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Should Federal or Regional Insurance Protect the EMU ?

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Abstract. Interregional transfers within EU account for less than 2 % of GDP. These transfers are redistributive and a federal insurance system does not exist. In this paper we analyse the scope for federal insurance and search for an economic explanation for the union wide resistance against extending the federal budget to include an insurance system. We find that regional insurance build into the public budget can make federal insurance less attractive. The more imperfect the capital market the more effective is regional insurance and the less attractive federal insurance becomes. We analyse the optimal division between regional and federal insurance and relate it to the capital market imperfection. The issue of the optimal number of countries in a fiscal federation is also discussed. A general finding of the paper is that union members will have different preferences for the structure of a federal insurance system and the decision procedure is therefore important when discussing the potential design.

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1. Introduction.

In the summer of 1998 it will be decided which countries are going to participate in the third stage of the Economic and Monetary Union (EMU). It is therefore no

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longer an interesting question whether the EMU project proposed in the Delors Report (1989) will be realized but the focus should instead be on how to ensure its success. One of the most threatening issues for European policy-makers is the stability of the system to adverse (income) shocks. They want to avoid that idiosyncratic shocks to countries can lead to divergent economic performance in terms of growth, inflation, unemployment etc.[1] The theory of optimum currency areas is still the corner stone when analyzing European monetary unification (see Mundell (1961), McKinnin (1963), Kenen (1969) and for a recent survey Bayoumi and Eichengreen (1996)). Since a common currency implies the loss of monetary policy as an instrument for alleviating adverse shocks to income the theory stress the importance of flexible prices (and wages) and the necessity of labour mobility[2]. It is hard to evaluate how well these conditions are satisfied ex ante (see Bayoumi and Eichengreen (1997) for the construction of an optimum currency area index for European Countries) and what really matters is of course how well these conditions are satisfied ex post (when the union is created and for example endogenous trade and production patterns have stabilized (see Frankel and Rose (1997)[3])). As stressed by many authors (see Buiter and Kletzer (1990), Delors Report (1989), Goodhart (1996) and Eichengreen (1990)) fiscal policy is one of the few remaining tools left to deal with fluctuations in income, although constraints on fiscal policy imposed by the Maastricht Treaty may restrict it workings (See Buti et al. (1997)).

[1] These economic measures are related to the stabilisation of transitory regional shocks and not related to the issue of reducing persistent differences in income as for instance income per capita is.

[2] Specifically migration is difficult within the EU due to language and cultural differences. It has also been considered as politically unacceptable as a mean of adjustment (see Doyle (1992)).

[3] Frankel and Rose (1997) find empirical support for the hypothesis that countries with closer trade links tend to have more tightly correlated business cycles. They argue that it is likely that countries joining the EMU will satisfy the optimal-currency-area crtiteria ex post economic integration even though they did not ex ante.

The purpose of this paper is to analyse the interplay and optimal design of two different fiscal mechanisms which can be used to smooth out the effect on income[4] from idiosyncratic shocks and thereby protect the EMU against disintegration[5] due to divergent economic performance. One possibility is to establish a federal system of transfers which can be designed such that it transfers resources from those states that are in a boom to those that are in a recession[6]. In existing federations of states, such as the US and Canada federal insurance is estimated to contribute significantly to reduce fluctuations in income (see Bayoumi and Masson (1994)). It has been argued that such a system of transfers among members of the European Monetary Union could compensate in part for the loss of monetary policy (see Sala-i-Martin and Sachs (1992), Von Hagen (1992) and Bayoumi and Masson (1994)). Fatás (1997) also analyses the issue of federal insurance and presents a new methodology focusing on permanent income instead of disposable income as done in the earlier literature. Within this framework another fiscal policy mechanism may provide insurance within a country[7] (and therefore called regional insurance) in the presence of capital market imperfections. In Andersen and Dogonowski (1998a) where the imperfection is that the government can lend and borrow at an interest rate lower than the one the households face, the financing of fiscal expenditures by a constant proportional income tax provides insurance. In a bad state (low income) the government will borrow money on behalf of the households and this will increase permanent income and thereby reduce the variance. In a good state (high income) the government will lend

[4] We will focus on the effect on permanent income.

[5] The costs of withdrawing from a single currency, and re-establishing a seperate currency, are not in reality so great. (See Goodhart (1996))

[6] The need of a sizable federal fund to stabilize transitory regional shocks within the EMU was presented in the MacDougall Report (1977). A budget of 5 % of the GDP in the union was estimated to be necessary for a succesfull arrangement (see Melitz and Vori (1993)).

[7] There is no difference between a region and a country in this paper.

out money on the behalf of the households and get a lower interest payment and thereby reduce the permanent income which also reduce the variance of permanent income.

Since all the countries which can decide to participate in the EMU have the regional insurance scheme established (this could also be designed for other purposes such as raising revenue or redistributing income) it is an important extension of the analysis of federal insurance to focus on how regional insurance affects its incentive.

To be more precise we will analyse whether the ex ante existence of regional insurance can give an explanation for the union wide resistance against extending the federal budget to include an insurance fund[8]. We also analyse the optimal division between regional and federal insurance and relates it to the capital market imperfections. We briefly discuss the optimal number of countries in a federation and at the end of the paper we relate some of the theoretical results to data. A general conclusion is that union members will have different preferences for the federal tax level and size, why the decision procedure is crucial when discussing the potential design of the federal insurance system.

The paper proceeds as follow. The first section contains the presentation of the model. The second section presents the issue of insurance and focus first on regional and federal insurance separately and then on its co-existence. In the fourth section we calibrate and simulate the model and the last section concludes the paper.

2. The model

In this section we present the model which will provide the framework of the analysis. The model is a simple permanent income model based on Fatás (1997) and extended in

[8] At the time being interregional transfers are mostly due to the structural operations and agricultural policy and accounts for less than 2 % of GDP in the EU (see Hoeller et al. (1996))

its explicit distinction between regional and federal insurance[9]. The most important feature of the model is that welfare of the household is related to permanent income, to be more precise the households are assumed to be risk averse with respect to permanent income. This means that they will appreciate all kinds of fiscal systems which reduce the variance of permanent income without reducing the ex ante expected value of permanent income. We will say that such a system provides fiscal insurance. By focusing on the permanent income in the economy the intertemporal dimension of insurance is captured and this is relevant when we assume that households can borrow and lend[10].

This methodology is different from the earlier literature (see for instance Sala-i-Martin and Sachs (1992)) which only focused on the fiscal systems ability to stabilize disposable income. The typical measure of interest was the size of transfers caused by a fall in state income and this is also an interesting measure if households do not have access to capital markets. But unfortunately such an analysis does not take into account the intertemporal dimension which occurs due to the future tax payments which have to ensure the balance of regional and federal budgets (see Del Negro (1998)).

The model is set in two periods[11] where income is stochastic only in the first period. Income is for simplicity modelled as an endowment and is therefore not affected by distortionary taxes. A capital market imperfection is present and modelled such that the household only can lend and borrow at an interest rate which is higher than the interest rate of the government.

The model is based on N countries which have the potential of creating a fiscal

[9]The model is not derived from first principles since the permanent income model is known by most economists.

[10]A point which has been stressed by both Fatás (1997) and Del Negro (1998).

[11]The model could be extended to infinite number of periods. See also Andersen and Dogonowski (1998a) for a model of regional insurance with an infinite number of periods.

federation. In our analysis we require that the fiscal systems does not affect the ex ante expected value which means that there will be no redistribution of income across countries. The focus will therefore only be on insurance, and transfers will be related to a stationary variable (see Melitz and Vori (1993)). But still an insurance scheme will ex post look like redistribution. We will focus on permanent income of what we will call region a and the $N-1$ identical other regions are called the aggregate b.

In all regions we will only have uncertainty about income in the first period $Y_{1,a}$ and $Y_{1,b}$ which have the same expected values $E[Y_{1,a}] = E[Y_{1,b}]=\overline{Y}$ but with the possibility of different volatilities σ_a and σ_b and a correlation[12] between $Y_{1,a}$ and $Y_{1,b}$ equal to ρ. In the second period all regions have the same income $\overline{Y}$ and shocks to income are therefore temporary.

The government in each country has to finance a constant level of fiscal expenditure G in each period. These expenditure are exogenously given and country specific[13]. The governments are assumed to be benevolent which means that they will try to minimize the variance of permanent income of its country.

2.1. The Benchmark Case. We will first present a benchmark case where no insurance is provided. In this case all financing takes place by levying lump sum taxes, $T_1 = G$ in period one and $T_2 = G$ in the second period and the public budget will balance in each period. The households may lend and borrow at the capital market at a real interest rate r and therefore we discount income by $\frac{1}{1+r}$. Permanent income for country a is defined as

$$Y_a^P \equiv (Y_1 - T_1) + \frac{1}{1+r}(Y_2 - T_2)$$

[12] ρ is the correlation between the stochastic income of the two regions a and b. It is defined as $\rho \equiv Cov(Y_a, Y_b)/\sigma_a\sigma_b$ and is by construction within the interval $[-1; 1]$.

[13] It is not possible to share fiscal spending across countries.

which is the net present value of disposable income of both periods. Its expected level is

$$E[Y_a^P] = (\overline{Y} - G)(1 + \frac{1}{1+r})$$

and the variance is given as

$$Var[Y_a^P] = \sigma_a^2$$

2.2. Regional Insurance. In this section we show that the presence of a capital market imperfection creates the potential for regional insurance. We will model the imperfection in a simple way, namely by assuming that government can borrow and lend at a lower rate than the private sector/households[14]. This assumption is theoretically supported by Blanchard (1985) who points out that uncertain lifetime combined with the absence of private bequest motive will lead to higher private discount rate. We could also think of this imperfection as the outcome of problems of information, moral hazard or liquidity constraints which pose a more binding constraint for private agents than the public sector in capital market, and this will be reflected by a higher shadow interest rate for private agents (see Neary and Roberts (1980))[15].

A simple construction of regional insurance is where the government collects taxes by a proportional tax τ^R on income in period 1 while taxation in the second period always will be as if it is lump sum since the governments intertemporal budget constraint has to be fulfilled (see also Andersen and Dogonowski (1998a)). The tax

[14]This assumption is similar to the one used in Wijnbergen (1987) and discussed in Seater (1993). It means that the government can borrow at more favourable terms but will lend out at less favorable terms than the household.

[15]The assumption of a lower interest rate for the government should therefore not be interpreted literally, but as a simple way to model the mentioned type of capital market imperfections.

functions can be written as

$$T_1 = \tau^R Y_1 \; where \; \tau^R = \frac{G}{\overline{Y}}$$

for the first period and the total tax payment in the second period is given as the sum of government expenditure and the deficit ($if \; Y_1 < \overline{Y}$) plus interest incurred in the previous period.

$$T_{2,a} = (1+i)(\tau^R Y_{1,a} - G) + G$$

The government will lend ($if \; Y_1 > \overline{Y}$) and borrow ($if \; Y_1 < \overline{Y}$) at the international capital market at a real interest rate $i < r$. The permanent income can then be written as

$$Y_a^P = Y_{1,a}(1-\tau^R) + \frac{1}{1+r}\left(Y_{2,a} - G + (1+i)\left(\tau^R Y_{1,a} - G\right)\right)$$

and will have an expected level of permanent income equal to

$$E[Y_a^P] = (\overline{Y} - G)(1 + \frac{1}{1+r})$$

and a variance

$$Var[Y_a^P] = \sigma_a^2 \left(1 - \tau^R \left(1 - \frac{1+i}{1+r}\right)\right)^2$$

We define $\Phi \equiv \frac{1+i}{1+r}$ as a measure of the capital market imperfection. By construction $0 < \Phi < 1$ and the closer Φ is to one the smaller is the imperfection. This fiscal system does not affect the *expected* level of permanent income, but since $0 < \tau^R = \frac{G}{\overline{Y}} < 1$ and $0 < \Phi < 1$ it reduces the variance on permanent income compared to the benchmark case. We will therefore say that it provides insurance within the country and call it regional insurance. In a bad state the government will borrow money on behalf of the households and this will increase permanent income in that state and thereby reduce the variance. In a good state the government will lend money out on behalf of the households and get a lower interest payment and thereby reduce the realized level of permanent income which also reduces the variance.

Regional insurance works by being an intertemporal intra-regional smoothing device. It is smoothing disposable income and thereby also permanent income.

We will briefly analyse how a marginal change of the regional tax rate influences the variance of permanent income. The marginal benefit in terms of reduced variance of permanent income can be written as

$$\frac{\partial Var(Y^P)}{\partial \tau^R} = -2\sigma^2(1-\tau^R(1-\Phi))(1-\Phi) < 0$$

It is interesting to note that the marginal benefit increases in the variance of income and decreases in the regional tax rate. A more imperfect capital market makes regional insurance more effective as we see it from

$$\frac{\partial Var(Y^P)}{\partial \tau^R \partial(1-\Phi)} = 4\sigma^2(\tau^R(1-\Phi) - \frac{1}{2}) \tag{1}$$

A sufficient condition for $\frac{\partial Var(Y^P)}{\partial \tau^R \partial(1-\Phi)} < 0$ is that the regional tax rate is smaller than or equal to 1/2 (given the presence of the capital market imperfection). If we evaluate the marginal insurance gain at $\tau^R = 0$ it can be written as

$$\frac{\partial Var(Y^P)}{\partial \tau^R} \mid_{\tau^R=0} = -2\sigma^2(1-\Phi)$$

and this condition shows us that the capital market imperfection $\Phi < 1$ is a necessary condition for the benefits of regional insurance.

The tax parameter τ^R was in this example set such that $\tau^R = \frac{G}{\overline{Y}}$, but can as long as we do not accept transfers from the government it can be varied within the interval of $\tau^R \in [0, G/\overline{Y}]$. Since we have not modelled any cost from taxation the tax rate which minimizes the variance is $\tau^R = \frac{1}{1-\Phi}$.

2.3. Federal Insurance. In this section we present the structure of a federal insurance system. The idea is that a proportional part of income is collected from the participating countries to a fund and then evenly redistributed to all N participating

countries. The federal tax rate is required to be identical for all countries, such that τ^F is the share of income which is transferred between the regions[16]. If a region experiences a boom it will transfer resources to the other regions and vice versa. We will first assume that regional fiscal expenditure G is financed by a lump sum tax such that we avoid any interaction between regional and federal insurance at this point of the analysis.

In this $N-$country setting b is the aggregate of all other regions in the federation. We assume that the aggregate of all the other regions is the result of $N-1$ regions all of the same size as region a, and each of them with income Y_b, a volatility equal to σ_b and a correlation of state income equal to zero. The system is designed such that country a pays $Y_{1,a}\tau^F$ to the federation and gets $1/N$ of its own payment back, and furthermore receives $\frac{1}{N}\tau^F Y_{1,b}$ as a contribution from each of the $N-1$ countries defining the aggregate b. We assume that all regions are equally responsible for the federal budget such that the tax share of all the regions is equal to $1/N$ (see Fatás (1997)). The considerations about the size of the federation is less important here and we will treat N as exogenous given.

Permanent income of region a may then be written as

$$Y_a^P = Y_{1,a}(1-\tau^F+\frac{1}{N}\tau^F) - G + \frac{1}{N}(N-1)\tau^F Y_{1,b} + \frac{1}{1+r}(Y_2 - G)$$

and again, expected permanent income is unchanged as required

$$E[Y_a^P] = (\overline{Y} - G)(1+\frac{1}{1+r})$$

and the variance will be

$$Var[Y_a^P] = \left(1-(1-\frac{1}{N})\tau^F\right)^2 \sigma_a^2 + \left((1-\frac{1}{N})\tau^F\right)^2 \sigma_b^2 +$$

[16]Italianer and Vanheukelen (1992) study another federal transfer system which provides unemployment insurance.

$$2\left((1-\frac{1}{N})\tau^F\right)\left(1-(1-\frac{1}{N})\tau^F\right)\rho\sigma_a\sigma_b$$

We will solve for the marginal federal insurance benefit for country a which can be written as

$$\frac{\partial Var(Y_a^P)}{\partial \tau^F} = -2(1-(1-\frac{1}{N})\tau^F)(1-\frac{1}{N})\sigma_a^2 + 2(1-\frac{1}{N})^2\tau^F\sigma_b^2 +$$
$$2(1-\frac{1}{N})\rho\sigma_a\sigma_b(1-2(1-\frac{1}{N})\tau^F)$$

If country a should have any incentive to participate in a federal insurance scheme the marginal insurance gain must be positive, which means that it has to reduce the variance of permanent income when $\tau^F = 0$

$$\frac{\partial Var(Y_a^P)}{\partial \tau^F} \mid_{\tau^F=0} = -2(1-\frac{1}{N})\sigma_a^2(1-\rho\frac{\sigma_b}{\sigma_a})$$

We see that a negative correlation of income is sufficient to ensure an interest for the members to participate and a perfect negative correlation $\rho = -1$ is most preferred. Even in the presence of positive correlation it is possible that the countries will be interested in federal insurance if $\rho < \min(\sigma_a/\sigma_b, \sigma_b/\sigma_a)$[17]. This condition defines an upper bound on the degree of correlation between income. If there is perfect positive correlation $\rho = 1$ between country a and the aggregate b, then country a will only find the federal scheme attractive if its variance is larger then the variance of the aggregate b, i.e. $\sigma_a > \sigma_b$ and vice versa for b, so there will be no scope for insurance in this case. We will assume that the condition on the correlation of incomes is fulfilled whenever we analyse federal insurance in this paper.

As this condition also may indicate we have decreasing marginal insurance benefits from an increase in the correlation of incomes. This is confirmed by the expression below

$$\frac{\partial\left(\frac{\partial Var(Y_a^P)}{\partial \tau^F}\right)}{\partial \rho} = 2(1-\frac{1}{N})(1-2\tau^F(1-\frac{1}{N}))\sigma_a\sigma_b$$

[17] This condition is based on the incentive constraints from both country *a and b*.

which says that the benefit gets smaller as ρ increases if $0 < \tau^F < 1$[18].We may solve for the preferred federal tax rate from the viewpoint of region a which is called $\tau_a^F(1)$ (where 1 indicates that $\Phi = 1$). This tax rate should be set as

$$\tau_a^F(1) = \frac{(\sigma_a^2 - \rho\sigma_a\sigma_b)N}{(\sigma_a^2 + \sigma_b^2 - 2\rho\sigma_a\sigma_b)(N-1)}$$

By the second order condition to the problem (minimization of the variance) we know that $\sigma_a^2 + \sigma_b^2 - 2\rho\sigma_a\sigma_b > 0$. We observe that this first best tax rate is decreasing in N, the size of the federation. If the relative variability of region a compared to region b increases ($\frac{\sigma_b}{\sigma_a}$ gets smaller) then region a will prefer a higher federal tax rate if

$$\rho\left(\frac{\sigma_b}{\sigma_a}\right)^2 - 2\left(\frac{\sigma_b}{\sigma_a}\right) + \rho < 0$$

This condition will in the case where $\rho > 0$ be satisfied when $\left(\frac{\sigma_b}{\sigma_a}\right)$ is in the interval defined by

$$\left(\frac{\sigma_b}{\sigma_a}\right) \in \left(\frac{1}{\rho} - \sqrt{\frac{1}{\rho^2} - 1}, \frac{1}{\rho} + \sqrt{\frac{1}{\rho^2} - 1}\right)$$

The less correlated the income of the two countries, the closer ρ gets to 0^+, and the larger is the relevant interval. If we have perfect correlation $\rho = 1$ the set will empty.

2.4. The Interplay Between Regional and Federal Insurance. We are now ready to consider the case where the region participates both in a fiscal federation and finance its fiscal expenditure by a proportional tax which will provide regional insurance due to the presence of the capital market imperfection. In this case permanent income of region a reads

$$Y_a^P = Y_{1,a}\left(1 - \tau^R - (1 - \frac{1}{N})\tau^F\right) + (1 - \frac{1}{N})\tau^F Y_{1,b} +$$

$$\frac{1}{1+r}\left(Y_2 - G + (1+i)\left(\tau^R Y_{1,a} - G\right)\right)$$

[18] $0 < \tau^F < 1$ is a sufficient condition for $1 - 2\tau^F(1 - \frac{1}{N}) > 0$ when $N \geq 2$.

Again there is no difference in the expected value of permanent income but the variance may be written as

$$\begin{aligned} Var[Y^P] &= \sigma_a^2\left(1-(1-\frac{1}{N})\tau^F-\tau^R(1-\Phi)\right)^2+\sigma_b^2\left((1-\frac{1}{N})\tau^F\right)^2+ \\ &\quad 2\sigma_a\sigma_b\rho(1-\frac{1}{N})\tau^F\left(1-(1-\frac{1}{N})\tau^F-\tau^R(1-\Phi)\right) \end{aligned}$$

It is a natural first step to analyse the marginal benefit from a change in either the regional or federal tax rates. The marginal regional insurance benefit is now

$$\frac{\partial Var[Y^P]}{\partial \tau^R}=-2(1-\Phi)\sigma_a^2\left(\left(1-\tau^R(1-\Phi)\right)-(1-\frac{1}{N})\tau^F(1-\rho\frac{\sigma_b}{\sigma_a})\right)$$

and we see that the presence of federal insurance reduce the marginal benefit of regional insurance

$$\frac{\partial Var[Y^P]}{\partial \tau^F\partial \tau^R}=2(1-\frac{1}{N})(1-\Phi)\sigma_a^2(1-\rho\frac{\sigma_b}{\sigma_a})>0$$

A similar expression for the marginal federal insurance benefit can be derived

$$\begin{aligned} \frac{\partial Var[Y^P]}{\partial \tau^F} &= -2(1-\frac{1}{N})\sigma_a^2(1-(1-\frac{1}{N})\tau^F-(1-\Phi)\tau^R)(1-\rho\frac{\sigma_b}{\sigma_a})+ \\ &\quad 2(1-\frac{1}{N})^2\tau^F\sigma_b^2\left(1-\rho\frac{\sigma_a}{\sigma_b}\right) \end{aligned}$$

and in this case the presence of regional insurance reduce the marginal benefit of the federal system. We see that regional and federal insurance are complements since the benefit from regional insurance gets smaller when we also introduce federal insurance and vice versa.

We will again see how the marginal benefits are related to the correlation of income and the imperfection in the capital market. If the capital market imperfection gets larger we see how it influences the incentive for regional insurance. The first term is written such that we have the direct effect from regional insurance (identical to

expression of equation (1)) and the second term is the indirect effect via the federal system.

$$\frac{\partial Var[Y^P]}{\partial \tau^R \partial(1-\Phi)} = -4\sigma_a^2((\frac{1}{2} - \tau^R(1-\Phi))\sigma_a^2 - \frac{1}{2}(1-\frac{1}{N})\tau^F\left(1-\rho\left(\frac{\sigma_b}{\sigma_a}\right)\right)$$

The first term indicates a positive effect on the incentive for regional insurance when the imperfection gets larger. The second term is positive which means that the interplay with federal insurance reduces the incentive.

Federal insurance gets less attractive when the capital market imperfection increases

$$\frac{\partial Var[Y^P]}{\partial \tau^F \partial(1-\Phi)} = 2(1-\frac{1}{N})\tau^R\sigma_a^2(1-\frac{\sigma_b}{\sigma_a}\rho) > 0$$

At a given regional tax rate less uncertainty is left to insure the more imperfect the capital market, since regional insurance gets more effective, and the smaller are the incentives for federal insurance.

If we instead relate the marginal regional insurance benefits to the correlation of income ρ we get

$$\frac{\partial Var[Y^P]}{\partial \tau^R \partial \rho} = -2(1-\frac{1}{N})(1-\Phi)(\sigma_a\sigma_b\tau^F) < 0$$

which says that regional insurance gets more attractive when the correlation of income increases. The reason is that the amount of insurance provided for a given federal tax rate is decreasing in the correlation of incomes (as we will se below) and more uncertainty is left uninsured, why regional insurance gets more attractive.

With respect to federal insurance we have

$$\frac{\partial Var[Y^P]}{\partial \tau^F \partial \rho} = 2(1-\frac{1}{N})(1-2(1-\frac{1}{N})\tau^F - \tau^R(1-\Phi))\sigma_a\sigma_b$$

which is positive since $(1-2(1-\frac{1}{N})\tau^F - \tau^R(1-\Phi)) > 0$ and we see that an increase in the correlation of income reduces the incentives for federal insurance.

Conditional on the regional tax rate the preferred federal tax rate $\tau_a^F(\Phi)|_{\tau_a^R}$ is given as

$$\tau_a^F(\Phi)|_{\tau_a^R} = \frac{\sigma_a^2(1-\tau_a^R(1-\Phi))(1-\rho\frac{\sigma_b}{\sigma_a})}{(1-\frac{1}{N})(\sigma_a^2(1-\rho\frac{\sigma_b}{\sigma_a})+\sigma_b^2(1-\rho\frac{\sigma_a}{\sigma_b}))}$$

and is decreasing in the regional tax rate

$$\frac{\partial\tau^F}{\partial\tau^R} = \frac{-\sigma_a^2(1-\Phi)(1-\rho\frac{\sigma_b}{\sigma_a})}{(1-\frac{1}{N})(\sigma_a^2(1-\rho\frac{\sigma_b}{\sigma_a})+\sigma_b^2(1-\rho\frac{\sigma_a}{\sigma_b}))} < 0$$

due to the complementariness.. If the capital market imperfection is reduced then the multiplier $\frac{\partial\tau^F}{\partial\tau^R}$ becomes smaller. This means that if the capital market imperfection is high, regional insurance is more effective and reduce the optimal federal tax more. The conditional federal tax rate is decreasing in the correlation of income and increases when the capital market imperfection gets smaller.

2.5. The Optimal Tax Structure. After having analyzed the interplay between the two insurance forms it is natural to analyse the optimal tax structure, by this we mean the optimal division between regional and federal insurance. We know distortions from taxation have costs (among other reasons) via its influence on the labour market where it creates a wedge between the marginal product of labour and the real wage why resources will be employed inefficiently. These costs can be modelled by having endogenous labour supply as in Andersen and Dogonowski (1998b)[19] or by using a postulated cost function as in Barro (1979). (See Andersen and Dogonowski (1998c) for a discussion of the cost functions used in the optimal income taxation literature.)

We will here follow the approach of Barro and measure the cost from taxation by a function $Z(\tau^R, \tau^F)$ which we define as

$$Z(\tau^R, \tau^F) \equiv C(\tau^R + \tau^F) \; where \; C' > 0 \; and \; C'' > 0$$

[19] In Andersen and Dogonowski (1998b) we have endogenous labour supply with the purpose to analyse the cost of having a social insurance system in an OLG-framework.

We assume that there is no difference whether the aggregate tax rate is high due to regional or federal taxation and the cost and marginal cost are assumed to be increasing in the aggregate tax level. (See Persson and Tabellini (1996a) for a discussion of moral hazard in models with federal risk sharing. They argue that moral hazard can be a problem in federal unions and the assumption of treating the tax rates identical can therefore be critical.) We will assume that the cost Z is measured in the same units as the variance of permanent income such that the problem of the government in country a is to minimize the sum of the variance of permanent income and the cost from taxation

$$\min_{(\tau^R,\tau^F)} Var(Y^p) + C(\tau^R + \tau^F)$$

The first order conditions to this problem are

$$\frac{\partial Var(Y^p)}{\partial \tau^R} = \frac{\partial Var(Y^p)}{\partial \tau^F} \tag{2}$$

$$\frac{\partial Var(Y^p)}{\partial \tau^R} = -C'(\tau^R + \tau^F) \tag{3}$$

The first condition equalize the marginal benefit of regional taxation to the marginal benefit of federal taxation. This condition defines a relation between τ^F and τ^R. The second condition equalize the marginal benefit due to a decrease in the variance of permanent income to the marginal cost measured by C'. The second condition can be said to close the system and thereby determine the aggregate level of taxation[20].

[20]The sufficient conditions for a stationary point to be a global minimum are

$$\begin{aligned} \frac{\partial^2 Var(Y^p)}{\partial \tau^R \partial \tau^R} + \frac{\partial^2 C(\tau^R + \tau^F)}{\partial \tau^R \partial \tau^R} &> 0 \\ \frac{\partial^2 Var(Y^p)}{\partial \tau^F \partial \tau^F} + \frac{\partial^2 C(\tau^R + \tau^F)}{\partial \tau^F \partial \tau^F} &> 0 \end{aligned}$$

and

$$\frac{\partial^2 H}{\partial \tau^R \partial \tau^R} \frac{\partial^2 H}{\partial \tau^F \partial \tau^F} - 2\frac{\partial^2 H}{\partial \tau^R \partial \tau^F} \geq 0$$

where

$$H = Var(Y^p) + C(\tau^R + \tau^F)$$

We will restrict our focus on the interior solution, i.e. $0 < \tau^R < 1$, $0 < \tau^F < 1$ and $0 < \tau^R + \tau^F < 1$[21].

Before analyzing the optimal tax structure we will show that the capital market can be so imperfect that the regional insurance is so effective that it does not leave any incentives to have a federal insurance system. This threshold value of Φ will be called Φ^*. When analyzing this problem we have to compare the marginal regional insurance benefit to that of federal insurance. We will given the benchmark scenario $(\tau^R = 0, \tau^F = 0)$ prefer regional insurance if

$$\frac{\partial Var(Y^P)}{\partial \tau^R} \mid_{\tau^R=0,\tau^F=0} < \frac{\partial Var(Y^P)}{\partial \tau^F} \mid_{\tau^R=0,\tau^F=0}$$

This condition will be satisfied if

$$\Phi < \Phi^* \equiv \frac{1}{N}\left(1 + (N-1)\rho\left(\frac{\sigma_b}{\sigma_a}\right)\right) < 1 \tag{4}$$

where it is written as a requirement on the capital market imperfection. The last inequality in equation (4) is given from the incentive constraint $\rho\left(\frac{\sigma_b}{\sigma_a}\right) < 1$ derived for federal insurance and that $N > 1$ by construction. From this condition it is easy to see that it may be the case that country a's incentives (given the benchmark scenario) pro federal or regional insurance depends on the structural parameters. If $\Phi < \Phi^*$ we will prefer regional insurance, if $\Phi = \Phi^*$ we will be indifferent between the two insurance forms and if $\Phi > \Phi^*$ we will prefer federal insurance. If we initially prefer regional insurance the condition $\Phi \leq \Phi^*$ implies that $\frac{\partial^2 Var(Y^P)}{\partial \tau^F \partial \tau^R} < \frac{\partial^2 Var(Y^P)}{\partial \tau^R \partial \tau^R}$ and it is therefore not sure that we will continue to prefer regional insurance when $\tau^R > 0$ (in the presence of regional insurance). The more regional insurance the less effective it is - and this will increase the incentive for federal insurance.

We assume that these conditions are satisfied in the following analysis.

[21] This assumption puts requirements on the parameters of the cost function.

We have chosen not to specify the cost function in greater detail but will instead try to extract information from the observable regional tax rates by interpreting it as if it was the outcome of optimal taxation for an economy without federal insurance $\tau^F = 0$. This assumption should reflect that potential member countries before the implementation of the EMU have the regional tax rate set without further considerations (expectations) about federal insurance. We will next see that this tax rate defines an upper bound on the aggregate tax level due to the complementariness of the two insurance forms. This upper bound on the aggregate tax level can be used to find upper bounds on the regional and federal tax rates when entering a federation.

The argument of the upper bounds on the aggregate tax rate can be presented in the following way. Assume that we initially have no federal insurance such that $\tau^F = 0$ and the regional tax rate $\tau^{R,*}$ is set optimally such that it satisfies the condition

$$-\frac{\partial Var(Y^p)}{\partial \tau^R}|_{\tau^R=\tau^{R,*},\tau^F=0} = C'(\tau^{R,*})$$

If $\Phi > \Phi^*$ we can reduce the variance of permanent income by decreasing the regional tax $\left(\Delta\tau^R < 0\right)$ and at the same time increase the federal tax $\left(\Delta\tau^F > 0\right)$ without affecting the aggregate tax level, i.e.

$$\Delta\tau^R + \Delta\tau^F = 0$$

since

$$\frac{\Delta Var(Y^p)}{\Delta\tau^R} + \frac{\Delta Var(Y^p)}{\Delta\tau^F} < 0$$

In this new situation $\frac{\partial Var(Y^P)}{\partial \tau^R}$ is smaller since we have increased the federal tax rate and diminished the regional tax rate with the same amount and therefore the optimality condition is not satisfied any longer

$$\frac{-\partial Var(Y^P)}{\partial \tau^R} < C'(\tau^R + \tau^F)$$

From the second order condition we know that we have to reduce the aggregate tax level and we know that this involves a further reduction of both the regional and

federal tax rates. It is due to the complementariness of the two insurance instruments that we will observe a lower aggregate tax level when both insurance system are optimally implemented compared to a situation with only one of the systems.

We then interpret the observations of the regional tax levels $\tau^{R,O}$ as if they were set optimally in a world without federal insurance and thereby defines an upper bound on the aggregate tax level. We will use this result to analyse the optimal division on the insurance system in the case $\tau^R + \tau^F = \tau^{R,Opt}$ and thereby find upper bounds on the federal $\overline{\tau^F}$ and regional $\overline{\tau^R}$ tax rates. We therefore solve the problem

$$\min_{(\tau^R,\tau^F)} Var[Y^p]$$

$$s.t\ \tau^R + \tau^F = \tau^{R,Opt}$$

By use of the same first order condition as in equation (2) and with the additional constraint on the aggregate tax level we find the upper bound of the federal tax to

$$\overline{\tau^F} = \frac{N\sigma_a((1-\tau^{R,O}(1-\Phi))(\sigma_a(1-N\Phi)+\sigma_b\rho(N-1))}{\Psi}$$

and the regional upper bound is given as

$$\overline{\tau^R} = \tau^{R,O} - \overline{\tau^F}$$

where

$$\Psi = -\sigma_a^2(1-2N\Phi+\Phi^2N^2) - \sigma_b^2(1-2N+N^2) + 2\sigma_a\sigma_b\rho(1-N(1+\Phi)+\Phi N^2)$$

These tax rates will be simulated in the next section.

2.6. The Optimal Size of a Fiscal Federation. We have until now treated the number of countries within the federation as exogenously given. But countries have preferences for the number of members in a federation as well as for the tax rates. In this section we will answer the questions whether and when there exists an optimal

size of a fiscal federation *given the federal tax rate* . With our structure of the fiscal federation two effects are present which depend on the number of countries. For a given federal tax rate we get less of our payment back the more countries participating and this makes the system more efficient. We are on the other hand exposed to more uncertainty when more countries participate since the weight of their volatility gets higher and this makes the system less attractive. It is the trade-off between these two effects which is decisive for the preferred size of a fiscal federation.

We may solve for the optimal size of the federation from the view-point of country a by solving the problem

$$\min Var(Y^P) \ w.r.t \ (1/N)$$

with the additional constraint $N \geq 2$[22]. We assume that the marginal country has the same volatility of income σ_b as those countries already defining the aggregate b[23]. The first order condition reads

$$\frac{\partial Var(Y^P)}{\partial(1/N)} = 2\tau^F \left(\sigma_a^2 - \sigma_a\sigma_b\rho\right)(1 - \tau^F + \frac{1}{N}\tau^F - \tau^R(1-\Phi)) \tag{5}$$

$$-2\left(\tau^F\right)^{(2)}(1-\frac{1}{N})\left(\sigma_b^2 - \sigma_a\sigma_b\rho\right) = 0$$

and the second order condition

$$\left(\sigma_a^2 - \sigma_a\sigma_b\rho\right) + (\sigma_b^2 - \sigma_a\sigma_b\rho) > 0$$

By using equation (5) we may then solve for N_a^* and get

$$N_a^* = \frac{(\sigma_a^2 - \sigma_a\sigma_b\rho) + (\sigma_b^2 - \sigma_a\sigma_b\rho)}{\frac{(1-\tau^F-\tau^R(1-\Phi))}{\tau^F}(\sigma_a\sigma_b\rho - \sigma_a^2) + (\sigma_b^2 - \sigma_a\sigma_b\rho)}$$

[22]This is the minimal size of the federation, and we know that this will be preferred to the benchmark scenario where $N = 1$.

[23]This is a strong assumption compared to the observation that countries normally have different risk profiles.

and the second order condition to the problem tells us that the numerator is positive. Let's furthermore simplify by assuming that $\sigma_a = \sigma_b$ and the optimal size is then given as

$$N_a^* = \frac{2}{1 - \frac{(1-\tau^F-\tau^R(1-\Phi))}{\tau^F}}$$

and if we take the constraint into account the result about the optimal size can be summarized as

$$N_a^* = 2 \; if \; \tau^F < \frac{1}{2}\left(1 - \tau^R(1-\Phi)\right)$$

$$N_a^* \; is \; not \; defined \; if \; \tau^F = \frac{1}{2}\left(1 - \tau^R(1-\Phi)\right)$$

$$N_a^* = \frac{2}{1 - \frac{(1-\tau^F-\tau^R(1-\Phi))}{\tau^F}} > 2 \; if \; 1 - \tau^R(1-\Phi) > \tau^F > \frac{1}{2}\left(1 - \tau^R(1-\Phi)\right)$$

$$N_a^* = 2 \; if \; \tau^F \geq 1 - \tau^R(1-\Phi)$$

and this result is illustrated in Figure 1.

Figure 1: The Optimal Size of a Fiscal Federation.

See Appendix (i)

It is useful to first to consider this result for the case where there is no regional insurance, i.e. $\tau^R(1-\Phi) = 0$. Then we prefer the smallest possible federation if $\tau^F < 1/2$ since the cost due to exposure to more uncertainty dominates the decision of the optimal size. If $\tau^F > 1/2$ the efficiency due to more countries participating in the federation is stronger and we prefer a federation larger than $N = 2$. The efficiency effect is stronger the closer τ^F is to $1/2$ which is reflected by the asymptote in the figure. The last interval $\tau^F > 1$ is not of any interest.

When we have regional insurance $\tau^R(1-\Phi) > 0$ there is less uncertainty to be exposed to when we extend the size of the federation and the result is similar, with the exception that the critical value of $\tau^F = \frac{1}{2}(1 - \tau^R(1-\Phi))$ is smaller. For a smaller range of values for $\tau^F < \frac{1}{2}(1 - \tau^R(1-\Phi))$ it is preferred that the federation is as small as possible ($N = 2$). When $1 - \tau^R(1-\Phi) > \tau^F > \frac{1}{2}\left(1 - \tau^R(1-\Phi)\right)$ then $N_a^* > 2$ is

preferred and we see that this interval gets larger as the capital market imperfection gets larger. Within this interval of federal taxes the optimal size of the federation is negatively related to both fiscal tax rates $\frac{\partial N^*}{\partial \tau^F} < 0$ and $\frac{\partial N^*}{\partial \tau^R} < 0$.

We have until now focused on the preferences for the tax rates (given the size of the federation) and the number of countries in the federation (given the federal tax rate), all of it from the viewpoint of a single country. The natural question to rise is how potential members of the EMU should agree on the design of a federal system. If the insurance potential is going to be realized we think that a bilateral insurance system is unlikely to be legitimate in today's Europe and what is left to agree on is the federal tax rate. Since the potential members are different with respect to the volatility of income and its correlation to the aggregate they also have different preferences for the optimal design of a federation. Given the decision procedure within the European Union, where the Council of Ministers controls all important decisions, this decision-making is best described by the veto-principle, which means that if just one country is against a proposal it will be rejected. If we expect this procedure to be used when designing a federal insurance system only the lowest preferred federal tax rate can be implemented.

With the recent enlargement of the Union in 1993 and the planned Eastern and Central European extension in the beginning of the new millennium we expect that the European Parliament will acquire a bigger role over policy formation in Europe. This future decision procedures is probably better described by asymmetric Nash-bargaining (see Binmore et al. (1986)) or voting and will change the predictions about the design of the federation[24].

[24]In a different setting where fiscal policy instruments are constrained, such that residents in the federation face a tradeoff between risk-sharing and re-distribution Persson and Tabellini (1996b) show how the outcome is resolved in two different political equilibria. When chosen by voting the federal insurance provides over-insurance, and when chosen by Nash-bargaining it provides under-

3. CALIBRATION AND SIMULATIONS OF THE MODEL.

We will end this paper by relating some of the results to data and thereby provide predictions about the insurance potential and the optimal division on the two insurance systems.

The data set is from Fatás (1997) and includes information on the volatility of income σ_a, the ratio of that volatility to the volatility of the aggregate $\frac{\sigma_a}{\sigma_b}$ and the correlation coefficient ρ between income in region a and the aggregate b. As in our modelling the country in question is not included when calculating the aggregate. The data is based on the growth rate of state income for the period 1979-1995[25] and are summarized in Table 1 which furthermore contains observations of the general government receipts as a percentage of nominal GDP[26] for 1996 (See OECD (1996)) which we are going to use as a measure of $\tau_a^{R,0}$ (the observed regional tax rates). The examination of the incentives for federal insurance are going to be based on historical data and can give a misleading picture since endogenous trade and production patterns can play an important role on the future economic structure (see Frankel and Rose (1997)). The purpose of our simulations is to illustrate the theoretical model we have developed.

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insurance.

[25] For a critical discussion of the construction of the data see Fatas (1997).

[26] This is done by using data on the size public spending to GDP as a measure of τ^R. We know that this is a crude measure since regional taxation is seldom proportional in income (se OECD (1995)) but usefull as a first approximation.

Table 1: Volatility, Correlations and the Observed Regional Tax Rates.

Europe: 1979-1996

a	σ_a	$\frac{\sigma_a}{\sigma_b}$	ρ	$\tau^R_{a,1996}$
GER	1.80	1.46	0.43	0.45
FRA	1.31	1.07	0.75	0.50
ITA	1.57	1.33	0.74	0.46
NET	1.48	1.23	0.71	0.48
BEL	1.53	1.29	0.68	0.51
LUX	1.85	1.56	0.76	0.34
UK	2.16	1.72	0.25	0.38
IRE	2.07	1.74	0.31	0.37
DEN	1.61	1.34	0.33	0.60
SPA	1.74	1.46	0.68	0.39
GRE	1.58	1.33	0.60	0.37
POR	2.29	1.93	0.62	0.43
SWE	1.76	1.49	0.75	0.61
FIN	3.40	2.88	0.49	0.55
AUT	1.32	1.11	0.77	0.48

The aim of Fatás (1997) is to estimate the insurance benefits of the federal budget by using the new methodology which is focusing on permanent income. He wants to compare his result to the work of Sachs and Sala-i-Martin (1992) and Bayoumi and Masson (1996) and therefore his analysis is based on the assumption that the tax system has to reduce volatility of regional disposable income by 30 %. In our setting this is identical to assuming that $\tau^F = 0.30$ and $\tau^R = 0$ and then measure the insurance effect on permanent income of the federal system and compare it to the reduction of volatility of regional disposable income. When measuring insurance is

defined as the (%) reduction of volatility as measured by the standard deviation of state permanent income Fatás finds that the previous estimates in the literature has overestimated (by a factor 3) the amount of federal insurance of the US system.

Our treatment of the data is different since our analysis of insurance is normative with the purpose to clarify which countries have incentives to participate in a federal insurance system and to find the optimal tax structure when we also take into account the existence of regional insurance. We will not try to estimate the measure of the capital market imperfection[27] but will instead present some simulations to show the potential influence from this channel.

We will set $N = 15$ which means that we analyse the potential of an insurance system covering the whole union. First we analyse the potential to participate in a federal insurance arrangement and this will be measured by the variance gain from federal insurance in the case where there is no regional insurance:

$$\frac{\partial Var(Y_a^P)}{\partial \tau^F} \mid_{\tau^F=0} = -2(1-\frac{1}{N})\sigma_a^2(1-\rho\frac{\sigma_b}{\sigma_a})$$

This measure is presented in Table 2.

[27] Although we argue that the probability of death could be one of the reasons for the capital market imperfection - we prefer to think of it as a much more complex measure due to various imperfections in the capital markets as assymmetric information, credit constraints etc. and this measure is not easy to estimate.

Table 2: Incentives and the Threshold Value Φ^*.

a	$\frac{\partial Var(Y_a^P)}{\partial \tau^F} \mid_{\tau^F=0}$	Φ^*
GER	-4.3	0.34
FRA	-1.0	0.72
ITA	-2.0	0.59
NET	-1.7	0.61
BEL	-2.1	0.56
LUX	-3.3	0.52
UK	-7.4	0.20
IRE	-6.6	0.23
DEN	-3.6	0.30
SPA	-3.0	0.51
GRE	-2.6	0.49
POR	-6.6	0.37
SWE	–2.9	0.54
FIN	-17.9	0.23
AUT	-1.0	0.71

Since the first measure in the table is negative for all the considered countries we know that they all have incentives to participate in a federation and those countries with the largest potential gains are Finland, England and Portugal.

We extend the simulations to include regional insurance and this will change the results. We identify the threshold value Φ^* which defines the lower bound above which there will be a role for federal insurance. Φ^* was found to be

$$\Phi^* \equiv \frac{1}{N}\left(1 + (N-1)\rho\left(\frac{\sigma_b}{\sigma_a}\right)\right)$$

The threshold value Φ^* varies between 0.20 for the UK and 0.72 for France. From Table 2 we also see that those countries with the smallest initial gain from federal

insurance will loose the incentives for federal insurance at smaller capital market imperfections (at higher values of Φ).

The last simulations we provide has to do with the optimal division between federal and regional taxation. We have argued that if the observed regional tax rate was set optimally in a world without federal insurance it could be interpreted as an upper bound on the aggregate tax rate. Based on this upper bound we simulate upper bounds of the federal and regional tax rates for the following values of the capital market imperfection $\Phi = [0.9, 0.8, 0.7, 0.6, 0.5]$

Table 3a: Upper Bounds on Federal and Regional Tax Rates

a	$\tau_a^F(0.9)$	$\tau_a^R(0.9)$	$\tau_a^F(0.8)$	$\tau_a^R(0.8)$	$\tau_a^F(0.7)$	$\tau_a^R(0.7)$
GER	0.31	0.14	0.28	0.17	0.24	0.21
FRA	0.06	0.44	0.03	0.47	0.00	0.50
ITA	0.13	0.33	0.09	0.37	0.05	0.41
NET	0.11	0.37	0.08	0.40	0.04	0.44
BEL	0.14	0.37	0.11	0.40	0.07	0.44
LUX	0.17	0.16	0.15	0.19	0.10	0.24
UK	0.52	0.00	0.38	0.00	0.38	0.00
IRE	0.48	0.00	0.37	0.00	0.37	0.00
DEN	0.34	0.26	0.30	0.30	0.26	0.34
SPA	0.19	0.20	0.15	0.24	0.11	0.28
GRE	0.19	0.18	0.16	0.21	0.12	0.25
POR	0.32	0.11	0.29	0.14	0.25	0.18
SWE	0.16	0.45	0.12	0.49	0.08	0.53
FIN	0.55	0.00	0.54	0.01	0.51	0.0.4
AUT	0.06	0.42	0.03	0.45	0.00	0.48

Table 3b: Upper Bounds on Regional and Federal Tax Rates (cont..)

a	$\tau_a^F(0.6)$	$\tau_a^R(0.6)$	$\tau_a^F(0.5)$	$\tau_a^R(0.5)$
GER	0.19	0.26	0.13	0.32
FRA	0.00	0.50	0.00	0.50
ITA	0.01	0.45	0.00	0.46
NET	0.00	0.48	0.00	0.48
BEL	0.02	0.49	0.00	0.51
LUX	0.05	0.29	0.00	0.34
UK	0.38	0.00	0.37	0.01
IRE	0.37	0.00	0.32	0.05
DEN	0.21	0.39	0.15	0.45
SPA	0.06	0.32	0.00	0.39
GRE	0.06	0.30	0.00	0.36
POR	0.20	0.23	0.13	0.30
SWE	0.03	0.58	0.00	0.61
FIN	0.46	0.09	0.40	0.15
AUT	0.00	0.48	0.00	0.48

These simulations show how the capital market imperfection matters for the optimal tax rates. The more severe the capital market imperfection the more effective is regional insurance and the less attractive is federal insurance. This is reflected by an increase in the optimal regional tax rate and a decrease in the optimal federal tax rate.

The optimal federal tax rates varies from 6 % (France) to 55 % (Finland) when the measure of the capital market imperfection is set to 0.9. If the capital market imperfection is reduced to 0.7 the preferred federal tax rates varies between 0.0 % (Austria and France) and 0.51 % (Finland). With an application of the veto decision

rule it will not be possible to agree on a federation larger than 6 % of the EU budget with a capital market imperfection of 0.9 and if the value of the capital market imperfection is 0.7 it will not be possible to agree on establishing a federal insurance system at all.

Although our results are based on simulations of the capital market imperfection we think that they indicate the importance of regional insurance when discussing the design of a federal insurance system.

4. Concluding Remarks

In this paper we have extended the analysis of federal insurance by taking into account the effect from regional insurance which is present due to a capital market imperfection. This is a very important consideration since those countries preparing for the EMU all ready have large regional spending (See Buti et al.(1997)). We find that at a given regional tax rate less uncertainty is left to insure the more imperfect the capital market and the smaller are the incentives for federal insurance. The two mentioned insurance forms are furthermore complements, which means that federal insurance gets less attractive in the presence of regional insurance and vice versa. We have argued that if the observed regional tax rates for the countries in the EU are interpreted as if they were set optimally in a world without federal insurance then they define an upper bound on the aggregate tax level. Based on this upper bound we simulate upper bounds of the federal and regional tax rates. Our simulations show that even with small capital market imperfections the veto-decision procedure may rule out the possibilities of a federal insurance system. These simulations did not take into account that the integration of capital markets in the EU and the constraints on regional fiscal policy due to the Maastricht treaty will reduce the measure of the capital market imperfection and thereby increase the incentives for federal insurance. Future research should extend the analysis by implementing some of the decision

models which we could expect with the extension of EU and it will also be fruitful to include a more explicit modelling of the cost from taxation.

5. Literature

Andersen T. M. & Dogonowski R. R., (1998a) EMU and Budget Norms, Forthcoming in Fiscal Aspects of European Monetary Integration, edited by Hallett A. H., Hutchinson M. M. and Hougaard S. E., Cambridge University Press.

Andersen T. M. & Dogonowski R. R., (1998b) Social Insurance and the Public Budget, memo, University of Aarhus.

Andersen T. M. & Dogonowski R. R., (1998c) What Should Optimal Income Taxes Smooth ?, Memo, University of Aarhus.

Barro J. R. (1979) On the Determination of the Public Debt, Journal of Political Economy Vol. 87: 940-971.

Bayoumi Tamim and Eichengreen Barry (1997) Ever Closer to Heaven ? An Optimum-Currency-Area Index for European Countries, European Economic Review, April 1997

Bayoumi Tamim and Eichengreen Barry (1996) Optimum Currency Areas and Exchange Rate Volatility: Theory and Evidence Compared, Memo

Bayoumi T.A and Masson P. R. (1994) Fiscal Flows in the United States and Canada: Lessons for Monetary Union in Europe, CEPR No 1057 and in European Economic Review.

Binmore, Rubinstein and Wolinsky (1986) The Nash Bargaining Solution in Economics, Rand Journal of Economics, Vol 17 (2).

Blanchard O.,(1985) Debt, Deficits and Finite Horizons, Journal of Political Economy, Vol 93, 223-247.

Buiter W. H. & Kletzer K. M. (1990) Reflections on the fiscal implications of a common currency, CEPR Discussion Paper 418

Buti M. et al. (1997) Budgetary Policies during Recessions, European Commission, Economic Papers No. 121, (May) 1997

Delors Report (1989) Report on Economic and Monetary Union in the European Community, Office for Official Publications of the EC, Luxembourg

Del Negro M.,(1998) Aggregate Risk Sharing Across US States and Across European Countries, Working Paper, Yale University

Doyle Maurice (1989) Regional Policy and European Economic Integration, Report on Economic and Monetary Union in the European Community, Collection of Papers, Luxembourg.

Eichengreen Barry (1990) One Money for Europe? Lessons from the US currency union, Economic Policy 10, April, 119-86

Fatás A., (1997) Does EMU Need a Fiscal Federation, Economic Policy, Vol 26, to appear.

Frankel Jeffrey and Rose Andrew (1997) The Endogeneity of the Optimum Currency Area Criteria, NBER Working Paper No. 5700.

Goodhart C. (1996) European Monetary Integration, European Economic Review 40 (1996) 1083-1090

Hoeller P, Louppe M-O and Vergriete P (1996) Fiscal Relations Within the European Union, OECD, Working Paper No 163.

Italianer A. & Vanheukelen M. (1992) Proposals for Community Stabilization Mechanisms: Some Historical Applications, forthcoming in EC. The Economics of Community Public Finance, European Economy, Special Issue.

Kenen P. (1969) The Theory of Optimum Currency Areas: An Eclective View, in Robert A. Mundell and K. Swoboda (eds), Monetary Problems in the International Economy, Chicago: University of Chicago Press

MacDougall Report (1977) Report of the study group on the role of public finance in European Integration, EC, Economic and Financial Series No A13 and B13.

McKinnin R. I. (1963) Optimum Currency Areas, American Economic Review, Vol 53, 717-724.

Mélitz J. and Vori S.,(1993) National Insurance against Unevenly Distributed Shocks in a European Monetary Union, Recherches Economiques de Louvain 59(1-2), 1993

Mundell R. A. (1961) A Theory of Optimal Currency Areas, American Economic Review, 657-664.

Neary, J.P. and Roberts K. W (1980) The Theory of Household Behavior under Rationing, European Economic Review 13 (1), January 1980, 25-42.

Persson Torsten and Tabellini Guido (1996a) Fiscal Constitutions: Risk Sharing and Moral Hazard, Econometrica, Vol. 64, No.3, 623-646.

Persson Torsten and Tabellini Guido (1996b) Federal Fiscal Constitutions: Risk Sharing and Redistribution, Journal of Political Economy, Vol 104, No. 5.

Persson T., Gerard R. and Tabellini G. (1997) The Theory of Fiscal Federalism, What Does It Mean for Europe? In Quo Vadis Europe? edited by Horst Siebert, J.C.B Tubingen.

Sachs Jeffrey and Sala-i-Martin Xavier (1992) Fiscal Federalism and Optimum Currency Areas: Evidence from Europe and the United States. In Matthew Canzoneri, Vittorio Grilli and Paul Masson, eds. Establishing a Central Bank: Issues in Europe and Lessons from the U.S.

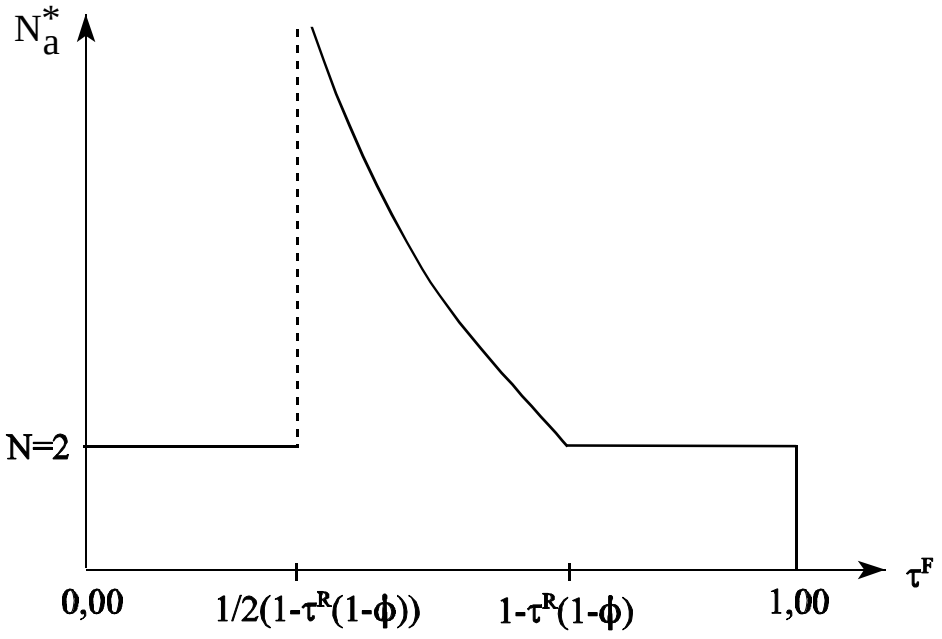
Seater J. J. (1993) Ricardian Equivalence, Journal of Economic Literature 31 (1), 142-190.

Von Hagen, Jürgen (1992) Fiscal Arrangements in a Monetary Union: Evidence from the US. In Don Fair and Christian Boissieuex, eds., Fiscal Policy, Taxes and the Financial System in an Increasingly Integrated Europe. Kluwer Academic Publishers.

Wijnbergen S., (1987) Government Deficits, Private Investment and the Current Account: An Intertemporal Disequilibrium Analysis, The Economic Journal, Vol 97,

596-615.

Appendix (i)



Working Paper

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