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Kullervo Hirvonen

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ABSTRACT

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This study introduces a model for adaptive control of the labour costs of an enterprise. Labour costs are divided into two components – net wage costs and other labour costs. The latter is named as labour force tax. The labour intensity of a firm is measured as the ratio of the sum of net wages to the value added of a firm. The tax rate of labour force is set to be dependent on the labour intensity and the amount of individual net wages of workers. In this way, a dynamic labour force taxation system is achieved. This system adapts to the varying business conditions and provides enterprises with more ability to compensate for the varying economic conditions. This is needed since the labour costs (in Finland) do not follow cyclical trends as do, for example, raw material costs, and the income of enterprises. Introducing the proposed system would result in business life being more resistant to disturbances. Adaptive control of labour costs would act as an automatic stabiliser in the economy.

Keywords: Adaptive control, employment, flexibility, labour costs, non-wage labour costs, payroll tax, taxation, unemployment

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PREFACE

The ideas in this study have their origin in the years of deep recession of 90's in the Finnish economy. I saw a few examples, where in basically solid firms were forced to bankruptcy. Many firms didn't have ability enough to adapt itself to the new business situation. More cost flexibility would have been needed.

The employers' association and many employers have asked for a greater cost flexibility. According to the employers one of the most rigid cost components of firms are the labour costs including wages and all types off payroll taxes. I tried to develop such a system, where the aggregate labour costs are dynamic and vary with varying business conditions so, that the labour costs are lower in economic shocks and higher in booms. Furthermore these dynamic variations should be targeted only to the sum of all taxes, that is, to income taxes and all non-wage labour costs, not to net wages of workers.

I took the first contact to the Economic Department of the University of Jyväskylä in 1996. I had the feeling that my results mainly concern the economy. I took part in the Economics Summer Seminar in Jyväskylä, 1996, and presented my ideas and some of the results. I also had a few useful conversations with professor Jaakko Pehkonen, and especially with Docent Matti Estola, who is one reviewer of this study. Docent Estola has given many valuable advices when reading the manuscript. Soon, however, it became clear that I can't present my results as thesis for dissertation in economics because my own background and basic studies are in mathematics. So I turned to the Department of Mathematics, where I had formerly carried out my licentiate thesis.

I continued my work on the subject along with the advise from Professor Pekka Neittaanmäki and Professor Viorel Arnautu, another reviewer of this work. The results were published under the title "On Flexibility and Adaptive Control of Labour Costs of Enterprise" in the series of University of Jyväskylä, Department of Mathematics, Laboratory of Scientific Computing, Report 12/1997. This report forms the core of this thesis and is included in the chapters A and 1-5. I have only done some minor corrections, the currency unit euro [€] has been observed, I have added new up-to-date data into tables, and plenty of new references. I also had useful discussions with Dr Alexandru Murgu when preparing the final version.

During the four years, many interesting domestic studies have appeared. I have tried to find the publications having connection to the subjects discussed here. All discussions concerning newer publications have been concentrated on the new chapter 6. An important appendix (5) has been added. It presents actual material.

Most surprising to me, as a beginner and unaware of the situation, have been the big differences in taxation systems between economies in OECD. However, all of these economies are working, some well and others not so well. As a consequence of this I concluded that it may not exist only one smart framework to improve the problems in these economies. So this study is one

among the others, in which by using the structural changes in the taxation system, one tries to improve the performance of an economy.

For my dissertation work, I have got two grants, for which I want to thank the Emil Aaltonen säätiö, Tampere, and the Teknillisen korkeakoulun tukisäätiö, Espoo.

I want to express my deep gratitude to all persons mentioned above. Additionally, I bring out my former academic colleagues, in the Department of Mathematics in the University of Jyväskylä (in 1967 - 1978), in the Department of Medical Physics in the University of Kuopio (in 1976 -1980), and the present colleagues in Pohjois-Savo polytechnic (since 1989). All these working environments have been very inspiring. There between in 1980-1988 I worked in the industry in the firm Altim Control - at present a part of the Honeywell Corporation. This firm developed and manufactured distributed process control systems. This time in the industry mainly in research and development work has widened my perspective to see things around me. The ideas in this study have their roots in the years I worked in the pioneering IT-firm Altim Control.

And finally I come to family matters. I thank my wife, Ulla, for the patience during the long lasting work for this thesis. At the same time, she has created five books in poetry. I yet bring out our adult daughters Anna-Elina, Katri with her family (husband Olli-Pekka, their sons Mikael, Markus, Oskari, Juho, Eetu, Sauli, Joona, Manuel and the daughter Linnea) and Saara. They all have been in the foreground or in the background in so many great moments in my life. I dedicate this thesis to my Mother, Aino Hirvonen, who is 90 years old and had a dream to study but it wasn't so easy at that time.

Varkaus, Savonmäki, November 2001

Kullervo Hirvonen

CONTENTS

INTRODUCTION

Economic increase that contributes to employment has been dealt with in the "white book" of the EU commission (year 1993), and later at conferences of the European Council in Essen (1994) and Madrid (1995). Unemployment in the EU countries has been increasing and the investment rate decreasing during the last 20 years. In the white book, the EU commission sets a goal to create 15 million new work places by the end of the century. (See Työministeriö (1996), §§ 5.1, 5.2)

Finland became a member of the EU at the beginning of 1995. The recession in Finland has been more severe than in most other EU countries. Unemployment in Finland (about 18% or more in 1993 -96) is one of the highest in industrialised countries; it is at the same level as in Spain. (See SVT 1995:3, Tables 67, 70 and SVT 2000, Table 349)

In Essen (1994) an employment strategy consisting of five points was accepted: (1) intensifying vocational education, (2) increasing employment by added flexibility of labour markets, moderate wage increases, and by utilising local wage agreements or other strategies, (3) reducing indirect labour costs, (4) effective manpower policy, (5) special arrangements for people difficult to employ.

Finland has outlined its own employment program (1995) according to these principles (see Työministeriö (1996) p.69). Our work concerns the principles 2 and 3.

According to the Työministeriö (1996, §§ 4.4, 4.5), in accommodating Finland to the EU markets (and especially to the EMU) the main stress lays on labour markets. The price of labour is an essential accommodation mechanism. This presupposes flexibility of the labour markets and mechanisms or systems for the elasticity of wages. Improving employment provides that indirect employee costs can be reduced.

The competitive price of labour is important for investments, too, which in turn affects employment. Finland is a net exporter of capital. Foreign investments in Finland are smaller than Finnish investments abroad (see Työministeriö (1995), §2.5). Foreign enterprises see a lack of freedom in activities and they have problems with tax regulations. They find that the Finnish labour markets are working well but they would appreciate more flexibility in wages (Työministeriö (1995) §5.3.3).

We take some direct quotations from Työministeriö (1996), ANNEX II pp 13 -14:

> *"The tools that are available to Finland in its battle against unemployment and its current mechanisms of adaptation to asymmetric shocks are inadequate, and furthermore there are no practical experiences of their need in an EMU situation. Apart from the priority strategy of strengthening growth, other means of reducing unemployment should be significantly improved and diversified, regardless of the decision is eventuality taken with EMU."*
>
> *"The EU does not have any adequate policy tools for dealing with asymmetrical shocks caused in individual countries by cyclic fluctuations or reducing differences in unemployment levels among Member States: in their present nor from neither the EU budget nor its structural funds are well-suited to this purpose." ... "Further we need to carry out examinations in order to find out what new tools can be developed for the use of the EU so that it could effectively cope with unemployment problems caused by asymmetrical shocks in individual countries."*
>
> *"The flexibility that is needed on the labour market requires the introduction of wage systems that take into account the company's liquidity. ... "*

The analysis in Rantala (1995) shows some interesting results. The effect of the employers' social security contributions has a roughly similar impact on profitability in industry and in the sheltered sector. It is important to know whether we need tools that affect quickly and can be utilised in possible crises, which may occur if Finland joins the EMU and active foreign exchange policy is not possible any more. See Rantala (1995) pp 5, 37, 50 -51. How we determine the social security contributions is important, too because the share of labour costs in all production costs of enterprises varies remarkably with respect to economic conditions (Rantala (1995) pp 34 -35).

The above ideas illustrate the motivation and purpose of our work to develop a model for flexibility and adaptive control of labour costs in enterprises.

A BACKGROUND AND STARTING POINT

In our study, we divide the costs of enterprises into labour costs (**LC**), contracts and purchases (**Purch**), and other costs. Furthermore, we divide the labour costs into two parts, namely, salaries and wages (**Sal**) and non-wage labour costs (**SoC**). We also use the terms *social security costs* and *indirect labour costs* for **SoCs**.

First we present some basic data concerning Finnish industries. If not specified otherwise, the data has been taken from Finnish Accounts (SVT 1995) and concerns the year 1993.

Data by branch of industry

TABLE A.1 Data by branch of industry in Finland. (1 € = 5.94573 FIM)

Branch	SIC (1988)	Earners	Labour costs	Raw mater.& energy	Gross value of product	Value added	La-bour costs [%]
Manufacturing	D	341 931	53 639	141 672	281 493	100 475	53.4
Wood etc	14	22 646	3 004	8 031	15 263	5 693	52.8
Paper etc.	15	38 344	7 379	26 814	48 472	16 473	44.8
Basic metal	23	15 159	2 662	15 724	23 816	6 555	40.6
Metal products	24 -27	120 028	18 676	48 662	48 863	30 623	61.0
Food etc.	11	43 519	6 568	29 019	49 477	13 420	48.9
Textiles etc	12 -13	17 842	1 994	2 569	6 292	2 926	68.2
Publishing etc.	16	30 226	4 871	2 452	15 019	6 660	73.1
Furniture etc.	17	8 756	1 031	1 315	3 084	1 358	75.2
Chem.& petrol.	18 -19	21 796	3 982	17 374	30 535	9 471	42.0
Rubber etc.	21	11 551	1 708	2 920	6 825	3 064	55.7
Glass etc.	22	12 064	1 785	2 154	6 454	3 041	58.7
Other manuf.	29	5 326	688	913	2 468	1 189	57.9
Energy & water	E	22 803	4 095	22 066	37 495	12 809	32.0
Mining, quarrying	C	3 157	518	421	2 621	1 390	37.3
Whole industry	C,D,E	367 891	58 251	164 160	321 610	114 674	50.8

Source: SVT 1995 Table 150. All costs are in units [million FIM]. SIC refers to Standard Industry Classification. The last column presents the share of all labour costs in the value added in the branch of industry. Labour costs include wages and social security costs.

The values in the last column show that the labour costs form a big part of the value added of each of the branches. The value in the last column is a measure of the labour intensity of the branch. Later we will use the share of net wages (take-home pay) in the value added of an enterprise as a measure of the enterprise's labour intensity. This share is smaller than the values in the last column and would be one half of the values in the table.

Cluster-oriented data concerning the Finnish economy is presented in ETLA 1995. Rantala (1995) presents the share of labour costs (years 1975 -93) in the turnover (or gross value of production) of some central industries of Finland (Taulukko 8 p.35 and Appendix 10 p.68). We show the statistics from Rantala (1995) Appendix 10 in TABLE A.2

Structure of taxation

In Finland, taxes on labour and wages are relatively high as in all Nordic countries. In TABLE A.2 we present some examples of the tax structure (taken from SVT 1995, Table 605: (year 1992)). All figures, except the first column, are expressed in per cent.

TABLE A.2 The share of total labour costs in the turnover by industry branch.

Industry or branch	SIC	Labour costs from turnover [%]
Industry		21
Food etc.	11	13
Textiles etc.	12 -13	32
Wood etc.	14	23
Paper etc.	15	20
Chemicals etc.	18	13
Construction material		27
Metal	23	13
Metal products etc.	24 -27	30
Sheltered sector		27
Construction	35 -38	31
Trade etc.	41 -48	40
Transport, communication	51 -58	33
Other sheltered sector		19
All industries		25

Source: Rantala (1995) Liitetaulukko/Appendix 10. Average values, years 1975-1993.

Next TABLE A.3 shows that axes on income and profits are the highest in Finland, Sweden and USA (third column) if we skip Australia, where no separate **SoCs** are reported. The stiffness of taxation can be seen to be the most severe in Finland, Sweden and the Netherlands if we also take into account the GDP per capita. Taxes per capita are low in Japan, USA and Australia. See also Hirvonen (1997), p. 4, concerning the values in the year 1992 when Finland had the highest aggregate tax burden.

On the other hand, the **SoCs** are not high in Finland. In the TABLE A.3 the relative figures on income taxes and **SoCs** differ from each other. In this study, we suggest a structural change in taxation so that the relationship between income tax and non-wage labour costs changes. More information on taxes and **SoCs** in the OECD -countries can be found e.g. in Rantala (1997) chapter 2, where also some trends concerning **SoCs** are displayed.

Dispersion in all columns is rather large. The figures are macroeconomic values. In an individual country the contribution rate for **SoCs** may depend on the branch (e.g in USA according to Hart (1988) Table 2.14: 18.5 - 27.9% from the total labour costs in 1985). The **SoC** value for Japan probably includes "bonuses", which is apparent if compared with the values in Hart (1988) Tables 2.4 & 2.5.

TABLE A.3 Structure of taxation in some countries.

Country	**Taxes per capita** [USD]	**Taxes from GDP** [%]	**Structure of taxes Share [%] of taxes based on**				
			Incomes & profits	SoCs	Wealth	VAT & al.	Other
Finland	10 999	46.5	41.4	25.2	2.3	30.9	0.1
Sweden	13 867	51.9	41.2	29.2	3.9	22.3	3.3
Netherlands	10 150	41.9	26.0	40.9	4.6	28.0	0.4
Great Britain	7 871	35.4	36.9	17.2	10.8	35.0	0.0
Luxemburg	17 363	46.5	38.9	25.4	7.7	27.0	0.9
Germany	9 606	37.2	27.9	41.6	2.7	27.7	0.0
Japan	9 530	28.8	35.5	36.9	10.8	16.5	0.2
USA	8 614	29.7	48.4	24.2	10.7	16.7	---
Australia	6 753	29.8	56.6	---	9.2	27.5	6.7

Source: SVT 2000, Table 633: year 1997.

The marginal tax rate of an APW worker (Average Production Worker) has been 54.5% and the marginal tax rate of labour costs (APW worker) 72.4% (year 1994; Lehtinen (1994) pp 9 and 13). The "wedge" value (w^p/w^c i.e. total wage price / net wage) for an APW worker is therefore 3.6 (year 1994). For wedge we refer also to Pehkonen (1991) §3.2 & 3.4, and to the thesis of Tyrväinen (1995) pp 15-16, 115, and chapter 4, and to Työryhmäraportti (1998) pp 11-14. For the aggregate tax rate development we refer to Työryhmäraportti (1998), chapter 2, and OECD (1997), and Joumard (2001), chapter 1.

TABLE A.4 The marginal tax rate of a (typical) taxpayer in Finland.

Year	1960	1970	1980	1985	1990	1995
Tax [%]	29.4	45.2	55.7	57.7	51	58.5

Sources: Holm & Honkapohja & Koskela (1990) years 1960 -85, Tyrväinen (1995) year 1990, and Viitamäki (1995) p.71 year 1995.

The share of different labour taxes in all labour costs of enterprises has been continuously increasing. The trend in operating profits in industries has been decreasing between the years 1960 -94 (see Rantala (1995) pp 15 -17). A subfactor for this has been the increase in labour costs. It is significant how these contributions of an enterprise are controlled. The **SoCs** are (at times) determined as fixed percentages from wages and salaries. In our study, we will develop a model for active control of these non-wage labour costs of an enterprise.

Non-wage labour costs

By non-wage labour costs we mean all contributions of enterprise that are fixed by regulations and determined by wages. The components of **SoC**s are (see SVT 1995, Table 308, Rantala (1995) pp 13 -14, Lehtinen (1994) Appendix/Liite 1, or Kiander (1996) pp 18 -20): (1) employment pension security, (2) national pension insurance, (3) sickness insurance, and (4) unemployment insurance.

For **SoC**s we also use the following expressions: social security costs or indirect labour costs. According to Kiander (1996), p 20, years 1991-1995, and Holm & Honkapohja & Koskela (1990) years 1960 -85, these costs in the manufacturing industry has been the following:
(% of salary)

TABLE A.5 The percentage of social security contributions in Finland.

Year	1960	1970	1980	1985	1991	1992	1993	1994	1995
SoC [%]	6.9	16.0	24.5	22.8	24.22	23.60	27.60	28.57	29.41

The increase in unemployment insurance costs can be seen here. For a longer period of time we refer to Holm & Honkapohja & Koskela (1990) Liite 4 (original source: Bank of Finland), Rantala (1995) section 2, and Tyrväinen (1995) chapter 1. The share of these taxes from aggregate taxes has been: (SVT 1995, Table 309, and SVT 2000, Table 325)

TABLE A.6 The share of social security payments from aggregate taxes in Finland.

Year	1975	1986	1990	1992	1994	1996	1997	1998	1999
SoC [%]	22.1	21.6	25.5	29.6	32.0	29.0	27.9	27.4	27.3

In the literature, non-wage labour costs can include many other costs than the mentioned (1) –(4). In Hart (1984), one finds a classification of labour costs by EC standard (Table 2.1, pp 8-9), and labour costs categories used in FRG (Germany), UK, Japan and USA (pp 20-30). Hart & al. (1988) p.6 use the following terms *statutory social welfare costs, voluntary social welfare costs, payments for days not worked, benefits in kind, other expenses of a social nature, vocational training costs, taxes and subsidies,* and even *bonuses*. If we use this kind of long list for non-wage labour costs, then the share of **SoC**s would in Finland now be close to 60% of salaries.

A.1 The structure of labour costs and taxes

We divide the labour costs into three components: take-home salary, income tax and non-wage labour costs. The salary is the sum of the take-home salary and the income tax. The non-wage labour costs consist of all other labour costs determined by the salaries. The structure of the labour costs means the relationships between these components.

In Finland, the income tax increases progressively with the salary. The highest marginal taxes including the municipal taxes and some social security contributions (see e.g. Viitamäki p.71) are about 62 ... 66% of the gross salary. The non-wage labour costs of enterprise depend linearly on salaries - the percentage may depend on the industry and the number of employees in the firm. See tables A.1-A.6 above. For a graphic representation see the appendix 3.1.

The development of the relationships between wages, income tax and labour costs have a long history. The highly progressive taxation of wages is based on solidarity. The people in high-paid jobs have a bigger relative responsibility for the welfare costs of the society. Social welfare necessitates high social security costs. This has raised the share of the non-wage labour costs of enterprises' total labour costs. We refer to the earlier mentioned Tyrväinen (1995) and the papers that discuss the effects of tax progression: Holm & Koskela (1995a & b), Koskela & Vilmunen (1994).

The graded income tax on salary income concerns us all. Year after year, we have a public discussion about the possibilities of reducing tax scales. The politicians promise tax reductions and so far the applications have been minor. (See SVT 1995, Tables 312, 604, 605; Lehtinen (1994), Tyrväinen (1995) p.146). It is agreed that the taxes on wages are too high. "Working is not profitable" is a frequent statement. Moreover, the monetary transfers based on social security benefits equalize the take-home income effectively. See Soininvaara (1994), Talonen (1995), and Viitamäki (1995) and OECD (1991) for discussion on benefits and taxation. Holm & Koskela (1995a & 1995b), Koskela & Vilmunen (1994), and Symons et al. (1990) study about the impacts the structure of taxation has on employment.

The public sector needs its present tax revenues. Perhaps the gross amount of taxation cannot be reduced. However, we can still ask whether the present structure of taxation is the only possible one? Can we change the tax system so that it works more effectively and agreeably than the present one, and so that the average flow of tax revenues for the public sector remains almost unchanged? This study intends to show a possible way of doing this.

The deviation between the tax rate of capital revenues and salary income causes controversies and has a social significance. People think that the taxation on wages should not be higher than on capital income. We can ask, why not to have a unique taxation rate for all kinds of income?

Our idea is to apply a progressive scale to the non-wage labour costs and a linear scale to the wage taxation. The sum of these components is what matters

(Tyrväinen (1995) p.46). Society would get its present tax revenues in this way. With this reform, the total labour costs of all enterprises would not change and take-home wages remain unchanged - at first.

This change in the structure of labour costs would provide the possibility to improve the performance of our economy, as we will see later. Most importantly we would add flexibility to the labour costs without touching the take-home wages of employees. We want to use this possibility for active or adaptive control of non-wage labour costs of enterprises.

We suggest another change in the structure of labour costs. We want to increase employment. Therefore, we have to reduce labour costs especially on low-paid jobs. For favourable development of industries based on skilled labour, it is necessary to reduce the labour costs of high qualified specialists. If we want to do this so that the revenues of society do not change, we must stiffen the taxation of the labour costs between the lowest and highest salaries (see chapter 1). We refer to the studies concerning the impact of tax progression to employment done by Holm & Koskela (1995b), Koskela & Vilmunen (1994). See also Lockwood & Manning (1993) and Symons & Robertson (1990).

The question of social benefits is not the subject of this study. Social monetary transfers are necessary in a welfare state. Because of many problems connected with these benefits, we should have a supervision of these monetary transfers. It means that all social benefits and taxes on an individual have to be handled together. The income equalisation has gone too far so that it diminishes people's interest in working. A fair taxation principle would mean that the net income of a person will increase with gross wage earnings. See analysis in Honkapohja & Törmä (1988), Honkapohja & Koskela & Paunio (1994), Ministry of Finance etc. (1992), Soininvaara (1994), Talonen (1995), and especially in Viitamäki (1995).

A.2 Problems concerning labour costs and taxation

There are some problems that concern the enterprises' labour costs and the taxation of personal salary income. They can be summarized in the following way: (see TABLE A.2)

(1) Labour costs are too rigid with respect to the varying business conditions.

(2) Taxes on salaries and wages are high if compared with the most important competing economies.

Labour costs of enterprises consist of wages and non-wage labour costs, and the non-wage labour costs are determined by wages in some fixed ratios. Flexibility of wages occurs in the form of contract wages and wage drift. The contract wages make wages too rigid and, at the same time, also the total labour costs of enterprise.

More flexibility is needed with respect to variations in economic conditions, seasonal fluctuations, and other short-term or random variations. Regulations concerning labour costs do not take into account, for example, the phase shift differences between industries or enterprises with respect to business cycles, the economic situation or liquidity of an enterprise, the stage of development of an enterprise, and the labour intensity of an enterprise. (See also the discussion in the chapter 6)

The high taxation of personal salary income has many consequences: for example, it decreases the international competitiveness of enterprises, slows down the development of economic life, decreases the possibilities of hiring experts, decreases the personal interest in developing professional skills. In addition, the taxation of personal salary income can be much higher than the taxation of capital income because of the progressive tax rate in wage tax.

The effects of high taxation of income are reinforced with social benefits, which very effectively equalises the net income of households. Viitamäki (1995).

A.3 Flexibility of labour costs

From the enterprise's viewpoint, labour costs are too rigid. The labour costs in Finland do not follow the cyclical trends as do the raw material costs, the capital costs and the income. In fact, the wages and, consequently, the labour costs are not quite inflexible, which can be seen in Pehkonen (1990) and Tyrväinen (1995) chapter 5. Flexibility is normally modelled using contract wages and wage drift. Wage drift is closely connected with the demand on labour (Pehkonen (1990) pp 28 -32, Tyrväinen (1995) chapter 5). The enterprise's viewpoint is understandable since that the relative flexibility in their labour costs is minor, if compared with the fluctuations in their other costs. Without wage flexibility, enterprise has to use notices and leaves of absence.

During booms, the wage drift is often too extensive and therefore a factor that accelerates inflation. Society does not have proper tools to control this wage drift. The Bank of Finland uses, among others, interest rates for retarding booms. Our opinion is that it is not the best way. High interest rates do not benefit the capital formation in enterprises, nor can it be utilised by society. The model we will present offers another possibility, which has certain advantages. During booms, enterprises have to pay more non-wage labour costs than in recessions. Society benefits from the high profitability of an enterprise, and on the other hand, the recovery takes place automatically in the form of lower labour costs in recession. This can be done, if we make the non-wage labour costs of an enterprise to depend on the capital intensity of the enterprise concerned. By the capital intensity we mean the share of the wages in the value added of an enterprise.

Many strategies to determine the social security contributions of enterprises have been presented. However, we have not seen proposals for the active control of these costs, which is essential in the proposed model. Perhaps the most important principles for determining the amount of these costs are listed in Holm & Honkapohja & Koskela (1993 & 1995), and Rantala (1995), and they are

Scaling with respect to

- (a) the average salary in the industrial branch,
- (b) the capital intensity of the industrial branch,
- (c) the unemployment of the industrial branch,
- (d) sales (or turnover) of the enterprise,
- (e) the sum of the salaries and the operating margin of the enterprise (approximately the value added),
- (f) the value added of the enterprise,
- (g) the profits of the enterprise.

See also Honkapohja & Törmä (1988), Holm & Honkapohja & Koskela (1990), Kansaneläkelaitos (1987), Ministry of Finance etc. (1992), Tyrväinen (1994). For international comparisons of the structure of non-wage labour costs, we refer to Hart (1984) and (1989), OECD (1991), and the references found in Tyrväinen (1995) and (1994).

The ways (a) and (c) do not offer the desired flexibility with respect to the varying market conditions. In the case of (b), the flexibility may be minor. In our model, the capital intensity of each enterprise is used instead of the one of the industrial branch concerned. Therefore our model has effects on macro- and microeconomic levels. It brings a considerable flexibility into the labour costs of enterprises as we will show later.

In the case of (d), the social security costs are an additional tax that apply to unit production costs (see Rantala (1995) Liite 1, or Appendix 6). We have also the same problem as with the former sales tax - taxation may be multiple. This way, (d) would be too hard on capital-intensive enterprises.

The cases (e) and (f) are very similar. They offer the desired flexibility of labour costs in enterprises. These possibilities, however, cannot be used because the EU directives forbid setting other taxes that have the same base as the value-add tax has. (See Holm & Honkapohja & Koskela (1995) footnote on p.38)

In the case of (g), the social security contributions have no affect on price or the amount of production, but only on the profits of enterprises. See Rantala (1995) Appendix/Liite 1, where the unit costs of production are presented in the cases of principles (a), (d), (f) and (g), or Appendix 6 of this study.

The wage drift is a natural consequence of varying economic conditions. However, it is not a controlled way for stabilising purposes. Contract wages have macroeconomic effects and long delay. Wage drift may be excessive and it is flexible mainly upwards, which accelerates inflation. The suggested control of the labour costs of enterprises offers an additional possibility to manipulate wages, wage drifts, and as a consequence, inflation and interest rate.

We could also achieve a suitable flexibility, if the value-add tax is set to depend on the capital intensity of the firm (e.g. in the percentage interval 18%

... 26%). This corresponds to the principle (f) above and therefore affects unit production costs similarly as if the social security contributions were based on salaries (see Rantala (1995) Appendix/Liite 1 p.57). This principle would give a simple method to favour labour-intensive enterprises over capital-intensive ones. If VAT is set to depend on the measured capital of an enterprise, it would mean a dynamic value added tax.

Many different value added tax rates are used in the EU countries. In Finland, we apply three different rates, namely 0%, 12%, 17%, and 22%. As far as the author knows, no country utilises a dynamic value added tax.

The flexibility in all costs of enterprises is essential for their competitiveness in the future. It could decrease many unnecessary business failures. The main advantages of flexibility in labour costs (and renewing the taxation of wages) for enterprises would be the following: non-wage labour costs become better synchronised with income, financing becomes easier, the variation in profits becomes smaller, it becomes easier to carry out a reasonable personnel policy and enterprises would have motivated and skilled labour. All these consequences take place automatically without active decisions of politicians. These consequences form the basis of why we speak about the adaptive control of labour costs.

The flexibility of labour costs has a considerable impact on employment as we will later show in chapter 4. Our results are based on the estimates presented in Holm & Honkapohja & Koskela (1995), and Rantala (1995).

We claimed above that the controlling of labour costs according to the fluctuating economic conditions could have a favourable effect on wage drift, interest rate and inflation level. Wage drift is restrained, fluctuations in interest rates become smaller and inflation becomes lower. Inflation and wage drift have created big problems to the Finnish economy as can be ascertained from the history of devaluation's of FIM. We do not analyse these relations and dependencies in this study. It could be, however, a very interesting topic for further research.

A.4 The control of labour costs

An enterprise wants to control and minimise its costs. Society is interested in the controlling of the economy for the welfare of all citizens. In our study, by the control of labour costs we mean an activity that manipulates these costs according to the varying economic conditions. Our purpose is to improve the performance of the economy. Society derives advantages from the high profitability of an enterprise, and on the other hand, recovery takes place automatically in the form of lower labour costs in a recession.

The supervision of the economy in Finland is not very good. During the last boom (1985 -91), wage drift was great, interest rates and inflation high etc. Active control of labour costs that we will suggest may diminish these problems. See the analysis of wages and employment in Pehkonen (1990) or

Tyrväinen (1995), and about the crisis of the Finnish economy in Honkapohja & Koskela (1993), Honkapohja & Koskela & Paunio (1994), Tyrväinen (1994 & 1995).

Our method to actively control labour costs of an enterprise is based on a system theoretic approach. We think that an enterprise is an input-output system with some limitations. We will apply the same ideas as used in the controlling of industrial processes. Technical insight into this subject can be found in any textbook of control theory; we refer to Stephanopoulos (1984), Åström & Wittenmark (1982), Franklin & Powell. (1980). The economic point of view can be found in Maciariello & Kirby (1994).

In our model, to control the labour costs, society sets the principles or control parameters used in the model. The control parameters determine how the economic situation affects the labour costs. Our purpose is to add flexibility to the labour costs via adaptive control, which offers a tool to retard undesirable effects in booms and recover recessions, automatically. Our solution is just one attempt to build the control system. Our goal is to show that we can improve the working of an economy by using adaptive control to manipulate labour costs of enterprises.

Our basic (or measured) variable in the controlling of labour costs is the share of wages in the value added of the enterprise - we refer to it by **Sal%**. This quantity varies with cyclical economic trends. It gets lower values during a boom than in a recession. It is also a measure for the capital intensity of the enterprise. A feature in our model is that we set higher non-wage labour costs for capital intensive (or good profitable) firms than for labour intensive firms (or firms having temporary problems in profitability). At the same time, we take into account the capital intensity of the firm and the economic situation.

We already mentioned in section A.2 above, that some suggested principles to determine the amount of non-wage labour costs of enterprises bring some flexibility into them. However, I have not found another research or models in addition to our model where adaptive control of labour costs is used, and where this principle has been used at enterprise level i.e. at microeconomic level. A macroeconomic view (without active control of labour costs) can be found in Honkapohja & Koskela (1990), Holm & Honkapohja & Koskela (1990 & 1993 & 1995), Hart (1989 & 1994), Holm & Koskela (1995a & b). Rantala (1995) shows how some principles in determining social security costs impact on unit production costs and the amount of production of an enterprise.

The flexibility of labour costs (as a consequence of adaptive control) gives certain advantages to enterprises (see sections A.3 and A.6). The benefits to the society are:

(1) tax revenues (based on wages) increase with the profitability of enterprises,

(2) recovery from depression (and retardation during boom) takes place automatically,

(3) an automatic stabilising mechanism in business cycles:
  * lower wage drift in booms,
  * lower or more even inflation,

(4) higher employment.

Advantages (1) and (2) take place both at macro- and microeconomic levels. We do not analyse the point (3) closer here and therefore, these statements only are probable outcomes. Naturally, we have no registered data for (3). Presumably, the effect on wage drift is about the same as the effect on wage setting, which has been analysed extensively. A survey on this subject can be found in Pehkonen (1991). We refer also to Tyrväinen (1995) and Rantala (1995).

For the sensitivity of labour costs with respect to fluctuations in the value added of an enterprise when the proposed system is applied, see §2.4 and §3.1 below.

A.5 Employment and labour costs

The main goal of our study is to introduce a model for adaptive control of the labour costs of an enterprise. This system could improve the performance of the economy and reduce the massive unemployment in Finland (SVT 2000, Table 349: 11.7% in 1992, 16.3% in 1993, 16.6% in 1994, 14.6% in 1996, 10.2% in 1999, about 9% in 2000) and perhaps also in other countries.

We have not developed our own environment to estimate the effects on unemployment specifically in the case where the proposed system is applied. It can be done later and in some other context. It has been possible to use the results of former publications. As mentioned earlier, Holm & Honkapohja & Koskela (1995) - henceforth abbreviated as HHK - have done studies where the impacts on employment have been analysed when social security contributions are reduced. Rantala (1995) presents estimates of the effects employers' social security contributions have on corporate profitability and employment in some central Finnish industrial branches.

In HHK, estimates are presented in four different ways to collect the social security contributions (the cases (a) - (c) mentioned in section A.3, and a general 1% drop in the contribution rate). Case (b) comes closest to the way used in our model. Therefore we will apply (in chapter 4) the estimates got in HHK for case (b). The difference between the approaches is that we use the capital intensity of enterprises instead of the industrial branches used in HHK.

It is presumable that the effects on unemployment are stronger in our model than in the case (b) used in HHK. Therefore the results we present in chapter 4 should be convincing. A question that could be rised here is, whether the results of HHK can be applied to such big changes as we propose and demonstrate in our model.

Rantala (1995) determines the direct impact on employment by using an econometric model. Firstly, he reports the elasticity of production volume with respect to **SoCs**, secondly the elasticity of labour input corresponding the production, and finally the elasticity of employment with respect to labour input. The effect of **SoCs** on employment he gets by multiplying the three elasticities.

In our model, we use the adaptive control of labour costs. Our results imply that if the structure of these costs is changed as we mentioned in section 1, unemployment will then be reduced from 80 000 to 170 000 people (or 3.3% ... 7.1%). These estimates are based on the results in HHK (more closely in the chapter 4). This decrease in unemployment corresponds to 4.8 -10.2 Billion FIM (≈ 0.8 - 1.7 Billion €) aggregate savings for the state per year. These calculations are based on the fact that (in year 1996) the aggregate unemployment costs were 27 Billion FIM, 60000 FIM for each unemployed people.

A.6 Principles for flexibility and control of labour costs

We seek solutions for two main problems. Firstly enterprises need more flexibility in their labour costs. Secondly people are not willing to work or develop their professional skills because of the high taxation of salaries. The taxation of salary income should be renewed and flexibility should be added to enterprises' labour costs as much as possible. We suggest the following two principles to achieve these goals:

(i) The income taxes of individuals should be determined by a linear scale, and the social benefits of people should be connected with their taxes in order to make the supervision possible.

(ii) Other labour costs than salary costs should be tied to the variations of the value added of an enterprise, and the rate of these payments should be determined by the share of the salaries in the value added and salaries (see §§ 1.1 & 1.2).

By following the principle **(i),** we can improve the motivation to work by reducing the high taxation or social benefits. The principle **(ii)** means that capital-intensive enterprises (CI firms) have to pay proportionally more social security contributions than labour-intensive enterprises (LI firms). Principle **(ii)** adds the desired flexibility to the labour costs of an enterprise.

The main advantages for an enterprise would be the following:

(1) non-wage labour costs are better synchronised with the revenues of the firm,
(2) variations in need of working capital become smaller,
(3) variation in profit becomes smaller,
(4) it becomes easier to carry out reasonable personnel policy,
(5) the enterprise will have better motivated and skilled employees.

All actions (1) ... (5) take place automatically without active political decisions. These consequences, especially (1) and (3), form the basis of why we use the term **adaptive control**. Our qualitative and quantitative results concerning these claims we present in the chapter 3 using simple simulations. In addition, we return to these themes in the chapter 6.

1 NUMERICAL MODELS

Now we move on to the numerical realisation of our ideas. The goal is to design simple formulas for calculating the non-wage labour costs of an enterprise. We will also consider how these payments should depend upon the labour intensity of an enterprise and on its salaries. In addition, we will make some remarks concerning part-time work, unemployment of young people and working hours and age.

We emphasise that the numerical solutions presented are only a sample of many alternatives. In our model, there exist some parameters, which control these effects. In simulations, these parameters have to be fixed and, in practical applications, calibrated to the right values for desired effects. In our simulations we have selected certain parameter values in order to show their effects on the firm's profitability and to present the properties of the new model.

We simplify the economic quantities of an enterprise and use the following variables and notations: (See Appendix 7 for conventional formulas for these variables)

Tover	=	turnover of a firm, or gross value of the production of a firm
Vadd	=	value added of a firm
Purch	=	purchases, materials, etc; all costs of a firm so that the formula (1-1a) is valid
Sal	=	net salary, net wage, take-home pay (of an individual employee/worker)
SRef	=	reference value for **Sal**; e.g. average salary in industry
SSal	=	sum of net salaries (and wages) of a firm
Sal%	=	share of the **SSal** in the value added of a firm
SRef%	=	reference value for **Sal%**; (at this point the factor **CCf** = 1, see below)
SoC	=	the amount of non-wage labour cost (of an individual employee); indirect labour costs; social security costs
SSoC	=	sum of individual **SoCs** of a firm
Bas	=	basic percentage for calculating **SoCs**

Here we have the relations (see SVT 1995, Table 150)

(1-1a) **Vadd** = **Tover - Purch**

(1-1b) **Sal%** = 100* **SSal / Vadd**

(1-1c) **SoC** = **Bas * Sal**

In our simulations, we use **Bas** = 0.6 as a reference value to calculate the present social security contributions. The exact value of **Bas** (0.6) is not essential. The results would remain the same independent of this specific value. Nowadays, the value of **Bas** may depend on the industrial branch or on the size of the enterprise. In our model, the industry dependence occurs in the form of the correction factor, which is determined by the capital intensity of the enterprise.

To add flexibility to non-wage labour costs, we introduce an Adaptive Correction factor, **AdCf.** We will add it to the formula (1-1c) to control the amount of these costs:

(1-2) **SoC** = **AdCf * Bas * Sal**

This correction factor **AdCf** we set to depend on

(1) the labour intensity of the firm (**Sal%**) and
(2) salaries of the employees (**Sal**'s) of the firm in question

or other possible data e.g. the age of the employee, the number of part-time working hours etc. (see §1.2 and 1.3).

For our purposes also, we define two types of correction or scaling factors, namely the **C**apital **C**orrection factor, **CCf**, and the **S**alary **C**orrection factor, **SCf**. We calculate these separately and combine their effects by using the product form as it is common in the analysis of time series and get **AdCf**:

(1-3) **AdCf** = **CCf * SCf**

CCf will depend on the capital intensity of the firm, and **SCf** depends on salaries and is determined for each employee individually.

1.1 Share of labour costs

The share of net wage costs in the value added, **Sal%**, is one of our basic variables. We use **Sal%** to realise the principles in **(ii)** concerning the idea to take the labour intensity of the enterprise or its capital intensity into account. This percentage value depends on the varying market conditions and economic activities. As a consequence, enterprises will have some flexibility in their labour costs.

In our simulations, we have used many different types of capital correction factors (**CCf**). Here we present and use the following types: (**C_1, C_2, C_3, D_1, D_2, K** being constants)

$$CCf = C_1 \exp(-C_2 * Sal\%) + C_3$$

(1-4) $$CCf = D_1 - D_2 * Sal\%$$

$$CCf = \exp(K*(Sal\% - SRef\%))$$

In the last formula, **SRef%** means a reference value for **Sal%**, when **Sref% = Sal%**, **CCf** =1. The exponential form of the correction factor (see 1-4 and 1-4a&b) has such an advantage that the relative change with respect to the salary remains constant. The exact expressions we use for these factors are:

(1-4a) **CCf1** $= 0.26 + \exp(-0.01*Sal\%) \approx \exp(-0.0077*(Sal\% -30))$

(1-4b) **CCf2** $= 1.35 * \exp(-0.01*Sal\%)$

(1-4c) **CCf3** $= 1.30 - 0.01*Sal\%$

In Appendix 1, we present the factors **CCf1-3** as curves. In the following table, there are the numerical values of these correction factors for some argument values of **Sal%**.

Example 1.1 Capital correction factor values

Sal%	0	5	10	15	20	25	30	35	40	45	50	60
CCf1	1.26	1.21	1.16	1.12	1.08	1.04	1.00	0.96	0.93	0.90	0.87	0.81
CCf2	1.35	1.28	1.22	1.16	1.11	1.05	1.00	0.95	0.90	0.86	0.82	0.74
CCf3	1.30	1.25	1.20	1.15	1.10	1.05	1.00	0.95	0.90	0.85	0.80	0.70

Here the value **Sal%** =30 is our reference point since at that point, the correction factors **CCf1-3** have the value 1. The values in the table mean that in practical cases, the non-wage labour costs of a firm may be about 20% higher or 20% lower than in the reference case. The exact reference point **Sal%**=30 used by us is not essential - it only serves our numerical simulations (see also § 2.3).

The presented **CCf** versions (1-4a , 4b, 4c) have somewhat different properties with respect to the variations in **Sal%**. See §3.1.

Low **Sal%** values occur, for example, in paper, chemical, and basic metal industrial branches where the **Sal%** value is about 10% -20%, and high **Sal%** values occur typically in services and in small and medium-sized firms. See TABLE A.2 and the appendixes 5.1-5.3.

Remark. In practice, the shortest period in calculating **Sal%** (and other quantities) is one month since it is the current period of paying taxes and **SoCs**. For confining to reasonable values for **Sal%,** we then have to use a suitable moving average for **Vadd**. Perhaps **Vadd** should be calculated as "an artificial value added" using the gross value of production (instead of the turnover) in that month. See also § 6.4.

1.2 Non-wage labour costs and salary

Now we raise the question of how non-wage labour costs, the abbreviations being **SoC** and **SSoc**, should depend on salaries. We presented earlier (see **(i)** and **(ii)**) that the progressive scale in the taxation of salary income should be replaced by a progressive scale to determine the amount of **SoC**s.

We take a reference level for salaries - we refer to it by **SRef**. It could be, for example, the average salary in industry. In our model it is a system parameter and can be used as a control parameter in economic policy. Using the relative salary **Qs** = **Sal/SRef,** we define the "Salary-dependent Correction factor" **SCf** as a function of the ratio **Qs**: (**D_1, D_2** being constants)

(1-5a) **SCf** $= \mathbf{SCf1} = 1 + \mathbf{D_1}\,(2/\pi)\arctan(\mathbf{D_2}\,(\mathbf{Qs}-1))$

(1-5b) **SCf** $= \mathbf{SCf2} = 1 + \mathbf{D_1}\,(2/\pi)\arctan(\mathbf{D_2}\,(1-\mathbf{Qs}^{-1})\;|\mathbf{Qs}-1|\;)$

In our simulations, we use the following special case **(SCf = SCf3):**

If **Qs** <1 that is **Sal** < **SRef** , then

(1-6a) **SCf3** $= 1 + \mathbf{D_1}\,(2/\pi)\arctan(\,\mathbf{D_2}\,(1-\mathbf{Qs}^{-1})\,)$; $(\mathbf{D_1} = 1.0,\ \mathbf{D_2} = 2)$

and if **Qs** ≥1 that is **Sal** ≥ **SRef** , then

(1-6b) **SCf3** $= 1 + \mathbf{D_1}\,(2/\pi)\arctan(\mathbf{D_3}\,(\,\mathbf{Qs}-1\,)\,)$; $(\mathbf{D_1} = 1.0,\ \mathbf{D_3} = \sqrt{2})$

In all cases **SCf** = 1 when **Qs** = 1 (i.e. **Sal** = **SRef**). The range of **SCf3** is the interval 0 < **SCf** < 2 if $\mathbf{D_1} = 1$. The factor value $\mathbf{D_2} > 1$ speeds up the correction effect (i.e. progression) if compared with the case $\mathbf{D_2} = 1$. The range of the factor **SCf2** (and **SCf3**) is $1-\mathbf{D_1} < \mathbf{SCf2} < 1+\mathbf{D_1}$ and the range of **SCf1** is $1-0.5\,\mathbf{D_1} < \mathbf{SCf1} < 1+\mathbf{D_1}$.

Example 1.2 The following table pesents numerical correction factor values. For the factors **SCf1** and **SCf2** in (1 -5a & 5b), the reference salary **SRef** =10 000 FIM (≈ 1 682 €) /month and the parameter values $\mathbf{D_1} = \mathbf{D_2} = 1$ have been used. For **SCf3** we use the same reference salary:

Sal	0	2	4	6	8	10	12	14	16	20	24	32	40
SCf1	0.50	0.57	0.66	0.76	0.87	1.00	1.13	1.24	1.34	1.50	1.61	1.73	1.80
SCf2	0.00	0.19	0.53	0.83	0.97	1.00	1.02	1.07	1.14	1.30	1.44	1.63	1.73
SCf3	0.00	0.08	0.20	0.41	0.70	1.00	1.18	1.33	1.45	1.61	1.70	1.80	1.85

In Appendices 1.1 and 1.2, the graphic representations of some alternatives of these correction factors are presented.

Part-time work

The correction factors (1-5 & 6) have values below one (**SCf** <1) when **Qs** < 1 (i.e. **Sal<SRef**), and will create a lowered contribution rate. However, in the case of part-time work, it might be reasonable to apply a higher rate. The right level would be the level which is calculated according to the corresponding full-time salary. If we use the notation **hh** for the number of weekly working hours, and **Ft** for the full-time reference (e.g. 40 h), the correction factor **SCf** is then calculated by using the corresponding full-time salary:

(1-7) **(Ft / hh) *Sal**

This practice guarantees that if the total salary consists of many part-time jobs, the sum of separate social security contributions will be about the same as in the case of one job with the same total salary.

Part-time work is often urgent and intense compared with work under contract but the earnings of employees may be low. This may cause a need for social support from the society. On the other hand, part-time work is often profitable for the employer who therefore is ready to pay the proposed "increase" in social security contributions.

Example 1.3 The following table demonstrates this principle of calculating the non-wage labour costs of part-time work. Here we use the reference value **SRef** =10 000 FIM = 1 682 € /month, the parameter values $D_1 = D_2 = 1$, (**CCf** =1 for simplicity) and the notation **Qh = hh/Ft.**

TABLE 1.1 Non-wage labour costs of part-time work

Sal		4 000 / 673 FIM/€	6 000 / 1009 FIM/€	8 000 / 1346 FIM/€	10 000 / 1682 FIM/€
Qh=1	SCf1	0.66	0.76	0.87	1.0
	SCf2	0.53	0.83	0.97	1.0
Qh=0.8	**Sal** scaled	5 000 / 841	7 500 / 1261	10 000 / 1682	12 500 / 2102
	SCf1	0.70	0.84	1.0	1.16
	SCf2	0.70	0.95	1.0	1.03
Qh=0.6	**Sal** scaled	6 667 / 1121	10 000 / 1682	13 333 / 2242	16 667 / 2803
	SCf1	0.80	1.0	1.2	1.37
	SCf2	0.89	1.0	1.05	1.17

Social security payments in these three cases would be: (**SCf** * 0.6 * **Sal**)

TABLE 1.2 Non-wage labour costs of part-time work

Sal		4 000 / 673 FIM/€	6 000 /1009 FIM/€	8 000 /1346 FIM/€	10 000 / 1682 FIM/€
Qh=1	SCf1	1 584 / 266	2 736 / 460	4 176 / 702	6 000 / 1009
	SCf2	1 272 / 214	2 988 / 503	4 656 / 783	6 000 / 1009
Qh=0.8	SCf1	1 680 / 283	3 024 / 509	4 800 / 807	6 960 / 1171
	SCf2	1 680 / 283	3 420 / 575	4 800 / 807	6 180 / 1039
Qh=0.6	SCf1	1 920 / 323	3 600 / 605	5 760 / 969	8 220 / 1383
	SCf2	2 136 / 359	3 600 / 605	5 040 / 848	7 020 /1181

1.3 Dependence on age

Perhaps the most undesirable feature of the Finnish unemployment is the remarkable percentage of young people among unemployed. There exist arguments for additional support to employ them. For this purpose, the control of social security contributions provides good opportunities.

Contribution rate and age

The payment rate could depend on the age of the employee. For example, we could apply a stepwise increasing scale in social security payments. Using 5% yearly steps we will get the following rates:

Age [a]	18	20	25	30	>30
Level [%]	40	50	75	100	100

Instead of this principle of taking the age of each employee into account, we could use the average age of the employees in a firm (see §3.5).

Working hours and age

Many employees have problems with giving their 100% contribution to work until the age of retirement. However, the amount of the pension income depends heavily on the earnings of the last few years before retirement. Therefore, the employees have the additional stress of trying to earn a good salary during these years. A solution to this problem is that the pension is determined by the cumulative earnings of the employee.

Furthermore we could consider decreasing working hours. We could ease the work load before retirement. Every year an individual, beginning at the age of 45, could decrease by 2% her/his yearly working hours:

Age [a]	45	49	54	59	64
Level [%]	98	90	80	70	60

This means a kind of stepwise retirement. It roughly releases work by the amount which corresponds to an average of 20% during 20 years. This means a total amount of 4 years of work. This increases employment because more people will get work.

If the pension is determined by the cumulative earnings, the above principle does not mean a big change. Perhaps then employees would more often maintain their working ability until the normal retirement age.

The salary structure of the civil servants today is quite peculiar. The work of many is highly standardised (e.g. a teachers' duty is to give a certain number of lectures). However, a young civil servant has a salary that is only two thirds of that of a middle-aged official. This proportion may not be the most effective or fair one.

1.4 Adaptive control

Now we will briefly explain why we use the term adaptive control - a more exact representation will be given later in chapter 2. In the control theory, adaptive control means that the controller takes into account the overall situation and adjusts one or more parameters used in the controlling and, as a consequence, to change the properties of the controller (see e.g. Stephanopoulos (1984)).

In our model, we have several variables. A part of them will change according to variations in the market conditions. The main variable in our model is the percentage of salaries in the value added of a firm, **Sal**%. Many things give rise to variations in **Sal**%:
(See A.6)

- **(ii-1)** cyclical trends and economic activities
- **(ii-2)** variations in the economic state of the enterprise
- **(ii-3)** seasonal variations in the turnover of the enterprise
- **(ii-4)** the employing efforts (or labour intensity) of the enterprise

The fluctuations in **Sal**% will change the correction factor **CCf** used when calculating the social security contributions (**SoC**s).

In our model, we use an additional parameter to control non-wage labour costs. It is the salary **ref**erence, **SRef**. **SRef** itself can be adjusted automatically: it can be the average salary in industry, or it can remain as a pure control parameter of economic policy. Adjustment of this parameter corresponds to the correction of the scale of taxation (e.g. compensation of inflation etc.).

We use the relative difference between **Sal** and **SRef** to determine the salary correction factor (**SCf**). This is how we create progression into the taxation system. Income taxes are determined on a linear scale where a special case is that tax rate is 0%. Non-wage labour costs are determined both on a progressive scale with respect to the salaries (**SCf** –effect) and on a special scale with respect to the capital intensity (**Sal%**) of the firm in question (see § 1.1 and the formulas (1-2) and (1-3)).

2 CONTROL SYSTEM

In a control system we have an object to be controlled and a control strategy for doing it. The simplest case has the form presented in FIGURE 2.1. There we have the set value (**s**) and the measured value (**m**). The purpose (or the control strategy) is that the error term **e = m - s** will remain as small as possible or zero. For this purpose we need a control unit that follows the error term **e** and makes corrections (in the controllers output **c**) to achieve the desired situation. The controller output signal is **c** and it maintains the state of the object i.e. affects the value of **m:**

- **m** = the measured state of the object (for example, liquid level in a tank), the controlled variable
- **s** = set value, the desired or target value of the controlled variable **m** (the desired level of liquid in a tank),
- **e** = error value, the difference between the measured and the desired values of the controlled variable, **e = m - s**
- **c** = control, the output of the controller in order to maintain the state of the object or the value of the variable **m** as close to **s** as possible

These four variables **s, m, e** and **c** may be thought to be real numbers with proper units.

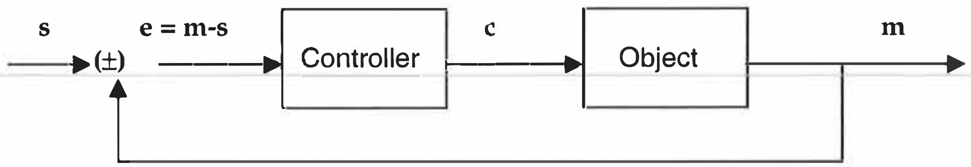

FIGURE 2.1 A simple control system

In our system theoretical approach (to control labour costs of enterprises), we have a more complicated situation than in FIGURE 2.1 where we have the control configuration of *single-input, single-output* (SISO system). We confine to the case where we think that our objects are enterprises with a plenty of different kinds of inputs and outputs. In FIGURE 2.2 we have such a multivariable (*multiple-input, multiple-output*, MIMO) system.

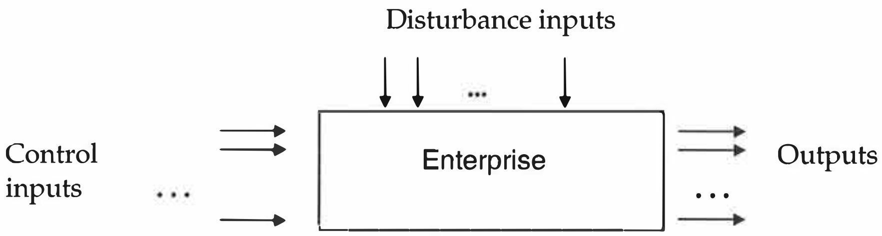

FIGURE 2.2 Enterprise as a system object

An *output* of an enterprise is, for example, turnover, sum of contracts, sum of purchases, salaries, social security contributions, interest payments, tax payments etc. All or some of the system outputs are to be maintained at the desired values. When inputs change, one or many of the outputs may change. This input may be further classified as *control inputs* and *disturbance inputs*.

A control input is called a manipulated variable. The value of this variable (**c**) is changed by the controller to maintain the object output (**m**) as close to its target value as possible.

Disturbance inputs are all other inputs that affect the outputs some way. These inputs often cause unwanted changes in outputs. In our case, they can be raw material costs, rates of interest, changes in labour costs, varying market conditions, changing directives etc.

In FIGURE 2.1, we have a *feedback control configuration* since we use direct measurements of the controlled variables to adjust the values of the manipulated variables. The name *inferential control configuration* is used if one cannot measure the controlled variables but uses some estimates or approximate values for them. These estimates may be calculated by using some mathematical, often simplified models for the system under control.

In *feedforward control configuration* we use direct measurement of disturbances to adjust the values of the manipulated variables. The control unit operates between the disturbances and control input.
(See e.g. Stephanopoulos (1984) parts I and II)

2.1 The Input-Output Model

In chapter 1, we presented a model to control or adjust the non-wage labour costs of an enterprise. For this we introduced some variables. Naturally, we can measure many more variables of an enterprise, but we concentrate only on those, which we need in our model. Our system's output variables are the following

Tover, Vadd, Sal's, SSal, Sal%, SoCs, SSoC,

and control input variables the following

CCf, SCf, AdCf, Bas,

and **Purch** is a control disturbance.

The variables **Bas, SRef** and **SRef%** are the main control parameters of the control block. They are economic policy variables. The controller calculates the values of the variables **CCf, SCf, AdCf** by using the values of the outputs of the enterprise, and the values of the control parameters. The numerical model we presented in chapter 1 can be expressed in the form of FIGURE 2.3.

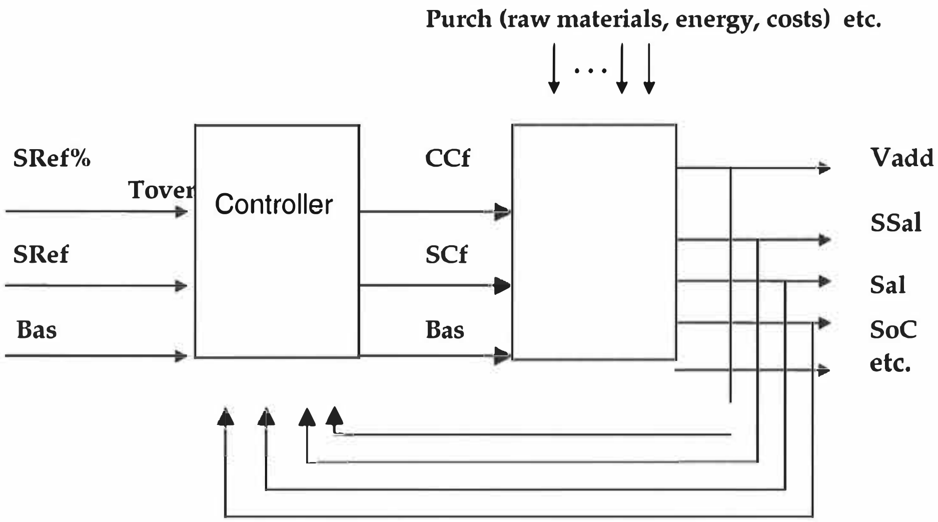

FIGURE 2.3 Control configuration to adjust the SoCs

The configuration in FIGURE 2.3 is not, however, a standard control system however since in the strict sense we do not have any set values. This can be clarified by a closer analysis.

We add details to the configuration of FIGURE 2.2. Every enterprise has goals and a strategy to achieve them. The owners set goals, strategy and resources and supervise the results of the operations. A schematic diagram for this is presented in FIGURE 2.4.

Next, we combine the control configuration in FIGURE 2.4 with the one in FIGURE 2.3. The idea is that the feedback information is used to adjust the properties of the controller in the FIGURE 2.4. We thus add an adjusting mechanism that uses the feedback information and other parameters and variables to calculate the new values of the controller parameters. It means that changes in outputs may induce changes in control parameters and furthermore in values of some output variables. Here we do not have exact preset values that are typical in process control. Instead, the owners' main goal is to get high or at least competitive profits for their investments. Other goals may be strategic, e.g. to get a higher portion of the market, high investments in research and development for future growth or competitiveness, good personnel policy, investments in know how, etc. See FIGURE 2.5.

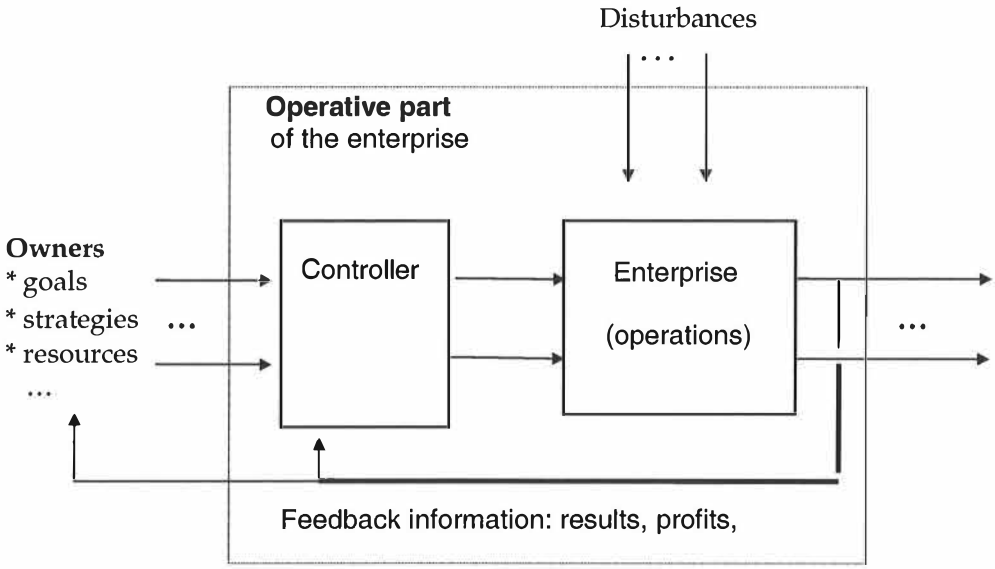

FIGURE 2.4 The configuration of an enterprise as a control system

In our application, we want to manipulate the labour costs of an enterprise. We do it by using the two correcting factors **CCf** and **SCf.** They depend on the labour intensity of the enterprise and the salaries of employees as presented below. We use in our simulations the following formulas for them: (See formulas (1-5 & 6), §1.2)

$$\text{(2-1)} \quad \mathbf{CCf} = 0.26 + \exp(-0.01 * \mathbf{Sal\%})$$

$$\text{(2-2)} \quad \mathbf{SCf} = \begin{cases} 1 + \mathbf{D_1}\, 2/\pi \ \arctan(\mathbf{D_2}\,(1 - \mathbf{SRef} / \mathbf{Sal})), & \text{when } \mathbf{Sal} \le \mathbf{SRef}, \\ 1 + \mathbf{D_1}\, 2/\pi \ \arctan(\mathbf{D_3}\,(\mathbf{Sal} / \mathbf{SRef} - 1)), & \text{when } \mathbf{Sal} > \mathbf{SRef}, \end{cases}$$

Most numerical results are calculated by using the values $\mathbf{D_1} = 1$, $\mathbf{D_2} = 2$ and $\mathbf{D_3} = \sqrt{2}$.

The configuration in FIGURE 2.5 (next page) comes very close to the so-called adaptive control mechanism utilised in industrial applications. This is the reason for us using the expression "adaptive control of labour costs of an enterprise". See Franklin & Powell (1980), Stephanopoulos (1984) or Åström & Wittenmark (1982). The owners set the goals and control the strategy of the enterprise as we discussed above. In the FIGURE 2.5, the parameters **SRef** and **SRef%** are set by the government, whose goals are a bit different from those of the owners of the enterprise. The society naturally benefits from the success of the enterprise but, perhaps, a more important factor is good employment situation, and therefore, it is reasonable to actively control the labour force costs. We can summarise the situation so that the goal of the government is high employment in our control loop (Fig. 2.5). Another and more complicated question is that the aggregate tax revenues have to be high enough - labour force taxes can't be minimised to zero. The government has to secure international competitiveness of the economic life, and on the other hand, to arrange the welfare services.

The configurations in FIGUREs 2.3 and 2.5 are slightly reduced or simplified; they do not include the taxation of wages. To the controller block, we can add a control input, **tax%**, that is used to determine these taxes. We suggest and simulate two ways for the taxation of wages:

(1) **tax%** is the same percentage as applied to the capital income,
(2) **tax%** =0% meaning there are no income taxes on wages;
in this case all salary-based payments are paid as **labour force taxes**.

In the controller block, the additional control input **tax%** includes the information needed in the taxation of personal incomes.

Also in the case of (1), we use the concept of labour force taxes. We suggest that an enterprise would handle all non-wage labour costs as an entity, which can be divided into separate parts and purposes by civil servants. thus, we can simplify the present complicated system in order to determine all the separate non-wage labour costs of an enterprise.

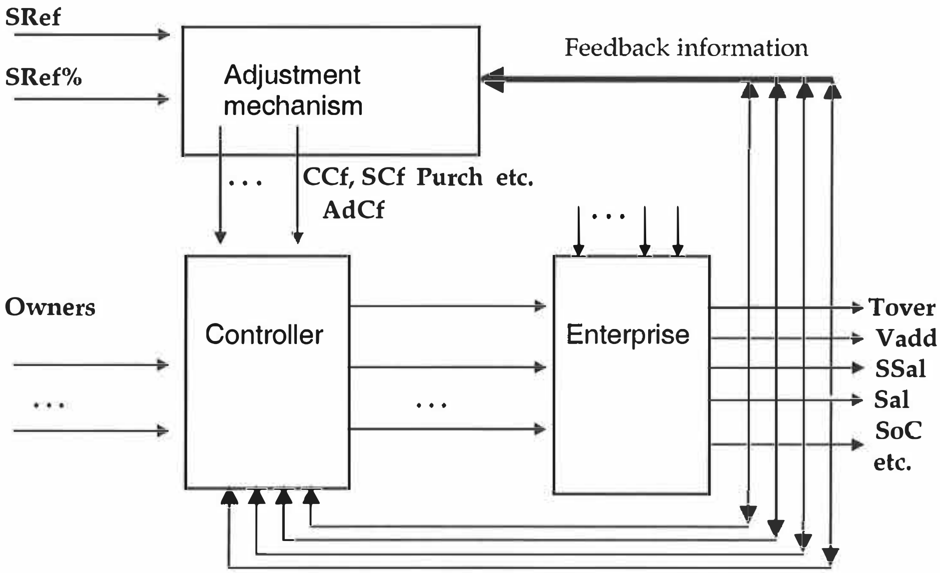

FIGURE 2.5 The configuration of the adaptive control of labour costs

The principles (1) and (2) mean a linear scale in the taxation of wages. In the case of (2), the share of labour costs, the part of the labour costs to which the adaptive control is applied, is as big as possible without affecting the take-home pay of employees. then the enterprise has remarkable flexibility in its labour costs, too. The consequences or advantages of this were listed in the introduction.

In the proposed new system we have a linear scale in the taxation of salary income but a non-linear and progressive scale in the non-wage labour costs.

2.2 Adaptive control

Here we discuss the nature of the control system presented in the section 2.1. An enterprise may be considered to be a (control) system but it is not a conventional control system. Typical of a control system is that we have a set value (**s**) and a controlled quantity (**m**), and the purpose is to keep the value of **m** as close to the value of **s** as possible. In the case of an enterprise, a control strategy of the firm owners is to maximise the profit.

In our study, we have limited ourselves to the control of the labour costs of enterprises. Our goal is to create a new system that would be more favourable for all the main economic players than in the prevailing system. In the new system

* the position of employees is not weaker than in the old one,
* enterprise has some flexibility in their labour costs, and, as a consequence, the variation in its operating profit becomes smaller,
* society derives advantages in the form of a more vigorous and robust economic life.

We argued that we achieve the above goals by changing the structure of the labour costs of an enterprise. Non-wage labour costs are reduced in the lowest and the highest salary classes, and in addition to that, the rate of these costs depends on the capital intensity of the enterprise. Capital-intensive firms will be losers and labour-intensive firms winners in the new system but all enterprises will benefit from the increased flexibility of labour costs.

Position of employees

The position of employees remains somewhat unchanged in the new system since their net earnings and salary-based benefits will be the same or higher than earlier. they get additional benefits from the improved employment and from the linear scale used in the taxation of income. This means that it is possible to become wealthy as an employee. The tax rate percentage of the salary income is the same (or zero) as that of the capital income.

Flexibility in labour costs of enterprises

In the new system, an enterprise's non-wage labour costs will vary with the fluctuations in the value added of the enterprise (see formulas (1-1&2)). The expenditures will be better synchronised with the revenues of the enterprise. an enterprise will pay more labour costs during its profitable periods and less during poor seasons. This helps in conducting a reasonable personnel policy and getting skilled employees.

Economic life becomes more robust against disturbances

The new system utilises flexibility of labour costs and this flexibility affects each enterprise separately. This is important since enterprises and industries differ from each other. the proposed system works better than the present one (in Finland) where the decisions in economic policy affect globally and often come too late to recover or to suppress.

Society profits from decreased unemployment resulting from increased activity in economic life.

An important principle is the unified percentage used for the tax rates of salary and capital income. This has a great social effect.

The adaptability in the new control system thus involves various favourable changes when compared with the current situation.

2.3 Control parameters

The main variables and control parameters of the system for the adaptive control of the non-wage labour costs of enterprise were presented in the section 2.2. Here we make a closer study of these variables.

The main control parameters in the system are **Bas, SRef** and **SRef%**. **Bas** is the overall percentage of the social security contributions of an enterprise. It scales (linearly) all non-wage costs, **SoCs**, as can be seen in the formula (see chapter 1)

(2-3) **SoC = AdCf * Bas * Sal**

SRef sets the reference level of salaries, that is, the point where the salary correction factor **SCf=1** (see §1.2). **SRef%** is used to calibrate the capital correction factor **CCf** so that this factor has the value 1 at the point **SRef%** (see §1.1).

In our simulations, we use the average salary in the industry (**SRef,** about 10 000 FIM = 1 682 € /month in 1996, 2 149 € / month in 2001) as the salary reference. In the proposed system, the same reference level would be

* about 9.000 FIM = 1 514 € / month when we use a 30% unified percent age in the taxation of salaries and
* about 6.300 FIM = 1 060 € / month when we have no taxes on salaries but only labour force taxes.

The reference level for **Sal%** is set to be 30% in our simulations. **Sal%** gives us the share of the sum of net salaries in the value added of the enterprise.

(2-4) **Vadd = Tover - Purch**

(2-5) **Sal% = 100 * SSal / Vadd**

Vadd is the value of the enterprise's production and **SSal** is the total value of net salaries (and wages) of the enterprise. When **Sal% > SRef%** the enterprise has to pay less non-wage labour costs, and when **Sal% < SRef%,** it has to pay more non-wage labour costs than in the case when **Sal% = SRef%**.

The meaning of the variable **Sal%** is fundamental in the proposed system. It presents the share of salaries in the value added of the enterprise, which varies with cyclical trends. The fluctuations in **Sal%** give rise to changes in the correction factor **CCf** (see §1.1, §2.1), and as a consequence, in the sum of the non-wage labour costs of an enterprise. The adaptability property of the proposed system is based on these phenomena.

In principle, the formula of the correction factor **SCf** indicates that yet there exist some other control parameters, namely, the variables $\mathbf{D_1}$, $\mathbf{D_2}$ and $\mathbf{D_3}$. These parameters set the exact form of the used correction factor as a function of the salary **Sal**. The values of these parameters, are, perhaps, not changed as actively as the values of the parameters **Bas, SRef** and **SRef%**. The values of these parameters will be changed by government, only.

For graphic representations, see Appendix 1.

2.4 Control input

The main control inputs, or manipulated variables in the control system 2.5, are **SCf** and **CCf** or their product **AdCf**. The value of **SCf** is calculated for each employee by using the values of **SRef** and the salary (**Sal**) of the employee. The value of **CCf** is calculated by using **Vadd**, **SSal** and **SRef%** and so **CCf** is enterprise-dependent.

Capital Correction factor CCf

In the formula (2-1) of **CCf**, we do not have the reference **SRef%** but we have calibrated the curve so that **CCf** = 1 when **Sal% = SRef%** (= 30%). At the interval 0% < **Sal%** < 60%, **CCf** (=**CCf1**) gets the values

1.26 > **CCf** > 0.81.

The adaptability of our system is based on the fact that the value of **CCf** varies with that of **Sal%**. When the absolute change of **Sal%** is ±1% at a given point of **Sal%**, we get the following changes (Δ**CCf**) in the value of **CCf** (we have used the formula of difference)

TABLE 2.1	Sal% ±1%	10 ±1%	20 ±1%	30 ±1%	40 ±1%	50 ±1%
	ΔCCf [%]	±0.78%	±0.76%	±0.74%	±0.72%	±0.70%

When the relative change of **Sal%** is ±10% (from its starting value), we get

TABLE 2.2	Sal% ± Δ%	10 ±1%	20 ±2%	30 ±3%	40 ±4%	50 ±5%
	ΔCCf [%]	±0.78	±1.5%	±2.2%	±2.9%	±3.5%

These values tell the corresponding changes in the non-wage labour costs according to the formula (2-3), and because of the product form of **AdCf**.

Salary Correction factor SCf

In the formula (2-2) for various **SCf,** we have four parameters: **SRef**, $\mathbf{D_1}$, $\mathbf{D_2}$ and $\mathbf{D_3}$. At the reference point, **Sal = SRef**, the correction factor **SCf** =1. The arcus tangent function in the formula (2-2) gives the factor **SCf** the so called S-form. The range of the function

$(2/\pi)\arctan(x)$, x real,

is the open interval (-1, +1), and thus the range of **SCf** is $(1-\mathbf{D_1}, 1+\mathbf{D_1})$ for **Sal** real.

When **Sal** varies from 0 to 50 000 FIM (≈ 8 400 €) and **SRef** = 10 000 FIM (≈ 1 700 €), the **SCf** varies from about $1-\mathbf{D_1}$ to $1+0.9\,\mathbf{D_1}$. In our simulations, we mainly use the value $\mathbf{D_1}=1$.

The meaning of parameters **D_2** and **D_3** is to weigh the relative differences

1 -**SRef / Sal** and **Sal / SRef** -1

in the formula (2-2). Most numerical results are calculated by using the values **D_1 =**1, **D_2 =**2 and **D_3 =**$\sqrt{2}$.

Adaptive Correction factor AdCf

The adaptive correction factor **AdCf** is the product of the former correction factors

AdCf = CCf * SCf

This factor brings adaptability into the proposed new system by controlling the non-wage labour costs of enterprises. Other factors, e.g. the age dependent factor (see §1.3), can be combined into **AdCf** in the same way. (Graphic representations are Appendix 1)

If **Sal%** =30% , then **CCf** =1 and the value of **AdCf** varies from 0 at **Sal** =0 FIM / € to about 1.8 at **Sal** =30 000 FIM (≈ 5 046 €). Then the non-wage part of the labour costs varies from 0 FIM / € to **Bas***1.8*30 000 FIM = 32 400 FIM (≈ 5 450 €, **Bas** = 60%). This means that we have a great potential in the non-wage costs to be used for the control purposes. From the TABLE 2.2 above we see that in the case **Sal%** =30 ±3%, the change in **SoCs** is ±2.2% e.g. (**Sal** =30 000 FIM ≈ 5 046 €)

SoC = 32 400 ± 713 FIM = 5 450 ± 120 € ,
Sal + SoC = 62 400 ± 713 FIM = 10 495 ± 120 €.

These numerical values correspond to the case when the taxation rate is 30%.

Yet, we have a greater control potential if we use the taxation rate of 0%, i.e. we have no taxes on wages and all taxes are paid as labour force taxes. Thus we have **Sal** = 21 000 FIM = 3 532 € (= net salary = gross salary = 70% of 30 000 FIM = 5 046 €), and the non-wage tax part is about (if we use the same tax revenue) 9 000 + 32 400 FIM
= 1 514 + 5 450 €. As above, we get

SoC = 41 400 ± 911 FIM = 6 963 ± 153 €,
Sal + SoC = 62 400 ± 911 FIM = 10 496 ± 153 €.

As a consequence of this variation in the labour costs, the variation of the enterprise's operating profit becomes smaller.

3 SIMULATION RESULTS

We test and illustrate the ideas presented by numerical simulations. It is done at several phases. First we illustrate separately the effects of capital and salary correction factors, *ceteris paribus,* and then we give examples of the combined effects.

We start by showing the effects of the capital correction factor **CCf**. We freeze the salary correction factor as unity, **SCf** =1, and change the basic level of **Sal**%, the percentage of salaries in the value added of the enterprise, by using 10% steps, and add a cyclical fluctuation into the turnover. This cyclical fluctuation illustrates the varying market conditions due to all possible reasons. The changes in the social security contributions, **SSoC**, can be seen when compared with the present system.

Similarly, we present the effects of the salary-dependent correction factor, **SCf**, generate some salary distributions and calculate the **SSoC** according to the present and the proposed system. Here, for simplicity, we set **CCf** to be a constant. The combined effect of the correction factors is easy to imagine by looking at the formulas (1-2) and (1-3).

As a new aspect, we also calculate the **SSoC** by using the average level of salary in a firm instead of the salaries of individual employees.

3.1 Effects of the capital correction factor

We simplify the calculations by eliminating the long-term trends. We set **Tover** =100, **Purch** = 20, and the six cases we use as starting points in our simulations are (**Bas** = 0.6; see example 1.1):

Tover =100, **Purch** = 20 (**Tover -Purch** =80) and **SSoC** =(**CCf1**)*0.6***SSal**

Sal%	10%	20%	30%	40%	50%	60%
SSal	8	16	24	32	40	48
SSoC (old)	4.8	9.6	14.4	19.2	24	28.8
SSoC (new)	5.59	10.4	14.4	17.9	20.8	23.3
CCf1	1.17	1.08	1.00	0.93	0.87	0.81

The value added is 80 (= **Vadd**). We explain the figures in the fourth column. By using **Sal%=** 40% we get **CCf1** = 0.93 and **SSal** = 40%*80 = 32, the sum of salaries. Furthermore, 60%*32 = 19.2 (= **SSoC)** according to the present system and 0.93*60%*32 = 17.9 according to the proposed system. These values remain constants if no cyclical trends occur.

Now we generate a ±10% sinusoidal fluctuation in the turnover in order to see how this fluctuation changes the values of **SSoC**. One sinusoidal cycle corresponds to one business cycle i.e. expansion, boom, slump, and recession. The results are presented in TABLE 3.1. We will explain the case where **Sal%** =40%. The first line shows that (according to the old system) the mean of **SSoC** is 19.2 and standard deviation 0 since there is no variation in wages. Using the capital correction factor **CCf1** we get the second line. It shows that the mean of **SSoC** (new) is 17.8 , the standard deviation 0.46, the range from 17.1 (minimum value) to 18.4 (maximum value), and the width of the range with respect to the mean value (17.8) is 7.3%.

The graphic representations (concerning TABLE 3.1) are seen in Appendix 2.1.

The relative variation of **SSoC** increases together with **Sal%**. The biggest variation in **SSoC** exists when **CCf3** is used, and the smallest with **CCf1** (see the table of example 1.1).

The relative effects of the correction factors are the smallest with low **Sal%** values. On the other hand, the enterprises with low **Sal%** values may have the biggest variations in their turnovers. In the different cases, the ratios between the widths of ranges of the **SoCs** are nearly the same as the ratios of the corresponding **Sal%** values.

In TABLE 3.1 (and 3.2), we have used **Bas** =60% and the same gross salary values in the old and new systems. Here, the correction factor **CCf** is applied to the sum of the social security contributions. We want to illustrate the dynamic variations of **SSoC** when calculated according the proposed system.

TABLE 3.1 Examples of non-wage labour costs (**SSoC**)

Case or quantity		**Mean**	**STD**	**Range**	**Range** [%]
Basic situation:					
Tover ±10%		100	7.1	90 - 110	20
Vadd ±10%		80	7.1	70 - 90	25
			SSoC		
Case or quantity		**Mean**	**STD**	**Range**	**Range** [%]
Sal% =10%	Old	4.8	0.00		
CCf1		5.59	0.04	5.53 -5.64	2.0
CCf2		5.86	0.05	5.78 -5.93	2.5
CCf3		5.76	0.04	5.69 -5.81	2.1
Sal% =20%	Old	9.6	0.00		
CCf1		10.3	0.14	10.1 -10.5	3.9
CCf2		10.6	0.19	10.3 -10.8	5.1
CCf3		10.5	0.17	10.3 -10.8	4.6
Sal% =30%	Old	14.4	0.00		
CCf1		14.4	0.29	14.0 -14.8	5.6
CCf2		14.4	0.39	13.8 -14.9	7.6
CCf3		14.4	0.39	13.8 -14.9	7.6
Sal% =40%	Old	19.2	0.00		
CCf1		17.8	0.46	17.1 -18.4	7.3
CCf2		17.3	0.62	16.4 -18.2	10.1
CCf3		17.2	0.69	16.2 -18.1	11.3
Sal% =50%	Old	24.0	0.00		
CCf1		20.8	0.65	19.8 -21.6	8.8
CCf2		19.6	0.88	18.3 -20.8	12.6
CCf3		19.1	1.08	17.5 -20.5	15.9
Sal% =60%	Old	28.8	0.00		
CCf1		23.2	0.84	22.0 -24.4	10.3
CCf2		21.3	1.14	19.6 -22.8	15.2
CCf3		20.0	1.55	17.7 -22.1	21.9

Range[%] in TABLE 3.1 has been calculated with respect to the mean value. **STD** refers to standard deviation.

We take another example (TABLE 3.2). Here we use the same basic situation as in the former example but we add a ±20% sinusoidal fluctuation into **Vadd** and **Purch** and a 45^o phase delay in **Purch** with respect to **Tover**. Both variations affect the values of **Vadd**. As numerical results, we only present those obtained by applying **CCf1**: (See Appendix 2.2)

TABLE 3.2 Examples of non-wage labour costs (**SSoC**).

Case\ quantity	**Mean**	**STD**	**Range**	**Range [%]**
Basic situation:				
Tover ±20%	100	14.1	80 - 120	40
Vadd ±20%	80	14.1	60 - 100	50
		SSoC		
Case\ quantity	**Mean**	**STD**	**Range**	**Range [%]**
Sal%=10%	4.8	0.00		
CCf1	5.58	0.07	5.47 -5.67	3.5
Sal%=20%	9.6	0.00		
CCf1	10.3	0.25	9.94 -10.6	6.8
Sal%=30%	14.4	0.00		
CCf1	14.4	0.51	13.6 -15.0	9.9
Sal%=40%	19.2	0.00		
CCf1	17.8	0.82	16.5 -18.8	12.8
Sal%=50%	24.0	0.00		
CCf1	20.7	1.15	18.9 -22.1	15.5
Sal%=60%	28.8	0.00		
CCf1	23.2	1.49	20.9 -25.1	18.0

Range% has been calculated with respect to the mean value. **STD** refers to standard deviation.

The graphic representations are seen in Appendixes 2.1-2.4. In Appendix 2.1 we deal with cases where **Sal%** has the values 10, 20, 30, 40, 50, and in **Tover** there is a ±10% sinusoidal variation and the value of **Purch** = 20. In Appendix 2.2, we have a ±20% cyclical fluctuation in both **Tover** and **Purch** and between them, a 45 degree phase shift (**Purch** has been delayed). In Appendix 2.3, the situation is the same as in 2.2 but **Purch** = 40, and we present the results concerning to two phase shifts (0 and 45 degrees) between **Tover** and **Purch**. In Appendix 2.4, we see the differences when using the correction coefficients **CCf1**, **CCf2** and **CCf3** applied to the case of Appendix 2.3 when no phase shifts occur.

3.2 Changes in taxation and social security contributions

In the taxation of salary income in Finland, a graded scale is used. The tax rate, including the communal rate, varies roughly between 20% and 65% from the gross salary with a progressive scale. The non-wage labour costs mean an additional 60% cost for the employer. We call the sum of these two costs as **labour taxes** or **labour force taxes.** Compared with the net salary (1.000 - 25.000 FIM ≈ 168 - 4 200 €), the prevailing tax rate varies between 80% and 250%. (See Appendix 3.1)

In the proposed model, this structure of labour costs will be radically changed. We prefer a linear scale in the taxation of personal income, and the tax rate used is the same as in the taxation of capital income. The other part of labour costs can be calculated by using a progressive scale, instead of the prevailing linear scale. In our model, the amount of labour tax varies between 60% and 200% (when **CCf** =1) when the net salaries vary between 1 000 - 25 000 FIM ≈ 168 - 4 200 € . The upper limit for the tax rate is about 215% when the formula (1 -6a&b i.e. **SCf3**) is applied with **Bas** =60% and **CCf1** =1.

In the proposed model, labour costs will be reduced for the lowest (1 000 - 6 000 FIM ≈ 170 - 1000 €) and the highest (above 12.000 FIM ≈ 2 000 €) groups of take-home salaries. These limits concern the case when **CCf1** =1. For combined effects with varying **Sal%** , see Appendices 3.1 and 4.1. The main purposes for our selection were

(1) to make it possible to increase the amount of conventional jobs,
(2) to limit labour costs at the highest salary levels in order for enterprises to have better possibilities to hire high-level professionals.

We argue that the only possibility to decrease the high unemployment in Finland is to reduce the labour force costs in the lowest salary groups. This solution compensates the new value added tax set for services in Finland. On the other hand, we also should reduce the labour costs in the highest salary groups to ensure that Finland will develop favourably as a country of high technology. Here we refer to the discussion in chapter 6 concerning the targeting of the labour costs.

3.3 Changes in salary distribution

The use of a unified percentage in the taxation of salary income diminishes the differences in earnings. If we look at the distribution of net salaries and calculate the corresponding distributions of gross salaries with respect to the proposed system and the old one, we see that

(1) the average of (gross) salaries is smaller and
(2) the standard deviation of (gross) salaries is smaller in the new system than in the old one.

An example of salary distribution

The appendices 3 (and 4) show the differences between the proposed and old system as distributions of gross salaries. For the results, we have generated a special sample of net salaries which approximately follows Poisson distribution (1 000 employees), and calculated the corresponding distribution of gross salaries. The numerical results are presented in the TABLEs 3.3 and 3.4. In the first table, the sample means of four distributions of net salaries, and the sample means and standard deviations for the corresponding distributions of gross salaries (with respect to the proposed system and the old one), are shown. (The figures are in units of [1000 FIM] / [1000 €])

TABLE 3.3 Examples of changes in gross salaries.

Net salary	Gross salary	(new, FIM / €)	Gross salary	(old, FIM / €)
Mean [FIM / €]	Mean	STD	mean	STD
5 238 / 881	7 478 / 1 258	2 980 / 501	7 768 / 1 306	3 933 / 661
6 138 / 1 032	8 769 / 1 475	3 659 / 615	9 514 / 1 600	5 069 / 853
7 502 / 1 262	10 724 / 1 804	4 573 / 769	12 316 / 2 071	6 719 / 1 130
8 899 / 1 497	12 270 / 2 064	5 322 / 895	15 305 / 2 574	8 173 / 1 375

The proposed model implies smaller sample means and standard deviations of gross salaries.

In the second table (TABLE 3.4), one sees the differences between the proposed and the old system with regard to labour force costs. Figures correspond to the second line in the TABLE 3.3 and are marked in units of [Million FIM / €] (1000 employees) or can be considered as average labour costs of one employee in units of [1000 FIM / €] . From this we can see the effect of the capital correction factor on the total labour costs at the enterprise level. Although the capital correction factor varies from 0.87 to 1.12 (about ±13%), the total labour costs only vary from -5.7% to +4.9% when compared with the values in the old system.

TABLE 3.4 Examples of total labour costs [Million FIM / €].

		Gross	salary	Non-wage	costs	Total	costs	Change
Sal%	CCf	Old	new	Old	new	Old	new	± [%]
15%	1.12	9.514	8.769	5.708	7.197	15.222	15.966	+4.9%
		1.600	1.475	0.960	1.210	2.560	2.685	
30%	1.00	9.514	8.769	5.708	6.426	15.222	15.195	-0.18%
		1.600	1.475	0.960	1.081	2.560	2.556	
50%	0.87	9.514	8.769	5.708	5.590	15.222	14.360	-5.7%
		1.600	1.475	0.960	0.940	2.560	2.415	

SCf calculated from the average salary

The following numerical results originate from the same case as in the TABLE 3.4 but now the non-wage costs are calculated by using the correction factor **SCf3** (**SRef** = 9 000 FIM ≈ 1 500 €) applied on the average salary of the firm (8.769 FIM / 1.475 € in the table). Here we also use the adaptive correction factor, **AdCf = CCf1*SCf3.**

TABLE 3.5 Examples of total salary costs [Million FIM / €].

		Gross salary		Non-wage costs		Total costs		Change
Sal%	**AdCf**	**old**	**new**	**old**	**new**	**old**	**new**	± [%]
15%	1.091	9.514	8.769	5.708	6.888	15.222	15.657	+2.9%
		1.600	1.475	0.960	1.158	2.560	2.633	
30%	0.974	9.514	8.769	5.708	6.150	15.222	14.919	-2.0%
		1.600	1.475	0.960	1.034	2.560	2.509	
50%	0.847	9.514	8.769	5.708	5.348	15.222	14.117	-7.3%
		1.600	1.475	0.960	0.899	2.560	2.374	

The labour costs are lower when we use the average salary for calculating the rate of **SSoC**, if compared with **SSoC** calculated by using the separate salaries. This principle would create the possibility that an employer could pay good salaries to firm's key persons.

Remark 3.1 We have calibrated the system parameters (TABLEs 3.3 -3.5) so that the revenues of the society are about the same in both systems in the case where **CCf** =1. The parameter values we have used for **SCf3** are **Bas** =0.72, $\mathbf{D_1}$ =0.7854 ≈ π/4, $\mathbf{D_2}$ =2 , $\mathbf{D_3}$ =√2, **Tax%** = 30% (in the proposed system).

3.4 All taxes paid as labour force taxes

In sections §2.1, 2.3 and 2.4, we have already mentioned the possibility of collecting all income taxes as labour force taxes. This means a model where no personal taxes on wages exist or, in other words, the employers pay all statutory taxes concerning salaries. In this way, we get a wide dynamic range for adjusting the labour force costs of an enterprise.

In the following example, we have the same situation as in §3.3. We have omitted the 30% income tax and replaced it by a raised level of non-wage costs. The results are presented in a graphical form in Appendix 4. In the following table, there are the earlier results from TABLE 3.4 for reference (the first line in each case; new values in boldface). Firstly (second line), we have used the same **CCf** factor as earlier (on TABLE 3.5), and secondly (third line), we have reduced the effect of **CCf** by taking **CCf** = 0.14 - exp(-0.005***Sal%**). The parameter values are **Bas** =1.35, $\mathbf{D_1}$ =0.707 ≈ 1/√2, $\mathbf{D_2}$ =1.6, $\mathbf{D_3}$ =2 (see Appendix 1.1 and remark 3.1):

TABLE 3.6 Examples of total salary costs [Million FIM / €].

		Gross salary		Non-wage costs		Total costs		change
Sal%	**CCf**	**old**	**new**	**old**	**new**	**old**	**new**	**±[%]**
15%	1.12	9.514 1.600	8.769 1.475	5.708 0.960	7.197 1.210	15.222 2.560	15.996 2.685	+4.9%
	1.12		**6.135** **1.032**		**10.168** **1.710**		**16.303** **2.472**	**+7.1%**
	1.07				**9.715** **1.634**		**15.850** **2.666**	**+4.1%**
30%	1.00	9.514 1.600	8.769 1.475	5.708 0.960	6.426 1.081	15.222 2.560	15.195 2.556	-0.18%
	1.00		**6.135** **1.032**		**9.079** **1.527**		**15.214** **2.559**	**-0.05%**
	1.00				**9.079** **1.527**		**15.214** **2.559**	**-0.05%**
50%	0.87	9.514 1.600	8.769 1.475	5.708 0.960	5.590 0.940	15.222 2.560	14.360 2.415	-5.7%
	0.87		**6.135** **1.032**		**7.899** **1.328**		**14.304** **2.360**	**-7.8%**
	0.92				**8.353** **1.405**		**14.488** **2.437**	**-4.8%**

The curves of the total labour costs given in appendixes 3.1 and 4.1 are similar. However, in the latter case, we have bigger changes (in non-wage labour costs) than in the former case since the flexibility now concerns a bigger share of the total labour force costs than in the former case where the gross salaries remained fixed.

Remark 3.2. Here we could also take as a starting point the case where the sum of 30% income tax and non-wage labour costs would be an entity, i.e. we would have the possibility to collect a 30% tax on wages and still get the maximal flexibility, if we used the adaptive correction factor to determine the sum of taxes and social security contributions. The amount of social security contributions is the difference between the sum and 30% tax (which may be negative).

3.5 Summary

We have presented the main results, in numerical form, based on ideas about how to improve the performance and robustness of the Finnish business life. The examples clearly show the potential of this model in affecting labour costs. Our model helps in reducing the variation in companies' profits. Additionally, the new model motivates people to work for their own earning and to develop their professional skills.

The proposed model is fair to all parties in work life if correctly calibrated. Enterprises pay more labour costs during booms and less in recessions than they currently do. The net earnings of employees remain as stable as possible. The adaptive control of labour costs acts as a stabiliser at the firm and economy levels. The system offers more possibilities for low-paid jobs, which increases employment. It is possible to reach good earnings by working - the taxation rate of wages is fixed and moderate. Society will benefit in the form of the more vigorous and robust economic activities.

Finally, we emphasise that the controversy between the taxation of wage and capital income has been eliminated in the proposed model, which is socially important.

4 ADAPTIVE CONTROL OF LABOUR COSTS, AND EMPLOYMENT

In our model, the flexibility of labour costs will be used for stabilising the economy. The total labour costs of an enterprise are higher in booms and lower in recessions than at the present system. The flexibility of labour costs makes business life more robust against disturbances. This improves employment during recessions. On the other hand, the variation in revenues of the society may increase, too.

Here we discuss the consequences of the change in the structure and the control of labour costs. We limit ourselves to the subjects of employment (chapter 4) and tax revenues of the society (chapter 5).

We notice that the changed structure of labour costs improves employment especially in conventional services and in industries with low average salaries. The flexibility of labour costs increases employment in recessions when compared with the prevailing system. The excess activity in booms will be retarded by means of higher non-wage labour costs. Active control of labour costs may thus be appropriate for smoothing out variations in economic activity.

In our model, we have simplified the situation so that the (**S**um of) **L**abour **C**osts (**SLC**, **LC**) consist of two parts; the (**S**um of) **Sal**aries (**SSal**, **Sal**) and the (**S**um of) non-wage labour costs (**SSoC**, **SoC**):

LC = Sal + SoC labour costs of an individual employee

SLC = SSal + SSoC sum of all labour costs (**LCs**).

Sal is in our model net wage and, **SoC** consists of the personal income tax and all non-wage labour costs (we introduced the term labour force tax). In determination of the income taxes, we use (see chapter 1) two principles. In both cases, we applied a unified percentage tax rate (**Tax%**):

* **Tax%** is the same as in the taxation of capital income (29% in Finland, 2001),
* **Tax%** is zero, which means that all contributions are paid as **labour force taxes**.

In the latter case, we can utilise a greater dynamic range adjusting the labour force taxes. See also Remark 3.2 in § 3.4.

We calculate non-wage labour costs by using the formula

SoC = AdCf * Bas * Sal ,

where **Bas** is the basic rate of these costs and **AdCf** the adaptive correction factor for adjusting these costs. This factor depends on (the sum of) salaries and labour intensity of the firm in question.

In the appendixes 3.1 and 4.1, we present the structures of labour costs as functions of the net salary in the cases of **Tax%** =30% and **Tax%** =0% as compared with the prevailing costs. In chapter 3, we presented how **SSoC** and **SLC** vary with the varying economic conditions, and what these costs are for enterprises with assumed salary distributions. Here we concentrate on the consequences of structural changes in labour costs in the proposed model. These changes will have the same effect in both cases of **Tax%** -values mentioned above and, therefore, we will handle them together. Our estimations are based on Holm & Honkapohja & Koskela (1995).

From the curves in the appendices (1.1 -1.3) we see how the labour costs depend on the net salary and the share of salaries in the value added of the enterprise (**Sal%**). For our examination, the following changes in the structure of labour costs are essential:

(C1) **LC** are lower than currently for low-paid jobs,

(C2) **LC** are lower than currently for high-paid jobs,

(C3) **LC** are lower, equal or higher than currently for moderate salaries. This depends on, **Sal%**, the capital intensity of the firm in question.

The changes (C1-C3) in the structure of labour costs have some impact on employment and wage determination.

4.1 Demand on labour

In the proposed model, total labour costs concerning employees with lower salaries than the average in industry (i.e. he reference value used in the model, **SRef**) are reduced as compared with the prevailing system. This has two main consequences:

(C1.1) An increasing demand for labour in low-paid jobs.

(C1.2) The possibility of raising (current) wages of low-paid jobs without increasing the total labour costs.

Both consequences are highly desirable. The first one means work for many people in services or conventional jobs, and the second a possibility to increase earnings. The need for social support and unemployment benefits becomes lower, which compensates the reduced level in work force taxes (i.e. in revenues of the society).

Theoretically, the changes (caused by (C1)) can be explained by using the neo-classical model, the classical Phillips curve presentation (the pair of price and amount of working hours), or equilibrium models (see e.g. Tyrväinen (1995), Pehkonen (1991), Layard & Nickell & Jackman (1991), MacDonald & Solow (1981) or Casson (1981)). One finds such theoretical models also in Holm & Honkapohja & Koskela (1995), and in Rantala (1995). We do not go to a closer examination of these models, because our main interest is in microeconomic – our model works at enterprise level.

One other way to explain the demand for labour is to use the method of "Newtonian economics" presented in thesis of Estola (1995). The decrease in labour costs increases the demand for labour until a new balance is reached. This theory is also presented in Estola (1996).

In Finland, the new taxing system (VAT since 1994, which is based on the value added of firms) has been a shock to many firms in service and industry sectors. It has been claimed that this new tax has increased unemployment and the volume of "black markets". The proposed way to determine the work force taxes would compensate for this shock.

The change (C2) has similar impacts (see C1.1-1.2) for high-paid jobs. It means an increased demand for high-level specialists. Experts would no more suffer from the lack of motivation to work for higher earnings due to high tax rate. This is of great importance for utilising human resources and for technological development. We can raise the question, why should we have higher taxes on wages than on capital income?

The case (C3) is enterprise dependent. If the enterprise is capital-intensive, its labour costs will increase, and if the firm is labour-intensive, its labour costs will decrease. The overall result depends on the salary distribution of the firm in question (see chapter 1 and appendixes 3.1 and 4.1).

4.2 Estimates of changes in employment

Here we will use the results of HHK (1995) to estimate the effects of the proposed model on unemployment. HHK (1995) analyses four different principles of incidence in social security contributions of enterprises. These principles are (for exact formulas see HHK (1995) p.62):

(a) scaling with respect to the average salary in the industry branch,
(b) scaling with respect to the capital intensity of the industry branch
(c) scaling with respect to the unemployment in the industry branch (the general unemployment as the reference)
(d) an equal decrease in the rate of social security contributions of all firms.

Here we use only the results concerning case (b). It is closely related to the principles we use, and it is the most effective method against unemployment of all the alternatives (a) –(d). According to the model used in HHK (1995), the researchers reported the following results. A 1% drop in the rate of social security payments will have the following consequences in Finland: (see tables 3, 4 in HHK (1995); the numbers refer to two cases of independent and interacting unions)

TABLE 4.1 Effects on unemployment according to HHK (1995):

Principle used	**Change in unemployment**	
	people	[%] of work force
Capital-intensive (b)	-10 300 ... -21 200	-0.43 ... -0.89
Equal drop (d)	- 8 100 ... - 8 200	-0.34 ... -0.35

We apply these results to get estimates for the change in unemployment if the proposed system is brought into use. Our principle (in the new system) corresponds mostly to case (b), but we apply the capital intensities at the enterprise level instead of the industrial branches used in HHK (1995). We do not estimate the changes in tax revenues since the calculation of taxes is not as straightforward as in the case of unemployment. Our discussion about the revenues of the society is presented in chapter 5. For employment, the total labour costs are the most important. It is not important how much we gather as taxes on wages and how much as social security payments (we refer to Tyrväinen (1995) p.46).

Firstly, we apply the above results to get an estimate for the employment effect in low-paid jobs (TABLE 4.2). We suppose they comprise about 40% (or 960 000) of the whole work force (2 400 000). The salaries in these jobs are below the average salary (**SRef**) used in our model as a reference. Therefore, these sectors get an average decrease of about 10% in the non-wage labour costs. The table above concerns the case of 1% drop. We scale the results linearly to the case of 10% decrease in the rate for **SSoC,** and apply this to 960 000 people in low-paid jobs. (See the remark after TABLE 4.3)

TABLE 4.2 Effects on employment in low-paid jobs:

Number	**Increase in employment**		
people	people (change)	[%]	[%] total employment
960 000	**41 000 ... 86 000**	4.3 ... 8.9	**1.7 ... 3.6**

The percentages 4.3 ... 8.9 are obtained by multiplying by 10 the percentages in TABLE 4.1. This means 41 000 ... 86 000 people or 1.7 ... 3.6% better total employment.

Secondly, we take all labour-intensive firms. We suppose that the total amount corresponds to 60% of the whole work force (1 400 000 people). We think that the case in TABLE 4.1 is included here, and we apply a drop of 5% in **SoC**s for the rest of the 440 000 people.

TABLE 4.3 The effects on employment in labour-intensive industries:

	Number	Increase in employment		
	people	people (change)	[%]	[%] total employment
(- 5% / **SoC**)	440 000	9 700 ... 20 200	2.2 ... 4.6	0.4 ... 0.8
(-10% / **SoC**)	960 000	41 000 ... 86 000	4.3 ... 8.9	1.7 ... 3.6
Sum	**1 400 000**	**51 000 ... 106 000**	**3.6 ... 7.6**	**2.1 ... 4.4**

We believe that the numbers in TABLEs 4.2 and 4.3 are not overestimated. The percentages for reduction in unemployment in TABLE 4.1 concern the whole work force (2 400 000 people), and we applied these percentages only to that restricted part of the work force, which is more sensitive to changes. We have calculated the average earnings of workers (around 1 140 000 people) in branches having lower wage level than the average of all wage earners by using data from SVT 1995 Table 329 (year 1993). This average value is about 13% lower than the average wage of all wage earners, which means the salary correction value **SCf3** = 0.815. In addition, these branches are labour-intensive, which also lowers the contribution level according to the factor **CCf** ≈ 0.9. If we think that the original contribution level is 30%, then the lowered level would be 0.815*0.9*30% ≈ 22%. Here we refer to the results in the article Rijckeghem (1997, p. 3) concerning targeted tax reduction for unskilled (low-income) workers. See also the more detailed discussion in the chapter 6 of this study, under the title "*Targeting of labour taxation, differentiated payroll taxes*".

Now, let us suppose that we have a recession where the value added of all firms will decrease 10% in the average. This corresponds roughly the last depression in Finland (see e.g. SVT 1996:II Table 5). Then the rate of **SoCs** will decrease on an average about 3.1% (a weighted average of drops; see TABLE 3.1 and §5.3 below); more in labour-intensive and less in capital-intensive firms, and we get: (direct scaling from results in TABLE 4.1)

TABLE 4.4 Additional effort on employment in recession
(10% average decrease in value added; 3.1% decrease in **SoCs**):

Total	Increase in employment	
people	people (change)	[%]
2 400 000	**32 000 ... 66 000**	**1.33 ... 2.76**

We suppose that the decrease in unemployment is greater since the effect is stronger in labour-intensive industries. These result is an estimate of the reduction in variation of employment that the proposed system offers for varying economic conditions. If we add these numbers to those in TABLE 4.3, we have an estimate of the combined effect of the proposed system on unemployment:

TABLE 4.5 Aggregate effect on unemployment due to recession (10% average decrease in value added):

Decrease in unemployment **80 000 ... 170 000** people or **3.3 ... 7.1** [%]

Remark 4.1 a) Our opinion is that the total effect is closer to the upper limit of the estimate in TABLE 4.5. The reason for this is that in the proposed model, the flexibility works in each firm separately, which gives better results than those in the TABLE 4.1, the results of which are based on a macroeconomic model and control. On the other hand, we have omitted the simultaneous drop in employment in capital-intensive industries. These branches are not so sensitive to changes in **SoC**s (see Rantala p. 41 -45, and Liitetaulukko 7 & 13). If these branches contain 200 000 employees, we get a rough estimate of this drop by using the average 10% rise in the **SoC** percentage for all enterprises, which gives (using the percentages in TABLE 4.1)

10*(0.43 ... 0.89%)* 200 000 = 8 600 ... 17 800 employees.

b) Trade unions in capital-intensive industries in Finland play the main role in the bargaining for wages; the results they achieve in negotiations will affect the other industries (see HHK (1995) Liite/appendix 2 section 2.2). The higher rate of non-wage labour costs in the proposed system will retard the increase of wages in these leading unions, which may have favourable consequences for the aggregate employment. This may affect the mentioned leading role of these strong unions. (See HHK (1995))
c) The immediate effect of a (-1%) reduction in **SoC** on employment is 0.05% according to Rantala (1995) p.41. This result means a very small impact on unemployment (as established in Rantala (1995) pp 47-48) if compared with the results above in TABLEs 4.1 -4.5. If we scale this result to correspond a 10% reduction in **SoC**s, we get the following immediate change in employment:

10 *0.0005 *2 400 000 = 12 000.

The unemployment costs for the Finnish society (year 1996) were 27 billion FIM (≈ 4.5 billion €) total or 60 000 FIM (≈ 10 000 €) for each unemployed person per year. The numbers in TABLE 4.5 then mean a cost reduction of 5 ...10 billion FIM (≈ 0.84 … 1.7 billion €) per year.

4.3 Changes in social security contributions of industries

In this section, we compare the **SoC** percentages presented in HHK (1995) with the values we get by using our model. However, we have calculated the **SoC** rates by using the capital intensity (**Sal%**) and average salary (**Sal**) of the branch in question. In fact, in the presented model, these values are calculated for each enterprise separately. Therefore, changes in the **SoC**s of individual enterprises may be considerable greater than the average values used in the TABLEs 4.2-

4.5. In the following table, TABLE 4.6, we present the **SoC** rate as in HHK (1995) in the form 1+s (e.g. 25% corresponds the value 1.25).

We use the values of HHK (1995) Taulukko L.4.7 in p.75 (columns 2 and 3 in TABLE 4.6). These values correspond to case (b) and the situation where the paper union has a kind of leadership in wage negotiations.

We have calculated the first part of TABLE 4.6 (Food etc, ... , Energy etc) by using SVT 1995 Table 150. We have determined the **Sal%,** the share of the sum of net salaries in the value added of each industrial branch, and the average salary (we label it **Sal**). Using these two values and the correction factor **AdCf**, we have got 1+s = 1 + **AdCf***0.2695. We use here the reference value 26.95% since it presents the average value for **SoC**s according to Lehtinen (1994) Liite 1, year 1993 (Kiander (1996) p.20 represents the value 27.60%).

TABLE 4.6 Social security rates of some industries.

Industry or branch	Present SoC (HHK 1995) (1+s)	HHK (1995) SoC (1+s) in case (b)	Our model SoC (1+s)	Change from old (or 1.27) [%]
Food etc.	1.261	1.254	1.251	-0.79%
Textile etc.	1.246	1.229	1.136	-8.83%
Wood etc.	1.263	1.248	1.201	-4.91%
Paper etc.	1.276	1.306	1.324	3.76%
Graph. ind.	1.240	1.225	1.239	-0.08%
Chemical etc.	1.244	1.250	1.300	4.50%
Petroleum etc.	1.280	1.286	1.373	7.27%
Rubber, plastic			1.236	-2.68%
Glass, clay, stone			1.233	-2.91%
Basic metal			1.305	2.76%
Metal & electr. prod.	1.262	1.267	1.247	-1.19%
Energy, water, gas	1.288	1.393	1.324	2.80%
Construction	1.272	1.247	1.266*	
Trade	1.261	1.245	1.266*	
Hotels & restaurants	1.235	1.220	1.216*	
Transport	1.264	1.260	1.295*	
Communication	1.264	1.260	1.285*	
Finance & insurance	1.310	1.288	1.337*	
Basic services			1.226*	
Tech.&busin. services	1.226	1.210	1.330*	
Social welfare	1.238	1.240	1.247*	
Recreation, culture etc			1.323*	

* Capital intensity not included - only average salary used.

In the second part, the values of 1+s (our model) have been calculated using only the average **Sal** of each industry (marked with *). Many enterprises of these industries are labour-intensive and therefore the presented values of 1+s are too high - real values would be lower. Because of this, we have not included [%] changes to these cases.

Social security contributions will rise in capital-intensive industries (paper, chemical, petroleum, basic metal, energy), and decrease in labour-intensive industries (textile, wood). The biggest differences, if compared with HHK (1995) are in textile, wood, chemical, petroleum, and energy, etc. These differences are mainly explained by the different ways of taking salaries into account. For example, salaries in the textile branch are very low (average about 6 600 FIM per month (≈ 1 100 €) compared with the average 9 600 FIM (≈ 1 600 €) in the whole industry), and the corresponding correction factor is **AdCf** = **CCf** * **SCf** = 0.913 * 0.554 = 0.506. The new model would reduce remarkably the labour costs of the textile industry.

The changes are so great that they may mean totally new possibilities for some industrial branches. According to Rantala (1995, Liitetaulukko 13), in textile industries, the average amount of employees in 1960 -1993 has been 65 100, and 20 000 in 1994 (and it has been over 100 000 in the 1960 's).

4.4 Some further remarks

Remark 4.2 In section 4.1, we repeated the principles (a) -(d) used in HHK (1995) to calculate the social security contributions of firms (see also Honkapohja & Koskela (1990)). Many other possibilities have been suggested, from which we point out the following four (see Rantala (1995) Liite 1 pp 53 -58):

(e) social security contributions based on the sales (or turnover) of a firm
(f) social security contributions based on the value added of a firm
(g) social security contributions based on the profits of a firm
(h) social security contributions based on the sum of salaries and on the operating margin of a firm

These cases (f & h) are perhaps not allowed in the EU (the case (e) may be unclear) as mentioned in Honkapohja & Koskela (1990) p.38 since, according to the EU rules/directives, we cannot use the same basis for other taxes as we use for the value-add tax. That is because the contributions to the EU membership are determined by the revenues of the value added tax.

In our model, salaries form the basis used for taxation. In our opinion, the effects on unemployment are roughly the same if we apply principle (b) or (f) to gather the non-wage labour tax contributions. In the case (e), dependence on capital intensity is much stronger than in our model, and labour force taxes may be very high but depend on the scaling of contributions.

Remark 4.3 **a)** Another possibility to take capital intensity into account would be to set the value added tax rate (**VAT**) to depend on capital intensity. The range of **VAT** could be e.g. 16% ... 25% with the following functional expressions

(4-1a) $\mathbf{VAT} = \mathbf{VAT(Sal\%)} = 25 - (9/60)*\mathbf{Sal\%}$ [%] , ($0\% \leq$ **Sal%** $\leq 60\%$)
or

(4-1b) $\mathbf{VAT} = 100*(0.26+\exp(-0.01*\mathbf{Sal\%})-1)$ [%] , ($0\% \leq$ **Sal%** $\leq 60\%$)

In (4-1b) we have the same exponential expression we used for our capital correction factor (**CCf1**, chapter 3). This principle would be one of the simplest to be applied in practise.

Besides the capital intensity, our VAT expression includes flexibility with varying economic conditions, which is important if we want to reduce the variations in economy. Here we refer to the discussions in Työryhmäraportti (1998) on taxation structure, and Goerke (1999), where the substitution of social security contributions in the form of VAT is studied (see also § 6.2).

b) If we had a reliable measure for the phase (Φ) of economic activities, we could make the **VAT** dependent on it. The range of the Φ could be [-1, 1] so that -1 corresponds to a deep recession and 1 to a high boom. Then for example

(4-2) $\mathbf{VAT} = \mathbf{VAT}(\Phi) = 20 + 4*\sin(\pi\,\Phi)$ [%]

and **VAT** would be 16% in a deep recession and 24% in a high boom. A possible quantity for calculating the Φ would be the operating level of the industrial branch λ [%] , and then, for example,

(4-3) $\Phi = 0.1*(\lambda - 95)$ and $\Phi = -1$ if $\lambda < 85$ and $\Phi = 1$ if $\lambda > 105$.

Instead of the percentage (20%) in the expression (b), we could use a basic value that depends on the industrial branch.

According to Rantala (1995, p. 57), these ways to collect **VAT** have similar effects on the price and volume of production of an enterprise as the wage based **SoC**s.

Remark 4.4 Some comments on cases (a), (c) and (d) in §4.2.

In case (a), non-wage labour costs increase with salaries. This increases progression on labour force taxes. This would be a threat to the favourable development in business in the long run. It is also unclear how employment would develop in this case.

In case (c), non-wage labour costs increase with the unemployment in industry. This renders the position of enterprises and industries having economic problems. The structural change in business may be accelerated, and so unemployment may not be decreased.

In case (d), the system will not be changed - only the contribution rate decreases. Here we do not have "any new strategy" in directing the taxes on labour force.

Remark 4.5 One question is whether the public sector should have controlled or dynamic non-wage labour costs in the same form as enterprises. Is it reasonable or possible to calculate the value added and the capital intensity for institutes in the public sector? Our opinion is that it is natural to take into account only salaries in calculating social security contributions (i.e. the value **CCf** = 1 is applied). Already this makes it possible to increase the number of low-paid jobs in the public services. Another possibility, however, would be to apply the average **CCf** of the industry.

4.5 Summary

The 90's recession in Finland lasted many years and was deeper than in most of industrialised or EU-countries. We have proposed that the economic system should be designed so that it follows the same principles as the modern production lines do, namely the "just on time" or JOT philosophy. We use this term since labour costs should be better synchronised with the income of enterprises than at present.

We have suggested changes in determining the non-wage labour costs by incorporating flexibility into the labour costs of an enterprise. In the proposed model the flexibility is realised in the form of an adaptive control mechanism. The adaptability is obtained by controlling the non-wage labour costs of an enterprise.

The control of labour costs of an enterprise is only one way of many parallel possibilities to supervise the economic activities. As we have seen, however, it may be one of the most important factors in controlling overall employment.

5 WHAT HAPPENS – HOW TO KEEP THE CONTROL?

We have suggested changes to the structure of labour costs of enterprises. We have also pointed out that the changes in taxation of income and the restructuring of the control on social benefits can be handled together. In the former chapter, we estimated the effects of the proposed system on employment. Here we consider the following themes:

* changes in salaries and in distribution of different types of jobs
* changes in the revenues of the society
* changes in the structure of the networks of enterprises.

These topics are complicated and difficult to handle. The last question is especially difficult to answer. On the other hand, it is necessary to build the new system so that we have sufficiently accurate comprehension of what might happen, and that the changes turn out to be the desired ones.

5.1 Distribution of jobs and salaries

In the proposed system, we have a dynamic control of the labour costs of an enterprise. Perhaps the most important feature (concerning the structure of labour costs) is that labour costs of low-paid jobs will decrease considerably if compared to the current costs - especially in industries having low capital intensity. This creates favourable circumstances for more jobs in service sector and in small and medium-sized firms. This is one way to reduce unemployment in Finland.

This change compensates for the shock effect the Finnish tax restructuring caused in 1994 when value added tax was brought into use. It also gives more opportunities in the international competition with countries of low cost level.

In chapter 1, we presented estimates for growth of employment in service sector and in labour-intensive industries. These estimates show the biggest changes in the distribution of jobs.

In the new system, the labour costs of the highest salary classes are lowered if compared to the current costs. This, together with the changes in taxation of wages, means

* more opportunities to reach high earnings as an employee,
* greater motivation to develop professional skills.

Both aspects are important to the favourable development of the high technology industries that require a lot of innovative research.

Remark 5.1 According to some studies (see e.g. Holm & Koskela 1995a and 1995b, Koskela & Vilmunen 1994), progressive tax system improves employment. Their results are based on models of trade union behaviour. The tax progression favours conventional low-paid jobs and, therefore, employment in the branches having low average salaries. If we compare the total labour costs shown in Appendixes 3.1 and 4.1 (chapter 3), we see that in the proposed model, we have a tightened progression in the most common salary classes. At the same time, however, we have reduced the total labour costs of the highest salaries.

Remark 5.2 The solution used in our model, that is, we reduce the (non-wage) labour costs in low-paid jobs, can be considered as one way to divide work for more employees. Highly-profitable industries (and firms) pay a part of the social costs of those industries (or firms) which have lower profitability.

Remark 5.3 It is known that a lowered social contribution rate will raise the salaries in the existing jobs; see Honkapohja & Koskela 1990. This is very desirable in low-paid jobs. It decreases the need for social security transfers.

Remark 5.4 In our system, all firms can derive the same advantages from the lowered non-wage labour costs (for low-paid jobs). In contrast to that, the current method of paying different kinds of selective labour support, often distorts the competition.

5.2 Revenues of the society

What happens if we change from the current system to the proposed one? What happens to the flow of revenues to society? It depends on how we calibrate our system. We can set the system parameters so that the total flow of taxes and social security payments
(1) remains unchanged or (2) increases or (3) decreases.

If we set the goal to halve unemployment, we should select case (3) with a considerable average reduction in non-wage labour costs. Then, at first, the flow of taxes and social security payments would decrease until the better employment turns the flow to an increase. This is typical in systems where there exists opposite effects with different time constants. See Stephanopoulos 1984. See also the remark 5.3 above and the discussion in chapter 6.

The capital intensity of an enterprise can be taken into use step by step during a transition period of several years. Then the fall in revenues would not be as big as without using these steps. However, in this case the positive effects would also be delayed.

The revenues of the society also depend on the possible changes in the network of enterprises. This subject will be discussed in the following section.

5.3 Rearrangements in the network of enterprises

In the proposed model, we take the capital intensity of each enterprise into account in determining the amount of their non-wage labour costs. If the contribution level "strongly" depends on the capital intensity of the firm, it causes natural rearrangements in the network of firms. Do we have, in the long run, more merely personnel firms and firms with very few employees, and the latter buy the work they need from the former?

In Finland, we have experience of progressive scale in pension fees in the case where the contribution rate depends on the number of employees in the firm. The firms may reorganize for minimising the amount of expenses, if these steps are "too large".

Perhaps it is not possible to know or forecast how progressive the contribution rate function (**CCf**) can be without undesirable rearrangements. On the other hand, for the purposes of controlling the labour costs of firms, this progression should be effective enough so that we would have a considerable dynamic range of labour costs with respect to the varying economic conditions.

First, we take a numerical example where we calculate the total labour costs of firms with three different capital intensities as starting values. Then we calculate the total labour costs when these firms hire various numbers of the work force needed, from a labour-intensive firm. Iy this way, we get results showing the revenues of the society concerning the work force taxes.

In all cases, we suppose that in the starting situation, turnover is 100, purchases are 20, social security percentage is 60% , and the capital correction factor (**CCf1**) is 0.87 in the firm which provides the work force (which corresponds the value **Sal%** =50%). We use 30% as the percentage for income tax , **SoC** means non-wage labour costs, revenue is the sum of all **SoC**s and taxes paid for the work force.

The three starting situations are: the share of the sum of salaries (own or hired work force) in the turnover is

1) 30% (TABLE 5.1), 2) 20% (TABLE 5.2), 3) 10% (TABLE 5.3).

In TABLEs 5.2 and 5.3 we repeat only a part of the rows we have in TABLE 5.1.

In TABLE 5.1, the firm needs work force of the amount of 30 units (turnover is 100 units). We explain the calculations in case 3 (the third column). The firm hires 10 units of work force needed. Then its own value added falls to 64.8 (= 80 - purchased work force; 10 + **SSoC**). The firm pays its own **SoC** 11.9 units, and 5.2 units for hired work. The taxes on the salaries are 30% from 20 and 10 units. Summing up these **SoC**s and taxes, we get the revenues of the society (VAT is not included in these figures). TABLE 5.1 shows how the capital intensity (**CCf1**) of the firm increases with the share of the hired work force and how this affects the capital correction factor and, furthermore, on the contribution rate of **SoC**s of the firm.

In the first case (TABLE 5.1), the operating profit (of the firm) may rise about 1.3% when the firm hires its work force (total amount of **SoC**s and taxes will decrease from 26.0 to 24.7), in the second case, about 2.1%, and in the last case, about 1.64%. In this section we suppose that the total work force needed and the sum of salaries are exactly the same in all alternatives and divided by "two firms".

The relative changes in **SoC**s are the biggest for capital-intensive firms and the smallest for labour-intensive firms. The changes in operating profits are, however, about the same. Perhaps it is not clear whether it is profitable to have separate firms for the work force needed.

TABLE 5.1 Changes in revenues when a part of the work force has been hired: (**Sal%** starting value is 100*30/80% = 37.5%)

Quantity \ Case	1	2	3	4	5	6	7	8
Salaries, work	**30**	25	20	15	10	6	4	0
Work (hired) *)	0	5	10	15	20	24	26	30
Value added	80	72.4	64.8	57.2	49.6	43.5	40.4	34.3
CCf1	0.947	0.968	0.994	1.03	1.08	1.13	1.17	1.26
SoC	17.0	14.5	11.9	9.26	6.46	4.07	2.80	0
SoC (hired)	0	2.6	5.2	7.8	10.4	12.5	13.6	15.7
Tax / salaries	9	7.5	6	4.5	3	1.8	1.2	0
Tax / hired work	0	1.5	3	4.5	6	7.2	7.8	9
Total SoC	17.0	17.1	17.1	17.1	16.9	16.6	16.4	15.7
Total SoC+Tax	26.0	26.1	26.1	26.1	25.9	25.6	25.4	24.7
Revenue [±%]		**+0.38**	**+0.38**	**+0.38**	**-0.38**	**-1.5**	**-2.3**	**-5.0**

*) We point out that no profit is included into the hired work in the TABLEs 5.1-5.3 and 5.4.

TABLE 5.2 Changes in revenues when a part of the work force has been hired: (**Sal%** starting value is 100*20/80% = 25%)

Quantity \ Case	1	2	3	4	5	6	7	8
Salaries, work	**20**	16	13	10	8	6	4	0
Work (hired) *)	0	4	7	10	12	14	16	20
Value added	80	73.9	69.4	64.8	61.7	58.7	55.7	49.6
Total SoC	12.5	12.3	12.2	11.9	11.7	11.5	11.2	10.4
Total SoC+Tax	18.5	18.3	18.2	17.9	17.7	17.5	17.2	16.4
Revenue [±%]		**-1.1**	**-1.6**	**-3.2**	**-4.3**	**-5.4**	**-7.0**	**-11.4**

TABLE 5.3 Changes in revenues when a part of the work force has been hired: (**Sal%** starting value is 100*10/80% = 12.5%)

Quantity \ Case	1	2	3	4	5	6	7	8
Salaries, work	**10**	8	6	5	4	3	2	0
Work (hired) *)	0	2	4	5	6	7	8	10
Value added	80	77.0	73.9	72.4	70.9	69.4	67.8	64.8
Total SoC	6.86	6.62	6.34	6.19	6.02	5.85	5.65	5.22
Total SoC+Tax	9.86	9.62	9.34	9.19	9.02	8.85	8.65	8.22
Revenue [±%]		**-2.4**	**-5.3**	**-6.8**	**-8.5**	**-10.2**	**-12.3**	**-16.6**

Remark 5.5 If we want more revenues (of society) to be gathered from capital-intensive firms and less from labour-intensive firms as is currently done, we could do as follows: (See § 4.4, remarks 4.2 and 4.3)

> We lower the rate of non-wage labour costs with -p% and raise the rate of the value added tax with +q% so that the desired average decrease (e.g. -5%) in the social security expenses of labour-intensive firms is achieved and the change is tax revenue neutral.

In this way, we will not have the risk of firms rearranging their operations in order to minimise their **SoC** -expenses. This alternative has been analysed in Honkapohja & Koskela (1990). One question is whether the EU-directives will prevent this alternative. Besides, we know that a rise in revenues of the value added tax will increase the EU-membership fees of Finland.

Extremes in free rearrangement

The extreme cases in rearrangement of firms mean that we either have no change, or we have a complete rearrangement. We estimate changes in revenues for the latter case in situations as presented in TABLEs 5.1-5.3. We use the special distribution of work force estimates in the following TABLE 5.4. By revenues we mean the sum of income taxes and social security contributions.

TABLE 5.4 Changes in the revenues of society in case of complete rearrangement: (no profit has been included into the hired work)

Capital intensity	10%	20%	30%	40%	50%
Share of work force	5%	15%	30%	30%	20%
Decrease in revenues	- 18%	- 13%	- 8.8%	- 4.2%	-0%

A robust estimate for the reduction in aggregate revenues then is about -6.75% ≈ -7%. This is an estimate for the decrease in revenues (tax +SoC) in the case of the complete rearrangement of firms compared with the case of no change.

In ETLA (1995), there exist information (year 1993) of the shares (in parenthesis) of labour costs in the turnover of some entire business clusters: forestry (36%), metal (36%), energy (42%), telecommunication (36%), welfare (34%), building (40%), transportation (48%), and food (33%). We emphasise that these figures concern the whole industrial clusters.

In our first chapter, A, which presents some background of the Finnish industry, we have examples of the shares of labour costs in the value added of some industrial branches. We also refer to Appendixes 5.1-5.4 where we present more examples of the share on labour costs in the turnover of industry branches and individual companies and results that show the variation of this share in business conditions.

The decreases in the contributions of firms are so big that a partial rearrangement would be very probable. This is not desirable and therefore, we present a solution that makes this rearrangement unprofitable.

5.4 How to keep the control

It is not desirable or natural that firms organise in such a way that nearly all employees are working in firms whose only "product" is labour force. Some regulations are needed to prevent this undesired development.

First, we need a definition of the work (force) needed in a firm for its production. We suggest the following principle:

> **All work that is needed continuously or regularly for production or other activities in a firm has to be considered work of that firm.**

This principle means that e.g. cleaning belongs to work of the firm where the cleaning takes place. The non-wage labour costs have to be paid according to the regulations that concern the firm where the work force is needed.

Nowadays, in invoices there exists the information how much value added tax is included in the invoiced sum. We could use the same principle to control the contributions of non-wage labour costs. The practice could be (for the work force that has been hired) the following:

(1) All invoices have to show how much non-wage labour costs (**nwLC**) is included, and what is the capital correction factor (**CCf**(1)) used.

(2) A firm that has hired work (needed in its normal regular activities), has to pay (or can use for its benefit) the difference
[**CCf**(2) / **CCf**(1) -1] * **nwLC**
where **CCf**(2) is its own capital correction factor.

These principles create a situation in which it is not reasonable to set up separate personnel firms. Another question is, how easy it is to accomplish these principles in practice.

In TABLE 5.5 we have calculated correction effects using these principles in the situations presented in TABLEs 5.1 -5.3: The principles (1) and (2) do not only compensate for the difference in **SoC** -expenses (in TABLEs 5.1-5.3 compared with the **SoC** -expenses without subcontracts) but cause higher total labour costs. This means that it is more profitable for the firms to use their own work force than to hire the work force needed in the production. We point out, however, that no profit is included into the hired work in the calculations in this table.

TABLE 5.5 Changes in revenues when principles (1) and (2) are used:

Quantity \ Case	1	2	3	4	5	6	7	8
Salaries, work	30	25	20	15	10	6	4	2
Work (hired)	0	5	10	15	20	24	26	28
Total SoC	17.04	17.12	17.13	17.06	16.86	16.55	16.32	16.01
Correction	0.0	0.304	0.767	1.47	2.53	3.81	4.67	5.74
Total SoC+Corr.	17.05	17.42	17.90	18.53	19.39	20.36	20.99	21.74
Revenue [±%]		**+2.19**	**+4.98**	**+8.66**	**+13.7**	**+19.4**	**+23.1**	**+27.5**
Salaries, work	20	16	13	10	8	6	4	2
Work (hired)	0	4	7	10	12	14	16	18
Total SoC	12.47	12.31	12.13	11.90	11.70	11.47	11.18	10.83
Correction	0.0	0.477	0.935	1.50	1.96	2.49	3.11	3.85
Total SoC+Corr.	12.47	12.78	13.07	13.40	13.66	13.95	14.29	14.67
Revenue [±%]		**+2.55**	**+4.84**	**+7.53**	**+9.60**	**+11.9**	**+14.6**	**+17.7**
Salaries, work	10	8	6	5	4	3	2	1
Work (hired)	0	2	4	5	6	7	8	9
Total SoC	6.85	6.61	6.34	6.18	6.01	5.83	5.64	5.43
Correction	0.0	0.355	0.757	0.980	1.22	1.47	1.75	2.04
Total SoC+Corr.	6.85	6.97	7.09	7.16	7.23	7.31	7.39	7.47
Revenue [±%]		**+1.64**	**+3.46**	**+4.44**	**+5.48**	**+6.58**	**+7.74**	**+8.97**

In the following table, we have calculated the changes in **SoC** revenues, if the profit in the hired work is 20% or 10%: (corresponding to the first group in TABLE 5.5; aggregate value of the work is 30)

TABLE 5.6 Changes in labour force revenues [%] of the society
when profit is included in the hired work:

Quantity \ Case	1	2	3	4	5	6	7	8
Profit included 20%)	0	-1.22	-2.02	-2.21	-1.43	0.31	1.75	3.72
Profit included 10%)	0	0.48	1.48	3.23	6.15	9.86	12.4	15.6
Value in TABLE 5.4	0	2.19	4.98	8.66	13.7	19.4	23.1	27.5

Profit in the hired work may be connected to the fact that the subcontractor needs less working hours or its labour force is less well paid.

6 DISCUSSION AND CONCLUSIONS

The EU and the EMU mean for Finland an added transfer into the global economy. The Finnish monetary policy has been strongly domestic including such ways to act, which are no longer possible in the EMU. One big question has been how the monetary union will affect the labour markets, especially unemployment.

Work group report (Työministeriö (1996), which includes an ANEX II in English (15 pages), discusses both the direct and indirect effects on the economy and presents many estimates concerning the changes in employment and possibilities to control the development. The report declares that the growth of production and active labour market policy are necessary. According to the report, "*the tools that are available to Finland in its battle against unemployment and its current mechanism of adaptation to asymmetric shocks are inadequate*"(ANEX II, p. 11) and furthermore (p. 12) "*the EU does not have any adequate policy tools for dealing with asymmetrical shocks caused in individual countries by cyclic fluctuations or reducing differences in unemployment levels among Member States: in their present form, neither the EU budget nor its structural funds are well suited to this purpose*".

The enterprises need an adequate stock of capital resources. Flexibility is needed in the unit production costs, including the prices of labour, capital, domestic raw materials and energy. One primary mechanism of adaptation is the effective functioning of the labour market and structural renewal of the economy (ANEX II, p. 14). See also the Introduction pp 1-2.

"*The flexibility that is needed on the labour market requires the introduction of wage systems that take into account the company's liquidity. Personnel funds and other wage systems tied to performance are well-suited for this purpose: at times of recession they provide the necessary flexibility automatically, without requiring any adjustments to basic wage rates*" (Työministeriö (1996), ANEX II, p. 14). In this report the authors find it necessary to develop new tools for the use of the EU so that it could effectively cope with the unemployment problems caused by asymmetrical shocks in individual countries.

Our work is one attempt to develop an economic control system, which is able to compensate different kinds of disturbances. As we have seen, our model affects both at macro- and the microeconomic levels.

6.1 Problems in the Finnish economy

The visible political and economical puzzle of the EU and the EMU has pointed out possible adaptation problems, and plenty of research work has been done to evaluate the future development. Finnish economy and labour market have been analysed and compared to the European or more general to the OECD countries. One has been interested in knowing what are the dependencies between factors in economies and employment. This knowledge is then used to suggest changes in goods or labour market structures and in the ways to act and co-operate. One central question has been how one can improve the employment.

A common observation of many studies is the better recovery of Anglo-American countries from economical shocks if compared with the economies of continental Europe; e.g. Kiander & Viren (1998), Eriksson (1994), Honkapohja & Koskela (1999), OECD Statistics (1995, 1997, ...), Pohjola (1998), SVT (2000). Additionally, the Finnish economy has been considered to be more sensitive to economic changes than the other OECD countries. Especially the big recession of the 90's has caused a deep crisis in Finland.

Finland differs from most of the other OECD countries with respect to economic structure and labour market. This has its evidence in results based on empirical studies. Albaek et al. (1999, pp 8, 20-22) present that in the Nordic Countries the wage-unemployment dependence is different compared with the other countries. Their result is "*no evidence of wage curve*". Guichard & Laffargue (2000) have studied the wage equation in 16 OECD countries. According to their findings Finland differs also from the other Nordic Countries. Both articles refer to Honkapohja & Koskela (1999) for a broader analysis of the 90's recession in Finland.

Rantala (1997, chapters 5, 6 and summary 7 (in English)) has studied the adaptation process of labour costs, the variability in profitability, and the compensation possibilities using payroll taxes. Rantala reports (pp 70-72, 73-74) that Finnish payroll taxes are approximately the same as in the other Nordic Countries and the same in average as in the other EU countries. On the other hand, the share of labour costs in aggregate production costs vary with varying economic conditions more in Finland than in the most important other economies competing at the same markets (Rantala (1995, p. 34). This is because in Finland the amount of working hours and wages are not as flexible as in the OECD countries in general. Rantala reports that the compensation needs in Finland are bigger than in the other countries. According to Rantala (1997), changing the payroll taxes would be more balanced between different industrial sectors than the former adjusting method, namely devaluation of Finnish currency. This kind of monetary policy is no longer possible in the EMU. Rantala uses the term "internal devaluation" in connection with changing the payroll taxes. The compensation policies and possibilities in Sweden are discussed in Calmfors (1998a,b); Sweden is not a member of the EMU. Calmfors too sees the possibility to operate with the payroll taxes next to the fiscal policy.

Calmfors claims that operating with the payroll taxes would only be an imperfect solution. This is readily understood because of the small share of payroll taxes in aggregate taxes, and the rigid way to set and change the contribution rates. Both of these limitations are eliminated in the model presented in this study.

6.2. Tax structure and labour force taxes

Many articles analyse the effects the taxation structure has on activities in an economy. Special interest has been put on employment, on recovery from shocks, and on the balance of public sector. By carrying out analyses, one wants to find some optimal strategies for overall activities and activity. Here we refer to Jourmad (2001). It gives an overall insight (chapters 1-2) to tax systems in the OECD countries and some results of tax reforms in individual EU countries (pp 12-13).

Taxation of capital incomes

In Finland, the total amount of capital taxes is minor if compared with the revenue of the other taxes (Työryhmäraportti (1998) p.5, http://www.stat.fi, OECD (1997) and http://www.vn.fi/vm/verotus/tilastoja/verotuksen_rakenne-Suomessa.htm). The capital income taxes affect quite strongly investments, and the investments have central importance for economic growth. This point of view is discussed in Työryhmäraportti (1998, tiivistelmä/summary pp III-VII and chapters 4-6 (only in Finnish)); it refers to OECD (1997). According to this report, the capital income tax rate in Finland is internationally competitive. We refer also to the articles of Kilponen & Vilmunen (2000, chapters 4-5) and De Long & Summers (1993). In the latter one the authors make an international analysis of the effects the investments have on growth. Globalisation of the Finnish economy requires that it is necessary to have a reasonable tax rate on capital income in every country, also in Finland.

Consumption tax, VAT

One central question in the structure of taxation is the one, which is the suitable or optimal balance between income and consumption taxes. VAT is the most important type of consumption taxes. The rate of VAT varies remarkable in the OECD countries as does the way to target it to different consumption goods or to different fields of industry. A lower rate is in general applied to foodstuff, publications, and services. The EU has imposed restrictions on the use of VAT in the member states. The member states are allowed to apply at most two different VAT rates below the standard rate for certain goods and services. The EU has made at 1999 an extension to these restrictions (Jourmad (2001, p. 13)). It is possible (in the years 2000-2002) to widen the scope in effects a lowered VAT on labour intensive services has on employment. Finland has not yet utilised this possibility. A theoretical analysis of the industrial sector-based tax differentiation can be found in Holmlund & Kolm (2000). Their conclusion is that international co-operation is needed, which can prevent undesired interactions between economies.

How should we set the tax burden - value added tax versus social security contributions? What are the effects on employment? Along with Työryhmäraportti (1998) it is better to adjust labour taxes (or income taxes) than VAT. On the other hand, Goerke (1999) presents that a tax revenue neutral reform, where social contributions are lowered and VAT is tightened is, favourable for employment but only if the prices do not rise. Coleman (2000) presents the general opinion that overall results are better if tax burden is targeted to consumption.

The summarising report Työryhmäraportti (1998, § 3.2.) presents also results concerning the graded VAT. All studies deal with a situation where social security contributions depend on the industrial sector. An international summary (concerning the OECD countries) can be found in Joumard (2001). We note that this kind of targeting of VAT taxes can not cause additional dynamics with respect to varying economic conditions.

In this study, we have not concentrated on this subject very closely. Here we refer to § 4.4. Remark 4.3, where we suppose that the dynamic taxation system presented in this work could be the easiest to simulate or demonstrate in practise in the form of a dynamic VAT system. Coleman (2000) even suggests that it would be favourable to welfare if all income taxes were replaced with consumption taxes (his results are based on empirical material from USA).

Taxation of labour

We have concentrated on the ways of how to target and describe the labour force taxes. Here we think that labour taxes include all contributions that are based on wages e.g. income tax, employer's and employee's social security contributions, pension insurance, unemployment insurance etc. The distributions of these contributions vary remarkable between economies. We refer to statistics found in http://www.vatt.fi/ and OECD -databases in http://www.OECD.org/daf/ , and OECD (1995 & 1997).

On the sites of Government Institute for Economic Research, http://www.vatt.fi/ "Talouden rakenteet, kohta 5 verotus", the whole picture of the Finnish taxation system is presented (text, tables, graphs). The international comparisons are based on OECD material. Section 5.2 includes the taxation structure in THE OECD in the form of different taxes in individual countries as percentage values of GDP. One finds that the structural differences between the countries are remarkable - indeed surprisingly great. We present three examples of taxes divided into income tax (Tax) and social security contributions (Ssc):

(1) In Finland and Sweden, the ratio between Tax and Ssc is about 60:40,
(2) In Denmark, Tax is dominant; the ratio Tax:Ssc is about 93:7,
(3) In Netherlands, Ssc is dominant; the ratio Tax:Ssc is about 27:73,

These facts show clear differences in the structure of national taxation systems and tell us that economies may be successful with very different taxation structures. Here we refer yet to the review type article Joumard (2001) where also some new tax reforms and future trends in the OECD countries are presented.

In Työryhmäraportti (1998, p.5), is presented how the taxation structure in Finland has been developed during the years 1965 - 1995. The biggest changes are that the share of SsCs in the aggregate tax revenue has been grown and the shares of income taxes and consumption taxes have been lowered.

Which kind of effects the aggregate tax rate or the taxation structure has on economies, especially on employment? One central question in this has been if there exists an optimal ratio between the taxes basing on wage income and the social security contributions. The answer is not clear, as we can suppose on the basis of the big differences of these ratios in the EU economies (see (1)-(3) above: Finland, Sweden, Denmark and Netherlands). One general and indisputable result is that the unit costs of industries have to be competitive. The aggregate labour costs are essential for the unit production costs of enterprises (Appendix 6). The countries, where the adjustment of labour and wages are the most flexible with respect to varying economic conditions, have recovered from recessions the fastest. For these results we refer to Rantala (1997), Työryhmäraportti (1998), Kiander & Viren (1998), Honkapohja & Koskela & Uusitalo (1999), Kiander & Kilponen & Viren (2000). In these studies, one also finds other references to international studies where the results based on empirical time series analyses show the same incidence.

The oldest studies on labour taxation reported that the aggregate tax burden will fully explain the effects the taxes have on employment. One of the main references here has been the book Layard & Nickel & Jackman (1991, e.g. pp 209-210). After the publication of that book, many researches have analysed empirical materials more closely and got more detailed results. Dependent on tax bases, the revenue neutral tax reforms between wage income taxes and social security contributions may have different effects on employment. The literature is numerous. We refer to Holm & Koskela (1995), Holm & Kiander & Koskela (1995), Rantala (1995 and 1997), Pehkonen (1997), Työryhmäraportti (1998), Koskela & Schöb (1999), Honkapohja & Koskela & Uusitalo (1999), Lockwood & Manning (1993), Kolm (1998a), Pissarides (1998), OECD (1995), Bovenberg & Graafland & Mooij (2000).

If one wants to improve employment fast, the most effective way is to lower the employer's labour costs e.g. social security contributions; we refer to Työryhmäraportti (1998, pp 18, 31), Honkapohja & Koskela & Uusitupa (1999, pp 8, 17-20) and Nickell & Bell (1996). This increases the labour demand, which improves employment more efficiently than the increased labour supply. The mechanism behind these findings has been explained in Työryhmäraportti (1998) in the introductory summary (pp I-VII, Pasi Holm), and Honkapohja &

Koskela & Uusitalo (1999). A change in the employer's contributions affects immediately labour costs, whereas a change in wage income tax affects after delays caused by the bargaining process between unions. Finland, as all Nordic countries in general, has strong corporations in labour market which strongly affect employment. This can be seen in the article of Holm & Sinko & Tossavainen (1999a, pp 13-15, 17), where one finds an analysis of most important contributors behind the (structural) unemployment in Finland. The labour policies explain about 70 percent of the structural unemployment. The main factors are unemployment benefits, labour costs, conditions of notice, and other compensations.

The use of payroll taxes as a compensating mechanism against variations caused by economic conditions has been proposed. Holm & Kiander & Tossavainen (1999) explain the use of buffer funds of social security contributions in cases of asymmetric shocks in an economy. This way is useful only in temporary shocks (overriding seasonal in nature) and not in the connection of long term or structural changes. The authors suggest also the amount of compensation in different industrial sectors, which face a simultaneous negative shock (10 per cent fall in prices, § 4.2), and sufficient buffer sizes (§ 4.3). Rantala (1997) presents calculations for the dynamic ranges needed for compensations if the used operating mechanism is the social security contribution rate. According to Rantala, this kind of dynamics needed in Finland would be higher than in the most important competing OECD economies.

For achieving the sufficient dynamics, we proposed in this work that all other labour cost components omitting the net wage of an employee, should be under dynamic control.

Progressive income tax

Researchers have mainly explained the effects of tax progression on wages and employment. The progressiveness of income tax diminishes the rise of wages, and thus improves employment. We refer to the results in articles Holm & Koskela (1995), Holm & Kiander & Koskela (1995), Koskela & Vilmunen (1997), Pissarides (1998), Zee (1999), Fuest & Huber (2000). Labour force policy and labour markets are a subject of discussion in Kiander & Kilponen & Vilmunen (2000).

Our model in this work also contains progressively increasing labour force taxation. The mechanism of automatic adjustment of labour costs works like the progressive taxation - it retards wage drifts in periods of growth or booms. (See § 6.3 below)

Targeting of labour taxation, differentiated payroll taxes

In labour force policy, perhaps the easiest way to operate is to adjust the taxes affecting on the aggregate labour costs. The main idea has been to favour labour intensive industrial sectors or small and medium size firms. (See § 4.3 for social security contribution rates of industrial sectors in Finland) The effects have been extensively studied. We refer to the articles that have been in a central role in our work: Holm & Honkapohja & Koskela (1995) and Rantala (1995). The newer results used are found in Rantala (1997), VATT publications Työryhmäraportti (1998), and the report Honkapohja & Koskela & Uusitalo (1999). Targeting the labour force taxes along with the industrial sectors and the favouring of the services is presented e.g. by Kolm (1996, 1998). Firm-specific differentiation is brought up in Vaillancourt (1990), Calmfors (1995). According to simulation results in Bovenberg & Graafland & Mooij (2000), targeting in-work benefits at the low-skilled is the most effective way to cut economy-wide unemployment.

Rantala (1997, pp 33-34) explains the possibilities to use social security contributions in compensating the variations in the profitability of enterprises. Työryhmäraportti (1998) is the summary written by the work group (Hjerppe et al., Introductory summary written by P. Holm, and text by P. Sinko) appointed by the Ministry of Finance of Finland. It mainly contains results presented in VATT publications concerning the effects the taxation system has on employment, investments, aggregate production, and the balance of the public sector. The report includes results of effects of the industrial specific social security contributions and/or VAT rates. About the same scope has the paper Honkapohja & Koskela & Uusitalo (1999); it presents the flexibility of employment with respect to different ways to tax the labour force. The flexibility figures are analysed to explain the international competitiveness of industrial sectors. This report recommends with caution the lowering of the social security contributions to control labour demand and employment. The authors remark that there exists lacks concerning the affects on the economy, and there also exist needs to fulfil and specify theoretical models and methods used in the research work. This is perhaps also the cause behind the controversies between the results got by different researchers and methods. The estimated parameters of models based on empirical data are often inaccurate or statistically non-significant.

The central references of this work include international references. Vaillancourt and Marceau presented already in 1990 that it can be theoretically argued that we should have firm-specific payroll taxes. Some differentiation is also presented by Calmfors (1995). In Kolm (1998b), one finds the benefits that can be achieved by differentiating taxes. However, it is not clear how the taxes should be targeted. Rijckeghem (1997, target country France) notes that the lowering of labour taxes is the most effective, when it is targeted on low paid jobs and especially to that part of labour costs paid by employers. According to her results, this targeting is six times more effective in improving the employment than the non-targeted lowering of these contributions. The same recommendation can be found in Nickell & Bell (1996). Zee (1999) proposes the use of income tax progression to finance the labour force costs and income transfers of people in low paid jobs. This kind of a feature is included in the model proposed in this work (appendix 3.1). Estimates of the effects the new model has on employment were presented in chapter 4. Our results are based on the flexibility parameter values reported in Holm & Honkapohja & Koskela (1995).

In the economies that have recovered from economic shocks fastest, the efficiency is based on bigger flexibility in wages and in the amount of labour force. Here we refer to Haskel & Kersley & Martin (1997) and Hall (1998). For the countries having rigidity in this (Finland and other Nordic Countries), it would be very important to find out new forms of flexibility which could help to compensate the undesirable effects caused by unexpected shocks. We argue that the principles we have presented in this work could form the basis for a reform of the taxation system of labour. We also suppose that it could be such a reform, which the political decision-makers and labour market participants can accept.

The industrial sector-specific social security contributions have the same shortage as the industrial specific VAT. Both do not create the dynamics needed for compensating the variations in economic cycles; especially, if we think the dynamics in labour costs. Therefore, the effects on employment are lower than in the model presented above. Another difference is that our model takes into account the firm-specific situation. We mention two articles here. In Vaillancourt & Marceau (1990) there are empirical data from Canada (1975-1984). They report differences the effects between firm-specific and general payroll taxes have. Anderson & Meyer (1995) have studied firm-varying payroll taxes in case of unemployment insurance.

The public sector

If one compares the structural changes in labour costs, he usually requires that the reform should neutral with respect to tax revenue, that is, the aggregate amount of taxes should remain unchanged. The best structure then is the one, which has the largest improvement in employment. The effects on public sector in Finland have been studied in articles Työryhmäraportti (1998), ja Honkapohja & Koskela & Uusitupa (1999). According to the results of these reports, the reforms, which lower labour taxes, are not self-financing. Viitamäki (1998) presents results that deal with the situation where an unemployed gets job. He calculates the balance of all essential tax revenues, contributions and social transfers, and gets the result of how much the public sector wins. According to Viitamäki, a 1% decrease in unemployment means 1 240 ... 2 470 Million FIM profit to the public sector in Finland. Rijckeghem (1997) presents results based on simulations concerning France. Her results mean that (the proposed) changes are self-financing. In simulations some parameter values are used. These values may be inaccurate, and the results (found in simulations) are very sensitive with respect to these inaccuracies. Rijckeghem, for example, supposes (p.20) that wage flexibility with respect to unemployment is 1%, that is, when wages rise 1% unemployment will decrease 1%. This value she gets from Laffarque (1996), who has used a very comprehensive model including all essential components of national accounts. According to Rijckeghem (p.17), Laffarque's model includes modules for government debt dynamics, intertemporal optimisation of consumption, bargaining, imperfect competition, complete specification of the French tax system, covering inter alia, social security, income and profit taxes, taxation of the returns to savings, VAT, investment taxes, and production taxes. Finnish wage flexibility results are found in Pehkonen (1991), Rantala (1995, pp 23-24; 1997, pp 48-52) and Honkapohja & Koskela & Uusitalo (1999, liite/appendix 2).

6.3 Summary

We presented a new way to adjust the labour force costs of enterprises. The main goal has been to build a system, where enterprise's labour force costs are dynamic, that is, these costs are adjusted along with the varying economic conditions of the enterprise. At the same time we want to simplify the current exaggerated system, which describes the labour costs of enterprises. Simplicity is achieved when all kinds of payroll tax type contributions are collected together. This way the enterprise does not need to be aware and take care of numerous of different kinds of payments. We can question whether all of this "welfare bureaucracy" should belong into the daily routines of enterprises. Could the body of civil servants take care of it?

Our main results are consequences of the dynamics of labour costs the new model offers. Now we pose a collection of these consequences as a list consisting of improvements in the economic life the society would get.

(1) labour force costs are better synchronised with enterprises' income,
(2) recovery and retardation take place automatically and concern each enterprise individually,
(3) higher and more even employment,
(4) an economy will be more stable and more robust against various shocks,
(5) the model helps regional economic policy in a natural way,
(6) it becomes easier to carry out a reasonable personnel policy,
(7) motivation to work increases,
(8) enterprises' bureaucracy is reduced,
(9) taxation of wage income becomes easier,
(10) the contradiction between tax rates of capital and wage income is removed,
(11) the need for local bargaining diminishes.

Benefits for enterprises, claims 1-2

If all the cost components of an enterprise remain constant, but the good's prices varies, then also vary the share of net wage costs in the firms turnover and value added. As a consequence of our adjusting principle, the sum of labour force taxes varies with the turnover. If the price level increases, the share of net wage in the value added decreases, which means a corresponding increase in labour force tax. An opposite effect is obtained when the price level decreases. In this way the aggregate labour costs (the sum of net wages and labour force taxes) are automatically synchronised with variations in the turnover.

The basic mechanism in adjusting an enterprise's labour costs in the proposed new taxation system, can be expressed as

- if the share of net wages in the value added increases, labour force taxes will decrease (recovery effect) and
- if the share of net wages in the value added decreases, labour force taxes will increase (retarding effect).

Recovery from recession and retardation in boom will take place automatically and concern each enterprise individually. At the prevailing system, recovery often requires political decisions that come too late, and the effects are obtained at the macroeconomic level having only weak possibilities to help individual enterprises.

One thing worth to note here is how the labour costs vary with the life cycle of a firm. At the starting time moment of a firm, it is typical that the firm has none or only few products to sell. This means small turnover and small value added. As a consequence the share of wages in value added is big, which means that labour force tax rate is "the smallest possible". The system also helps new firms in their start in the form of a low rate in social security contributions. On the other hand, if a firm is booming and successful in its business, the labour force taxes will become higher.

Benefits for the economy, claims 3-5

The automatic correction effects mentioned in points 1-2 have suitable effects on the economy. The system becomes more robust and easier to manage. Employment rate increases especially because of the lower labour costs in low paid jobs; this will reduce the structural unemployment. Another effect is that in the long run (net) wages will rise in industrial sectors having low nominal wages, which also has suitable effects on the economy. (Viitamäki (1998))

Our model will benefit regional employment, too. The dynamics in labour force taxes compensate the differences caused by the environment. For example, bigger transportation costs may mean lower aggregate labour costs.

Our model helps the economy to become more robust against various shocks as the labour costs are no longer rigid but flexible which helps in the adaptation to new conditions. In the new model adaptation takes place automatically - no special political operations or decisions are needed. It is also important that this adaptation takes place in every enterprise individually.

Benefits with social dimensions, simplified taxation, claims 6-10

Our model makes it easier to carry out a reasonable personnel policy. Enterprises can better hold their skilled workers because their labour force costs vary with economic conditions. This improves employment. The bureaucracy in firms diminishes. The labour costs consist only of two main components, (net) wage and the labour force tax. Currently under the name of payroll taxes there exist several components, and many descriptions have to be taken into account depending on the industrial sector and employees. The complexity of the existing system may be a bigger drawback than the benefits it offers. The collected labour force taxes can be processed centralised, which makes the system more effective. It also may be simpler to govern a new system (based on the proposed principles) than the current system.

Our model makes the taxation of personal income simpler. We have proposed two possibilities for these taxes. Either (i) a fixed percentage, which may be the same as for capital income, or (ii) a net wage principle with fixed percentage 0%. It is simple to think that if I will work 10% more hours, I will get 10% more money. This makes profitable to work. Total labour costs will rise progressively with the (net) wage but the rise is included in the form of labour force tax the employer pays. This reform of income taxes means that there is no need for people to fill reports on taxable incomes.

One popular question is, if it is fair to have income tax rates higher than the rate of capital incomes. This contradiction will be removed by the proposed tax reform, which may be socially important for the society.

Local bargaining, claim 11

Employers have increasingly demanded on the possibilities for local bargaining of labour conditions. This is a big question for unions, and many problems are connected with such a practice. Our model automatically takes into account the firm-specific conditions, which diminishes the need for local bargaining. The variability of labour costs may solve a remarkable part of firm-specific problems.

Other proposals that support employment

At times of the beginning and ending of the working career people may have some problems. A young person does not get a job because of not having practical experience, and because he doesn't get a job he can't become experienced. At the end of the working career there often exists a need to reduce the daily working hours. Our proposals to solve these problems are:

The employment of young people can be supported if the labour force taxes (or payroll taxes) increase stepwise. For example, the payments could have a starting level of 40% of the full rate (for 18 years old or younger), and then increase annually stepwise by 5% into 100% level at the age of 30 years. Then the labour supply for the young will increase. On the other hand, youngsters will be motivated to complete without delays their (vocational) studies and to start their careers.

The stepwise retirement. We propose a system, where the number of yearly working hours will decrease stepwise. E.g. a 2% drop in working hours annually from the age of 45 to the age of 65 will mean a final level of 60% of normal annual working hours. This practice could help people to work until the entitled full retirement age of 65 years. Mathematically, this solution means a decrease in the aggregate labour supply, and this decrease corresponds to the working hours of 4 years, which improves employment.

These kinds of practices would be natural to be combined with the principle that the pension is determined by the whole working time period, that is, by the aggregate earnings during the work life.

Some further aspects

Our simulations have dealt with very simple and ideal cases. Of course, there are many different aspects to be explored. We comment only a few of them.

In the connection of introducing our theoretical model, we argued that the shortest natural period to pay labour force taxes is one month; the same period is used in paying the value added tax. In practice, however, the variation in the value added can be so great that some kind of moving average is needed. Another possibility could be to use the value of production, which is a parallel variable with the turnover. And furthermore, we could have reasonable limits to be used in exceptional cases. In the long run the account figures can be adjusted compatible. This kind of organising is needed to prevent the legislative speculations by using irregular flows of income by suitable timing. The time window used in moving average may normally be a year, but some industrial sectors may need even longer periods.

We have presented a dynamic model to adjust and control the labour costs of enterprises. The results we have got need a plenty of more deep economical analysis and testing with empirical data. One is the already mentioned problem of describing the value for the share of the net wages in the value added (**Sal%**, chapter 1) used in calculations that give the rate for social security contributions of the firm. Each of the improvements 1-11 listed in § 6.3 deal with wide and problematic questions. A closer analysis requires the use of macroeconomic models. In addition, such a model has to be completed to run according to principles presented here.

Empirical material has to be used if one wants to analyse more precisely the following questions:

(1) ranges or values for parameters in the model to correspond the wanted tax revenues,
(2) ranges or values for parameters in the model that are used in the control loop which describes the dynamic properties of the system,
(3) how to use the model parameters in economic policy,
(4) the effects the new model may have on the economic structure,
(5) the arrangements needed to organise and govern the operations in the new model.

Subject (1). In our simulations we have used rough estimates for the parameters in our model. The curves in the appendix 3.1 show the tax progressiveness in the proposed model compared to the current system, and is also connected to aggregate tax revenues.

Subject (2). The curves in the appendixes 1.1-1.3 show a dynamic range in the adjustment process of labour force contributions. From FIGURE 1 in the appendix 1.1 we can see that the range of capital correction factor CCf1 is about 0.8 ... 1.27 corresponding to the values of **Sal%** in the range 0% ... 60%. The highest level 1.27 (**Sal%** =0%) means nearly 60% higher labour force taxes than at the level 0.8 (**Sal%** =60%). Correspondingly, the appendix 1.3 shows the dynamics in labour force tax of an individual worker with respect to net wage when **Sal%** varies from 10% to 60%.

Subject (3). This point of view has been discussed in chapter 2. In principle, all the parameters used in the expressions for capital correction and salary correction factors, and the base level parameter (**Bas**) can be used in adjustment. We argue that the main control parameters are **Bas, SRef** and **SRef%**. The changes in **Bas** can be considered equal to overall changes in the contributions. The parameter **SRef** may be the average mean in the industry and, if so, it automatically calibrates the taxation against wage inflation. Another possibility is to keep it under the control of the government. The third parameter, **SRef%**, can be used as a control parameter; it refers to the point where the capital correction factor (**CCf**) has the value 1.

Subject (4) is associated with the question, how the business structures may change when the capital intensity describes the labour force tax rate of enterprises. This is a big question that has to be solved in the proposed system. See the chapter 5 for a discussion.

Subject (5). How the supporting governmental services are most reasonably arranged? The bureaucracy in firms will diminish because the taxation of wages is simplified. On the other hand, the public sector will get the aggregate tax revenues and divides them into different headings. We suppose that in that way this process becomes centralised and more rational and efficiently than at present. Yet one thing is, that it may be easier than nowadays to do political decisions, how this sum will be divided into different purposes. We argue that there may exist more room for the representative political democracy.

Special economic regions?

High unemployment is a difficult and a widely spread problem in Finland. It could be of great importance for the Finnish (or European) economy to find the right control structures for the general welfare. One way to test the proposed model for dynamic control of labour costs of enterprises could be to set up **special economic regions** where the model is applied. The whole economy can utilise the results of experiments of this kind. The presented model is more impartial or balanced between individual firms than different kinds of special support mechanisms used at present to smooth down the regional differences.

Only in Utopia?

The presented model for the dynamic adjustment of the labour force costs of individual enterprises means a great change in the taxation of labour. The model may include too idealistic ideas to be realised in any real economy. In spite of the improvements it offers, it can only be a theoretical model and suitable to be set up only in Utopia? We hope, however, that our work gives rise to new ideas for research and generates some economic discussion if not a debate.

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List of some symbols, terms and synonyms

Tover	=	turnover of a firm, gross value of production of a firm
Vadd	=	value added of a firm
Purch	=	purchases, materials, subcontracts etc of a firm all costs of a firm so that the formula **Vadd = Tover - Purch** is valid
Sal	=	net salary or net wage or take home pay (of an individual employee/worker)
SRef	=	reference value for **Sal**; e.g. average net salary in industry
SRef%	=	reference value for **Sal%**; the point where the factor CCf = 1.
SSal	=	sum of all net salaries (and wages) **Sal**'s of a firm
Sal%	=	share of the sum of net salaries in the value added of a firm
SoC	=	the amount of non-wage labour costs (of an individual worker); indirect labour costs; social security costs
SSoC	=	sum of individual **SoC**s of a firm
Bas	=	basic percentage for calculating **SoC**s
SCf, SCfx	=	salary correction factor, causes the progression of labour force tax
CCf, CCfx	=	capital correction factor, scales the labour force tax along the labour intensity of firm
AdCf	=	adaptive correction factor (= CCf * SCf); the labour force tax rate of an individual worker.

Some expressions, thought as synonyms

Social security costs or contributions, non-wage labour costs, indirect labour costs, and payroll taxes are used as synonyms (**SoC, SSoC**). In the case where income tax rate is 0%, this refers to all other labour force costs but the take-home pay (Sal).

Appendices Some comments

Appendices 1.1-1.3 Correction factors CCf and SCf

Appendices 1.1-1.3 give examples of how the labour force taxes are scaled by the capital intensity of a firm and the amount of net wage of individual workers. The forms of these curves depend on how the parameters in the expressions are fixed (see § 1.1-1.2).

The curves in FIGURE 1 present the scaling factors **CCf1-3** as used in our simulations. By parameter selections we affect the dynamics used to manipulate the labour force taxes. In the horizontal axis **Sal%** ranges from 0% to 60% (**Sal%** is the percentage share of the sum of net wages in the value added). We have selected the point **Sal%** = 30 to be a reference so that all curves intersect at this point. In practice, we have to cut the real variations in **Sal%** to a reasonable range. If **Sal%** is limited to the range in 0% ... 100%, then **CCf1** will range in the interval 1.26 ... 0.63. See the appendix 5 for an example of variations in **Sal%** and **CCf**'s in the case of a real firm. See also the TABLE A.2 in the introduction.

In the FIGUREs 2, 2a, 2b we see curves that present the scaling of labour force taxes along the amount of the net wage. In all of these curves we have the progression effect; the curves for **SCf1-3** are increasing with the increasing net wage **Sal**. Here the reference point (all curves are intersecting) is thought to be the average salary in the industry.

FIGUREs 3 and 4 present the combined effect the scaling factors **CCf** and **SCf** have on the labour force taxes. As curves we also see the values for the adaptive correction factor **AdCf** as a function of net wage **Sal** and for six different values of the capital intensity of the firm (**Sal%**). In the horizontal direction we see the dynamics we have when the **Sal%** varies from 10% to 60%.

If both of the variables **Sal** and **Sal%** have their reference point values, then the adaptive scaling factor takes the value 1, **AdCf = CCf * SCf** = 1*1 = 1.

Appendices 2.1-2.4 and 4.3 Dynamics in labour force taxes

In appendices 2.1-2.3 we have examples that show the differences in labour force taxes when calculated according to the proposed system and the present one. In these examples, we suppose that the net wages remain fixed as the turnover of the firm varies. Then in the old system, also the labour force tax remains fixed, but in the new system we see the dynamics along the business cycle. The situation is idealistic but it tells the difference between the systems. Beside this difference, the curves also show the difference in the average contribution rates. In the proposed system, capital intensive firms pay labour force taxes more and labour intensive firms less than in the old one.

We point out that the same firm can vary in this scale (for capital intensity). If the firm has a boom, its **Sal%** value may be low (refers to a capital intensive situation) and in the recession, its **Sal%** value may be high (refers to a labour intensive situation). For example, in the information technology we have examples of this kind of firms.

The appendix 2.4 shows the differences the scaling factors **CCf1-3** may cause in the amount of labour force taxes. With parameter selections we can affect to the dynamics utilised in manipulating or compensating the effects caused by business cycles.

The results in the appendix 4.3 correspond to those in the appendix 2.3 but here we collect all the taxes in the form of labour force taxes.

Appendices 3.1 and 4.1 Labour force taxes with respect to net wage

In these appendices we show the ratio between aggregate labour force taxes and the net wage of an individual worker as a function of the net wage. The aggregate labour force tax includes the income tax and the social security contributions. In the new system the ratio depends on the capital intensity of the firm (the curves are shown for **Sal%** values 15%, 30% and 50%). The ratio increases by decreasing **Sal%** and by increasing net wage **Sal**.

Appendices 3.2 -3.3 and 4.2 Distributions for salaries and taxes

In these appendices we have utilised the **Matlab** programming environment. We have generated a Poisson type of distribution of net salaries of a firm having 1000 workers. Then we have calculated the corresponding distributions for gross salaries, social security contributions, and aggregate taxes in the prevailing system and the proposed one as functions of net wage.

The results in appendices 3.2-3.3 deal with the situation where we have a fixed income tax rate of 30% in the proposed system (This corresponds to the situation in the appendix 3.1). In the appendix 4.2 the income tax rate has been set to 0% (all taxes are collected as labour force taxes) and the parameters have been scaled so that the total tax revenue is the same as in the appendices 3.2-3.3.

The variability, measured by the standard deviation, is smaller in the proposed system than in the prevailing one.

Appendices 5.1 – 5.4 Dynamics in Sal% and CCf

In the Appendix 5.1, we present the figures of a real firm concerning the years 1997 and 2000. In the tables, we see for every month the values of the sum of net wages, value added, and the calculated values of **Sal%** and three different expressions of **CCf**. The variations in these variables are remarkable and based on seasonal fluctuations.

In the Appendix 5.2 we present information concerning value added per person in some Finnish industry branches in the year 1999.

In the Appendices 5.3.a and 5.3.b we present information concerning share of personnel costs of some Finnish companies in the year 2000.

In the Appendix 5.4 we present the wage index and turnover index (time series) in the years 1996, 1998 and 2000 concerning the Finnish manufacturing industry and showing the aggregate variations in these quantities.

Appendices 6 and 7 Unit production costs, expressions

The content of the Appendix 6 is somewhat separate from the other results we give. Here we calculate the result of how the proposed taxation system effects on the unit costs of production. Here we utilise the study in Rantala (1995), Liite/appendix 1.

In the Appendix 7 we present the connection of the variables and formulas used in our model with them common used in the literature. We refer to Estola (1995 & 1996).

Appendix 1.1 Correction factors CCf and SCf

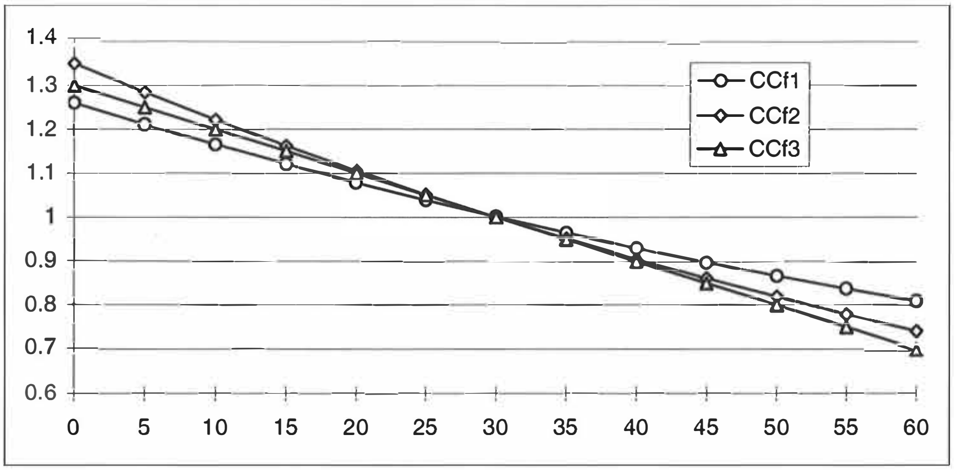

FIGURE 1 Capital correction factors **CCf1, CCf2, CCf3** as a function of **Sal%**:
CCf1 = 0.26 + exp(-0.01***Sal%**)
CCf2 = 1.35 * exp(-0.01***Sal%**)
CCf3 = 1.30 - 0.01***Sal%**

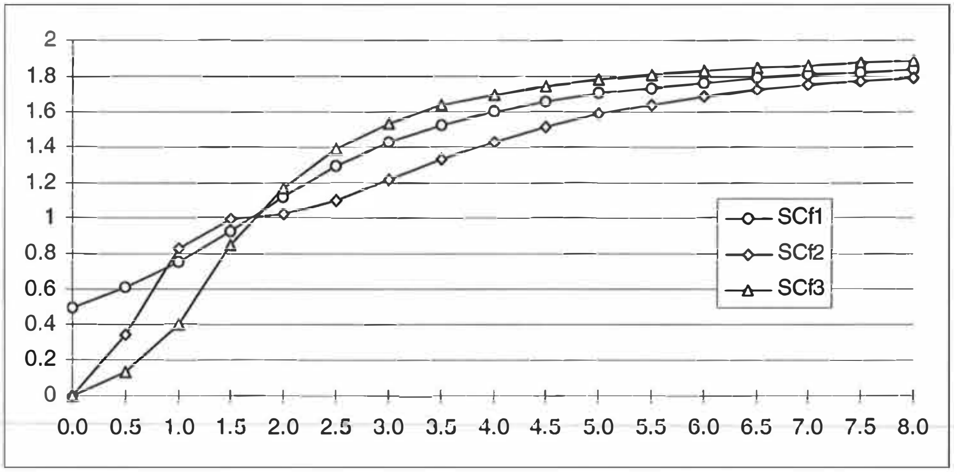

FIGURE 2 Salary correction factors **SCf1, SCf2, SCf3** as a function of **Sal**
SCf1 = 1 + (2/π) atan(**Sal/SRef** -1)
SCf2 = 1 + (2/π) atan((**Sal/SRef** -1) | **SRef/Sal** –1 |)
SCf3 = 1 + (2/π) atan(2* (1-**SRef/Sal**)) , if **Sal < SRef**
SCf3 = 1 + (2/π) atan(√2* (**Sal/SRef** -1)) , if **Sal > SRef**
(**Sal** in units of 1000 €)

Appendix 1.2 Correction factors SCf1 and SCf3

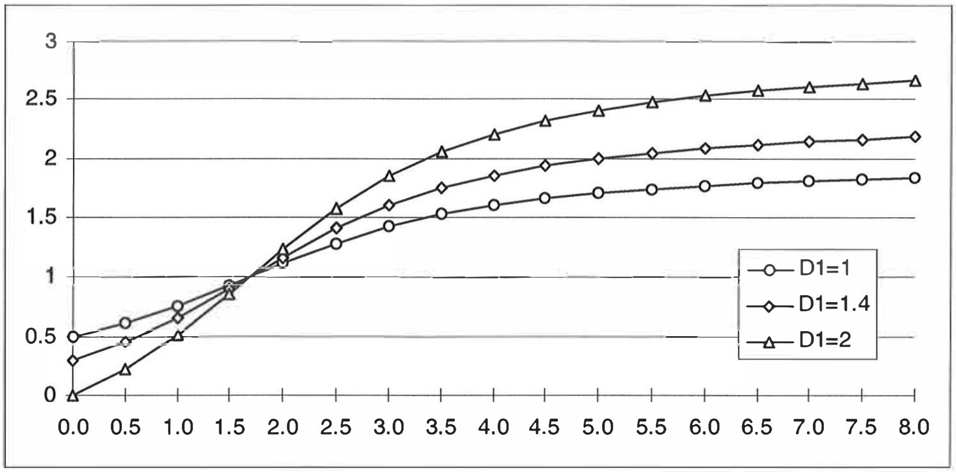

FIGURE 2a Salary correction factor **SCf1** as a function of **Sal**, when **D1**=1, **D1**=√2, **D1**=2.
SCf1 = 1 + **D1***(2/π) atan(**Sal/SRef** -1) ; (see § 1.2)
(**Sal** in units of 1000 €)

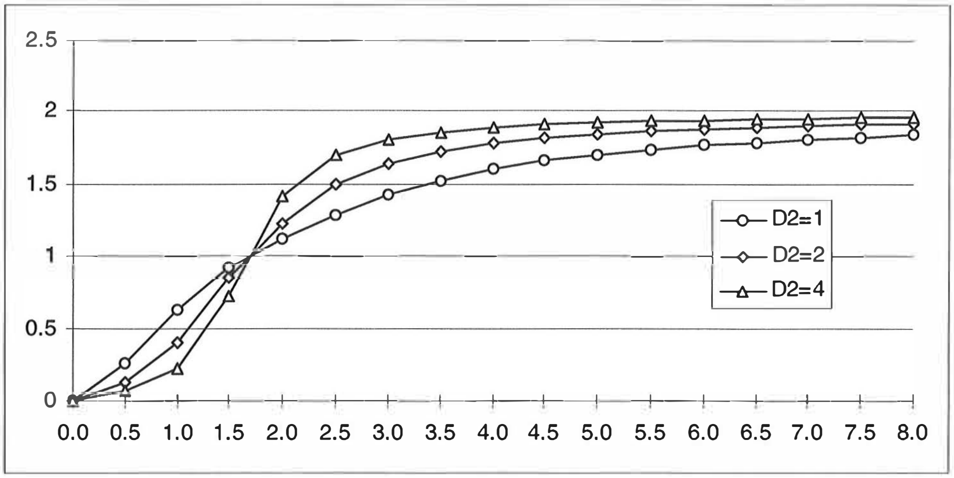

FIGURE 2b Correction factor **SCf3** as a function of **Sal** in the cases **D2**=1, **D2**=2 and **D2**=4.
SCf3 = 1 + (2/π) atan(**D2***(**SRef/Sal** -1)) , when **Sal ≤ SRef**,
SCf3 = 1 + (2/π) atan(**D2***(**Sal/SRef** -1)) , when **Sal > SRef**; (see § 1.2)
(**Sal** in units of 1000 €)

Appendix 1.3
Combination of correction factors CCf and SCf

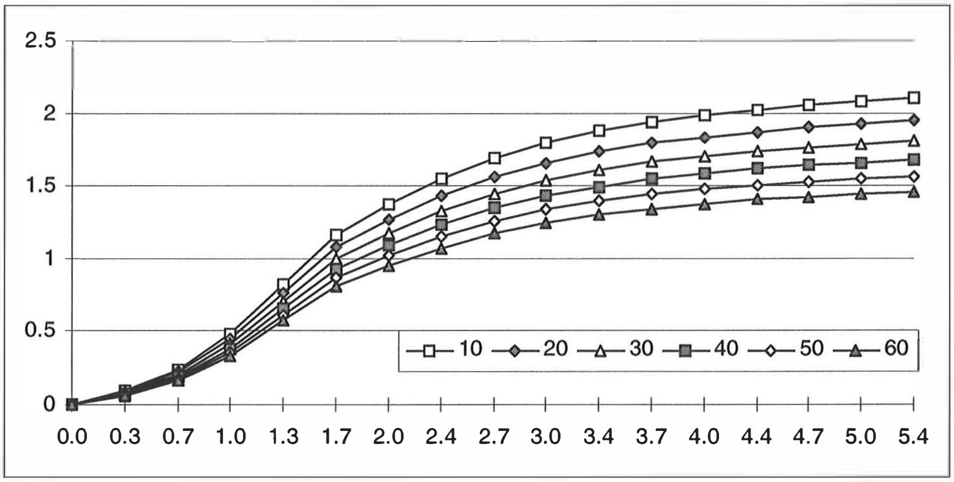

FIGURE 3 **AdCf**, product of the correction factors **CCf1** and **SCf3** as a function of **Sal** [in 1000 €] for **Sal%** values 10, 20, ..., 60. (See § 1.2 formulas (1-6a&b))

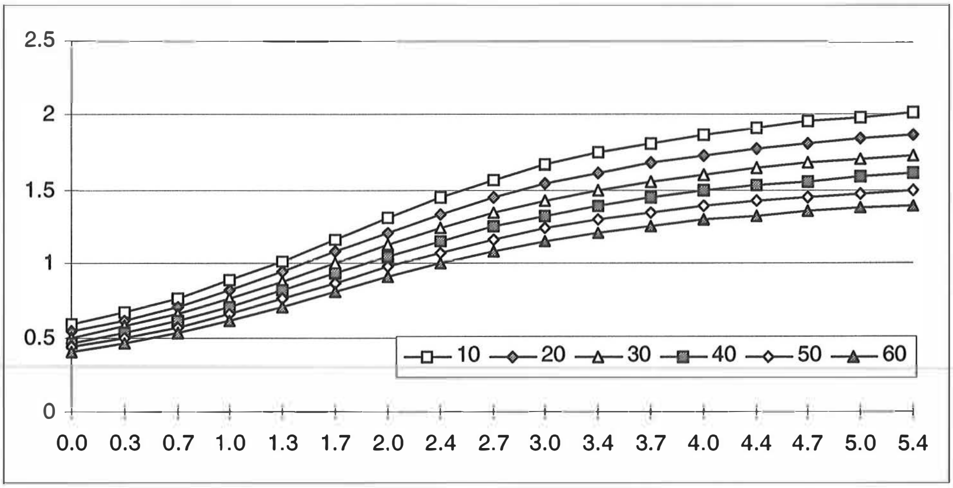

FIGURE 4 **AdCf**, product of the correction factors **CCf1** and **SCf1** as a function of **Sal** [in 1000 €] for **Sal%** values 10, 20, ..., 60. (See § 1.1-2)

Appendix 2.1

Non-wage labour costs according to the old and the new system

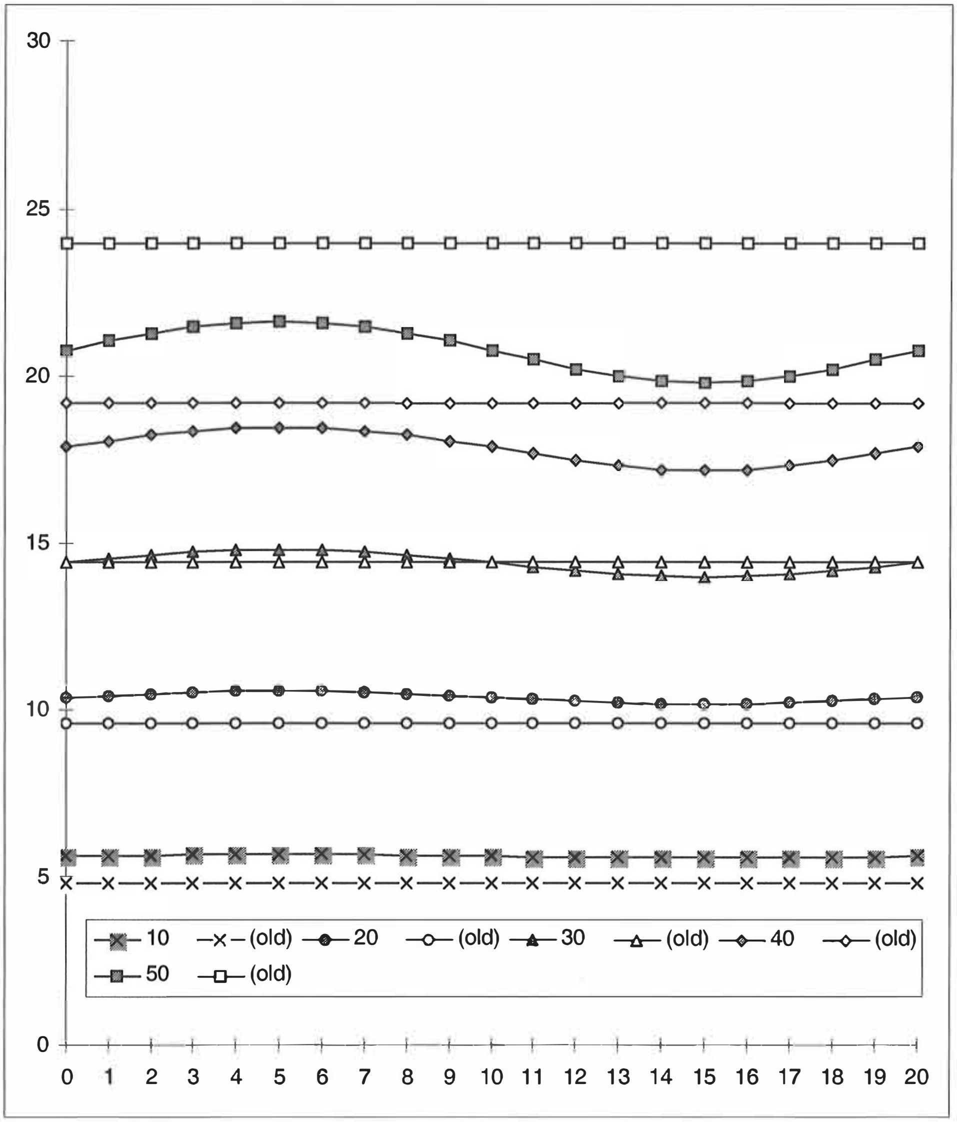

FIGURE 5 The effect of **CCf1** on non-wage labour costs (**Tover** =100, **Purch** =20) in the cases **Sal%** = [10, 20, 30, 40 , 50], when in the turnover there exists a 10% sinusoidal fluctuation (see § 3.1, Table 3.1). Old system values (white) and new system values (grey). One business cycle with 20 sample value points.

Appendix 2.2

Non-wage labour costs according to the old and the new system

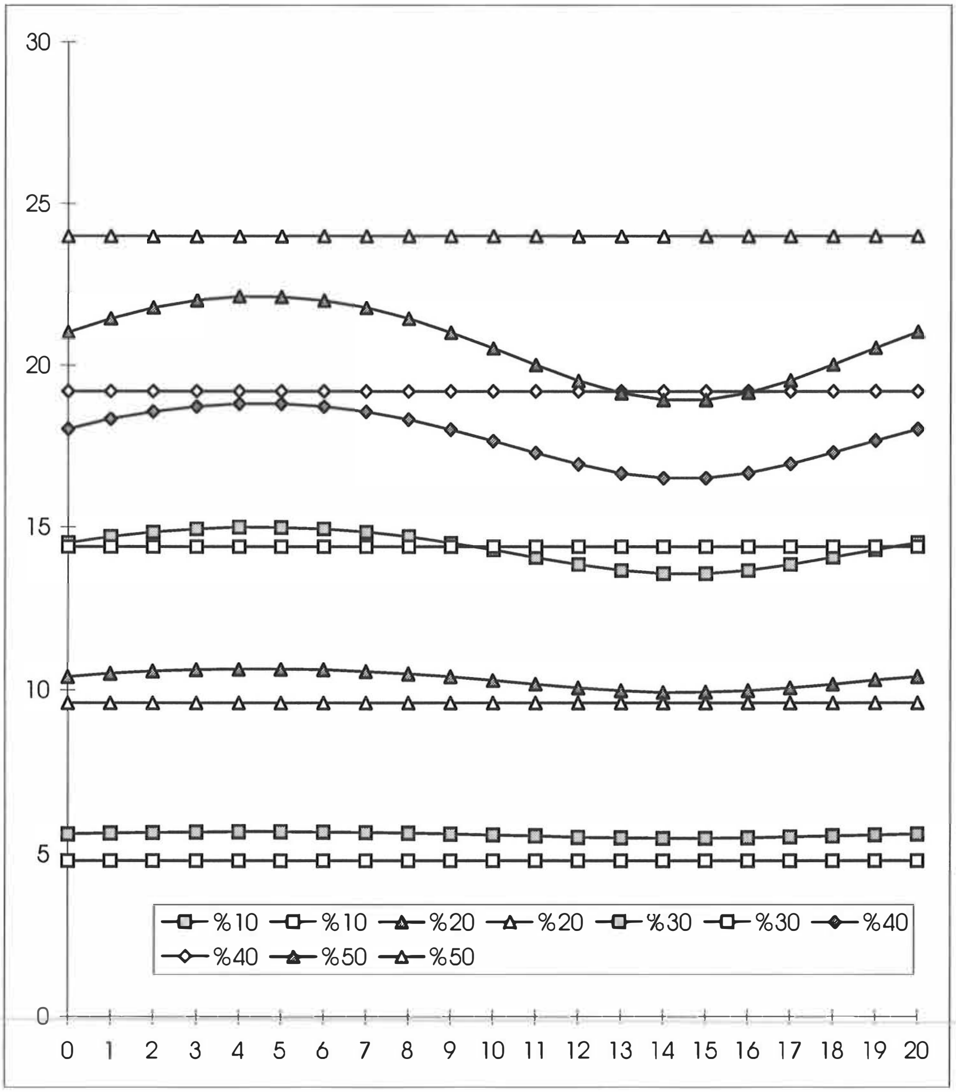

FIGURE 6 Non-wage labour costs in the cases **Sal%** = [10, 20, 30, 40 ,50] when in the turnover and the purchases there exists ±20% fluctuation and between them a phase shift of 45 degrees (the whole cycle 360 degrees). Old system values (white) and new system values (grey). **Tover** =100, **Purch** =20. One business cycle. (See § 3.1; Table 3.2)

Appendix 2.3

Non-wage labour costs according to old and new systems

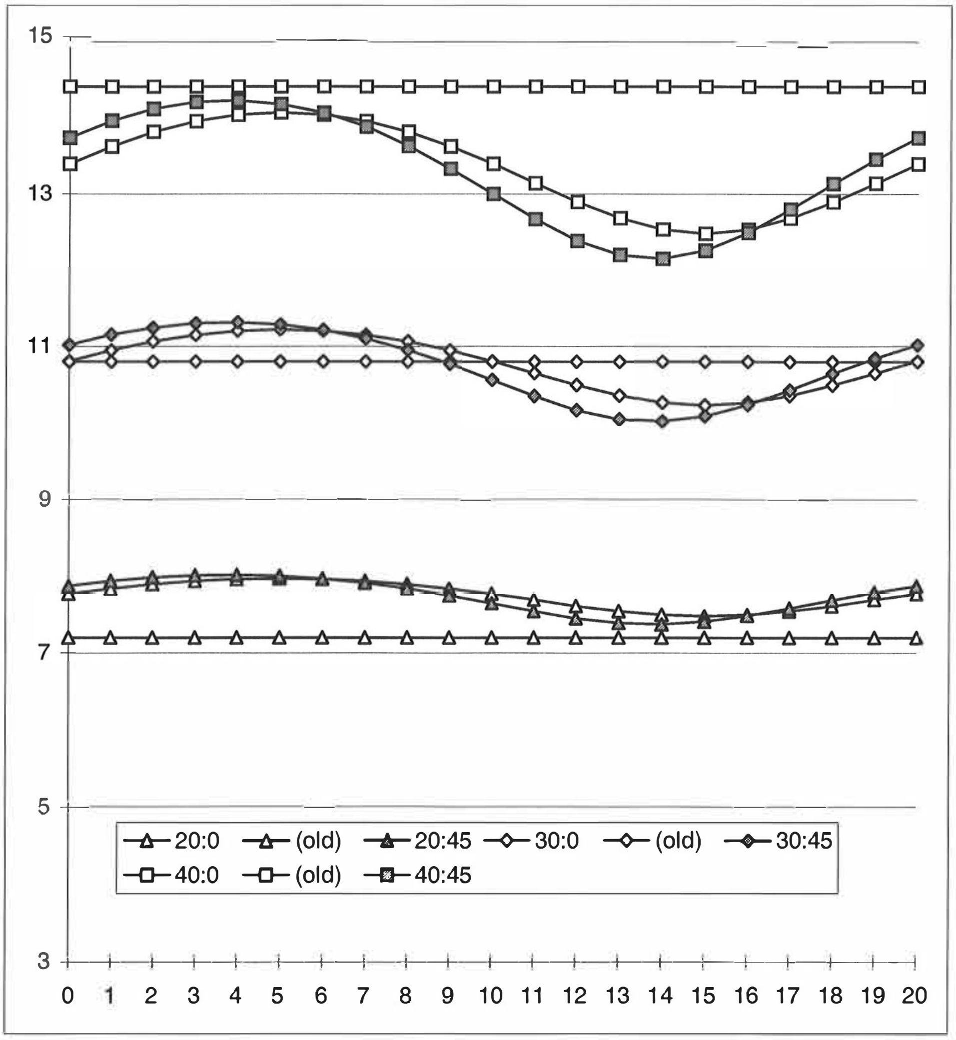

FIGURE 7 Non-wage labour costs in the cases **Sal%** = [20, 30, 40] , when in the turnover and in the purchases there exists a ±20% fluctuation and between them phase shifts of 0 and 45 degrees. Old system values (white no fluctuation) and new system values (white and grey). As starting values we have used **Tover** =100 and **Purch** =40. (20 sample points; 360 degrees corresponds to a whole business cycle; see § 3.1)

Appendix 2.4

Non-wage labour costs according to the new system by using correction factors CCf1, CCf2 and CCf3

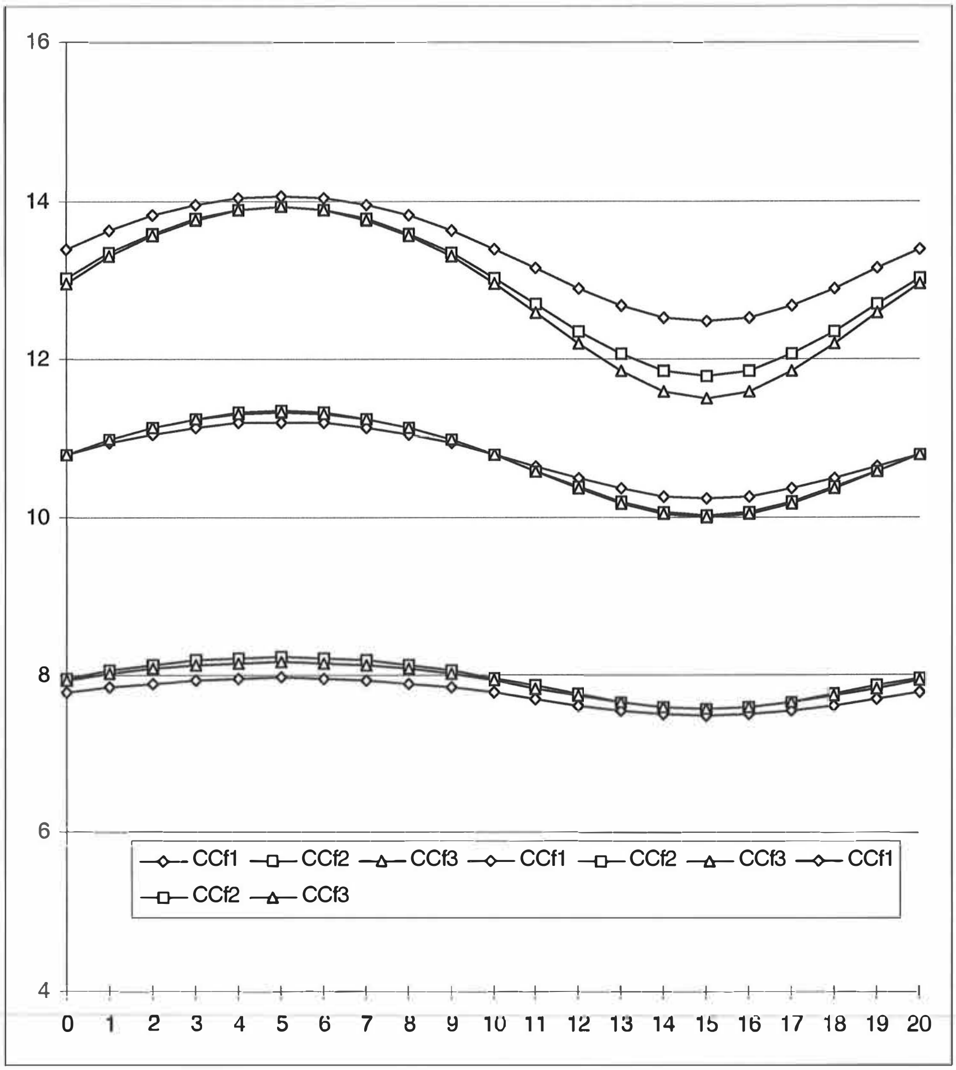

FIGURE 8 Non-wage labour costs in the cases **Sal%** = [20, 30, 40] when in the turnover and in the contracts there exists a ±20% fluctuation. The curves show the differences between the results got by using the correction factors **CCf1, CCf2** and **CCf3**. As starting values we have used **Tover** =100 and **Purch** =40. (20 sample points; a whole business cycle; see § 3.1)

Appendix 3.1 Labour costs in proportion to net salary

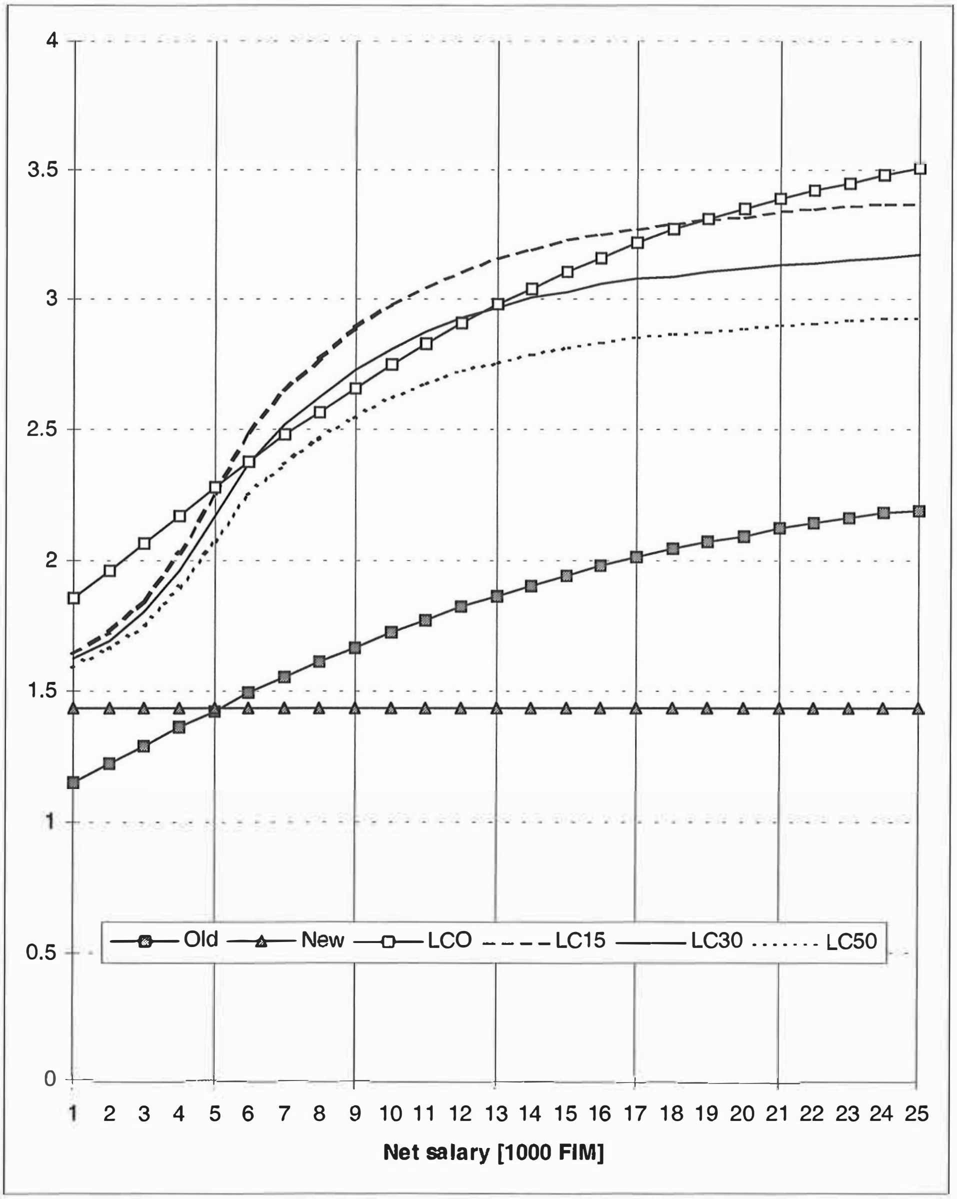

FIGURE 10 Gross salaries and total labour costs in the old and new system. Old (Old) and new (New) salaries, old total labour costs (LCO) and new total labour costs (LCnn) for **Sal%** values 15, 30 and 50 in proportion to the net salary. **Sal** FIM range 1 … 25 corresponds to € range 0.17 … 4.20.

Appendix 3.2 Examples of salary distributions

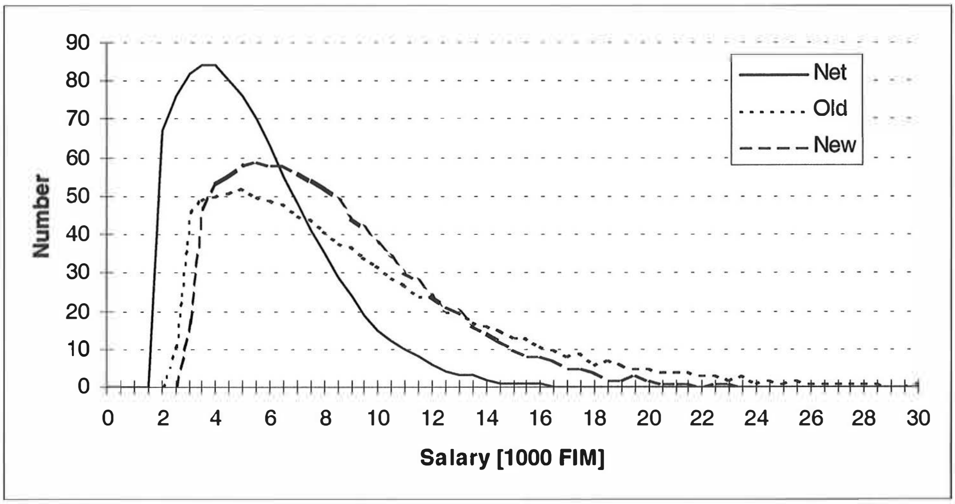

FIGURE 11 Salary distributions. Number of net and gross salaries (old and new system) as functions of the net salary.
(**Sal** FIM range 0 ... 30 corresponds to € range 0 ... 5.0)

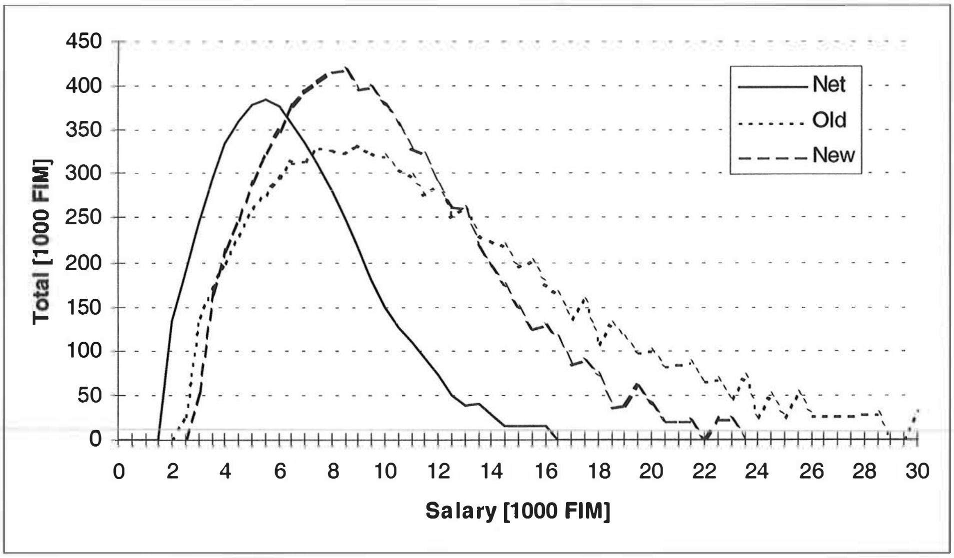

FIGURE 12 Salary distributions. Amount of total net and gross salaries as functions of the net salary.
(**Sal** FIM range 0 ... 30 corresponds to € range 0 ... 5.0)

Appendix 3.3
Examples of non-wage labour costs and taxes

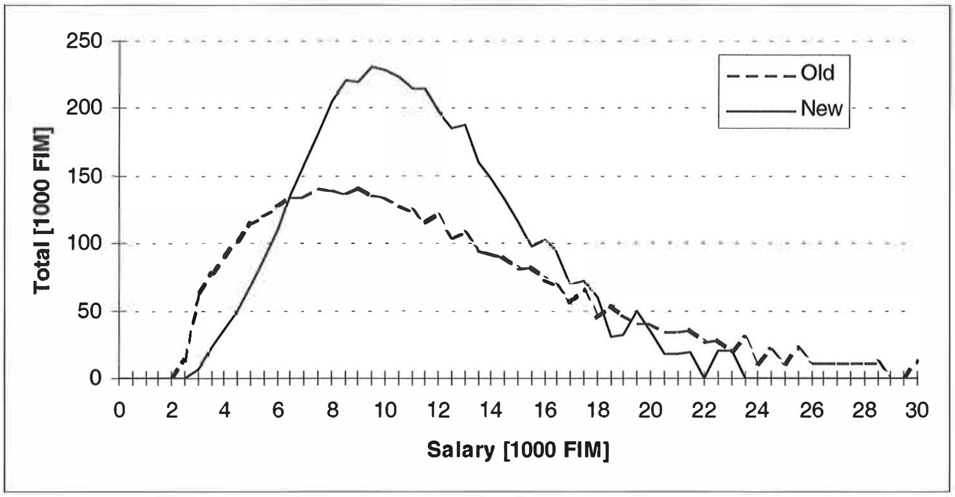

FIGURE 13 Distributions of non-wage labour costs as functions of the net salary. (**Sal** FIM range 0 ... 30 corresponds to € range 0 ... 5.0)

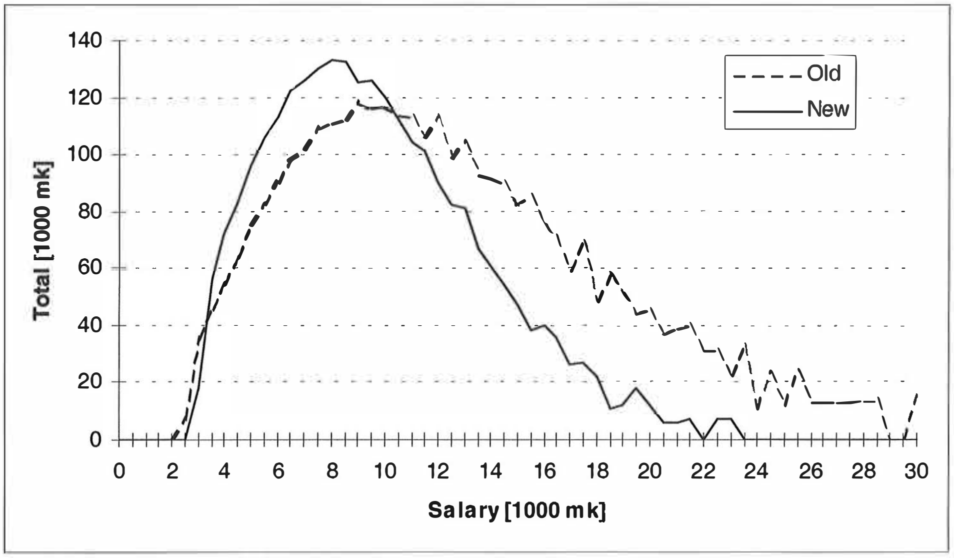

FIGURE 14 Distributions of taxes as functions of the net salary. (**Sal** FIM range 0 ... 30 corresponds to € range 0 ... 5.0)

Appendix 4.1 Labour costs in proportion to the net salary

All taxes paid as work force taxes

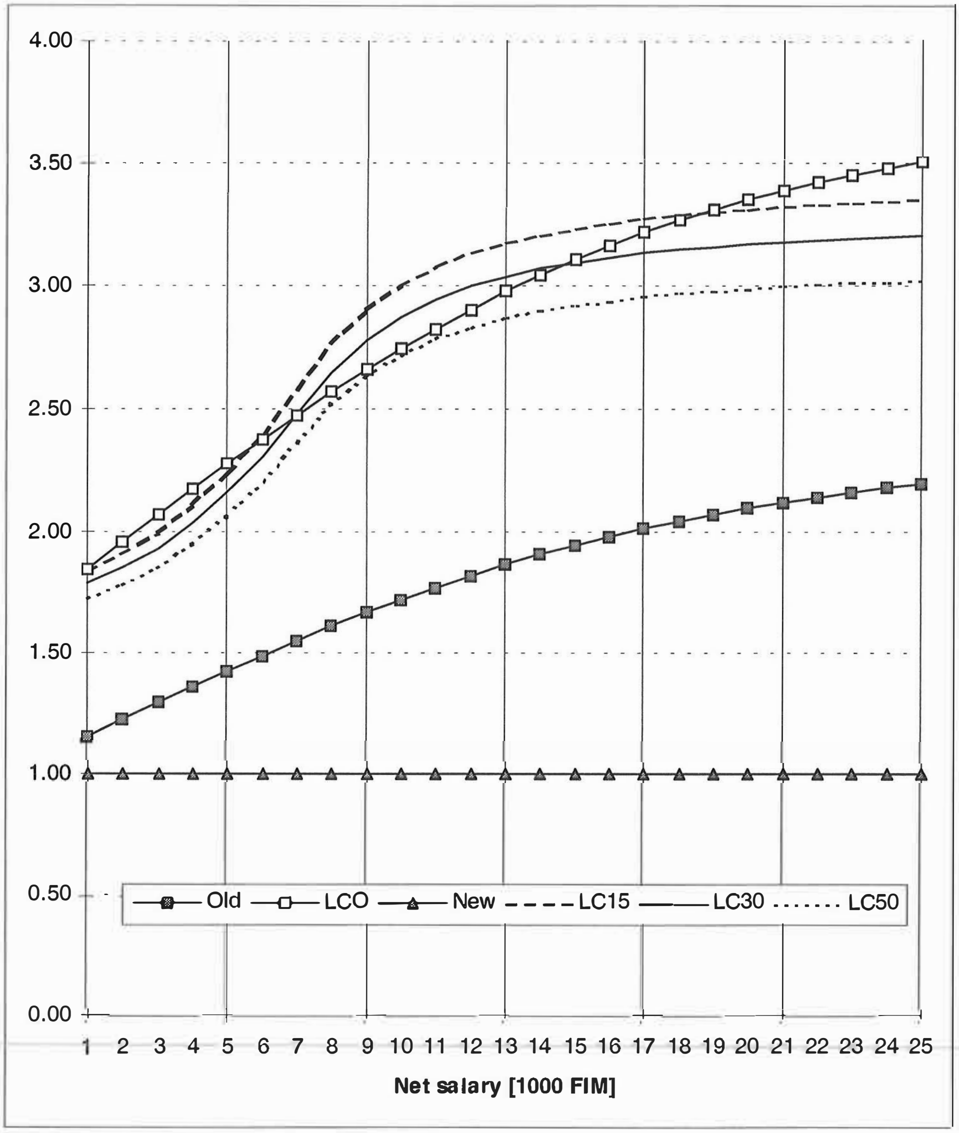

FIGURE 15 Gross salaries (grey) and total labour costs in the old and new systems. Old (Old) and new (New) salaries, old total labour costs (**LCO**) and new total labour costs (**LCnn**) for Sal% values 15, 30 and 50% in proportion to the net salary. Income tax rate 30%.
(**Sal** FIM range 0 ... 25 corresponds to € range 0 ... 4.2)

Appendix 4.2

Example of salary and labour costs distributions

All personal income taxes paid as labour force taxes

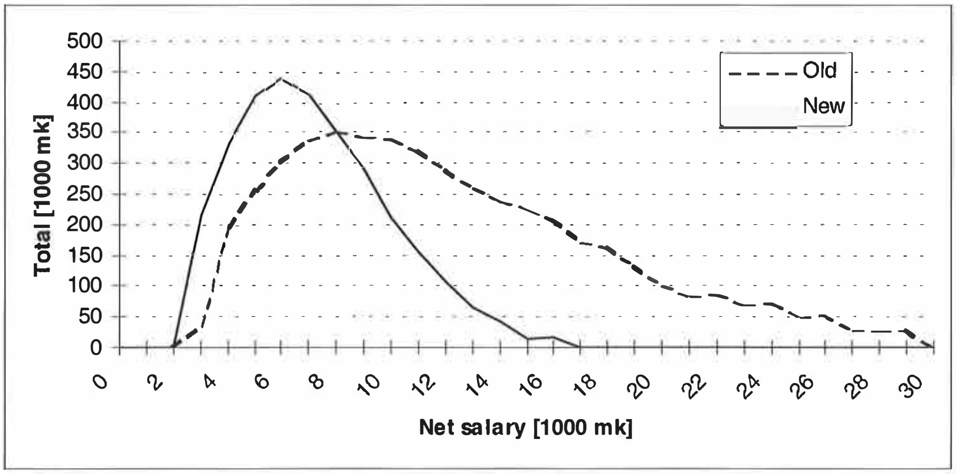

FIGURE 16a Salary distributions. Total gross salaries as functions of net salary. (**Sal** FIM range 0 … 30 corresponds to € range 0 … 5.0)

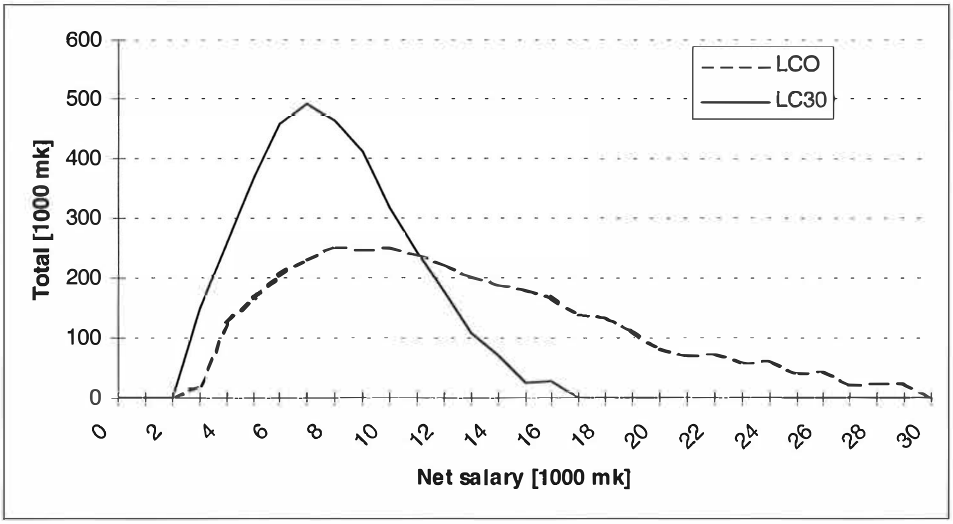

FIGURE 16b Distributions of non-wage labour costs as functions of net salary. (**Sal** FIM range 0 … 30 corresponds to € range 0 … 5.0)

Appendix 4.3
Labour costs according to sections 3.1 and 3.4.

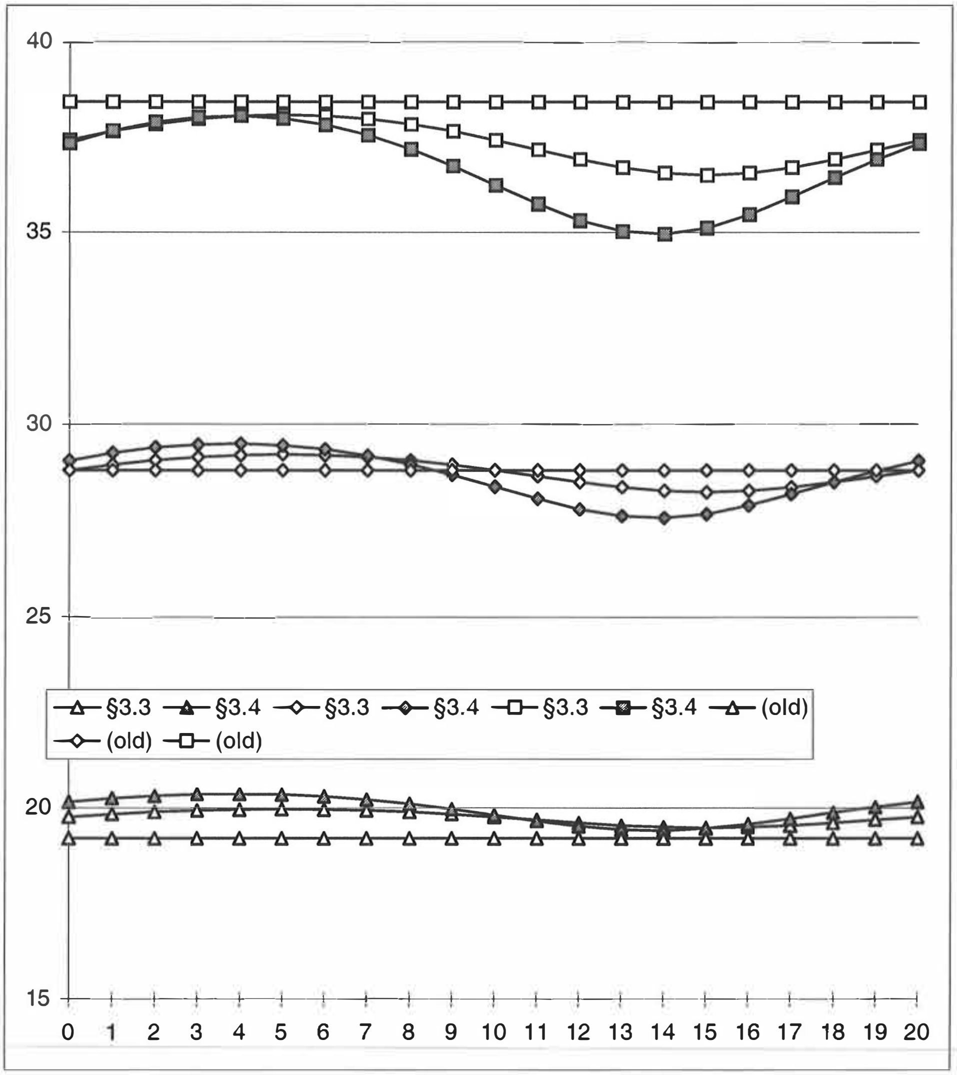

FIGURE 17 Labour costs in the cases **Sal%** = [20, 30, 40] when in the turnover and in the purchases there exists a ±20% fluctuation. New system values have been calculated as in sections 3.1 and 3.4. One sees a greater fluctuation in the values calculated according to § 3.4. Old system values as reference (no fluctuation). As starting values we have used **Tover** =100 and **Purch** =40; see § 3.1-2; §4.1. (20 sample points; 360 degrees correspond to one whole business cycle)

Appendix 4.4
Profits according to sections 3.1 and 3.4.

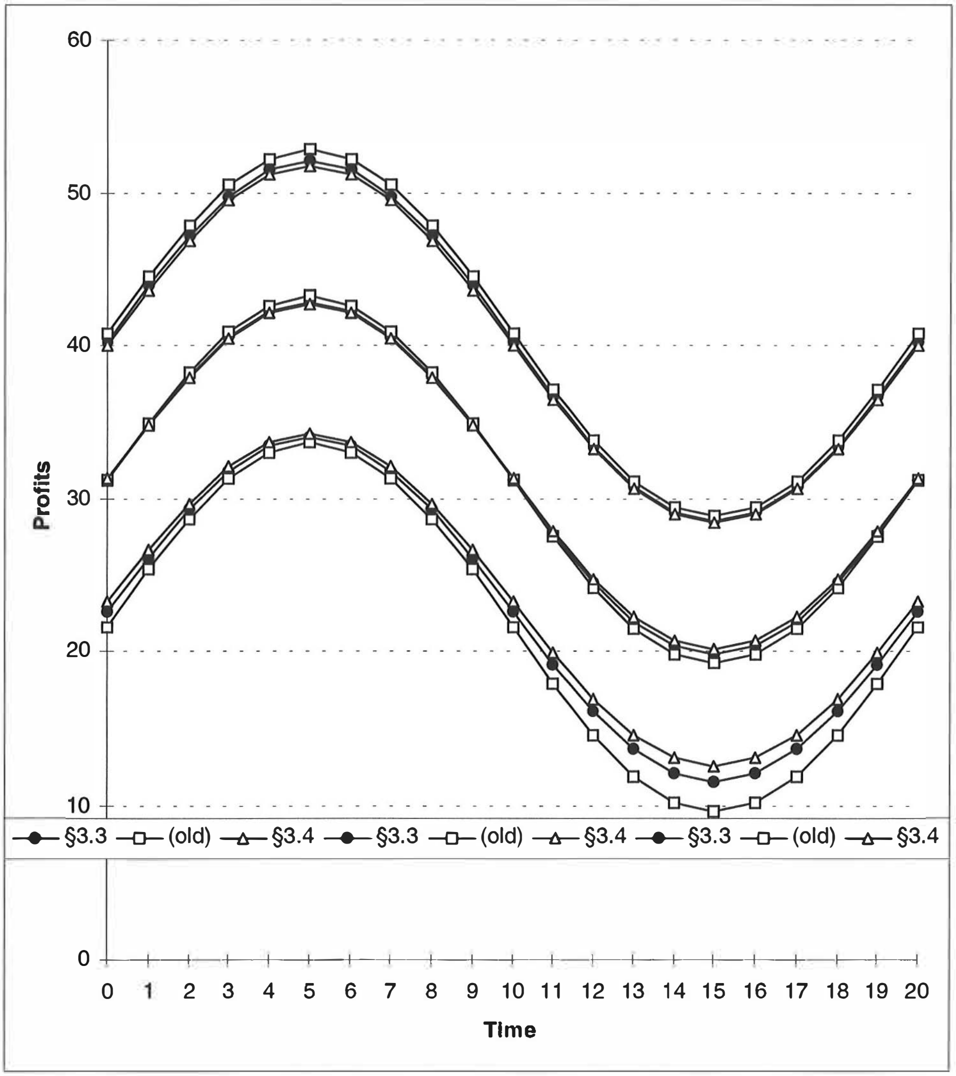

FIGURE 18 Profits in the cases **Sal%** = [20, 30, 40] when in the turnover and in the purchases there exists a ±20% fluctuation. New system values have been calculated as in sections 3.1 and 3.4. One sees a smaller fluctuation in values calculated according to § 3.4. Old system values as reference. As starting values we have used **Tover** =100 and **Purch** =40 ; see § 3.1&4. (20 sample points; 360 degrees correspond to one whole business cycle)

Appendix 5.1 An example of figures in an existing firm

Monthly figures of a firm in the years 1997 and 2000: **nWage** = sum of net wages, **Vadd** = value added, **Sal%** = percentage of the sum of net wages in the value added, Capital Correction factors **CCf1 ... CCf3.**
(See appendix 1.1 and § 1.1, § 3.3).

Year	month	nWage	Vadd	CCf1	CCf2	CCf3	Sal%
1997	1	71 250	475 886	1.12	1.16	1.15	14.97
	2	74 400	1 422 514	1.21	1.28	1.25	5.23
	3	77 250	268	0.26	0.00	-286.75	28805.08
	4	72 950	1 642 345	1.22	1.29	1.26	4.44
	5	82 380	1 685 727	1.21	1.29	1.25	4.89
	6	84 410	2 135 273	1.22	1.30	1.26	3.95
	7	94 350	1 721 882	1.21	1.28	1.25	5.48
	8	85 650	1 220 436	1.19	1.26	1.23	7.02
	9	76 920	595 909	1.14	1.19	1.17	12.91
	10	88 790	1 668 973	1.21	1.28	1.25	5.32
	11	74 770	126 186	0.81	0.75	0.71	59.25
	12	75 200	506 759	1.12	1.16	1.15	14.84
	whole	**958 320**	**13 202 159**	**1.19**	**1.26**	**1.23**	**7.26**
Year	**month**	**nWage**	**Vadd**	**CCf1**	**CCf2**	**CCf3**	**Sal%**
2000	1	105 810	514 200	1.07	1.10	1.09	20.58
	2	118 680	2 166 682	1.21	1.28	1.25	5.48
	3	109 130	1 281 386	1.18	1.24	1.21	8.52
	4	117 874	2 276 950	1.21	1.28	1.25	5.18
	5	114 435	1 984 382	1.20	1.27	1.24	5.77
	6	123 909	3 042 982	1.22	1.30	1.26	4.07
	7	133 421	3 554 241	1.22	1.30	1.26	3.75
	8	139 616	1 433 664	1.17	1.22	1.20	9.74
	9	119 032	55 491	0.38	0.16	-0.85	214.51
	10	119 749	552 418	1.07	1.09	1.08	21.68
	11	123 761	237 995	0.85	0.80	0.78	52.00
	12	112 110	206 382	0.84	0.78	0.76	54.32
	whole	**1 437 527**	**17 306 773**	**1.18**	**1.24**	**1.22**	**8.31**

The factors **CCf2** and **CCf3** have some exceptional values (1997: month 3, and 2000: month 9). These examples show that we have to set reasonable lower and upper limits for the used **CCf**. See the ranges for **CCfs** in appendix 1.1, and also the discussion in § 6.4.

Appendix 5.2 Value added per person

Value added per person in some Finnish industry branches in the year 1999. The last column tells the relative differences between the industry branches. We have calculated the ratio as the value added per person compared with that of the total industry (see the first line of the table).

Branch of industry	Personnel	Value added in production		Value added / person	Relative Value added
		FIM million	%	FIM	/ person
Total industry	**436 613**	**169 075**	**100**	**387 242**	**1.00**
Mining and quarrying	4 352	1 610	1,0	369 945	0.96
Manufacturing	414 301	155 036	91,7	374 211	0.97
- food, beverages, etc.	41 245	11 305	6,7	274 094	0.71
- textiles, etc.	15 578	3 383	2,0	217 165	0.56
- wood and wood products	27 868	7 394	4,4	265 322	0.69
- pulp, paper, paper products	37 196	25 292	15,0	679 966	1.76
- publishing and printing	30 396	9 177	5,4	301 915	0.78
- chemicals, chemical products, etc.	38 555	17 159	10,1	445 053	1.15
- non-metallic mineral products	14 650	4 886	2,9	333 515	0.86
- processing of metals	16 951	5 927	3,5	349 655	0.90
- fabricated metal products	34 762	9 397	5,6	270 324	0.70
- machinery and equipment	55 837	16 125	9,5	288 787	0.75
- electrical equipment	63 876	36 001	21,3	563 608	1.46
- transport equipment	2 060	5 405	3,2	2 623 786	6.78
- furniture	11 164	2 449	1,4	219 366	0.57
- other manufacturing	4 163	1 137	0,7	273 120	0.71
Electricity, gas and water supply	17 960	12 429	7,3	692 038	1.79

The basic information (three first columns): http://www.stat.fi/ (Statfin – tilastopalvelu)

Appendix 5.3.a Share of personnel costs

The share of personnel costs in the turnover of some Finnish companies, year 2000.

Firm	Industry Branch	Turnover costs Million	Personnel number [1 000 FIM]		Share of personnel costs [%]
Nokia	Electronics	180 607	17 142 736	58 708	**9.5**
Elcoteq		13 161	641 358	9 630	**4.9**
Vaisala		1 068	327 152	1 016	**30.6**
L M Ericsson		1 047	363 747	1 073	**34.7**
JOT Automation		833	147 084	714	**17.7**
Sanmina		625	89 628	582	**14.3**
Honeywell		609	161 262	578	**26.5**
Teleste		591	140 448	616	**23.8**
Filtronic		518	193 965	965	**37.4**
Orbis		461	61 143	267	**13.3**
Okmetic		408	116 100	516	**28.5**
Elektrobit		347	136 320	568	**39.3**
Sonera	Telecommunication	12 230	2 648 385	10 305	**21.7**
Elisa communications		7 398	1 429 352	6 161	**19.3**
Finnet International		375	24 072	118	**6.4**
Tietoenator	Information	6 659	3 397 428	9 934	**51.0**
Hewlett-Packard	... technology	2 682	0	364	**0.0**
IBM		2 149	320 019	933	**14.9**
ICL Invia		1 975	816 959	2 561	**41.4**
Novo Group		1 899	514 604	2 026	**27.1**
Done		439	190 864	632	**43.5**
Metso	Metall products	23 135	6 264 160	22 372	**27.1**
Wärtsilä		16 094	3 300 220	10 715	**20.5**
Kone		15 473	6 658 768	22 804	**43.0**
Partek		15 119	2 785 224	11 752	**18.4**
Fiskars		4 898	1 132 080	5 340	**23.1**
KCI Konecranes		4 180	1 264 712	4 244	**30.3**
Foster Wheeler		1 416	210 210	910	**14.8**
Lillbacka		1 229	292 752	1 284	**23.8**
Raute		810	208 750	835	**25.8**
Ponsse		709	120 250	481	**17.0**
Oras		664	160 446	1 122	**24.2**
Abloy		648	188 352	981	**29.1**
Halton		520	168 740	767	**32.5**
Sulzer Pumps		400	186 960	779	**46.7**
Sarlin		331	90 720	360	**27.4**
Larox		329	103 596	356	**31.5**

Source: http://www.Talentum.com, 500 biggest firms.

Appendix 5.3.b Share of personnel costs ... (continues)

Firm	Industry Branch	Turnover Million	Personnel costs [1 000 FIM]	number	Share of personnel costs [%]
Outokumpu	Basic metall	21 958	3 523 777	12 193	**16.0**
Rautaruukki		16 101	3 083 184	13 176	**19.1**
Ahlström	Multi branch	12 567	3 126 519	9 801	**24.9**
Instrumentarium		5 428	1 702 035	5 205	**31.4**
Raisio		4 756	604 950	2 775	**12.7**
Stora Enso	Pulp, paper	77 390	11 866 940	41 785	**15.3**
UPM-Kymmene		56 978	8 747 520	32 640	**15.4**
Metsäliitto		44 670	6 021 595	22 723	**13.5**
Kesko	Trade	37 503	1 875 731	11 099	**5.0**
Huhtamäki		19 667	4 343 800	23 480	**22.1**
SOK		16 375	893 200	5 075	**5.5**
Fortum	Energy, Oil	65 558	4 038 780	16 220	**6.2**
Teboil		5 765	65 830	290	**1.1**
Shell		4 121	225 705	1 101	**5.5**
Esso		2 406	93 600	312	**3.9**
Vattenfall		1 630	206 668	854	**1.27**
Kemira	Chemistry and plastic	14 781	2 507 440	9 644	**17.0**
Uponor		8 060	1 139 775	6 513	**14.1**
Orion		5 634	1 113 008	5 351	**19.8**
Perlos		2 690	718 115	3 503	**26.7**
Eimo		627	129 792	768	**20.7**
Sanoma, WSOY	Printing and communication	8 609	2 204 550	10 350	**25.6**
Alma Media		2 880	914 976	4 236	**31.8**
Otava kuvalehdet		1 103	213 720	822	**19.4**
Talentum		697	340 515	1 081	**48.9**
Atria	Food etc	3 661	735 471	3 519	**20.1**
Hartwall		3 639	490 329	6 335	**13.5**
Sinebrychoff		3 408	433 056	2 082	**12.7**
HK -Ruokatalo		3 021	546 657	3 877	**18.1**
Jaakko Pöyry	Consulting	2 821	1 344 610	4 558	**47.7**
Engel	Services	762	510 251	5 123	**67.0**
Lindström		698	201 058	1 406	**28.8**
SOL -Yhtiöt		322	228 262	3 882	**70.9**

Source: http://www.Talentum.com; 500 biggest firms.

Appendix 5.4 The relative variation between the indexes of sum of wages and turnovers

The following table contains monthly indexes for wages and turnovers in the Finnish manufacturing industry in the years 1996, 1998 and 2000. The last column is the ratio of these indexes. It tells of "seasonal" variation between wages and turnovers.

Year	Month	Wage Index	Turn-over index	Index ratio
1 966	Jan	96.2	86.7	1.11
	Feb	99.3	91.3	1.09
	Mar	103.6	101.2	1.02
	Apr	99.3	102.8	0.97
	May	107.0	109.4	0.98
	Jun	137.9	104.1	1.32
	Jul	110.0	90.9	1.21
	Aug	103.4	100.3	1.03
	Sep	99.5	104.1	0.96
	Oct	99.3	118.2	0.84
	Nov	100.9	114.8	0.88
	Dec	104.6	120.3	0.87
1 998	Jan	111.8	102.1	1.10
	Feb	112.0	112.6	0.99
	Mar	117.2	124.9	0.94
	Apr	118.6	123.2	0.96
	May	116.8	123.3	0.95
	Jun	145.7	126.3	1.15
	Jul	138.0	108.2	1.28
	Aug	110.3	113.9	0.97
	Sep	113.3	125.7	0.90
	Oct	112.6	131.0	0.86
	Nov	107.1	122.1	0.88
	Dec	129.6	129.1	1.00
2 000	Jan	112.8	115.8	0.97
	Feb	123.1	127.7	0.96
	Mar	134.9	142.8	0.94
	Apr	119.6	133.6	0.90
	May	127.3	145.9	0.87
	Jun	174.8	142.6	1.23
	Jul	136.7	121.7	1.12
	Aug	124.3	137.7	0.90
	Sep	131.8	151.6	0.87
	Oct	119.7	161.8	0.74
	Nov	121.6	159.8	0.76
	Dec	141.7	154.3	0.92

The basic information (two first columns): http://www.stat.fi/ (Statfin – tilastopalvelu)

Appendix 6

The effect of employers' social security contributions on unit production costs

Rantala O. (1995) Liite/Appendix 1 presents the effects the employers' social security contributions (**SoC**) have on production price (P_k) and enterprises' production quantities (Q_k). The (simplified) expression of profit (Π_k) is as follows:

(A 6-1) $\Pi_k = P_k Q_k - C_k Q_k - K_k = Q_k (-e \Sigma Q_i + X) - C_k Q_k - K_k$

where C_k is unit production price (changing costs), K_k is the fixed costs, $e > 0$ constant, X an exogenous demand factor on price. If we use the notation $dQ_i / dQ_k = r_{ki}$ $(i \neq k)$ for reaction parameters, then the maximizing of the enterprise' profit corresponds to the production quantity

$$Q_k = (a_k / e) (-e D + X - C_k),$$

where $a_k = 1/ (1+\Sigma r_{ki})$ illustrates the hardness of competition in the industry branch. The equilibrium condition gives the supply of products of the firm and the corresponding price and quantity

(A 6-2) $P_k = b \Sigma_{i \neq k} a_i C_k + (1-b \Sigma a_i) X$

(A 6-3) $Q_k = (a_k / e) (b \Sigma_{i \neq k} a_i C_i - (1-b a_k) C_k + (1-b \Sigma a_i) X)$.

We see that in the expression of Q_k the unit prices of competitors (C_i) have positive coefficients but the coefficient of C_k is negative. Fixed costs thus do not affect the price or the quantity of production but only the profit.

Effect of social security contributions on unit prices

Case 1. If **SoC**'s are determined by wages as a fixed ratio to the wages, then (Rantala (1995)) the unit production costs are

(A 6-4) $C_k = m_k C_{ok} + l_k (1 + s_k) W_k$,

where s_k is the ratio of **SoC**'s to wages, W_k is the average wage, C_{ok} the costs of intermediate products, and m_k and l_k are the relative weights of C_{ok} and W_k in the total production costs. If the expressions (A 6-4) are substituted in formulas (A 6-2 & 3) the **SoC**'s have identical effects on the production and price as the other changing costs of an enterprise.

Case 2. If the **SoC**'s are determined by the turnover or an enterprise as a fixed ratio to the value of production and sales, then the profit function (A 6-1) changes to

(A 6-5) $\Pi_k = (1 - s_k) P_k Q_k - C_k l_k W_k - K_k$

where s_k is the mentioned ratio. Then (Rantala (1995)) the unit production costs would become the following

(A 6-6) $C_k = (1 + s_k)(m_k C_{ok} + l_k W_k)$.

This means that **SoC**'s are added on all other unit production costs and not only on unit wage costs as in (A 6-4).

Case 3. If **SoC**'s are determined by the value added of an enterprise as a fixed ratio to the value added, then the profit function has the form (Rantala (1995))

(A 6-7) $\Pi_k = (1 - s_k)(P_k Q_k - m_k C_k Q_k) - l_k W_k Q_k - K_k$

where s_k is the mentioned ratio. Now the expression for unit production costs has the same form as in the Case 1 i.e. (A 6-4). This means that the impact on the price and production is the same.

Case 4. If **SoC**'s are determined by profits of an enterprise as a fixed ratio to the profit, then the profit function has the form (Rantala (1995))

(A 6-8) $\Pi_k = (1 - s_k)(P_k Q_k - C_k Q_k - K_k)$,

where s_k is the mentioned ratio. Because s_k acts as a multiplier in the expression of Π_k it does not affect on the equilibrium condition $d\Pi_k / dQ_k = 0$. This means that **SoC**'s do not affect the price or the production of the firm.

Unit production costs in the proposed model

The case 3 differs from our model in that instead of a fixed s_k we use a functional epression. s_k is determined by the share of all salary costs in the value added (**Sal%**) and, in addition, it depends on salaries. We take these changes into account in (A 6-4), and get

(A 6-9) $m_k C_{ok} + l_k W_k + l_k s_k W_k = m_k C_{ok} + l_k W_k + l_k N^{-1} \Sigma s_{ki} W_{ki}$,

where N is the number of employees, s_{ki} and W_{ki} the individual **SoC** rate and wage of individual employees, and the summing is made with respect to i. In our model

(A 6-10) s_{ki} = **Bas * AdCf = Bas * CCf$_k$ * SCf$_i$.**

where **Bas** is the basic rate of **SoC**, **CCf$_k$** is the (enterprise dependent) capital correction factor, and **SCf$_i$** the salary correction factor. We substitute the expression of s_{ki} into the formula (A 6-9) and get the unit production costs in our model as follows

(A 6-11) $C_k = m_k C_{ok} + l_k W_k + l_k * \mathbf{CCf_k} * \mathbf{Bas}\, N^{-1} \; \Sigma\, \mathbf{SCf_i} * W_{ki}$.

This means that the capital intensity of an enterprise ($\mathbf{CCf_k}$) and the distribution of salaries of enterprises will affect on their unit production costs. C_k increases with the capital intensity.

Appendix 7 The conventional formulas for expressions

Here we present our central variables and formulas of chapter 1 in a more conventional form (as in the Appendix 6):

A common model for the profit Π of an enterprise is (corresponding to the used time period): See for example Estola (1996), pp 202-221.

(A 7-1) $\Pi = p\,q - (1+s)\,w\,L - \Sigma_i C_i$,

where

p is the average product price,

q is the quantity of products during the time period,

$(1+s)\,w\,L$ is the labour cost,

w is the average wage,

L is the number of hours during the time period,

s is the average rate of non-wage labour costs,

$\Sigma_i C_i$ is sum of other costs.

The connection to our model we present only in that case where wage tax rate, **tax%,** is zero. Then we have the following expressions:

Tover	$= p\,q$,	
Purch	$= \Sigma_j C_j$,	(a subset of C_i's: **Vadd = Tover - Purch**)
Sal = Sal$_k$	$= w_{nk}\,L_k$	(employee's net wage w_{nk} and hours L_k)
SoC = SoC$_k$	$= s_k$ **Sal** ,	(s_k is employee dependent)
SSal	$= \Sigma_k\, w_{nk}\,L_k$	
AdCf$_k$	$= s_k$,	(depends on each employee's **Sal$_k$** and firm's labour intensity)
SSoC	$= \Sigma_k$ **SoC$_k$** .	

In our model the rate for social security contributions are employee dependent:

$$s_k = \mathbf{AdCf_k} = \mathbf{CCf_k} * \mathbf{SCf_k} ,$$

where **CCf$_k$** is calculated as a function of share of net salary sum in the turnover of the firm, and **SCf$_k$** depends on net salary of each employee separately. In addition, the formulas for these correction factors include some economic policy parameters and a few parameters for calibration purposes: (here **f** means some function expression of variables listed)

(A 7-2a) $\mathbf{SCf_k = f\,(Sal, SRef) = f\,(w_{nk}, L_k)}$,

(A 7-2b) $\mathbf{AdCf_k = f\,(SSal, Tover, SRef\%) = f\,(Sal\%, SRef\%) = f\,(w_{nk}, L_k, p, q, C_j)}$.

The parameters **SRef** and **SRef%** will affect on these values, but these parameters will be changed by government only. Therefore we have omitted them from the last expressions in the formulas (A 7-2a and 2b). If we look closer at the expressions for $\mathbf{AdCf_k}$ and $\mathbf{SCf_k}$, we see that they can be written as follows:

$$\mathbf{SCf_k = f\,(w_{nk}\,L_k, L_k)}\ ,$$

$$\mathbf{AdCf_k = f\,(\,(\Sigma_k\, w_{nk}\, L_k\,) / (p\, q - \Sigma_j\, C_j)\,)}\ .$$

In the latter,

$$\mathbf{p\, q - \Sigma_j\, C_j = Vadd = Tover - Purch}\ ,$$

$$\mathbf{(\Sigma_k\, w_{nk}\, L_k) / (p\, q - \Sigma_j\, C_j) = Sal\%}\ .$$

Sal% is used to measure the labour intensity of the firm.

In the case where all taxes are paid as labour force taxes (**tax%** = 0), the profit will have the following expression

(A 7-3) $\mathbf{\Pi = p\, q - \Sigma_k\, (1+s_k)\, w_{nk}\, L_k - \Sigma_i\, C_i}$.

YHTEENVETO (FINNISH SUMMARY)

Kohti parempaa työllisyyttä yritysten työvoimakustannusten adaptiivisella säädöllä

Tämän tutkimustyön lähtöajatuksia ovat olleet, että:

1) Yritysten työvoimakustannukset ovat jäykät verrattuna yritysten monien muiden keskeisten menojen sekä tulojen vaihteluun. Työvoimakustannusten suhdannedynamiikka saisi olla nykyistä suurempi.
2) Nykyinen työvoimakustannusten rakenne on merkittävä syy massatyöttömyyteen Suomessa - elinkeinoelämällä on ollut vaikeuksia sopeutua toimintaympäristön muutoksiin.
3) Valtiovallan työvoimapoliittiset päätökset vaikuttavat kansantalouteen makrotasolla. Päätökset tulevat viiveellä, ne kohdistuvat tehottomasti tai niiden vaikuttavuus yksittäisen yrityksen tasolla on vähäinen.

Nykyisin tiettyyn palkkatasoon liittyvät työvoimakustannukset ovat likimain samat riippumatta yrityksen toimialasta, työvoimavaltaisuudesta, suhdannetilanteesta tai kehitysvaiheesta. Työvoimakustannusten uudella kohdistamisella pyritään korkeaan työllisyyteen. Hyvin kannattavat tai hyväpalkkaiset alat ja yritykset kustantavat osittain heikommin kannattavien tai matala-palkka-alojen työvoimakuluja. Kansantalouden kannalta on edullisempaa hyödyntää mahdollisimman monen työpanos kuin maksaa työttömyyskuluja. Kokonaisverotuotto voidaan silti säilyttää - kyse on maksujen oikeasta kohdistamisesta ja työllisyysvaikutuksista.

Laskemalla työvoimakustannuksia matalapalkka-aloilla luodaan edellytykset tavanomaisille työpaikoille, mikä monien tutkimusten mukaan tehokkaimmin parantaa työllisyyttä. Lisäksi tavanomaisiakin työpaikkoja tarvitaan. Palveluja emme voi tuoda; niiden tuottamisessa kustannustason tulisi olla sellainen, että luodaan edellytykset hyvinvointivaltion kehittymiselle.

Yhtä tärkeää on, että taataan tietämystä vaativien tuotantoalojen menestyminen. Se edellyttää, että pystytään pitämään näiden alojen tuotekehityskustannukset kurissa ja tarjoamaan kansainvälisesti kilpailu-kykyinen palkkataso. Tämä on mahdollista, kun työvoimakuluja leikataan nykyisestä myös ylimmissä palkkaluokissa.

Palkansaajan kannalta ehdotettu malli tarkoittaa siirtymistä kiinteän tuloveroon (veroprosentti esimerkiksi sama kuin pääomaverolla) tai eräänlaiseen nettopalkkajärjestelmään. Verot muuttuvat yhdeksi **työvoimavero**ksi, joka sisältää perinteisen tuloveron ja sosiaaliturvamaksut. Työvoimavero esitetään määräytyväksi nettopalkan ja yrityksen pääomaintensiteetin perusteella ja siitä huolehtisi kokonaisuudessaan työnantaja.

Työvoimakustannusten säätely

Tutkimuksessa kehitetään malli työvoimakustannusten säätelylle **yritystasolla**. Säätötarvetta voivat aiheuttaa toisaalta yleiset suhdanne- ja kausivaihtelut ja toisaalta täysin yrityskohtaiset erityisvaihtelut. Työvoimakustannusten säädön tavoitteena on vähentää vaihtelua yrityksen toimintakatteessa. Yhteiskunnan kannalta tavoitteena on tasapainoisempi talous ja parantunut työllisyys.

Työvoimakustannusten säätely tapahtuu siten, että kohteena on henkilöverojen ja palkkasivukulujen osuus työvoimakuluissa. Säätely perustuu siihen, että huomioidaan yrityksen nettopalkkasummataso ja sen vaihtelu suhteessa tuotettuun arvonlisään. Kun nettopalkkasumman osuus yrityksen arvonlisässä kasvaa, sen maksama työvoimavero laskee ja toisaalta osuuden laskiessa työvoimavero nousee. Yritys siis maksaa työvoimaveroa enemmän, kun sillä menee hyvin ja vähemmän, kun sillä menee huonosti. Yksi mallin tunnuspiirre on se, että se suosii työvoimavaltaisia aloja.

Työssä esitetyllä yrityskohtaisella työvoimakustannusten säätelyllä saavutetaan monia etuja kansantalouden kannalta. Suhdannevaihteluiden osittainen kompensointi lisää elinkeinoelämän mahdollisuuksia sopeutua erilaisiin muutoksiin ja häiriöihin nykyistä paremmin:

Elinkeinoelämää ja yhteiskuntaa hyödyttäviä etuja ovat:

(1) yritysten työvoimakulut synkronoituvat (nykyistä paremmin) tulovirtojen kanssa, jolloin suhdannevaihtelut ja yrityksen kehitysvaihe huomioituvat automaattisesti,

(2) elinkeinoelämän elvytys ja ylikuumenemisen hidastaminen tapahtuvat automaattisesti ja yrityskohtaisesti,

(3) korkeampi ja tasaisempi työllisyys,

(4) kansantalouden lisääntynyt sopeutumiskyky muutostilanteissa,

(5) malli tukee järkevää aluepolitiikkaa,

(6) yritys pystyy harjoittamaan nykyistä järkevämpää henkilöstöpolitiikkaa,

(7) työvoimakustannuksiin liittyvä byrokratia yrityksissä vähenee,

(8) henkilöverotus yksinkertaistuu,

(9) työmotivaatio paranee (henkilöverotuksen muutoksien johdosta),

(10) ristiriita pääoma- ja palkkatulojen välillä poistuu,

(11) tarve paikallisiin työehtoneuvotteluihin vähenee.

Suhdannevaihteluiden tasoittuminen, kohdat (1-4)

Työvoimakulut säätyvät siis yrityksen rahavirtojen vaihdellessa ja synkronoituvat nykyistä paremmin niiden kanssa. Säätyminen ja sen vaikutukset tapahtuvat yritystasolla, mutta summautuvat kokonaisvaikutuksiksi kansantaloudessa. Työvoimakulujen säätyminen auttaa elinkeinoelämän mukautumista erilaisiin häiriötilanteisiin. Talouden elvytys ja ylikuumenemisen hidastaminen tapahtuvat automaattisesti ja yrityskohtaisesti työvoimakustannuksissa tapahtuvien muutosten kautta. Tarve erilliseen suhdannepoliittisiin päätöksiin vähenee ja säätelyn vaikutukset kohdistuvat tehokkaasti. Esitetty työvoimakustannusten säätö siis stabiloi kansantaloutta.

Työllisyys paranee arviolta 80 000 - 170 000 henkeä tutkimuksessa käytetyllä mitoituksella. Tällöin valtion työttömyysturvamenot supistuvat jopa 10 miljardia markkaa vuodessa (vuoden 1995 tietojen mukaan laskettuna).

Työllisyyttä parantaa erityisesti (työvoimavaltaisten) matalapalkka-alojen työvoimakustannusten madaltuminen. Toinen vaikutus on näiden alojen nettopalkkatasojen nousu, millä myös on myönteinen vaikutus kansantalouden kehittymiseen.

Tuki aluepolitiikalle, (5)

Malli tukee järkevää aluepolitiikkaa. Tämä perustuu siihen, että malli tasoittaa yritysten toimintaedellytyksiä alueellisesti. Edullisemmilla alueilla sijaitsevien yritysten kustannusrakenne on erilainen kuin syrjäisten alueiden yritysten. Kustannuserot puolestaan vaikuttavat yrityksen työvoimaverojen määrään.

Henkilöstöpolitiikka, (6)

Mallin yhteydessä voidaan harjoittaa nykyistä järkevämpää henkilöstöpolitiikkaa. Ammattitaitoisesta henkilökunnasta on helpompi pitää kiinni, kun työvoimakuluissa on joustoa suhdanteiden vaihdellessa.

Yritysten taloushallinto yksinkertaistuu, (7)

Työvoimakustannuksiin liittyvä byrokratia yrityksissä vähenee, jos vero ja palkkaan liittyvät sivukulut voidaan hoitaa yhtenä kustannuskokonaisuutena. Nykyisin palkan sivukuluissa on lukuisia eri maksuja, joiden hallinta on erityisen työlästä pienille ja keskisuurille yrityksille.

Henkilöverotus yksinkertaistuu, (8)

Henkilöverotus yksinkertaistuu, jos siirrytään tutkimuksen mallin mukaiseen henkilöverotukseen. Toteutustapoina ehdotetaan joko

1) kiinteää tuloveroprosenttia, joka on sama kuin pääomaverotuksessa tai

2) siirtymistä nettopalkkaukseen, jolloin palkkaan liittyvät verot ja sivukulut maksetaan yhtenä kokonaisuutena - **työvoimaverona**.

Tapauksessa 2 vapaudutaan kokonaisuudessaan palkkoihin kohdistuvasta henkilöverotuksesta. Vapautuvat resurssit voidaan suunnata työvoimaveron hallinnointiin eli kohdistamaan eri nimikkeille: kunnille, valtiolle, eläkerahastoihin jne. Näin kerättävin varoin kustannettaisiin lakisääteinen sosiaaliturva. Keskitetty käsittely olisi nykyistä menettelyä tehokkaampi. Esitetyssä mallissa sosiaaliset tulonsiirrot ja palvelut olisivat nykyistä helpommin ja oikeudenmukaisemmin järjestettävissä.

Palkkatulo, pääomatulo, kohdat (9-10)

Henkilöverotuksen muuttuminen, yksinkertaisimmillaan "palkka puhtaana käteen" -periaatteen mukaiseksi, lopettaa keskustelun palkkatulojen korkeasta verotuksesta. Jokainen tehty työtunti lisää tuntipalkan verran tuloja puhtaana käteen. Työvoimaveron progressio sisältyy työnantajan maksamaan työvoimaveroon.

Esitetyssä työvoimakustannusmallissa nykyisenlainen kiistely pääoma- ja palkkatulojen verotuksesta poistuu. Henkilön palkkatulojen vero on 0% nettopalkkausmallissa tai vaihtoehtoisesti kiinteä prosenttimäärä joka voisi olla pienempi tai sama kuin pääomatuloilla.

Paikalliset työehtoneuvottelut, (11)

Työnantajat ovat vaatineet lisää mahdollisuuksia paikallisiin työehtoneuvotteluihin. Työntekijöiden kannalta kyse on merkittävästä periaatteellisesta asiasta siihen kytkeytyvien monien ongelmien ja riskien vuoksi. Esitetty malli ottaa huomioon yrityskohtaisen tilanteen, mikä vähentää tarvetta paikallisiin neuvotteluihin. Työvoimakustannusten suhdannedynamiikka saattaa ratkaista merkittävän osan yrityskohtaisista ongelmista.

Muita työllisyyttä tukevia ehdotuksia

Nuorisotyöllisyyttä tukee tutkimuksessa ehdotettu työvoimaverotuksen (tai palkkasivukulujen) porrastus. Maksutaso voisi olla 40% 18 vuoden iässä ja kasvaa 5% vuosittain, jolloin maksut saavuttavat 100% tason 30 ikävuoteen mennessä. Nuorten työllistäminen tulee tällöin nykyistä edullisemmaksi. Malli vaikuttaisi myös siihen, että nuorten kannattaisi valmistua ja hakeutua töihin mahdollisimman nuorina.

Liukuva siirtyminen eläkkeelle siten, että vuosittainen työaika - työtuntien lukumääränä mitattuna - laskee vuosittain. Jos lasku olisi 2% vuosittain alkaen 45 vuoden iässä, niin vaadittava työmäärä on 60% normaalista 64 vuoden ikäisenä - vaihtoehtoisesti 4% kymmenen tai 5% kahdeksan vuoden aikana vuosittain. Tämä malli tukisi sekä työssä jaksamista nykyistä korkeampaan ikään että työllisyyttä.

Erityistalousalue, utopiaako?

Työssä on keskitytty esitetyn uuden työvoimakustannusten määräytymistavan mukaisen pääidean vaikutusten kuvaamiseen. Paljon selvitettävää ja mielenkiintoista tutkittavaa jää tehtäväksi. Mallia olisi luonnollista kokeilla jollain **eritystalousalue**ella Suomessa ja ehkä muuallakin EU:n alueella. Kokeiluun voisi ottaa mukaan valitun alueen pieniä ja keskisuuria yrityksiä. Mallin vaatimat muutokset ovat yksinkertaisempia yrityksissä kuin työvoimaveron jatkokäsittelyssä, mihin liittyy lainsäädännöllisiä asioita. Siirtyminen uuden mallin mukaiseen toimintaa koko taloudessa vaatisi vuosien sitkeän valmistelun nopeimmillaankin. Onko esitetty malli toteutettavissa vain Utopiassa?