Regional Stabilization by Fiscal Equalization?
Theoretical Considerations and Empirical Evidence from Germany

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Abstract

In the context of EMU fiscal equalization schemes have been proposed as a means to stabilize regions against asymmetric shocks. A theoretical analysis shows that besides reducing the cross–sectional income variance the redistributive element of fiscal equalization causes incentive effects for regional governments, undermining the efficient supply of public goods. Yet, this objection is shown to be less important in a situation of insufficient demand, where interregional redistribution actually favors stabilization. In an empirical analysis for Germany, the paper adds support for the finding of significant regional stabilization by fiscal flows. The results indicate that about 17 % of GDP variation across West Germany's states has been removed by fiscal flows during the last two decades. Thus, in Germany where the fiscal federalism is critizised for its heavy equalization the extent of regional stabilization provided by fiscal flows is quite similar to other federal countries.

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Nontechnical Summary

As EMU excludes the exchange rate as a means of adjustment to different economic evolutions among the joining countries fiscal equalization schemes have been proposed as an alternative means to stabilize regions against asymmetric shocks. The intuition is obvious: if some regions suffer from an unexpected slump and others experience an unexpected boom, an income transfer from the booming regions would stabilize income across regions. Yet, a problem with this intuition is that besides reducing the cross–sectional income variance the redistributive element of fiscal equalization causes incentive effects for regional governments. As a part of the income gains from a productivity enhancing policy of regional governments is transferred abroad, an efficient local supply of public goods is incompatible with incentives. But this objection is shown to be of less relevance in a situation of insufficient demand. Here, due to interregional demand spillovers public expenditures are already at an inefficient level and the interregional redistribution may actually improve efficiency by its demand stimulating effect. Hence, it seems difficult to reject fiscal equalization as a means of stabilization solely on theoretical grounds, and it is important to investigate empirically the consequences of fiscal equalization.

In it's empirical part the paper adds support for the finding of significant regional stabilization by fiscal flows from the case of Germany. The empirical analysis is based on a panel of GDP and fiscal flows among Germany's states. Since GDP is probably subject to measurement error, highly reliable employment data from the complete set of the social security files are employed as instruments. Taking into account not only the explicit horizontal fiscal equalization (Finanzausgleich) but also the system of tax revenue sharing (Umsatzsteuer, Einkommenssteuer, Gewerbesteuer), the federal grants to states (Bundesergänzungszuweisungen), as well as the unemployment insurance, the results indicate that about 17 % of GDP variation across West Germany's states has been removed by fiscal flows during the last two decades. Thus, in Germany where the fiscal federalism is critizised for its heavy equalization the extent of regional stabilization provided by fiscal flows is quite similar to other federal countries.

1 Introduction

The European Monetary Union (EMU) excludes the exchange rate as a means of adjustment to different economic evolutions among the joining countries. Some argue that this loss of an instrument is of no importance because the relevance of asymmetric shocks is declining as the process of European integration moves on (e.g., Frankel / Rose, 1997). But, other authors argue that a possible consequence of EMU is increased specialization and, therefore, asymmetric shocks might even become more important (e.g., Krugman, 1993). Although differing, those predictions point to a specific difficulty in discussing the consequences of the monetary union: it constitutes a major step of integration and its consequences are hard to predict from the status quo ante. Facing that situation several economists have studied the experience in existing federations which show some fiscal autonomy of provincial or state governments but share the same national currency. Many authors have pointed to the existence of substantial interregional fiscal flows acting as stabilizers in the presence of asymmetric shocks (e.g., Eichengreen, 1990, Bayoumi / Eichengreen, 1993, Sala-i-Martin / Sachs, 1992). Consequently, given the relatively small budget of the European Union institutions, there seems to be a need for a system of equalizing grants and transfers between the countries joining EMU (e.g., EC Commission, 1977, Goodhart / Smith, 1993).

From a theoretical viewpoint the basic effect of such a *fiscal equalization scheme* is to reduce the dispersion of the cross–sectional distribution across the set of joining countries. Yet, depending on the nature of the cross–sectional income variation there are further consequences. A part of the literature suggests that for purposes of stabilization equalization payments should be triggered by stochastic shocks rather than deterministic differences, which would give the equalization scheme the flavor of an insurance mechanism (e.g., Sala-i-Martin / Sachs, 1992, von Hagen / Hammond, 1998). But, at least because it will be quite difficult to find a consensus of what should be considered as a stochastic income component of the cross–sectional income variation, equalization schemes will always carry elements of redistribution. The theoretical discussion shows that redistributive effects give rise to (dis-)incentives which may result in an underprovision of local public goods. However, the discussion of stabilization policy in a context of equilibrium is somewhat strange and leads to the question why there should be an insurance against temporary shocks (cf. Sinn, 1997) anyway. Yet, in a disequilibrium context regional governments might be trapped in a situation

with insufficient demand, if debt financed stabilization policy is limited because of Ricardian equivalence (see Sala-i-Martin / Sachs, 1992). Especially, this will be relevant in federations where single countries have no own currencies (cf. Krugman, 1993). Using a simple extension of the basic model of fiscal equalization the theoretical analysis shows that redistribution actually increases the stabilizing effect of equalization in this situation, whereas ineffiencies due to disincentive effects play a minor role.

Since fiscal equalization shows ambiguous effects in theory, the case for regional stabilization by means of fiscal equalization mainly rests on the empirical finding that this type of stabilization is in fact significant in all federations. The earlier finding of large stabilizing effects was followed by an upsurge of empirical studies measuring the importance of fiscal flows in stabilizing regional incomes (see von Hagen, 1998, for an overview). The present paper adds empirical evidence for the case of Germany. This case is of interest in this context, since the German states (Länder) have only limited autonomy in taxation but obtain most of their tax resources from taxes shared with the federal level. The lack of taxing autonomy is accompanied by a federal system of fiscal transfers and social security which might have strong regional stabilization effects. Furthermore, with the exception of a simulation study by Pisani-Ferry et al. (1993) pointing to quite large effects, there is to the best of my knowledge no empirical evidence for the German case.

The theoretical section lays out the basic mechanism behind an interregional stabilization by fiscal equalization and gives a discussion of incentive effects of fiscal equalization schemes. In order to obtain more general results, the discussion employs both a standard setting with productivity shocks as well as a disequilibrium context with insufficient demand. The second part then discusses the estimation of regional stabilization effects by fiscal flows in the literature, and adds empirical evidence from the case of Germany. The paper ends with a short conclusion.

2 Theoretical Considerations

From a general viewpoint the case for regional stabilization by means of fiscal equalization flows rests on a reduction of the variance of the cross-sectional distribution of income caused by those flows. Consider the case of N countries with per-capita income Y_i $(i = 1, 2, ..., N)$. Cross-sectional income differences are defined by the distance between country i's per-capita income and the

average income Y:

$$Y_i \Leftrightarrow Y \;=\; Y_i \Leftrightarrow \left(\sum_{j=1}^{N} l_j Y_j\right), \quad \sum_{j=1}^{N} l_j = 1, \tag{1}$$

where l_i denotes country i's population share. The term in brackets is the average per-capita income in the aggregate, i.e. in the joint set of all countries, obtained by weighting the countries' per capita income with their population shares. Fiscal equalization is introduced as a uniform linear tax on income. If the funds are redistributed equally among inhabitants, income per head disposable after redistribution in country i becomes:

$$\tilde{Y}_i \;=\; (1 \Leftrightarrow t)\, Y_i \,+\, tY, \qquad Y \,=\, \sum_{j=1}^{N} l_j Y_j \tag{2}$$

where $\tilde{Y}_i$ denotes disposable income after taxes and transfers. Under the equalization scheme country i gives away tY_i of its income per-capita but receives a proportion t of the average per-capita income Y, making disposable income a weighted average of the two countries' incomes. Consequently, the fiscal equalization scheme shortens the distance between disposable and average income:

$$\tilde{Y}_i \Leftrightarrow Y = (1 \Leftrightarrow t)\,(Y_i \Leftrightarrow Y), \quad i = 1, 2. \tag{3}$$

Taking squares and expectations, it can be shown that the cross-sectional variance of disposable income is only a fraction $(1 \Leftrightarrow t)^2$ of the cross-sectional variance of per–capita income.

$$Var\left(\tilde{Y}\right) = (1 \Leftrightarrow t)^2\, Var\,(Y) \tag{4}$$

Therefore, it can be stated that a fiscal equalization scheme reduces the cross-sectional variance of disposable income relative to actual income. At $t = 1$ both countries receive the same income, and there is no cross-sectional variation left. Note, that the marginal variance reduction is a decreasing function of the tax rate.[1] Hence, especially increases at low tax rates will yield gains in reduced variance.

2.1 Incentive Effects of Fiscal Equalization

So far, the nature of the cross-sectional income variation was not specified. The importance of distinguishing an equalization of stochastic and deterministic income differences can be demonstrated in a simple two country

[1] The marginal variance reduction is: $\frac{\partial Var(\tilde{Y})}{\partial t} = 2\,(1-t)\,Var\,(Y)$.

setting, where per-capita income in each country is additively separable into a deterministic (Π_i) and another stochastic productivity term (ϵ_i):

$$Y_i \;=\; \Pi_i + \epsilon_i, \quad \epsilon_i \sim N\left(0, \sigma^2\right), \quad i = 1, 2, \tag{5}$$

where ϵ_i may be normally distributed with mean zero and variance σ^2. In difference to the cross-sectional income variance addressed above, σ^2 is the income variance of country i. Imposing the above fiscal equalization scheme yields the following equation for disposable income (compare equation (2)):

$$\Leftrightarrow \tilde{Y}_i \;=\; \underbrace{(1 \Leftrightarrow tl_j)\,\Pi_i \;+\; (tl_j)\,\Pi_j}_{\tilde{\Pi}_i} \quad + \quad \underbrace{(1 \Leftrightarrow tl_j)\,\epsilon_i \;+\; (tl_j)\,\epsilon_j}_{\tilde{\epsilon}_i}. \tag{6}$$

Consequently, the fiscal equalization scheme has two effects: it has a stabilizing effect as it averages the shocks but it also has a distributive effect as it averages expected income. This double effect is central to the assessment of fiscal equalization schemes (Sala-i-Martin / Sachs, 1992, Heinemann, 1995). Not only does the redistributive effect introduce strong regional pressures in the policy process, which limit the chances to reach interregional agreements. But, if the deterministic income component is subject to equalization it causes incentives for the regional governments to pursue a policy, which may undermine efficiency.

The incentive incompatibility of fiscal equalization can easily be shown in a model, where government policy has a role in enhancing the economy's productivity. Consider the simple case, where the government increases productivity by providing a factor augmenting (Matsumoto, 1998) public input E_i:

$$Y_i \;=\; \Pi_i E_i^{\eta} + \epsilon_i, \quad 0 \leq \eta < 1. \tag{7}$$

η measures the elasticity of total productivity with respect to the per-capita supply of public inputs. Suppose public inputs are financed by a country-specific tax τ_i on income.

$$E_i \;=\; \tau_i Y_i. \tag{8}$$

If the benevolent government maximizes expected disposable income, the optimum tax rate necessarily fulfills (cf. Barro, 1990):

$$\frac{\partial \mathrm{E}Y_i\,(1 \Leftrightarrow \tau_i)}{\partial \tau_i} \;=\; 0, \quad \text{yielding:}$$

$$\tau_i^* \;=\; \eta, \tag{9}$$

where the optimum tax rate τ_i^* equals the productivity of the public input. In presence of a fiscal equalization scheme, however, the impact on disposable income is reduced, since part of the income generated is transferred abroad. Disposable income in country i becomes:

$$\tilde{Y}_i = (1 \Leftrightarrow tl_j \Leftrightarrow \tau_i)\, Y_i + (tl_j)\, Y_j. \tag{10}$$

Now, the benevolent government chooses a tax rate which fulfills:

$$\begin{aligned} \frac{\partial \mathrm{E}\tilde{Y}_i}{\partial \tau_i} &= 0, \quad \text{yielding:} \\ \tau_i^* &\stackrel{!}{=} \eta\,(1 \Leftrightarrow tl_j) \end{aligned} \tag{11}$$

As the incentive to stimulate productivity is reduced, it comes at no surprise that the government sets a lower tax rate if there is fiscal equalization ($t > 0$). Therefore, an equalization scheme reduces the incentive of joining countries to increase their own productivity by provision of public inputs, and thus may lead to an undersupply of public inputs. The incentive to provide public inputs is reduced most in case of the smaller country, i.e. the country with the smaller population share.

However, if the separation between deterministic and stochastic income components were known, a fiscal equalization scheme could be constructed which only averages the shocks. Then, fiscal flows would act more like an insurance.[2] In fact, the literature provides proposals for the design of equalization schemes which reduce the redistributive effects, either by estimating productivity on basis of historical record, or by focusing on specific problems, for instance, the unemployment insurance (e.g., Italianer / Vanheukelen, 1993). Yet, practical considerations doubt the possibility to find an adequate formula for productivity trend computation (see von Hagen / Hammond, 1998). Also, linking equalization payments to labor market problems will only shift the problem of disincentive effects to the wage negotiations.

2.2 Fiscal Equalization in Disequilibrium

So far, the theoretical analysis has assumed away what some economists will regard as the essential justification of stabilization policy, namely disequilibrium. This section shows that with insufficient demand, the assessment of

[2] Additionally one may discuss cases where the variance of shocks is a function of policy. However, the corresponding moral hazard problems can be considered as part of the general incentive effects.

fiscal equalization flows is more positive, as there are additional stabilizing effects.

Under conditions of a temporary fix price equilibrium country i's aggregate income (Y_i) is equal to the minimum of aggregate supply (YS_i) and demand (YD_i) of country i's production:

$$Y_i \;=\; \min\left(YS_i\,,\,YD_i\right). \tag{12}$$

Aggregate supply is defined by the right hand side of equation (5) above. Aggregate demand per-capita in both countries is assumed to be a linear function of income plus a stochastic term:

$$\overline{YD_i} \;=\; \overline{A}_i + bY_i + u_i, \qquad u_i \sim N\left(0,\sigma_u^2\right), \quad b<1, \tag{13}$$

where $\overline{A}_i$ is an autonomous component, b is the familiar propensity to spend out of income, and u_i is a random variable. For simplicity, it is assumed that the demand shocks are i.i.d. in both countries. In order to determine aggregate demand for the output of country i Dixit / Norman (1980) suggest to simply define shares of total demand relating to a country's own or home output s_H and the foreign country's output s_F, with $s_H + s_F \leq 1$. Then aggregate demand for country i's per-capita production becomes:

$$YD_i \;=\; s_H\overline{A}_i + s_F\overline{A}_j \;+\; bs_HY_i + bs_FY_j \;+\; \underbrace{s_Hu_i + s_Fu_j}_{\substack{\text{composite}\\ \text{dmd. shock}}}. \tag{14}$$

As in familiar income-multiplier analysis own and foreign income enters with a positive sign. If the countries differ in population the foreign income effect (s_F) would have to be weighted with the population size. However, in order to isolate the basic stabilizing mechanism let us abstract from the general problem of different country sizes. The last two terms build a weighted average of the disturbances to residents' demand u_i, u_j. Consequently, depending on the importance of trade the composite demand shocks for the good produced in the countries are positively correlated.

In this simple setting, there are four different constellations, depending on whether each of the two countries is in a demand- or supply-constrained regime. The impact of fiscal equalization in the case where both countries are in a supply-constrained regime was already discussed in the previous sections. Stabilizing and incentive effects from fiscal equalization schemes can be found also in the other cases including the familiar Keynesian regime,

where both countries are demand-constrained and are subject to stochastic demand shocks. For simplicity, the following discussion focuses on this case.

Under conditions of insufficient demand, if government purchases are part of the autonomous demand in country i ($\overline{A}_i$) the impact on income before taxes and transfers can be expressed as:

$$m_1 \equiv \frac{dY_i}{d\overline{A}_i} = \frac{s_H\left(1 \Leftrightarrow bs_H\right) + bs_F^2}{\left(1 \Leftrightarrow bs_H\right)^2 \Leftrightarrow \left(bs_F\right)^2}. \tag{15}$$

Due to trade there is also an impact on income in country j:

$$m_2 \equiv \frac{dY_j}{d\overline{A}_i} = \frac{s_F}{\left(1 \Leftrightarrow bs_H\right)^2 \Leftrightarrow \left(bs_F\right)^2}, \tag{16}$$

which is smaller than the impact on own income ($m_1 > m_2$).[3] Due to spillover effects on each others incomes it is obvious that there are gains from the coordination of fiscal policies, if individual countries only target at the own effect (see Mundell, 1968, and Dixon / Santoni, 1997).

Applying the fiscal equalization scheme, income in the demand equation (14) must be replaced by disposable income defined analogous to equation (2). This amounts to replace the demand shares s_H, s_F by:

$$\tilde{\gamma}_H = s_H \Leftrightarrow \frac{t}{2}\left(s_H \Leftrightarrow s_F\right), \qquad \tilde{\gamma}_F = s_F + \frac{t}{2}\left(s_H \Leftrightarrow s_F\right). \tag{17}$$

If there are sufficiently strong home market effects, own production has a larger share in local demand than in foreign demand ($s_H > s_F$). If the degree of fiscal equalization is increased, the own income effect becomes weaker ($\frac{\partial \tilde{\gamma}_H}{\partial t} < 0$), whereas the cross-country demand effects become stronger ($\frac{\partial \tilde{\gamma}_F}{\partial t} > 0$). This has two consequences for the cross-sectional income variance in the model. First, similar to the above discussion of productivity shocks, fiscal equalization leads to a stronger averaging of demand shocks u_i, u_j causing the variance of demand shocks to decrease. In addition, the impact of shocks on the income of a country decreases. This becomes evident from the reduction

[3] The condition $m_1 > m_2$ is fulfilled, if:

$$s_H\left(1 - bs_H\right) + bs_F^2 > s_F,$$

which is equivalent to:

$$1 > b\left(s_H + s_F\right).$$

of the government expenditure multiplier (see appendix), similar to the well-known effect of taxes raising built-in stability. Consequently the variance of each countries' income before taxes and transfers is reduced. In addition, income insecurity is further reduced with respect to disposable income, since fiscal equalization reduces the variation around the mean, as discussed above.

On the other hand, because the expenditure-multiplier is reduced, also the incentive of governments to pursue an active demand-stimulating policy is reduced by fiscal equalization. And, if governments target at disposable income they are further deterred from pursuing active demand policy, since part of the gain in income is transferred abroad, just as in the case of public inputs. But, since a basic justification for fiscal equalization flows is that local governments are not able to undertake a substantial stabilization policy of their own (see above), this disincentive is of minor importance.

3 Evidence on Regional Stabilization by Fiscal Flows

Given the ambiguous effects of fiscal equalization in theory, the case for regional stabilization by means of fiscal equalization is based on the empirical observation that this type of stabilization is in fact significant in existing federations. Studies in the MacDougall Report reported substantial effects, and more recently Sala-i-Martin / Sachs (1992) have stated that about 40 % of state income variations are removed by the federal tax and transfer system in the US. However, as laid out below these findings have been challenged by several other studies (for an overview see von Hagen, 1998).

Fiscal equalization has been introduced as a means of reducing the cross-sectional variance of income. But, actual fiscal flows in federal economies are not designed specifically for that purpose. Rather, they are paid for specific redistributive purposes, or as part of the social insurance system. Also, they aim at inducing local governments to spend for specific public goods, or they are simply resulting from sharing of tax sources between governments. Consequently, fiscal flows are not tied to deviations in output, but are determined by various regional characteristics, such as productivity, density, and unemployment. As only a part of these characteristics vary with the current regional economic performance it is largely an empirical question how strong the actual stabilizing effects of fiscal flows are.

Following a variance decomposition suggested by Asdrubali et al. (1996) the variance reduction of fiscal equalization flows can be measured by the follow-

Table 1: Stabilization Estimates, Selected Results

Study	(1)	(2)
von Hagen (1992)	0.10	United States
Bayoumi / Masson (1995)	0.30	United States
Asdrubali et al.(1996)	0.13	United States
Obstfeld / Peri (1998)	0.10	United States
Melitz / Zumer (1998)	0.20	United States
Bayoumi / Masson (1995)	0.17	Canada
Obstfeld / Peri (1998)	0.13	Canada
Melitz / Zumer (1998)	0.14	Canada
Melitz / Zumer (1998)	0.19	France
Melitz / Zumer (1998)	0.21	United Kingdom

Notes: column (1) displays estimates obtained from estimations comparable in a broad sense to the slope coefficient in equation (18) using regional data for the federal countries listed in column (2). For the details confer the respective studies.

ing cross-sectional regression in logarithmic differences:

$$\mathrm{d}\log Y_{i,t} \Leftrightarrow \mathrm{d}\log \tilde{Y}_{i,t} = \alpha_t + \beta\,\mathrm{d}\log Y_{i,t} + u_{i,t}, \quad i = 1, ..., N. \tag{18}$$

Intuitively, β measures to what extent a variation in the growth differential between actual and disposable income depends on a variation in actual income. Obviously, if β equals 1, an increase in actual income is fully reflected in the differential between actual and disposable income growth, and, consequently, disposable income is not affected. This is the case of full stabilization. On the other hand, if β equals 0 there is no effect on the growth differential between actual and disposable income. Then, the variation in actual income growth is fully mirrored in disposable income: there is no stabilizing effect. Positive values of β between zero and unity can be interpreted as showing the extent of smoothing by fiscal flows. The obtained estimate will vary across time, and in order to obtain an average effect the equation is applied to pooled cross-sections ($t = 1, ..., T$).

Using this procedure Asdrubali et al. (1996) for the case of the US found that about 13 % of regional shocks were absorbed by fiscal flows. Although this result is in line with the estimate of von Hagen (1992) and others (see Table 1) the coefficient is much smaller than the estimate of Bayoumi / Masson (1995). Using a different technique Sala-i-Martin / Sachs (1992) even obtained a figure of about 40 % for the regional shock absorption due to fiscal flows, an estimate which is in line with the earlier result in the MacDougall

Report (EC Commission, 1977). Asdrubali et al. attribute their lower estimate to the short-term character of the procedure. Fatas (1998) additionally points to the distinction between general stabilizing effects of tax and transfer payments affecting the variance of state income and actual interregional stabilization affecting the cross-sectional income variance (see also von Hagen, 1998). Differences between empirical studies may also arise from a different importance of methodological problems, in particular problems of simultaneity and of measurement error (see Goodhart / Smith, 1993, for a critical discussion). Due to measurement error many of the regional data used for this kind of study may lead to estimates of variance reduction which are biased downwards. And, if there is a stabilizing role of fiscal flows the observed variance of the level of regional activity may be reduced already (see above). As a remedy against both types of problems the literature suggests to employ instrumental variables (e.g., Asdrubali et al.,1996).

A further shortcoming of the analysis is that equation (18) considers only short-term stabilization in income and disposable income. If the tax and transfer system needs time to adjust to changes in the actual income distribution the stabilization effect may increase over time. Then, we should check whether the long-term relationship between income earned and income received is different. Assuming an error-correction process, this can be identified by the level regression:

$$\log Y_{i,t} \Leftrightarrow \log \tilde{Y}_{i,t} \quad = \quad \gamma_t^1 + \gamma_i^2 + \delta \log Y_{i,t} + u_{i,t}, \quad i = 1, ..., N. \qquad (19)$$

Similar to its dynamic analogue this equation deals with income relative to the national mean and includes a time-specific effect (γ_t^1). Since we are not concerned here with general interregional distribution but more specifically with the consequences of changes in the regional income positions the average regional gain from redistribution is captured by a region-specific effect (γ_i^2). Except for this effect, which is differenced out in the dynamic regression, the interpretation of this equation is analogue to the dynamic case: δ measures to what extent a variation in local income is reflected in a variation in the gap between actual and disposable income. If δ is approaching unity an income variation is fully reflected in this gap, and disposable income is not at all affected by income changes. On the other hand, with δ equal to zero the gap between income earned and income disposable is not affected by variations in income, thus, there is no income stabilization.

3.1 Empirical Evidence from Germany

Using the techniques developed in the previous section, this section investigates the stabilization properties of the system of fiscal flows in Germany. The German case is of particular interest because of the low level of taxing autonomy of states in the German federation, which however absorb a large fraction of the consolidated government budget in Germany. In 1996 41.1% of total tax revenues were received by the states' budgets compared to a federal share of 42.3 %, the remainder belonging to communities (Source: Statistisches Jahrbuch). Most of the tax resources available to the states result from taxes shared with the central and the local level governments. The low taxing autonomy of states may lead to a strong stabilization effect since states are prevented from pursuing a procyclical tax policy. The lack of taxing autonomy is accompanied by substantial fiscal equalization flows between German states, which also favors a stabilizing role of fiscal flows.

The effect of fiscal flows is estimated using annual data for income (GDP) in the ten West-German States (Länder) in the period from 1970 until 1996. Table 2 gives an overview of vertical and horizontal payments relative to GDP. The states transfer a part of the tax revenues from personal and corporate income taxation (column 3) as well as from an additional business tax (column 4) to the federal budget. Also the revenues from the value added tax (columns 2 and 9) are shared between the central and the states' budgets. Actually, the states' share is divided among states with the explicit aim of reducing differences in the states' per capita tax revenues. Additionally, there are horizontal transfers (columns 1 and 8) between states as well as direct transfers from the central budget (column 10). Unemployment insurance contributions as well as actual benefit payments are displayed in columns (6) and (11).[4]

Individual contributions and payments received from the public pension system are also listed in the table (column 13 and 14). Yet, taking into account the public pension system in the estimation of stabilization effects is problematic. There certainly will be a temporary stabilizing effect since local contributions to the public pension system vary with the regional level of economic activity but current payments stay constant. A similar type of stabilization results from the integration of capital markets, causing local

[4]The difference between unemployment contributions and unemployment benefits received is absorbed by the budget of the federal employment service. The regional allocation of the other expenditures of the federal employment service is, however, difficult to calculate given the official data.

Table 2: Selected Fiscal Flows for West German States

	Outflows						
	Horiz. Fiscal Equali-zation	VAT	Federal Share Income Tax	Federal Share Business Tax	Federal Taxes	Contr. Unempl. Insu-rance	Sum of Out-flows
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1970	0.19	5.65	4.13	0.32	4.06	0.47	14.82
1980	0.15	6.35	5.24	0.22	3.13	1.20	16.29
1990	0.17	6.08	4.69	0.11	2.72	1.67	15.44
1995	0.38	6.87	4.43	0.20	3.92	2.46	18.26
	Inflows						
	Horiz. Fiscal Equali-zation	Own Share of VAT	Federal Transfers	Unempl. Benefits	Sum of In-flows	Public Pension System	
						Contri-butions	Pay-ments
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1970	0.19	1.70	0.02	0.11	2.02	6.60	6.47
1980	0.15	2.07	0.10	0.68	3.00	7.86	8.16
1990	0.17	2.14	0.13	1.00	3.44	7.47	7.88
1995	0.05	2.12	0.11	1.61	3.89	6.63	7.97

Notes: In Percentage of GDP. Own computations. Figures refer to the total sum of payments among the ten West German Länder relative to GDP.

capital earnings to vary with the national income from capital (see Atkeson / Bayoumi, 1993). Consequently, this type of stabilization does not require the existence of a federal public pension system. Moreover, even under a public pension system a reduction in current contributions will cause a reduction of future payments, therefore, there is no long-term stabilization at first sight. Long-run regional income stabilization is, however, provided in the German case since pensions are calculated on the basis of national rather than regional wage growth. The importance of this effect is difficult to quantify, especially since the German system of labor relations seems to provide this specific type of insurance anyway by equalizing wages across regions (see Burda / Mertens, 1995). Summing up, the public pension system should not be taken into account when calculating the interregional stabilization from fiscal flows. But, in order to enable comparisons with other studies, in the following results including the public pension system are also displayed.

Table 3: Stabilization Effects of Fiscal Flows

Period	Est.	Pensions excl.			Pensions incl.		
		β	t-Stat.	o.i.r.	β	t-Stat.	o.i.r.
1971-1996	SUR	0.099	$(5.63)^{***}$		0.138	$(7.21)^{***}$	
1977-1996	SUR	0.150	$(11.7)^{***}$		0.235	$(19.4)^{***}$	
1977-1996	3SLS	0.172	$(13.3)^{***}$	0.45	0.242	$(40.3)^{***}$	0.36
		δ	t-Stat.		δ	t-Stat.	
1970-1996	SUR	0.118	$(30.0)^{***}$		0.164	$(34.8)^{***}$	
1976-1996	SUR	0.139	$(42.6)^{***}$		0.241	$(77.4)^{***}$	

Notes: Estimates of equations (18) and (19). All regressions employ per-capita income series. The 3SLS estimates employ equation-specific instruments, thus they constitute GMM estimators with conditional homoscedasticity. t-Statistics in parentheses. Significant coefficients are marked with one, two or three stars for levels of 10%, 5%, and 1%. o.i.r. denotes the P-value of the test of overidentifying restrictions.

Table 3 displays the estimates of stabilization effects according to the specifications suggested above. A more detailed description of data sources and definitions is given in the appendix. The β and δ estimates are obtained by means of full information methods in order to take into account the covariance of GDP between states. Depending on whether there are instrumental variables employed, estimation is carried out using Seemingly Unrelated Regression (SUR) or Three Stage Least Squares Estimation (3SLS), using, however, equation-specific instruments. The results for the total period 1971-1996 suggest that vertical and horizontal fiscal flows between West German states on average removed about 10% or 14 % of the short run differences in these states' GDP growth, depending on whether the public pension system is included. However, it was already pointed out that estimates may be biased because of endogeneity as well as errors in variables. Therefore, an instrumental variable approach was also carried out. Besides lagged values of GDP and population growth, lagged values of total employment growth as reported in the statistic of employees (Beschäftigtenstatistik) are added as instruments. Compared to other data this series is considered quite reliable as it is obtained from the complete set of social security files at the federal

employment service (Bundesanstalt für Arbeit). Since data are not available for the whole period, the instrumental variables estimation was carried out for the period 1977-1996. The resulting figure of about 17.2 % (24.2 %) is higher than the basic estimate. But, since also the SUR estimate for this period is higher, the difference is partly attributable to the general increase in fiscal flows in the seventies, which was already evident from Table 2. The estimates for long-run income stabilization are quite similar in size both for the total as well as for the reduced period. However, they simply represent the long run rather than a causal relationship, as no instrumental variable technique was used, since the set of instruments employed in the differenced equation was rejected to be exogenous in the level regression.

Whereas the empirical investigation has focused on the states in West Germany, fiscal flows are probably much more important in reducing the income difference between East and West Germany. This might be regarded as an example of large interregional flows within a monetary union (e.g., Obstfeld / Peri, 1998). Yet, this case is certainly peculiar, as the payment of transfers is related to consequences of more than 40 years of German separation, rather than beeing a "shock" occuring incidentally within German monetary union. But, when focusing on the states in the west, one would expect different conditions after unification, due to larger overall outflows. In fact, Table 2 reports an increase in outflows between 1990 and 1995 which is stronger than the increase in inflows. This points to an increase in stabilization effects after unification.

Concluding the analysis of the case of West Germany's Länder, it can be stated that fiscal flows have reduced the cross-sectional variance of income relative to GDP in the West German states in the last two decades by about 17 % on average. Being quite below the range of 34-42 % obtained from simulation exercises by Pisani-Ferry et al. (1993) this estimate is in line with the evidence from other federal countries.

4 Conclusion

Whereas it is straightforward to show that fiscal equalization will reduce the cross-sectional income variation, it may be critized because of its adverse incentive effects. The theoretical discussion has shown that the disincentives from redistribution will undermine the efficiency of the allocative function of the public sector. In order to prevent those effects one might think of a special design of the fiscal equalization scheme which limits the redistribu-

tion of deterministic productivity differences. But, it will be quite difficult to come up with a consensus of what is to be considered as a stochastic income component. However, in a disequilibrium with insufficient demand, the redistributive element of fiscal equalization will actually favor the stabilization of the regional economy against demand shocks. And, disincentives effects are probably less important in the disequilibrium with insufficient demand, because the reduction of incentives to pursuit an active regional fiscal policy conflicts with the precondition that regional governments are not able to undertake such a policy.

Turning back to the issue of European Monetary Union it is obvious that the budget of the EU institutions is small compared to the central budget in federal states such as Germany or the US. Actually, with the Edinburgh Agreement 1992 the European Council has set an overall ceiling for own resources of 1.27 % of each members GNP. The expected cross-sectional variance reduction of a fiscal equalization scheme of that size can be computed from equation (4) at 2.5 %. This is, of course, much smaller than the 17 % figure found for Germany in the present study. Yet, the actual variance reduction from the EU budget will be different, since contributions are not strictly related to GDP and transfers from Brussels are not redistributed according to population size. However, the evidence provided for the German case supports the view that the importance of stabilization by fiscal flows was overestimated by the study of Sala-i-Martin / Sachs (1992) and the earlier MacDougall Report (EC Commission, 1977).

A Income Effects in the Demand Constrained Case

In a setting with fiscal equalization the government-expenditure multiplier $\tilde{m}_1$ is obtained by inserting the modified demand shares into equation (15). The derivation with respect to t yields:

$$\frac{\partial \tilde{m}_1}{\partial t} = \Leftrightarrow 0.5 \frac{(s_H \Leftrightarrow s_F)}{(1 \Leftrightarrow b(s_H \Leftrightarrow s_F))^2} < 0. \quad (20)$$

The effect of the degree of fiscal equalization on the foreign income multiplier is just the opposite:

$$\frac{\partial \tilde{m}_2}{\partial t} = \Leftrightarrow \frac{\partial \tilde{m}_1}{\partial t} > 0. \quad (21)$$

As the variance of income before taxes and transfers is:

$$Var(Y_i) = \left(\tilde{m}_1^2 + \tilde{m}_2^2\right) \sigma_u^2, \quad (22)$$

it can be shown to decrease with the degree of fiscal equalization:

$$\frac{\partial Var(Y_i)}{\partial t} = 2\left[\tilde{m}_1 \Leftrightarrow \tilde{m}_2\right] \frac{\partial \tilde{m}_1}{\partial t} < 0 \quad (23)$$

B Data Sources and Definitions

Income: The income data refer to GDP per-capita in prices of 1991. Data on GDP are obtained from the states' national accounts (Volkswirtschaftliche Gesamtrechnungen der Länder). Population is defined as yearly average population obtained from the German statistical yearbook (Statistisches Jahrbuch). As there are no reliable data on states' prices the aggregate GDP deflator is used. Source: national accounts.

Horizontal Equalization: Transfers between states (Finanzausgleich) are obtained from the finance report (Finanzbericht) published annually by the federal ministry of finance (Bundesministerium der Finanzen).

Value Added Tax (VAT): The reported distribution of VAT revenues constitutes only a weak measure of VAT incidence. Therefore states' outflows of VAT resources are computed by applying the share of VAT in national GDP to the states' GDP. However the actual distribution of VAT revenues among states is taken from the official fiscal revenue statistics and takes into account horizontal equalization between states.

For the years 1991-1996 the states' unification contributions (for instance to the Fonds Deutsche Einheit) are included in the federal share. Source: German statistical yearbook (Statistisches Jahrbuch), various issues.

Federal Share of Income Tax: Federal share of personal and corporate income tax revenues. Source: German statistical yearbook (Statistisches Jahrbuch), various issues.

Federal Share of Business Tax: Federal share of business tax revenues (Bundesanteil der Gewerbesteuerumlage). For the years 1991-1996 the federal share is defined including extra shares for unification. Source: German statistical yearbook (Statistisches Jahrbuch), various issues, and Institut Finanzen und Steuern (IFSt), 1997.

Federal Taxes: Taxes levied by the central government including the fuel tax as well as a special unification tax (Solidaritätszuschlag). Source: German statistical yearbook (Statistisches Jahrbuch), various issues.

Unemployment Insurance: Annual contributions to the unemployment insurance as reported by the federal employment service (Bundesanstalt für Arbeit) are allocated among states according to their share in the payroll tax revenues. This procedure assumes the same earnings distribution across states. Annual payments of unemployment insurance (Arbeitslosengeld) as well as benefits to long-term unemployed (Arbeitslosenhilfe) are allocated according to the states' share of total unemployed.

Public Pension System: Annual contributions to the public pension system (Gesetzliche Rentenversicherung) as reported by the federal ministry of labor (Bundesministerium für Arbeit) are allocated among states according to their share in the payroll tax revenues. As in the case of the contributions to the unemployment insurance, this procedure assumes that the earnings distribution is similar across states. Aggregate annual pension payments are allocated according to the states' population shares.

Federal Transfers: Transfers from the central budget to the states (Bundesergänzungszuweisungen, BEZ) are obtained from the finance report (Finanzbericht, see above). The specific grants allocated to Saarland and Bremen for debt reduction (Sanierungs-BEZ) starting in 1994 as well as correction payments to Nordrhein-Westfalen and Bremen in

1991 and 1992 (Nachteilsausgleich) are excluded as their temporal assignment is not known.

States' Employment: Local employment as reported in the social security accounts. The data are referenced at the 30th of June. Source: federal employment service (Bundesanstalt für Arbeit).

C References

Asdrubali, P., Soerensen, B. E. and O. Yosha. 1996. Channels of interstate risk sharing: United States 1963-1990. *The Quarterly Journal of Economics* 111, 4, 1081-1110.

Atkeson, A. and T. Bayoumi. 1993. Do private capital markets insure regional risk? Evidence from the United States and Europe. *Open Economies Review* 4, 303-324.

Bayoumi, T. and B. Eichengreen. 1993. Shocking aspects of European monetary integration. In: Torres, F. (ed.). *Adjustment and growth in the European Monetary Union*. Cambridge: Cambridge Univ. Press, 193-229.

Bayoumi, T. and P. R. Masson. 1995. Fiscal flows in the United States and Canada: Lessons for monetary union in Europe. *European Economic Review* 39, 253-274.

Barro, R. J. 1990. Government spending in a simple model of economic growth. *Journal of Political Economy* 98, 103-125.

Burda, M. and A. Mertens. 1995: Locational competition versus cooperation in labour markets: an implicit contract reinterpretation. In: Siebert, H. (Ed.): Locational competition in the world economy. Tübingen: Mohr, 71-107.

Dixit, A. and V. Norman. 1980. *Theory of international trade*. Cambridge, UK: Cambridge University Press.

Dixon, H. D. and M. Santoni. 1997. Fiscal policy coordination with demand spillovers and unionised labour markets. *Economic Journal* 107, 403-417.

EC Commission. 1977. Report of the study group on the role of public finance in European integration. Commission of the European Communities, Economic and Financial Series, No. A13, Brussels.

Eichengreen, B. 1990. One money for Europe: Lessons from the US customs union. *Economic Policy* 10, 119-186.

Fatas, A. 1998. Redistribution against Insurance: Does EMU need a fiscal federation? *Economic Policy* 26, 165-203.

Frankel, J. A. and A. K. Rose. 1997. The endogeneity of optimum currency area criteria. *Economic Journal* 108, 1009-1025.

Goodhart, C. A. E. and S. Smith. 1993. Stabilization. *European Economy* 5, 417-455.

von Hagen, J. 1992. Fiscal arrangements in a monetary union: evidence from the US. In: Fair, D. E. and C. de Boissieu (eds.). *Fiscal policy, taxation and the financial system in an increasingly integrated Europe*. Dordrecht: Kluwer, 337-359.

von Hagen, J. 1998. Fiscal policy and intranational risk-sharing. *ZEI Working Paper* 13.

von Hagen, J. and G. W. Hammond. 1998. Regional insurance against asymmetric shocks: an empirical study for the European Community. *The Manchester School* 66, 3, 331-353.

Heinemann, F. 1995. *Die Finanzverfassung und Kompetenzausstattung der Europäischen Union nach Maastricht*. Baden-Baden: Nomos.

Italianer, A. and M. Vanheukelen. 1993. Proposals for Community stabilization mechanism: some historical applications. *European Economy* 5, 493-510.

Krugman, P. 1993. Lessons of Massachusetts for EMU. In: Torres, F. (ed.). *Adjustment and growth in the European Monetary Union*. Cambridge: Cambridge Univ. Press, 241-261.

Matsumoto, M. 1998. A note on tax competition and public input provision. *Regional Science and Urban Economics* 28, 465-473.

Mélitz, J. and F. Zumer. 1998. Regional redistribution and stabilization by the centre in Canada, France, the United Kingdom and the United States: new estimates based on panel data econometrics. *CEPR Discussion Paper Series* 1829.

Mundell, R. A. 1968. *International economics*. Macmillan: New York.

Obstfeld, M. and G. Peri. 1998. Asymmetric shocks: regional non-adjustment and fiscal policy. *Economic Policy* 26, 207-259.

Pisani-Ferry, J.; Italianer, A. and R. Lescure. 1993. Stabilization properties of budgetary systems: a simulation analysis. *European Economy* 5, 511-538.

Sala-I-Martin, X. and J. Sachs. 1992. Fiscal federalism and optimum currency areas: evidence for Europe from the United States. In: Canzoneri, M. B. (ed.). *Establishing a central bank*. Cambridge: Cambridge Univ. Press, 195-219.

Sinn, H. W. 1997. Verlangt der Euro einen Finanzausgleich. Comment on: von Hagen, J. and G. W. Hammond: Coping with aymmetric shocks in EMU: the insurance approach. in: Mayer, O. G. and H.-E. Scharrer (eds.): *Schocks und Schockverarbeitung in der Europäischen Währungsunion*. Baden–Baden, 215-219.