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CAPITAL MOBILITY AND SOCIAL INSURANCE IN AN INTEGRATED MARKET

Economic Integration
Capital movements
Social Security
Labour market

by Arjan Lejour and
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Capital Mobility and Social Insurance

in an Integrated Market

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Abstract

In a two-country model with mobile capital we analyse decentralized social insurance policies. Decisions made about social insurance are a compromise between the preferences of workers and capital owners. Due to the rigidity of the labour market in the EC, the substantial social insurance contributions are borne partly by capital owners. These contributions affect the profitability of investment, and consequently the direction and size of capital flows. Countries will regard these effects in determining their level of social insurance. Noncooperative decision making between both countries results in tax competition. Given the characteristics of the labour market, this implies an underprovision of social insurance. In addition, increasing economic integration, represented by increasing capital mobility, could imply a divergence of the social insurance levels in the two countries.

Keywords: economic integration, social insurance policies, capital mobility, tax competition.

1. Introduction

In the literature to date the effects of decentralized decision making on redistribution in an economic union have mainly been studied in a framework in which labour is mobile.[1] Although this is plausible for the US, labour mobility in the EC is much lower or even negligible. Therefore, it is often concluded that the process of economic integration in the EC will not affect the social insurance policies of the member states. And, given the various preferences for insurance in the member states, there is no need for coordination at the EC level.

This paper will challenge this view. Although the mobility of the production factor labour has increased negligibly during the process of integration, this does not hold for the factor capital. Over the last decade, the mobility of capital has increased enormously due to the introduction of new financial products, and the liberalization of capital controls, especially in the EC. The size and direction of capital flows, however, are influenced by social insurance taxes. In spite of the non-mobility of workers in the EC, capital owners are not able to shift fully the tax contributions to the former, because of the downward rigidity of the wages. These social insurance contributions affect the profitability of investments, and could act as an indirect source-based tax on capital. This effect could be substantial, taking into account the size of social insurance contributions in the EC.[2]

From the literature,[3] it is known that the mobility of capital in combination with a source-based tax can lead to competition between governments to attract scarce capital, resulting in an underprovision of (local) public goods. In our context, this could imply that the competition between countries pushes the level of social insurance below the level that results from cooperation between these countries. However, because risk-averse workers prefer social insurance as a means of providing income during spells of joblessness, the social insurance level will not be pushed down to zero.

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[1]See Pauly (1973), Brown and Oates (1987) and Wildasin (1991), where the effects on pure redistribution policies are analysed. In Lejour and Verbon (1993), the effects on social insurance systems are considered.

[2]In 1988 the total social insurance contributions equal 25.7% of GDP in the EC. 41.9% of these contributions is paid by employers, 24.1% by households, and 28.4% by the government, see Eurostat (1991).

[3]e.g. Wilson (1986), Zodrow and Mieszkowski (1986), Wildasin (1988, 1989), and Bucovetsky and Wilson (1991).

In general, workers and capital owners will have opposite views on the desirability of the social insurance system. Workers prefer a higher level of social insurance than capital owners, although the difference in the preferred levels is lower if countries do no not coordinate decision making on social insurance than if they do coordinate. Workers prefer an inefficient low level to prevent capital owners from investing abroad. On the other hand, just because of the possibility that foreign investments at home will reduce the return on capital, capital owners prefer an inefficient high level of social insurance. As a result of these various preferences, the effect of noncooperative behaviour of the member states is not unambiguous, but crucially depends on the distribution of political power and the characteristics of the labour market.

This paper uses a two-country model to analyse the issues above. Section two introduces the analytical framework, examining the relationship between capital mobility and decision making on social insurance. Capital owners/employers and workers both have a say in the policy decisions on social insurance. That section will also describe the capital and labour market and the production sector in both economies. The subsequent section analyses the decision-making process and the relation between social insurance tax rates and capital mobility. Moreover, we discuss the different preferences of capital owners and workers. It appears that in our model capital owners prefer a higher social insurance tax rate in an integrated economy than they would in a nonintegrated economy, while workers prefer a lower tax rate, although that level is still higher than the one preferred by capital owners. The Nash-equilibrium is presented in section four. We compare the results of coordinated and noncoordinated fiscal policy and discuss the causes of tax competition. In section five the effects of increasing integration are examined. It follows that in the process of integration capital-importing countries reduce the level of social insurance, while capital-exporting countries raise it. The last section will briefly discuss some generalizations of the model and summarize the main results.

2. The social insurance model and capital mobility

Social insurance contributions are an important labour cost factor for employers because workers try to shift their social insurance contributions on to employers in wage negotiations, while employers are not able to shift the employer-based taxes to the workers. In our model we simply assume that workers pay all social insurance contributions, but that a part of these contributions is passed on to employers through higher wages as a result of wage negotiations. These contributions are equal to τw for every employed worker, where τ represents the social insurance tax rate and

w the gross wage level. Every worker who becomes jobless as a consequence of illness, disability, unemployment, or old age receives a benefit, ηw, where η represents the benefit rate. The budget equation of the social insurance system in a country reads[4]

$$\tau w N = \eta w(H-N) \quad \rightarrow \quad \eta = \tau\gamma \quad \gamma \equiv \frac{N}{H-N} \tag{1}$$

where N represents the number of employed workers and $H-N$ the number of non employed. It is assumed that the total number of employed and non employed workers, H, is exogenous and that the employment level is endogenously determined by profit maximisation. It follows that the risk of being non employed is endogenous on a macroeconomic level.[5] Note that the inverse of the workers-beneficiaries ratio, $\frac{1}{\gamma}$, can be interpreted as the price of the social insurance system.

Decisions on social insurance levels are made by politicians/policymakers. Because politicians want to be in office, their (proposed) policies are restricted to maximise their expected plurality in the coming elections. Using a probabilistic voting model,[6] Coughlin et al. (1991) have shown that in such a case the decision-making function has the following form:

$$D = \xi H E(U_l) + (1-\xi)\overline{K}E(U_c) \tag{2}$$

Because politicians embrace policies that maximise the expected utilities of voters in such way that they vote for them, the decision-making function is a weighted average of the expected utilities of workers, $E(U_l)$, and employers, $E(U_c)$. $\overline{K}$ indicates the number of employers, and the exogenous weight ξ refers to the relative political influence of workers, which depends, among other factors, on the bias term of the voters.

All workers have a chance, $\frac{N}{H}$, of being employed and a chance, $\frac{H-N}{H}$, of being non employed. The expected utility of a representative worker in a country is equal to

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[4]To avoid confusion, we do not indicate that the variables in the equations are country-specific. Later on we will use the superscript I to refer to country I, etc.

[5]Although the risk of becoming ill or disabled is partly determined by medical causes, and so from an economic point of view this risk is exogenous, economic circumstances determine the risk of being non employed and the effort of employers to attract partially disabled. For the sake of simplicity, this paper abstracts from the exogenous risk.

[6]In a probabilistic voting model, voters will support the party that maximises their expected utility, corrected for an expected utility bias in favour of a party. That bias arises from ideological and other non-policy-related factors, personal characteristics of the politicians, and the like. This bias term is a random variable for politicians.

$$E(U_l) = \frac{N}{H} U((1-\tau)w) + \frac{H-N}{H} U(\eta w) \tag{3}$$

It is assumed that workers fully consume their income. $U(\ )$ represents the utility of labour or benefit income. The utility function is twice continuously differentiable, increasing, strictly concave and satisfies the Inada conditions.

Assume that the employers own capital; from now on they will be referred to as capital owners. Capital owners maximise their expected indirect utility, $E(U_c)$, by maximising their return on capital. In both countries, each capital owner possesses a fixed endowment of one unit, which cannot be sold. So, the total endowment in country I is equal to $\overline{K}_I$. In our two-country model with capital mobility, capital owners can invest their endowment in one or both countries. The investment decision depends on the marginal products of capital in both countries, which are equal to the interest rates, r^I. A capital owner from country B invests in country A if

$$r^A > r^B + C \tag{4}$$

C represents the costs of investing abroad. Persson and Tabellini (1992) call it 'mobility costs'. These costs consist of physical costs of gathering extra information about legal issues or about marketing, of overcoming country-specific regulations, of hiring foreign employees, and, most important, of gathering information to judge the profitability of investment possibilities and the solvency of firms. The fact that this information is not easily obtainable from abroad makes foreign investors reluctant to invest abroad. So, the elimination of all formal restrictions to capital mobility in the EC is not a sufficient condition for international capital mobility. Molle (1991) argues that capital markets have to become more transparent by informing investors and creditors about the quality of financial products to make the liberalization of capital markets effective.

It is expected that capital mobility will increase in coming years. According to the White book, a lot of country-specific rules will be standardized, and the Commission of the EC is working on a harmonization of company laws. This will have a positive effect on the transparency of capital markets. We will represent the further integration of capital markets by lowering the parameter C in our model, as will be done in section five. To simplify the analysis, we consider only capital flows from country B to A. So capital owners in country A invest their endowment completely in their own country, while capital owners in country B may choose to invest in both countries.[7]

Given the initial situation that the difference between the marginal product of capital in country A and country B outweighs the mobility costs, capital flows to country A, which leads to a decrease in r^A and an increase in r^B, due to the changing marginal productivities of capital. We assume that there exists an internal equilibrium with a positive capital stock in country B where

$$r^A = r^B + C \tag{5}$$

From this equation it follows that the size of the capital stock in country A, K^A depends only on the rate of return in one country, and the mobility costs, $K^A = K(r^A, C)$.

In both countries there is one consumer good produced, with labour and capital as inputs. The production function is characterised by constant returns to scale, so there are no profits. The production function for the economy as a whole reads

$$F(N,K) = wN + rK \qquad F_x \equiv \frac{\partial F(x)}{\partial x} > 0 \quad F_{xy} \equiv \frac{\partial^2 F(x)}{\partial x \partial y} \begin{array}{l} < 0 \;\; y=x \\ > 0 \;\; y \neq x \end{array} \qquad x,y = N, K \tag{6}$$

The assumption of constant returns to scale implies that the determinant of the Hessian is equal to zero, so $F_{KK}F_{NN} - F_{NK}F_{KN} = 0$. We will use this property of the production function in the succeeding sections. The demand for capital and labour is determined by their prices, so it follows that

$$F_K \equiv \frac{\partial F(N,K)}{\partial K} = r \tag{7}$$

$$F_N \equiv \frac{\partial F(N,K)}{\partial N} = w \tag{8}$$

The total demand of capital in both countries, $K^A + K^B$, is equal to the exogenous supply of

[7]We have simply assumed that mobility costs are constant per unit of foreign investment. Persson and Tabellini (1992) use a more complicated function to model the mobility costs. In the first place they assume that the mobility costs are convex in the size of the investment abroad. They need this assumption to get an internal equilibrium because, contrary to our model, the gross rates of return on capital are exogenous. In the second place, their function allows for bidirectional capital flows. We could also use such a function for the mobility costs, but that does not alter the main results.

capital by the capital owners, $\overline{K} = \overline{K_A} + \overline{K_B}$. The rate of return on capital depends on the size of the investment in both countries.[8]

The labour markets in the EC are characterised by high and persistent unemployment rates and real wage rigidity. Layard et al. (1991) provide an overview, arguing that the rigidity in the labour markets can be largely explained by wage bargaining. In the EC, 75% of all workers' wages are covered by collective bargaining, which is mostly decentralized to the firm or industry level. Layard et al. (1991) provide data and estimation results that support their theory. Interestingly, from their empirical material follows that an increase in the wedge between gross and net labour costs of one percent induces an immediate rise of the gross labour costs of one half percent. Although this effect is not permanent, it probably has a significant impact on unemployment for a decade or more. This implies that workers are able to shift taxes, and that increases in the social insurance tax rates can have long-lasting effects on the gross wage.

Based on these considerations, we represent national labour supply in the EC by a wage-setting function in our model that can be underpinned by a decentralized wage-bargaining model, see appendix 1. We will not deal extensively with the derivation of this function, because we are interested mainly in the wage at the macroeconomic level. In our macroeconomic wage-setting function, social insurance taxes affect the wage level positively. Because higher tax rates reduce the net wage and increase the benefit, and therefore strengthen the bargaining position of labour unions, an increase in the tax rate has a positive effect on the wage level. An increase in employment also strengthens the bargaining position of decentralized unions, because it increases the probability of having a job outside the firm, and the benefit rate. It follows that

$$w = w(N,\tau) \quad w_N \equiv \frac{\partial w}{\partial N} > 0, \quad w_\tau \equiv \frac{\partial w}{\partial \tau} > 0 \tag{9}$$

Next, we eliminate the unrealistic possibility that higher tax rates have a downward effect on the gross wage level through the negative effect on employment, and a positive effect on the wage

[8]The total mobility costs, $C(K^A - \overline{K^A})$, are paid to lawyers, consultants, etc., who spend this income on consumption. They have no influence on the social insurance policy, because they are self-employed, and have their own private insurance. Secondly, the size of the group is too small and their interests are too heterogenous, to form a relevant interest group in the decision-making process on social insurance.

level by assuming that $0 < \frac{dw}{d\tau} = w_\tau + w_N \frac{\partial N}{\partial \tau} < \frac{w}{1-\tau}$.[9] Note that if wages are fully flexible, there is full employment: the risk of being non employed, therefore, consists only of the exogenous risk. In that case, social insurance taxes are completely borne by workers, and do not affect the economy. Then the whole model fades away.

3. The level of social insurance: a partial equilibrium analysis

With the model that is presented in the last section, we are able to examine the effects of capital market integration on the level of social insurance. This section will derive the optimal social insurance tax rate for one country, and compare it with the tax rate that results if capital is immobile. The analysis of the Nash-equilibrium, and the comparison with the cooperative equilibrium are carried out in the next section.

In studying fiscal equilibria in two-country models, it is quite natural to assume that noncooperative policymakers take the fiscal decisions of the other country as given (see Mintz and Tulkens (1986) and Buiter and Kletzer (1991)). These fiscal equilibria are characterised as Nash-equilibria. In addition, the fiscal decisions of the policymakers affect the private sector at home and abroad. It is assumed that policymakers take these effects into account in optimising the decision-making function, while the private agents take the announced policy decisions as given.[10]

Taking all information about the private sector into account, policymakers maximise a decision-making function, given the budget restriction, the equilibrium condition on the capital market in the integrated economies, the equilibrium condition for the capital flow between the countries, the demand for capital and labour in both countries, and the wage-setting functions.[11] After substitution of the budget restriction, and the wage-setting functions in the other equations, the decision-making function, $D = D(\tau, N, r)$, is differentiated with respect to the tax rate, taking into account the effects on the other variables, $\frac{\partial N}{\partial \tau}$ and $\frac{\partial r}{\partial \tau}$.

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[9]If the wage-setting function is founded on the wage-bargaining model indicated in appendix 1, the first inequality is always satisfied, while the second one is satisfied with some weak conditions on some parameters.

[10]Of course policymakers have the possibility to deviate from the announced policy. Because this problem is beyond the scope of our paper, we simply assume that it is not profitable for them to deviate.

[11]That is to say, they maximise equation (2), given (1), $\overline{K} = K^A + K^B$, (5), (7), (8), and (9).

These derivatives can be obtained by differentiating the economic sub-model with respect to all endogenous variables. This exercise is carried out in appendix 2. An increase in the tax rate raises labour costs. Therefore employment is reduced, which has a negative effect on the marginal productivity of capital. So, the demand of capital is decreased, which in turn lowers the marginal productivity of labour. Employment is further reduced, until the marginal productivity of labour equals the gross wage. The decrease in the capital stock also exerts upward pressure on the marginal productivity of capital, but that does not offset the downward pressure caused by the decrease in employment. In the new equilibrium the employment level, the capital stock, and the return on capital are lowered. So, $\frac{\partial N}{\partial \tau}, \frac{\partial r}{\partial \tau}, \frac{\partial K}{\partial \tau} < 0$.

The first-order condition of the maximisation problem is equal to

$$Z \equiv \frac{dD}{d\tau} = \xi H \frac{\partial E(U_l)}{\partial \tau} + \xi H \frac{\partial E(U_l)}{\partial N}\frac{\partial N}{\partial \tau} + (1-\xi)\bar{K}\frac{\partial E(U_c)}{\partial r}\frac{\partial r}{\partial \tau} = 0 \tag{10}$$

$H\frac{\partial E(U_l)}{\partial \tau}$ represents the direct effects of a change of the tax rate on the expected utility of workers, which is positive if the social insurance system is assumed to be incentive-compatible ($\eta \leq 1-\tau$).[12] $H\frac{\partial E(U_l)}{\partial N}\frac{\partial N}{\partial \tau}$ represents the indirect effects through the change in the employment level on the expected utility of workers. These indirect effects consist of the change in the risk of being non employed, the gross wage level and the price of the social insurance system. If the social insurance system is incentive-compatible, $H\frac{\partial E(U_l)}{\partial N}$ has a positive sign. So, in determining their preferred social insurance tax rate, workers have to trade off the direct effect of a change in the tax rate on the net wage and benefit against the indirect effects through the induced change in employment. For capital owners, an increase in the tax rate always implies a loss in expected utility, through the negative effect on the marginal productivity of capital ($\frac{\partial E(U_c)}{\partial r} > 0$). Obviously, their preferred tax rate is equal to zero.

In equilibrium the positive social insurance tax rate is lower than the one preferred by the workers. As a result, an increase in the relative political influence of the workers will have an upward effect on the tax rate, while an increase in the relative influence of the capital owners will have the opposite effect. Notice that a higher tax rate implies a higher benefit level, and therefore a higher level of social insurance. In general a change in the tax rate leads to an opposite effect in

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[12]Due to the formulation of the maximisation problem, incentive compatibility is not guaranteed. Given the fact that in practice all social insurance systems are incentive compatible it is assumed that any solution of the maximisation problem will satisfy this characteristic.

the employment level, and therefore the effect on the benefit level is not immediately clear. However, in equilibrium the marginal benefit of a change in the tax rate is higher than the marginal cost for the workers. Given the fact that the effect on their net wage is negative, it follows that the effect on the benefit has to be positive. So, the direct effect of a change in the tax rate on the benefit level dominates the indirect effect through a change in the employment level in equilibrium.[13]

We are interested in the effects of international capital mobility on the level of social insurance. Therefore we compare this situation with one in which capital is not mobile, and is completely invested in the home country. This is labelled as the nonmobility case. We make the comparison with capital mobility at the point that there is no foreign investment, so that $K^I = \overline{K^I}$ in both countries. The size of the capital stock and the employment level are the same in both cases. The influence of capital mobility appears from the derivatives of employment and the interest rate with respect to the tax rate, denoted by $\frac{\partial N}{\partial \tau}^m$ and $\frac{\partial r}{\partial \tau}^m$, which are presented in appendix 2. For the nonmobility case, $\frac{\partial N}{\partial \tau}^n$ and $\frac{\partial r}{\partial \tau}^n$, can be derived in a similar way.

The effect of capital mobility on the tax rate is analysed by evaluating the first derivative of the decision-making function, at the point where capital is not mobile. In fact, we substitute the first-order condition for the case in which capital is not mobile in equation (10). The effect of capital mobility follows from the sign of the expression below:

$$V^m \equiv Z^m - Z^n = \xi H \frac{\partial E(U_l)}{\partial N}\left[\frac{\partial N}{\partial \tau}^m - \frac{\partial N}{\partial \tau}^n\right] + (1-\xi)H_c \frac{\partial E(U_c)}{\partial r}\left[\frac{\partial r}{\partial \tau}^m - \frac{\partial r}{\partial \tau}^n\right] \tag{11}$$

In particular, if $V^m < 0$, policymakers decide on a lower tax rate for the case in which capital has become mobile. The first term on the right-hand side is negative. It is in the interest of workers to lower the tax rate if capital becomes mobile, because the negative effect of an increase in the tax rate on employment will increase. If capital is mobile, capital will flow away, due to the lower marginal productivity of capital. This results in a lower employment level. Since this effect does not exist in the nonmobility case, the absolute value of $\frac{\partial N}{\partial \tau}^n$ is smaller. The second term is positive. With the introduction of capital mobility, capital owners get better opportunities to invest, thereby increasing the return on investment. The marginal costs of an increase in the tax

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[13]Because it follows from this analysis that the level of the tax rate and benefit change in the same direction, we will only discuss changes in the tax-rate levels in the next sections.

rate decrease, because taxes can be escaped by investing abroad. Although capital owners still prefer no social insurance system, their opposition against the system is reduced.[14]

From looking at the preferences of workers and capital owners, we can thus conclude that with the introduction of capital mobility the conflict between workers and capital owners is diminished. The total effect of capital mobility on the tax rate is basically determined by the strength of the tax effects on the utility of workers and capital owners. However, these effects are related via the first-order condition. Taking this relation into account, appendix 3 demonstrates that

$$V^m < 0 \quad if \;\; H\epsilon_\tau^w - (H-N)\epsilon_N^w > 0 \qquad \epsilon_\tau^w = \frac{\partial w}{\partial \tau}\frac{\tau}{w}, \quad \epsilon_N^w = \frac{\partial w}{\partial N}\frac{N}{w} \tag{12}$$

Interestingly, the effect of introducing capital mobility depends on the characteristics of the wage-setting function. The degree of tax shifting, reflected by the elasticity ϵ_τ^w, should be relatively high compared with the product of the unemployment rate times the effect of employment on wages, ϵ_N^w. In other words, if the decrease in gross wages engendered by the lower tax rate is not fully offset by the positive employment effects on the gross wage, policymakers will set a lower tax rate. This result is not surprising because the most important effect of capital mobility is the change in the employment level. In order to avoid an increase in the unemployment rate, workers will vote for measures aimed at that policy goal, such as a decrease in the tax rate. As noted before, the wage- bargaining model has not been made explicit in the paper. However, the well-known wage-bargaining model alluded to in appendix 1, appears to generate the condition in equation (12) as a result. This condition seems to hold more or less generally, and we will consider its fulfilment as our benchmark case. So, the introduction of capital mobility implies a downward pressure on the social insurance level.

4. The noncoordinated and coordinated equilibrium

4.1 The noncoordinated equilibrium

Thus far, we have studied only the optimal tax rate of one country given the foreign tax rate. In this section the fiscal Nash-equilibrium will be analysed. It will be compared with the coordinated equilibrium to consider the question whether the member states use the social insurance tax

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[14]This result seems to be surprising because, especially in the northern member states of the EC, employers argue that the level of social insurance must be lowered, due to the economic integration. However, the arguments of the employers are based mainly on the idea that European integration increases competition between the firms on the consumer goods market. This issue is examined in Lejour (1993).

strategically to influence the capital flows. Such strategic behaviour of the member states could lead to an underprovision of social insurance.

First, we analyse the reactions of policymakers to changes in the foreign tax rate. Because the home tax rate can not be written explicitly as a function of the foreign tax rate, we differentiate the first-order condition to obtain the slopes of the reaction curves. As a result

$$\frac{dZ^I}{d\tau^I}d\tau^I + \frac{dZ^I}{d\tau^J}d\tau^J = 0 \qquad \frac{dZ^I}{d\tau^J} = \frac{\partial Z^I}{\partial N^I}\frac{\partial N^I}{\partial \tau^J} + \frac{\partial Z^I}{\partial r^I}\frac{\partial r^I}{\partial \tau^J} \qquad I \neq J \quad I,J = A,B \tag{13}$$

Equation (13) describes the reaction of the tax rate to a change of the foreign tax rate. $\frac{dZ^I}{d\tau^I}$ represents the second-order condition of maximisation of the policy function. It is assumed to be negative. $\frac{dZ^I}{d\tau^J}$ indicates the effect of a change of the foreign tax rate on the marginal utility with respect to the home tax rate. This effect on the home country is induced by the change in the capital flow, which has an effect on employment and the marginal productivity of capital. The algebraic derivation of equation (13) is given in appendix 4. In this derivation the elasticities $\epsilon_\tau^x = \frac{\partial x}{\partial \tau}\frac{\tau}{x}$, $x = N, w, r$ and ϵ_N^w are used, which are assumed to be constant. These effects will now be discussed in more detail.

The effect of employment on marginal (political) welfare consists of several elements. First, an increase in employment decreases the probability of being non employed, which implies that the negative effect of an increase in the tax rate on the net wage will receive a larger weight. As a consequence, the demand for social insurance expressed by the workers will decrease. Second, the wage is raised due to an increase in employment and, given the characteristics of the utility function, the need for insurance is diminished. On the other hand, an increase in employment decreases the price of the social insurance system as measured by $\frac{1}{\gamma}$. For any value of the tax rate the benefit rate will be higher. This substitution effect provides an incentive to raise the tax rate. The total effect of a change in the employment level on the marginal value of the policy function to the tax rate is negative if the income effect dominates the substitution effect, so $1 - \sigma < 0$ with $\sigma = -\frac{xU''(x)}{U'(x)}$. Because an increase in the foreign tax rate stimulates employment, the workers need less insurance.

$\frac{\partial Z^I}{\partial r^I}$ represents the effect of the marginal productivity of capital to the marginal welfare. In appendix 4 it is shown that a decrease in the marginal productivity of capital lowers the marginal cost of taxes, if $1 - \sigma < 0$. Because an increase in the foreign tax rate exerts downward pressure on the marginal productivity of capital, capital owners will apply pressure to lower the home tax rate.

From the analysis above it follows that workers and capital owners demand less social insurance if the foreign tax rate is increased, $\frac{dz^I}{d\tau^J} < 0$, if $1-\sigma < 0$. The reaction functions of both countries have a negative slope in that case. As discussed in section 3, the policymakers of both countries decide on a lower tax rate if capital becomes mobile in the benchmark case. It thus follows that the social insurance tax rates in the fiscal Nash-equilibrium will be lower than in the nonmobility case.[15]

4.2 The coordinated equilibrium

As is well known, noncooperative behaviour under the Nash-equilibrium is not efficient due to the external effects of decision making. Member states in general do not take into account the beneficial or harmful effects that impact the other member states due to the increase of their own tax rate.[16] These fiscal externalities could be corrected if the countries would coordinate decision making on social insurance. By the term 'coordination' we mean to imply the situation in which countries decide autonomously on the level of social insurance taking into account the external effects on the other countries. This issue is especially relevant for the situation in the EC. Given the absence of a central authority, the externalities can be internalized only if the countries voluntarily coordinate their decisions. So, coordination must be 'welfare' improving for all countries involved. For an individual country, coordination is strictly welfare improving if

$$dD^I = \xi \frac{\partial E(U_l^I)}{\partial \tau^I} d\tau^I + \xi \frac{\partial E(U_l^I)}{\partial N^I}\left[\frac{\partial N^I}{\partial \tau^I} d\tau^I + \frac{\partial N^I}{\partial \tau^J} d\tau^J\right] + (1-\xi)\frac{\partial E(U_c^I)}{\partial r^I}\left[\frac{\partial r^I}{\partial \tau^I} d\tau^I + \frac{\partial r^I}{\partial \tau^J} d\tau^J\right] > 0 \quad (14)$$

If this expression is evaluated at the Nash-equilibrium, it follows that a country wants to coordinate decision making if it holds that

$$dD^I = \left[\xi \frac{\partial E(U_l^I)}{\partial N^I}\frac{\partial N^I}{\partial \tau^J} + (1-\xi)\frac{\partial E(U_c^I)}{\partial r^I}\frac{\partial r^I}{\partial \tau^J}\right] d\tau^J > 0 \qquad I \neq J,\ I, J = A, B \quad (15)$$

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[15]We will assume that the Nash-equilibrium is unique. Unfortunately, we are not able to prove this for all parameter values.

[16]For a more detailed analysis of the fiscal externalities that arise in an economy with decentralized fiscal decision-making with mobile capital, see Wildasin (1989).

As before, workers and capital owners have different ideas about the desired change in the foreign tax rate.[17] Workers prefer an increase in the foreign tax rate because that attracts capital and stimulates employment in their country, while capital owners prefer a decrease because that improves their opportunities abroad. As in the previous section, we substitute $\frac{\partial N}{\partial \tau}$ and $\frac{\partial r}{\partial \tau}$, and the first-order condition in the equation above. In a similar way as described in appendix 3 it follows that

$$\frac{dD^I}{d\tau^J} > 0 \qquad if \quad H\epsilon_\tau^w - (H-N)\epsilon_N^w > 0 \tag{16}$$

This is the same condition as in equation (12). Provided that the wage-setting function entails this condition, member states are willing to coordinate their decisions if the other member state is willing to raise the social insurance rate. An increase in the foreign tax rate would stimulate employment. Because the ensuing upward pressure on wages is relatively modest, the increase in employment can be substantial, partly offsetting the decrease in the marginal productivity of capital due to the extra inflow of capital.

Given that coordination implies gains for the member states, let us suppose that they agree to coordinate their decisions by acting 'as if' they maximise the following policy function:

$$D^{I'} = D^A + D^B \qquad I = A, B \tag{17}$$

It is of interest to consider in which direction the tax rates change compared to the Nash-equilibrium. Taking the derivative of this modified policy function and evaluating it in the Nash-equilibrium (see equation (10)), it follows that

$$Z^{I'} \equiv \frac{dD^{I'}}{d\tau^I} = \xi \frac{\partial E(U_l^J)}{\partial N^J}\frac{\partial N^J}{\partial \tau^I} + (1-\xi)\frac{\partial E(U_c^J)}{\partial r^J}\frac{\partial r^J}{\partial \tau^I} \qquad I \neq J \quad I,J = A,B \tag{18}$$

Using the same procedure as in equation (12), we derive that equation (18) has a positive sign if $H\epsilon_\tau^w - (H-N)\epsilon_N^w > 0$. The upshot of this is that the social insurance tax rates are higher in the coordinated equilibrium than they are in the Nash-equilibrium. In the Nash case, the policymakers of both countries use the tax rate to attract capital and do not take into account the negative 'welfare effect' on the other country. We obtain here the familiar result in fiscal federalism that

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[17]The signs of the derivatives above are determined in section 3 and appendix 2.

when countries do not coordinate decision making, tax competition will arise. Normally, tax competition is defined as the case where countries compete to attract the mobile good by manipulating the tax rate on that good (see Wildasin (1988)). Interestingly, in this case the relation between the tax rate (on labour) and the mobile good (capital) is indirect. The result is based on the link between the capital market and the distorted labour market. In the first place the size of the capital stock determines partly the employment level and therefore the tax base of the social insurance system. In the second place, the level of the tax rate influences through the labour costs the return on capital. Consequently, also in this case a change in the tax rate distorts the tax base through the induced mobility effects.[18] In fact, due to the rigidity on the labour market the social insurance tax rate is an indirect source-based tax on capital.

5. The effects of increasing capital mobility

Since European integration is an ongoing process, it is important to analyse the consequences of removing the remaining barriers to capital mobility, and the initiatives of the Commission of EC to make capital markets more transparent for foreign investors. The measures in this area can be represented in the model by lowering the mobility costs. Such changes in costs can be due to several policy measures, for example by lifting or standardizing country-specific rules that restrict the mobility of capital, as the harmonization of company laws, or by starting campaigns to inform potential foreign investors about investment policies.[19]

We consider the effect of a change in the mobility costs on the social insurance tax rate in one country. This effect can be analysed by differentiating the first-order condition, equation (13), and the economic sub-model with respect to all the endogenous variables and the mobility costs, given the foreign tax rate. Also in this case the elasticities are assumed to be constant.

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[18]Bucovetsky and Wilson (1991) derive the same sort of result. In analysing tax competition they conclude from their model that jurisdictions use a lump-sum tax on wage income as an instrument to attract capital.

[19]It is assumed that the reduction of the mobility costs is part of an agreement between the member states to complete the internal market. It is expected that this agreement is beneficial to all member states involved, although the reduction of mobility costs in itself is not necessarily beneficial to all member states. In particular, there is a negative welfare effect of lower mobility costs for the capital exporting country in the benchmark case.

$$\frac{dZ^I}{d\tau^I}d\tau^I + \frac{dZ^I}{dC}dC = 0 \qquad \frac{dZ^I}{dC} = \frac{\partial Z^I}{\partial N^I}\frac{\partial N^I}{\partial C} + \frac{\partial Z^I}{\partial r^I}\frac{\partial r^I}{\partial C} \qquad I = A,B \tag{19}$$

$\frac{dZ^I}{dC}$ represents the total effect of a change in the mobility costs on the marginal utility with respect to the tax rate. As in the previous section, this total effect is induced by the change in the capital flow, which affects the employment level and the marginal productivity of capital.

If the incentives to invest abroad are increased, the capital owners of country B would increase their investments in country A. Employment in the capital-importing country would be stimulated, while the marginal productivity of capital would be reduced by the increased competition on the capital market. In the capital exporting-country opposite forces are at work. Due to the outflow of capital, employment would be reduced and the return on investment increased. More formally, $\frac{\partial N^A}{\partial C} < 0$, $\frac{\partial r^A}{\partial C} > 0$, $\frac{\partial N^B}{\partial C} > 0$ and $\frac{\partial r^B}{\partial C} < 0$ (see appendix 2 for the derivation). Given the signs of the other derivatives, explained in section 4, it follows that $\frac{dZ^A}{dC} > 0$ and $\frac{dZ^B}{dC} < 0$. These signs imply that lower mobility costs have a downward (upward) effect on the marginal value of the policy function with respect to the tax rate in the capital-importing (exporting) country.

If the absolute value of the slope of the reaction curve of country A is larger than the one of country B,[20] it follows that not only in the partial equilibria, but also in the fiscal Nash-equilibrium $\frac{d\tau^A}{dC} > 0$ and $\frac{d\tau^B}{dC} < 0$. The policymakers in the capital-importing member state lower the social insurance rate if the mobility costs are lowered, while in the capital-exporting country the tax rate would be raised. As can be seen in figure 1, a decrease in mobility costs shifts the reaction curve of country A and B to the left and above, respectively. Due to the change in employment and the interest rate, workers and capital owners in the capital-importing country are less willing to pay social insurance contributions, while both groups in the capital exporting country want to raise social insurance contributions in comparison with the old equilibrium, E^0.

(insert figure 1)

Notice that as the direction of the change of the tax rate and of the benefit level are always the same, as is argued earlier, the benefit level in the capital-importing (exporting) country is decreased (increased). Whether this implies a convergence or a divergence of the social insurance

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[20]In a dynamic setting, this would imply that the equilibrium is stable.

systems in both countries depends on the initial situation. If the attractiveness of the capital-importing country for investors is based on the lower level of social insurance, increasing integration will imply a divergence of the level of social insurance between capital-importing and capital-exporting countries.

A reduction in the mobility costs also has an asymmetric effect on the externalities of noncoordinated behaviour of the member states. This can be seen by differentiating $\frac{\partial z^{I'}}{\partial \tau^J}$ (see equation (18)) to the mobility costs, in which the constant elasticities $\epsilon_\tau^{N'} = \frac{\partial N^J}{\partial \tau^I}\frac{\tau^I}{N^J}$ and $\epsilon_\tau^{r'} = \frac{\partial r^J}{\partial \tau^I}\frac{\tau^I}{r^J}$ are substituted. It follows that an increase of the social insurance tax rate of country A, the capital- importing country, has a larger effect on the welfare in country B as the mobility costs are reduced given that $1-\sigma < 0$. In an opposite way, an increase in the tax rate of country B has smaller effects on the welfare of country A. So, the capital-exporting country seems to face more harmful effects from tax competition if the integration process proceeds than does the capital- importing country. This result can be explained by the upward effect on the rate of return on capital and the downward effect on the employment level in country B due to a reduction in mobility costs. This implies that the marginal costs of an increase in the foreign tax rate are lowered while the marginal benefits are raised. So, for workers and capital owners of the capital-exporting country, an increase in the foreign tax rate is more beneficial if the mobility costs are reduced. The opposite effects in the capital-importing country can be explained by similar reasoning.

6. Concluding remarks

In this paper we have considered the effect of capital mobility on decision making concerning social insurance systems in an integrated market. It was assumed that social insurance is financed by worker-based taxes that can be partly shifted to employers. The existence of a social insurance system, then, affects the level of employment and, through adaption of the capital-labour ratio, the rate of return on capital. Changes in the rates of return incite a capital flow between the member countries.

Decisions about the tax rate or, which amount to the same thing, the benefit rate were represented as a compromise between employers/capital owners and workers. Whether or not capital is mobile, workers want a higher benefit rate than do capital owners. However, the difference in the preferred level diminishes if capital is mobile. The reason for this is that workers want to reduce the tax rate to attract capital with the aim of stimulating employment, while, on the other hand, the effects of the tax rate on rate of return on capital are less severe now, because capital owners have obtained the opportunity to invest abroad. In a two-country model where the policymakers of both countries take the other tax rate as given, the equilibrium tax rates are below the levels that prevail in the nonmobility case, given the characteristics of the labour market. These characteristics are satisfied if the wage-setting function is based on a general wage-bargaining model, which we assumed to hold in our benchmark case.

As is well-known, autonomous decision making creates external effects for other countries in the integrated market. In our model the externalities consist of the effects of the tax rate in one country on the employment level and the marginal product of capital in other countries. The nature of the externality differs for both distinguished groups. If the tax rate is increased, the employment level in the other countries will increase but the rate of return on capital in the other countries will decrease. In other words, the workers gain but the capital owners in the other country lose as a consequence of the increased tax rate. In our benchmark case coordination of decision making does protect the level of social insurance against social dumping.

Increasing economic integration leading to more capital mobility will have a downward effect on the tax rate in the capital-importing country and an upward effect in the capital-exporting country. If the capital-importing countries are also the ones with the lowest level of social insurance, as is the case for the southern member states of the EC, increasing economic integration could imply a divergence of social insurance systems in the member states. Furthermore, capital-importing countries have less reason to coordinate social insurance policies, because their benefits from the coordination of social insurance policies are inversely related to the progress of the integration process.

Of course, if one looks beyond the scope of the model other factors come into play. Capital import could have a positive effect on economic growth, thereby stimulating the development of the social insurance systems in these countries. Second, the political willingness of the capital-importing countries to coordinate social insurance policies could be increased with some package deals. Both elements can (partly) offset the divergence of social insurance systems that is induced by the continued process of integrating the capital markets in the EC.

In the economic literature to date political factors have predominantly been neglected as determinants of policies in an integrated market (for an exception, see Persson and Tabellini (1992)). However, this paper has elucidated the importance of politics for the effects of capital mobility and ongoing economic integration. In particular, the distribution of political power influences the size of the changes in the tax rate heavily, and is therefore a determining factor for the importance of tax competition.

It can be noted here that the conflicting interests between workers and capital owners as represented in equation (2) is not the only interpretation of our model. More generally, we described the interests of the owners of a mobile endowment, and of an immobile endowment in social insurance policies. In particular, the owners of the immobile endowment have an interest in policies that attract the mobile endowment, while the owners of the mobile endowment want to prevent crowding, given the properties of the production function. This implies that the owners of the immobile endowment want to restrict the social insurance system, and that the owners of the mobile endowment want less restrictions compared to the case that both endowments are immobile.

Using the assumption that only employers own the mobile endowment capital, and workers the immobile endowment labour, we emphasised the political conflict between employers and workers. It is possible to argue that this conflict is less severe in particular, if employers cannot move their fixed physical capital to other countries,[21] and, secondly, if workers save a part of their income and have access to the international capital market, through e.g. pension funds.[22]

In line with the traditional literature on tax competition we kept the supply of capital fixed. Two-period models can be used in which the supply of capital can be endogenised, as in the two-country models of Buiter and Kletzer (1991), Persson and Tabellini (1992), and Sørensen (1991). With an endogenous supply of capital, a reduction in the mobility costs increases the effective interest rate in the capital-exporting country, thus stimulating the supply of capital in that country, if the elasticity of savings with respect to the interest rate is positive. On the other hand, the extra

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[21]This is another reason, in addition to the one mentioned in footnote 15, why employers plea for a lower level of social insurance in an integrated market.

[22]If individuals own a mobile and an immobile endowment, the composition of their income is also a determining element in the decision-making process. In a median voter model, where individuals have different ratios of capital income to labour income, analogous results can be obtained as here, where this ratio has the same role as the political power in our model.

inflow of capital and its concomitant depressing effect on the marginal productivity of capital reduces the supply in the capital-importing country. Although the quantitative results will change, the direction of the change in employment and the marginal productivity of capital will be the same as with a given endowment of capital. As a consequence, it is not to be expected that any of our qualitative results will change if the supply of capital is endogenised.

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Appendix 1: the underpinning of the wage-setting function

We give in this appendix an underpinning for the wage-setting function that is presented in equation (9). The underlying model is based on Layard et al. (1991). For details we refer to their book. A wage-setting function with the characteristics mentioned in equation (9) can be derived with a decentralized wage-bargaining model of the following type:

$$\Omega = (\overline{L}_i(E(U_i) - E(U_a))^{\beta} E(U_c) \qquad \text{(A1.1)}$$

Equation (A1.1) is a Nash-bargaining function that will be maximised to derive the optimal wage rate. In this function $\overline{L}_i$ represents the number of union members in firm i, and β the relative bargaining power of the labour union. The expected utility of an union member is:

$$E(U_{li}) = \frac{L_i}{\overline{L}_i} U((1-\tau)w) + \frac{\overline{L}_i - L_i}{\overline{L}_i} E(U_a) \qquad \text{(A1.2)}$$

The expected utility to work outside the firm or to receive a benefit is equal to

$$E(U_a) = \frac{N}{H} U((1-\tau)w_a) + \frac{H-N}{H} U(\tau\gamma w_a) \qquad \text{(A1.3)}$$

w_a represents the average wage rate. This expected utility is also assumed to be the threatpoint of the union members. The utility of capital owners in their threatpoint is assumed to be zero. From differentiating this function to the wage rate, and aggregating over all firms, it follows that the average wage depends on the employment level, the tax rate, and the benefit level. The utility function is specified as $U(x) = (x^{1-\sigma} - x_0)/(1-\sigma)$ and the production function as a Cobb-Douglas function. The constant in the utility function is necessary to guarantee a positive amount of utility; without the constant, the wage rate could be eliminated from the wage-setting function, because of the proportionality of the benefit level with the wage level. This characteristic is not uncommon for wage-setting functions derived from bargaining (see Layard et al.). Given the specifications for the utility and production function, the average wage rate is equal to

$$w_a = \frac{\alpha}{1-\alpha} \frac{\pi_0^{\frac{1}{1-\sigma}}}{N} \left(1 - \alpha \left((1-\alpha) \frac{H}{H-N} \left[\left(\frac{1-\tau}{\tau\gamma} \right)^{\sigma-1} - 1 \right]^{-1} + \alpha - \beta \right)^{-1} \right)^{\frac{1}{\sigma-1}} \qquad \text{(A1.4)}$$

α is the labour income share in national income, and π_0 is the positive constant in the utility function of capital owners. The signs of w_τ and w_N can be derived by differentiating equation (A1.4) to both variables.

Appendix 2: the determination of the partial derivatives of the economic sub-model

In this appendix we derive the effects of changes in the home and foreign tax rate, and in the mobility costs on the employment level, marginal productivity of capital, and the capital stock. The differential equations of the economic sub-model are

$$F^I_{KN}dN^I + F^I_{KK}dK^I = dr^I \qquad I = A,B \tag{A2.1}$$

$$F^I_{NN}dN^I + F^I_{NK}dK^I = w^I_N dN^I + w^I_\tau d\tau^I \qquad I = A,B \tag{A2.2}$$

$$dr^A = dr^B + dC \tag{A2.3}$$

$$dK^A + dK^B = 0 \tag{A2.4}$$

The subscripts refer to the first and second-order derivatives of the production and wage-setting function. We carry out the following substitution steps: first, substitute dN^B from equation (A2.2) in (A2.1); second, substitute dK^B from equation (A2.4) in the modified equation (A2.1); third, substitute dr^A and dr^B from the modified equation (A2.1) in (A2.3); and, fourth, substitute dK^A from the modified equation (A2.3) in (A2.2). It follows that

$$\left[F^A_{NN}X^B + w^A_N(F^A_{KK} - X^B)\right]dN^A = (X^B - F^A_{KK})w^A_\tau d\tau^A + F^A_{NK}Y^B d\tau^B + F^A_{NK}dC \tag{A2.5}$$

$$X^B \equiv \frac{F^B_{KK}w^B_N}{F^B_{NN} - w^B_N} > 0, \quad Y^B \equiv \frac{F^B_{NK}w^B_\tau}{F^B_{NN} - w^B_N} < 0 \tag{A2.6}$$

In equation (A2.5) the expression preceding dN^A has a negative sign and the expression preceding $d\tau^A$ a positive one. Hence, $\frac{\partial N^A}{\partial \tau^A} < 0$. From this equation it also follows that $\frac{\partial N^A}{\partial \tau^B} > 0$ and $\frac{\partial N^A}{\partial C} < 0$. In the same way we can derive for country B: $\frac{\partial N^B}{\partial \tau^B} < 0$, $\frac{\partial N^B}{\partial \tau^A} > 0$ and $\frac{\partial N^B}{\partial C} > 0$.

To determine the partial derivatives of the marginal productivity of capital we use the same substitution steps as before, supplied with the substitution of dK^A in equation (A2.1). This gives us a relation between dr^A and dN^A. If equation (A2.5) is substituted in this relation, it follows that

$$\left[F^A_{NN}X^B + w^A_N(F^A_{KK} - X^B)\right]dr^A = F^A_{KN}X^B w^A_\tau d\tau^A + w^A_N F^A_{KK}\left[Y^B d\tau^B + dC\right] \tag{A2.7}$$

So $\frac{\partial r^A}{\partial \tau^A} < 0$, $\frac{\partial r^A}{\partial \tau^B} < 0$ and $\frac{\partial r^A}{\partial C} > 0$. In the same way it follows that $\frac{\partial r^B}{\partial \tau^B} < 0$, $\frac{\partial r^B}{\partial \tau^A} < 0$ and $\frac{\partial r^B}{\partial C} < 0$. Note that in the nonmobility case the economic sub-model consists of the equations (A2.1) and (A2.2) with $dK = 0$. For both countries it follows that, *ceteris paribus*, without capital mobility the absolute values of $\frac{\partial N^I}{\partial \tau^I}$ and $\frac{\partial r^I}{\partial \tau^I}$ are smaller and larger, respectively.

The partial derivatives of the capital stock follow by substitution of equation (A2.5) in the modified equation (A2.3) (see the third substitution step).

$$\left[F^A_{NN}X^B + w^A_N(F^A_{KK} - X^B)\right]dK^A = F^A_{KN}w^A_\tau d\tau^A + \left[w^A_N + F^A_{NK} + \frac{F^A_{NK}X^B}{F^A_{KK} - X^B}\right]\left[Y^B d\tau^B + dC\right] \tag{A2.8}$$

So $\frac{\partial K^A}{\partial \tau^A} < 0$, $\frac{\partial K^A}{\partial \tau^B} > 0$ and $\frac{\partial K^A}{\partial C} < 0$. In the same way: $\frac{\partial K^B}{\partial \tau^B} < 0$, $\frac{\partial K^B}{\partial \tau^A} > 0$ and $\frac{\partial K^B}{\partial C} > 0$.

Appendix 3: the sign of equation (12) and (16)

In this appendix we give more details about deriving the sign in equation (12) and (16). At first $\frac{\partial N^m}{\partial \tau}$ and $\frac{\partial r^m}{\partial \tau}$ from appendix 2 are substituted in equation (11). If the relation between these two derivatives is used, this equation can be written as

$$V^m = \frac{-F_{KK}w_N}{(F_{NN}X^J + w_N(F_{KK} - X^J))}\left[\xi H \frac{\partial E(U_l)}{\partial N}\frac{\partial N^n}{\partial \tau}\frac{F_{NN}}{w_N} + (1-\xi)\bar{K}\frac{\partial E(U^c)}{\partial r}\frac{\partial r^n}{\partial \tau}\right] \tag{A3.1}$$

The expression preceding the brackets has a negative sign. So, we have to determine only the sign of the term in brackets. Second, after substitution of the first-order condition in the nonmobility case in equation (A3.1) in order to eliminate the marginal utility of employers, it follows that

$$V^m \approx -\xi H\left[\frac{\partial E(U_l)}{\partial N}\frac{\partial N^n}{\partial \tau}\left(\frac{F_{NN}}{w_N} - 1\right) - \frac{\partial E(U_l)}{\partial \tau}\right] \tag{A3.2}$$

Third, substitution of $\frac{\partial N^n}{\partial \tau}$ reduces $\frac{\partial N^n}{\partial \tau}\left(\frac{F_{NN}}{w_N} - 1\right)$ to $\frac{w_\tau}{w_N}$. If the derivatives of the expected utility of workers with respect to employment and the tax rate are written out, the term in brackets becomes

$$(U((1-\tau)w) - U(\tau\gamma w))\frac{w_\tau}{w_N} + NwU'((1-\tau)w) + (H-N)\gamma w\left(\frac{\tau H w_\tau}{N(H-N)w_N} - 1\right)U'(\tau\gamma w) \tag{A3.3}$$

Define the elasticities $\epsilon_\tau^w = \frac{\partial w}{\partial \tau}\frac{\tau}{w}$ and $\epsilon_N^w = \frac{\partial w}{\partial N}\frac{N}{w}$. Then it is easy to see that if $\frac{H}{H-N}\frac{\epsilon_\tau^w}{\epsilon_N^w} - 1 > 0$ equation (A3.3) has a positive sign. In that case $V^m < 0$. Note that this is a sufficient condition.

Appendix 4: the sign of the second-order derivatives in equation (13) and (19)

In section 4 and 5 we need the derivatives of the first-order condition with respect to employment and the interest rate. Before this is carried out, the first-order condition, equation (10), is rewritten. The expected utilities of workers and capital owners are substituted in that equation and the elasticities $\epsilon_\tau^x = \frac{\partial x}{\partial \tau}\frac{\tau}{x}$, $x = N, w, r$ and ϵ_N^w are used.

$$\begin{aligned} Z = {} & \xi[U((1-\tau)w) - U(\tau\gamma w)]N\epsilon_\tau^N + \xi(1-\tau)wN\left(-\frac{\tau}{1-\tau} + \epsilon_\tau^w + \epsilon_N^w\epsilon_\tau^N\right)U'((1-\tau)w) + \\ & \xi(H-N)\tau\gamma w\left(1 + \frac{H}{H-N}\epsilon_\tau^N + \epsilon_\tau^w + \epsilon_N^w\epsilon_\tau^N\right)U'(\tau\gamma w) + (1-\xi)\bar{K}r\epsilon_\tau^r U'(r) = 0 \end{aligned} \tag{A4.1}$$

This equation is differentiated to the interest rate and the employment level, assuming that the elasticities are constant.

$$\frac{\partial Z}{\partial r} = (1-\xi)\overline{K}\epsilon_{\tau}^{r}U'(r)(1-\sigma) \gtrless 0 \qquad 1-\sigma \lessgtr 0 \tag{A4.2}$$

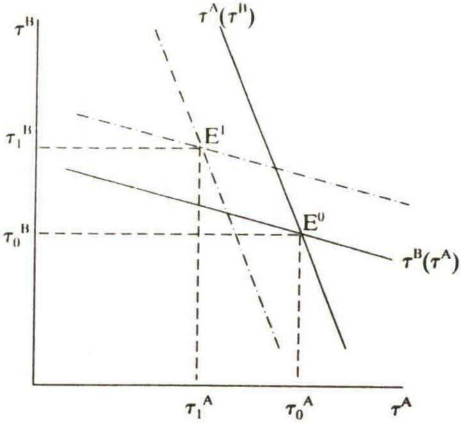
The second derivative is more complicated. After differentiation of the first-order condition to the employment level, some manipulations are needed for the derivation of the sign. At first, some terms can be eliminated. Second, given that the utility functions are of the CRRA type with $\sigma = \frac{xU''(x)}{U'(x)}$, some first-order derivatives of the utility function can be written as utility functions. Now it is possible to substitute the first-order condition times $(1+\epsilon_N^w(1-\sigma))/N$ in this equation. As a result

$$\frac{\partial Z}{\partial N} = -\xi\frac{H}{N}\tau\gamma w(1+\frac{H}{H-N}\epsilon_{\tau}^{N}+\epsilon_{\tau}^{w}+\epsilon_{N}^{w}\epsilon_{\tau}^{N})U'(\tau\gamma w)\sigma - (1-\xi)\frac{\overline{K}}{N}r\epsilon_{\tau}^{r}U'(r)(1+\epsilon_{N}^{w}(1-\sigma)) \tag{A4.3}$$

Using the first-order condition it is easy to show that the condition $1-\sigma < 0$ is sufficient to guarantee that equation (A4.3) has a negative sign.

Given the wage-bargaining function that is indicated in footnote 9, the elasticities are in fact not constant. This is, however, not necessarily a problem. By assuming constant elasticities we only intended to say that we assume that the effects of changes in the foreign tax rate and mobility costs on the elasticities do not change the qualitative results that we derived with constant elasticities. In case the production and wage-setting function are specified as Cobb-Douglas functions we have proved that taking into account differentiation of the elasticities did not change the qualitative results.

Figure 1. Nash equilibrium and increasing capital mobility



E^0: equilibrium with $dC = 0$

E^1: equilibrium with $dC < 0$

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