW) for 2004 is shown in Figure 2 computed with the OECD Tax-Benefit Models. This figure is the 2004-update of the 2002-Figure 3.1b in p. 101 (OECD 2004). These curves are normative, that is, rule-based and are derived from national eligibility conditions with no use of any empirical data. For instance, the black solid line for Germany exhibits an abrupt decrease after the first year of unemployment. It means a reduction of social benefits caused by transition from unemployment insurance to a less generous social assistance.

The last step made by the OECD in evaluating national social security systems is computing the average NRR along the 60 month of unemployment, to characterize the average NRR-coverage during this period, and on four family types (OECD, 2004, Table 3.3a, p. 102):

As in previous editions of this publication, NRR calculations for different family types, earning levels and unemployment durations are combined to derive an overall measure of the generosity of benefits relative to net earnings. The resulting measure is a simple average of the NRRs with each family type and month of benefit receipt weighted equally. This global indicator does not intend to cover all existing salary levels and family types and is not meant to take into account the relative numbers of each of the family types consid-





ered. When using this measure for international comparisons, it is therefore important to keep in mind that population structures differ across countries.

OECD (2004, p. 99)

Thus, the OECD approach stops at this point. Our study undertakes the next step prompted in the above quotation. Namely, the NRRs for particular personal situations are weighted on the size of relevant groups of unemployed. For this purpose, the *census-simulating* model described in Section 3 is applied.

Figure 2: Normative NRR-curves (Net Replacement Rate) for one-earner couple with 2 children(40 year-old earner, 22 years working record, earning before unemployment 100 percent APW) for 2004. Source: Author's derivation from OECD Tax-Benefit models



6 Evaluating European social security

The census-simulating model outputs national weighted average NRRs regarded as indices of generosity of social security. Recall that such indices show the average degree (in percent) with which social benefits replace preceding earnings of an unemployed. Figure 3 shows the state of the European social security systems in 2004. Figure 4 is its more detailed version, where every country is depicted by three bars. The upper bar shows the national average NRR as in Figure 3. The middle bar (pale color) shows the NRRindicator for young unemployed under 25 years. The bottom bar (saturated color) shows the indicator value for old unemployed above 55 years.

Figure 3: European social security in 2004 shown by the census-simulated national Net Replacement Rate (NRR). Source: Author's Census-Simulating Model with the EuroStat Labour Force Survey data and OECD Tax-Benefit Models



Figure 4: European social security in 2004 (average national Net Replacement Rates (NRR) for all, young, and old unemployed). Source: Author's Census-Simulating Model with the EuroStat Labour Force Survey data and OECD Tax-Benefit Models



7 Monitoring European social security

The dynamics of national NRR-indicators is depicted in Figure 5. The common property of the national curves is that they are, roughly speaking, cap-shaped loosely resembling inverted parabolas. They attain some peaks during the period 1999–2002 and decrease by 2004, meaning "the good times are over".

This viewpoint is illustrated in Figure 6, showing the change of the national NRR by 2004 with respect to its peak in some previous year. The bottom countries have the largest social security decline and their bars in Figure 6 are red. The higher the country in the graph, the less the security decline, and the "more blue" is the color. Throughout the paper, except Figures 3 and 4, every country is associated with its color from the red-blue scale (bad-good), showing its relative rank on the 2004-decline axis.

Figure 7 is a more detailed version of Figure 6. Here, each country is depicted by three bars, the top one showing the change of national NRRs as in Figure 6, the middle bar showing the change of NRRs for young unemployed (< 25 years, pale color), and the bottom bar showing the change of NRRs for old unemployed (≥ 55 years, saturated color). This detailed representation shows, for instance, that in well-doing Luxembourg the social security declines for young unemployed while old unemployed, on the contrary, get some advantages.

What follows from these graphs?

• Total decline of European social security in 2004

As one can see, *all* European countries except Poland exhibit a social security decline in 2004. However, the growth of Polish indicator by 0.8% is, as has been noted, accompanied by a devaluation of the APW by 24%. With no this APW-devaluation the Polish social system would decline by about 23%, so that the real position of Poland in Figure 6 should be at the bottom next to Slovac Republic.

• High statistical significance of European social security decline-2004

Estimate the statistical significance of the null-hypothesis that such a decline for all the 22 countries is just a random coincidence. As usual, assume that the countries are independent, and every year can be the peak of a national curve with probability 1/7 (we consider seven years). Then the probability that no of 22 curves attains its peak in 2004 is quite low, meaning that such a coincidence is very unlikely to occur by chance:

Prob{No country has peak in 2004} =
$$\left(1 - \frac{1}{7}\right)^{22} = 0.0337 < 3.4\%$$

Figure 5: Census-simulated nationally-aggregated NRR-curves (Net Replacement Rate) weighted on the size of 450 different groups of unemployed. Source: Author's Census-Simulating Model with the EuroStat Labour Force Survey data and OECD Tax-Benefit Models



Figure 6: Decline of European social security by 2004 after a peak in 1995–2003 shown by reduction of national Net Replacement Rates (NRR). Source: Author's Census-Simulating Model with the EuroStat Labour Force Survey data and OECD Tax-Benefit Models



Figure 7: Decline of European social security by 2004 after a peak in 1995–2003 shown by reduction of national Net Replacement Rates (NRR) for all, young, and old unemployed. Source: Author's Census-Simulating Model with the EuroStat Labour Force Survey data and OECD Tax-Benefit Models



8 Analysis of decline of European social security

What are the causes of the decline of European social security?

• No decline of social security at the institutional level

In many countries the actual decline of social security occurs under institutional improvements: "Contrary to the decline in benefit amounts seen in earlier period, payment rates were made more generous in several countries" (OECD 2004, p. 116). Some countries considerably increased their benefits and some relaxed eligibility conditions. Indeed, as reported by Adema and Ladaique (2005, p. 12) the social expenditure in the OECD countries grows with the GDP and in certain years even more rapidly.

For instance, the dynamics of German institutional development is shown in Figure 8 which plots are made from curves like in Figure 2 for all the seven years and for six levels of previous earnings: 40, 50, 67, 100, 150, and 200% APW. They are computed with the OECD Tax-Benefit Models under the same rule-based approach with no statistical data. The abrupt increase in the plot relief in 2001 indicates that social security benefits became more generous for all the six earning levels. At the same time Germany exhibits a decline of social security by 4.1% in Figure 6.

A similar situation is inherent in many other countries. The institutional development of their social security is shown by graph reliefs in Annex 2. The color of the graphs indicates at the country rank in Figure 6, with red meaning a considerable decline and blue — negligible decline of social security.

• Structural change of labour markets as the only cause of decline

Our model operates both on institutional and empirical data on personal situations. Since no institutional decline is observed, the only cause of the general decline is a structural change in personal situations. Recall that the personal situations are specified with family type (single, married couple with one earner, married couple with two earners, number of children), age, and employment parameters like previous earnings and duration of unemployment. According to EuroStat (2005), the dynamics of family types is not much changing in the recent years. The earnings do, as follows from 1, but together with the GDP and social expenditure (EuroStat 2005).

Therefore, the only explanations of the decline of European social securitry are longer periods of unemployment and shorter periods of employment which disqualify employees from high social benefits. These phenomena follow from the flexibilization of employment relations. Therefore, the **flexibilization results not only in employment insecurity but also in social insecurity**, reducing the NRR due to shorter employment periods. Figure 8: Normative Net Replacement Rate (NRR) during 1–60 months of unemployment for one of 75 family situations (one-earner couple with 2 children, 40 year-old earner, 22 years working record) in Germany. Source: Author's derivation from OECD Tax-Benefit models



9 Possible solution: Basic income model and flexinsurance

At the beginning of the paper the following European policies have been mentioned:

- European welfare policy which suggests certain living standards independently of employment. It assumes a stable labour market performance and is backed up by a strong social security system.
- Flexibilization of employment relations which assumes "less state" but more personal responsibility. The compatibility with the European welfare tradition is imagined as a *flexicurity* trade-off between the relaxation of the employment protection legislation and advances in social and employment security; see Jepsen and Klammer (2004).
- "Make work pay" policy which is aimed at enhancing the sustainable development by stimulating the unemployed to a more active labour market participation. Similarly to flexicurity, the "make work pay" policy is also a trade-off, but between the social protection and maximizing the gain from moving to work. Contrary to flexicurity, the "make work pay" suggests a certain reduction of security benefits.

As follows from the very ideas of trade-offs, all the three policies contradict to each other. Since they interact through the social security system, making them consistent means making them consistent with the social security. Or, the social security should be made consistent with all the three policies.

The social security system has been developed for many decades. It is overcomplicated especially in interaction with the tax system, and it is quite difficult to change one of its elements without affecting others. The unprecedented decline of European social security in the background of institutional improvements shows that only a global reform can make it actually efficient and resolve policy contradictions.

A possible solution could be the basic income model together with *flexinsurance* (Tangian 2005). The basic income model assumes a flat income paid by the state to all citizens regardless of their earnings and property status. The traces of this model appear in some social security branches like child care allowances. For instance, *Kindergeld* in Germany is paid to all parents.

The flexinsurance assumes that the employer's contribution to social security should be proportional to the flexibility of the contract. Thereby the higher risk of atypical employees to become unemployed will be compensated. On the other hand, such progressive contributions will stimulate employers to hire employees more favorably, without however rigidly restricting the labour market flexibility.

The basic income model in combination with the flexinsurance is consistent with the three European policies mentioned and thereby resolves their contradiction:

1. Development of the welfare policy

The basic income model meets the concept of welfare state since it guarantees some unconditional living standards and discharges the social tension. The additional budget expenditures come from flexinsurance which also non-rigidly constrains flexibilization, from higher taxes of high-earners (to subtract the flat income) and by the funds released from an army of civil servants currently working in social security.

2. Compensation of flexibilization according the flexicurity concept

The basic income model would mean a progress in social security and therefore meets the idea of the flexicurity trade-off "more flexibilization and more security".

3. Contribution to the "make work pay" policy

The basic income is not reduced while moving to work. Therefore, there can be no situations when moving to work is little attractive due to loosing out-of-work benefits, since every work immediately improves the net income.

10 Summary

The paper suggests:

- (Methodology) a model of *census simulation* combining empirical data on the population with individual answers computed with a normative rule-based model,
- (Indicator) an integral quantitative evaluation of social security in Europe, which reveals its total decline by 2004 contrary to institutional improvements,
- (Analysis) an explanation of the decline by a structural change of European labour markets with rapidly growing 'atypical' employment groups,
- (Policy implications) a possible resolution of European policy contradictions by the "basic income model" with "flexinsurance".

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11 Annex 1: Implementation of the census-simulating model

The model for this paper consists of several modules for different computer environments. Besides, a number of auxiliary programs have been developed to test the reliability of the modules which are charged with huge data processing.

1. The first module is a MATLAB program which prepares a control file (in fact, divided into several parts due to a large size) for the OECD Tax-Benefit Models. The control file consists or computer commands, specifying different personal situations of unemployed and indicating two scenarios of the Tax-Benefit Models. They are generated from combinations of the following 8 parameters:

	Country name	Label in graphs
1	Austria	AT
2	Belgium	BE
3	Czech Republic	CZ
4	Germany	DE
5	Denmark	DK
6	Greece	EL
7	Spain	\mathbf{ES}
8	Finland	FI
9	France	FR
10	Hungary	HU
11	Iceland	IS
12	Ireland	IE
13	Italy	IT
14	Luxembourg	LU
15	Netherlands	NL
16	Norway	NO
17	Poland	PL
18	Portugal	PT
19	Sweden	SE
20	Switzerland	CH
21	Slovac Republic	SK
22	United Kingdom	UK

(a) 22 countries

- (b) 7 years: 1995, 1997, 1999, 2001–2004
- (c) 5 age levels: 15–24, 25–34, 35–44, 45–54, 55-65 years with corresponding working record 2, 12, 22, 32, and 42 years
- (d) 3 types of family: single or lone parent, married couple with one earner, married couple with two earners
- (e) Number of children: 0–4
- (f) 6 earning levels before unemployment, in % APW: 40, 50, 67, 100, 150, and 200

- (g) 9 unemployment duration periods, in months (corresponding to coding the DURUNE variable of Labour Force Survey by the EuroStat): 0 (just become unemployed, waiting period for security benefits), < 1, 1–2, 3–5, 6–11, 12–17, 18–23, 24–47, 48 or longer
- (h) 2 scenarios of Tax-Benefit Models: Scenario 0 for out-of-work net income and Scenario 2 for in-work net income

Totally, the control file contains $22 \cdot 7 \cdot 5 \cdot 5 \cdot 3 \cdot 9 \cdot 2 = 207900$ records.

- 2. The second module consists of the OECD Tax-Benefit Models themselves. They run under the STATA computer environment. Their input is the control file created by Module 1. The output is the 207900 files with computed tax and social security parameters which correspond to the response of the national social systems to different personal situations in the given year. In particular, the output contains the average production wage in the national currency and net income (after taxes and benefits) in case of work and in 60 cases of unemployment duration 1-60 months.
- 3. Module 3 is a MATLAB program which collects the output of the OECD models from the 207900 files. Next, it computes NRR-indicators for all combinations of personal parameters and converts APW into EUR.

The net replacement rate is computed by the formula:

$$NRR = \frac{NRR_{\text{out of work}}}{NRR_{\text{in work}}} \qquad \text{output of Scenario 0} \\ \text{output of Scenario 2}$$

for all the 103950 combinations of 7 parameters from Item 1 (the parameter with two model scenarios is not relevant). The results are collected into a 7-dimensional matrix NRR which elements are the NRR for the combinations of the 7 parameters. The output of the module (files of 47 and 12 MB) is saved to avoid unnecessary processing in repeated runs of the model.

4. Module 4 is a MATLAB program to process the EuroStat data with the crosstabulation of unemployed (represented in several EXCEL tables). Its output is a 7-dimensional Population-weighting matrix P which elements are the population fractions in the cross-tabulation specified by the 7 parameters from Item 1.

The only statistics unavailable from the EuroStat is the income preceding the unemployment which are processed as missing data and replaced by average values.

The output of the module is also saved separately.

5. Module 5, also a MATLAB program, computes the annual national NRR-indicators for all, young, and old unemployed. It is done by element-by-element multiplication of matrices NRR and P with subsequent summation of certain elements, depending on the task.

Basing on the computations, Module 5 generates eps-files with the figures of the paper and a $I_{E}X$ document template which consists of figure captions and calls of the figure files. The given article is written by inserting text into this $I_{E}X$ template saved under a new filename. If figures have to be modified, Module 5 is activated

and the figure files of the paper are overwritten with their new versions which are called while recompiling the $L^{AT}EX$ -paper.

The run of the full program cycle takes about six hours on a PC with 2.4 GHz Pentium IV-processor and 1GB RAM. To make new graphical output, only Module 5 should process the previously stored normative and empirical data from Modules 3 and 4. A run of Module 5 takes about five minutes.

12 Annex 2: Visual directory of European social security systems

The following figures represent the same information on 21 European countries as Figure 8 on Germany. They are derived directly from the OECD Tax-Benefit Models, representing *normative* properties of the social security systems. These figures give an immediate impression at a glance "Who, When, Where" (the year of reforms, most affected earning levels, and changes in the monthly dynamics of security benefits). In a sense, they constitute a visual directory to the OECD (2005) country chapters downloadable from the Internet.

The *empirical* aspect of our study is shown by color. The country colors are the same as in Figures 6 and 7. A considerable 2004 decline of the national social security system after 1995–2003 is shown by red. Blue corresponds to a negligible decline.

Figure 9: Normative Net Replacement Rate (NRR) during 1–60 months of unemployment for one of 75 family situations (one-earner couple with 2 children, 40 year-old earner, 22 years working record) in Austria. Source: Author's derivation from OECD Tax-Benefit models



Figure 10: Normative Net Replacement Rate (NRR) during 1–60 months of unemployment for one of 75 family situations (one-earner couple with 2 children, 40 year-old earner, 22 years working record) in Belgium. Source: Author's derivation from OECD Tax-Benefit models



Figure 11: Normative Net Replacement Rate (NRR) during 1–60 months of unemployment for one of 75 family situations (one-earner couple with 2 children, 40 year-old earner, 22 years working record) in Czech Republic. Source: Author's derivation from OECD Tax-Benefit models



Figure 12: Normative Net Replacement Rate (NRR) during 1–60 months of unemployment for one of 75 family situations (one-earner couple with 2 children, 40 year-old earner, 22 years working record) in Denmark. Source: Author's derivation from OECD Tax-Benefit models



Figure 13: Normative Net Replacement Rate (NRR) during 1–60 months of unemployment for one of 75 family situations (one-earner couple with 2 children, 40 year-old earner, 22 years working record) in Greece. Source: Author's derivation from OECD Tax-Benefit models



Figure 14: Normative Net Replacement Rate (NRR) during 1–60 months of unemployment for one of 75 family situations (one-earner couple with 2 children, 40 year-old earner, 22 years working record) in Spain. Source: Author's derivation from OECD Tax-Benefit models

Figure 15: Normative Net Replacement Rate (NRR) during 1–60 months of unemployment for one of 75 family situations (one-earner couple with 2 children, 40 year-old earner, 22 years working record) in Finland. Source: Author's derivation from OECD Tax-Benefit models

Figure 16: Normative Net Replacement Rate (NRR) during 1–60 months of unemployment for one of 75 family situations (one-earner couple with 2 children, 40 year-old earner, 22 years working record) in France. Source: Author's derivation from OECD Tax-Benefit models

Figure 17: Normative Net Replacement Rate (NRR) during 1–60 months of unemployment for one of 75 family situations (one-earner couple with 2 children, 40 year-old earner, 22 years working record) in Hungary. Source: Author's derivation from OECD Tax-Benefit models

