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ABSTRACT

Monetary Union and Fiscal Federalism

Does a monetary union need fiscal shock absorbers helping the participating countries to cope with asymmetric shocks? The consensus in the debate over EMU argues that the answer is yes. In this Paper, we revisit the issue, building on a dynamic, general equilibrium framework of regions in a monetary union exposed to asymmetric shocks. We show that interregional taxes and transfers can stabilize regional employment or consumption, but not both. The welfare effects of such a stabilization are, however, ambiguous. In contrast to a popular argument in the EMU debate, interregional taxes and transfers do not reduce the incentives for goods and labour market deregulation in the regions, provided that the degree of trade integration among the regions is large. There is, however, reason to coordinate regional reform policies to avoid adverse effects on the aggregate performance of the union.

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NON-TECHNICAL SUMMARY

Monetary union implies the loss of the exchange rate as an instrument of adjustment to asymmetric shocks affecting the participating countries. Beginning with Robert Mundell's seminal contribution, the literature on monetary union has argued that countries forming a monetary union need adequate fiscal policy tools to provide the proper adjustment to asymmetric shocks. This argument also runs through the debate over European Monetary Union (EMU). For example, the Delors Report argued that EMU needed powerful fiscal shock absorbers to deal with asymmetric shocks to the member states. Delors was later joined by eminent macro-economists in the US such as Feldstein, who predicted that EMU would soon collapse in the absence of a fiscal mechanism absorbing asymmetric shocks.

Much of the debate over this issue in the context of EMU has focused on the empirical question, how important fiscal mechanisms absorbing asymmetric shocks are in existing monetary unions. This literature has now converged on the apparently puzzling result that fiscal flows in existing monetary unions react much less to asymmetric shocks affecting regional output than Mundell's argument seems to suggest.

In contrast, the analysis of the economics of EMU in the 1990s has paid surprisingly little attention to the question how Mundell's proposition stands up in a modern macroeconomics framework. In this Paper, we consider how transfer schemes affect welfare under monetary union in a dynamic general equilibrium with optimizing households and firms and nominal wage rigidities. The regions of this monetary union are affected by asymmetric productivity shocks causing output to fluctuate around its steady-state value. These shocks also affect consumption and employment in the two regions, if there is some asymmetry on the 'demand side' of the two regional economies, i.e. when the home bias in consumption and the elasticity of substitution between the two regional outputs are sufficiently large. Depending on the values of these parameters, consumption and employment in each region can be positively or negatively correlated in response to the productivity shocks. Although the shocks are purely transitory, they have long-run consequences for regional employment and consumption, because they change the regions' relative wealth positions through the current accounts. Within this framework, we explore the properties of an interregional transfer system channeling demand from one region to another. We consider two versions of such a scheme, one that collects taxes and pays transfers directly to and from households in response to asymmetric shocks, and one that keeps taxes paid by households constant and consists instead of intergovernmental transfers.

Our results can be summarized as follows. First, both schemes can be devised such that regional output is completely shielded against the effects of asymmetric productivity shocks. However, the resulting tax and transfer

payments may destabilize private consumption under the first scheme and they do destabilize regional public spending under the second scheme. This implies that the welfare effects of employment stabilization are ambiguous and may well be negative. Furthermore, because the correlation of changes in consumption and employment is ambiguous, stabilizing employment may involve paying transfers to regions where consumption is already high.

Second, a scheme collecting taxes and paying transfers directly to households reverses the long-run effects of asymmetric productivity shocks. An intergovernmental transfer system, in contrast, leaves these effects unchanged. This means that, for a given productivity shock, the two schemes have very different distributional consequences.

Third, the two schemes can alternatively be designed to stabilize regional consumption rather than employment. Since consumption is less responsive to temporary shocks than employment, this requires smaller transfer volumes than stabilizing regional employment.

Fourth, with asymmetry also on the 'production side' of the economies, i.e. different labor supply elasticities, asymmetric productivity shocks change not only the composition but also the aggregate level of output. With a constant money supply, they do, therefore, also affect the monetary union's interest rate and price level. The implication is that a scheme aiming at stabilizing regional employment will interfere with the monetary authority's attempt to stabilize aggregate inflation.

An implication of these results is that large fiscal transfers in response to asymmetric shocks may not be very desirable. Our analysis thus offers several explanations for why we find much less responsiveness of interregional transfers to asymmetric shocks in existing monetary unions than Mundell's conjecture and the subsequent discussion suggested.

Finally, the debate over regional insurance has raised the objection that automatic transfers among regions reduce the incentives of the regional governments to undertake policies of economic reform increasing the ability of their regions to cope with asymmetric shocks. In the final section of our Paper, we address this issue by asking what is the relationship between structural reform policies at the regional level and a system of interregional transfers. We assume that reform policies raise the elasticity of labour supply and ask what effect such reforms have on the expected transfer a region receives for a given negative asymmetric shock. If the effect is negative, labour-market reforms reduce the benefits from the transfer scheme. It is plausible to assume that this would discourage governments from undertaking labour-market reforms. While the results depend on the parameter values of the model, we find another important difference between a scheme paying transfers directly to households and a scheme paying transfers to governments. Specifically, the former is more likely to discourage

governments from undertaking labour-market reforms, while the latter is more likely to encourage such reforms.

I. Introduction

Monetary union implies the loss of the exchange rate as an instrument of adjustment to asymmetric shocks affecting the participating countries. Beginning with Robert Mundell's seminal contribution (1961), the literature on monetary union has argued that countries forming a monetary union need adequate fiscal policy tools to provide the proper adjustment to asymmetric shocks. This argument also runs through the debate over European Monetary Union (EMU). The MacDougall Report (Commission 1977), a study on the feasibility of EMU in the 1970s, suggested that adjustment to asymmetric shocks affecting regions sharing a common currency typically works through the budget of a central or federal government collecting taxes from and paying transfers to these regions. The Report concluded that a monetary union in Europe would need a significant budget at the union level to fulfill this role. Specifically, it recommended a Community budget of seven percent of Community GDP, much larger than the current 1.3 percent.[1] Similarly, the Delors Report (1989) argued that EMU needed powerful fiscal shock-absorbers to deal with asymmetric shocks to the member states. Delors was later joined by eminent macro economists in the US such as Feldstein, who predicted that EMU would soon collapse in the absence of a fiscal mechanism absorbing asymmetric shocks. More recent contributions to the debate over EMU in the 1990s have cast the argument into a framework of regional insurance against asymmetric shocks and proposed that the EMU should be vested with a system providing automatic transfers from regions enjoying relative prosperity to regions in relative distress. Recognizing that any significant increase in the European Commission's budget is politically infeasible, this approach proposes the creation of a European-wide unemployment insurance or of a system of fiscal equalization

[1] Note that the Report was considering a monetary union among a smaller and less heterogeneous group of countries than the current members of EMU; that is, it would likely have recommended an even larger budget knowing who the current members are.

patterned after Germany's *Länderfinanzausgleich*[2] instead. The automatic and non-discretionary nature of such a system would also raise the credibility of the promise to make transfers to regions in distress, an important aspect of any arrangement among sovereign nations.

Mundell's original argument can be summarized follows. Consider two economies with fixed wages and prices producing two output goods which are not perfect substitutes. Assume that output demand exogenously falls in one country and rises in the other, leaving aggregate output the same. In Mundell's Keynesian scenario, output and employment falls in the first and rises in the second country. With two currencies and a flexible exchange rate, the currency of the first country depreciates, and the implied decline in the relative price of its output helps smooth the recession in the first and the boom in the second country. With a fixed exchange rate, however, this relative price effect disappears, and the divergence in economic stance between the two countries becomes larger. This could be avoided by channeling demand from the second to the first country through the public sector, e.g., by increasing taxes in the second and spending the proceeds in the first. In terms of the Keynesian model, this would amount to an inward shift of the IS curve in the prospering country and an outward shift in the country facing a recession. With a proper choice of taxes and expenditures in the two countries, the adjustment mechanism of the flexible exchange rate could be emulated.

Much of the debate over this issue in the context of EMU has focused on the empirical question, how important fiscal mechanisms absorbing asymmetric shocks are in existing monetary unions. This literature, reviewed in section 2 of this paper, has now converged on an apparently puzzling result. Fiscal flows in existing monetary unions react much less to asymmetric shocks affecting regional output than Mundell's argument seems to suggest. In contrast, the debate of the last 40 years has accepted Mundell's basic framework of analysis.

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[2] *Länderfinanzausgleich* is a system of horizontal transfers among the states of the Federal Republic designed to reduce differences in the annual per-capita revenues from the main taxes of the states.

This is significant, as the macro economic model underlying his reasoning, a Keynesian world of fixed wages and prices in which output is determined by demand and supply has no role to play, has long been rejected. Von Hagen (1998) analyzes the properties of regional insurance against asymmetric shocks in a static, neo-Keynesian rational-expectations framework. In that framework, regional insurance may exacerbate fluctuations of output and employment over time and interfere with macro economic stabilization at the union level. Obviously, this casts some doubts on the desirability or regional insurance against asymmetric shocks.

Surprisingly, the analysis of the economics of EMU in the 1990s has paid little attention to the question how Mundell's proposition stands up in a modern macro economics framework. Exceptions are Kletzer and Buiter (1997) and Kletzer (1999), who use dynamic general equilibrium models based on optimizing decisions with capital accumulation and perfect competition to analyze the role of fiscal transfer schemes as a replacement for nominal exchange rate flexibility. In this paper, we consider how transfer schemes affect welfare under monetary union in a dynamic general equilibrium with optimizing households and firms and nominal wage rigidities. Specifically, section three of the paper presents a model of a monetary union whose regions are affected by asymmetric shocks. Section four uses this model to analyze the properties of an interregional transfer system channeling demand from regions enjoying a positive to regions suffering from a negative shock.

Our results can be summarized as follows. First, both schemes can be devised such that regional output is completely shielded against the effects of asymmetric productivity shocks. However, the resulting tax and transfer payments may destabilize private consumption under the first scheme and they will destabilize public spending under the second. As a result, the welfare effects of employment stabilization may well be negative both at the regional and at the aggregate level. Second, a scheme collecting taxes and paying transfers directly to households reverses the long-run effects of asymmetric productivity shocks. An intergovernmental transfer system, in contrast, leaves these effects unchanged. This means that the two systems have

very different distributional consequences.Third, the two schemes can be designed alternatively to stabilize regional consumption rather than employment. Since consumption is less responsive to temporary shocks than employment, this requires smaller transfer volumes than stabilizing regional employment. Fourth, with asymmetry also on the 'production side' of the economies, i.e. different labor supply elasticities, asymmetric productivity shocks change not only the composition but also the aggregate level of output. With a constant money supply, they do, therefore, also affect the monetary union's interest rate and price level. The implication is that a scheme aiming at stabilizing regional employment will interfere with the monetary authority's attempt to stabilize aggregate inflation.

An implication of these results is that large fiscal transfers in response to asymmetric shocks may not be very desirable. Our analysis thus offers several explanations for why we find much less responsiveness of interregional transfers to asymmetric shocks in existing monetary unions than Mundell's conjecture and the subsequent discussion suggested.

Finally, the debate over regional insurance has raised the objection that automatic transfers among regions reduce the incentives of the regional governments to undertake policies of economic reform increasing the ability of their regions to cope with asymmetric shocks (e.g., Migué, 1993; Persson and Tabellini,1996). Persson and Tabellini argue that the implementation of regional insurance in a monetary union might call for a program of union-financed conditional grants to overcome such disincentives. In the final section of our paper, we address this issue by asking what is the relation between structural reform policies at the regional level and a system of interregional transfers. We assume that reform policies involve increasing the elasticity of labor supply and ask what effect such reforms have on the expected transfer a region receives for a given negative asymmetric shock. If the effect is negative, labor market reforms reduce the benefits from the transfer scheme. It is plausible to assume that this would discourage governments from undertaking labor market reforms. While results depend on the parameter values of the model, we find another important difference between a scheme

paying transfers directly to households and a scheme paying transfers to governments. Specifically, the former is more likely to discourage governments from undertaking labor market reforms, while the latter is more likely to encourage such reforms.

II. Regional Insurance Against Asymmetric Shocks: International Evidence

Much of the recent literature on regional insurance against asymmetric shocks has focused on the US and asked how much regional insurance the federal tax and transfer system provides in that context. Table 1 summarizes the main results of that research. 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 fiscal 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 (1991). Both find that the federal fiscal system provides a large offset against regional income disparities, with estimates ranging between 28 and 40 percent.

Von Hagen (1992) first pointed out that the empirical analysis of regional insurance must distinguish between permanent redistribution reducing lasting income differences between regions, and temporary transfers providing insurance against asymmetric shocks. This is because the context of replacing the exchange rate mechanism for adjustment suggests that the focus should be on insurance against temporary shocks. Adjustment to permanent asymmetric shocks, in contrast, remains possible through other adjustment channels even in the presence of a fixed exchange rate, albeit that the speed of adjustment might be slower. Table 1 shows that the *insurance* effect of the federal tax and transfer system is, indeed, substantially lower than suggested by the MacDougall Report or by Sachs and Sala-i-Martin,

while the redistributive effect is large.

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. Mélitz 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.

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

Author	Type of Transfer	
	Redistribution	Insurance
MacDougall Report	0.28	
Sachs, Sala-i-Martin	0.33-0.40	
von Hagen	0.47	0.10
Atkeson, Bayoumi		0.07
Goodhart, Smith	0.15	0.13
Gros, Jones		0.04-0.14
Bayoumi, Masson	0.07-0.22	0.07-0.30
Mélitz, Zumer	0.16	0.12-0.20
Asdrubali et al.		0.13
Sorensen, Yosha		0.15
Fatas		0.11
Obstfeld, Peri	0.19	0.10
Athanasoulis, van Wincorp	0.20	0.10

Note: Entries indicate the estimated (range of) net federal transfers (in dollars) received by a state in response to a 1-dollar difference in the level (redistribution) or annual increase (insurance) in state income compared to US average income.

In sum, the empirical studies of the 1990s confirm that there is a significant fiscal insurance against asymmetric shocks 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.

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, in contrast, estimate an insurance of 14 cents to the dollar, 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.[3]

[3]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, 1999). 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.

Recent literature has also evaluated intranational insurance in France, Germany, Italy, and the UK. The results show a surprising degree of variation across countries. Mélitz and Zumer (1997) and Goodhart and Smith (1993) obtain similar estimates for the UK, where fiscal insurance seems somewhat larger than in Canada and the US. Mélitz and Zumer and Pisani-Ferry et al (1993) find that fiscal insurance is much larger in France than in North America. While this might suggest that fiscal insurance is generally larger in unitary than in federal states, Obstfeld and Peri (1998) show that fiscal insurance is tiny in Italy. Thus, the existing evidence allows no clear-cut conclusions about the importance of federal insurance in federal compared to unitary states. Von Hagen and Hepp (2000) find no insurance against asymmetric shocks provided by the German Finanzausgleich,

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

Country/Author	Redistribution	Insurance
Canada		
MacDougall	0.32	
Bayoumi/Masson	0.39	0.14
Goodhart, Smith		0.12 - 0.19
Mélitz/Zumer	0.18	0.14
Obstfeld, Peri	0.53	0.13
France		
MacDougall	0.54	
Mélitz/Zumer	0.38	0.40
Germany		
MacDougall	0.29	
von Hagen and Hepp	0	0.082
Italy		
MacDougall	0.47	
Obstfeld, Peri	0.08	0.03
UK		
Goodhart, Smith		0.21
Mélitz/Zumer	0.29	0.21

Note: Entries indicate the estimated (range of) net transfers (in dollars) to a region in response to a 1-dollar difference between the level of state income and average national average income or product (redistribution), or a 1-dollar difference between the annual increase in regional and average national income.

and a significant albeit small redistributive effect.[4]

In sum, the empirical evidence shows that fiscal insurance against asymmetric shocks is a significant part of existing monetary systems. 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. A Macro Model of Regional Shocks in a Monetary Union

In this section, we set up a macro economic model of two regions forming a currency area. Each region produces an output good for consumption using a set of intermediate input goods produced with labor supplied by the residents of that region. Output goods are traded between the two regions in perfectly competitive markets; they are imperfect substitutes in consumption. In contrast, intermediate goods are not traded between the regions; they are supplied by monopolistically competitive producers. One may think of these intermediate goods as production-related services. Wages in each region are sticky in the sense of being determined at the beginning of a period and remaining constant throughout. In this setting output is demand determined in the short run, and the adoption of a common currency impacts real economic performance. The regions are populated by consumers characterized by their intertemporal consumption and labor supply choices. Governments in each region collect lump sum taxes used to finance the production of a regional public good. The two regions share the same currency and an integrated money market as well as an integrated bond market.

Call the two regions "home" and "foreign," respectively. Subsequently, we mark variables pertaining to the foreign region with a "*" and suppress time indexes where possible without creating ambiguities. The home region uses an infinite number of intermediate goods,

[4]Von Hagen and Hepp (2000) show that Germany's equalization system provides almost perfect insurance of state budgets against revenue shocks and substantial redistribution of tax revenues among the states. However, state revenues and GDP at the state level are only weakly correlated.

q_j indexed $j \in [0,1]$, and a technology of the CES type, to produce its output good, y,

$$y = a[\int_0^1 q_j^{\varepsilon} dj]^{\frac{1}{\varepsilon}} . \quad \textbf{(1)}$$

In equation (1), “a” denotes regional productivity, which will be subject to stochastic shocks later on. Each intermediate good is produced using labor and a linear technology,

$$q_j = l_j . \quad \textbf{(2)}$$

From equation (1) and profit maximization, the derived demand for each intermediate good is

$$q_j = (\frac{y}{a})(\frac{p_j}{p_1})^{\frac{1}{\varepsilon-1}} , \quad \textbf{(3)}$$

where p_j and p_1 are the domestic prices for intermediate goods of type j and of the domestic output good, respectively. The zero-profit condition for the output good yields the price of this good as a function of output prices,

$$p_1 = \frac{1}{a}(\int_0^1 p_j^{\frac{\varepsilon}{\varepsilon-1}} dj)^{\frac{\varepsilon-1}{\varepsilon}} . \quad \textbf{(4)}$$

Intermediate goods producers operate under conditions of monopolistic competition and set prices with a fixed mark-up over wages, $p_j = \varepsilon\, w$. Similar equations hold for the foreign economy.

Household preferences are given by the intertemporal utility functions

$$u_t = \sum_{s=t}^{\infty} \beta^{s-t}[\ln c + \delta \ln G + \eta \ln\frac{M}{p} - \frac{\kappa}{\alpha} l^{\alpha}] . \quad \textbf{(5)}$$

In equation (5), c is the composite consumption index determined from a CES-type

instantaneous utility function

$$c = [\gamma^{\frac{1}{\theta}} c_1^{\frac{\theta-1}{\theta}} + (1-\gamma)^{\frac{1}{\theta}} c_2^{\frac{\theta-1}{\theta}}]^{\frac{\theta}{\theta-1}} , \tag{6}$$

where γ is the share of home goods in expenditures, θ is the elasticity of substitution between home and foreign goods in consumption, and c_i is the quantity of good i consumed by the household. We assume symmetry of preferences in the sense that the expenditure share of good i=1 in the home region equals the share of good i=2 in the foreign region. Equation (7) yields the consumption price index in the home region,

$$p = [\gamma p_1^{1-\theta} + (1-\gamma) p_2^{1-\theta}]^{\frac{1}{1-\theta}}. \tag{7}$$

Furthermore, in equation (5), G is real government spending in the home region, M denotes the cash balances held by the household, and l is the household's labor supply. Government expenditure is divided between home and foreign goods in the same way as private consumption. Households buy and sell nominally indexed bonds denominated in the common currency, and pay nominal lump sum taxes $p_t\, T_t$. Their budget constraint is

$$B_{t+1} = (1+i_t)B_t + (\pi_t + w_t l_t) - (p_{1t}c_{1t} + p_{2t}c_{2t}) - p_t T_t - (M_t - M_{t-1}) . \tag{8}$$

Here, i_t is the one-period nominal interest rate, and π_t are profits earned by the firms. All profits are distributed to households. Utility maximization yields the following demand conditions,

$$\frac{p_{t+1}c_{t+1}}{p_t c_t} = \beta(1+i_{t+1}),$$

$$c_1 = \gamma(\frac{p_1}{p})^{-\theta}c, \quad c_2 = (1-\gamma)(\frac{p_2}{p})^{-\theta}c, \tag{9}$$

$$\frac{M_t}{\kappa p_t c_t} = \frac{1+i_{t+1}}{i_{t+1}}.$$

The first line determines household savings as a function of the interest rate. The second line determines the choice between the two output goods depending on their relative prices. The third line gives money demand as a function of the nominal rate of interest and current consumption spending. The home region's government faces the budget constraint pG = pT. With flexible prices, we also have the labor supply function

$$l = (\frac{w}{p\kappa c})^{\alpha-1}. \tag{10}$$

The marginal utility of leisure is decreasing, α > 1. Labor demand by intermediate-goods producers is given by

$$\frac{p_1}{w} = \frac{1}{a\varepsilon}(\frac{al}{y})^{1-\varepsilon}. \tag{11}$$

Similar conditions hold for the foreign economy.

In equilibrium, we have the market clearing conditions for the two final goods,

$$y = c_1 + c_1^* + G_1 + G_1^*, \quad y^* = c_2 + c_2^* + G_2 + G_2^*, \tag{12}$$

where c_i denotes home consumption of region-i goods and c_i^* denotes foreign consumption of region-i goods. Furthermore, we have the clearing conditions for the money market and the bond market,

$$M + M^{*} = \bar{M}, \; B + B^{*} = 0 \; . \qquad \textbf{(13)}$$

We can now analyze the effect of asymmetric productivity shocks on the two regions. Subsequently, we assume that wages are sticky in the sense of being set at the beginning of a period, while employment is demand-determined. We linearize the model around its steady state equilibrium and obtain the reactions to the asymmetric shocks. The linearized output market equilibrium condition, assuming that government spending does not change, is

$$\hat{y}_t = \hat{c}_t - (1-\gamma)(\hat{c}_t - \hat{c}_t^{*}) - \gamma\theta(\hat{p}_{1t} - \hat{p}_t) - (1-\gamma)\theta^{*}(\hat{p}_{1t} - \hat{p}_t^{*}) \qquad \textbf{(14)}$$

Next, domestic money demand becomes

$$\hat{M}_t = \hat{p}_t + \hat{y}_t - \beta\hat{r}_{t+1} - \frac{\beta}{1-\beta}(\hat{p}_{t+1} - \hat{p}_t) \; , \qquad \textbf{(15)}$$

where r is the real interest rate. Corresponding equations hold for the foreign region, together with the condition that the deviations of money demand from steady state must sum to zero. Next, we have domestic savings,

$$S_t = \hat{p}_{1t} + \hat{y}_{1t} - (\hat{p}_t + \hat{c}_t) = \hat{B}_{t+1} + \frac{\kappa}{1-\beta}\hat{M}_t \; . \qquad \textbf{(16)}$$

Note that the deviation of savings and of net claims on the foreign region from their steady states are evaluated as percentages of current expenditures, as their steady state values might be zero. In this model, the change in B_{t+1} from its steady state value is the home region's current account balance with regard to the foreign regions, which together with its foreign-region counterpart sums to zero,

$$\hat{B}_{t+1} = \hat{p}_{1t} + \hat{y}_t - (\hat{p}_t + \hat{c}_t) - \frac{\kappa}{1-\beta}\hat{M}_t \qquad \textbf{(17)}$$

An asymmetric shock in this model is a pair (â, â*) of productivity shocks at time t such that â = -â*. Wage stickiness implies a short run adjustment in prices proportional to this shock,

$$\hat{p}_{1t} = -\hat{p}_{2t} = -\hat{a}; \quad \hat{p}_t = -(2\gamma-1)\hat{a}. \quad \textbf{(18)}$$

In this economy, the new steady state is achieved in one period after a single period productivity shock, so that the economy is in a new steady state in period t+1. We analyze the deviations of variables in both periods t and t+1 from the original steady state.

To analyze the effects of this shock on the two economies, it is convenient to first derive its impact on current savings in the home region,

$$S_t = \frac{2(1-\gamma)(\gamma(\theta+\theta^*)-1)}{1+2(1-\gamma)A(\frac{1-\beta}{\beta})}\hat{a}, \quad A = \frac{\gamma(\alpha-1)(\theta+\theta^*)+(1-\gamma)(\frac{\alpha}{\alpha^*}-1)+\gamma}{\alpha(1+\gamma(\theta+\theta^*))} \quad \textbf{(19)}$$

For now, we let $\alpha = \alpha^*$, so that A > 0. If $\gamma(\theta+\theta^*) \geq 1$, a positive productivity shock in the home economy increases home savings. The money market equilibrium condition, money demand equations and Euler equations together imply that the real rate of interest is constant and consumption in each country changes by the same percentage in period t and period t+1.

Home consumption in the short run and new steady state increases by

$$\hat{c} = A\rho S, \quad \textbf{(20)}$$

where $\rho=(1-\beta)/\beta$ equals the equilibrium real interest rate. Finally, the home region's short-run output and employment change by

$$\begin{aligned} \hat{y} &= (2\gamma-1)\hat{c} + 2(1-\gamma)\gamma(\theta+\theta^*)\hat{a}, \\ \hat{l} = \hat{y}-\hat{a} &= (2\gamma-1)\hat{c} + (2(1-\gamma)\gamma(\theta+\theta^*)-1)\hat{a}. \end{aligned} \quad \textbf{(21)}$$

A first result from these equations is that asymmetric shocks affect consumption and saving

only if the demand side is asymmetric. Consider a symmetric monetary union in which the expenditure shares of both goods are the same in both regions, $\gamma = 0.5$, and the elasticity of substitution between the two goods is the same, $\theta = \theta^*$. Further, assume unitary elasticities of substitution; that is, consumer preferences are Cobb-Douglas. We observe from (19) and (20) that aggregate consumption and saving in the home region are unaffected by the shock. Output increases in the home region and decreases in the foreign, but employment remains the same in each. Thus, consumers in each of the two regions simply substitute home goods for foreign goods in the same quantities.

With enough asymmetry on the demand side, asymmetric shocks affect consumption, savings, and employment. Let $\gamma > (\theta+\theta^*)^{-1}$ and $\theta, \theta^* > 1$. This assures that the average elasticity of substitution exceeds unity and that the home goods bias in consumption is sufficiently large. In this case, home consumption and savings increase, while foreign savings and consumption decrease as a result of a positive asymmetric shock to the home region. Output in the home region increases by more than in the symmetric case, and increases more in relative terms than the productivity gain caused by the shock. In the foreign region, output falls correspondingly.

In equilibrium, the relative price of the home good falls due to the positive productivity shock. This causes consumers in both regions to substitute the foreign good for the home good. To realize this, foreign consumers must dissave, causing a current account deficit vis-a-vis the home region. Thus, domestic wealth increases and foreign wealth declines. The consumption effect in the home region reflects this increase in wealth. Steady state consumption goes up by the same amount.

The short-run response of home employment is more ambiguous. For sufficiently large elasticities of substitution and a sufficiently large home goods bias, $2(1-\gamma)\gamma(\theta+\theta^*)>1$, the increase in demand for the home good is large enough to make firms demand additional labor. For a range of substitution elasticities given by $[2\gamma(1-\gamma)]^{-1} > 2(\theta+\theta^*) > \gamma^{-1}$, consumption responds positively to a positive asymmetric shock and partially offsets the negative response

of home employment to this shock. In this case, the increase in labor productivity exceeds the increase in the demand for home goods, with the result that firms reduce their demand for labor in equilibrium. Finally, if $2(1\text{-}\gamma)\gamma(\theta+\theta^*) < 1$, both consumption and employment decline in response to an asymmetric shock.

Note, finally, that asymmetric shocks have permanent effects on output and employment, although the shocks themselves are purely transitory. To see this, assume again that $\gamma(\theta+\theta^*) > 1$, i.e., the foreign demand for home goods goes up in response to an asymmetric shock, and the foreign region runs a current account deficit. To pay for its increased liabilities in the new steady state, the foreign region must permanently produce more, while the home region produces less in the new steady state. While total output is the same in the new and in the old steady state, foreign goods are a larger share of total output. Consequently, steady-state employment falls in the home region and rises in the foreign region.

IV. Government Taxes and Transfers to Offset Asymmetric Shocks

We can now use the model to evaluate the macroeconomic effects of fiscal policies aiming to offset the effects of asymmetric shocks on the two economies. In our framework, such policies might target the stabilization of either regional employment, regional output, or regional consumption. Since the basic distortion in both economies, wage rigidity, is of a Keynesian flavor, we consider the cases of employment stabilization and consumption-risk sharing in this paper. We also consider two methods for regional governments to achieve stabilization: a scheme of lump-sum collected and transfers paid directly from and to the households in the two regions, and intergovernmental transfers that serve to redistribute government expenditures between the two regions.

IV.1. Transfers Between Households

First, we consider a tax and transfer scheme that is chosen to keep employment in each region unaffected by the asymmetric shock. Transfers are paid out directly to individual consumers, entering their budget constraints. Since, in both regions, the relative change in employment equals the relative change in output less the asymmetric shock, the transfers must be chosen so that short-run outputs are

$$\hat{y} = \hat{a}; \; \hat{y}^* = -\hat{a} . \tag{22}$$

From the previous section we know that this holds automatically when the elasticities of substitution are unitary and the expenditure shares for home and foreign goods are equal in both regions. With asymmetries on the demand side, however, the transfer scheme must be designed so that any additional effect on output is eliminated. Because output is demand determined in the short run, such additional output effects work through final goods demand.

From (21), the direct effect of a positive asymmetric shock on employment is positive and stabilizing employment calls for a decline in home consumption, when $2\gamma(1-\gamma)(\theta+\theta^*) > 1$. Since taxes and transfers only affect employment by changing the distribution of aggregate consumption spending across home and foreign goods, they must be chosen so that the consumption effects offset the direct effect of the asymmetric shock on employment,

$$\hat{c} = \frac{-1}{\rho A}\left[\frac{2\gamma(1-\gamma)(\theta+\theta^*)-1}{2\gamma-1}\right]\hat{a} . \tag{23}$$

We also have that savings in period t are

$$S_t = (\hat{p}_1+\hat{y}) - (\hat{p}+\hat{c}) - \hat{T} = (2\gamma-1)\hat{a} - \hat{c} - \hat{T} . \tag{24}$$

An increase in taxes reduces net wealth in the home region, which reduces both savings and consumption. Combining (20), (23), and (24) yields

$$S_t = \frac{(2\gamma-1)\hat{a}-\hat{T}}{1+\rho A} . \quad \textbf{(25)}$$

Solving for the change in lump-sum transfers from the home region to the foreign region, we obtain the transfer scheme that holds employment constant in both regions:

$$\hat{T} = [(2\gamma-1) + (1+\frac{1}{\rho A})\frac{2\gamma(1-\gamma)(\theta+\theta^*)-1}{2\gamma-1}]\hat{a} = -\hat{T}^* . \quad \textbf{(26)}$$

Equation (26) relates the transfer paid by the home region to the asymmetric shock realized in period t. Depending on the parameters of consumption demand, this transfer can be positive or negative in response to a positive shock hitting the home economy. Define the value $2\theta_m \in [\gamma^{-1}, (2\gamma(1-\gamma))^{-1}]$ by

$$\frac{\rho A_m 4\gamma(1-\gamma)\ [\theta_m-1]}{1-4\gamma(1-\gamma)\theta_m} = 1 , \quad A_m \equiv \frac{\gamma((\alpha-1)2\theta_m+1)}{\alpha(1+\gamma 2\theta_m)}, \quad \textbf{(27)}$$

For values of $\theta+\theta^* > 2\theta_m$, the home region pays a transfer to the foreign region in response to a positive, asymmetric; otherwise it receives a transfer. Unless the demand parameters satisfy the condition $\gamma^{-1} < (\theta+\theta^*) < (2\gamma(1-\gamma))^{-1}$, this transfer is large enough to reverse the sign of the response of savings and consumption to a positive asymmetric shock negative. Because steady-state consumption changes one-for-one with short-run consumption, the implication is that, under the same condition, the scheme also reverses the long-run distributions effect of temporary asymmetric shocks between the two regions.

Finally, if the elasticities of substitution are either small, $\theta+\theta^* \leq 2\theta_m$, or sufficiently large, the tax-transfer scheme increases the absolute value of the change in consumption in response to the asymmetric shock in each region. Only for an intermediate interval in which the average elasticity of substitution exceeds unity but is not too large, the tax- transfer scheme stabilizing

regional employment reduces the impact of the shock on consumption.

The important implication is that the welfare effects of the fiscal arrangement between the two regions are ambiguous. An increase in the absolute value of the change in home consumption in response to an asymmetric shock implies that the difference between consumption in the two regions increases. For values of the demand parameters, γ, θ and θ^*, for which this happens, the transfer scheme reduces an equally-weighted sum of the consumption portions of the utilities of the two regions for a given shock. This means that the expected utility (ex ante) from consumption for either region is lower under the transfer scheme if the shock, $\hat{a}$, is a random variable with zero mean. Equivalently, if the utility parameters weighting leisure consumption, κ and κ^*, are small, the transfer scheme that stabilizes employment will lower expected utility for each region for values of $(\theta+\theta^*)$ sufficiently large or less than $2\theta_m$.

IV.2. Intergovernmental Transfers

Instead of taxing and paying transfers to individuals, schemes of horizontal fiscal equalization often provide revenue sharing among regional governments: governments in one region pay for expenditures of governments in other regions. In our framework, we can analyze this alternative by assuming that taxes remain constant in the two regions, but government spending adjusts in response to asymmetric shocks. Changes in regional public expenditures are made possible through interjurisdictional grants such that the aggregate public sector budget is balanced in every period,

$$T + T^* = G + G^*, \tag{28}$$

so that $\hat{G} + \hat{G}^* = 0$. The equilibrium condition for home goods implies

$$\hat{y} = (2\gamma-1)(\hat{c} + \hat{G}) + 2\gamma(1-\gamma)(\theta+\theta^*)\hat{a} . \tag{29}$$

This leads to the policy rule for stabilizing employment in the two regions through aggregate demand management using public expenditures given by

$$\hat{G} = -\hat{G}^* = -[\frac{\rho A}{1+\rho A}(2\gamma-1)+\frac{2\gamma(1-\gamma)(\theta+\theta^*)-1}{2\gamma-1}]\hat{a}. \quad \textbf{(30)}$$

Note that the changes in government spending in the two regions are related to the transfers between households analyzed above by the factor -ρA/(1+ρA). In response to a positive asymmetric shock that raises domestic consumption, the government of the home region reduces spending and uses its revenue surplus to pay a transfer to the foreign region' government which is used to raise foreign public spending by the same amount. In contrast to the pure tax-transfer rule considered in the previous section, consumption and saving do increase in the home region under this rule. Government expenditures enter household utility as public goods spending. Therefore, a reduction in government spending reduces welfare in the home region. The welfare effects of intergovernmental transfers depend critically on the relative weight of public goods spending compared to private consumption expenditures in the utility function.

A second difference between the two schemes is that the intergovernmental transfers do not affect the response of savings to asymmetric shocks in equilibrium. This holds because short-run output is demand determined in the presence of temporary wage rigidities and monopolistic competition so that an increase in government demand directly raises short-run output. There are no wealth effects, hence no savings impacts, of government spending when the taxes imposed on households are unchanged. By contrast, the scheme of transfers between households changes household permanent income, hence savings and future consumption. Under intergovernmental transfers, the net effect of a positive asymmetric shock is to raise levels of consumption, leisure, and welfare in the new steady state for the home region.

Finally, comparing equation (30) with equation (26) reveals that the absolute value of intergovernmental transfers is smaller than the absolute value of transfers paid to households to achieve the same degree of employment stabilization in the two regions. The reason is that transfers to individuals have wealth effects, implying that households use these transfers partly to consume more, partly to save more. Thus, the impact on current aggregate demand is greater if given size transfers are used to finance government spending than if they are paid as transfers to households. The policy implication is that intergovernmental transfers dominate transfers to individuals if it is desirable that the transfer scheme only affect employment in each region temporarily and that smaller magnitude transfers are preferable. In our model, all taxes are lump-sum so that the size of the transfer to achieve the same ends does not matter, but in a more general environment with distortionary taxation, it can be welfare-improving to choose a policy that involves lower magnitude transfers.

IV. 3. Consumption Risk Sharing

An alternative objective of the design of a tax transfer system between the two regions would be to stabilize consumption in the regions rather than employment. This requires setting taxes and transfers so that consumption is left unaffected by the asymmetric shock. This can be accomplished by choosing taxes and transfers so that any impact of the asymmetric shock on savings in the two regions is exactly offset by the tax-transfer scheme. This requires

$$\hat{T} = [2\gamma(1-\gamma)(\theta+\theta^{*})-1+2\gamma]\hat{a} \ . \qquad \textbf{(31)}$$

Compared to employment stabilization, a policy rule seeking to pool consumption risk implies that taxes and transfers respond less to asymmetric shocks than under a rule aiming at employment stabilization in the case that $2\gamma(1-\gamma)(\theta+\theta^{*})>1$. A suggestive interpretation is that the relatively weak response of interregional taxes and transfers to asymmetric shocks observed in existing federations reflects a desire to stabilize consumption rather than employment in

practice.

Any welfare ranking of the two approaches depends on the relative weights of consumption and leisure in utility for the two regions. If the weights on leisure, κ and κ^*, are small, and the asymmetric shocks are mean zero, consumption-risk pooling is preferable in an expected-utility sense. Furthermore, by eliminating any effect of asymmetric shocks on savings, this rule also eliminates all long-run distributional consequences of transitory asymmetric shocks between the two regions. That is, steady-state consumption for each region is unaffected by the transitory shock under this tax-transfer scheme.

IV.4. Aggregate Implications of Regional Stabilization

An important paradigm underlying the current debate over monetary and fiscal policies in the EMU, and one implicitly accepted in the discussion about fiscal federalism and monetary union, is that aggregate macroeconomic stabilization of the monetary union can be separated from economic stabilization in the regions. This paradigm is reflected in the widespread proposition that the central bank of a monetary union should focus on stabilizing inflation (and, perhaps, employment) for the monetary union as a whole, while the regional governments should use their policy tools to combat any asymmetric shocks affecting output and employment. Furthermore, the popular proposition holds, there is no need for policy coordination among the central bank and the regional governments.

This proposition clearly assumes that asymmetric shocks have no bearing on the aggregate performance of the monetary union; they have purely distributional effects. In our model, this will be the case, if

$$\hat{y} + \hat{y}^* = \frac{\alpha^* - \alpha}{\alpha^*}\hat{y} = 0. \qquad \textbf{(32)}$$

This condition requires the elasticities of labor supply, α and α^*, to be equal across regions.

Otherwise, aggregate output in the two regions will change, with the result that the aggregate demand for money will change. This in turn will cause the aggregate price level and the interest rate to change. Thus, the separability between aggregate stabilization and regional stabilization depends critically on symmetry of the two regions on the supply side.

To explore the consequences of asymmetric labor supply elasticities, consider the aggregate equilibrium inflation rate for the two regions. For simplicity, we assume that the two regions are equal in size, so that they receive equal weights in computing aggregate price indices. Let P be the price index for the combined regions. We then have

$$\hat{P}_{t+1} - \hat{P}_t = [2 + \frac{\gamma(2\gamma-1)}{(1-\gamma)(1+2\gamma(\theta+\theta^*))}](\frac{1}{\alpha} - \frac{1}{\alpha^*})\rho S_t \ . \tag{33}$$

The effect of asymmetric shocks between the regions on the aggregate rate of inflation for the monetary union depends on how savings in each region respond to these shocks. We have shown that savings respond to the asymmetric shocks except in the special case that demands are symmetric and the elasticities of substitution are one. Combining asymmetries on the demand and on the supply side implies that aggregate and regional fluctuations are correlated, and that aggregate and regional stabilization cannot be separated. If domestic saving increases in response to a positive asymmetric shock, the correlation between domestic saving and aggregate inflation depends on the difference between the labor supply elasticities. The correlation is positive if the foreign labor supply elasticity exceeds the domestic elasticity.

Equation (33) shows that, under these circumstances, any tax and transfer scheme between the regions that affects savings will interfere with the central bank's policy to achieve price stability at the aggregate level. One implication of our analysis is that regional stabilization using intergovernmental transfers is neutral with regard to aggregate stabilization, since intergovernmental transfers do not affect the response of regional rates of saving to asymmetric shocks. A second implication is that using taxes and transfers for the purpose of consumption-

risk sharing helps aggregate stabilization, since consumption-risk sharing requires the use of taxes and transfers to offset any response of domestic savings to asymmetric shocks.

When the goal of regional stabilization is to stabilize regional employment, the tax-transfer scheme may increase or reduce the response of household savings to asymmetric shocks, depending on the parameters of demand. If it increases the absolute value of the savings response to an asymmetric shock, then it raises the variance of overall inflation for a given distribution of asymmetric shocks, â. Specifically, regional employment stabilization increases the variability of savings in response to asymmetric productivity shocks and, hence, the variability of inflation for the monetary union as a whole if either $\gamma(\theta+\theta^{*}) < 1$ or

$$\gamma(\theta+\theta^{*}) > \frac{(2(1-\gamma))^{-1} + 2(1-\gamma)\rho A}{1 + (3-4\gamma)\rho A} > 1 \ . \qquad \textbf{(34)}$$

These relationships are derived from equations (19) and (24). The second term in inequality (34) exceeds unity when the expenditure share of home goods, γ, is greater than one-half. Thus, while the increase in the variance of aggregate inflation due to asymmetric productivity shocks depends on the degree to which labor supply elasticities differ, the sign of the correlation between aggregate inflation and home productivity shocks depends on the demand elasticities, expenditure shares, and the relative labor supply elasticities.

V. Regional Stabilization Policies and Incentives for Structural Reforms

An important objection against the creation of a system of taxes and transfers responding to asymmetric shocks in a monetary union is that this might reduce the incentives of the regional governments to undertake structural reform policies making their economies fit for coping with such shocks. Persson and Tabellini (1996), for example, argue that the availability of fiscal insurance against asymmetric shocks would induce regional governments to invest less in

projects improving their economies' shock absorbing capacity. These authors conclude that, in the presence of such adverse incentive effects, the implementation of fiscal insurance against asymmetric shocks would call for the creation of federal grants subsidizing such projects in the regions to assure a sufficiently high level of investment in shock absorbing capacity. In a similar vein, one might argue that structural reform improving the flexibility of regional markets are politically costly for the governments, and that the availability of transfers in times of bad asymmetric shocks reduces the political incentives to engage in reforms.

While the analysis of the incentives for reform is beyond the scope of this paper, our model can shed some light on these issues. A first way to think about reforms making regional markets more flexible is to consider the properties of the intermediate goods market. Recall that producers in these markets act under conditions of imperfect competition. The elasticity of substitution between any two intermediate goods can be regarded as a measure of market rigidities: the larger the elasticity of substitution, the more intense competition is among producers in this market. Thus, structural reforms to overcome market rigidities may aim at increasing the substitutability between intermediate inputs. Intuitively, reducing product regulation and the protection of producers against market entry, now often called for in the EU would fall under this type of structural reform.

Do structural policies of this kind increase the shock-absorbing capacities of the regional economies? In our model economy, the elasticity of substitution between intermediate inputs does not affect the parameters determining the transmission of asymmetric shocks to output, employment, savings and consumption. This implies these types of reform policies and fiscal insurance against asymmetric shocks are unrelated to the policy issues in this paper.

A second way to think about structural reforms using this model concerns the elasticity of labor supply. Intuitively, labor market regulations may reduce the elasticity of labor supply, as they increase reservation wages as well as search costs. Alternatively, the equilibrium labor supply elasticity may be raised by imperfect competition in the labor market, due, for example,

to unionization. While the details of such effects are clearly beyond the scope of our model, we can ask how policies aiming at increasing the elasticity of labor supply, α, affect the transmission of asymmetric shocks.

To derive an answer, we note that the labor supply elasticity enters the transmission of asymmetric shocks to regional employment through the composite parameter A in equation (20) above. Taking derivatives, we find that A always increases with the home labor supply elasticity. Furthermore, increasing α raises the responsiveness of savings to a given asymmetric shock. This means that the size of the response of consumption to the asymmetric shock rises as α increases in the absence of fiscal policy interventions using a tax-transfer scheme.

With transfers collected and paid directly from and to households, however, the responsiveness of consumption to the asymmetric shock is unaffected by changes in the labor supply elasticity. The increase in A is exactly offset by a proportionate decrease in the absolute value of savings using the relationship, $\hat{c} = \rho AS$. Thus, the tax-transfer scheme eliminates any impact of labor market reforms on the variability of consumption. In contrast, with intergovernmental transfers, the response of consumption to asymmetric shocks rises as α increases. Thus, the variability of consumption rises under the alternative employment-stabilizing intergovernmental transfer scheme.

Furthermore, equation (31) implies that the size of intergovernmental transfers for the purpose of employment stabilization decreases as A increases. The effect of an increase in the labor supply elasticity on the size of transfers between households depends on whether post-transfer savings are positive or negative. If post-transfer savings are negative in response to a positive asymmetric shock ($\theta+\theta^* > (4\gamma(1-\gamma))^{-1}$, the size of the transfers paid to households decreases as the elasticity of labor supply rises. This is also true when the transfers made by the home region are negative, which is the case if ($\theta+\theta^* < \theta_m$). However, for the intermediate case, $\theta_m < \theta+\theta^* < (4\gamma(1-\gamma))^{-1}$, an increase in the labor supply elasticity, α, raises the absolute value of transfers. This means the volume of transfers, whether made between households or

between governments, is sensitive to labor market reforms.

We summarize these effects in the following table:

	Effect of an increase in labor supply elasticity on transfer size	
Case	Transfers between households	Intergovernmental transfers
I: $2(1-\gamma)\gamma > (\theta+\theta^*)^{-1}$	fall	rise
II: $(2\theta_m)^{-1} > (\theta+\theta^*)^{-1} > 2(1-\gamma)\gamma$	rise	rise
III: $(\theta+\theta^*)^{-1} > (2\theta_m)^{-1}$	fall	fall

It is reasonable to think that governments considering structural reform policies will be concerned with two issues in our context: the impact on the variability of consumption and the effects on the size of transfers that each government expects to pay or receive in response to asymmetric shocks. The table implies that the incentives to undertake structural reforms from this point of view depend on the share of home goods in consumption expenditures, the elasticity of substitution between home and foreign goods, and on the type of fiscal tax-transfer mechanism implemented to absorb the effect of asymmetric shocks on regional employment.

When a structural reform is defined as an increase in the elasticity of labor supply, reforms always increase the variability of consumption absent any fiscal insurance scheme or under the government expenditure redistribution scheme in response to asymmetric productivity shocks. On the other hand, such reforms reduce the magnitude of transfers made under the government expenditure scheme in the case that net positive payments are made by regions realizing positive shocks. Therefore, regional governments may choose labor market policies that reduce the cost of an employment stabilizing transfer scheme but also lead to higher consumption variability.

For the tax and transfer scheme between households, consumption variability is unaffected by increases in the labor supply elasticity. Such reforms reduce the size of employment-stabilizing transfers except in case II, which applies when the elasticities of substitution in consumption exceed unity but are not too large. In cases I and III, increasing the

elasticity of labor supply is consistent with reducing inter-household transfers across regions. In case II, these two goals would be in conflict.

We can interpret these policy conflicts and complementarities by observing that the degree of substitutability between the two region's final goods may increase as economies become more specialized in production as a consequence of economic integration. Furthermore, integration and specialization should reduce the expenditure share of home goods in home consumptions. Trade integration can change the incentives for structural reforms in this model economy. Our results suggest that the incentives to undertake structural reforms are more likely to be negatively affected by a fiscal transfer scheme when the monetary union consists of relatively similar regions with a low degree of trade integration (this makes case II more robust). In contrast, the incentive effects may turn positive, if the monetary union consists of sufficiently dissimilar regions with a sufficiently high degree of trade integration.

Finally, we recall from equation (30) that large differences in the regional labor supply elasticities turn purely asymmetric shocks into aggregate shocks to the common inflation rate. In the current context, this means that regional reform policies have consequences for the aggregate performance of the monetary union. The suggestive implication is that regional reform policies in a monetary union should be coordinated among the governments to avoid adverse consequences for the aggregate performance of the union.

VI. Conclusions

Almost 40 years ago, Mundell argued that a monetary union requires fiscal shock absorber mechanisms to deal with asymmetric shocks. Empirical evidence, however, indicates that fiscal shock absorbers in existing monetary unions are quite small. In this paper, we have developed a macro economic model of a monetary union to revisit Mundell's argument. In contrast to Mundell's Keynesian framework, we propose a dynamic general equilibrium framework where imperfect competition in goods markets and sticky wages are the basis for

aggregate demand policies having effects on real output and employment.

In this model, purely transitory, asymmetric shocks affect regional output and employment provided that there is sufficient asymmetry in the economic structures describing the demand side. Furthermore, if there is structural asymmetry also in the labor markets of the regional economies, asymmetric shocks between the regions have aggregate effects on the performance of the monetary union as a whole. In the presence of demand asymmetries, transitory shocks have wealth effects with lasting distributional consequences among the regions.

To cope with these shocks, we have considered taxes and transfers paid to households and intergovernmental transfers. Both can be designed to stabilize regional employment, yet with different distributional and welfare consequences. Taxes and transfers paid to households can also be used to provide full consumption risk insurance between the regions. However, fiscal insurance restricted to one instrument (implied by budget balance) cannot aim at stabilizing consumption and employment at the same time. Our model implies that fiscal policies aiming at stabilizing regional employment may well have negative welfare effects in expected value. Overall, the welfare effects of fiscal insurance are quite ambiguous. This may be the main reason why, in contrast to Mundell's claim and popular arguments in the policy debate, we do not more substantial fiscal insurance against asymmetric shocks in existing monetary union.

Finally, we have analyzed the interaction between regional reform policies aiming at increased goods and labor market flexibility, and fiscal insurance against asymmetric shocks. While a detailed analysis of this interaction would require a model of political economy and reform, which is beyond the scope of this paper, our model allows us to derive some suggestions. One is that the type of reform matters. Deregulation of intermediate goods markets is an issue orthogonal to fiscal insurance in this framework, labor market reform is not. Another one is that the interaction between labor market policies and fiscal insurance depends critically on the degree of trade integration among the regions; it is positive with high and negative with

low degrees of integration. Finally, regional reform policies have consequences for the aggregate performance of the union. This suggests that such policies should be coordinated among the governments pertaining in a monetary union.

The last three results have clear implications for fiscal federalism in the broad sense of the term, that is, the assignment problem of different functions of government to different levels of government (see von Hagen, 1993). Specifically, the adoption of a common currency among a set of highly integrated regions implies that governments of these regions should no longer regard policies aiming at structural reforms of their local goods and labor markets as matters of purely regional concern.

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