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THE RESEARCH INSTITUTE OF THE FINNISH ECONOMY
Lönnrotinkatu 4 B 00120 Helsinki Finland Tel. 358-9-609 900
Telefax 358-9-601 753 World Wide Web: http://www.etla.fi/

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Kari E.O. Alho

LABOUR MARKET INSTITUTIONS AND THE EFFECTIVENESS OF TAX AND BENEFIT POLICIES IN ENHANCING EMPLOYMENT: A GENERAL EQUILIBRIUM ANALYSIS *

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ABSTRACT: The paper aims to shed light on the relationships between labour market institutions with respect to wage formation and the effectiveness of economic and labour market policies in enhancing employment and overall economic performance. We evaluate tax and benefit policies under four alternative specifications of wage formation: fixed, market determined, and bargained wages. In the latter, we also distinguish between the short- and long-run effects, and between uncoordinated and coordinated (nation-wide) bargaining. To this end, we build a computable general equilibrium model which is calibrated using data on the Finnish economy and labour market, distinguishing workers of three skill categories by the level of their education. Evaluating policies under various possible labour market institutions, the paper also seeks relevance in a wider EU perspective. Overall, the model simulations show that labour market institutions with respect to wage formation influence to a large extent the effectiveness of many policies aiming at enhancing employment.

When wages are allowed to react, policies expanding the demand for labour, which work well under fixed wages, turn out to be quite inefficient in the short run. The reverse emerges with supply side policies such as reducing benefits so that wage reactions reinforce the positive effects of these policies. The reduction of marginal taxes interacts with labour market institutions in quite a sensitive way. Under wage bargaining, tax reductions should be channelled to low-income earners, while the reverse holds under flexible wage formation. Policies directed at raising labour demand for a targeted group, typically the low skilled, are able, on the other hand, to lower unemployment amongst this group of workers also under coordinated wage bargaining. However, if the group concerned enters in a new wage bargaining round unilaterally, the effect of this policy can even be quite negative in terms of its impact on employment due to the rise of compensatory wage claims through the wage-wage links. We also consider a hypothetical, fully flexible labour market and find the extent of the widening of the wage distribution, but also the magnitude of clear economic gains, related to a low rate of unemployment reached through the assumed wage adjustment process. The most effective policy in terms of employment, labour supply and unemployment is the curtailment of social security benefits while out of work. Also a neutral policy of compensating the cut in unemployment benefits by a tax reduction leads, under bargaining, to an expansion in the economy. The results call for coordination in tax and benefit policy measures, so that incentives to work and to stay out of work are not created simultaneously.

KEY WORDS: Employment, Tax and benefit policies, Wage formation, CGE model

JEL Code: J31, J32, H20

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1. Introduction

Enhancing employment is crucial for the goals of the EU and its Lisbon process. Taxes and benefits are key policy instruments which affect the functioning of the labour market and employment. These and other instruments of economic and labour market policies should be analysed in conjunction with wage formation, the role of which is often neglected when considering policies affecting the demand or supply side of the labour market, despite the potentially large impact wage formation can have on the effect of these policies.

In this paper we make a distinction between four cases of wage formation to shed light on its role as to the effectiveness of various policies in enhancing employment. The first case assumes fixed wages, the second market-determined wage formation where wages correspond to the marginal revenue product of labour at the given level of unemployment, and the third wage bargaining, where wages are negotiated between the employer and employee trade union organisations in an uncoordinated way. The fourth case is that of coordinated wage bargaining under a nation-wide incomes policy. The second case, i.e., market-based wages, allows us to consider also the hypothetical case of a fully flexible labour market and contrast this to the effects of various labour market policies. The computable general equilibrium model built in the paper is static, but also makes a distinction between short- and long-run equilibria in the labour market so that in the long run the capital stock of firms changes in response to shifts in profitability in the short run. This gives us an estimate of the change in the equilibrium rate of unemployment, too.

The motivation for this extensive modelling is two-fold. First, we want to shed light on the relationship between policies and institutions of wage formation, which, to our knowledge, has not been studied earlier so thoroughly. This way the paper strives to be of wider relevance as the EU countries differ with respect to their labour market institutions and wage formation, and given the current intensive debate in the EU on how to reform the tax and benefit systems and to improve the functioning of the labour market in order to enhance employment.[1] Second, in terms of a single-country analysis for Finland, in addition to raising the above issue in more precise empirical terms, we also want to see how wage reactions influence policy effects over time. To do so, wages are initially fixed, then are influenced by market forces, and finally negotiated by the social partners. In the spirit of recent labour market analyses, where attention has been paid to the diverging developments across various skill levels, we divide the stock of workers into three categories based on their level of education: basic, secondary and tertiary. There are wide and persistent differences in the balance of these respective labour markets, not only in Finland (see Figure 1), but in other EU countries as well.

The tools used in the process of enhancing employment are peer review of and peer pressure on the national action plans because, due to subsidiarity, the main and often sole responsibility for taking measures rests on national action. Although having been able to improve markedly the imbalance in its labour market since the deep recession in the early 1990s, Finland still suffers from high unemployment. So, there is room for adjustment and further policy measures.

[1] See, e.g., the recent guidelines of the EU concerning the strategies on Growth and Jobs 2005-2008, which emphasise (Guideline No. 22): "Encouraging the social partners […] to set the right framework for wage bargaining …".

To obtain empirical results, an aggregative numerical general equilibrium model is built for the Finnish economy as it would not be meaningful to try to apply a model like this at the EU level due to, among other things, the fact that there does not exist an EU-wide labour market in terms of, for example, wage bargaining and identical labour market institutions. Of course, there exist links in wage rises between the various EU countries, but mostly through indirect economic relations. So, the approach taken here is that it is best to illuminate empirically the effects of policies and how they depend on the various possible labour market institutions using a single-country model. Of course, data limitations and differences, for example, in tax and benefit structures between various countries also justify this kind of approach.

Our model has some similar features with the CGE model of the Dutch labour market by Bovenberg et al. (2000),[2] but also elements which are quite different. The latter are basically related to the key role given to the various assumptions of wage formation. Other different features are the cooperative structure of production combining the different components of labour, allowing for the case of subsidised labour recruited under an employment support scheme, and the specification adopted on how to combine the job flow market with recruitment costs in the model. Similarly, we deviate from the disaggregated model, with respect to production, built for the German labour market by Böhringer et al. (2005), i.a., by considering here only one aggregate sector of production.

We analyse several measures, such as reductions in average and marginal income taxes, indirect labour costs of firms, both uniformly and targeted to low-skilled employees only, and in unemployment benefits, and an increase in the employment subsidy scheme, all of which, in principle, boost the economy. Wage formation is found to be essential in determining the outcome of policies and their overall effectiveness. Basically, the apparent effectiveness of certain policies reached under fixed wages may be quite misleading, because the ensuing reaction of wages may neutralise much of the positive policy effects. However, there are also policy measures whose positive effects are strengthened by the reaction of wage formation. The former include measures affecting labour demand, like reducing the indirect labour costs of firms. The effects of such measures, which reduce wage claims directly or indirectly, are, however, magnified by wage reactions, while with fixed wages their positive effects are only marginal.

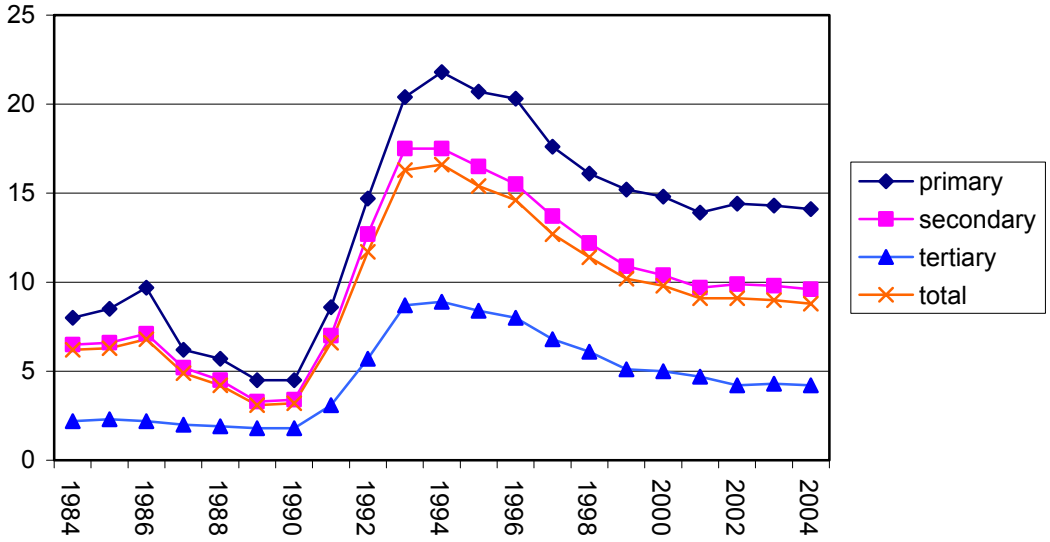
Of the more specific results, the role of tax policies is problematic under wage bargaining. Typically, a reduction of marginal tax rates does not work in a satisfactory manner, as it will lead to a rise in wage claims by the labour unions. Under wage bargaining, the tax reduction should be targeted to low-income earners. However, the interaction between a reform to create a more competitive labour market and tax policy leads to another kind of result. Under a flexible labour market, the incentives to work created by a reduction of the marginal tax rates, as channelled to in-work labour, work best. The situation existing in wage negotiations, like the intensity of wage-wage competition between the trade unions, also plays a key role with respect to the outcome of some policies. This is especially so if the policy concerned affects the negotiation positions of the various worker groups in an asymmetric way, as does a lowering of the indirect labour costs of firms targeted to apply only one group of workers. The role of benefit policies should, on the other hand, deserve

[2] See also the similar approach to the Estonian labour market by Hinnosaar (2004). The model specification for Estonia by Paulus et al. (2006) (also a part of the TAXBEN project) has some similarities with ours, and uses a similar approach to consider alternatives of wage formation as we do here.

more attention than perhaps that of tax policies because, under bargaining, a very clear expansion in the economy occurs, if benefit levels are curtailed. Of course, this is quite a harsh policy in social terms. But, combined with tax reductions, the policy tool is effective under bargaining, and more neutral in terms of its social impacts.

The paper proceeds as follows. In Section 2 the building blocks of the model are presented. In Section 3 we turn to the empirical calibration of the model, and in Section 4 we use the model in a number of policy exercises to see their effects on a range of key economic and labour market indicators. Section 5 concludes.

Fig. 1. Rate of unemployment by various skill categories in Finland, per cent



2 The model

The model comprises blocks for labour demand and labour supply, in combination with job flows for recruitment of new workers, various types of wage formation, and a goods market with aggregate production. We also identify the key government policy instruments affecting the economy and the labour market and the government budget constraint. Then we put these pieces to work together in a general equilibrium framework in order to find out the effects of a number of economic and labour market policies on key economic and labour market indicators under various wage formation hypotheses, as outlined above.

2.1 Labour demand

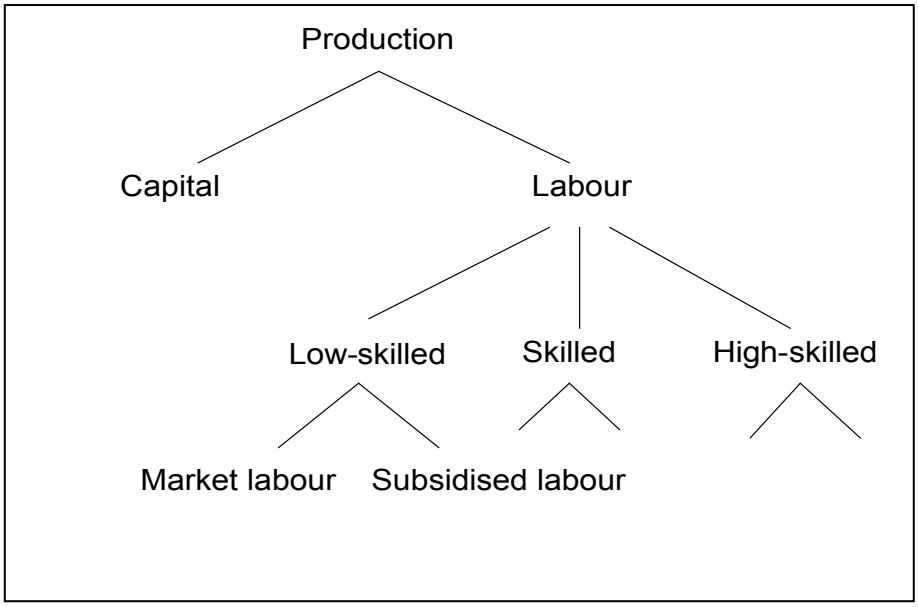
We distinguish between workers of various skill levels, i = 1,2,3, because they have a different position in the labour market, as we saw in Fig. 1, and which may be differently

affected by various policies. In each skill group we divide the working-age population, excluding the retired, into the following categories, those:

(1) employed at normal, market-based terms of pay and employment, L_i,
(2) employed through employment policies at subsidised rates of labour cost to the employers, M_i,
(3) unemployed, U_i ,
(4) those not belonging to the labour force.

The production structure of the aggregate production, GDP, is as follows, see Fig. 2. There is no mobility of labour between the skill categories through acquiring additional education, although that would potentially be an important theme to be introduced. The model is basically a medium-run one where endogenous educational choices are not likely to be so essential, as these trends seem to be determined by other economic and social long-term factors, which do not play a key role in our analysis.

Fig. 2 Production structure of the model



Thus, in each skill group i the aggregate labour input N_i demanded by the firms comprises of those employed at normal market based terms L_i and those at subsidised terms M_i. So, we have, using a CES aggregator,

$$N_i = (L_i^{\chi} + a_i M_i^{\chi})^{1/\chi}, \chi \leq 1 \ , \tag{1}$$

where a_i is the parameter describing the efficiency of subsidised employment from the employer's point of view, in relation to the normally employed, and $1/(1-\chi)$ is the elasticity of substitution between these two types of labour.

We make a separation between the wage W_i paid by the employer to an employee when he or she is a permanent employee of the firm (consumer wage), and the effective wage W_i^* paid by the firm on its total labour input, which cost also includes the costs related to recruitment of new personnel (producer wage). This extension is carried out in Section 2.3 and will be first omitted in this section. The labour costs to the employer, related to an employee, including the indirect labour cost for financing of the social security system, are $C(L_i) = (1+v_i^L)W_i$ and $C(M_i) = (1+v_i^M)(1-s_i)W_i$, respectively, where the v_i^j's are the rates of indirect labour costs to the employer, j = L,M, and s_i is the subsidy rate in terms of labour cost, extended to the employer, linked to employment of a person under an employment subsidy scheme. The relative demand for these two components of labour is given by cost minimisation,

$$\frac{M_i}{L_i} = a_i^{\frac{1}{1-\chi}} \left[\frac{(1+v_i^M)(1-s_i)}{(1+v_i^L)} \right]^{-\frac{1}{1-\chi}}. \tag{2}$$

From this expression we can identify the efficiency parameter a_i, once we know the other quantities in the data and fix the substitution parameter. The corresponding aggregate unit labour cost in skill category i is the dual CES function to (1), i.e.

$$C(N_i) = \left[C(L_i)^{-\frac{\chi}{1-\chi}} + a_i^{\frac{1}{1-\chi}} C(M_i)^{-\frac{\chi}{1-\chi}} \right]^{-\frac{1-\chi}{\chi}}. \tag{3}$$

Each skill group participates in production so that the aggregate labour input L demanded in the economy is

$$L = \left[\sum_1^I (e_i N_i)^{\phi} \right]^{1/\phi}, \phi \le 1, \tag{4}$$

where the e_i's are the efficiency parameters related to the individual skill groups ($e_1 = 1$). Given the aggregate labour input, we can again derive the demands for individual labour categories through cost minimisation so that we have

$$\frac{C(N_i)}{C(N_1)} = \left(\frac{e_i}{e_1}\right)^{\phi} \left(\frac{N_i}{N_1}\right)^{\phi-1}. \tag{5}$$

This implies that it is only reasonable to specify the elasticity of substitution $(1-\phi)^{-1}$ between the skill groups to be higher than unity, i.e. that ϕ is positive, because only then a higher efficiency e_i leads to a higher wage rate for labour of skill category i, as is natural. The aggregate unit labour cost C (equivalently, aggregate wage rate W) is again a CES function, similarly to Equation (2) above, of the individual cost (wage) components,

$$C = \left[\sum_{i=1}^{I} (C(N_i)/e_i)^{-\frac{\phi}{1-\phi}} \right]^{-\frac{1-\phi}{\phi}} . \quad (6)$$

The aggregate production function is specified as a constant returns to scale CES function,

$$Q = A\left[\alpha K^{\sigma} + (1-\alpha)L^{\sigma} \right]^{1/\sigma}, \sigma \le 1, \quad (7)$$

where K is the aggregate capital stock, A is the level of total factor productivity and α is the distribution parameter. Let there be identical monopolistic firms in the economy, which is a small open economy, and assume that the goods produced by the domestic firms are sold at the market for tradable goods, including the international and domestic markets, see Section 2.6. The aggregate demand for goods Q^* in the international market depends on the international price level P* through a demand function $Q^* = b(P^*)^{-\varepsilon}$, $\varepsilon > 0$. Defining the market share h = Q/Q* of Finnish firms in this relevant market, and assuming Cournot competition, we get for labour demand,

$$(1-t_Q)P^*(\frac{dP^*}{dQ^*}\frac{Q^*}{P^*}\frac{Q}{Q^*}+1)Q_L = C \ , \quad (8)$$

where Q_L is the marginal productivity of labour, and t_Q is the rate of total taxes levied on domestic production, so that $P_Q = (1-t_Q)P^*$ is the producer price for the domestic firms. Eq. (8) can be written,

$$\left[P_Q(1-h\varepsilon^{-1}) \right] Q_L = C, \quad (9)$$

where the term $1-h\varepsilon^{-1}$ is the inverse of the mark-up factor 1+m, which is higher than unity and assumed to be fixed in the sequel, but solved as an endogenous item in the calibration of the model.

We derive the equilibrium in the economy and the labour market in two cases: in the short, or rather medium, and the long run. The former means that the aggregate capital stock K remains unchanged at the initial value and the short-run solution for aggregate labour demand is then given by (9). The long run means a situation where the firms adjust their capital stock to its new equilibrium size K*, defined through

$$\frac{P_Q Q - CL}{K^*} = \bar{\rho}, \quad (10)$$

where $\bar{\rho}$ is given initial required gross rate of return on capital. We consider the relationship between these two horizons of the model in more detail in Section 2.5, once we have presented the other elements of the model.

Changes in company or capital income taxes or in taxes levied on production are not considered in this paper. The firms pay out their net profits, after deduction of the cost of borrowed capital and the depreciation allowances, to their owners, and interest cost to the

savers, and leave as undistributed profits in the firms the funds required to maintain the net capital stock intact. The three worker categories own a share of the total capital as based on their share of capital income. All capital income is taxed, as was the case the case in Finland from 1993 to 2005, only once and at a uniform rate. Foreign ownership of capital, either inward or outward, is not so far explicitly considered in the model.

2.2 Labour supply

The individual in each skill group i has an endowment of time equal to unity. This he or she desires to spend to work, L_i^S, i.e. labour supply and the rest $1-L_i^S$ to leisure. The utility function H_i is specified as

$$H_i = H(C_i, 1-L_i^S, G_i), \tag{11}$$

where C_i is private and G_i public consumption. We specify H to be a CES function with elasticity of substitution δ between leisure and consumption, and government consumption being weakly separable from leisure and consumption. Public consumption is considered by the consumer-worker as a fixed item, not linked to his or her labour supply decision, although that would be an interesting further theme to be considered since this assumption may be a simplification of the true situation.

We consider simultaneously the labour market participation decision and the labour supply decision. So, we make no distinction between the extensive (participation) and intensive margin (hours), but rather think that the relevant decision in a medium-run situation is the amount of hours desired to work.[3] The relevant budget constraint for a worker is

$$P * C_i^F = (1-t_i^L)W_i L_i^S + (1-t_i^B)b_i(1-L_i^S) + O_i + Tr_i \ , \tag{12}$$

where C_i^F is defined as the potential consumption, which is in a static setting the same as after-tax income, if he or she could work for the full desired extent of labour supply, instead of the actual employment, which is also determined by the demand for labour. The benefit b_i when out of the labour force is taxed at rate t_i^B. O_i is the after-tax property income, and Tr_i

[3] So, we skip here the distinction between the labour supply at the extensive margin and the intensive margin. This is based on four factors. The addition of this separation would make the model quite much more complex, see Arntz et al. (2005) for such a CGE model, as it would require data on the working time distributions and identification of more types of households, which we have wanted to avoid here. On the other hand, as Saez (2002) argues, the relative size of these two elasticities, with respect to participation and hours, of labour supply are not constant. The extensive elasticity would decrease and the intensive increase, if the employers offer flexible hours. But more important, the relative importance of these elasticities depends on the length of the period considered. If the period is long, the amount of work, i.e. average hours, approaches the desired amount of work, and the extensive margin becomes irrelevant (Saez 2002, 1043). Third, as explained below, in Finland the number of recipients of unemployment benefits is markedly larger than the number of unemployed in the national accounts, so that both decisions are affected by marginal income tax and the unemployment benefit. And fourth, aggregation over the workers in a skill category gives the aggregate labour supply, which is the variable in the empirical model.

is the other transfers from the public sector, excluding pensions, netted with the rest of the total taxes, not considered explicitly in the model.

Income of the households is made, in addition to labour and capital income, by transfers, net, from the public sector. These transfers are typically in various ways means-tested so that when labour income rises, the amount of transfers received is reduced, which withdrawal is captured in the formulation of the budget constraint in (12). This situation raises the effective marginal tax rate, relevant to the labour supply decision.[4] In the following b_i in (12) is identified to be of the same magnitude as the unemployment benefit. A justification for this assumption is that the number of persons living on unemployment benefits is in the Finnish case in fact essentially larger (some 50%) than the registered number of unemployed in the official statistics. A second reason is that the unemployment benefit makes the bulk of an unemployed persons income, see OECD (2004). This means that the most relevant factor from the point of view of labour supply is likely to be the level of unemployment benefits. A further reason for this solution is that the unemployment benefit can be taken to serve as a reference level for generosity of other social benefits as well. The rest of the net transfers, Tr_i is assumed to be a fixed item. In the empirical model the unemployment benefits are linked to the previous wage level in the base year, as is the case in Finland with respect to earnings-related unemployment benefits. However, as is discussed more closely in Section 2.4., in the long-run solution the unemployment benefits are indexed to the resulting equilibrium long-run wage level.

Because of our specification of the potential consumption C^F in (12), our labour supply is thus a kind of notional labour supply, not an effective one, where the actual consumption would play a role. However, we think that our specification better reflects the actual labour supply decision of an individual. The income tax function T = t(WL) is progressive, with the marginal tax rate $m_i = dT_i/d(WL)_i$ exceeding the average tax rate t_i^L, $m_i > t_i^L$, see Section 3. The marginal tax at the level of income of the unemployment benefits is m_i^B. Derivation of the consumer-worker optimum, which maximises (11) under (12), gives the following optimal decision for labour supply,

$$1 - L_i^S = a_{Ci} C_i^F dwr_i^{-\delta} \quad , \tag{13}$$

where a_{Ci} is a constant which depends on the distribution parameter of leisure in the welfare function H, and dwr_i is the real after-tax difference between the marginal net wage and the after-tax outside option, i.e.

$$dwr_i = \frac{(1-m_i)W_i - (1-m_i^B)b_i}{P*} \quad . \tag{14}$$

Tax policy has diverse effects on labour supply as a rise in the average tax t_i^L leads through the income effect to an increase in labour supply, while a rise in the marginal tax has a substitution effect, implying a reduction in the labour supply. Aggregation of (13) gives the labour supply for the working-age population in each skill group.

[4] See Carone et al. (2003) for estimates of the marginal effective tax rates in the EU member countries.

2.3 The flow market for jobs and the recruitment costs

The interplay between labour demand, labour supply, wage formation and employment is a crucial element in a model of the labour market.

The firms need a stock of employees and their labour input in order to carry out their production activity. But this is not the whole of their activities in the labour market. The literature on search models of the labour market is based on the idea that firms and workers are engaged in a process where the firms open vacancies as a certain number of their workers leave the firms, and they have to recruit new workers to keep their level of employment at the desired level. At the same time, there are unemployed workers seeking for jobs to be recruited by firms. The actual recruitment process is described by specifying a matching function, where the number of matches (i.e. recruitment) is a combination of vacancies and unemployed job seekers. There are hiring costs for firms related to the recruitment process so that they are a component of the total labour cost of the firms, as introduced by Bovenberg et al. (2000). In the following, we follow this idea, but take a somewhat different approach to the specification of this item in the model. The basic idea is that it is easier and less costly for a firm to recruit workers when there are more unemployed job seekers in the labour market in relation to open vacancies and vice versa.

In each period, the share μ of the firm's personnel quits the firm, and new recruitments have to be made. In the following, we basically think that this takes place so that the firm has special persons among its personnel management team who take care of the recruitment process, by screening and interviewing the job applicants who either actively on their own initiative, or through the public employment agencies (which services cost nothing to the employers), or by job advertisement come to seek for a job at the firm. We thus take as a starting point that the bulk of the recruitment costs are included in the overall labour costs of the firm. When the labour market tightens in the sense that there are more vacancies in relation to unemployed job seekers, the firms have to allocate more persons, or more effective working time of its personnel, to this task. This will raise the overall effective labour cost of the firms, and thereby the cost of production is higher and the level of employment (available for production) and output lower than before. The procedure in the calibration of the model in this respect is explained in Section 3.

Let us now specify the recruitment costs related to this process, see Section 2.1, where we introduced the general distinction between the wage cost related to a person, already employed at the firm, and the effective wage cost per all employees to the firm. The latter also includes the cost related to the recruitment of new personnel. The total wage cost of the firm related to a newly recruited employee in skill category i is the wage paid to the employee, W_i, added by component of the recruitment cost D_i, so that the total wage cost for the firm is $W_i(1+D_i)$. This latter cost depends on the mismatch situation in the labour market so that

$$D_i = \frac{\Omega_i}{M_i / V_i} \ , \tag{15}$$

where Ω_i is the cost related to a single recruitment, and the denominator indicates how difficult it is to fill the open vacancies. Here M_i is the matching function, specified in the typical way so that

$$M_i = V_i^{\tau} U_i^{1-\tau}, \; 0 < \tau < 1 , \tag{16}$$

where V_i is the number of vacancies and U_i unemployed workers in skill category i. As the number of open vacancies is μN_i, the cost related to the recruitment of a new worker for the firm is as follows,

$$D_i = W_i \frac{\xi \mu N_i}{(\mu N_i)^{\tau} U_i^{1-\tau}} = W_i \xi \mu^{1-\tau} (\frac{N_i}{U_i})^{1-\tau} = W_i \xi \mu^{1-\tau} (\frac{1-u_i}{u_i})^{1-\tau} , \tag{17}$$

where $W_i \xi = \Omega_i$ and ξ is the initial (or normal) time of the firm's recruitment personnnel allocated per recruited person, and u_i is the unemployment rate. So, altogether, we have now that on the aggregate the effective unit wage cost W_i^* (see Section 2.1) will be the following,

$$W_i^* = (1 + \bar{D}_i) W_i , \text{ where} \tag{18}$$
$$\bar{D}_i = \xi \mu^{2-\tau} (\frac{1-u_i}{u_i})^{1-\tau} .$$

Here $\bar{D}_i$ is the rise in the effective wage cost due to the cost of recruitment. Based on this overall aggregate wage cost, and the components of indirect labour cost, affecting also the firms' demand for labour input, the level of employment is determined. It is essential to note, that using this specification leads to the case where even under fixed wages, paid to the employees (consumer wage), a change in labour supply (through the consequent rise in unemployment) has an effect on producer wage and labour demand by firms and thereby on realised employment, too. Empirically Eq. (18) is specified in Section 3.

2.4 Wage formation

As mentioned in the Introduction, alternative institutional specifications of wage formation are an integral part of our analysis here. As outlined there, we define them to be of the following types, which reflect possible differences in labour market institutions, but also roughly identify the different roles of wage formation over the time span after an initial change in policies. First, we consider fixed wages, which do not react to a change in the imbalance in the labour market and in the economic and labour market policies. Second, wages react to a change in the balance of the labour market, so that wage formation is based on market pressure on wages, but preserving the initial unemployment rates. Third, wages are negotiated between labour unions, representing the various labour categories introduced above, and the employers, without coordination between these negotiations, but with implicit links between them. The fourth case is that of nation-wide wage bargaining, which bears the title of centralised income policy agreements in Finland.

The first of these, fixed wages, is of course, quite a simple case analytically. However, due to our description of the job flow market, an increase in labour supply has an effect on the realised employment under this case, too (see also Section 3). Market determined wage

formation means that the wage rate is the value of the marginal revenue product of labour, at the given level of unemployment. So, in the model simulations, we either fix the unemployment rates in each skill category to remain at the initial level, or allow them to change in a desired way. Accordingly, the former case is a kind of a short-run situation affected by market pressure in wage formation, wage drift. The latter is a kind of very long run hypothetical equilibrium, where the labour market is liberalised. Let there be a desire to increase the labour input and lower the unemployment rate $u_i = U_i / L_i^S$, so that, assuming for a while a fixed labour supply, the aim is to reduce the old unemployment rate u_i^{OLD} to a new level u_i^{NEW}. This means that,

$$N_i^{NEW} = N_i^{OLD} \frac{1-u_i^{NEW}}{1-u_i^{OLD}} \quad . \tag{19}$$

Assuming that the new unemployment rates are desired to be equal in all skill categories so that they are all pushed down to the level of the tertiary education category (No. 3), see Fig. 1, the relative wage costs have to change so that

$$\frac{C(N_i)^{NEW}}{C(N_3)^{NEW}} = (\frac{e_i}{e_3})^{\sigma} \left[\frac{N_i^{OLD}}{N_3^{OLD}} \frac{1-u_i^{NEW}}{1-u_i^{OLD}} \right]^{1-\phi} = \frac{C(N_i)^{OLD}}{C(N_3)^{OLD}} \left[\frac{1-u_i^{NEW}}{1-u_i^{OLD}} \right]^{1-\phi} . \tag{20}$$

As normally the unemployment rates in the more skilled categories of the labour market are lower than that for the low skilled (see Fig. 1), this sort of policy requires a widening of income distribution (because ϕ < 1, see above), or anyway such a change that the labour cost distribution becomes more unequal between the skill categories. Empirically, an analysis of this kind of a change is carried out in Section 4.6.

Turn then to wage bargaining. Presently, the Finnish organisation of the labour market comprises in the private sector of one employer confederation and three nation-wide central organisations on the employee side, which could be taken to represent blue-collar workers, white-collar employees and high-skilled employees with a university degree, corresponding roughly to our division of the labour force into the three educational groups. In reality the uncoordinated, or as it is called union-level wage bargaining, takes place between the respective trade unions and employer federation in the various industries, not between the central organisations. This feature is skipped in our model, as we have here an aggregative production structure. However, our modelling of the wage bargaining has relevance from the point of view of the industry-level negotiations, too, as there are in this situation simultaneous negotiations between the trade unions representing various employee groups, based on skill differences, within a single industry and the respective employer federation. So, we in a way emulate the actual situation by our model with three skill categories. Böhringer et al. (2005) present a model for Germany with uncoordinated bargaining in the various production sectors explicitly analysed in the model. However, our analysis emphasises instead the wage-wage links as a key feature in wage bargaining, see below.

There is also in practice some sort of coordination in wage negotiations between the unions in the same central organisation. There is also a close link between the public and private sector negotiations so that the same employee central organisations, mentioned above, also

participate into the public sector negotiations. It is also normally recognised that the private sector, or export industry should be, and is also in reality, the wage leader in the wage bargaining. This justifies our solution of concentrating on the private sector bargaining framework here.

The negotiations on wages take place either in an uncoordinated or coordinated nation-wide manner, the latter being called incomes policy. The former means that in each skill category and the respective wage negotiation with the employer a Nash bargaining solution is reached, given the outcome of the other two wage negotiations. In centralised bargaining the aggregate wage rate (rise) is negotiated between the employer confederation and the labour unions, the latter forming a single negotiating party, and then the same relative wage increase is given to all the workers in comparison to the initial situation, see Alho (2002a) on a more thorough discussion of this process over time.

In the explicit modelling of wage bargaining we also take into consideration the recent literature of behavioural economics, applied in the field of wage formation, too. The starting point of this approach is that, not only the own wage itself, but also the relative wage of a worker with respect to that of other workers, has an effect on worker satisfaction. And further, it is argued that the preferences related to relative wage gains and losses are not symmetric, but asymmetric so that a loss in the relative wage means a larger loss of utility than the gain related to an equal rise in relative wage. This approach has been formulated, e.g., by Driscoll and Holden (2004), see also Alho (2004a).

We assume that the goal of the trade union is to maximise the following function,

$$(R_i - \bar{W}_i)N_i + \bar{W}_i L_i^S \ , \tag{21}$$

where L_i^S is the number of members in the union, N_i is full-time employment, $\bar{W}_i$ is the outside option of the union members (see below) and the objective function R_i reflects the above considerations, and is defined as

$$R_i = \frac{(1-t_i^L)W_i}{P*}\left(\frac{W_i}{W_{i-1}}\right)^{\theta_i}\left(\frac{W_i}{W_{i+1}}\right)^{\psi_i}, \tag{22}$$

where t_i^L is again the average tax rate on wage income of skill category i and the unions are arranged in ascending order of wages, and $\theta_i, \psi_i > 0$. Driscoll and Holden (2004) make the above distinction in such a way that the marginal utility reacts more vigorously to a lowering in the relative wage than to a corresponding increase, which would call the θ and ψ parameters to be step-functions. In order to ease the explicit derivation of the outcome of wage determination, let us here make a simplification to this kind of nonlinear specification and assume in a straightforward way that the relative wage with respect to the lower wage bracket matters more than that to the higher, i.e. that $1 > \theta_i > \psi_i > 0$.

The aggregate profit Π of the firms is given by

$$\Pi = P_Q Q(K,L) - \sum_i \left[(1+v_i^L) W_i^* L_i + (1+v_i^M)(1-s_i) W_i^* M_i \right] - (r+d)K = P_Q Q(K,L) - \sum_i C_i^*(N_i) N_i - (r+d)K \,, \quad (23)$$

where r is the (net) cost of capital, d the rate of depreciation, and $C^*(N_i)$ is identical to that specified in Eq. (3), but added by the effective cost related to recruitment derived in (18).

The Nash bargaining solution of the wage negotiation is then reached by maximising

$$(\Pi - \Pi_0)^{a_i} (R_i N_i - R_{i,0})^{1-a_i} \,, \; 0 \le a_i \le 1, \; i = 1,..I \,, \quad (24)$$

where a_i is the power of the employers in wage bargaining, and the reservation (fall-back) levels of utility are defined as

$$\Pi_0 = -(r+d)K \; and \; R_{i,0} = \bar{W}_i L_i^S \,. \quad (25)$$

The outside option $\bar{W}_i$ is further elaborated to be as follows. It is based in a standard way on the assumption that a part (with probability p_i) of the unemployed can become re-employed in the labour market, if they become unemployed, and a part ($1-p_i$) will remain unemployed, so that we have

$$\bar{W}_i = (1-p_i)(1-t_i^L) W_i + p_i (1-t_i^B) b_i \,, \quad (26)$$

where $1-p_i$ is the probability of becoming employed again and b_i is the unemployment benefit taxed at the rate t_i^B and W_i is the equilibrium wage level as in (28) below. We assume that in the short-run solution the unemployment benefit b_i is linked to be a fixed share of the wage rate in the base period, i.e., before the change in policies. But in the long run situation the benefit is taken to be indexed to the new long-run equilibrium market wage.

It should be added that specification of the outside option $\bar{W}_i$ can bear a substantial effect on the outcome of various policies, as will be demonstrated below in connection with lowering of the income tax. Note also that we do not here consider the value of tax exempt leisure, or black market job in (26), see on their inclusion by Bovenberg et al. (2000).

We further define the probability of getting unemployed and re-employed simply as based on the unemployment rate, in the manner being normal in the literature, i.e.,

$$p_i = \frac{U_i}{L_i^S} = u_i \,. \quad (27)$$

The solution to (24) is derived under the right-to-manage assumption, i.e. that the demand for labour is determined by the firms after the wage rate has been negotiated. In deriving the optimal wage we can make two alternative assumptions. First, we can assume that unemployment rate in (27), and the fact that a component of the outside option in (26) is the

going wage level, being negotiated over in wage bargaining, are considered as exogenous items to the unions. Second, we can allow these two items to be an integral part of the union's optimisation behaviour. Next, we only derive the former case which is simpler. In the empirical model we used both specifications and made some testing of the two cases. The solution of the bargained wage W_i is the solution to the following equation system,

$$W_i = \frac{\lambda_i \bar{W}_i + \Delta_i \left(\frac{P_Q Q}{N_i} - \frac{C^*_{i-1}(N_{i-1})N_{i-1}}{N_{i-1}} - \frac{C^*_{i+1}(N_{i+1})N_{i+1}}{N_{i+1}} \right)}{\lambda_i (1 - t^L_i)\left(\frac{W_i}{W_{i-1}}\right)^{\theta_i}\left(\frac{W_i}{W_{i+1}}\right)^{\psi_i} + \Delta_i (1 + v_i)}, \tag{28}$$

where $1+v_i$ is the overall indirect labour cost in category i, $1+v_i = C^*_i(N_i)/W^*_i$, and Δ_i is defined as

$$\Delta_i = (1+v_i)^{-1}\left[\left(\frac{W_i}{W_{i-1}}\right)^{\theta_i}\left(\frac{W_i}{W_{i+1}}\right)^{\psi_i}(1 - m_i + (1-t^L_i)(\theta_i + \psi_i + \varepsilon_{Ni})) - \varepsilon_{Ni}\frac{\bar{W}_i}{W_i} \right]. \tag{29}$$

λ_i is the relative power of employers in wage negotiations, $\lambda_i = a_i/(1-a_i)$. The "envy" parameters θ and ψ have an essential impact on the outcome of some, but not all of the policy simulations, as they reflect the role, which wage competition, or wage-wage -links potentially play in the labour market (see Section 3 on their empirical specification). In (29) ε_{Ni} is the elasticity of the demand for labour and it is,

$$\varepsilon_{Ni} = \varepsilon(N_i, WC^*_i) = -\frac{1}{1-\sigma}\eta_i - \frac{1}{1-\phi}(1-\eta_i), \tag{30}$$

where η_i is the share of labour category i in the total labour cost WC*L of the firms. From (28) we see that the bargained wage rate is a weighted average of the outside option and the productivity of the skill category concerned less the wage cost of the other components of labour.

How the outcome of wage bargaining is affected by both average and marginal tax rates, is a topic which has been much discussed and analysed recently in labour market literature.[5] The general outcome, derived under wage bargaining, is that higher marginal taxes lead to wage moderation, while higher average taxes lead to wage hikes. The former effect is based on the fact that the trade-off for the union between employment and the real wage worsens if the marginal tax rate rises and this calls for wage moderation. The latter effect depends on the fact that a part of the rise in the rent of the union, produced by the tax reduction, is under bargaining given to the employers. However, the former result is not unambiguous. It depends on the specification of the union objective, whether it incorporates the union member utility or not in relation to hours worked and whether labour supply is elastic. Including the member utility with respect to hours into the objective function of a trade union, Aronsson et al. (2003) and Sinko (2004), derive results indicating that it is possible

[5] See Koskela (2001) for a survey of the monopolistic bargaining model and the effects of taxation in it.

that a higher marginal tax rate leads to a wage hike under monopolistic wage bargaining, if labour supply is elastic.

In the standard trade union model, as here, where the number of hours, value of leisure and labour supply are considered to be fixed in the union's behaviour, the effect of a rise in marginal taxation as such, through its inclusion in the goal in the R function in (21), is a smaller wage claim. In our specification in (22), the union objective is based on after-tax wage, but not on hours, as we think that the wage-wage links are more predominant than hours as a determinant of union behaviour. On the basis of the solution (28) and (29), the lowering of the average tax, if $\overline{W}_i$ remains fixed, leads to wage moderation, as the sum of the envy parameters is less than unity and the relevant elasticity of labour demand is higher than unity. But, on the other hand, a rise in marginal tax should lead to wage moderation.[6]

Of the other partial effects, it should be mentioned that a lowering of the indirect labour cost leads to a compensating wage claim as a part of the extra profits of firms is transferred to the employees. When the outside option b of the unions is lowered, there will also be a reduction in wage claims as normal.

Under the assumption of a monopoly union, when $a_i = 0$, and $\Delta_i = 0$, the optimal wage is set at the solution of the following expression,

$$W_i = \left[(W_{i-1})^{\theta_i} (W_{i+1})^{\psi_i} \frac{\varepsilon_{Ni} \overline{W}_i}{(1-m_i) + (1-t_i^L)(\theta_i + \psi_i + \varepsilon_{Ni})} \right]^{\frac{1}{1+\theta_i+\psi_i}} . \qquad (31)$$

Note that (31) is a weighted average of the standard monopolistic behaviour, i.e. the last term in square brackets, and in addition of the wage-wage links or wage competition, represented by the two first terms. The more intense are the wage-wage links in the preferences of the unions, the less the own monopolistic behaviour affects wage formation, and also the impact of changes in the marginal tax rate on wage moderation. However, the necessary condition for expression (31) to make sense is that the denominator is negative so that the envy parameters θ and ψ have to be small enough and the elasticity of labour demand ε_{Ni} has to be high enough, typically larger than unity in absolute terms. We further discuss the channels of taxation in Section 4.

It is normally conceived that the competitive labour market can be reached when the relative power a_i of the labour unions in the wage negotiations goes to zero and that of the employers goes to unity and when the after-tax wage is pushed down to the level of the after-tax unemployment benefit. In our model we prefer to formulate the case of market determined wages so that wages are flexible but the unemployment rates are fixed to their initial levels. So, we identify the case of competitive, or rather market determined, wages to be a fairly short-run situation where, in contrast to the fixed wages, wages are under market

[6] There is ample evidence, based on a survey directed to Finnish labour market actors, that a rise in the tax rate leads to a wage hike according to the respondents' views. The questionnaire was sent both to the employer and the shop stewards in firms, and leaders of the trade unions and employer federations, including the nation-wide central organisations although no distinction was made between the average and marginal tax rates in that connection, see Alho et al. (2003) and Pekkarinen and Alho (2004).

pressure which is induced by the policy concerned. In Section 4.6, we also analyse the long-run equilibrium with flexible wages, approaching that situation from the angle of reaching a very low level of unemployment.

As mentioned, uncoordinated bargaining means that there are three simultaneous wage negotiations going on, each described by a Nash bargaining model, the overall outcome of which gives the wage rates for the three skill categories of workers. In the centralised wage bargaining (incomes policy), as mentioned above, the employer confederation and the three central organisations of the trade unions, as combined, negotiate on a uniform wage rise for all the employees in the economy so that the following expression is maximised,

$$\Pi^{a}(V^{AGGR})^{1-a} \quad , \tag{32}$$

where V^{AGGR} refers to a similar target as above in (21) and (22), with the average income tax rate in the whole population of workers, but without paying attention to the relative wages. The solution to (32) then gives the new aggregate wage level, but retains the initial relative wages between the skill categories. The elasticity of the labour demand is now lower than in the case of uncoordinated bargaining, see (30). Sinko (2004) defines centralised bargaining in another way, namely so that under it the social partners take into account the government budget, the balance of which imposes a constraint on the wage negotiations. This may be plausible in itself, but we want to emphasise in our specification more the case, where the different pattern of bargained wage rises is the key element.

It is important to note, however, that our model does not address the general situation in wage bargaining, observed so far in Finland, that centralised bargaining has produced smaller overall rises in bargained wages over time, see Alho (2004a) and Uusitalo (2004). We here just consider wage formation in connection with certain policy measures and the interaction in this respect.

One further note is in place with respect to the outside option. In Finland, the earnings related unemployment insurance (UI) system is organised so that it comprises of sectoral unemployment funds, administered mostly by the trade unions, financed by employers and employees, and subsidised by the government (the so-called Ghent system, see Böckerman and Uusitalo 2005). There is also a central fund, which smoothens the payments of the individual funds and which makes the UI system partially funded, see Alho (2004b) for details. This means that the system can absorb an aggregate shock in the unemployment rate which is around 4 percentage points without a need to raise UI payments. If the shock is higher, the UI payments by the firms and the employees have to be raised. Similarly, as unemployment goes down, as in most of the simulations here, the payments by the employers and employees will be reduced in the end. This potential endogeneity of the UI system is not so far captured so far in our model, due to the fact that the changes in the overall unemployment are fairly small in the simulations.[7] The UI payment was in 2002 only 0.4% for employees and 2% for the employers on average in terms of wages, so that the changes induced to them cannot be sizeable in the cases considered here and can be omitted in the simulations.

[7] See Holmlund and Lundborg (1999) for an analysis of the Ghent system.

2.5 The short and the long run

As mentioned above in Section 2.2, the model defines the short run, or rather a medium run, in such a way that the capital stock of the firms is fixed. The situation is depicted in Fig. 3. In the short run, the rate of return on capital is given once the labour costs and employment are determined in the new equilibrium. In the short run, the rate of return on the existing stock of capital changes as a result of economic policies, and this gives an incentive to the firms either to expand or contract their stock of capital to restore the equilibrium situation in terms of rate of return.

From the short run to the long-run solution we can imagine to proceed as is illustrated in Figure 3 and presented in the literature, see e.g. Bean (1993), Broer at al. (2002) and Alho (2002b). In the long run, the rate of return on capital is given by the condition (10) which determines the equilibrium capital intensity K/L. In the long run, the aggregate real labour cost does not therefore change, either. This condition stipulates the horizontal long-run ability-to-pay -curve in Figure 3. The long-run solution thus gives an estimate of the change in the equilibrium unemployment rate. Changes in economic policies normally cause shifts in all the curves in the figure, or in some of them. We shall delve into this more below in connection with the simulations.

In effect, we take as the starting point that in the long run, but not in the short, labour bears the burden of all the taxes considered in this paper. However, this does not mean that the outcome from a change in tax and benefit policies could not have in other respects an impact on the economy, like on GDP and employment. Only the rate of return and the share of capital in total income remains intact, see argumentation concerning this point, and the role of real wage resistance in this respect by Bovenberg et al. (2000).

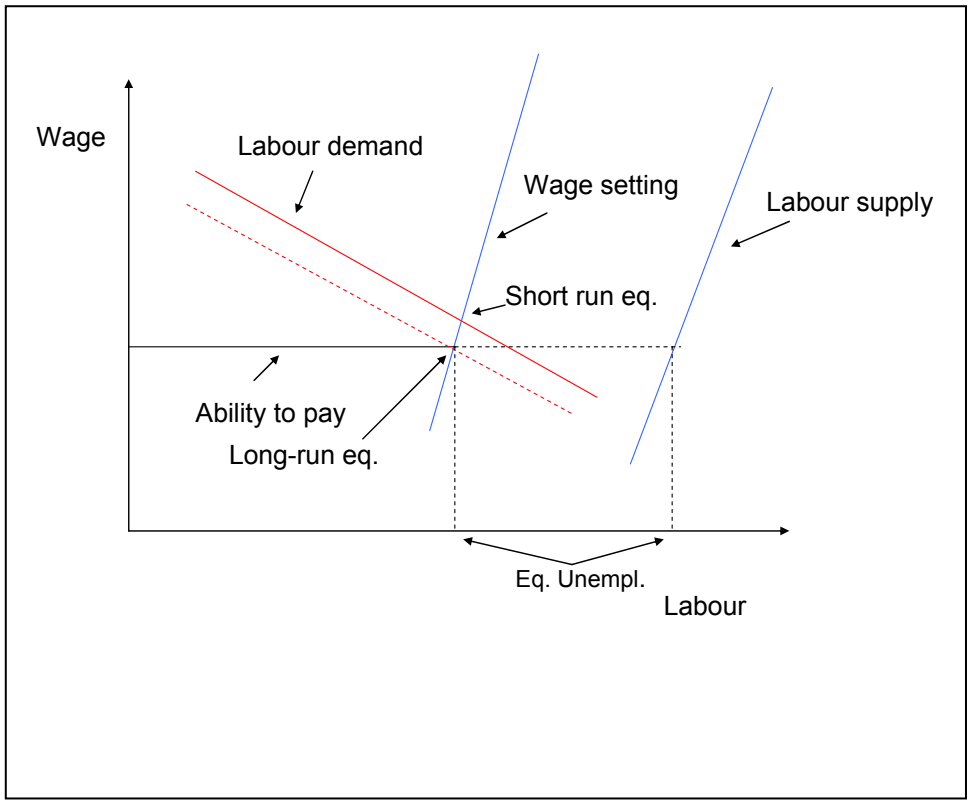
In principle, we could analyse the short and long run in each of the various cases of wage formation mentioned above, but this would be too much to handle and report, so that we have concentrated on the long run only in the case of wage bargaining. This is also theoretically the most plausible case under a monopolistic labour market, as it produces the estimate of the change in the equilibrium unemployment rate. Namely, under competitive wages, the natural long-run solution would be full employment which would be located on the labour supply curve, which is not a realistic situation in the Europe.

Technically, the long run is another static solution of the model in the sense that only the firms reoptimise their new capital stock to meet the required rate of return defined in (10), but consumers are not assumed to behave in an intertemporal sense in their labour supply decision.

2.6 The goods market

There is a single tradable good used both in private and public consumption and the rest of the domestic production, which is not consumed in the home economy, is sold to the international, or rather the market for tradables, in the way stated above. Aggregate

Fig. 3. The short and long-run equilibria in the labour market under bargaining



production (GDP) was defined above in (7). The market price level P* is given from abroad for the small open economy over the medium run considered in the paper. It can be conceived to be determined from the international market under a fixed exchange rate as in EMU, or through the inflationary target by the ECB. Consumption C of the tradable good is simply given by a similar budget constraint of the households as in (12), but with realised income items inserted. The total factor productivity A in Eq. (7) is kept fixed throughout, due to the essential static nature of the model, as also the efficiency parameters e_i in (4) and a_i in (1), so that we do not consider here productivity issues other than those which have an endogenous effect on the outcome in wage bargaining, see Eq. (28), and which induce a long-run reaction in the capital stock, see Eq. (10) above. Domestic demand items are basically a residual in the model and only influence welfare of the households, not directly the level of economic activity, but of course, indirectly through the labour supply decision. The imported consumer goods are solved as a fixed share, determined by preferences, of the total private consumption expenditure, as the relative price of imported and domestic goods stays intact in our model with a homogeneous price level of tradable goods.

2.7 Government policies and the budget constraint

The government takes part in the operation of the labour market by taxing the use of labour through indirect (social security) labour taxes levied on firms, by taxing labour income of the employees using a progressive income tax schedule, by taxing property income and production, and uses these revenues to extend unemployment benefits to the unemployed and wage subsidies linked to the recruitment of workers on an employment support scheme in each labour category. The rest of the government revenues is used to finance outlays on public transfers and public consumption.

However, in the welfare calculations, which are not systematically reported below due to space limitations, as we concentrate more on the usual labour market and total economy indicators, it is assumed that the consumers realise that they can in effect only consume the amount of public consumption, specified above, less the government budget deficit, to which the policy concerned will lead and which has to be financed later on by levying higher taxes on households. So, in effect the policies cutting tax revenues of the public are assumed to be financed by cutting public consumption expenditure. The income flows related to capital income were explained at the end of Section 2.1. The rest of the total taxes, not specified in the model, are collected into a single item, and other transfers than unemployment benefits and pensions are netted with this residual item in taxes, and allocated as fixed items to the three worker populations, based on their shares as recipients in government social welfare programmes.

The income tax rates endogenously adjust in the model to the induced changes in the wage level, based on the difference between the marginal and average tax rates.

We only consider the consolidated budget constraint for the public sector to get a better overall grasp of the effects of individual policies. Public consumption is a factor which affects individual welfare, see Eq. (11) above. The amount of public consumption, not explicitly modelled, is typically based on public employment. Here the public employment is not explicitly modelled, see above Section 2.4. So, its volume is assumed to change similarly as the labour input in the economy overall. Similarly, the public sector budget surplus takes into account the change in the labour cost of public employment, which is simply taken to be the same as rise in the labour cost rise in the economy in general. In the initial equilibrium, the government budget is set to be in balance.

This ends the specification of the model and its various elements, and we now turn to its empirical specification.

3 Empirical calibration of the model

The model is calibrated to data of the Finnish economy for the three skill categories, low-skilled (primary education), skilled (secondary education) and high-skilled (tertiary education). The year of calibration is 2002, for which Statistics Finland has produced us data on employment (distinguishing market and non-market based employment, see Fig. 2),

unemployment, labour income and other (capital) income, unemployment benefits, and various taxes. The model was calibrated to this data and other data in national accounts with respect to total taxes, share of wage income in total incomes, capital-output ratio and the mark up factor. Also other information was used concerning the tax scales of personal income taxation.

The mark-up factor (1+m) in Eq. (9) was solved in the calibration to be around 1.07. The gross rate of return on capital in Eq. (10) is 13.8 per cent in the national accounts, and the capital-output ratio is fixed in the calibration to that in the base year. In the calibration, it is then possible to solve for the implicit capital cost per unit of capital, which is 11.7 per cent.

The other key parameters were fixed as follows. The average tax rates and the social security contributions of the firms were fixed on the basis of actual tax scales, including its various elements and deductions in taxable income, including the social security contributions by the employee. The actual tax scales also include the earned income tax credits applied in the taxation of personal income. The marginal tax rates were specified by fixing approximately the residual income progression to its initial values, which was for the three worker categories on average 0.784.[8]

The unemployment benefits were calculated on the basis actual scales of unemployment insurance, see OECD (2004). The net replacement rates are 69%, 64% and 59% for skill groups 1, 2, and 3, respectively. The corresponding marginal effective tax rates (METR) based on (14) are high, slightly less than 90% for skill categories 1 and 2 and 80% per cent for skill category 3, see the estimates of METRs for unemployed persons in the EU15 countries by Carone et al. (2003).

The production function was calibrated by specifying $\alpha = 0.4$ in Equation (7). The aggregate elasticity of substitution between capital and aggregate labour is fixed at the value 0.8 according to the estimate by Alho (2004b), where it was found to be in the long run 0.75. A statistical test very strongly suggests that this elasticity of substitution in the aggregate economy is lower than unity. The estimate by Siljander (2004) is the same, as is also that used in the FOG CGE model built at ETLA, see Lassila and Valkonen (2003). The elasticity of substitution between the various skill categories in Eq. (4) is fixed to 2 according to Asplund (1991). The elasticies of labour demand in the union level is then solved from Eq. (30) to be clearly higher than unity, around 1.3.

There seems to be quite little evidence on the labour supply elasticities in Finland. The elasticity of substitution between consumption and leisure in (11) is fixed at 0.5, slightly less than in Forsström and Honkatukia (2002). However, implicitly the labour supply reactions are much more vigorous for the low-skilled than for the other groups as in this group 1 the participation rate is much lower than in the other skill groups. This led to use an additional multiplier of 0.4 in the substitution parameter δ in this labour supply equation to reduce the implicit substitution and income elasticities to be smaller than those in Equation (13).[9] The income elasticity was on average fixed at somewhat smaller than 0.2 and the substitution elasticity to slightly less than 0.1.

[8] The residual income progression is defined as (1-marginal tax rate)/(1-average tax rate).

[9] This is due to fact that the participation rate in this group is much lower than for the others. As the relevant elasticities of labour supply are reached by multiplying the substitution and income elasticity by the factor (P_i-

The elasticity of substitution between the normal labour and subsidised labour, χ (see Eq. (1) above), is fixed to 1.3. The productivity of the subsidised labour is in the model roughly 70% of that of the normal labour, corresponding to the estimate by Hietala (2005).

In the matching function in Eq. (16) the weight of vacancies is given a typical value of 0.6. The other terms of the recruitment process are harder to specify empirically, as their virtually exists no actual data on these. Based on our formulation of them in Section 2.3, we think that their size is anyway quite limited in overall costs of the firms. Data provided by Confederation of Finnish Industries shows that of the personnel of manufacturing firms, 2.8 per cent are currently engaged in personnel management. It is evident that only a share of their time goes to recruitment activities. So, we impose that, on average, these costs are around 1.5 per cent of total labour costs of the firms. Using then the matching parameter gives the outcome that the elasticity of realised employment, under a fixed wage W_i, with respect to a rise in the labour supply and the consequent rise in the rate of unemployment u_i, is around 0.2 (see Equation (18)).

In the case of wage bargaining we introduced in Equation (19) the envy parameters ψ and θ related to the relative wages in union behaviour. These wage-wage links can play quite an important role in the functioning of the labour market and with respect to the outcome of some policies, see Section 4.

There is a common conception that the relative wages matter quite much in practice, and wages are fairly closely linked to each other also in the union-level bargaining. However, on the basis of the specification in (22), and what was discussed above in connection with Equation (31), it would not be proper to fix the sum of θ and ψ to be higher than unity, either theoretically, or empirically in the model, based on the condition binding the denominator in (31) to be negative. On the basis of some experimentation in this respect we fixed ψ to 0.5 for skill category 1, $\theta = 0.2$ and $\psi = 0.3$ for skill category 2, and $\theta = 0.4$ for skill category 3. This choice is anyway somewhat arbitrary, and therefore we shall below in a case, where these parameters turned out to especially matter with respect to the results of policies, let the parameters to vary.[10]
In connection with policies where the various skill groups are treated in a symmetric way, these parameters do not seem to mean much as to the results. There seems to be a

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$L_i)/L_i$, where P_i is working-age population, the elasticities are implicitly higher for those categories where the participation rate is low.

[10] We made some empirical time series estimation on the links between wages of blue-collar and white-collar workers in Finland. There exists a strong long-term equilibrium ratio (cointegration) between them roughly preserving the relative wages. It also turns out, using this model, that if the blue-collar workers get an extra rise in their wage, the old wage ratio between the two groups will be restored in around five years. On the other hand, there does not seem to be tight links in the short run between the wages, as there is no indication of Granger causality between the rises in wages of blue- and white-collar workers. However, it would not proper to base the specification of the envy parameters on the basis of this kind of empirical evidence. First, there have been made quite commonly in Finland centralised wage agreements, stipulating roughly the same rise to all wage earners. Second, there is in practice also coordination on the employer side, not explicitly introduced into our model, between the various negotiations. The actual wages are also influenced by wage drift within firms, in addition to the wage rises agreed in the negotiations, and firms may typically want to maintain the relative wages in such a situation. So, altogether, the situation in uncoordinated wage bargaining is a complex one, and it is not easy to specify it in exact terms in a numerical model. The above parameter choices used in the simulations show that, in effect, the own wage typically matters three times in comparison to the wage of the neighbouring trade union in the preferences specified in (22).

marginally bigger expansion in the economy, if these parameters are removed, but the difference was not noteworthy in the experiments carried out so far. The intuitive reasoning for this is that in such a case the various trade unions do not in effect face a situation where their relative wages would initially diverge as a result of the policy change, and and which would lead to a new round of wage competition.

On the other hand, in practice there may exist some more complex implicit structures in the wage bargaining, like wage leadership of one union and then implicit links of the others to that outcome. In such a case, the situation may be different from that stated above, and the policy effects also. But then the question also arises, whether the game theoretic specification used here of three simultaneous Nash bargaining solutions should be changed to another one to recognise properly that kind of leadership situation. We leave these considerations aside without further elaboration in this paper. The relative power λ_i in the wage negotiations was first fixed to unity for all skill categories. In effect, and data using VAR estimations shows that the central organisation of the lowest education category (cat. 1) has in effect showed to have some sort of a stronger position with a rising relative wage up until the recent years, and so we define for it a stronger position with value 0.5 for λ_1.

4. Policy simulations

We now turn to the empirical part of the analysis. We evaluate effects of a range of economic and labour market policies with the aid of the model. In more detail, they are changes in:

a) Personal Income taxes (average tax rates and marginal tax rates), i.e. in the tax progression
b) Indirect labour costs (social security contributions by the employers),
    - both a general lowering and
    - a targeted lowering directed only to the low-skilled
c) Increase in the subsidy rate in employment support scheme
d) Reduction of unemployment benefits
e) The case of a fully flexible labour market,

on the target variables of the economy and the labour market, i.e. changes in:

e) GDP, aggregate employment, aggregate labour supply, aggregate unemployment rate, separately that of the low skilled, aggregate and individual wage levels, profitability of firms
f) The government budget deficit
g) Welfare change, reported only in the case of a fully flexible labour market.

In the model, aggregate employment is a CES aggregate of the individual skill categories, as defined in (4). In reporting the results of the simulations, however, we turn to use the standard definitions of the key labour market variables, i.e. we count simply the number of employed, and similarly for the aggregate labour supply. The aggregate labour cost and wage are calculated as CES indices, defined above in (6) and in connection with (23), added

by the costs related to recruitment of new workers. The individual wage rates W_i do not include these costs.

The size of the policy measure in groups a) and b) was fixed, similarly as in Bovenberg et al. (2000), to 0.5% of GDP ex ante. I.e. with existing wage levels, employment and unemployment, the ex ante cost of the measure for the public sector would be this. This means that the cost would be of this magnitude when no feedback reactions are taken into account in planning the size of the measure. The measure is quite a big one, as it has to be taken to be sustained over time. Smaller ones can be roughly scaled on the basis of the results shown below. The measure in case c) was lower, 0.07% of GDP, due to the smaller amount of money spent on these measures overall, and meant that the subsidy rate would be raised by 10 percentage points. Measure d) would mean a lowering of the replacement rates by 5 percentage points and bring a saving in government expenses by 0.18% of GDP ex ante.

In a time dimension, the interpretation of the results should be done so that the results mean a deviation from a reference path for growth of the economy and inflation, as discussed above in Section 2.6. As we do not have endogenous inflation, due to the small open economy assumption, the changes in wages in fact refer to real changes in them.

Let us now turn to report the policy simulations. The effects of each single policy measure concerned under all the alternative hypotheses of wage formation are presented in the tables below. The columns are: FIX for fixed wages, MARK for market determined wages, NEG for uncoordinated wage bargaining, LONG RUN for the solution of NEG in the long run, and CIPA, centralised incomes policy agreement, for coordinated bargaining.

4.1 Lowering of the income tax

We have here two sub cases. First, we lower **average tax rates** over the whole income distribution, including those related to taxation of unemployment benefits. The second simulation considers lowering of **the marginal tax rates**. However, note that the marginal tax rates are also lowered at the same time when average tax rates are lowered, if the residual income progression is maintained at the initial level, as is done in the first case (see footnote 8 on p. 20).

Changes in taxation have many effects on wage formation under bargaining. Some of the partial effects were discussed above in Section 2.4. A lowering of the average tax rate will first lead to wage moderation, as the after-tax rent of the labour union will rise, and a part of this is in the wage negotiations shifted to the counterpart, the firms. However, the value of the outside option $\overline{W}_i$ in (26) will also rise, and this will lead to a rise in wage claims. A change in the marginal tax rate was also addressed above. In the uncoordinated bargaining the partial effect from lowering the marginal tax rate should be an increase in wage claims (with the reservations mentioned in Section 2.4). In addition to these effects, there is, of course, an important link running through the overall balance in the labour market, as a rise in the unemployment rate also has a curbing effect on wage claims. Finally, it is important to be aware that taxation of benefits may have an impact on the effects of tax policies. The

magnitude of the overall uniform reduction of the income tax scale was by 1.2 percentage points, which leads to an ex ante budget deficit of 0.5% of GDP. The results are reported in Table 1. Note also, as mentioned above in Section 2.7, that the average and tax rates are endogenous and reflect the change in the wage rate vis-à-vis the baseline situation.

Fig. 4. The average and marginal income tax scale in 2005 in Finland, per cent

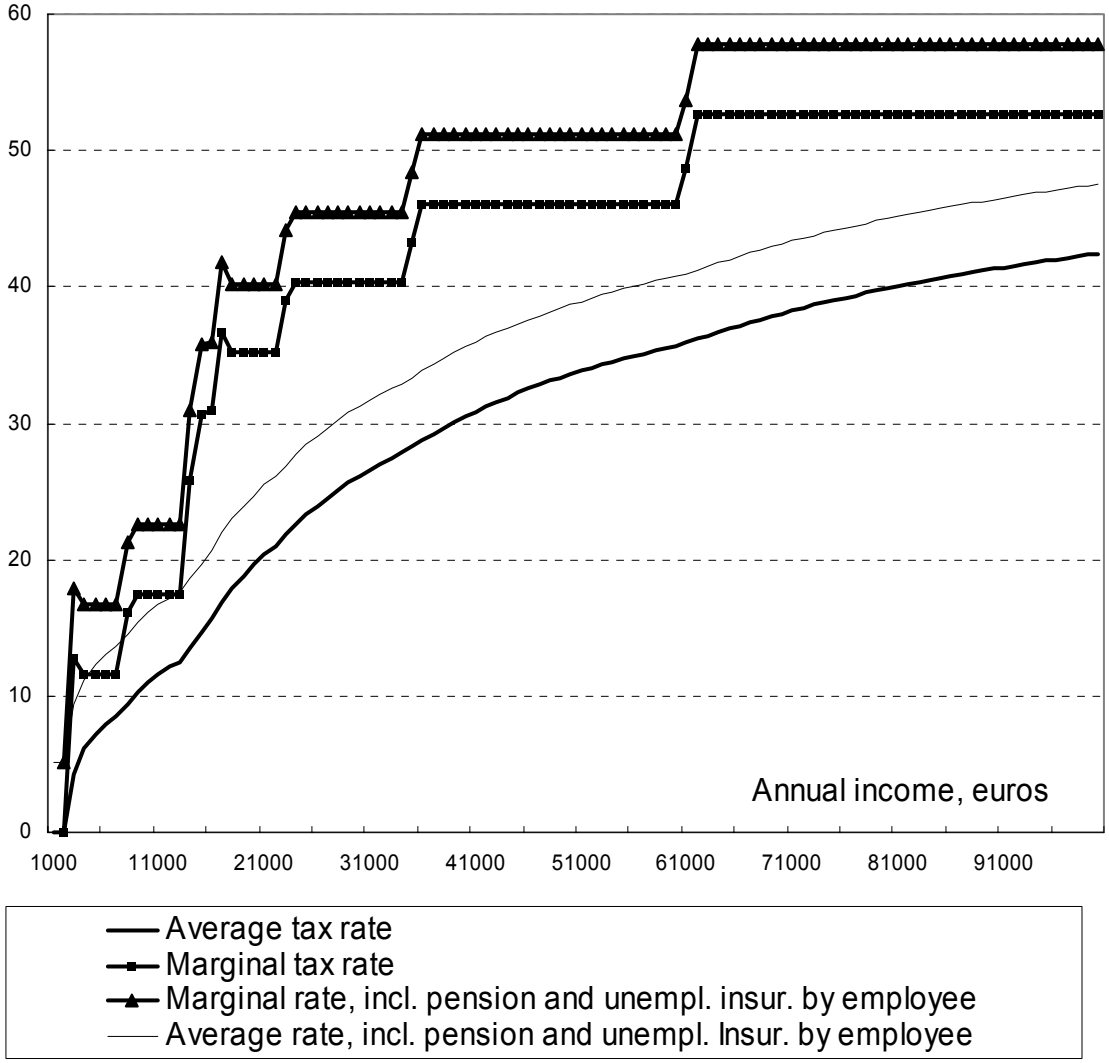


Table 1. The effects of a uniform lowering of the average tax rates in income taxation by 1.2 percentage points, % (a) or %-points (b) deviation from the initial equilibrium values

Effect on:	FIX	MARK	NEG	LONG RUN	CIPA	CIPA, fixed tax rates in outside option $\bar{W}_i$ *	CIPA, compen-sating tax red. with lower b_i, LONG RUN *
GDP[a]	0.00	-0.02	0.05	-0.04	-0.01	1.84	0.40
Employment[a]	-0.01	-0.04	0.14	-0.05	-0.02	3.11	0.41
Unempl. rate[b]	-0.06	-0.02	-0.18	-0.02	-0.03	-3.20	-0.17
Labour supply[a]	-0.05	-0.05	-0.04	-0.05	-0.05	-0.39	0.22
Budget surp/GDP[b]	-0.50	-0.51	-0.47	-0.53	-0.51	0.26	-0.38
Unempl. rate of skill cat 1[b] (low-skilled)	-0.06	0.00	-0.59	0.02	-0.05	-3.36	-0.03
Aggregate labour cost[a]	0.00	0.02	-0.04	0.00	0.01	-1.47	0.00
Aggregate wage level[a]	0.00	0.02	-0.04	0.00	0.00	-2.01	-0.02
Wage of skill cat. 1[a]	0.00	0.04	-0.39	0.03	0.00	-2.01	-0.02
Wage of skill cat. 2[a]	0.00	0.03	-0.04	0.00	0.00	-2.01	-0.02
Wage of skill cat. 3[a]	0.00	0.01	0.05	-0.02	0.00	-2.01	-0.02
Rate of return on capital[b]	0.00	0.00	0.01	0.00	0.00	0.31	0.00

* For explanations, see the text.

The overall results of the reduction in average taxes do not, however, indicate that a general lowering of the average income tax rates would have an effect on the labour market in a model based on longer run equilibrium factors, where the short-run aggregate demand effects do not play a role. Accordingly, the budget deficit would stay quite near the level which is the ex ante size of the measure (0.5% of GDP). The effect is negative on labour supply due to the income effect.

Under wage bargaining, it is essential to note that a lower average tax rate raises the value of the after-tax outside option $\bar{W}_i$ in (26) through both terms there. It is true that a lower income tax increases the rent of the trade unions in (22), see also Equation (31), a part of which will in the negotiations be shifted to the employers. But this effect is neutralised by the rise in the after-tax value of the outside option. Just to illustrate, how very essential a role the outside option can play, and the importance of the fact, how it is conceived to influence the labour market negotiations, we have added the last but one column to Table 1, where the outside option in (26) is solely based on the previous tax rates under centralised bargaining. The results show in this case a very large wage moderation and expansion in the economy and employment. Of course, this situation is not consistent with the theoretically proper way to specify the outside option, which should be that which really matters for trade unions. With this example, we just want to raise attention to the fact, how important such issues of model specification can be from the policy point of view. However, this result is important in the sense that it indicates that wage moderation can be achieved by reducing simultaneously the outside option b in (26) when the tax rates are lowered. This exercise is done in the last column on the right. There the reduction in the tax rate of the unemployment benefits is compensated by a cut in the replacement rate so that the unemployed break even in this tax reform, and those employed gain. Now we see some quite clear expansion in the economy and the labour market.

Next, turn to consider a **lowering of the marginal tax rates**. We evaluated several alternative ways of reduction of marginal tax rates, so that one of them (that reported) was a general uniform lowering of the marginal tax rates over the whole income distribution by 2 percentage points. The second was a reduction of four percentage points channelled to the three employed worker categories and the third was only applied to the low end of the distribution, i.e. those who are unemployed. In all the cases the size of the measure was chosen so that the desired ex ante size (0.5% of GDP) was reached recognising that a reduction in the marginal tax rate on one income level also lowers the average tax rates of the upper income categories. So, the measure reported is directed in effect to the non-working and working population in such a way that the average tax rate of unemployed in skill category 1 was kept unchanged and the tax rates of the higher income levels were lowered accordingly. The results are shown in Table 2.

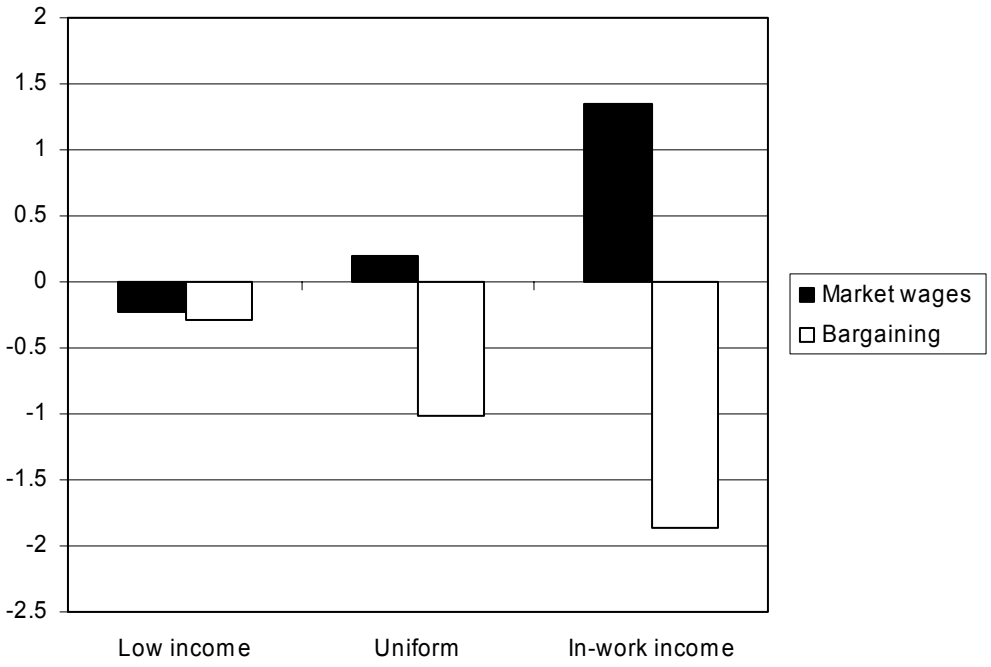
Table 2. The effects of lowering of the uniformly marginal tax scale by 2 percentage points, % (a) or %-points (b) deviation from the initial equilibrium values

Effect on:	FIX	MARK	NEG	LONG RUN	CIPA
GDP[a]	0.02	0.10	-0.53	-0.73	-0.47
Employment[a]	0.03	0.20	-1.02	-0.71	-0.76
Unempl. rate[b]	0.15	-0.01	1.06	0.84	0.96
Labour supply[a]	0.22	0.20	0.18	0.24	0.29
Budget surp/GDP[b]	-0.52	-0.48	-0.77	-0.78	-0.74
Unempl. rate of skill cat 1[b] (low-skilled)	0.29	0.00	2.50	0.91	1.05
Aggregate labour cost[a]	-0.01	-0.08	0.44	0.00	0.38
Aggregate wage level[a]	0.00	-0.08	0.44	0.00	0.47
Wage of skill cat. 1[a]	0.00	-0.18	1.61	0.04	0.47
Wage of skill cat. 2[a]	0.00	-0.12	0.41	0.04	0.47
Wage of skill cat. 3[a]	0.00	-0.02	0.22	0.12	0.47
Rate of return on capital[b]	0.00	0.02	-0.09	0.00	-0.08

Under fixed wages, lowering the marginal tax rates has only very limited effects on GDP and employment. However, if wages are allowed to reflect market pressure (column "MARK"), there is a somewhat positive effect on employment. This is due to a reduction in the labour cost of the firms. Under wage bargaining, the results are quite negative, as there is a wage hike, in the manner indicated above in Section 2.4. The lower average taxes do not have the power to change this picture. In the long run this contractive effect on employment will be even stronger, due to the induced reduction of the capital stock. However, the wage rate of the low skilled behaves in a bit different way from the general pattern, and leads to a bigger rise in the unemployment rate for this category than just that based on the increase in labour supply. Under centralised bargaining, the effects are quite similar. The budgetary figures show that, in terms of public finances, the policy does not work well.

As mentioned above, we also made simulations with two other forms of reducing the marginal tax rates, i.e. that applied to higher incomes and that the only the low income levels. In general, the harmful effects of marginal tax reduction under bargaining will be the smaller, the more the reduction of the marginal income taxes is channelled to the low income brackets living on benefits. But on the other hand, under market determined wages the effect of a marginal reduction is the more vigorous and positive, the more it is channelled to the in-work income brackets where the handicap of high marginal tax rates is the highest, see also Section 4.6. These diverging results are illustrated in Fig. 6.

Fig. 6 The effect of three forms of reduction of the marginal tax under market wages and wage bargaining on aggregate employment, per cent*



* For explanations, see the text.

4.2 Lowering of the indirect labour cost (social security payments) of the firms

Here we consider two cases: a general, uniform lowering of the indirect labour cost by 1.2 percentage points in all skill categories (which means ex ante 0.5% of GDP) and that directed only to the low skilled (category 1), in which case the size of lowering is as high as 7.3 percentage points. The latter type of policy has been much discussed and advocated recently in European policy making, also in Finland. The results of the former case are in Table 3.

Fig. 6 The indirect labour cost in Finland, % of wages

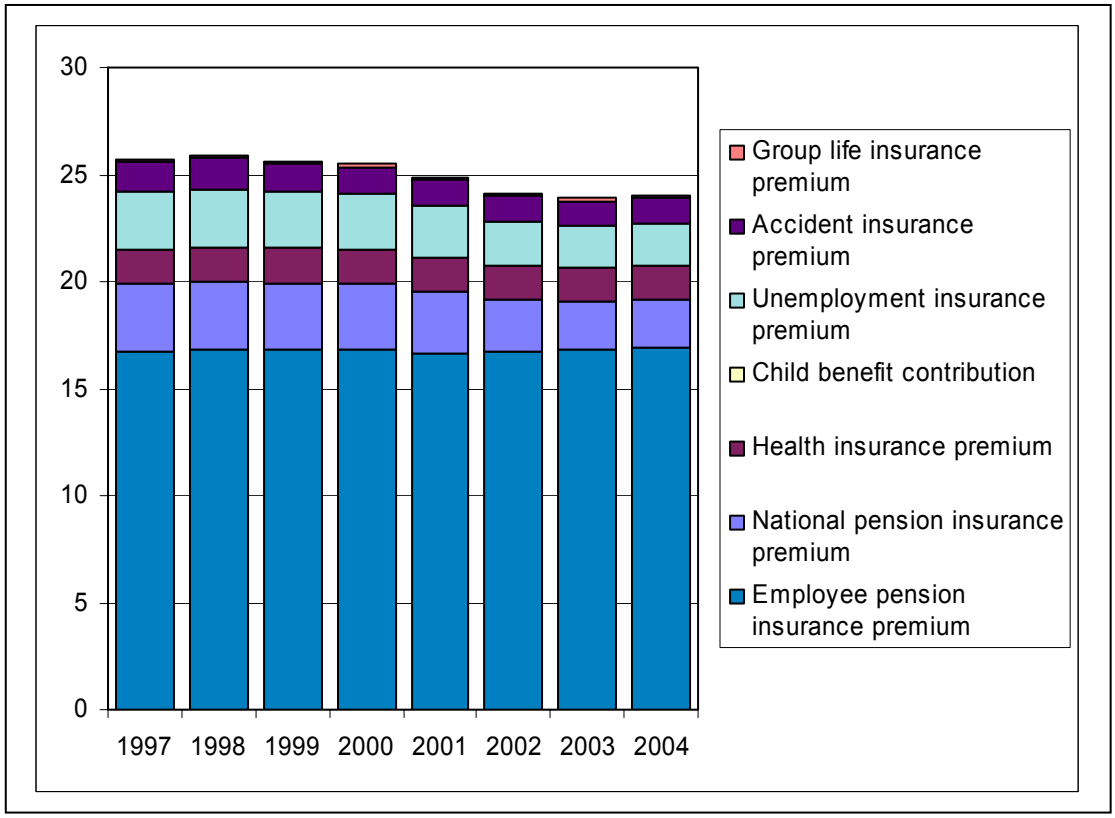


Table 3. The effects of a uniform lowering of the indirect labour cost by 1.2 percentage points, % (a) or %-points (b) deviation from the initial equilibrium values

Effect on:	FIX	MARK	NEG	LONG RUN	CIPA
GDP[a]	1.00	0.06	0.05	1.27	-0.16
Employment[a]	1.66	0.11	0.10	1.34	-0.26
Unempl. rate[b]	-1.56	-0.02	-0.17	-1.17	0.38
Labour supply[a]	-0.04	0.11	-0.06	0.08	0.15
Budget surp/GDP[b]	0.18	-0.21	-0.20	0.16	-0.31
Unempl. rate of skill cat 1[b] (low-skilled)	-1.49	0.00	-0.38	-1.61	0.42
Aggregate labour cost[a]	-0.80	-0.05	-0.04	0.00	0.13
Aggregate wage level[a]	0.00	0.96	0.97	1.02	1.18
Wage of skill cat. 1[a]	0.00	0.92	0.80	0.54	1.18
Wage of skill cat. 2[a]	0.00	0.94	0.96	0.88	1.18
Wage of skill cat. 3[a]	0.00	1.00	1.02	1.03	1.18
Rate of return on capital[b]	0.17	0.01	0.01	0.00	-0.03

Under fixed wages, this policy has a big positive effect on employment in the short run. However, when we allow for reactions in wages to take place, quite another picture emerges. We see that the expansionary effect is neutralised through an offsetting rise in wages and thereby in firms' overall labour costs. Under wage bargaining, this can be illustrated by looking at Fig. 3. In the short and long run several shifts in the curves there take place. First, the labour demand curve shifts to the right. The wage setting curve also shifts up, as unions demand a higher wage when the profitability of the firms rises. The labour supply curve does not shift, because the income and substitution effects offset each other. The ability to pay -curve, defined in terms of aggregate wage rate, shifts up by one per cent (1.2 percentage points means quite exactly a one per cent change in the indirect

labour cost). The long-run equilibrium is determined by intersection of the wage setting and ability to pay -curves.

If the wage setting curve did not shift at all, or only a little, the result would be a permanent expansion in the long run. However, this situation does not happen as the wage setting curve will shift upwards to such an extent that the full initial increase in firms' profits is shifted on to the workers in the short run to restore the initial distribution of factor income between workers and the firms. The overall result of the various forces is that a policy which basically boosts labour demand leads to no expansion in the economy, but to some in the long run. The same also holds with respect to employment subsidy scheme in Section 4.4 below.

Centralised bargaining is very similar to that of uncoordinated bargaining, which is a result of the fact that a uniform measure was put into effect affecting symmetrically the labour cost related to the different skill categories. We shall, however, next demonstrate that cutting of firm's indirect labour cost can pay in terms of employment also under centralised bargaining.

4.3 Lowering of the indirect labour cost of a targeted group of workers

In the EU policy debate it is quite commonly recommended that labour cost reductions should be targeted to the low-skilled workers. Analysis of the outcome of this kind of a targeted lowering of the firms' indirect labour cost is now divided into two parts. First, in Table 4 we consider the results under fixed, competitive and centralised bargained wages. The uncoordinated bargaining case is more complex and it has to be approached so that there is a variation in the key parameters describing the wage-wage links, to get a closer picture of the potential, and the risks, related to this policy. This possibility of negative effects is due to the fact that we now consider a policy, which in a strongly asymmetric way treats the various skill groups and their bargaining position vis-à-vis the employer federation, and this may lead to compensatory wage claims by the other unions.

The same broad message as to the activity effects as in the previous case emerges also here as in Table 4. However, the policy seems to be anyway very effective with respect to employment of the targeted group of workers, i.e. the low skilled, even under centralised bargaining. As can be seen from the MARK column, there is a strong market pressure to a rise in the wage rate of this labour category. But, this can be kept limited in centralised wage bargaining. The wage rates of all labour categories will rise and this offsets the initial positive effect of the measure at the aggregate level of the total economy. But this negative outcome does not apply with respect to the targeted low-skilled labour category in terms of its unemployment situation.

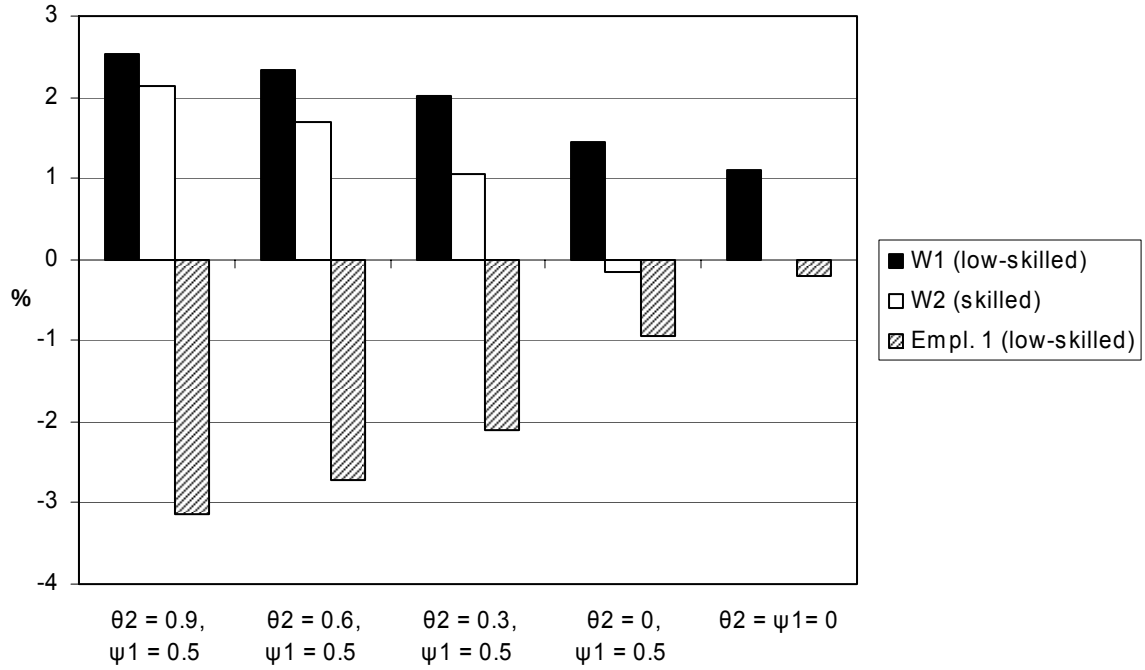
Table 4. The effects of a targeted lowering of the indirect labour cost of the firms by 7.3 percentage points, directed to low skilled (skill cat. 1), % (a) or %-points (b) deviation from the initial equilibrium values

Effect on:	FIX	MARK	CIPA
GDP[a]	0.95	0.10	-0.46
Employment[a]	2.09	0.21	-0.20
Unempl. rate[b]	-1.95	-0.01	0.35
Labour supply[a]	-0.03	0.22	0.19
Budget surp/GDP[b]	0.15	-0.24	-0.45
Unempl. rate of skill cat 1[b] (low-skilled)	-8.18	0.00	-6.32
Aggregate labour cost[a]	-0.77	-0.08	0.37
Aggregate wage level[a]	0.00	0.92	1.40
Wage of skill cat. 1[a]	0.00	5.75	1.40
Wage of skill cat. 2[a]	0.00	0.00	1.40
Wage of skill cat. 3[a]	0.00	0.00	1.40
Rate of return on capital[b]	0.16	0.02	-0.08

Turn then to the case of uncoordinated wage bargaining. Let us now concentrate on a smaller measure, i.e. a reduction of the employers' indirect labour cost by 1.2 percentage points for skill category 1 only. This is a strongly asymmetric policy improving only the bargaining position of worker union 1 vis-à-vis the employer confederation. Consequently, wage competition is likely to play a key role as to the effects of this policy. Therefore, we now want to see how the magnitude of the parameters describing the intensity of the wage competition, introduced in Eq. (22) in Section 2.4 above, affect the compensation demanded by the various labour categories in wage bargaining under such a policy. This may reduce, or even turn into negative, the positive effect on employment for this group of workers,

initially created by the policy measure under no wage reaction. These results of uncoordinated bargaining are illustrated in Figure 7.

Fig. 7. The reaction of wages (W) and employment under uncoordinated bargaining when the indirect labour cost of low skilled (category 1) is lowered by 1.2 percentage points (see Eq. (22) for definition of the parameters)



Start looking at the results from the situation on the right, where there are no mutual wage-wage links in the trade union objective functions for unions 1 and 2 in Equation (22). This will lead to a compensation by one percent in the bargained wage of the low-skilled workers, which means a full offset in the firms' position in terms of total labour costs.[11] The outcome is virtually no change in employment of the targeted sector concerned. But, this is the best outcome. When the wage-wage links become more intensified (move to the left in the figure), so that the trade unions of skill categories 2 and 1 pay more attention to their relative wage, the wage claims of both unions rise and the new equilibrium implies higher wages for both. Naturally the wage of the trade union of skill category 1 rises more than that of skill category 2, because the bargaining position of the former towards the employer has improved most. But the difference between the wage rises of skill categories 1 and 2 becomes the smaller, the bigger is the effect of the relative wage in the objective function of union 2, as is plausible. When wage-wage links become more intensified, and the aggregate wage level rises more, the overall new equilibrium becomes all the time worse in terms of employment of the targeted group as compared to the situation before the measure.

[11] A reduction in the payroll tax by 1.2 percentage points means that the overall reduction in labour cost is roughly 1 %, i.e. the size of the rise in the wage W_1 in the case most on the right.

4.4 Increase in the subsidy rate of the employment support scheme

Turn next to the employment support scheme, which is a form of active labour market policy. Because of a markedly smaller overall size of the subsidy system in terms of employment and budgetary outlay than the above cases, we consider here a smaller measure in size of the budgetary cost than above and raise the subsidy rate of the labour cost to the employer by 10 %-points in each skill category. The average prevailing rate of subsidisation is around 25%. The budgetary cost of this measure is just 0.07% of GDP. The results are shown in Table 5.

As in the case of a general lowering of the indirect labour cost, also this policy is quite effective under fixed wages, but its effects are again neutralised through wage reactions. As above in connection with the lowering of indirect labour costs, under bargaining there is an offsetting rise in the wage claims when the profitability of the firms rises. Anyway, it is noteworthy that, in the various cases of wage formation, this policy has very uniform effects on the target group, i.e. on the subsidised employment. The number of this type of employment would rise by 11 000 persons. However, this rise takes place at the cost of labour employed at normal terms so that aggregate employment only rises under fixed wages. The reason for the uniform rise in employment of this group of workers in the various cases of wage formation is the fact that the size of this group is so small that its employment depends quite little on what happens elsewhere in the economy, and mostly depends just on the amount of the subsidy directed to these employees.

Table 5. The effects of an increase in the subsidy rate of the employment support scheme by 10 %-points, % (a) or %-points (b), deviation from the initial equilibrium values, or contribution to the rise in overall employment, %-points (c)

Effect on:	FIX	MARK	NEG	LONG RUN	CIPA
GDP[a]	0.21	0.02	-0.14	0.40	-0.05
Employment[a]	0.38	0.03	-0.32	0.48	-0.03
Subsidised employment[c]	0.48	0.47	0.45	0.48	0.47
Unempl. rate[b]	-0.37	-0.02	0.24	-0.45	0.06
Labour supply[a]	-0.01	0.03	-0.04	0.01	0.03
Budget surp/GDP[b]	0.01	-0.08	-0.15	0.05	-0.10
Unempl. rate of skill cat 1[b] (low-skilled)	-0.47	0.00	1.12	-0.97	-0.07
Aggregate labour cost[a]	-0.17	-0.01	0.11	0.00	0.04
Aggregate wage level[a]	0.00	0.19	0.31	0.22	0.25
Wage of skill cat. 1[a]	0.00	0.29	1.16	-0.05	0.25
Wage of skill cat. 2[a]	0.00	0.26	0.33	0.20	0.25
Wage of skill cat. 3[a]	0.00	0.10	0.03	0.25	0.25
Rate of return on capital[b]	0.03	0.00	-0.02	0.00	-0.01

4.5 Reduction of the replacement rate

The next policy measure is a reduction of the replacement rate (unemployment benefit in relation to wage), the size of the reduction being 5%-points in all skill categories. In the government budget this would save 0.18% of GDP. The results are shown in Table 6.

This is an effective policy with respect to employment, although a harsh one, operating on the supply side of the labour market. It also markedly increases labour supply. Especially the interaction with wage formation is quite evident and strong, and wage reactions magnify the positive effect of this policy. However, the reaction in the wage rate of the low skilled diverges from the overall picture of wage moderation, caused by lowering of the outside option. The consequent boom in the capital stock leads to a further expansion in the economy. Labour supply rises vigorously especially among the low skilled, where the effective supply elasticity is highest (see footnote 9 on p. 20). Centralised bargaining would also lead to a marked moderation in wage claims, and an expansion in GDP and employment. The government budget surplus is, of course, higher than what was the initial saving related to the measure concerned, and the difference is quite substantial, indeed. The large short-run reduction of the wage rate of union 1 under bargaining is, however, somewhat puzzling in the results.

Table 6. The effects of a reduction of the replacement rate by 5%-points, % (a) or %-points (b) deviation from the initial equilibrium values*

Effect on:	FIX	MARK	NEG	LONG RUN	CIPA
GDP[a]	0.10	0.69	1.69	2.63	1.08
Employment[a]	0.20	1.34	3.80	3.03	1.82
Unempl. rate[b]	1.11	0.01	-1.97	-1.52	-0.42
Labour supply[a]	1.46	1.37	1.62	1.36	1.35
Budget surp/GDP[b]	-0.17	0.30	0.72	0.84	0.43
Unempl. rate of skill cat 1[b] (low-skilled)	1.85	0.00	-6.80	-3.15	0.34
Aggregate labour cost[a]	-0.08	-0.56	-1.36	0.00	-0.87
Aggregate wage level[a]	0.00	-0.56	-1.36	0.05	-0.95
Wage of skill cat. 1[a]	0.00	-1.18	-6.28	-1.72	-0.95
Wage of skill cat. 2[a]	0.00	-0.78	-2.00	-0.36	-0.95
Wage of skill cat. 3[a]	0.00	-0.16	0.58	0.70	-0.95
Rate of return on capital[b]	0.02	0.12	0.29	0.00	0.18

4.6 The case of a fully flexible labour market

The last simulation deviates from those above. It deals with a hypothetical case of a fully flexible labour market where wages are flexible in real terms and thereby lead to a better balance in the labour market. The unemployment rate would decline, or unemployment even be eliminated in such a process. In this spirit, the following kind of experiment was made in the case of competitive wage formation. We want to lower the unemployment rates of all the skill categories to the level of the high-skilled (cat. 3), see Fig. 1 above. This process

was illustrated above in Equation (20). Now we solve numerically, what this would require in terms of wage flexibility. The results are shown in Table 7.

Table 7. The case of a hypothetical fully flexible labour market, % (a), %-points (b), deviation from the initial equilibrium values, or in relation to initial income, %-points (c)*

Effect on:	FLEX	FLEX & marg. tax upper	FLEX & marg. tax lower
GDP[a]	2.14	2.97	2.00
Employment[a]	4.46	6.13	4.33
Unempl. rate[b]	-4.90	-4.90	-4.90
Labour supply[a]	-0.86	0.72	-0.99
Budget surp/GDP[b]	1.28	1.03	0.13
Unempl. rate of skill cat 1[b] (low-skilled)	-10.20	-10.20	-10.20
Aggregate labour cost[a]	-2.54	-3.19	-2.43
Aggregate wage level[a]	-2.53	-3.18	-2.43
Wage of skill cat. 1[a]	-6.87	-8.16	-7.22
Wage of skill cat. 2[a]	-3.65	-4.54	-3.53
Wage of skill cat. 3[a]	0.07	-0.10	0.36
Rate of return on capital[b]	0.51	0.66	0.49
Welfare of skill cat. 1 (equivalent variation)[c]	10.29	10.81	4.91
Welfare of skill cat. 2 (equivalent variation)[c]	6.19	6.95	4.72
Welfare of skill cat. 3 (equivalent variation)[c]	8.20	9.24	4.27

* The unemployment rates in all skill categories lowered to the level of cat. 3 (= 4.2%).

This would yield very positive results in terms of GDP, employment, and the government budget, too. However, there would be a marked widening of the income distribution, so that the wage rate of the low skilled would go down in real terms by 7%, while the high skilled would in contrast slightly gain from this situation. This is due to the fact that the various labour categories are cooperative factors of production, and thereby the rise in the amount of a factor also raises the marginal productivity of another factor.

The welfare indicators show that shift to a flexible labour market would deliver big gains for all the skill categories, irrespective of the lowering in real wages. However, these indicators refer to the change concerning a skill category as a whole, and there is likely to emerge divergence in this respect between those who are already employed and those unemployed who will now find a job. The overall wage adjustment needed in wages may look as quite modest. In this respect it is important to note, however, that we evaluate changes between two equilibria of the labour market. The wage adjustment needed depends on both the elasticity of labour demand and supply. The figures in the table refer to the final outcome of this process, not to the initial shock to wages. The reactions are subdued compared to those reported in CEPR (1996) about a similar type of exercise of restoring full employment through wage adjustment. Of course, the magnitude of the relevant elasticities also matter essentially with respect to the magnitude of wage adjustment needed.

There are also two additional columns in Table 7 which indicate that there is quite a strong positive interaction between labour market reform and reduction of the marginal tax rates. The results show the plausible fact that it pays to channel the reduction of the progressivity of taxation to an in-work incentive to increase labour supply rather than to a reduction of taxation of the out-of-work benefits. Note that this result is the opposite to that reached under wage bargaining in Section 4.2.

5. Conclusions

Overall, we have found in this paper that wage formation bears quite a strong impact on the effects of various policies aimed at enhancing employment. It is to be noted that this concerns both labour demand and labour supply, the effects on which may deviate widely under different cases of wage formation. However, labour supply reacts in quite a similar way in the various wage formation alternatives. This uniform pattern partly depends on our specification of the labour supply decision in Equation (12) to reflect desired (or notional) consumption, rather than actual consumption. Of course, labour supply responses are quite different across the policy measures.

The case of fixed wages and those where wages react to policies yield the most of contrasting results. In some cases, the expansionary effect on the economy and employment can be even bigger under wage bargaining than under market-determined wages, which bears importance as to policy making in a European context and to consideration of labour market institutions.

The diverse wage reactions and their relationship with the effects of policies should be recognised when planning actual policies, e.g., by taking into consideration that policies may have quite different outcomes depending on labour market institutions and the respective type of wage formation prevailing in various EU countries. The other angle is that the reactions of wages are also different over time, and thus cause variation in the results of economic policies during the course of time.

The effects of a reduction in average tax rates seem to be inefficient in this type of a model, which is basically due to the fact that this policy does not lead to a change in the supply side

of the labour market, i.e., in wage setting. Rather, the expansionary and contractionary effects of this reduction neutralise each other. A marked reduction in the progressivity of the income tax scale, on the other hand, is quite effective and has a sizeable positive effect on the economy and the labour market, but only when coupled with market-determined wage formation. It is a problematic policy under bargaining, as we saw.

As expected, a lowering of firms' indirect labour costs is not effective under flexible wages. The effects of policies in enhancing labour demand directly, resulting under fixed wages, are in many cases fully neutralised through wage changes over time. Under bargaining, a lowering of the labour cost has no positive effects, as the positive impulses just lead to offsetting wage rises based on the higher profitability of the firms. A reduction of indirect labour costs targeted to a specific group of workers like the low-skilled is, in contrast, effective with respect to lowering the unemployment of the targeted group. This holds not only under fixed wages, but also under centralised wage bargaining, where relative wages are a priori fixed and do not, therefore, play a crucial role as to the overall outcome. Under uncoordinated bargaining, however, due to wage-wage links, the compensatory wage claim by the trade union concerned, and that by others linked to it, may lead to a new overall equilibrium in the labour market which is quite unsatisfactory in terms of raising the employment of the targeted group, which is the primary goal of the policy concerned. One conclusion from the results concerning policies aimed at boosting labour demand is that, when formulating policies, the short-run gains in employment reached under fixed wages have to be weighed against the long-run neutrality of such policies.

As is plausible in connection with the tool built here, policies that boost the supply side of the labour market, including wage moderation caused by these measures, work better and the activity of the economy will expand as a result of them. The welfare system, described here by the size of the replacement rate, seems to play quite a substantial role in the outcome of the labour market. On the other hand, it is also important to note that these measures lead to large enough wage moderation which expands the economy and employment to an extent that could absorb the increase in labour supply, created by policy-induced changes in incentives, and thus could lead to a fall in the unemployment rate, too. How much this outcome depends on the exact specification of the model and the magnitude of the relevant elasticities used in the simulations needs to addressed in future research.

The uncoordinated wage bargaining solution seems to be somewhat sensitive to its exact specification, which is quite natural due to the basic approach adopted in the model. This depends also on the specification made that the unemployment benefit, and the overall outside option of wage bargaining, is in the long run linked to the current, not initial, wage level, as in all the other cases. This dampens some of the positive effects of policies.

Wage bargaining turned out to yield quite small impacts, and not always as positive, which is notably the case with respect to lowering the marginal tax rates.[12] This sheds some reservation as to the overall positive public view of comprehensive incomes policy agreements prevailing in Finland. But, on the other hand, centralised bargaining could deliver a positive result with respect to the unemployment rate of the targeted group of workers, when their indirect labour costs are lowered, which uncoordinated bargaining

[12] This was discussed above in Section 2.4.

cannot do. It is, of course, a totally different matter whether it is at all likely that a centralised wage agreement can be reached in this type of a case, where the labour market partners are treated in such a mutually asymmetric way by economic policies.

Carone and Salomäki (2001) summarise their evaluation of policies adopted in the EU countries to enhance labour supply and lower structural unemployment, that they encompass reductions in taxes on labour during the late 1990s, but no essential changes on the benefit side. On the basis of the results of this paper, it might be cost effective also to operate on the benefit side. The problem lies, of course, in the fact that tax reductions are socially more attractive than benefit reductions, which are socially quite harsh. Of course, during recent years some notable reforms have also been made in the unemployment benefit systems of some EU member countries.

The best policy is liberalising wage formation, which polarises the society. However, we suggest that under bargaining there should be a combination of tax policies, namely lowering average taxes, while simultaneously curtailing social security benefits with an equivalent amount, which is an effective policy under a bargained labour market structure. The results call for coordination of measures in tax and benefit policies, so that incentives both to seek employment and to stay out of work are not created simultaneously.

As to the size of the effects, it should be noted that we did not pay any attention to all the indicators and their significance from a policy point of view. So, it should be noted that a 0.2% increase in employment means 5000 persons, which is not negligible. Many of the effects are much bigger than this. As to practical policy-making, it must also be added that it takes time before the labour market behaviour captured in the model makes itself felt when wages start to react. Therefore, the results reported in the paper basically refer to a medium-term or even longer-term outcome, not the short run, where changes in aggregate demand in the goods market play their role, but which have no permanent role as to economic activity in the general equilibrium model built in this paper. This should also be the relevant case empirically over the longer term.

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