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**Fiscal Policy and
Intranational Risk-Sharing**

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by

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Abstract

A general feature of national fiscal systems is that they provide buffers against regional fluctuations in output and employment by redistributing income between the different regions of a country. Recent literature in connection with European monetary integration has stressed the insurance aspect of this function: Through the fiscal system, regions obtain insurance against asymmetric shocks. In this paper, we review the literature on risk-sharing through fiscal mechanisms. While consumption smoothing would call for full risk-sharing among regions, moral hazard problems, political economy problems and considerations of macro economic stabilization reduce the optimal degree of risk sharing. This may explain why empirical research generally finds that intranational risk-sharing based on fiscal policy seems rather modest.

I. Introduction

A fundamental feature of the modern state is to provide risk-sharing arrangements for its citizens. In this paper, we focus on the state as a provider of intranational risk-sharing, defined as sharing income risk among the inhabitants of the different regions of a state. State-provided intranational risk-sharing occurs, when a nation's fiscal system redistributes income across regions in response to unforeseen economic developments. This can take a variety of forms in practice. Often, it is simply a by-product of general welfare and tax-transfer systems. In some federal states, e.g., Australia, Germany, and Canada, intranational risksharing is provided by fiscal mechanisms designed for the horizontal redistribution of income among subcentral governments. In the US and elsewhere, intranational risksharing is the product of budgetary transfers from the central government to regional or local governments. Such mechanisms are generally based on equity considerations: Protecting the individual against economic hardship is part of the solidarity defining a society. As Delors (1989, p. 89) puts it in his plea for a fiscal risksharing mechanism among the members of the European Monetary Union (EMU),

"... in all federations the different combinations of federal budgetary mechanisms have powerful "shock-absorber" effects dampening the amplitude either of economic difficulties or of surges in prosperity of individual states. This is both the product of, and the source of the sense of national solidarity which all relevant economic and monetary unions share."

Furthermore, intranational risk-sharing has an obvious aspect of intranational economic stabilization. Channeling income from prospering regions to regions in distress can help attenuate asymmetries in the cyclical fluctuations of different regions belonging to the same country and produce a more even economic development across all regions. This aspect has gained particular attention in the context of EMU in the past 25 years. Starting with the MacDougall Report (European Commission, 1977), many economists have argued that a viable EMU requires a fiscal transfer mechanism to deal effectively with "asymmetric" shocks, i.e., economic disturbances that affect its different regions in different ways. More recently, Sachs and Sala-i-Martin (1992) claim that a successful EMU must be vested with instruments for regional redistribution comparable to those existing in the US. Although their empirical analysis has been the subject of a large debate, the basic argument, that the loss of the exchange rate channel for adjustment to asymmetric

shocks must be compensated by an appropriate fiscal policy tool to avoid large and protracted regional swings in economic growth and unemployment has received wide acceptance (e.g. Wyplosz, 1991; Frenkel and Goldstein, 1991, Pisani–Ferry et al, 1993).

Section II of this paper discusses the principles of intranational risksharing, including the moral hazard problems involved and some aspects of political economy. Section III reviews the empirical evidence of intranational risksharing provided by fiscal mechanisms in the US and other countries. In contrast to the general acceptance of the claim that viable monetary unions need such mechanisms, the empirical literature suggests that fiscal policy contributes relatively little to the stabilization of asymmetric in most federal systems. Section IV develops an argument to resolve that puzzle. We show that regional asymmetries in the propagation mechanisms of fiscal and monetary policy may lead to a conflict between stabilizing regional income fluctuations around average national income and stabilizing regional incomes over time, and a conflict between stabilizing asymmetric shocks and stabilizing aggregate shocks at the national level. If such asymmetries are large, large-scale fiscal mechanisms for intranational risksharing may not be desirable.

II. Principles of Intranational Risk-sharing

Economists have approached intranational risk-sharing from two ends. One strand of the literature considers risksharing among consumers inhabiting different regions as a special case of consumption smoothing (e.g. Asdrubali et al, 1996; Atkeson and Bayoumi, 1993; van Wincorp, 1995; Athanasoulis and van Wincorp, 1998). The basic question is, to what extent consumers of a given country are able to diversify regional risk. The other strand of the literature starts from optimum-currency area considerations and regards intranational transfer mechanisms as an alternative to flexible exchange rates and other market mechanisms for regional economic stabilization of output and employment (e.g., Mundell, 1961; Kenen, 1969; Wyplosz, 1991; Goodhart and Smith 1993; von Hagen and Hammond, 1998).

II.1. Consumption Smoothing

In a world of complete capital markets, all risk-sharing would be provided by capital markets.¹ Consumers would insure themselves against region-specific shocks by holding portfolios that pay higher returns when their incomes out of economic activities in their own region are low. As a result, consumption would be highly correlated across regions, and interregional consumption correlations would be stronger than interregional income correlations.²

When capital markets are incomplete, however, consumption smoothing can be provided by fiscal transfers of income across regions. Consider a country composed $i = 1, \dots, n$ regions.³ The representative consumer in each region receives an income y_{it} , which is a random variable with expectation y_{0i} and a fixed variance. We abstract from private sector saving, for simplicity.⁴ Thus, in the absence of a central government fiscal policy the representative consumer's budget constraint in each region is $c_{it} = y_{it}$.

If the representative consumers are risk averse, a central government can make them better off by using fiscal policy to pool income risk across the regions. Assume that the central government can employ three types of instruments for this purpose, a set of state-independent taxes τ_{0i} , state dependent-taxes $\tau_i(y_i)$, and state-dependent transfers $g_i(y_i)$. Assume, further, that inter-regional equity considerations constrain tax policies such that the marginal income tax rate is the same in all regions. Budget balance for the central government requires

$$\sum_{i=1}^n [\tau(y_{it} - y_{0i}) - g_{it}] = 0 = \sum_{i=1}^n \tau_{0i} . \quad (1)$$

¹Asdrubali et al (1996) distinguish between capital markets and credit markets. While this distinction is useful in their analysis for statistical reasons, we use the term "capital markets" in the common, more general sense of financial markets.

² There is an obvious analogy here with models of international risk sharing tested in the context of tests of international capital mobility, e.g. Backus et al. (1992).

³See Fatas (1998) for a similar exposition.

⁴Alternatively, one might assume that y_{it} contains asset incomes and is defined net of saving.

Finally, let the transfers paid to all regions be the same, $g_{it} = \tau (y_t - y_0)$, where y_t denotes average national income and y_0 its expected value. The consumer's budget constraint then is $c_{it} = (1-\tau)(y_{it} - y_{i0}) + \tau(y_t - y_0) - \tau_{i0}$.

Consider, first, the case of purely state-dependent taxes and transfers, so that fiscal policy has no element of pure redistribution. Optimal intranational risk-sharing is obtained by choosing τ minimizing the variance of consumption, c_{it} . For region i , the optimal tax rate is

$$\tau^{*i} = \frac{w_i(w_i - \rho_i)}{1 + w_i(w_i - 2\rho_i)}, \quad \text{where } w_i = \sqrt{\frac{\text{var}(y_{it})}{\text{var}(y_t)}}. \quad (2)$$

Here, ρ_i is the correlation between region i 's income and the country's average income.

Equation (2) bears a number of insights. Region i 's optimal tax rate depends on the correlation of its income with the country's average income, and on the relative variance of its income compared to average income. If all shocks are uncorrelated and identically distributed, optimal intranational insurance amounts to full equalization of all stochastic incomes, $c_{it} = y_{i0} + (y_t - y_0)$. More generally, however, this is not true. For high-risk regions ($w_i > 1$), the optimal tax rate increases with the correlation of its income with average income. For $\rho_i < 2w_i/(1+w_i^2)$, the optimal tax rate increases as the variance ratio increases, i.e., high-risk regions desire more insurance. In general, regions with different risk characteristics desire different tax rates.

Thus, a single state-contingent tax rate that is optimal for all regions cannot be chosen. To make consumers in all regions agree on the same rate, the central government can use the state-independent taxes to implement side payments between regions, compensating those that are further off from their welfare maximizing tax rate (Persson and Tabellini, 1996b). In such a scenario, high-risk regions would pay a risk premium to low-risk regions to compensate the latter for providing more insurance that they would themselves desire.

II.2. Regional Stabilization

The other approach to intraregional risk-sharing derives from the theory of optimum

currency areas (Kenen, 1969; Mundell, 1961) and considers the consequences of losing the exchange rate channel of adjustment to asymmetric shocks between regions sharing the same currency for the stability of these regional economies (e.g. Wyplosz, 1991; Goodhart and Smith 1993; von Hagen and Hammond, 1998). The macro economic perspective brings a broader range of alternative adjustment mechanisms into the picture. Apart from capital markets, these are wage and price adjustment to regional shocks and migration of labor between regions. Ingram (1959) first noted the potential usefulness of interregional fiscal transfers to achieve a greater degree of regional income and employment stability, if market mechanisms do not provide sufficient regional stabilization. The macroeconomic perspective allows to consider fiscal transfers paid to regional governments instead of individual consumers.

The classical case under this approach was first presented by Mundell (1961). Consider an autonomous shift in aggregate demand which reduces the demand for the products of one region and raises the demand for the products of the other region. If each region had its own currency and the exchange rate was flexible, the decline in income in the first region would cause its currency to depreciate. Sticky prices imply that this would cause the relative price of its products to fall both at home and in the other region. The result would be an increase in domestic and export demand which would partly offset the initial demand shock. Thus, exchange rate adjustment contributes to stabilizing the economies in both regions.

If the two regions share the same currency, other mechanisms for adjustment must play this role. While the required relative price adjustment could still work through output price and wage adjustments, prices and wages do not seem sufficiently flexible in practice.⁵ This leaves factor movements, and movements of labor in particular as alternative market adjustment mechanisms.⁶

⁵ Hochreiter and Winckler (1995) present empirical evidence suggesting that real wage flexibility increased under the “hard” peg of the Austrian Schilling to the DM. Nevertheless, the role of price and wage flexibility in adjusting to regional shocks seems very limited in practice as Obstfeld and Peri (1998) for the US, Canada and European countries.

⁶The importance of labor mobility for the operation of a common currency was first stressed by Mundell (1961).

As workers move from the first to the second region, full employment output would adjust to the shift in demand.

If labor markets do not provide sufficient adjustments either, fiscal transfers between the two regions can do the job. Specifically, taxing the prosperous region and paying the proceeds to the region in distress restores aggregate demand there and reduces aggregate demand in the former region. The same result can be obtained by increasing central government spending in the depressed region and reducing it in the prospering region.

Regarding fiscal transfers as a substitute for nominal exchange rate adjustment has an important implication. The literature generally agrees that nominal exchange rate flexibility accelerates economic adjustment to asymmetric shocks, but it is not a necessary condition for adjustment in the long run. Even if prices and wages are sticky and labor migration is slow, regional markets sharing the same currency should eventually adjust to asymmetric shocks. This suggests that fiscal transfers offsetting temporary asymmetric shocks are more important to secure the viability of a monetary union than transfers tied to permanent shocks. The resulting limitation of intranational risksharing to temporary shocks seems much less natural under the consumption-smoothing approach where insurance against both temporary and permanent shocks is considered.

Fiscal transfers offsetting temporary asymmetric shocks between regions can obviously be carried out in a fully discretionary, case-by-case manner. Mundell's analysis bears little relation to intranational insurance *per se*, if insurance is understood to imply an *ex ante* guarantee that transfers be paid when asymmetric shocks occur. However, constitutional rules ensuring transfer payments between regions or the existence of a central budget providing for appropriate transfers can give assurance to all regions involved that payments will be executed should they be hit by adverse shocks in the future. Such assurance may be important to make the promise of paying transfers to regions in distress credible. The literature on EMU (Delors, 1989; Wyplosz, 1991; Pisani-Ferry et al, 1993) has emphasized the importance of credible promises of fiscal transfers for a country's willingness to surrender its monetary autonomy.

II.3. Mutual Insurance versus Self-Insurance

In principle, regional governments can self-insure their regions against transitory shocks by borrowing and lending in the national or international capital market. In our example above, the depressed region's government could borrow and spend the proceeds on domestic output, while the prospering region's government would invest its higher tax revenues in national or international assets. Since the issue is insurance against transitory shocks, a region's borrowing and lending would be zero on average over long time horizons. Thus, no fiscal mechanism spanning across regions would be required.

However, self-insurance of this kind requires that regions in distress have access to the capital market. In the presence of credit rationing, this may not be the case. Self-insurance then requires that a region's net position in the capital market is never negative, which demands the accumulation of a sufficiently large capital fund over time. The cost of this fund in terms of consumption foregone makes self-insurance less attractive than intranational insurance. Regions, particularly if they are small, may also face higher borrowing rates than lending rates in the market. If so, the average cost of self-insurance is positive even if the average level of borrowing is zero, and the cost is larger, the larger the variance of the shocks insured. Capital market imperfections are thus important to justify the preference for intranational insurance.

Bayoumi and Masson (1997, 1998) point to another advantage of intranational insurance. Self-insurance implies that increased government spending during a recession is matched by a future tax liability. Rational, forward-looking consumers anticipate the future tax payments and reduce consumption accordingly. Under intranational insurance, in contrast, transfers paid to a depressed region do not increase that region's expected future tax liabilities, if the expected value of future asymmetric shocks is zero and the insurance scheme is balanced across regions. Under these assumptions, intranational insurance is a more effective tool of regional stabilization. Interestingly, Bayoumi and Masson report evidence from Canada suggesting that the demand effect of payments to provinces resulting from intranational insurance is positive and significant, while debt-financed central government transfers to the provinces have no significant demand

effects.

II.4. Moral Hazard Problems

Like all kinds of insurance, intranational insurance is plagued with moral hazard problems.⁷ Moral hazard problems arising in the context of unemployment insurance and other welfare programs are well understood and need no elaboration in our context, though intranational insurance based on such mechanisms obviously suffers from the same problems. In our more special context, two specific aspects of moral hazard deserve attention.

One regards the incentive of regional governments participating in intranational insurance to invest in risk-avoidance strategies. Persson and Tabellini (1996a) show that a government's incentive to raise local taxes and spend the proceeds on projects that make negative asymmetric shocks less likely in the home region is reduced by the prospect of transfers from other regions when such shocks hit. With decentralized policies geared at risk-avoidance, local governments invest too little in such activities. The implication is that investment in risk-avoidance strategies should not be left uncoordinated between the regional governments. A central government providing intranational insurance will find it preferable to centralize policies aiming at risk-avoidance or to subsidize investment in such strategies by the regional governments in order to increase the level of their investment. Thus, moral hazard creates an "incentive complementarity" (Persson and Tabellini, 1996b), in the sense that making intranational insurance a central government program raises the incentive to create further central government programs related to regional risk.

The other moral hazard problem regards the effectiveness of market mechanisms for adjustment to transitory, asymmetric shocks. Migué (1993) argues that, since taxes and transfers are generally distortive in practice, redistributive policies reduce the incentive for private individuals to adjust to regional shocks. Here, it is particularly important to go beyond Mundell's example and

⁷von Hagen (1993), van der Ploeg (1991), Wyplosz (1991), Goodhart and Smith (1993) all warn of the potential moral hazard risk involved in interregional insurance in a European Monetary Union. Courchene (1993) points to the example of Quebec which maintained a higher minimum wage than other Canadian provinces in the 1970s and was able to shift the cost of higher unemployment in bad times on to the federal budget.

consider supply shocks. Individuals who receive transfer incomes from the central government when their region fares badly, may see less reason to accept wage cuts, to move into other industries or to move into other regions. The implication is that central-government provided intranational insurance can reduce the effectiveness of market mechanisms for adjustment.

Obstfeld and Peri (1998) discuss one important example for this, namely labor market adjustment to regional, asymmetric shocks. They show that regional differences in unemployment rates are much more persistent within European states than within the US, and that interregional migration within European states contributes much less to the adjustment to asymmetric shocks than it does in the US. Since cultural and language barriers, which are often referred to explain the slow labor market adjustment across European states, do not exist within these states, but fiscal transfers paid in response to asymmetric shocks are much larger in European states than in the US, Obstfeld and Peri interpret this observation as showing that the generous welfare programs in Europe reduce the incentive for workers to move in response to economic shocks. In doing so, European transfer programs reduce the effectiveness of labor market adjustment.

While the logic of the argument is compelling, interpreting the evidence is difficult, as the causality might be reversed. Countries where markets adjust sluggishly for whatever reason would likely choose higher levels of intranational insurance. Still, the theoretical arguments and the empirical evidence suggest that full intranational insurance is unlikely to be desirable, and that the choice of an efficient level of intranational insurance is a complicated matter, even more so when intranational insurance is a byproduct of a central government budget or welfare system.

II.5. Political Economy Aspects

Existing mechanisms of intranational risksharing are the product of political choices. The design and size of such programs are, therefore, likely to depend on the political processes by which they are chosen. Persson and Tabellini (1996a,b) present models of federations and federal states analyzing this dependence. In their analysis, federations rely on intergovernmental transfers, while federations implement intranational insurance on the basis of federal government programs.

In Persson and Tabellini's analysis, regions are exposed to uncorrelated regional income shocks which give rise to risk pooling, but which have different risk characteristics. In particular, a region can be "riskier" than others in the sense that it is more often hit by adverse economic shocks. As explained in section II.1., efficient intranational risksharing under such circumstances involves full insurance but requires that a "riskier" region pays a risk premium to the less risky ones. To facilitate this, the insurance must combine state-dependent with state-independent transfer payments, where the latter represent the risk premium. But the existence of state-independent transfers implies a scope for permanent redistribution between regions and creates a source of conflict between citizens of the different regions.

Persson and Tabellini (1996b) show that full insurance combined with the efficient risk premium can be obtained when the intergovernmental transfers are the result of a Nash bargain (or unanimity vote) among the representative agents from each region. In contrast, majority voting in each region separately does not sustain a voting equilibrium with efficient intranational insurance. Moreover, a voting equilibrium in which all regions decide separately on the same combination of state-dependent and state-independent transfers does not exist, since voters in each region will try to exploit the state-independent tax to extract permanent redistribution in their favor from the other regions. With separate votes in all regions, a voting equilibrium can only be reached if the insurance mechanism is limited to state-dependent transfers, and this produces an undersupply of intranational insurance. One interpretation of this is that intranational insurance should be decided at the constitutional design stage of a federation, i.e., be the result of negotiations between the representatives of the regions and subject to a ratification requirement in each region.

If intranational risksharing is provided by a federal program targeting individuals rather than regions and voted in federal referenda in which citizens of all regions take part, Persson and Tabellini show that the efficient intranational insurance can be obtained in a majority vote if all regions have the same risk properties. With different degrees of riskiness, majority voting leads again to inefficiencies. If voters are subject to other kinds of risk in addition to regional income risk, the federal referendum can facilitate the formation coalitions across regional borders allowing

voters to exploit intranational insurance against the latter to insure themselves against other types of risk. As intranational risksharing becomes intertwined with other purposes, such coalitions will vote for too much of it.

III. Empirical Evidence

III.1. Market Adjustment to Asymmetric Shocks in the US

The debate over European monetary integration in the last decade has produced numerous empirical studies of intranational insurance in the US and elsewhere. Most of these studies have focused on the fiscal transfer mechanisms involved. Intranational insurance provided through capital markets is much harder to estimate due to data problems. Only a few studies exist for the US. Atkeson and Bayoumi (1993) use state data from 1966 to 1986 to estimate the extent to which state incomes are insured against state-specific risks through US capital markets. They do this by regressing changes in per-capita incomes earned from capital located in a state on changes in per-capita incomes earned from capital located in the rest of the country, state labor incomes and state capital products. Their estimate suggest that state capital incomes are mainly driven by incomes earned from capital located in the rest of the country, and that a decline in state labor incomes is offset by a small but significant increase in capital incomes. Thus, asset markets provide significant but little intranational insurance. The strong correlation between state consumption (proxied by retail sales) and state incomes suggests also that intranational insurance is far from perfect.

Asdrubali et al (1996) provide a more elaborate study of income smoothing across states. The model they estimate is directly derived from accounting relations and, therefore, involves no further assumptions about consumer choices as Atkeson and Bayoumi's analysis does. Using data from 1964 to 1990, their estimates suggest that capital markets smooth 39 percent of cross-state fluctuations in gross state product, and that credit markets smooth another 23 percent of these fluctuations. This gives financial markets a much larger role in consumption smoothing than Atkeson and Bayoumi's results do. The more direct method of estimation lends more credibility to their results. Athanasoulis and van Wincoop (1998), who estimate the reduction of the standard

deviation of state income due to financial markets at different time horizons, find that financial markets smooth about thirty percent of shocks to gross state products at horizons of 1-2 years, and 35 percent on average over up to 26 years.

III.2. Intranational Insurance through the US Federal Fiscal System

Turning to intranational insurance provided by the federal fiscal system, recent literature has provided a large number of estimates, summarized in Table 1. The numbers indicate the estimated increase, measured in cents, in the net transfers received by a state or region in response to a one-dollar decline of the state's or region's income relative to US average.

The MacDougall Report looked at the issue of intranational insurance by asking to what extent does the federal fiscal system reduce income differences between US states. The same question is asked in Sachs and Sala-i-Martin, who consider the following regression for an answer:

Table 1: Estimates of Federal Intranational Redistribution and Insurance in the US

Author	Type of Transfer	
	Redistribution	Insurance
MacDougall Report	28	
Sachs, Sala-i-Martin	33-40	
von Hagen	47	10
Atkeson, Bayoumi		7
Goodhart, Smith	15	13
Pisani-Ferry et al.		17
Gros, Jones		4-14
Bayoumi, Masson	7-22	7-30
Mélitz, Zumer	16	12-20
Asdrubali et al.		13
Sorensen, Yosha		15
Fatas		11
Obstfeld, Peri	19	10
Athanasoulis, van Wincorp	20	10

Note: Entries indicate the estimated (range of) net federal transfers received by a region in response to a 1-dollar difference in the level or change in state income or product compared to US average income or product.

$$\ln\left(\frac{tax_{it}}{tax_t}\right) = \alpha + \beta \ln\left(\frac{Y_{it}}{Y_t}\right) + trend + residual, \tag{3}$$

where “ tax_{it} ” denotes the taxes paid by region i to the federal government in period t , “ tax_t ” is the national aggregate of tax_{it} , Y_{it} is personal income in region i and year t , and Y_t is the national aggregate of Y_{it} . Sachs and Sala-i-Martin run a similar regression with transfers as the dependent variable. They consider the nine US census regions as geographical units.

Sachs and Sala-i-Martin interpret the coefficient β as a measure of the offsetting effect of the federal fiscal system to region-specific income shocks. Estimating the combined effect of taxes and transfers at 33 - 40 cents to the dollar, they conclude that the federal fiscal system provides very substantial insurance against asymmetric regional shocks, a conclusion that conforms with the MacDougall Report.

But this conclusion is unwarranted. As von Hagen (1992) first pointed out, equation (3) shows by how much the tax liabilities and transfer benefits of a region are reduced or increased relative to the national average, if its income is larger or smaller than the national average by a given amount, without making a distinction between permanent and transitory income differences. Thus, equation (3), like the MacDougall Report, lumps together two very different things provided by a federal fiscal system, namely permanent redistribution to reduce secular income differences between regions, and insurance against asymmetric shocks. von Hagen (1992) proposes to get a better estimate of the second issue by running Sachs’ and Sala-i-Martin’s regression in first differences:

$$\Delta \ln(tax_{it}) = \alpha_t + \beta \Delta \ln(Y_{it}) + Dummies + residual . \quad (4)$$

Rather than estimating a trend, von Hagen allows the intercepts of his panel regression to vary and account for the US business cycle. The dummies are for the oil-producing states. von Hagen uses state gross products as the explanatory variable. As Table 1 shows, the *insurance* effect thus obtained is substantially lower than the Sachs and Sala-i-Martin estimate, while the redistributive effect is about the same.

Subsequent papers have generally accepted the distinction between redistribution and insurance or regional stabilization and come out with estimates that are closer to von Hagen’s

(1992) results. Bayoumi and Masson's (1995) study, who estimate the insurance effect based on the following regression,

$$\Delta\left(\frac{Y_{it} - tax_{it} + transfer_{it}}{Y_t - tax_t + transfer_t}\right) = \alpha_i + \beta\Delta\frac{Y_{it}}{Y_t} + residual , \quad (5)$$

stands out among the later estimates for a relatively high insurance coefficient (see Table 1). But this may be due to a second distinction between this and Sachs and Sala-i-Martin's regression and von Hagen's, discussed more elaborately by Fatas (1998). This is that an increase in the net transfers received by a state may be financed either by a reduction of the net transfers received by all others, which corresponds to intranational insurance, or by an increase in the federal budget deficit, in which case the federal government implicitly undertakes the borrowing on behalf of that state. Neither Sachs and Sala-i-Martin nor Bayoumi and Masson (1995) distinguish between these two possibilities, while the time-varying intercepts in von Hagen's regression can be interpreted to do just that implicitly.⁸ Fatas (1998) shows that accounting for this distinction properly reduces the insurance effect implied by the Sachs and Sala-i-Martin estimate to about 10 cents on a dollar change in relative income.

Méltz and Zumer (1997) compare estimates based on state income and estimates based on gross state products as the measure of regional economic activity. They find that the insurance effect associated with gross-state-product estimates tends to be lower than the effect associated with state-income estimates. Conceptually this raises the difficulty that state incomes include incomes earned from economic activities outside the state. Athanasoulis and van Wincoop (1998) estimate the stabilizing role of the federal fiscal system at time horizons of different lengths. They find that the federal fiscal system reduces the standard deviation of changes in state incomes by about ten percent at an horizon of 1-2 years, and by 15 percent on average over all horizons.

⁸More specifically, Fatas (1998) notes that a necessary condition for intranational insurance is that the correlation between shocks at the state level and shocks at the national level is less than one. Empirically, he finds that the average correlation coefficient between state and aggregate US annual real income growth rates is 0.72.

The study of Pisani-Ferry et al. (1993) stands out in this group for its very different methodology. These authors use a macroeconomic simulation model augmented by a model of budgetary flows within a country based on government accounting relations to assess the tax and transfer effects of asymmetric regional shocks. Despite their different methodology, however, their estimate for the US is similar to most of the post-Sachs and Sala-i-Martin literature.

In sum, the empirical studies of the 1990s confirm that there is a significant intranational insurance provided by the federal fiscal system in the US. While there is still some disagreement about the size of the insurance, the empirical evidence clearly suggests that such insurance is of much smaller magnitude than the redistributive effect of the federal fiscal system, and that the insurance does not offset much more than 10 cents on a dollar change in state income caused by an asymmetric shock.

III.3. Intranational Insurance in Other States

Several studies have presented similar estimates for countries other than the US. Table 2 summarizes these results. Canada is an obvious study object in the context of EMU; it was included also in the MacDougall Report. It is of particular interest, because Canada has an explicit, constitutionally grounded mechanism for horizontal transfers among the provinces, the Canadian Equalization System. Equalization aims at reducing differences in the standards of living between Canadian provinces by compensating the poorer provinces for their less prosperous tax bases. According to Canadian legal tradition, equalization is an outflow of the principle of equality of all citizens before the law.

The MacDougall Report estimated that the Canadian federal system reduces income differences between provinces by 32 cents per dollar. Bayoumi and Masson, based on the regression equation (5), estimate an insurance of 14 cents to the dollar, less than their estimate for the US and put the redistributive effect of the Canadian system at 39 cents to the dollar. Other studies agree with the magnitude of the intranational insurance in Canada, but provide more

different estimates of the redistributive effect.

One difficulty with the Canadian equalization system is that it is designed to bring relatively poor provinces up to a standard defined by the average per capita revenues of Ontario, British Columbia, Saskatchewan, Manitoba, and Quebec (Courchene, 1997). Under the rules of the system, Alberta, British Columbia, and Ontario do not receive equalization payments at all, the remaining provinces that are included in the standard receive a partial offset for a revenue short fall, and those not included in the standard receive full offset for a decline in revenues. At the same time, a poor province receives a transfer when revenues in the provinces included in the standard increase, even if the economy of that province performs like the Canadian average. This shows the emphasis on redistribution rather than intranational insurance, and implies that regressions like equation (5) employed by Bayoumi and Masson and Mélitz and Zumer are likely to misrepresent the working of the system.

Recent literature has also evaluated intranational insurance in France, Germany, Italy, and the UK. The results show a surprising degree of variation across

Table 2: Estimates of Central Government Intranational Redistribution and Insurance in Other Countries

Country/Author	Redistribution	Insurance
Canada		
MacDougall	32	
Bayoumi/Masson	39	14
Goodhart, Smith		12 - 19
Mélitz/Zumer	18	14
Obstfeld, Peri	53	13
France		
MacDougall	54	
Pisani-Ferry et al.		37.4
Mélitz/Zumer	38	40
Germany		
MacDougall	29	
Pisani-Ferry et al.		34-42
Italy		
MacDougall	47	
Obstfeld, Peri	8	3
UK		
Goodhart, Smith		21
Mélitz/Zumer	29	21

Note: Entries indicate the estimated (range of) net federal transfers received by a region in response to a 1-dollar difference in the level or change in state income or product compared to US average income or product.

countries. Mélitz and Zumer and Goodhart and Smith obtain similar estimates for the UK, where intranational insurance seems somewhat larger than in Canada and the US. Mélitz and Zumer find that intranational insurance is substantially larger in France than in the North America. This result is confirmed by Pisani-Ferry et al. (1993) despite their different methodology. While this might suggest that insurance is generally larger in unitary states than in federations, Obstfeld and Peri (1998) estimate that intranational insurance is tiny in Italy. Pisani-Ferry et al (1993) find that intranational insurance in Germany is as large as in France. Thus, the existing evidence allows no clear-cut conclusions about the importance of intranational insurance in federal compared to unitary states.

In sum, the empirical evidence shows that intranational insurance is a significant part of intranational macroeconomics. But the size of the insurance can be very different in different countries, and there is no empirical evidence to answer the question how important it is in practice for the stabilization of the regional economies.

III.4. Intranational Insurance in Europe?

Several studies have recently explored the prospects for fiscal insurance among the countries participating in the future European Monetary Union. Mélitz and Vori (1993) explore the insurability of shocks to the national economies of the European states by estimating their correlations across states. For real incomes, they find that the correlations are positive and large for all EU states except the U.K., Denmark, and Ireland. Since only the latter will be a member of the monetary union, the scope for intra-EMU insurance would be small. Even less scope for insurance is found when the transfers are tied to unemployment rather than real income figures. Fatas (1998) reports a similar result and concludes that nothing much is lost if the European Monetary Union operates without a fiscal insurance mechanism.

von Hagen and Hammond (1997, 1998) evaluate the hypothetical performance of intra-EMU insurance mechanisms against regional shocks. They construct time series of asymmetric shocks from historical data and simulate the transfer mechanism under various assumptions about the

properties of the shocks and the design of the system. Their main focus is on the robustness of the system against changes in the simulation parameters. The results suggest that a satisfactory insurance mechanism against asymmetric shocks can be designed, but that the system would have to be based on very complicated and hence unrealistic formulae to compute the appropriate transfers. Importantly, von Hagen and Hammond find that the quality of the system's performance deteriorates radically with even small changes in the assumptions about the properties of the shocks. Given the complexity of the design, the implication is that the probability of a misdesign is high and the resulting damage considerable.

IV. The Macroeconomics of Intranational Risk-sharing

The literature discussed so far takes the desirability of intranational risk-sharing for the stabilization of regional economies for granted and assumes that there is no conflict between intranational risk-sharing and stabilizing a nation's aggregate economy. In this section, we turn to the macroeconomics of intranational risk-sharing and look at these questions more closely. Conforming with the literature, we assume that intranational risk-sharing is a rules-based approach aiming at reducing income differences between regions through interregional taxes and transfers.

In the appendix, we develop a model of regional macroeconomic stabilization for a country consisting of two regions. A central ingredient of this model is its neo-keynesian flavor, i.e., the assumption that prices and wages are sticky, which allows aggregate demand to have short-run real effects. While one may debate the validity of these keynesian assumptions in principle, they are clearly appropriate for discussing the issue of regional stabilization policy, which is void if aggregate demand policies have no real effects at all. Furthermore, we assume that the two regions have heterogeneous economic structures in the sense that the aggregate demand effect of government spending and the real interest rate elasticities of aggregate demand are different in the two regions. This structural heterogeneity is of key importance for the analysis. Empirically, it is validated by the fact that structural parameters can vary substantially across countries in structural multi-country models, and the observation that monetary policy shocks affect different

regions in different ways in existing monetary unions.⁹ The two regions in our model produce outputs which are imperfect substitutes in demand. Both are affected by demand and supply (wage and productivity) shocks.

Regional fiscal policy, represented in the model by regional government spending, is able, in principle, to offset the effects of relative demand and supply shocks perfectly in this economy. This, however, requires that the individual shocks can be identified and observed as they occur, and that the regional governments coordinate their fiscal policies very closely. Both requirements seem unrealistic in practice, making discretionary fiscal policy unfit for regional insurance against relative income shocks.

IV.1. Intranational Risk-sharing and Regional Stabilization

We consider a transfer mechanism between the two regions that aims at reducing income differentials between the two regions,

$$g = -g^* = -\frac{\alpha}{2}(y - y^*) . \quad (6)$$

The parameter α indicates the degree of insurance, the larger it is, the more closely the regional incomes are tied to national average income. We ask how such a mechanism affects output and prices in the home region in the presence of purely asymmetric shocks. Equations (A5) and (A6) provide the basis for an answer.

Consider, first, the case of a relative demand shock which shifts demand from the home region to the foreign region. Home output falls and so does the regional output price. In the absence of fiscal transfers, this real exchange rate depreciation helps the home region recover partly from the initial shock, the more so, the larger the relative price elasticity of demand. If the latter is taken as a measure of economic integration, asymmetric shocks matter less when the regions are highly integrated.

⁹ For empirical evidence on these issues see von Hagen and Waller (forthcoming).

With symmetric output effects of a fiscal impulse in the two regions, the transfer from the foreign to the home region unambiguously stabilizes both output and prices in the home region. However, if the output effect of a fiscal impulse is larger in the foreign region than in the home region,, the transfer scheme can be counterproductive in the sense that it weakens the economy's self-stabilizing capacity. The reason is that the transfer paid by the foreign region reduces demand there by more than the initial shift in autonomous demand increased it, thus lowering the foreign region's import demand for domestic output. In this case, therefore, home output would be more stable in the absence of a fiscal transfer mechanism.

Consider next the case of a negative relative wage or productivity shock. As before, the fiscal transfer mechanism stabilizes home output unless the impact of government spending of foreign aggregate demand is too large. However, the transfer scheme amplifies the response of the home output price. The reason is straightforward. The transfer increases demand for the home product in a situation where output is down and prices are already rising due to the supply shock. The desirability of a fiscal stabilization mechanism depends, therefore, on the relative size of the price effect and the relative weight of regional price stability in the utility function of the residents of the region. Clearly, when output is inelastic to price changes, the transfer mechanism only raises inflation in the home region and is entirely undesirable.¹⁰

IV.2. Intranational Risk-sharing and National Stabilization

Next, we turn to the implications of the regional stabilization mechanism for aggregate output and price level fluctuations. Equation (A7) in the appendix demonstrates that regional asymmetries in the response of aggregate demand to a fiscal impulse imply that the fiscal transfer mechanism translates purely relative into aggregate fluctuations. The reason is that the transfer lowers (raises) demand in one region by less than it raises (lowers) demand in the other, raising national aggregate demand as a result. In the presence of such asymmetries, the transfer scheme

¹⁰See Holzmann and Herve (1998), who discuss this case in the context of the classical "transfer problem" of international economics.

can, therefore, create a conflict between stabilization policy at the national level and stabilization of the regional economies. For example, a central bank firmly committed to price stability would be enticed to raise interest rates, if the regional stabilization scheme causes aggregate demand to rise following a relative demand or supply shock between the two regions. The monetary restriction would obviously aggravate the recession in the region affected by a negative shock. Thus, in the presence of asymmetric regional responses to fiscal stimuli, the regional transfer mechanism can intensify conflicts between the national monetary and fiscal authorities.

These results were derived assuming equal interest rate elasticities of aggregate demand in the two regions. Releasing that restriction turns the attention to asymmetric reactions to the aggregate shock in the two regions, including asymmetric responses to the common monetary policy. As the income differential now depends on the size of the aggregate shock (see equ. A8), the transfer mechanism triggers income flows between the regions in response to aggregate shocks. For example, if a monetary contraction affects output demand in the home region more than elsewhere, the impact effect will be a greater recession in this area, which makes the home region receive transfers from the other region. As shown in the appendix, the regional stabilization mechanism can increase or reduce the effect of an aggregate shock on aggregate income, depending on the relative size of the regional responses to a fiscal impulse. Thus, in the presence of asymmetries in the regional propagation mechanisms of aggregate shocks and fiscal policy, intranational risksharing can reduce or improve the effectiveness of monetary policy.

V. Conclusions

Intranational risksharing through a nation's tax and transfer system is a fundamental aspect of the fiscal system of developed economies. It can be justified generally by the desire of consumers to smooth consumption over time, and by the desire to stabilize regional output and employment in the absence of exchange rate flexibility between regions. Moral hazard problems and political economy considerations, however, suggest that full risksharing among regions of

asymmetric shocks is not optimal.

The empirical evidence available for a number of countries shows that intranational risk-sharing through the fiscal system is significant in all countries. However, there is a large degree of variation in the size of the intranational insurance provided by the tax and transfer system. In the US, as in most countries for which empirical evidence exists, the actual risksharing seems to be rather modest. The empirical literature shows that the distinction between redistribution and insurance or stabilization is crucial in the proper estimation. Surprisingly perhaps, there is no clear evidence that intranational risksharing is larger in unitary than in federal states. Existing research gives no basis for explaining why countries chose the degree of intranational risksharing they have, and for judging whether the observed degree of risksharing is close to the optimal one.

An important aspect of tax and transfer-based intranational risksharing is that payments cannot be implemented to offset regional shocks directly, since the shocks are not directly observed in practice. Thus, practical implementation of intranational risksharing must rely on rules tying payments to income differentials. Such transfers, however, can increase the variability of regional output and prices, and interfere with the stabilization of the national economy. Interference between regional and national stabilization may be one reason why we do not observe more intranational risk-sharing through the fiscal system in large federations such as Canada and the US.

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Appendix: A Neo-keynesian Model of Regional Stabilization and Risksharing

We consider a “country” consisting of two regions, the home region and the foreign region. A “*” denotes variables of the foreign region. Let y be output, p the output price, r the nominal interest rate, which is common to both regions, m the country’s money supply, and g the fiscal impulse. All variables denote relative deviations from steady state. Output demand in the two regions is

$$\begin{aligned} y^d &= a - c(r - \pi^e) + d(p^* - p) + g, \\ y^{d*} &= a^* - c^*(r - \pi^e) - d(p^* - p) + f^*g^*. \end{aligned} \quad (A1)$$

Here, π^e denotes the expected national rate of inflation, a and a^* shocks to the levels of demand, and $p^* - p$ is the real exchange rate of the home region. With $c^* \neq c$ and $f^* \neq 1$ we allow for some asymmetry in the propagation mechanisms of the two regions. Output supply is characterized by price-setting functions

$$p = w + \theta + \gamma y, \quad p^* = w^* + \theta^* + \gamma y^*, \quad (A2)$$

where w is a nominal wage shock and θ is a productivity shock. Money market equilibrium is given by the condition

$$m + \frac{1}{2}(p + p^*) = y + y^* - \frac{1}{2}br. \quad (A3)$$

For now, we assume that $c^*=c$. Assuming that all current shocks are transitory, we have inflation expectations $\pi^e = -E - 0.5\gamma(y+y^*)$. Taking this into account yields the equilibrium solutions

$$\begin{aligned} y &= \frac{1}{\Delta} [a + g + (2+\gamma)bc(g-f^*g^*) + \phi(f^*-1)g^* + E + D], \\ y^* &= \frac{1}{\Delta} [a^* + f^*g^* - (2+\gamma)bg(g-f^*g^*) + \phi(f^*-1)g^* + E - D], \end{aligned} \quad (A4)$$

where $\phi=(d+.5c)\gamma$ and $\kappa=c(b-.5)$, and where E is the aggregate shock common to both regions and D is the differential shock¹¹.

Consider now the transfer mechanism defined in equation (6). Calculating the equilibrium solutions yields

$$y = \frac{2 - \frac{\alpha(1-f^*)}{\Gamma}}{2(1+2\phi) + \alpha(1+f^*)} [a + \frac{1+(2+\gamma)bc+2\phi}{(1+2\phi)\Gamma} D], \quad (A5)$$

where $\Gamma=1+2(2+\gamma)bc$. The equilibrium solution for the home region’s output price level is

$$p = \frac{1 - \frac{\alpha(1-f^*)}{\Gamma}}{2(1+2\phi)+\alpha(1+f^*)} \gamma a + [1 - \frac{2 - \frac{\alpha(1-f^*)}{\Gamma}}{2(1+2\phi)+\alpha(1+f^*)} \frac{1+bc(2+\gamma)+2\phi}{(1+2\phi)\Gamma} 2\gamma] (w+\theta). \quad (A6)$$

¹¹ The aggregate shock is $E = \phi(a+a^*+g+g^*-\kappa(1+2\phi)(w+w^*+\theta+\theta^*-2m))$ and the differential shock $D=(2+\gamma)bc(a-a^*)+(1+2\phi+(2+\gamma)bc)(w^*-w+\theta^*-\theta)$

Consider first the case of a relative demand shock, $a < 0$. With $0 < f^* \leq 1$, the fiscal transfer mechanism is unambiguously stabilizing both output and prices in the home region. However, if $f^* > 1$, a fiscal transfer scheme weakens the economy's self-stabilizing capacity.¹²

Consider next the case of a negative relative supply shock to the home region, $w > 0$ or $\theta > 0$. Output is stabilized unless f^* is again too large. The response of the output price of the home region, however, is increased by such a mechanism.

Aggregate, national output and prices are:

$$y + y^* = \frac{\alpha}{\Delta}(f^* - 1)(y - y^*), \quad \frac{1}{2}(p + p^*) = \frac{\alpha\gamma}{4\Delta}(f^* - 1)(y - y^*). \quad (\text{A7})$$

With $f^* \neq 1$, the fiscal transfer mechanism translates purely relative into aggregate fluctuations.

To study the implications of asymmetric interest elasticities of aggregate demand, we simplify the analysis and set all asymmetric shocks to zero, i.e., $a = a^*$, $w = w^*$, and $\theta = \theta^*$, implying that $D = 0$. Furthermore, we let $d = 0$. Assuming $f^* = 1$, this yields

$$y - y^* = -\frac{(b - \frac{1}{2})(c - c^*)E}{\Delta' + \alpha(1 + b(2 + \gamma)(c + c^*))}, \quad (\text{A8})$$

$$\Delta' = 1 + (c + c^*)(0.5\gamma + b(2 + \gamma)) + 2bcc^*(2 + \gamma)$$

for the income differential. Thus, aggregate shocks, including monetary policy shocks affect income in the two regions in different ways. With asymmetric effects of fiscal policy in the two regions, the transfer scheme can reduce or amplify the impact of aggregate shocks on the two region's combined incomes, which, in this case is

$$y + y^* = \frac{-(b - \frac{1}{2})c^*}{\Delta'} \left[1 + \zeta + c\gamma - \frac{\alpha}{2}(1 - f^* + \gamma(1 - \zeta f^*)) \frac{1 - \zeta}{\Delta' + \alpha(1 + c^*(1 + \zeta)(2 + \gamma))} \right] E, \quad (\text{A9})$$

where $\zeta = c/c^*$.

¹² This is the case, if $f^* > (1 + \phi + bc(2 + \gamma)) / (\phi - bc(2 + \gamma)) > 1$.

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