

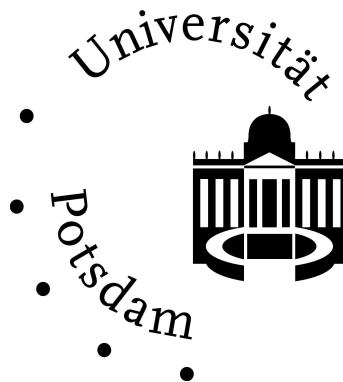
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REGIONAL UNEMPLOYMENT INSURANCE



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Regional unemployment insurance

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Abstract

This study examines the effects of regionalising the budget of unemployment insurance (UI) on wages, employment, and on UI parameters, which, for their part, determine the agents' preferences concerning such a reform. A numerical example shows that, under reasonable assumptions, the intuition that the reform would enhance efficiency and improve the economic situation of agents from the low-unemployment region to the disadvantage of agents from the high-unemployment region is not valid in general.

Keywords: Unemployment insurance; Wage bargaining; Migration

JEL classification: J65; C78; H72

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1 Introduction

The extent to which workers are threatened by unemployment varies considerably, e.g. across industries, age, educational status, and regions. Nonetheless, it is customary to levy obligatory contributions to unemployment insurance (UI) regardless of the specific risk a worker bears of becoming unemployed. Branches of industry or regions characterised by a relatively high rate of unemployment are favoured by this practice because workers and / or employers contribute less than the actuarially fair insurance premium. This leads to a distortion of the decisions regarding where or what kind of labour is being supplied. The purpose of this paper is to discuss the effects of placing the UI under the obligation to equilibrate its budget in each region of a federation instead of on the whole. After such a reform, regionally differentiated UI parameters reflect the risk of unemployment within each region. The results may nevertheless be applied to other characteristics, systematically influencing the probability of entering unemployment.

In some cases, one might argue, such a distortion by a central UI can be justified, namely, if other distortions are countervailed. For instance, risk aversion could lead to an inefficiently low number of workers choosing to supply labour in regions where employment varies relatively strongly. In this case, the implementation of a uniform UI scheme could be welfare-enhancing. The argument, though, is only valid if labour markets are in equilibrium, which is hardly an adequate assumption, in particular if UI is at the centre of the investigation.

But also the intuitive reasoning of some protagonists of a regionalisation of UI implicitly takes for granted that labour markets clear. The Kommission für Zukunftsfragen der Freistaaten Bayern und Sachsen (1997), a committee prominently advocating regionalisation of UI in Germany, argues that it would encourage workers to migrate into those regions where labour is relatively scarce, thereby improving the allocation of labour in the federal state. However, in the presence of involuntary unemployment¹ in both origin and destination region, there would not be any efficiency gain from such reallocation of unemployment.

¹Chiu and Karni (1998, p. 807) point out that the intention of UI is to insure against income losses associated with being laid off involuntarily.

Concerning the distributional effects of the reform, it seems to be straightforward that economic agents from rich regions² would profit to the disadvantage of agents from poor regions. Contributions differ only with reference to the assessment of this circumstance. From a politico-economic point of view, von Hagen and Hammond (1998, p. 334f.) argue in a related context that an insurance systematically favouring one group over another is likely to lose the acceptance of those who are paying net transfers on average over time. The increase of the so-called fictitiously self-employed in Germany over the last years indeed seems to underline this argument in favour of a regionalisation. Other authors align their arguments to the ideal of homogenous net incomes and reject regionalising the budget of UI because of a presumed increase of income differentials.

However, the effects which actually arise from binding UI to equilibrate budgets regionally are not as clear as it seems if the analysis allows for migration in a system of regions with involuntary unemployment occurring within each region, and wages being determined endogenously. In such a framework, the reform produces an increase of migration from the poor to the rich regions because either UI taxes increase or benefits decrease to counterbalance the loss of transfer income in the poor region and vice versa. How the regional unemployment rates differ in equilibrium is yet not clear because it depends on how wages are influenced by the changes in benefits, contributions and migration. Consequently, it may well be that workers and / or employers in the poor region benefit from the measure. This study's aim is to shed some light on the complex effects of reforming UI along this line. The focus is on the conditions under which workers and employers from both regions prefer one or the other institutional arrangement.

In the analytical framework, wages are determined in bargains between unions and firms on the firm level, leaving employment as a sole responsibility of the firms (right-to-manage-approach, see Nickell and Andrews (1983), and, for adaptations of the model with UI, e.g. Pissarides (1998), and Holmlund (1998)). In the following section, after introducing the main assumptions, the bargaining setup is discussed. Sections 3 and 4 respectively compare a model with central UI to a model with

²In what follows, the termini *rich* and *poor* regions are used synonymously with "regions characterised by relatively low/ high unemployment rates", respectively.

regional UI, for the cases when contributions or benefits are adjusted to maintain equilibrated UI budget(s). In section 5, a calibration allows to compare the outcomes of the models. Special interest lies in the comparative advantage the agents have if UI is regionalised. Section 6 contains some concluding remarks.

2 Assumptions and bargaining setup

In order to keep the analysis manageable, we employ the following assumptions and standardisations:

- A1** A federal state consists of two regions ($i \in 1, 2$) which differ only with respect to the endowment of an immobile, inelastically supplied factor of production subsequently referred to as infrastructure, x^i , with $x^1 > x^2$, i.e. region 1 is the rich region and region 2 is poor.
- A2** In each region, many (K) identical firms produce a single homogeneous good which is taken as numeraire. The technology of a representative firm shall be described by the production function

$$f^i = f(n^i, x^i),$$

where n denotes labour input. Labour supply per worker is standardised to unity, so that n symbolises the number of employed workers as well. Denoting derivatives with subscripts, it is assumed that $f_{n^i} > 0$, $f_{x^i} > 0$, $f_{n^i n^i} < 0$. Additionally, the cross-derivative is assumed to be positive, $f_{n^i x^i} > 0$, meaning that infrastructure enhances the productivity of labour. Infrastructure is costless, and there are no fixed costs, so that profits of a firm can be written as $\pi^i = f(n^i, x^i) - n^i w^i$, where w signifies the gross wage rate per worker. Profit maximisation yields the inverse labour demand function:

$$f_{n^i} = w \tag{1}$$

A3 M identical workers have the same concave utility function:

$$u^i = u(c^{i,j}),$$

where c stands for consumption of the homogenous good³, and where the superscript j with $j \in e, u$, indicates the occupational status of a worker. If $j = e$ (employed), consumption reads $c^{i,e} = (1 - \tau^i)w^i$, where τ is the proportional UI tax rate. In the case $j = u$ (unemployed), consumption reads $c^{i,u} = \beta^i \bar{w}^i$. The variable \bar{w} denotes the wage level used to calculate UI benefits, and β is the benefit rate. Workers maximise expected utility by choosing the region where they supply labour.

A4 Ex ante, half of the workers live in each region. We assume that migration takes place in one direction only, namely, from the poor to the rich region. If a worker migrates, costs corresponding with an annuity of k occur. In both regions, workers are distributed equally over the firms, sharing the same employment opportunities within the region (Creedy and McDonald, 1991, p. 348). The number of workers per firm is denoted by m .

A5 All workers attached to a firm are members of a trade union. Each firm bargains with a trade union over the gross wage rate w paid to all employed workers, while the firms retain control over employment. Unions maximise the expected utility of a representative member (see e.g. Oswald, 1985, p. 163). We employ the symmetric Nash solution to the bargaining problem, which maximises the geometric mean of a union's and a firm's payoff. Firms attain zero profits if the bargain breaks down, so that the payoff of an agreement equals the profits (Creedy and McDonald, 1991, p. 350). The 'threat point' of a union is given by the situation when all of its members receive UI benefits. The payoff of a union is thus the difference between the expected utility of a representative worker in the case of an agreement, and the utility of an unemployed worker (see Farber, 1986, p. 1070).

³The consumption good and the produced good need not literally be identical, as long as they are both traded at exogenously fixed prices on world markets, see Wellisch and Wildasin (1996, p. 192).

A6 The UI is obliged to balance its budget. The exact form of the budget constraint depends on whether β or τ is used to attain an equilibrated budget (while the other parameter is given exogenously), and whether the UI is central or regional. The following cases are being considered:

Model TC. The tax rate is adjusted to adapt the revenues of the UI to its expenditures, while the benefit rate is exogenous. Both, tax rate, and benefit rate are uniform across the regions.

Model TR. Like in model TC, the endogenously determined parameter is the tax rate of UI. The UI has to equilibrate its budget within each region separately, so that, in general, the tax rate differs between the regions, while the benefit rate remains uniform.

Model BC. The benefit rate is used to equilibrate the budget for a given tax rate. Both are uniform across the federal state.

Model BR. As in model BC, the benefit rate is choice variable, but with regionally balanced budgets, which leads to differences of the benefit rates, whereas the tax rate is uniform.

Because firms and unions take benefit and tax rate, as well as the number of attached workers as given, the wage-bargain can be considered in a separate submodel. The results of the subsequent analysis thus apply to each of the models.

The bargain

Under assumptions A2-A5, the Lagrangian to be maximised by the bargaining parties reads⁴

$$\begin{aligned} \max_{n,w,\lambda} \mathcal{L} &= \left\{ \frac{n}{m} [u(c^e) - u(c^u)] \right\} \cdot \{f(n, x) - nw\} + \lambda(f_n - w) \\ &= G \cdot \pi + \lambda(f_n - w), \end{aligned} \quad (2)$$

⁴For the sake of simplicity, the superscript i is omitted in this submodel. The results apply to both regions.

where G denotes the payoff of a union. The outcome of the bargain is given by differentiation of equation (2) with respect to employment, gross wage rate, and λ , and setting the partial derivatives equal to zero.

$$\frac{\partial \mathcal{L}}{\partial n} = G_n \cdot \pi + G \pi_n + \lambda \cdot f_{nn} = 0, \quad (3)$$

$$\frac{\partial \mathcal{L}}{\partial w} = G_w \cdot \pi - G \cdot n - \lambda = 0, \quad (4)$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = f_n - w = 0. \quad (5)$$

Since firms and unions are equal ex ante, there is no reason, why the outcome of the bargains should differ from each other. Setting $\bar{w} = w$, elimination of λ from equations (3) and (4) and rearranging yields the *wage equation* (Pissarides, 1998, S. 164):

$$\frac{n_w}{n} + \frac{u_w^e}{u^e - u^u} - \frac{n}{f(n, X) - nw} = 0. \quad (6)$$

The effects of changing the benefit rate or the contribution rate on wages and employment can be derived by means of linear algebra. The bordered Hessian (Jakobian) derived from equations (3-5) reads

$$|J| = \begin{vmatrix} f_{nn} \cdot G + \lambda \cdot f_{nnn} & G_{nw} \cdot \pi - 2 \cdot G & f_{nn} \\ G_{nw} \cdot \pi - 2 \cdot G & G_{ww} \cdot \pi - 2 \cdot n \cdot G_w & -1 \\ f_{nn} & -1 & 0 \end{vmatrix} \quad (7)$$

$$= 3 \cdot f_{nn} \cdot G - 2 \cdot f_{nn} \cdot G_{nw} \cdot \pi - f_{nn}^2 \cdot G_{ww} \cdot \pi + 2 \cdot f_{nn}^2 \cdot n \cdot G_w - \lambda f_{nnn}$$

and is positive if the second-order conditions for a maximum of the Nash-product are fulfilled, which is assumed in what follows. Employing Cramer's rule, the comparative-static derivatives $\partial w / \partial \beta$, $\partial w / \partial \tau$, $\partial n / \partial \beta$ and $\partial n / \partial \tau$ can be calculated. If the second-order condition holds, the indicated signs of the derivatives are thus⁵

$$\frac{\partial w}{\partial \beta} = \frac{G_{n\beta} \cdot \pi \cdot f_{nn} - (f_{nn})^2 \cdot G_\beta \cdot n}{|J|} > 0,$$

⁵Note that from the definitions of G and π it is straightforward that $G_w > 0$, $G_n > 0$, $G_\beta < 0$, $G_\tau < 0$, $G_{w\beta} = 0$, $G_{n\beta} < 0$, $G_{n\tau} < 0$ and $\pi_n = 0$. The sign of $G_{w\tau}$ is negative in general.

$$\begin{aligned}\frac{\partial w}{\partial \tau} &= \frac{G_{n\tau} \cdot \pi \cdot f_{nn} + (f_{nn})^2 \cdot (G_{w\tau} \cdot \pi - G_{\tau} \cdot n)}{|J|} > 0, \\ \frac{\partial n}{\partial \beta} &= \frac{-f_{nn} \cdot n \cdot G_{\beta} + G_{n\beta} \cdot \pi}{|J|} < 0, \\ \frac{\partial n}{\partial \tau} &= \frac{f_{nn} \cdot (G_{w\tau} \cdot \pi - G_{\tau} \cdot n) + G_{n\tau} \cdot \pi}{|J|} < 0.\end{aligned}$$

The indicated signs of the derivatives with respect to τ only follow if $G_{w\tau} \leq 0$ is sufficiently small. This derivative reads

$$G_{w\tau} = \frac{n}{m} [-u_{c^e} - (1 - \tau) \cdot w \cdot u_{c^e c^e}].$$

After rearranging, we obtain

$$G_{w\tau} = \frac{n}{m} u_{c^e} (R - 1),$$

where $R = -(u_{c^e c^e} / u_{c^e}) \cdot (1 - \tau) \cdot w$ is the Arrow-Pratt measure of relative risk-aversion. If the utility function has the assumed properties, this measure is positive. In the case of the utility function $u = \ln c$, the measure amounts to 1, which yields $G_{w\tau} = 0$. In the case of utility functions of the form $u = c^{\frac{1}{\rho}}$, it follows that $R = 1 - 1/\rho$. Risk-aversion ($\rho > 1$) then implies $0 < R < 1$. The more risk-averse workers are, the closer the measure is to unity. This means, that $G_{w\tau}$ is close to zero. In this case, the derivatives with respect to τ have the indicated signs, which is presumed in what follows.

Thus, a higher benefit rate, or higher contributions to UI bring about higher equilibrium wages and lower equilibrium employment. It should be emphasised, however, that the derivatives with respect to τ hinge on the degree of risk-aversion. The result that benefits have a positive impact on wages, while the contribution (tax) rate has an ambiguous effect, is parallel to the findings of e.g. Oswald (1985, p. 168) and Vijlbrief and van de Wijngaert (1995, p. 238) for the case of a monopoly union. In comparison, Malcomson and Sator (1987) and Lockwood and Manning (1993), respectively for the cases of a monopoly union and wage bargaining, establish that a higher marginal contribution rate lowers the wage rate. Here, due to the assumption of proportional payroll contributions, marginal and average contribution rate coincide.

3 Endogenous tax rate

In contrast to the wage-bargaining, the way UI is modelled depends on which parameter serves to equilibrate the budget of UI (tax rate or benefit rate), and on whether a central or a regional UI is considered. The complete models consist of the characteristic submodel, containing the conditions for a migration equilibrium and the condition of a balanced budget, and the submodels describing the wage bargain for each region, respectively. First, the case is considered where a central UI adjusts the tax rate to balance its budget.

3.1 Central UI, endogenous contribution rate (model TC)

Workers from region 2 emigrate if the expected utility in region 1 - taking migration costs into account - exceeds expected utility in region 2. In equilibrium, the utility a worker from region 2 expects in the case of emigration is the same as in his home region. Thus, workers from region 2 are indifferent concerning the regions. As a consequence, the extent to which migration occurs, depends positively on wages and the rate of employment in region 1, and it depends negatively on wages and the rate of employment in region 2 (Borjas, 1996, S. 314). Due to the costs of migration, workers from region 1 strictly prefer to stay in their home-region. The following equation poses the condition for a migration equilibrium:

$$F^{mig} = \frac{n^1 K}{s M} u[(1 - \tau)w^1 - k] + \left(1 - \frac{n^1 K}{s M}\right) u(\beta w^1 - k) - \frac{n^2 K}{1 - s M} u[(1 - \tau)w^2] - \left(1 - \frac{n^2 K}{1 - s M}\right) u(\beta w^2) = 0, \quad (8)$$

where $s = m^1 K/M$ is the share of workers in region 1. The first row of equation (8) stands for the expected utility of a worker from region 2 who emigrated to region 1. The second row contains (with a negative sign) the expected utility of a worker from region 2 who stays.

The condition for an equilibrated budget in the case of a central UI reads:

$$F^{UI} = n^1 K \tau w^1 + n^2 K \tau w^2 - (sM - n^1 K) \beta w^1 - [(1 - s)M - n^2 K] \beta w^2 = 0. \quad (9)$$

In equation (9), the revenue of the UI, $R = n^1 K\tau w^1 + n^2 K\tau w^2$, has a positive sign, and the expenditure $E = (sM - n^1 K)\beta w^1 + [(1 - s)M - n^2 K]\beta w^2$ has a negative one. If the budget is balanced, both must sum up to zero.

Equations (8) and (9) respectively describe, how migration (symbolised by s) and UI contributions (τ) react if variables, which are exogenous from the point of view of the UI or a single worker, vary. They build a submodel, which determines τ and s , whereas the outcome of the wage-bargains in both regions is taken as exogenous. This technique allows to consider only that part of the model, which depends on the organisation of UI. Partially differentiating equation (9) yields the following comparatively static results:

$$\begin{aligned}\frac{\partial \tau}{\partial n^1} &= \frac{-\tau(\beta + \tau)w^1 K}{R} < 0, & \frac{\partial \tau}{\partial n^2} &= \frac{-\tau(\beta + \tau)w^2 K}{R} < 0, \\ \frac{\partial \tau}{\partial w^1} &= \frac{sM\beta\tau - n^1 K\tau(\beta + \tau)}{R} < 0, & \frac{\partial \tau}{\partial w^2} &= \frac{(1 - s)M\beta\tau - n^2 K\tau(\beta + \tau)}{R} > 0, \\ & & \frac{\partial \tau}{\partial s} &= \frac{\beta M\tau(w^1 - w^2)}{R} > 0.\end{aligned}$$

In the appendix, it is shown that the signs of the derivatives with respect to wages only follow if the rate of employment in the region with a better endowment with infrastructure (region 1) is higher than the average. This condition will be referred to hereafter as *condition a*. The contribution rate depends positively on s if $w^1 > w^2$ (*condition b*). The reason is that migration to region 1 increases the number of unemployed who are eligible for benefits according to the wage rate w^1 . If this wage rate is higher than w^2 , the expenditure of the UI increases with a given number of employed in both regions.

Partially differentiating the implicit equation (8) gives

$$\begin{aligned}\frac{\partial s}{\partial n^1} &= \frac{s(1 - s)^2 (u^{m1,e} - u^{m1,u})}{n^1(1 - s)^2 (u^{m1,e} - u^{m1,u}) + n^2(s)^2 (u^{2,e} - u^{2,u})} > 0, \\ \frac{\partial s}{\partial n^2} &= \frac{-s^2(1 - s) (u^{2,e} - u^{2,u})}{n^1(1 - s)^2 (u^{m1,e} - u^{m1,u}) + n^2(s)^2 (u^{2,e} - u^{2,u})} < 0,\end{aligned}$$

$$\frac{\partial s}{\partial w^1} = \frac{s(1-s)^2 [(1-\tau)Kn^1u_c^{m1,e} + b(sM - n^1K)u_c^{m1,u}]}{Kn^2(s)^2(u^{2,e} - u^{2,u}) + Kn^1(1-s)^2(u^{m1,e} - u^{m1,u})} > 0$$

$$\frac{\partial s}{\partial w^2} = \frac{-s^2(1-s) [(1-\tau)Kn^2u_c^{2,e} + b((1-s)M - n^2K)u_c^{2,u}]}{Kn^2(s)^2(u^{2,e} - u^{2,u}) + Kn^1(1-s)^2(u^{m1,e} - u^{m1,u})} < 0,$$

$$\frac{\partial s}{\partial \tau} = \frac{s(1-s) [n^2w^2su_c^{2,e} - n^1w^1(1-s)u_c^{m1,e}]}{n^1(1-s)^2(u^{m1,e} - u^{m1,u}) + n^2(s)^2(u^{2,e} - u^{2,u})},$$

where $u^{m1,j} = u(c^{1,j} - k)$ denotes the utility of a worker from region 2 after emigration to region 1. $(u^{i,e} - u^{i,u})$ is always positive because otherwise the union would not have an incentive to reach an agreement. $\partial s/\partial \tau$ is ambiguous in general. The sign depends on the value of the expression between square brackets in the numerator. Because labour has a higher intramarginal productivity in region 1, it is likely that $n^1 > n^2$ and $w^1 > w^2$. By definition, $s > 1 - s$. The condition for a negative relationship between UI contributions and migration (*condition c*) is

$$n^2w^2su_c^{2,e} < n^1w^1(1-s)u_c^{m1,e}.$$

Model TC consists of the characteristic submodel described above, and the submodels determining wages and employment in both regions. The equilibrium conditions needed to calculate the endogenous variables are equations (1) and (6) respectively for the poor and the rich region, equations (8) and (9). Figure 1 illustrates and summarises the interactions between endogenous variables in the model. Each arrow represents a direct partial effect. The arrows are labeled with the sign of the effects, respectively. If the effect is ambiguous, the arrow is labeled with a sign and the letter of the condition that must hold to yield the respective result.

[insert figure 1 here]

3.2 Regional UI, endogenous contribution rate (model TR)

In the case of regionally balanced UI budgets, equilibrium conditions (8) and (9) must be modified. In model TR, there are two regional contribution rates,

whereas the benefit rate remains uniform and exogenous. The condition for a migration equilibrium then reads:

$$F^{mig} = \frac{n^1 K}{s M} u[(1 - \tau^1)w^1 - k] + \left(1 - \frac{n^1 K}{s M}\right) u(\beta w^1 - k) - \frac{n^2 K}{1 - s M} u[(1 - \tau^2)w^2] - \left(1 - \frac{n^2 K}{1 - s M}\right) u(\beta w^2) = 0, \quad (10)$$

which differs from (8) only with respect to the superscripts of τ . More differences arise concerning the condition of an equilibrated UI budget. Here, two equations, one for each region, express the requirement of self-financing UI:

$$F^{UI1} = \tau^1 n^1 - \beta \left(s \frac{M}{K} - n^1 \right) = 0 \quad (11)$$

and

$$F^{UI2} = \tau^2 n^2 - \beta \left[(1 - s) \frac{M}{K} - n^2 \right] = 0. \quad (12)$$

Differentiating implicitly equation (10) yields the partial derivatives of s . The derivatives with respect to n^i and w^i remain unchanged with the exception of the definitions of $u^{m1,j}$ and $u^{2,j}$. Therefore, only the derivatives with respect to τ^1 and τ^2 are calculated. They read

$$\frac{\partial s}{\partial \tau^1} = \frac{-s(1-s)^2 n^1 w^1 u_c^{m1,e}}{n^1(1-s)^2 (u^{m1,e} - u^{m1,u}) + n^2(s)^2 (u^{2,e} - u^{2,u})} < 0$$

and

$$\frac{\partial s}{\partial \tau^2} = \frac{(s)^2(1-s)n^2 w^2 u_c^{2,e}}{n^1(1-s)^2 (u^{m1,e} - u^{m1,u}) + n^2(s)^2 (u^{2,e} - u^{2,u})} > 0.$$

Equations (11) and (12) show that the contribution rates only depend on variables related to the respective region. Wages have no impact because both, revenues and expenditures, depend linearly on the respective wage. Solving for τ^i and differentiating partially yield:

$$\begin{aligned} \frac{\partial \tau^1}{\partial s} &= \frac{\beta M}{n^1 K} > 0, & \frac{\partial \tau^2}{\partial s} &= -\frac{\beta M}{n^2 K} < 0, \\ \frac{\partial \tau^1}{\partial n^1} &= -\frac{\beta s M}{(n^1)^2 K} < 0, & \frac{\partial \tau^2}{\partial n^2} &= -\frac{\beta(1-s)M}{(n^2)^2 K} < 0. \end{aligned}$$

The derivatives hold the expected signs. When the number of employed workers is given, an increase of the population of one region is accompanied by a rise of

the number of unemployed. If the budget of the regional UI is to be balanced, the contribution rate has to increase, too. If, in contrast, the number of employed workers increases, the revenue of the UI rises and the expenditures are lower. The contribution rate, which corresponds to an equilibrated budget is lower.

Model TR consists of the characteristic submodel described above, and of the submodels determining employment and wages in both regions. The relevant equilibrium conditions are thus equations (1) and (6) respectively for region 1 and region 2, and equations (10), (11) and (12). Figure 2 summarises the partial effects of the endogenous variables on one another. As the formal analysis shows, under the assumptions set above, all effects can be derived unambiguously. The only link between the regions is migration, symbolised by the variable s . If the situation of workers in region 1 improves by lower UI contributions, higher gross wages, or higher employment, immigration from region 2 increases. This lowers the equilibrium UI contribution rate in region 2, which has an impact on the wage rate and consequently on employment. As can be seen, all variables mutually depend on each other. The complexity of the simultaneous equations brings about that the total effects of variations of exogenous variables cannot be determined in general. Therefore, a comparison of the models TC and TR is undertaken only in the calibrated form of the models (section 5).

[insert figure 2 here]

4 Endogenous benefit rate

Many contributions concerned with self-financing UI assume that the UI tax rate adjusts to equilibrate the budget. Examples are Pissarides (1998) and Albrecht and Vroman (1999). Likewise, many authors assume, that the benefits, or the replacement ratio is used to maximise welfare or the utility of the median voter under the constraint that an equilibrated budget is maintained (see e.g. Persson and Tabellini (1996), Gruber (1997)). Studies, which consider both possibilities an UI has to balance the budget, are rarely found. Exceptions are Vijlbrief and van de Wijngaert (1995) and Rocheteau (1999). The former authors assign the

different regimes to periods of the dutch UI policy. In contrast, we imagine of endogenous contributions as related to the short term, while endogenous benefits are related to the long term. An argument for this interpretation is that benefits are in most countries legal entitlements, while contributions can be adjusted more easily by UI authorities.

4.1 Central UI, endogenous benefit rate (model BC)

In the case of a central UI, the conditions for a migration equilibrium and for a balance budget remain, compared to model TC, formally unchanged. The only difference is, that β is endogenous, while τ is given. The conditions read

$$F^{mig} = \frac{n^1 K}{s M} u[(1 - \tau)w^1 - k] + \left(1 - \frac{n^1 K}{s M}\right) u(\beta w^1 - k) - \frac{n^2 K}{1 - s M} u[(1 - \tau)w^2] - \left(1 - \frac{n^2 K}{1 - s M}\right) u(\beta w^2) = 0 \quad (13)$$

and

$$F^{UI} = n^1 K \tau w^1 + n^2 K \tau w^2 - (sM - n^1 K) \beta w^1 - [(1 - s)M - n^2 K] \beta w^2 = 0. \quad (14)$$

Partially differentiating equations (13) and (14) gives

$$\begin{aligned} \frac{\partial \beta}{\partial n^1} &= \frac{K w^1 \beta (\tau + \beta)}{E} > 0 & \frac{\partial \beta}{\partial n^2} &= \frac{K w^2 \beta (\tau + \beta)}{E} < 0 \\ \frac{\partial \beta}{\partial w^1} &= \frac{\beta (K n^1 (\beta + \tau) - \beta s M)}{E} > 0 & \frac{\partial \beta}{\partial w^2} &= \frac{\beta (K n^2 (\beta + \tau) - \beta (1 - s) M)}{E} < 0 \\ & & \frac{\partial \beta}{\partial s} &= \frac{-(\beta)^2 M (w^1 - w^2)}{E} < 0 \end{aligned}$$

and

$$\frac{\partial s}{\partial \beta} = \frac{\frac{1}{K} [(1 - s)w^1 (sM - n^1 K) u_c^{m1,u} - s w^2 ((1 - s)M - n^2 K) u_c^{2,u}]}{n^1 (1 - s)^2 (u^{m1,e} - u^{m1,u}) + n^2 (s)^2 (u^{2,e} - u^{2,u})}.$$

In contrast to the derivatives of τ in model TC, the derivatives of β have the inverse sign because the impact of an increase of the benefit rate on the balance of the UI has the same direction as the impact of a decrease of the tax rate.

This means, that the signs of the derivatives with respect to wages require that the rate of employment in region 1 is higher than in region 2 (*condition a*, see the appendix). $\partial\beta/\partial s$ has the indicated sign if *condition b* is met. UI benefits have an ambiguous effect on migration in general. It is negative, if the following inequality holds (*condition d*):

$$(1-s)w^1 (sM - n^1 K) u_c^{m1,u} < sw^2 ((1-s)M - n^2 K) u_c^{2,u}.$$

Model BC consists of equations (1) and (6) respectively for both regions, equations (13) and (14). Figure 3 illustrates the interplay of the endogenous variables. Again, the ambiguous effects are labeled with the letter of the condition that must be fulfilled.

[insert figure 3 here]

4.2 Regional UI, endogenous benefit rate (model BR)

In model BR, the UI tax rate is uniform and exogenously determined. In contrast to model BC, the budget of the UI has to be balanced within each region by adjustments of the benefit rate. Accordingly, the regional benefit rates differ in general. The condition that workers from region 2 are indifferent between staying in region 2 and going to region 1 then reads

$$\begin{aligned} F^{mig} = & \frac{n^1 K}{s M} u[(1-\tau)w^1 - k] + \left(1 - \frac{n^1 K}{s M}\right) u(\beta^1 w^1 - k) \\ & - \frac{n^2 K}{1-s M} u[(1-\tau)w^2] - \left(1 - \frac{n^2 K}{1-s M}\right) u(\beta^2 w^2) = 0. \end{aligned} \quad (15)$$

The budget constraints of the regional departments of the UI read

$$F^{UI1} = \tau n^1 - \beta^1 \left(s \frac{M}{K} - n^1\right) = 0 \quad (16)$$

and

$$F^{UI2} = \tau n^2 - \beta^2 \left[(1-s) \frac{M}{K} - n^2\right] = 0. \quad (17)$$

Partial differentiation of the implicit equilibrium conditions gives the comparative-static effects of the endogenous variables on each other. The derivatives of s with respect to wages and employment remain unchanged as compared to model BC,

except for the definition of $u^{m1,j}$ and $u^{2,j}$. The derivatives with respect to the benefit rates read

$$\frac{\partial s}{\partial \beta^1} = \frac{\frac{1}{K} \left[s(1-s)^2 w^1 (sM - n^1 K) u_c^{m1,u} \right]}{n^1(1-s)^2 (u^{m1,e} - u^{m1,u}) + n^2(s)^2 (u^{2,e} - u^{2,u})} > 0$$

and

$$\frac{\partial s}{\partial \beta^2} = \frac{-\frac{1}{K} \left[(s)^2(1-s)w^2 ((1-s)M - n^2 K) u_c^{2,u} \right]}{n^1(1-s)^2 (u^{m1,e} - u^{m1,u}) + n^2(s)^2 (u^{2,e} - u^{2,u})} < 0.$$

Differentiation of the balanced budget conditions gives

$$\frac{\partial \beta^1}{\partial s} = \frac{n^1 M \tau}{K \left(s \frac{M}{K} - n^1 \right)^2} < 0, \quad \frac{\partial \beta^2}{\partial s} = \frac{n^2 M \tau}{K \left[(1-s) \frac{M}{K} - n^2 \right]^2} > 0,$$

$$\frac{\partial \beta^1}{\partial n^1} = \frac{s M \tau}{K \left(s \frac{M}{K} - n^1 \right)^2} > 0, \quad \frac{\partial \beta^2}{\partial n^2} = \frac{(1-s) M \tau}{K \left[(1-s) \frac{M}{K} - n^2 \right]^2} > 0.$$

The interplay of the endogenous variables is summarised in figure 4. As in the section with endogenous tax rate, the ambiguity of some effects disappears when a regional UI is considered. The reason is that, for instance, in the model with central UI, immigration in region 1 has a negative effect on the UI's budget because the number of unemployed in region 1 increases, and it has a positive effect because the number of unemployed in region 2 shrinks. Consequently, the total effect is not clear without additional assumptions. In the cases of regional UI, the effect is split into two unambiguous effects.

[insert figure 4 here]

5 Calibration and comparison

There are two motivations to calibrate the models. First, it is possible to visualise and to elucidate functional relationships, which can also be derived generally. The second aim is to qualify effects, which are ambiguous in general. For these results to have a weight it is important that the assumed functional forms and parameters are plausible. On the other hand, the functions should be as simple as possible.

The following functions are assumed:

$$\text{utility function} \quad u(c) = \sqrt{c},$$

$$\text{production function} \quad f(n, x) = \frac{1}{a} \left(nx - \frac{1}{2}n^2 \right),$$

where a is a positive parameter. Both functions have the assumed properties, i.e. positive first derivatives, and negative second derivatives with respect to consumption and employment, respectively⁶. The cross-derivative of the production function is positive, so that infrastructure has a positive effect on the productivity of labour. The labour demand function can be obtained by partially differentiating $f(\cdot)$, and rearranging: $n = x - aw$. Both, production function and utility function, have mainly been chosen due to their simplicity.

If the indicated functions are employed, the wage rate can be calculated by insertion in equation (6):

$$w = \frac{x}{a \left(7 - 6 \frac{\sqrt{\beta}}{\sqrt{1-\tau}} \right)}$$

and, using equation (1), labour demand is

$$n = \frac{6x}{6 + \frac{\sqrt{1-\tau}}{\sqrt{1-\tau} - \sqrt{\beta}}}.$$

The exogenous parameters have the values given table 1 in the appendix (τ in models BC and BR and β in models TC and TR).

To assess the effects of a regionalisation of the UI's budget, profits and expected utilities of firms and workers from both regions have to be derived. Then, the difference between the respective values with a central and with a regional UI indicates, which of the alternatives an agent prefers. If it is positive, central UI is preferable, and vice versa.

5.1 Models TC and TR

Figure 5 shows the preferences of firms and workers concerning the organisation of UI for different benefit rates. Positive values mean that the expected utility or

⁶The signs of the derivatives only follow if $x > n$, which is guaranteed by the choice of the parameters made hereafter.

the profits are higher with a central UI, negative values mean that regional UI is preferred. The definitions and interpretations of the curves are:

$$\begin{aligned}
 Fi \equiv \pi_{TC}^i - \pi_{TR}^i & \begin{cases} > 0 & \text{firms from region } i \text{ prefer central UI} \\ < 0 & \text{firms from region } i \text{ prefer regional UI} \end{cases} \\
 Wi \equiv Eu_{TC}^i - Eu_{TR}^i & \begin{cases} > 0 & \text{workers from region } i \text{ prefer central UI} \\ < 0 & \text{workers from region } i \text{ prefer regional UI} \end{cases}
 \end{aligned} \tag{18}$$

Apart from the preferences of the agents, an efficiency criterion, z , is used to assess the reform. For this aim the total production in both regions have to be calculated, lowered by the total costs of migration. Related to one firm from each region, the variable is defined as follows:

$$z \equiv f(n^1, x^1) + f(n^2, x^2) - k \left(m^1 - \frac{M}{2K} \right).$$

The number of workers per firm is $M/2K$ ex ante since workers are distributed evenly across all firms (see assumption A4). To find out under which arrangement more income rests for consumption, the difference between z in the case of central UI and z in the case of regional UI is calculated:

$$\begin{aligned}
 \Delta z = z_{TC} - z_{TR} &= f_{TC}(n^1, x^1) + f_{TC}(n^2, x^2) \\
 &\quad - \left[f_{TR}(n^1, x^1) + f_{TR}(n^2, x^2) \right] - k \left(m_{TC}^1 - m_{TR}^1 \right).
 \end{aligned} \tag{19}$$

Again, positive values signify an advantage of central UI and negative ones that regional UI is preferable. If, for instance, the value of Δz is positiv, it is *potentially* possible that all workers and firms are better off with central UI if the excess of production is distributed appropriately.

In contrast to the above mentioned intuition, figure 5 shows, that central UI may well be preferable for efficiency reasons. For every given benefit rate β , Δz is positiv. This means, that firms and workers who profit from central UI, could compensate those, who are worse off. The figure also shows, that only firms from the rich region would be better off with regional UI. With the given functional

relationships and parameters, the conjecture that the interests of agents from the poor region are contrary to the interests of those from the rich region, cannot be confirmed. While the profit differences for the firms are considerable, the preferences of workers from both regions toward central UI are only weak.

[insert figure 5 here]

The described results can be explained by the partial effects summarised in figures 1 and 2. Because region 1 (region 2) has an unemployment rate below (above) average, the UI tax rate is lower (higher) in the case of regional UI. If workers are sufficiently risk-averse, this leads to lower (higher) equilibrium wages. Then, employment is higher (lower) in equilibrium, which reinforces the initial effect on the UI tax rate. The effects on the expected utility of workers and also on migration are not quite clear, yet. On the one hand, the relatively lower UI tax rate and higher probability of entering employment have a positive impact on migration from the poor to the rich region, respectively. On the other hand, wages are, in comparison to central UI, higher in the poor region, and lower in the rich region, which has a negative influence on migration. For the specific functions and parameter values we assume the positive effect prevails, so that equilibrium migration is higher in the case of regional UI. The additional costs of migration may explain to some extent, why the efficiency criterion supports central UI. The contrary effects on the expected utilities, together with compensatory migration involve the relatively small preference of workers from both regions towards central UI.

5.2 Models BC and BR

Figure 6 indicates, which organisational form of UI the agents prefer if the benefit rate(s) is (are) adjusted to balance the UI's budget. The definitions of the curves are analogous to the previous subsection, given by equations (18) and (19). The figure shows, that it has an influence on the preferences of the firms, whether the tax rate or the benefit rate is adjusted to balance the budget of UI. With endogenous benefit rate, firms from the rich region make higher profits if UI is

central, while firms from the poor region are better off with regional UI. In the former case, it is the other way around. In comparison, workers from both regions are always better off with central UI. As with endogenous tax rate, the efficiency criterion supports central UI.

[insert figure 6 here]

The reason for the diverging results concerning the relation of profits in the two cases lies in the determination of wages. Here, a regionalisation of UI leads -compared to central UI - to higher (lower) equilibrium benefit rates in the rich (poor) region. A higher (lower) benefit rate unambiguously leads to higher (lower) equilibrium wages in the context of the assumed bargaining setup. This causes labour demand and profits to shrink (increase). The effects on expected utilities and thus on migration are contradictory, though. On the one hand, workers from the rich region have higher wages and a higher benefit rate. On the other hand, the probability of becoming employed is smaller in equilibrium, and vice versa for the poor region. With the assumed functions and parameter values, however, equilibrium migration from the poor to the rich region increases, if UI is regionalised. The costs connected with this additional migration have a negative impact on the efficiency measure, which supports thus central UI. Migration equilibrates the differences of the expected utility between workers because it increases the expected utility in the origin region, and it lowers the expected utility in the destination region. Hence, workers from both regions prefer central UI. The latter result is thus independent of which parameter of the UI serves to equilibrate the budget.

6 Conclusion

The aim of this contribution is to shed some light on the effects of putting a self-financing UI under the obligation to have balanced budgets in every region. A broad analytical framework is established to examine the impact on wages, employment, and on UI parameters, which, for their part, determine the agents'

preferences towards a regional or a central UI. This framework allows for numerous extensions and reinterpretations. For instance, one could speak of two levels of qualification, instead of regions. Then, the parameter k would represent the costs of a higher qualification. Another example of a reinterpretation would be to consider the question of a centralisation of national social security systems on a supra-national level, as von Hagen and Hammond (1998) do for the case of the European Union. A possible extension would be to derive endogenously the extent and the foundation of UI by maximising a welfare function to be defined, or to model a bargain between workers and firms over UI parameters, as in Hamermesh and Scoones (1999).

The intuition is that the regionalisation would enhance efficiency and improve the economic situation of agents from the low-unemployment region to the disadvantage of agents from the high-unemployment region. Although the effects are complex and cannot be derived unambiguously, a numerical example shows that the intuition is not true in general. Migration connects the expected utilities of workers from both regions through constant migration costs. Hence, the preferences of workers are marching in step. The higher volume of migration in the case of regional UI budgets leads to a loss of efficiency. A conflict only arises between firms from the rich and from the poor region. Under the restriction to self-financing UI, the regionalisation leads, depending on the assumed regime, either to lower UI taxes or to higher UI benefits in the rich region. Because both parameters have a positive impact on wages under reasonable assumptions, equilibrium wages in the rich region fall in the former case, and rise in the latter. This causes firms to prefer regional UI budgets if the tax rate is endogenous, and to prefer central UI if the benefit rate is endogenous. The inverse is valid for firms from the poor region.

Even though these results hinge partially on assumed functions and parameters, the underlying effects are plausible. Other effects, neglected in these models, may alter our results. Nonetheless, the mere possibility of these results shows that sweeping and intuitive judgements are not appropriate when dealing with this complex subject.

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Appendix

The partial derivatives with respect to w^1 have the indicated sign if

$$n^1 K \tau - s M \beta + n^1 K \beta > 0,$$

i.e.

$$\frac{\beta + \tau}{\beta} > \frac{sM}{n^1 K}. \quad (20)$$

The budget constraint of the UI (9) or (14) can be transformed into

$$n^1 K w^1 (\beta + \tau) + n^2 K w^2 (\beta + \tau) = s M \beta w^1 + (1 - s) M \beta w^2$$

or

$$\frac{\beta + \tau}{\beta} = \frac{sMw^1 + (1 - s)Mw^2}{n^1Kw^1 + n^2Kw^2}.$$

Insertion of the right-hand side of the equation in place of the left-hand side of inequality (20), and multiplication with the denominators of the fractions yields

$$(1 - s)Mn^1K > sMn^2K.$$

Multiplication with $1/(s(1 - s)M)$ then gives

$$\frac{n^1K}{sM} > \frac{n^2K}{(1 - s)M}. \quad \square$$

The left-hand side is the rate of employment in region 1, the right-hand side is the rate of employment in region 2. For the derivative with respect to w^2 , a parallel consideration applies.

parameter	value	parameter	value
a	0.6	M	1
β	0.57	τ	0.05
k	0.27	x^1	1
K	1	x^2	0.6

Table 1: parameter values for the calibration

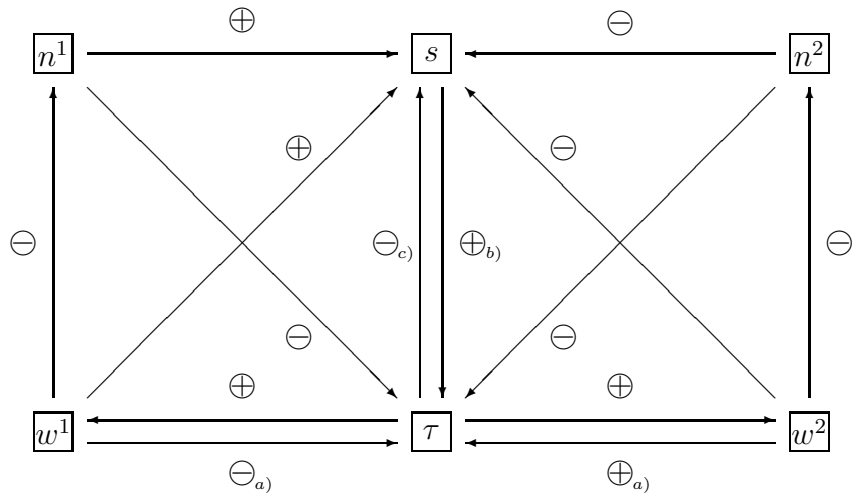


Figure 1: Partial effects in model TC

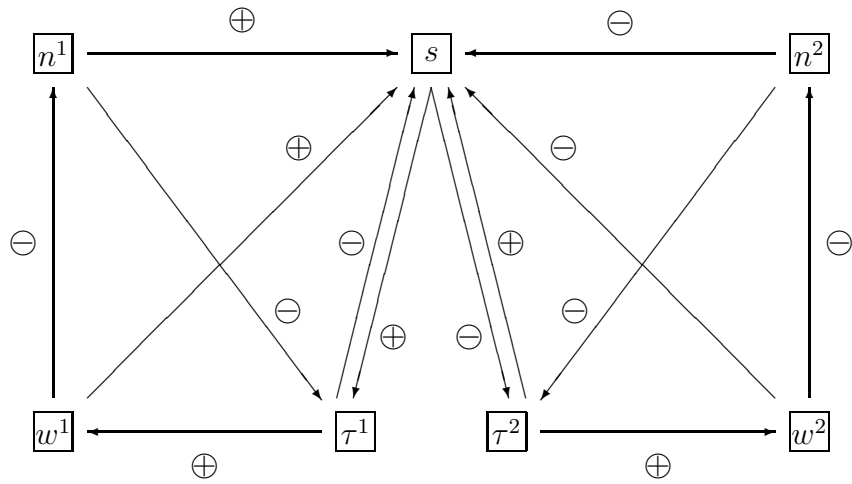


Figure 2: Partial effects in model TR

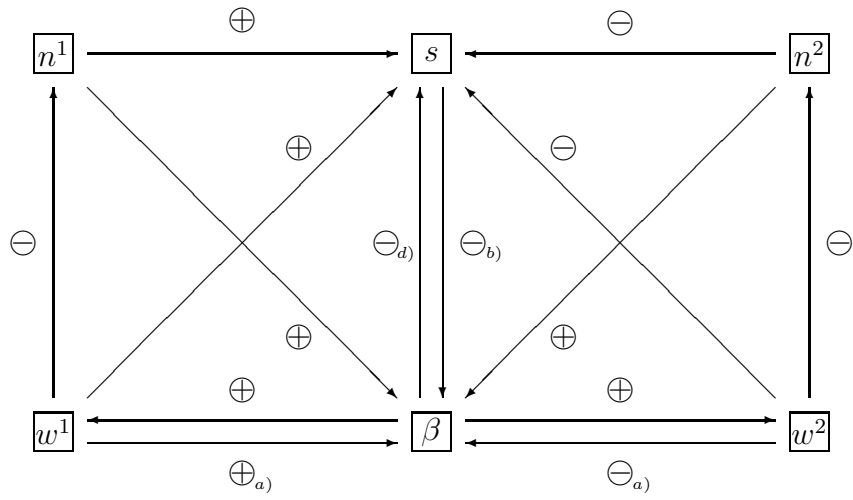


Figure 3: Partial effects in model BC

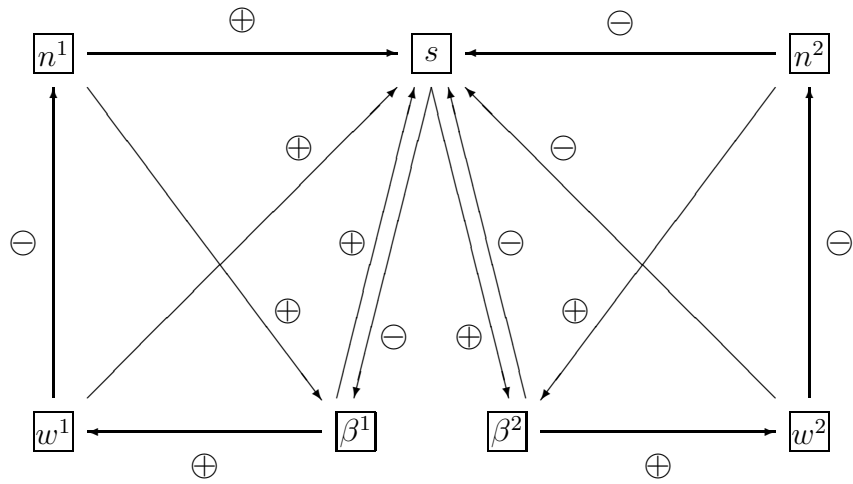


Figure 4: Partial effects in model BR

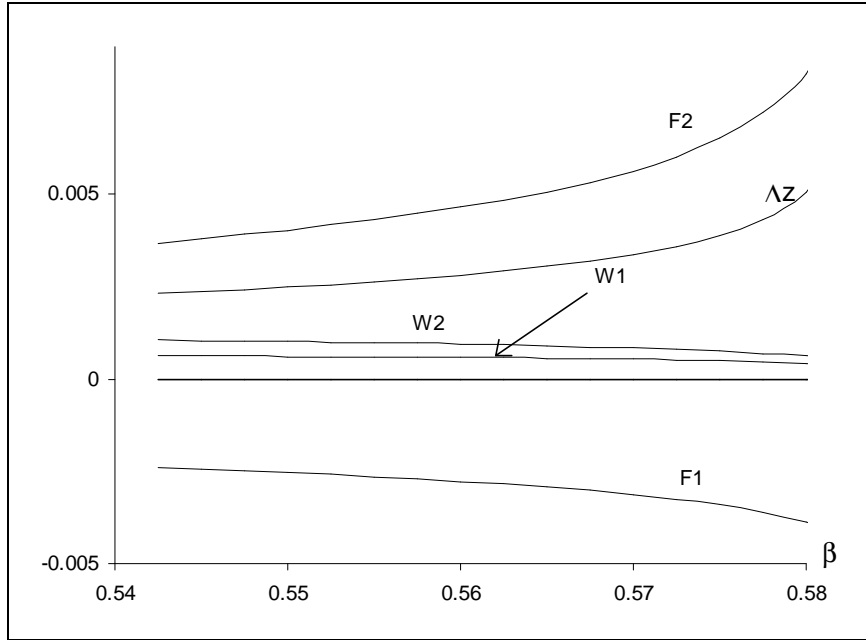


Figure 5: Preferences and efficiency with endogenous tax rate

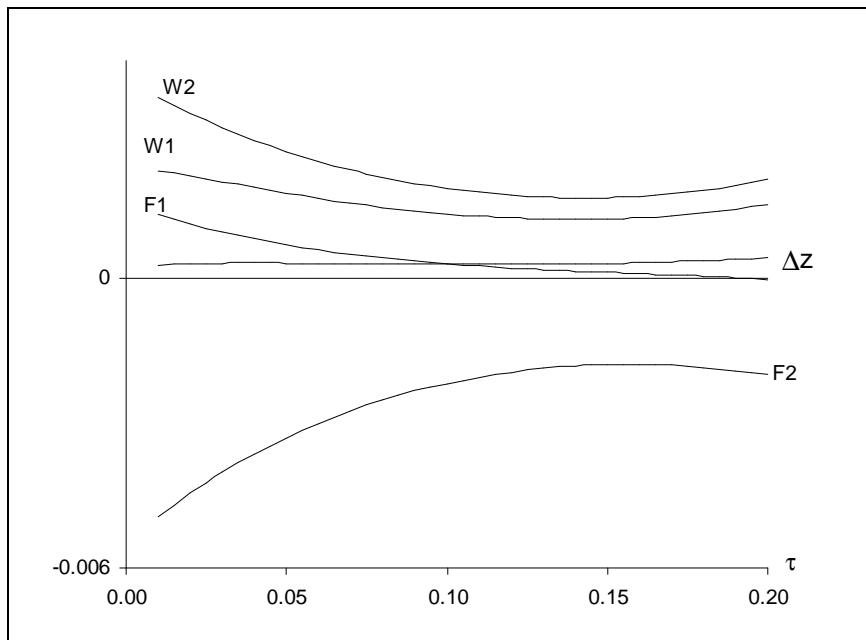


Figure 6: Preferences and efficiency with endogenous benefit rate

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