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# Fiscal Unions Redux

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### Abstract

Before the advent of sophisticated international financial markets, the widely accepted belief was that within a monetary union, a union-wide authority orchestrating fiscal transfers between countries is necessary to provide adequate insurance against country-specific economic fluctuations. This belief prompts a question: Do sophisticated international financial markets obviate the need for such an active union-wide authority? We argue that they do. Specifically, we show that in a benchmark economy with no international financial markets, an activist union-wide authority is necessary to achieve desirable outcomes. With sophisticated financial markets, however, such an authority is unnecessary if its only goal is to provide cross-country insurance. Since restricting the set of policy instruments available to member countries does not create a social externality across them, this result holds in a wide variety of settings. Finally, we establish that an activist union-wide authority concerned just with providing insurance across member countries is needed only when individual countries are either unable or unwilling to pursue desirable policies.

**Keywords:** *International transfers; Optimal currency area; International financial markets; Fiscal externalities; Cross-country externalities*

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A monetary union sets union-wide monetary policy in the hope of achieving desirable outcomes. When a monetary union is established, a classic question arises: How should the fiscal policies of member states be coordinated? In particular, is it desirable to establish a union-wide authority to coordinate the fiscal policies of member countries as well as to implement international fiscal transfers between countries? Amid the recent debate about the desirability of greater fiscal integration within the European Union, such a question has regained center stage.

Before the advent of sophisticated international financial markets, a widely accepted belief was that within a monetary union, a union-wide authority orchestrating fiscal transfers is desirable to provide adequate insurance against country-specific macroeconomic shocks. In this paper, we examine whether the need for such an authority to provide cross-country insurance is diminished as international financial markets become more developed. In short: Can international financial markets substitute for a fiscal union?

One view, associated with Mundell (1973), is that sophisticated international financial markets are sufficient to provide insurance against country-specific fluctuations. Mundell illustrated this point using a simple example in which the world consists of two islands: Capricorn, which is South of the equator and produces its crops in the fall, and Cancer, which is North of the equator and produces its crops in the spring. Both countries are subject to random fluctuations in their crop output, and goods can be stored only for six months. Mundell explains how, even with labor immobile across countries, well-developed insurance markets can achieve the same outcomes that would be achieved if labor were perfectly mobile and individuals migrated every six months to the countries in which crops can be grown. In short, in Mundell's view, international financial markets can provide all the necessary cross-country insurance, thereby obviating the need for a fiscal union to implement any transfer.

An alternative view, associated with Kenen (1969), is that transfers between regions of a monetary union are critical to its functioning. Hence, Kenen argues that in a currency union, "the domain of fiscal policy ought to coincide with the currency area" (Kenen 1969, p. 46). In this essay, Kenen also explains how a well-functioning fiscal union entails large-scale transfers between regions in the face of country-specific fluctuations.

We argue that the key difference between Mundell's and Kenen's view of international

transfers can be traced back to their distinct ideas of what a union-wide authority should accomplish. From Mundell's point of view, the role of a union-wide authority is simply to provide *insurance* to member countries, whereas from Kenen's point of view, the role of such an authority also entails performing an ex-ante *redistribution* of wealth, say, from richer countries to poorer countries in a union. Our main result is that under Mundell's view, the advent of sophisticated financial markets obviates the need for any such authority to provide international transfers whereas under Kenen's view, such a union-wide authority should play an active role even in the presence of sophisticated financial markets.

We consider several settings for policy. In our *benchmark* setting, member countries' policies are rich enough to correct all their domestic distortions. We then investigate a *restricted policy* setting in which member countries' policies are symmetrically constrained in a way that prevents them from resolving all their domestic distortions. In both settings, we find support for Mundell's view: if the role of a union-wide authority is simply to provide insurance and its only instruments are transfers between countries, then there is still no need for it to play an active role. In particular, restrictions on member countries' policies do not create a *fiscal externality*, whereby each country adopts a policy that is optimal for that country but is suboptimal for the union as a whole.

The assumptions underlying our result are that: *i*) all countries are small in the relevant sense, *ii*) the union-wide authority and member countries can commit to their policies, *iii*) the union-wide authority has no advantage over national governments in its choice of policy instruments, *iv*) the government of each country maximizes the welfare of its citizens, and *v*) the union-wide authority maximizes a Pareto-weighted sum of each countries utilities, with weights that ensure that the union-wide authority cares only about providing insurance to member countries. If we dispense with any of these assumptions, a role for an active union-wide authority emerges.

We illustrate this point by considering three settings that relax some of these assumptions. First, we allow the union-wide authority to have access to instruments that some of the national governments do not have available. In particular, we envision a more powerful union-wide authority that, in addition to its ability to impose international transfers, can levy portfolio taxes on each member countries' international financial transactions. This ex-

pansive view of a union-wide authority's powers goes well beyond the limited role envisioned for it by Mundell, but is consistent with the role envisioned for it by Kenen. In this setting, when the policies of member countries are restricted in various ways, it is typically optimal for the union-wide authority to intervene by levying portfolio taxes on the countries facing policy restrictions. The rationale for this intervention, however, is not specifically to improve cross-country insurance, but rather to help ameliorate domestic distortions in countries that are unable to do so on their own.

Our first setting might lead one to conjecture that the need to levy portfolio taxes is intimately connected to countries belonging to a monetary union and that these taxes offset cross-country externalities. Our second setting shows this conjecture is incorrect: if national governments face constraints on their policies, then the union-wide authority of a fiscal union typically has an incentive to intervene and impose portfolio taxes even when countries have flexible exchange rates.

In the settings considered so far, equilibrium outcomes, except for international transfers, are invariant to whether a given policy is delegated to national governments or to the union-wide authority. Our third setting is one in which this *irrelevance of delegation of authority* result no longer holds. In this case, we allow for self-interested governments that maximize objective functions that differ from those of their citizens and choose government spending that only benefits governments. We think of this environment as capturing the idea that for a whole host of reasons, including political ones, some governments are unwilling to pursue policies that are most desirable for their citizens. We show that in this scenario, it is better to delegate the authority to levy portfolio taxes to a union-wide authority rather than to national authorities.

These three scenarios clearly generate a role for an active union-wide authority. All of them, however, clearly have a paternalistic flavor: a responsible and powerful union-wide authority should provide remedial help to its member countries. Indeed, a union-wide authority intervenes only when its member countries' governments are either unable or unwilling to pursue desirable policies.

In our analysis, we closely follow Farhi and Werning (2013), henceforth *FW*, by considering a simple one-period economy with a continuum of countries, each of which produces

traded and nontraded goods. The nontraded goods sector consists of a continuum of monopolistically competitive intermediate goods firms that produce differentiated products. The prices of these firms are sticky in that they must be set before the realization of preference and productivity shocks. The traded goods sector is competitive and has flexible prices. This economy builds on Obstfeld and Rogoff (1995) and is a special case of Gali and Monacelli (2005, 2008).

Even though we purposely follow FW closely in our analysis, we arrive at very different conclusions. The key difference between our work and that of FW is that we build in as part of Mundell's view the idea that the goal of a union-wide authority is simply to provide insurance rather than to redistribute ex-ante wealth, whereas FW presume that a union-wide authority is also concerned with redistribution over and above insurance.

Our *benchmark* fiscal policies grant each government a payroll tax on labor income, an excise taxes on nontraded goods, and portfolio taxes, whereas *restricted* fiscal policies disallow the use of nontraded goods taxes. The fiscal union features three tiers of decision makers. At the top tier, a union-wide authority chooses international transfers between countries to maximize a weighted sum of the welfare of consumers in each country. At the middle tier, the governments of all countries, taking as given international transfers set by the union-wide authority, noncooperatively choose their countries' fiscal policies, or simply *national policies*, in order to maximize the welfare of the consumers of their country. At the bottom tier, consumers and firms in each country, taking as given both the policies of the union-wide authority and the national governments, make production and consumption decisions.

We begin by studying the need for a fiscal union when each national government has access to the benchmark fiscal policies. We start with an *incomplete market* setting that captures in a stark way the idea that before the modern era of international financial markets, cross-country insurance could only be provided through direct cross-country transfers. As both Mundell and Kenen agree, in such an era there is a clear need for an active union-wide fiscal authority.

We then consider a setting with complete international financial markets. We think of this *complete market* setting as capturing the idea that, in the modern era of sophisticated international financial markets, countries can rely on these markets to obtain cross-country

insurance. The key question we address is: Does the advent of sophisticated financial markets obviate the need for an active union-wide authority? Our answer is that with complete markets, a union-wide fiscal authority is *unnecessary* if and only if this authority is concerned solely with providing insurance to member countries. That is, under Mundell's view of the role of a fiscal authority, complete markets ensure that the optimal amount of insurance is obtained, whereas under Kenen's view, a fiscal authority is still needed to accomplish redistribution between member countries.

We then investigate whether, once we restrict the fiscal instruments of governments, a fiscal externality arises across countries that necessitates an activist union-wide authority. That is, we repeat our previous exercise, now with restricted policies, to determine whether the policies that governments choose to pursue are inefficient from the viewpoint of the union as a whole. Our key result is that no fiscal externality arises: even though national governments are unable to correct all their domestic distortions, they still pursue policies that are optimal for the union. Thus, even here, we find that a union-wide fiscal authority is unnecessary with complete markets if and only if this authority is concerned solely with insurance among countries in the union.

We then turn to identifying circumstances under which it is optimal for a union-wide authority interested solely in insurance to pursue an activist role in fiscal policy. For simplicity, we consider a setting in which one group of countries in the union, called the *North*, optimally sets traditional fiscal instruments, that is, payroll and nontraded goods taxes, but the other group, called the *South*, is unable (or unwilling) to use nontraded goods taxes. Here we equip the union-wide authority with portfolio taxes that it can levy on any country in the union.

The idea is that the well-functioning governments in the North have available a rich set of policies, the imperfectly functioning governments in the South do not, and the union-wide authority has available a limited set of instruments. In the world equilibrium, it is optimal for the union-wide authority to impose portfolio taxes only on the Southern countries. By doing so, the authority raises the welfare of all countries in the union by partially offsetting the distortions that the Southern countries are unable to correct on their own.

This last result may lead one to think that the reason why the union-wide authority

takes an active role stems from the feature that when countries belong to a monetary union, they cannot use domestic monetary policy to offset country-specific shocks. To show that this reasoning is incorrect, we consider a fiscal union with flexible exchange rates. Northern countries optimally set their traditional policy instruments but Southern countries again have imperfectly functioning governments in that they are unable to levy payroll taxes. The union-wide authority can levy portfolio taxes on any country in the union. We show that in this case, the union-wide authority finds it optimal to levy payroll taxes only on the Southern countries. As before, though, doing so does not correct any macroeconomic externality, rather it simply helps Southern countries to ameliorate their domestic distortions and, hence, raises the welfare of all countries in the union.

Throughout we have maintained the assumption that national governments are benevolent in that they maximize the welfare of their citizens. Under this assumption, an *irrelevance of the delegation of authority* result holds: the equilibrium is unchanged if any of the labor taxes, nontraded goods taxes, or portfolio taxes are delegated to the national governments or the union-wide authority. Our last economy shows that if, instead, national governments pursue their own self interests, then there is typically an incentive for the union as a whole to delegate powers, such as portfolio taxes, to the union-wide authority rather than to the national governments.

These latter results provide a deeper perspective on the differing views of Mundell and Kenen. Overall, Mundell had in mind well-functioning national governments and a relatively weak union-wide authority concerned only with insurance, whereas Kenen had in mind relatively poorly functioning national governments and a relatively strong union-wide authority concerned with redistribution as well as insurance.

We have shown that even when governments have only restricted fiscal instruments available, no fiscal externalities arise. A key feature of our model behind this finding is that governments have the power to commit to their fiscal policies once and for all. By doing so, we abstract from the fiscal externalities that result from the time inconsistency issues emerging when national fiscal policies are set noncooperatively. These issues are the focus of the work of Chari and Kehoe (2007, 2008) and have recently been revisited by Aguiar et al. (2013), who draw the same conclusions.



# 1. A Currency-Fiscal Union with Incomplete Financial Markets

Here we set up a model of a joint currency-fiscal union with incomplete international financial markets. This model is meant to capture a setting in which international financial markets cannot provide adequate insurance between countries against country-specific macroeconomic shocks. For simplicity, we make the extreme assumption that no international financial markets exist.

Throughout, we carefully distinguish between transfers motivated by insurance reasons and transfers motivated by redistributive reasons. To this end, we are interested in transfers that respect *private ownership*, that is, transfers that are optimal when the union-wide fiscal authority uses a weight for each country that, at the appropriately defined shadow prices, does not involve an ex-ante redistribution of wealth from one country to another, say, from ex-ante richer countries to ex-ante poorer countries.

The timing of the economy involves three stages, which reflect the three-tiered structure of decision-making discussed earlier. At the first stage, the union-wide authority moves and sets international transfers. At the second stage, taking as given the decisions of the union-wide authority, national governments set their national fiscal policies noncooperatively. At the third stage, taking as given the policies set in the previous stages, consumers and firms in each country make their production and consumption decisions. It is convenient to both set up and solve for equilibrium by working backwards from the end of the period. We therefore start with the bottom tier.

## A. Bottom Tier: Competitive Equilibrium

We start by laying out the economy and defining a competitive equilibrium, given the union-wide and national policies chosen at higher tiers.

The economy lasts one period, has a continuum of countries  $i \in I = [0, 1]$  that belong to a currency union, and is adopted from FW. The uncertainty in the economy is represented by a finite set of states  $s \in S$  in which  $\mu(s)$  denotes the probability of state  $s$ . This uncertainty affects preferences and technology. Each consumer in country  $i$  has preferences over nontraded

goods,  $C_N^i(s)$ , traded goods,  $C_T^i(s)$ , and labor,  $L^i(s)$ , given by

$$(1) \quad \sum_s \mu(s) U(C_N^i(s), C_T^i(s), L^i(s), s).$$

Trade of state-contingent assets in *domestic asset markets* between consumers in country  $i$  takes place before the state  $s$  is realized, subject to the constraint

$$(2) \quad \sum_s Q^i(s) D^i(s) \leq 0.$$

In each state  $s$ , a consumer also faces a budget constraint given by

$$(3) \quad [1 + \tau_N^i(s)] P_N^i C_N^i(s) + P_T(s) C_T^i(s) \\ \leq W^i(s) L^i(s) + P_T(s) [Y_T^i(s) + T^i(s) + T_I^i(s)] + \Pi^i(s) + [1 + \tau_D^i(s)] D^i(s).$$

All prices are expressed in units of a common currency, say euros. Here  $Q^i(s)$  is the price at the beginning of the period for the delivery of one euro in state  $s$ ,  $P_N^i(s)$  is the country-specific price of nontraded goods, and  $P_T(s)$  is the union-wide price of traded goods. Consumers in country  $i$  have endowments of traded goods  $Y_T^i(s)$ , elastically supply labor  $L^i(s)$  to produce nontraded goods at a nominal wage of  $W^i(s)$ , and receive nominal profits  $\Pi^i(s)$  from the ownership of nontraded goods firms. Each consumer takes as given the policies of its *national government*, namely the tax rate on the purchases of nontraded goods in state  $s$ ,  $\tau_N^i(s)$ , the tax rate on domestic assets  $\tau_D^i(s)$ , and the *domestic transfers*  $T^i(s)$ , as well as the policies of the *union-wide fiscal authority*, namely the *international transfers*  $T_I^i(s)$ .

The first-order conditions for the consumer's problem imply that for all states  $s$ ,

$$(4) \quad \rho^i = \mu(s) \frac{U_T^i(s) [1 + \tau_D^i(s)]}{P_T(s) Q^i(s)},$$

$$(5) \quad \frac{U_T^i(s)}{P_T(s)} = \frac{U_N^i(s)}{[1 + \tau_N^i(s)] P_N^i},$$

$$(6) \quad -\frac{U_L^i(s)}{U_T^i(s)} = \frac{W^i(s)}{P_T(s)},$$

where  $\rho^i$  is the multiplier on the borrowing constraint (2). Here all asset trade is domestic in that

$$(7) \quad D^i(s) = 0 \text{ for all } i \text{ and } s.$$

In each country  $i$ , competitive nontraded final goods firms buy differentiated varieties of nontraded goods from intermediate producers and sell them to consumers in country  $i$ . These firms solve

$$(8) \quad \max_{\{C_N^{i,j}(s)\}} \left\{ P_N^i C_N^i(s) - \int_0^1 P_N^{i,j} C_N^{i,j}(s) dj \right\},$$

subject to  $C_N^i(s) = \left[ \int_0^1 C_N^{i,j}(s)^{\frac{\varepsilon-1}{\varepsilon}} dj \right]^{\frac{\varepsilon}{\varepsilon-1}}$ , where  $\varepsilon$  is the elasticity of substitution among varieties,  $P_N^i$  is the price of the aggregate bundle of goods and  $P_N^{i,j}$  is the price of variety  $j$ . This problem generates a downward-sloping demand for each variety  $j$ ,

$$(9) \quad C_N^{i,j}(s) = \left( \frac{P_N^{i,j}}{P_N^i} \right)^{-\varepsilon} C_N^i(s).$$

The intermediate goods producers are monopolistically competitive and have sticky prices in that they set their prices before the realization of the state,  $s$ . The producer of variety  $j$  produces goods with technology  $C_N^{i,j}(s) = A^i(s)L^{i,j}(s)$  and charges price  $P_N^{i,j}$ . The profits in state  $s$  of such an intermediate goods producer are

$$(10) \quad \Pi^{i,j}(s) = P_N^{i,j} C_N^{i,j}(s) - (1 + \tau_L^i) W^i(s) L^{i,j}(s),$$

where  $\tau_L^i$  is a payroll tax on the labor hired by these firms. The optimal price is set to maximize the expected value of profits,

$$(11) \quad \max_{P_N^{i,j}} \sum_s Q^i(s) \left[ P_N^{i,j} - (1 + \tau_L^i) \frac{W^i(s)}{A^i(s)} \right] \left( \frac{P_N^{i,j}}{P_N^i} \right)^{-\varepsilon} C_N^i(s),$$

where we have substituted the production technology and the demand function (9) in the

expression for profits. The resulting optimal price is given by

$$(12) \quad P_N^{i,j} = (1 + \tau_L^i) \frac{\varepsilon}{\varepsilon - 1} \frac{\sum_s Q^i(s) \frac{W^i(s)}{A^i(s)} C_N^i(s)}{\sum_s Q^i(s) C_N^i(s)},$$

which is a markup over a weighted average of the marginal costs across states. Notice that the price of each variety  $j$  in country  $i$  is the same and equal to the right side of (12). We denote this common price by  $P_N^i$ .

Consider now the national policies of country  $i$ . The policies of country  $i$ 's government are summarized by  $\pi^i = \{\pi^i(s)\}$ , where  $\pi^i(s) = (\tau_L^i, \tau_N^i(s), \tau_D^i(s), T^i(s))$ . For each  $s$ , the government budget constraint requires that domestic transfers equal domestic tax revenues,

$$(13) \quad P_T(s)T^i(s) = \tau_L^i W^i(s)L^i(s) + \tau_N^i(s)P_N^i C_N^i(s) + \tau_D^i(s)D^i(s).$$

The government collects revenues from the payroll tax, the tax on the consumption of non-traded goods, and the portfolio tax, and rebates these revenues to its consumers in a lump-sum fashion.

The policies of the union-wide authority are international transfers,  $T_I^i = \{T_I^i(s)\}$ . The budget constraint of this authority specifies that, for each state  $s$ , international transfers across countries sum to zero in each state  $s$ ,

$$(14) \quad \int_i T_I^i(s) di = 0.$$

Notice that here the union-wide authority transfers resources directly to consumers rather than to national governments.

Formally, let  $X = \{X^i\}$ , with  $X^i = \{X^i(s)\}$  and  $X^i(s) = (C_T^i(s), C_N^i(s), L^i(s), D^i(s))$ , denote the allocations in country  $i$ ,  $P = \{P^i\}$ , with  $P^i = \{P^i(s)\}$  and  $P^i(s) = (P_N^i, W^i(s))$ , and  $\{Q^i\}$ , with  $Q^i = \{Q^i(s)\}$ , denote the domestic prices in country  $i$ , and  $\pi = \{\pi^i\}$  denote national policies. Let  $P_T = \{P_T(s)\}$  denote the world prices of traded goods, and let  $T_I = \{T_I^i\}$ , with  $T_I^i = \{T^i(s)\}$ , denote the international transfers for country  $i$ .

Given the policies of the union-wide authority,  $T_I$ , and the national policies  $\pi$ , a *competitive equilibrium with incomplete markets* consists of world prices  $P_T$  together with

allocations,  $X$ , and domestic prices,  $P$  and  $\{Q^i\}$ , for each country  $i$  such that: *i*) consumer maximization in each country  $i$  holds, *ii*) profit maximization for both final goods firms and intermediate goods firms in each country  $i$  holds, *iii*) the national policy  $\pi^i$  satisfies the government budget constraint, (13), for each country  $i$ , *iv*) the union-wide policies  $T_I$  satisfy the budget constraint of the union-wide authority, (14), *v*) all asset trade is domestic in the sense that (7) holds, and, finally, *vi*) the nontraded and traded goods markets clear in that

$$(15) \quad C_N^i(s) = A^i(s)L^i(s) \text{ for all } i \text{ and } s,$$

$$(16) \quad C_T^i(s) = Y_T^i(s) + T_I^i(s) \text{ for all } i \text{ and } s.$$

Note that if we combine the budget constraint of the union-wide authority (14) with traded goods market clearing, condition (16), we obtain the world market clearing condition for traded goods,

$$(17) \quad \int_i C_T^i(s) di = \int_i Y_T^i(s) di \text{ for all } s.$$

The following lemma characterizes the set of allocations that can be implemented in such an equilibrium.

**Lemma 1.** *The allocations in a competitive equilibrium with incomplete markets satisfy the nontraded and traded goods market clearing, namely, (15) and (16). Moreover, given any allocations that satisfy these constraints, we can construct prices and policies for each country that, together with the given allocations, constitute an equilibrium with incomplete markets.*

**Proof.** For necessity, by definition of an equilibrium, the allocations satisfy nontraded and traded goods market clearing. For sufficiency, given some allocations, we construct prices, policies, and asset holdings as follows. Clearly, there is one degree of nominal indeterminacy in the construction of nominal good prices, which we resolve by setting  $P_T(s_0) = 1$  for some particular state  $s_0$ . To see there is also some indeterminacy in the setting of nontraded taxes,

$\tau_N^i(s)$ , note that (5) implies

$$(18) \quad \frac{U_T^i(s)/U_N^i(s)}{U_T^i(s_0)/U_N^i(s_0)} = \frac{P_T(s)[1 + \tau_N^i(s_0)]}{1 + \tau_N^i(s)}.$$

We uniquely pin down  $P_T(s)$  by picking a country, say  $i = 0$ , and setting  $\tau_N^0(s) = 0$  for all  $s$ . Doing so gives

$$(19) \quad P_T(s) = \frac{U_T^0(s)/U_N^0(s)}{U_T^0(s_0)/U_N^0(s_0)}.$$

Given  $P_T(s)$ , however, (18) makes clear that for each country  $i \neq 0$ , there is still one degree of indeterminacy in nontraded taxes. To resolve this indeterminacy, we pick a state, say  $s_0$ , and set  $\tau_N^i(s_0) = 0$  for all  $i$ . Then, using  $P_T(s_0) = 1$  and  $\tau_N^i(s_0) = 0$  for all  $i$ , from (5) we obtain

$$(20) \quad P_N^i = \frac{U_N^i(s_0)}{U_T^i(s_0)}.$$

Then, substituting (19) into (18) and using  $\tau_N^i(s_0) = 0$  gives that the tax on nontraded goods for a country  $i \neq 0$  is given by

$$(21) \quad 1 + \tau_N^i(s) = \frac{U_T^i(s_0)/U_N^i(s_0)}{U_T^i(s)/U_N^i(s)} P_T(s),$$

and from (6) wages are given by

$$W^i(s) = -\frac{U_L^i(s)}{U_T^i(s)} P_T(s),$$

where  $P_T(s)$  is given by (19).

There is also one degree of nominal indeterminacy in asset prices. We resolve this indeterminacy by setting  $Q^i(s_0) = 1$ . There is clearly also a joint indeterminacy in  $Q^i(s)$  and  $\tau_D^i(s)$ . We resolve it by letting  $Q^i(s) = Q(s)$  for all  $i$  and  $s$ , setting  $\tau_D^0(s) = 0$  for all  $s$ , and  $\tau_D^i(s_0) = 0$  for all  $i \neq 0$ . Now, using these normalizations, we can divide (4) for country 0

evaluated at state  $s$  by this same equation for country 0 evaluated at state  $s_0$  to obtain

$$(22) \quad Q(s) = \frac{1}{P_T(s)} \frac{\mu(s)U_T^0(s)}{\mu(s_0)U_T^0(s_0)},$$

where  $P_T(s)$  is given by (19). Now, for  $i \neq 0$ , dividing (4) for states  $s$  and  $s_0$  and then using our normalizations and the expression for  $Q(s)$  in (4) gives that portfolio taxes are given by

$$(23) \quad 1 + \tau_D^i(s) = \frac{U_T^i(s_0)}{U_T^i(s)} \frac{U_T^0(s)}{U_T^0(s_0)}.$$

Given  $P_N^i$ ,  $W^i(s)$ , and  $Q^i(s)$ , the payroll tax  $\tau_L^i$  is set so that (12) holds. Domestic transfers are given from the government budget constraint, whereas international transfers are given by

$$(24) \quad T_I^i(s) = P_T(s) [C_T^i(s) - Y_T^i(s)].$$

To see that such transfers are consistent with the consumer and government budget constraints, combine these budget constraints and substitute for profits from (10) with  $D^i(s) = 0$  to obtain (24). To see that such transfers are consistent with the union-wide constraint on international transfers, integrate (24) over countries and use world market clearing in traded goods, (17), to obtain (14). *Q.E.D.*

Note that the competitive equilibrium is defined for each possible setting of union-wide and national policies,  $(T_I, \pi)$ . As will become clear below, in what follows it is best to think of the competitive equilibrium as the continuation equilibrium of the noncooperative equilibrium of the second stage among national governments for given union-wide policies. That is, we can think of this equilibrium as specifying allocation functions,  $X(T_I, \pi)$ , world price functions,  $P_T(T_I, \pi)$ , and domestic price functions,  $P(T_I, \pi)$  and  $\{Q^i(T_I, \pi)\}$ , that vary with union-wide and national policies,  $(T_I, \pi)$ . Noncooperative national governments will use these maps to forecast how outcomes change as they vary their national policies.

## B. Middle Tier: Noncooperative Equilibrium between National Authorities

Consider now the middle tier. Taking as given the decisions of the union-wide fiscal authority, national governments set their policies noncooperatively. The *policy* for country  $i$ 's government,  $\pi^i = \{\pi^i(s)\}$ , with  $\pi^i(s) = (\tau_L^i, \tau_N^i(s), \tau_D^i(s), T^i(s))$ , consists of taxes on labor, the consumption of traded goods and asset holdings, and of transfers. The *strategy* of country  $i$ 's government,  $\pi^i(T_I)$ , depends on the history it faces which, in this three-tiered structure, is simply the union-wide transfers,  $T_I$ , chosen at the top tier.

For any given set of union-wide policies,  $T_I = \{T_I^i\}$ , a *noncooperative equilibrium of the incomplete market economy* consists of strategies  $\pi(T_I) = \{\pi^i(T_I)\}$  for national governments, together with world price functions,  $P_T(T_I, \pi)$ , and allocations and domestic price functions for each country,  $\{X^i(T_I, \pi), P^i(T_I, \pi), Q^i(T_I, \pi)\}$  where  $\pi = \{\pi^i\}$ , such that: *i*) given the union-wide policies  $T_I$  and the national policies of every other country  $j \neq i$ , denoted  $\pi_{-i}(T_I)$ , the national policy of any country  $i$ ,  $\pi^i = \pi^i(T_I)$ , maximizes the welfare of country  $i$ 's consumers, and *ii*) for every  $(T_I, \pi)$ , the world price functions, the allocations functions, and the domestic price functions form a competitive equilibrium with incomplete markets.

The equilibrium outcomes associated with these strategies are  $\hat{T}_I, \pi(\hat{T}_I), P_T(\hat{T}_I, \pi(\hat{T}_I))$ , and  $\{X^i(\hat{T}_I, \pi(\hat{T}_I)), P^i(\hat{T}_I, \pi(\hat{T}_I)), Q^i(\hat{T}_I, \pi(\hat{T}_I))\}$ , where  $\hat{T}_I$  is the optimal policy of the union-wide authority. Moreover, the noncooperative equilibrium should be thought of as simply the continuation of the world equilibrium for a given set of union-wide policies.

Consider the notion of perfection built into this noncooperative equilibrium definition. As the government of country  $i$  contemplates alternative policies,  $\tilde{\pi}^i$ , it anticipates that the resulting prices and allocations,  $P_T(T_I, \tilde{\pi})$  and  $\{X^i(T_I, \tilde{\pi}), P^i(T_I, \tilde{\pi}), Q^i(T_I, \tilde{\pi})\}$ , with  $\tilde{\pi} = (\tilde{\pi}^i, \pi_{-i}(T_I))$ , form a competitive equilibrium. Given the structure of the world economy, as the government of country  $i$  changes its policies, consumers and firms in country  $i$  change their production and consumption decisions, domestic prices change but, because country  $i$  is small in the world economy, all other countries' allocations and domestic prices are unchanged. That is, since  $P_T(T_I, \tilde{\pi})$  with  $\tilde{\pi} = (\tilde{\pi}^i, \pi_{-i}(T_I))$  is invariant to  $\tilde{\pi}^i$ , given the union-wide transfers  $T_I$ , the government of country  $i$  just faces a given price function, say  $P_T = P_T(T_I, \pi_{-i}(T_I))$ .

We now show how this feature of equilibrium simplifies the problem of country  $i$ 's



government. Using logic standard in the primal approach to optimal policy, we can think of national governments as choosing policies, allocations, and domestic prices for country  $i$ 's consumers and firms, subject to the conditions of the competitive equilibrium of the third stage. Formally, the problem of the government of country  $i$ 's problem can be written as follows: taking as given international transfers,  $T_I^i$ , and traded goods prices,  $P_T = P_T(T_I, \pi_{-i}(T_I))$ , choose country  $i$ 's allocations, prices, and policies to solve

$$(25) \quad \tilde{V}^i(T_I^i) = \max_{X^i, P^i, Q^i, \pi^i} \sum_s \mu(s) U^i(C_N^i(s), C_T^i(s), L^i(s), s),$$

subject to consumer and firm first-order conditions in country  $i$ , the consumer and government budget constraints in country  $i$ , and country  $i$ 's market clearing conditions in nontraded (15) and traded goods (16), where in the consumer and government budget constraints  $P_T = P_T(T_I, \pi_{-i}(T_I))$ .<sup>1</sup>

We claim that the best-response problem of a noncooperative government can be reduced to a simpler form, that is,

$$(26) \quad V^i(T_I^i) = \max_{\{C_N^i(s), C_T^i(s), L^i(s)\}} \sum_s \mu(s) U^i(C_N^i(s), C_T^i(s), L^i(s), s),$$

subject to nontraded goods market clearing

$$(27) \quad C_N^i(s) \leq A^i(s)L^i(s) \text{ for all } s,$$

and a country-wide budget constraint

$$(28) \quad C_T^i(s) \leq Y_T^i(s) + T_I^i(s) \text{ for all } s.$$

Note that since there are no international financial markets. the government of country  $i$  realizes that there is no choice in the consumption of traded goods: the consumers in country  $i$  simply consume their endowment plus international transfers of traded goods.

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<sup>1</sup>Here, and throughout the paper, we follow the primal approach in assuming that if there are multiple equilibria associated with its policies, a government can select the best one.

**Lemma 2.** *In an economy with incomplete markets, for any international transfers  $T_I$  and strategies of other governments,  $\pi_{-i}(T_I)$ , the best response of the government of country  $i$  gives rise to allocations that solve (26).*

**Proof.** The constraints facing the government of country  $i$  are summarized by the asset constraint, (2), the consumer budget constraint, (3), the first-order conditions for consumers, (4), (5), and (6), the market clearing for domestic assets, (7), the first-order condition for nontraded goods firms, (12), the government budget constraint, (13), and the nontraded and traded goods market clearing conditions, (15) and (16).

We first show that an allocation that is feasible for the government must satisfy (27) and (28) for country  $i$ . First, (15) is the same as (27), since (27) holds as an equality. Second, to see how the constraint (28) arises, substitute in the consumer budget constraint the expression for profits,  $\Pi^i(s) = P_N^i C_N^i(s) - (1 + \tau_L^i) W^i(s) L^i(s)$ , the expression for domestic transfers,  $T^i(s)$ , using the government budget constraint, (13), and  $D^i(s) = 0$  from (7). After cancelling terms, we obtain  $P_T(s) C_T^i(s) \leq P_T(s) [Y_T^i(s) + T_I^i(s)]$ , which is equivalent to (28). Now, given any allocations that satisfy (27) and (28), we can construct national policies and national prices so that the rest of the constraints are satisfied, by following the same steps as in Lemma 1. *Q.E.D.*

To develop some intuition for why a noncooperative government's problem can be reduced to a country-specific Ramsey-type problem, note that each country  $i$  is small and, hence, the domestic allocations, prices, and policies chosen by the government of this country cannot have an impact on world prices. Moreover, the policy choices of the countries in the rest of the union only affect a given country indirectly through traded goods prices, which are set competitively.

Lemma 2 makes it clear that, given the vector of international transfers for each country,  $\{T_I^i\}$ , and world prices,  $P_T$ , the utility of country  $i$  only depends on the international transfers to country  $i$ . Thus, Lemma 2 establishes the precise sense in which no fiscal externalities across countries exist.

### C. Top Tier: World Equilibrium

The union-wide authority chooses international transfers to maximize a weighted sum of consumers' utility in each country, that is, to solve

$$(29) \quad \max_{\{T_I^i\}} \int_i \lambda^i V(T_I^i) di$$

subject to

$$(30) \quad \int_i T_I^i(s) di = 0 \text{ for all } s.$$

Notice that the union-wide authority predicts that as it changes its transfers, the noncooperative governments will alter their policies, and thus the associated prices and allocations, so that the solution to (26) arises as a noncooperative equilibrium. In particular, for every set of transfers  $\tilde{T}_I$  it contemplates, the union-wide authority predicts that the national governments will choose policies  $\pi(\tilde{T}_I)$  consistent with a noncooperative equilibrium.

A *world equilibrium with incomplete markets* is a set of union-wide transfers,  $T_I$ , strategies for national governments, together with world price functions, and allocations and domestic price functions for each country, such that: *i*) the union-wide transfers,  $T_I$ , are optimal for the union-wide authority, and *ii*) the strategies for national governments, together with the world price functions, allocation functions, and domestic price functions for each country, form a noncooperative equilibrium.

This notion also has a type of perfection built into it: as the union-wide authority contemplates alternative transfers,  $\tilde{T}_I$ , it understands that national governments will best respond to each such set of transfers using  $\pi(\tilde{T}_I)$  and the resulting competitive allocations and prices will be those consistent with  $\tilde{T}_I$  and  $\pi(\tilde{T}_I)$ .

Using standard primal logic, we can think of the union-wide authority as choosing all policies, allocations, and prices subject to two sets of conditions.<sup>2</sup> The first set are all the first-order conditions of consumers and firms, the budget constraints of consumers and

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<sup>2</sup>Here, as is standard in the primal approach, if there are multiple continuation equilibria for a given set of policies, we implicitly let both the union-wide authority and the national governments select the best such equilibrium.

governments, and the market clearing conditions that define the competitive equilibrium. The second set are the optimality conditions for the policies of each government's best-response problem. Notice that since the consumption of traded goods is pinned down by the endowment and international transfers, the only optimality conditions from the government's best-response problem are for nontraded goods and labor. Substituting the constraints (27) and (28), holding as equalities, into the objective function (26), these first-order conditions for nontraded goods and labor reduce to

$$(31) \quad U_N^i(s) + A^i(s)U_L^i(s) = 0.$$

Notice also that if allocations satisfy (28) and the union-wide authority can choose international transfers that satisfy (30), then the union-wide authority is only constrained by the world resource constraint for traded goods, (17).

Now consider a relaxed version of the authority's problem, where we substitute out all the policies and drop the first-order condition (31), which arises from (26). This relaxed problem, referred to as the *union-wide problem*, is

$$(32) \quad \max_{\{C_N^i(s), C_T^i(s), L^i(s)\}} \int_i \lambda^i \left[ \sum_s \mu(s) U^i(C_N^i(s), C_T^i(s), L^i(s), s) \right] di$$

subject to

$$(33) \quad C_N^i(s) \leq A^i(s)L^i(s) \text{ for all } s,$$

$$(34) \quad \int_i C_T^i(s) di \leq \int_i Y_T^i(s) di \text{ for all } s.$$

We claim that it is immediate that the solution to this relaxed problem has first-order conditions that are consistent with the dropped first-order condition (31) of the government's best response problem. Hence, the solution to the relaxed problem coincides with the solution to the original problem. We summarize this discussion as follows.

**Lemma 3.** *The allocations in the world equilibrium with incomplete markets solve the union-wide problem (32).*

## 2. A Currency-Fiscal Union with Complete Financial Markets

Here we consider a joint currency-fiscal union with complete international financial markets. We think of this *complete market* setting as capturing the idea that in the modern era of international financial markets, countries can access these markets to obtain cross-country insurance. We again work backwards from the end of the period, starting from the competitive equilibrium.

### A. Bottom Tier: Competitive Equilibrium

We begin with a definition of a competitive equilibrium. Given the national policies  $\pi^c$  and the policies of the union-wide authority,  $T_I^c$ , a *competitive equilibrium with complete markets* consists of world prices,  $P_T^c$  and  $Q^c$ , together with allocations,  $\{X^{i,c}\}$ , and domestic prices,  $\{P^{i,c}\}$ , for each country  $i$  such that: *i*) consumer maximization in each country  $i$  holds, *ii*) profit maximization for final goods firms and intermediate goods firms in each country  $i$  holds, *iii*) the national policy  $\pi^{i,c}$  satisfies the government budget constraint of each country  $i$ , (13), *iv*) the union-wide policies  $T_I^c$  satisfy the budget constraint of the union-wide authority, (14), *v*) the world asset market clears in that

$$(35) \quad \int_i D_i^c(s) di = 0 \text{ for all } s,$$

and, finally, *vi*) the nontraded and traded goods markets clear in that

$$C_N^{i,c}(s) = A^i(s)L^{i,c}(s) \text{ for all } i \text{ and } s,$$

$$\int_i C_T^{i,c}(s) di = \int_i Y_T^i(s) di \text{ for all } s.$$

Note that with complete markets, there is now one world asset market rather than separate domestic asset markets. Given the presence of complete markets, any vector of international transfers,  $T_I^i(s)$ , with the same present value is equivalent from the perspective of both the consumers and the government of country  $i$ . Thus, in defining a world equilibrium, there will be an indeterminacy in international transfers because under complete markets, any two sets

of transfers,  $T_I^i(s)$  and  $\hat{T}_I^i(s)$ , are equivalent if they satisfy

$$\sum_s Q(s)P_T(s)T_I^i(s) = \sum_s Q(s)P_T(s)\hat{T}_I^i(s),$$

for given  $Q(s)$  and  $P_T(s)$ . We resolve this indeterminacy by representing international transfers as a constant transfer across states,  $T_I^{i,c}$ , such that  $T_I^{i,c}(s) = T_I^{i,c}$  for all  $s$ . Here, as earlier, we can think of equilibrium as specifying allocation functions,  $X^c(T_I^c, \pi^c)$ , world price functions,  $P_T^c(T_I^c, \pi^c)$  and  $Q^c(T_I^c, \pi^c)$ , and domestic price functions,  $P^c(T_I^c, \pi^c)$ , that vary with union-wide and national policies,  $(T_I^c, \pi^c)$ . The proof of the following lemma is nearly identical to that of Lemma 1 and is left to the reader.

**Lemma 4.** *The allocations in a competitive equilibrium with complete markets satisfy the nontraded and traded goods market clearing, namely, (15) and (16). Moreover, given any allocations that satisfy these constraints, we can construct prices, policies, and asset holdings for each country that, together with the given allocations, constitute an equilibrium with complete markets.*

## B. Middle Tier: Noncooperative Equilibrium between National Authorities

Consider now the middle tier. As before, taking as given the decisions of the union-wide authority, national governments set their policies noncooperatively.

For any given set of union-wide policies,  $T_I^c = \{T_I^{i,c}\}$ , a *noncooperative equilibrium of the complete market economy* consists of strategies  $\pi^c(T_I^c) = \{\pi^{i,c}(T_I^c)\}$  for national governments, together with world price functions,  $P_T^c(T_I^c, \pi^c)$  and  $Q^c(T_I^c, \pi^c)$ , and allocations and domestic price functions for each country,  $\{X^{i,c}(T_I^c, \pi^c), P^{i,c}(T_I^c, \pi^c)\}$  where  $\pi^c = \{\pi^{i,c}\}$ , such that: *i*) given the union-wide policies  $T_I^c$  and the national policies of every other country  $j \neq i$ , denoted  $\pi_{-i}^c(T_I^c)$ , the national policy of any country  $i$ ,  $\pi^{i,c} = \pi^{i,c}(T_I)$ , maximizes the welfare of country  $i$ 's consumers, and *ii*) for every  $(T_I^c, \pi^c)$ , the world price functions, the allocation functions, and the domestic price functions form a competitive equilibrium with complete markets.

Using similar logic to the one used before, the best-response of a noncooperative

government can be reduced to a simpler form, that is,

$$(36) \quad V^i(T_I^{i,c}) = \max_{\{C_N^i(s), C_T^i(s), L^i(s)\}} \sum_s \mu(s) U^i(C_N^i(s), C_T^i(s), L^i(s), s),$$

subject to nontraded goods market clearing

$$(37) \quad C_N^i(s) \leq A^i(s)L^i(s) \text{ for all } s,$$

and a country-wide budget constraint

$$(38) \quad \sum_s Q^c(s) P_T^c(s) C_T^i(s) \leq \sum_s Q^c(s) P_T^c(s) [Y_T^i(s) + T_I^{i,c}],$$

where  $P_T^c = P_T^c(T_I^c, \pi_{-i}(T_I^c))$  and  $Q^c = Q^c(T_I^c, \pi_{-i}(T_I^c))$ . Here, as earlier, we use the property that the world prices do not vary with the policies of country  $i$ .

**Lemma 5.** *In an economy with complete markets, for any international transfers  $T_I^c$  and strategies of other governments,  $\pi_{-i}(T_I^c)$ , the best response of the government of country  $i$  gives rise to allocations that solve (36).*

**Proof.** The proof follows closely that of Lemma 2 with a few exceptions. The constraints facing the government of country  $i$  are the same as in Lemma 2 except that the asset market clearing condition (7) is replaced by (35). To see that an allocation that is feasible for the government must satisfy the country-wide budget constraint (38), multiply the consumer budget constraint for each  $s$  by the world asset price  $Q^c(s)$ , sum across states, then perform the same substitutions as in Lemma 2 to arrive at (38).

Now, given any allocations that satisfy (37) and (38), we can construct national policies and national prices so that the rest of the constraints are satisfied. Here country  $i$  takes as given the world prices,  $Q^c(s)$  and  $P_T^c(s)$ . Given these prices we proceed as in Lemma 2, by setting the portfolio tax to zero in only one state, that is,  $\tau_D^i(s_0) = 0$  so that (4) becomes

$$(39) \quad 1 + \tau_D^i(s) = \frac{U_T^i(s_0) Q^c(s) P_T^c(s)}{U_T^i(s) Q^c(s_0) P_T^c(s_0)}$$

and let (39) determine  $\tau_D^i(s)$ . (In contrast to Lemma 1, where we also constructed world

prices, here we only characterize the best response of a government given these prices.) We set  $\tau_N^i(s)$ ,  $P_N^{i,c}$ ,  $W^i(s)$ ,  $\tau_L^i$ , and  $T^{i,c}(s)$  as in Lemma 2. *Q.E.D.*

### C. Top Tier: World Equilibrium

A *world equilibrium with complete markets* is a set of union-wide transfers,  $T_I^c$ , strategies for national governments, together with world price functions, and allocation and domestic price functions for each country, such that: *i*) the union-wide transfers,  $T_I^c$ , are optimal for the union-wide authority, and *ii*) the strategies for national governments, together with the world price functions, allocation functions, and domestic price functions for each country, form a noncooperative equilibrium.

As before, using standard primal logic, the union-wide authority can be thought of as choosing all the policies, allocations, and prices subject to two sets of conditions. The first set are all the first-order conditions of consumers and firms, the budget constraints of consumers and national governments, and the market clearing conditions that define the competitive equilibrium of the third stage. The second set of conditions are the optimality conditions for policies for each government's best-response problem. Now consider a relaxed version of this authority's problem, where we substituted out all the policies and dropped the first-order conditions of national governments that arise from the rewritten government's problem (36).

This relaxed problem has the form

$$(40) \quad \max_{\{C_N^i(s), C_T^i(s), L^i(s)\}} \int_i \lambda^i \left[ \sum_s \mu(s) U^i(C_N^i(s), C_T^i(s), L^i(s), s) \right] di$$

subject to

$$C_N^i(s) \leq A^i(s)L^i(s) \text{ and } \int_i C_T^i(s) di \leq \int_i Y_T^i(s) di, \text{ for all } s.$$

Clearly, the solution to the relaxed problem has first-order conditions that are consistent with the first-order conditions of each government's best response problem (36). Thus, the solution to the relaxed problem is a solution to the original problem. In sum, we have established the following result.

**Lemma 6.** *The allocations in the world equilibrium with complete markets solve the*



union-wide problem (40).

It is worth noting that in the world equilibrium with complete markets that supports these allocations, portfolio taxes are not used. To see why, note that the solution to the union-wide problem implies complete risk sharing in that

$$(41) \quad \lambda^i U_T^i(s) = \lambda^0 U_T^0(s) \text{ for all } i \text{ and } s.$$

Dividing this condition by its analog in state  $s_0$  gives that allocations with complete risk sharing satisfy

$$(42) \quad \frac{U_T^i(s)}{U_T^i(s_0)} = \frac{U_T^0(s)}{U_T^0(s_0)} \text{ for all } i \text{ and } s.$$

Now, consider the decentralized equilibrium: with complete international financial markets, which imply  $Q^i(s) = Q(s)$  for all  $i$ , the first-order condition (4) implies that

$$(43) \quad \frac{[1 + \tau_D^i(s)] \mu(s) U_T^i(s)}{[1 + \tau_D^i(s_0)] \mu(s_0) U_T^i(s_0)} = \frac{[1 + \tau_D^0(s)] \mu(s) U_T^0(s)}{[1 + \tau_D^0(s_0)] \mu(s_0) U_T^0(s_0)} = Q^c(s) P_T^c(s),$$

where we have used the normalizations that  $Q^c(s_0) = P_T^c(s_0) = 1$ . Clearly, the allocations that satisfy (42) can be supported as competitive allocations with  $\tau_D^i(s) = 0$  for all  $i$  and  $s$ . In this sense, portfolio taxes are redundant given nontraded goods taxes.

Note that in the benchmark economy, we allowed national governments to have a payroll tax, a nontraded goods tax, and a portfolio tax. We note that if instead we endowed governments only with a payroll tax and a nontraded goods tax, then the allocations that solve the best response problem for noncooperative governments and the union-wide problem would be the same. To understand this result, note that with  $\tau_D^i(s) = 0$  for all  $i$  and  $s$ , dividing the first-order condition in a given country  $i$  for state  $s$  by the corresponding one for state  $s_0$  gives that allocations must satisfy the extra constraint

$$(44) \quad \frac{\mu(s) U_T^i(s)}{\mu(s_0) U_T^i(s_0)} = P_T(s) Q(s) \text{ for all } s \neq s_0.$$

This constraint would then need to be added to the best-response problem, (36). To see that

this extra constraint is superfluous, consider a relaxed version of this problem without the constraint (44). The first-order conditions to the relaxed problem then imply (44), so the solution to the relaxed problem is feasible for the original problem with the constraint and hence solves it. It is then immediate that the union-wide problem is unchanged. Now when there are incomplete markets, the portfolio taxes are irrelevant. Hence, our results would be unchanged.

### 3. Do Financial Markets Obviate the Need for a Fiscal Union?

We have argued that the key difference between Mundell's and Kenen's views of a union is that Mundell envisions a union in which international transfers are motivated solely by insurance reasons, whereas Kenen imagines a union in which these transfers are motivated by redistributive reasons as well. To formalize these different views, we need to distinguish clearly a union's goal of providing insurance to member countries from its goal of redistributing ex-ante wealth.

Given our setup with self-interested consumers and governments, acting on behalf of their own consumers, obviously no government will willingly give away ex-ante wealth. Hence, regardless of how sophisticated international financial markets are, if the goal of a union is to redistribute ex-ante wealth, a union-wide authority is needed to extract ex-ante resources from one group of countries and redistribute them to another. That is, under Kenen's view, an activist union-wide authority is necessary to implement such redistribution.

We argue that the key difference between Mundell's and Kenen's views of a union amounts to different specifications of the Pareto weights used by the union-wide authority when deciding on international transfers. Specifically, note that for an arbitrary set of welfare weights,  $\lambda = \{\lambda^i\}$ , a union-wide authority *both* provides insurance and redistributes ex-ante wealth. To focus on insurance only, we proceed as follows. For any given set of weights, we construct our decentralization of the allocations from the union-wide problem in the incomplete market equilibrium, (32), as in Lemma 1, with artificial prices  $Q(s; \lambda)$  and  $P_T(s; \lambda)$  and associated consumption levels  $C_T^i(s; \lambda)$ . The international transfers that decentralize this

problem are defined by

$$(45) \quad T_I^i(\lambda; s) = Y_T^i(s) - C_T^i(s; \lambda),$$

that is,  $T_I^i(\lambda; s)$  are the transfers in state  $s$  given to each consumer in country  $i$  when the union-wide authority uses the Pareto weights  $\lambda$ . Under the decentralization of this problem, these transfers have an ex-ante value of

$$(46) \quad W_I^i(\lambda) = \sum_s Q(s; \lambda) P_T(s; \lambda) T_I^i(\lambda; s).$$

We say that the weights  $\lambda$  *involve no ex-ante transfer of wealth* between countries if

$$(47) \quad W_I^i(\lambda) = 0 \text{ for all } i \in I.$$

We will say that a union-wide fiscal authority is *concerned solely with insurance* if its objective function has weights that involve no ex-ante transfer of wealth between countries, and that it has *redistributive motives* otherwise.

In short, according to Mundell's view, in the incomplete markets era, the union-wide authority has weights that satisfy (47). Given these weights, we then address Mundell's question: In the modern era of complete markets, is there any role for an activist union-wide policy of transfers? More precisely, we say that the union-wide fiscal authority is *unnecessary* with complete markets if the allocations in the world equilibrium in which this authority implements international transfers coincide with those in which all international transfers are restricted to zero. That is, letting  $\hat{T}_I^{i,c}(\lambda)$  denote the optimal transfers under complete markets, the union-wide authority is unnecessary if  $\hat{T}_I^{i,c}(\lambda) = 0$  for all  $i$ . The following is our first main proposition.

**Proposition 1.** (*Complete Markets Obviate the Need for a Fiscal Union*) *A union-wide fiscal authority is unnecessary with complete markets if and only if this authority is concerned solely with insurance.*

**Proof.** The problem of the union-wide authority with incomplete markets reduces to the one in (40). Let  $C_T^i(s; \lambda)$  and  $Q(s; \lambda)$  solve this problem. The first-order conditions imply

perfect risk-sharing in that

$$(48) \quad \lambda^i U_T^i(s; \lambda) = \lambda^0 U_T^0(s; \lambda) \text{ for all } i \text{ and } s,$$

which yields

$$(49) \quad \frac{U_T^i(s; \lambda)}{U_T^i(s_0; \lambda)} = \frac{U_T^0(s; \lambda)}{U_T^0(s_0; \lambda)} \text{ for all } i \text{ and } s.$$

Using the decentralization in Lemma 1, we obtain

$$(50) \quad P_T(s; \lambda) = \frac{U_T^0(s; \lambda)/U_N^0(s; \lambda)}{U_T^0(s_0; \lambda)/U_N^0(s_0; \lambda)} \text{ and } Q(s; \lambda) = \frac{1}{P_T(s; \lambda)} \frac{\mu(s) U_T^i(s; \lambda)}{\mu(s_0) U_T^i(s_0; \lambda)},$$

where (49) and (50) imply that  $Q(s; \lambda)$  does not vary with the country  $i$ . The transfers are

$$(51) \quad T_I^i(s; \lambda) = Y_T^i(s) - C_T^i(s; \lambda),$$

that is,  $T_I^i(s; \lambda)$  are the transfers in state  $s$  given to each consumer in country  $i$  when the union-wide authority uses the Pareto weights  $\lambda$ . These transfers involve no ex-ante transfer of wealth between countries if

$$(52) \quad W_I^i(\lambda) = \sum_s Q(s; \lambda) P_T(s; \lambda) T_I^i(s; \lambda) = 0 \text{ for all } i.$$

Now consider the problem of the union-wide authority with complete markets. As we have argued, that problem also reduces to (40) and thus are also equal to  $C_T^i(s; \lambda)$  above. We can decentralize these allocations as we did in Lemma 4. Clearly, the prices  $Q^c(s; \lambda)$  and  $P_T^c(s; \lambda)$  that decentralize these allocations as a complete market equilibrium equal the prices  $Q(s; \lambda)$  and  $P_T(s; \lambda)$  that decentralize it as an incomplete market equilibrium. The state-uncontingent transfers  $T_I^{c,i}(\lambda)$  that decentralize this outcome under complete markets are related to the state contingent transfers  $T_I^i(s; \lambda)$  that decentralize this outcome under

incomplete markets by

$$(53) \quad T^{c,i}(\lambda) \sum_s Q(s; \lambda) P_T(s; \lambda) = \sum_s Q(s; \lambda) P_T(s; \lambda) T_T^i(s; \lambda).$$

Thus, for the weights  $\lambda$  that involve no ex ante transfer of wealth under incomplete markets, namely those that satisfy (46), the complete market transfers necessarily satisfy

$$(54) \quad T^{c,i}(\lambda) = 0 \text{ for all } i.$$

Thus, (54) establishes that a union-wide fiscal authority is unnecessary with complete markets if and only if this authority is concerned solely with insurance. *Q.E.D.*

#### **4. Do Restrictions on Instruments Generate Fiscal Externalities?**

So far we have considered economies in which national governments have available rich enough fiscal instruments so that they can correct private distortions and achieve allocations in which the distortions associated with monopoly power, sticky prices, and a fixed exchange rate can be eliminated by a suitable choice of policies. Thus, with such instruments and complete markets, each national government can maximize its residents' welfare subject only to a country-wide budget constraint and the nontraded goods resource constraint.

Here we consider economies in which national governments have a restricted set of fiscal instruments available so that they cannot eliminate all private distortions. The question we address is the following: Does restricting the set of fiscal instruments of national governments introduce a fiscal externality across countries? That is, with restricted instruments, is a union-wide fiscal authority necessary to achieve the relevant constrained efficient outcomes? Our answer is no: even with restricted instruments, no fiscal externality arises and, thus, a union-wide fiscal authority is unnecessary if the authority is concerned solely with insurance.

##### **A. Restrictions on the Policy Instruments**

Here we restrict governments to have no domestic policy instrument that affects the relative prices of traded and nontraded goods, that is, we make the *restricted policy* assump-

tion that

$$(55) \quad \tau_N^i(s) = 0 \text{ for all } i \text{ and } s.$$

We again proceed by working backwards from the end of the period. To characterize the set of allocations that can be implemented by a suitable choice of policy, consider the first-order conditions of consumers in (4)–(6) and the intermediate goods firms in (12) under the restricted policy assumption. We claim that in addition to the resource constraints, these allocations must satisfy some additional constraints that we refer to as *incomplete tax system constraints*. To see how these constraints arise, note that with  $\tau_N^i(s)$  restricted to zero and the normalization that  $P_T(s_0) = 1$ , the first-order condition (5) implies

$$(56) \quad P_T(s) = \frac{U_T^i(s)/U_N^i(s)}{U_T^i(s_0)/U_N^i(s_0)},$$

where the right-most term does not vary across countries. Thus, the left side of (56) must be the same across all countries for any state  $s$ . Letting  $R^i(s) \equiv U_T^i(s)/U_N^i(s)$ , we can compactly express these constraints relative to some particular country, say  $i = 0$ , as

$$(57) \quad \frac{R^i(s)}{R^i(s_0)} = \frac{R^0(s)}{R^0(s_0)} \text{ for all } i \text{ and } s.$$

Hence, for each country  $i \neq 0$ , there is one constraint per state  $s \neq s_0$ . Here we discuss how these incomplete tax constraints change the analysis in the incomplete and complete market economies.

## B. Incomplete Markets with Restricted Policy

We again proceed with each tier. A competitive equilibrium with incomplete markets and restricted policies is defined analogously to that of the our economy with unrestricted instruments. The key lemma characterizing the competitive equilibrium is the analog of Lemma 1.

**Lemma 7.** *With restricted policies, the allocations in a competitive equilibrium with incomplete markets satisfy the nontraded and traded goods market clearing conditions, namely,*

(15) and (16), and the incomplete tax constraints, (57). Moreover, given any allocations that satisfy these constraints, we can construct prices and policies for each country that, together with the given allocations, constitute an equilibrium with incomplete markets.

**Proof.** For necessity, by definition of an equilibrium, the allocations satisfy nontraded and traded goods market clearing. To see that they must also satisfy the incomplete tax constraints, divide each term in (5) for some state  $s$  by its counterpart in state  $s'$ , imposing  $\tau_N^i(s) = \tau_N^i(s') = 0$  to get

$$(58) \quad \frac{R^i(s)}{R^i(s')} = \frac{P_T(s)}{P_T(s')}.$$

To see that (58) implies (57), pick state  $s'$  to be state  $s_0$  and divide (58) for country  $i$  by the same constraint for country 0. This yields (57). For sufficiency, the construction follows the same steps as in Lemma 1. *Q.E.D.*

Given the policies of the union-wide authority,  $T_I = \{T_I^i\}$ , a *noncooperative equilibrium of the incomplete market economy* consists of strategies  $\pi(T_I) = \{\pi^i(T_I)\}$  for national governments, together with world price functions,  $P_T(T_I, \pi)$ , and allocation and domestic price functions for each country,  $\{X^i(T_I, \pi), P^i(T_I, \pi), Q^i(T_I, \pi)\}$ , such that: *i*) given the union-wide policies  $T_I$  and the national policies of every other country  $j \neq i$ , denoted  $\pi_{-i}(T_I)$ , the national policy of any country  $i$ ,  $\pi^i = \pi^i(T_I)$ , maximizes the welfare of country  $i$ 's consumers, and *ii*) for every  $(T_I, \pi)$ , the world price functions, the allocations functions, and the domestic price functions form a competitive equilibrium with incomplete markets and restricted policies.

We claim that it is immediate from Lemma 7 and the definition of the noncooperative equilibrium that the best response of country  $i$ 's government has allocations that solve

$$(59) \quad V_i(T_I^i) = \max_{\{C_T^i(s), L^i(s)\}} \sum_s \mu(s) U^i(A^i(s) L^i(s), C_T^i(s), L^i(s), s),$$

subject to a country-wide budget constraints

$$(60) \quad C_T^i(s) \leq Y_T^i(s) + T_I^i(s) \text{ for all } s$$

and the incomplete market constraint

$$(61) \quad R^i(s) = P_T(s)R^i(s_0) \text{ for } s \neq s_0,$$

with  $P_T(s_0) = 1$  where  $P_T = P_T(T_I, \pi_{-i}(T_I))$ . The reason governments' best responses solve this problem is that, taking as given the union-wide policies  $T_I^i$  and the strategies  $\pi_{-i}(T_I)$  of other governments, the government of country  $i$  can manipulate its national policies to implement any allocation that satisfies (60) and (61). Notice that with restricted instruments, the constraints (61) imply that we can no longer reduce this best response problem to one in which all the traded goods prices have been substituted out as we did earlier with unrestricted instruments. The presence of these extra constraints, (61), clearly introduces additional distortions into this problem relative to the one with an unrestricted tax system. Here, the incomplete tax system constraints typically bind when countries face different shocks. Finally, the analog of Lemma 3 is immediate.

**Lemma 8.** *The allocations in the world equilibrium with incomplete markets solve the union-wide problem of maximizing (32), subject to the resource constraint for nontraded goods, the world resource constraint for traded goods, and the incomplete tax constraints in (57).*

For any given set of weights  $\lambda = \{\lambda^i\}$ , we construct our decentralization of the solution to the union-wide problem for the incomplete market economy with restricted instruments as in Lemma 1, with artificial prices  $Q^i(s; \lambda)$  and associated consumption levels  $C_T^i(s; \lambda)$ . The international transfers that decentralize this problem satisfy (45). The definitions of a union-wide authority being concerned solely with insurance, having redistributive motives, and being unnecessary with complete markets are the natural analogs of those introduced earlier for the economy with no restrictions on instruments.

### C. Complete Markets with Restricted Policy

The analysis here is an immediate extension of our analysis above. The key lemma for the competitive equilibrium is the analog of Lemma 7. For simplicity, we drop the superscript  $c$  whenever unambiguous.

**Lemma 9.** *With restricted instruments, the allocations in a competitive equilibrium*



with complete markets satisfy the nontraded and traded goods market clearing conditions, namely (15) and (16), and the incomplete tax constraints (57). Moreover, given any allocations that satisfy these constraints, we can construct prices, policies, and asset holdings that, together with the given allocations, constitute an equilibrium with complete markets.

The proof of Lemma 8 is essentially identical to that of Lemma 5. Given the world prices  $P_T$  and  $Q$  and the international transfers  $T_I^{i,c}$ , the problem of the noncooperative government of country  $i$  is to choose allocations to maximize the welfare of country  $i$ , where

$$(62) \quad \max_{\{C_T^i(s), L^i(s)\}} \sum_s \mu(s) U^i(A^i(s)L^i(s), C_T^i(s), L^i(s), s)$$

subject to

$$(63) \quad \sum_s Q(s) P_T(s) C_T^i(s) \leq \sum_s Q(s) P_T(s) [Y_T^i(s) + T_I^{i,c}],$$

$$(64) \quad R^i(s) = P_T(s) R^i(s_0) \text{ all } s \neq s_0,$$

where  $P_T$  and  $Q$  are defined as functions of  $(T_I, \pi_{-i}(T_I))$  and are part of a competitive equilibrium with complete markets and restricted policies. The second main result of the paper is summarized in the following proposition.

**Proposition 2.** *(Even with Restricted Instruments, Complete Markets Obviate the Need for a Fiscal Union) In an economy with restricted instruments, a union-wide fiscal authority is unnecessary with complete markets if and only if this authority is concerned solely with insurance.*

**Proof.** The proof is essentially identical to that of Proposition 1. The union-wide authority's problems under incomplete and complete markets reduce to the same planning problem, namely, maximize (29) subject to the resource constraints for nontraded goods, (27), the world resource constraints for traded goods, (34), and the incomplete tax constraints, (57). Using the decentralizations of Lemmas 7 and 8, if the weights that decentralize the incomplete market allocations have international transfers  $T_I^i(s; \lambda)$  that involve no ex-ante

transfer of wealth in that

$$\sum_s Q(s; \lambda) P_T(s; \lambda) T_I^i(s; \lambda) = 0,$$

then clearly for those same weights, the complete market transfers,  $T^{i,c}(\lambda)$ , that decentralize these same outcomes necessarily satisfy

$$T^{c,i}(\lambda) \sum_s Q(s; \lambda) P_T(s; \lambda) = 0 \text{ for all } i,$$

so that  $T^{c,i}(\lambda) = 0$  for all  $i$ . *Q.E.D.*

## 5. When is There a Role for an Activist Union-Wide Authority?

We have shown that for the economies considered, there is no role for an activist union-wide authority when that authority is concerned solely with insurance. Here we determine conditions under which there might be a role for such an authority.

Our results so far depend on the idea that the union-wide authority has no instruments, except for international transfers, that national governments do not have available and that the national government of each country is benevolent, in that it chooses policies to maximize the welfare of its residents. It is primarily the combination of these two assumptions, along with the assumption that policy-makers have commitment, and that each country is small in the world in the relevant sense, which allows us to establish this result. If we drop any of these assumptions, there may be a role for a union-wide authority, even one concerned solely with insurance.

We prove this point through three examples. Our first example shows that if some countries are constrained in their choice of instruments, there is a role for an active union-wide authority to levy portfolio taxes. Our second example shows that even when countries have flexible exchange rates, if national governments face constraints on their policies, then the union-wide authority typically has an incentive to intervene and impose portfolio taxes. Finally, our last example shows that if national governments do not maximize the welfare of their citizens but rather pursue their own self interests, then there is an incentive for the union as a whole to delegate the power to set portfolio taxes to the union-wide authority

rather than to the national governments.

### A. Portfolio Taxes To Help Policy-Constrained Countries in a Union

Suppose that all countries in one group of the union,  $N$  or the *North*, have access to labor taxes, nontraded goods taxes and lump-sum transfers,  $\{\tau_L^i, \tau_N^i(s), T^i(s)\}$  for  $i \in N$ , but that countries in another group,  $S$  or the *South*, have access to only labor taxes and lump sum taxes,  $\{\tau_L^i, T^i(s)\}$  for  $i \in S$ . Suppose, moreover, that the union-wide authority, rather than national governments, can levy taxes on the portfolios of all countries in the union,  $\{\tau_D^i(s)\}$  for all  $i$ , and when it levies such taxes on a country, it rebates the proceeds to that country.

Clearly, the restriction on instruments for the Southern countries add incomplete tax constraints of the form

$$(65) \quad \frac{R^i(s)}{R^i(s_0)} = \frac{R^0(s)}{R^0(s_0)} \text{ for all } i \in S \text{ and } s,$$

where country 0 is a Southern country. Now, given that the union-wide authority can levy portfolio taxes  $\{\tau_D^i(s)\}$  on any country, it is easy to show that the problem of the union-wide authority becomes

$$(66) \quad \max_{\{C_T^i(s), L^i(s)\}} \int_i \lambda^i \left[ \sum_s \mu(s) U^i(A^i(s) L^i(s), C_T^i(s), L^i(s), s) \right] di,$$

subject to the incomplete tax constraints for the Southern countries (65) and the world resource constraint for traded goods. Now consider two pairs of countries, countries  $i, j \in N$  and  $k, l \in S$ . The first-order conditions imply that, for all  $s$

$$(67) \quad \lambda^i U_T^i(s) = \lambda^j U_T^j(s) = \lambda^k U_T^k(s) + \phi^k(s) = \lambda^l U_T^l(s) + \phi^l(s),$$

where for  $c = k, l$ ,  $c \neq 0$ , and  $s \neq s_0$ ,

$$(68) \quad \phi^c(s) = \lambda^c [A^c(s) U_N^c(s) + U_L^c(s)] \frac{\partial R^c(s) / \partial C_T^c(s)}{\partial R^c(s) / \partial L_T^c(s)}.$$

As we show in the Appendix, the expressions for  $\phi^c(s)$  for  $c \neq 0$ ,  $s = s_0$  and  $c = 0$  are similar.

The first-order condition (67) implies there is perfect risk-sharing between any two Northern countries but, because of the incomplete tax constraints, there is imperfect risk-sharing either between a Northern country and a Southern country or between any two Southern countries. To achieve these allocations, the union levies the following portfolio taxes

$$(69) \quad \tau_D^i(s) = \begin{cases} 0 & \text{for } i \in N \\ \frac{1}{\lambda^i} \frac{\phi^i(s)}{U_T^i(s)} & i \in S \end{cases} .$$

To see why, note that in the decentralized equilibrium with complete markets, the first-order conditions for consumers imply

$$(70) \quad \frac{U_T^i(s)[1 + \tau_D^i(s)]}{\rho^i} = \frac{U_T^0(s)[1 + \tau_D^0(s)]}{\rho^0},$$

where  $\rho^i$  is the multiplier on the asset market constraint (2). Here with  $\tau_D^i(s)$  defined by (69) and the multiplier  $\rho^i$  set to  $1/\lambda^i$ , the decentralized first order conditions (70) coincide with those in the union-wide problem (67).

**Proposition 3A.** (*Portfolio Taxes To Help Policy-Restricted Countries*) *A union-wide fiscal authority concerned solely with insurance makes no transfers to any country and levies portfolio taxes on the policy-restricted Southern countries solely to help ameliorate the distortions in these policy-restricted countries.*

Here the union-wide authority simply helps policy-restricted countries by levying a less powerful tax, a portfolio tax, to partially fix the limited risk-sharing implied by its incomplete tax system. It does so only because a policy-restricted country is incapable of levying a nontraded goods tax for itself that would undo the incomplete tax constraint.

Notice that here an active role for a union-wide authority is intimately connected to the countries belonging to a monetary union. To see why, suppose that our countries still belong to a fiscal union, but that exchange rates between member countries are flexible. Here each country  $i$  has its own nominal price  $P_T^i(s)$  for its traded goods, where  $P_T^i(s)$  is intended to be the price of traded goods in the local currency of country  $i$ . For this economy with flexible exchange rates, note that even if  $\tau_N^i(s)$  is restricted to zero under the normalization

that  $P_T^i(s_0) = 1$ , the first-order condition (5) implies

$$(71) \quad \frac{R^i(s)}{R^i(s_0)} = \frac{U_T^i(s)/U_N^i(s)}{U_T^i(s_0)/U_N^i(s_0)} = P_T^i(s).$$

But now the right-side of (71) varies with  $i$  so that there is no incomplete tax constraint: allocations can be constructed ignoring this constraint and then  $P_T^i(s)$  can be chosen so that it holds. We summarize this discussion with a proposition.

**Proposition 3B.** *(Portfolio Taxes To Help Policy-Restricted Countries Unnecessary Under Flexible Exchange Rates) Under flexible exchange rates, a union-wide fiscal authority concerned solely with insurance neither makes transfers nor levies portfolio taxes.*

These results might lead one to conjecture, more generally, that the need to levy portfolio taxes is intimately connected to countries belonging to a monetary union and that these taxes offset cross-country externalities. The next section shows that this conjecture is correct.

## B. Portfolio Taxes without a Monetary Union

Here we consider a fiscal union with flexible exchange rates and severe restrictions on the policies of national governments. Specifically, no countries have access to a payroll tax on labor, the Northern countries have access to portfolio taxes, whereas Southern countries do not. The union-wide authority, however, has the ability to levy portfolio taxes on any country  $i$  it chooses. To make our point even starker, imagine that the price of nontraded goods is flexible rather than sticky.

Here the lack of a payroll tax means that the country no longer has an instrument to offset the monopoly distortion. Thus, since nontraded goods prices are flexible, the price setting rule (12) reduces to

$$(72) \quad P_N^i = \frac{\varepsilon}{\varepsilon - 1} \frac{W^i(s)}{A^i(s)},$$

which adds an extra constraint to the national governments' problems. In particular, using

the consumer first-order condition

$$-\frac{U_L^i(s)}{U_N^i(s)} = \frac{W^i(s)}{P_N^i},$$

we can rewrite (72) as

$$(73) \quad -\frac{U_L^i(s)}{U_N^i(s)} = \frac{\varepsilon - 1}{\varepsilon} A^i(s).$$

This *monopoly distortion* constraint implies that the marginal rate of substitution between labor and nontraded goods is strictly lower than the marginal rate of transformation between these variables.

Now, imagine repeating our analysis for this environment. Clearly, the union-wide authority can simply levy the appropriate portfolio tax on each Southern country and achieve the same allocations as when all countries have access to and use their portfolio taxes to maximize their residents' welfare. We summarize this discussion with the following proposition.

**Proposition 4.** (*Portfolio Taxes to Help Policy-Restricted Countries*) *In this economy with restricted instruments, a union-wide fiscal authority concerned solely with insurance is necessary with complete markets only to levy the portfolio taxes that policy-restricted countries are unable to levy for themselves.*

Clearly, this proposition offers a paternalistic view of the union-wide authority: Southern countries are unable to carry out desirable policies so the benevolent union-wide authority has to do their job for them.

### C. Policy with Self-Interested Governments

In the environments that we have so far considered, except for the international transfers, the equilibrium does not depend on the tier of decision making at which policies are set. For example, if instead of allowing national governments to set their country-specific fiscal policies, we attributed this power to the union-wide authority, then we would obtain the same equilibrium. We refer to this property of equilibrium as an *irrelevance of delegation of authority*. The key assumptions that lead to this result is that the government of each country maximizes the utility of the consumers of country  $i$  and the union maximizes a

weighted-average of the utility of consumers in each country (along with the assumption of commitment to policy and that each country is small). Here we consider self-interested governments, namely those with objective functions that differ from that of consumers in their countries, and show how the delegation of authority matters for the allocations that can be achieved.

We modify the benchmark model as follows. Government  $i$  chooses the amount of nontraded goods  $G_t$  to devote to government spending so that the resource constraint for nontraded goods is now

$$(74) \quad C_N^i(s) + G^i(s) \leq A^i(s)L^i(s).$$

Consumer preferences are unchanged, in particular, consumers do not value government spending. We model a self-interested government by assuming that the preferences of the government of country  $i$  are given by

$$(75) \quad \sum \mu(s)W(C_N^i(s), G^i(s), C_T^i(s), L^i(s)).$$

The utility function  $W(\cdot)$  of the government is sufficiently general so that it can capture many different types of self interest. Here we show how equilibrium is affected by the delegation of portfolio taxes by considering two environments. In both environments, we assume that the national government sets nontraded goods taxes and transfers, and the union-wide authority sets international transfers. In the *national delegation* model, however, the national governments also set portfolio taxes, whereas in the *union delegation* model, the union-wide authority sets these taxes. We study these alternative delegation schemes in a complete market version of the model. As before, we drop the superscript  $c$  whenever unambiguous.

### ***National Delegation***

We start by characterizing equilibrium at the middle tier. Building on our earlier logic, given  $T_I$  and the strategies of other governments, the problem of country  $i$  becomes

$$\max_{\{C_N^i(s), G^i(s), C_T^i(s), L^i(s)\}} \sum_s \mu(s)W^i(C_N^i(s), G^i(s), C_T^i(s), L^i(s)),$$

subject to (74) and

$$\sum_s Q(s)P_T(s)C_T^i(s) = \sum_s Q(s)P_T(s) [Y_T^i(s) + T_I^{i,c}],$$

where the prices  $P_T = P_T(T_I, \pi_{-i}(T_I))$  and  $Q = Q(T_I, \pi_{-i}(T_I))$  are taken as given by this government. The first order condition for nontraded consumption, labor, and traded goods can be summarized by

$$(76) \quad W_N^i(s) = W_G^i(s),$$

$$(77) \quad -W_L^i(s) = A^i(s)W_N^i(s),$$

$$(78) \quad \frac{\mu(s)W_T^i(s)}{\mu(s_0)W_T^i(s_0)} = Q(s)P_T(s),$$

where we have used the normalization that  $Q(s_0) = P_T(s_0) = 1$ . The extra constraints (76) and (77) should be thought of as *self-interested governments* constraints. That is, the union-wide authority must respect the incentives of the self-interested national governments to distort allocations away from those that maximize the utility of their consumers. The union-wide authority's problem is thus,

$$(79) \quad \max_{\{C_N^i(s), G^i(s), C_T^i(s), L^i(s)\}} \int_i \lambda^i \left[ \sum \mu(s)U^i(C_N^i(s), C_T^i(s), L^i(s)) \right] di,$$

subject to (74), (76), (77), (78), and

$$\int_i C_T^i(s)di \leq \int_i Y_T^i(s)di.$$

The constraints in the union-wide authority's problem capture the union's inability to control the policies of noncooperative governments.



### ***Union Delegation***

As before, we start by characterizing equilibrium at the middle tier. Building on our earlier logic, given  $T_I$  and the strategies of other governments, the problem of country  $i$  becomes

$$\max_{\{C_N^i(s), G^i(s), C_T^i(s), L^i(s)\}} \sum_s \mu(s) W^i(C_N^i(s), G^i(s), C_T^i(s), L^i(s)),$$

subject to (74) and

$$(80) \quad \sum_s q^i(s) C_T^i(s) = \sum_s q^i(s) [Y_T^i(s) + T_I^{i,c}],$$

where  $q^i(s) = Q(s)P_T(s)/[1 + \tau_D^i(s)]$  is under the control of the union-wide authority. The first order conditions for this problem are (76), (77), and

$$(81) \quad \frac{\mu(s)W_T^i(s)}{\mu(s_0)W_T^i(s_0)} = q^i(s).$$

Critically, here the union-wide authority can set portfolio taxes in a way that completely controls the first-order condition governing traded goods consumption in each country. The union-wide authority's problem is a relaxed version of (79) since (78) is no longer a constraint.

**Proposition 5.** (*Union Delegation of Portfolio Taxes Preferred*) *The welfare of the union-wide authority is higher under the union delegation scheme than under the national delegation scheme.*

The proof is simple: the union-wide authority's problem with national delegation is a more constrained version of the union-wide authority's problem with union delegation.

## **6. Nontraded Goods Taxes in Practice**

As we have shown, when governments have access to nontraded goods taxes, there is no need to ever levy portfolio taxes under complete markets. Here we argue that, in practice, governments both have the ability to levy nontraded goods taxes and actually do so. In this sense, our model does not provide a strong justification for instituting a new regime of portfolio taxes within the European Union.

Specifically, although free trade agreements in currency areas typically make it very

difficult to differentially tax traded goods, they usually allow some differential tax treatment of nontraded goods. For example, in May 2009 the Council of the European Commission adopted a directive (2009/47/EC) that permanently allowed the optional use of reduced rates for the value-added tax (VAT) on certain labor-intensive local services, including restaurant services. The rationale was that for such nontraded goods, there is no risk of unfair competition between service providers in different member states. Moreover, a document of the European Commission on VAT rates (European Commission 2009) discusses how, in practice, VAT taxes on nontraded goods vary widely across countries and goods, as shown in Figure 1.

In addition to this varying VAT for nontraded goods, excise taxes on specific goods also vary significantly across countries in the European Union. Using beer as a case study of a specific example of an excise tax, we observe that tax rates and even tax methods vary widely by country within the European Union. For instance, several countries within the European Union employ a progressive beer duty that allows the tax rate to vary by quantity produced, thus effectively subsidizing smaller brewers. Also, a few countries choose to allow tax rates to vary by the percentage alcohol content of beer. Even ignoring these differences, if we look only at the VAT on beer in 2002 across select countries in the European Union, we observe that the range of actual rates is quite wide, as depicted in Figure 2. These data seem to suggest that the assumptions underlying the Mundell economy are not unreasonable for the European Union.

## 7. Conclusion

We have argued that sophisticated financial markets obviate the need for a union-wide authority to orchestrate fiscal transfers across countries for insurance reasons. This result holds true even when national governments are subject to additional constraints because of the paucity of fiscal instruments available to member countries. The key idea behind these results is that even with restricted fiscal instruments and noncooperative governments, no macroeconomic externality of any kind arises across countries. If the goal of a union is to transfer ex-ante wealth from one group of countries to another, then clearly an activist union-wide authority is necessary to carry out such forced redistribution.

In terms of the optimal delegation of authority, as long as the objective of the noncoop-

erative governments is to maximize the welfare of their citizens, we show that an irrelevance of delegation of authority result holds. That is, equilibrium is unchanged if any of the labor taxes, nontraded goods taxes, or portfolio taxes are delegated to the national governments or the union-wide authority. If, instead, the noncooperative governments pursue self-interested policies while the union-wide authority is benevolent, then it is typically more desirable to delegate relatively more powers to the union-wide authority rather than to the national governments.

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## 9. Appendix

Here we show more of the details behind the derivations in the text.

Set up for Proposition 3A. It is convenient to substitute out traded goods prices and write the incomplete tax constraints as (65). Here, using logic similar to that used earlier, the union-wide problem is to solve

$$\max_{\{C_T^i(s), L^i(s)\}} \int_i \lambda^i \left[ \sum_s \mu(s) U^i(A^i(s) L^i(s), C_T^i(s), L^i(s), s) \right] di,$$

subject to the resource constraint

$$\int_i C_T^i(s) di \leq \int_i Y_T^i(s) di \text{ for all } s$$

and the incomplete tax constraints

$$\frac{R^0(s)}{R^0(s_0)} - \frac{R^i(s)}{R^i(s_0)} = 0 \text{ all } i \in S \text{ and } s \neq s_0,$$

where  $\mu(s)\theta(s)$  and  $\mu(s)\eta^i(s)$  are the normalized multipliers on the resource constraint and the incomplete tax constraints. The first-order conditions for  $C_T^i(s)$  for  $i \in N$

$$(82) \quad \lambda^i U_T^i(s) = \theta(s).$$

The first-order conditions for  $L^i(s)$  for  $i \in N$  are

$$(83) \quad A^i(s) U_N^i(s) + U_L^i(s) = 0.$$

The first-order conditions for  $C_T^i(s)$  for  $i \in S$  with  $i \neq 0$  and  $s \neq s_0$  are

$$(84) \quad \lambda^i U_T^i(s) - \phi^i(s) = \theta(s),$$

where  $\eta^i(s_0) = 0$  and

$$(85) \quad \phi^i(s) = \eta^i(s) \frac{\partial R^i(s) / \partial C_T^i(s)}{R^i(s_0)}.$$

The first-order condition for  $C_T^i(s_0)$  for  $i \in S$  with  $i \neq 0$  has the form of (84) with

$$(86) \quad \phi^i(s_0) = \frac{\partial(1/R^i(s_0))}{\partial C_T^i(s_0)} \sum_s \frac{\mu(s)}{\mu(s_0)} \eta^i(s) R^i(s).$$

The first-order conditions for  $C_T^0(s)$  and  $s \neq s_0$  have the form of (84) with

$$(87) \quad \phi^0(s) = -\frac{1}{R^0(s_0)} \frac{\partial R^0(s)}{\partial C_T^0(s)} \int_{j \in S} \eta^j(s) dj,$$

whereas the first-order condition for  $C_T^0(s_0)$  has the form of (84) with

$$(88) \quad \phi^0(s_0) = -\frac{\partial(1/R^0(s_0))}{\partial C_T^0(s_0)} \sum_s \left[ \frac{\mu(s)}{\mu(s_0)} R^0(s) \int_{j \in S} \eta^j(s) dj \right],$$

where  $\eta^0(s) = 0$  for all  $s$ . Let  $H^i(s) \equiv \lambda^i [A^i(s)U_N^i(s) + U_L^i(s)]$  be the Pareto-weighted value of the net marginal utility of supplying one more unit of time as labor in the nontraded goods sector. The first-order condition for  $L^i(s)$  for  $i \in S$  with  $i \neq 0$  and  $s \neq s_0$  are

$$(89) \quad H^i(s) = \eta^i(s) \frac{1}{R^i(s_0)} \frac{\partial R^i(s)}{\partial L_T^i(s)},$$

so that for  $i \neq 0$  and  $s \neq s_0$

$$(90) \quad \eta^i(s) = \frac{H^i(s)R^i(s_0)}{\partial R^i(s)/\partial L_T^i(s)}.$$

Substituting for  $\eta^i(s)$  into the various expressions for  $\phi^i(s)$  allows us to express  $\phi^i(s)$  directly in terms of allocations. For example, substituting (90) into (85), and using the definition of  $H^i(s)$ , gives

$$(91) \quad \phi^c(s) = \lambda^c [A^c(s)U_N^c(s) + U_L^c(s)] \frac{\partial R^c(s)/\partial C_T^c(s)}{\partial R^c(s)/\partial L_T^c(s)},$$

which is expression (68) in the text.

As for the setup of the competitive equilibrium, to show how the first-order conditions for risk sharing can be decentralized, consider the competitive equilibrium. The consumer's

problem is

$$\max_{\{C_N^i(s), C_T^i(s), L^i(s), D^i(s)\}} \sum_s \mu(s) U^i(C_N^i(s), C_T^i(s), L^i(s), s) di \text{ subject to } \sum_s Q(s) D^i(s) \leq 0.$$

In each state  $s$ , the consumer also faces a budget constraint given by

$$(92) \quad \mu(s) \alpha^i(s) : [1 + \tau_N^i(s)] P_N^i C_N^i(s) + P_T(s) C_T^i(s) \\ \leq W^i(s) L^i(s) + P_T(s) [Y_T^i(s) + T^i(s) + T_I^i(s)] + \Pi^i(s) + [1 + \tau_D^i(s)] D^i(s).$$

Letting  $\rho^i$  be the multiplier on the asset market constraint and  $\mu(s) \alpha^i(s)$  be the normalized multiplier on the budget constraint, the first-order conditions for  $C_T^i(s)$ ,  $D^i(s)$ ,  $L^i(s)$ ,  $C_N^i(s)$  are  $U_T^i(s) = \alpha^i(s) P_T(s)$ ,  $\rho^i Q(s) = \alpha^i(s) \mu(s) [1 + \tau_D^i(s)]$ ,  $U_L^i(s) + \alpha^i(s) W^i(s) = 0$ , and  $U_N^i(s) = \alpha^i(s) [1 + \tau_N^i(s)] P_N^i$ . We can manipulate these conditions to obtain

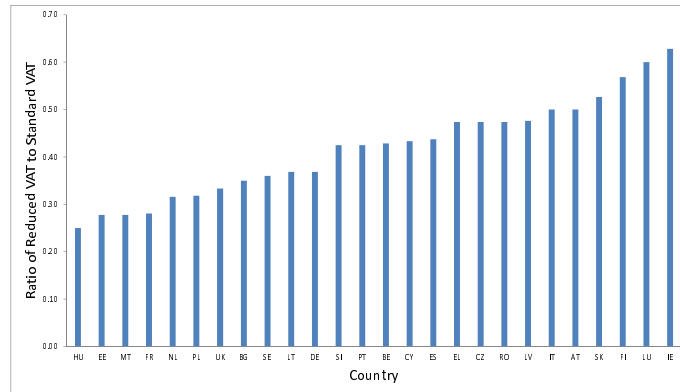
$$\frac{U_T^i(s) [1 + \tau_D^i(s)]}{\rho^i} = \frac{U_T^j(s) [1 + \tau_D^j(s)]}{\rho^j}.$$

Suppose that we are given the allocations from the union-wide problem with weights  $\lambda^i$  and the multipliers  $\phi^i(s)$ . If we set

$$\phi^i(s) = \frac{U_T^i(s)}{\rho^i} \tau_D^i(s) \text{ for } i \in S \text{ and } \tau_D^i(s) = 0 \text{ for } i \in N,$$

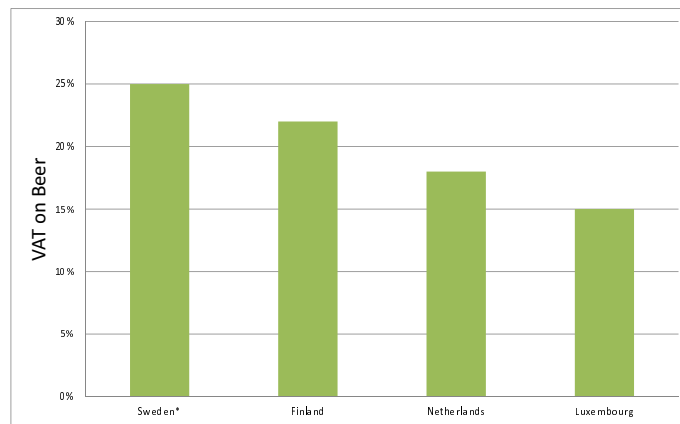
then the risk-sharing first-order conditions in the union-wide problem and the competitive equilibrium coincide. *Q.E.D.*

Figure 1: Reduced VAT by Country



Source: European Commission (2009). Authors' calculations.

Figure 2: VAT on Beer in 2002 for Select Countries in the European Union



Note: \*VAT is 12% for beers with <3.5% alc. vol. in Sweden

Source: Brewers of Europe (2003).