

Fortress Building in Global Tax Competition

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Abstract

This paper studies whether a group of countries can gain from harmonizing their capital income taxes if the rest of the world does not follow suit. It is shown that cooperation among the subgroup of countries is beneficial if tax rates in the initial fully non-cooperative Nash equilibrium are strategic complements. In this case tax harmonization among a subset of countries is Pareto improving for all countries.

1 Introduction

The issue of capital taxation in an open economy has been hotly debated by both politicians and economists the last decade. Two benchmark results have emerged from the literature on tax competition for internationally mobile portfolio capital. First, tax competition among partially or fully benevolent governments induces inefficiencies. In equilibrium, tax rates will be too low and no country will dare to increase its tax rate for fear of losing parts of its capital tax base. This fiscal externality of tax competition, known as the tax base effect, suggests that countries may benefit from jointly increasing their capital tax rates (e.g. Zodrow and Mieszkowski [19], Wildasin [15], Edwards and Keen [8], Keen and Marchand [12]). Second, the losses from tax competition can be asymmetrically distributed. Small countries in particular, win the competition over internationally mobile portfolio capital in the sense that they will have lower rates of taxation and attract a more than proportionate share of the world's capital stock in equilibrium. As a consequence, small countries

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have a higher per capita utility than large countries (Bucovetsky [2], Bucovetsky and Wilson [3] and Wilson [18]).¹

The costs of tax competition and the prospect of being among the losers from tax competition has led both politicians and economists to advocate tax harmonization as a remedy against the unwanted side effects of tax competition (e.g. Sinn [14] and Cnossen and Bovenberg [6].)

Global tax harmonization, although desirable, is difficult to achieve partly because some countries may prefer a low tax country status. This is exemplified by tax havens which have a commercial interest in not harmonizing their level of taxation. Thus, harmonization of capital taxation worldwide seems to be a difficult task. As an alternative to global harmonization of capital taxes, a subgroup of countries may decide to form a union or to choose a cooperative scheme of capital taxation. For example, the EU countries have already harmonized their VAT rates and policymakers now call for aligning capital taxes.

Policy proposals for tax harmonization within a region raises several related research questions. One is coalition formation. An equilibrium concept for coalition formation is considered by Burbidge et al. [4]. The coalition formation problem is related to coalition stability: it is difficult to enforce international contracts, and, as is well known from the literature on cartels, defecting from a coalition may be beneficial if either the probability of being caught, or the penalty for defection, is low. The analysis of coalition stability in the context of tax harmonization, however, is somewhat different from that of firms forming coalitions. The endogeneity of coalition formation and the coalition stability problem of a harmonized tax area may, for example, be overcome if some countries are linked via common policies in other fields and common institutional arrangements, like the member countries of the EU, or in other federations of countries or states. For instance, within the EU, common redistributive mechanisms such as structural funds operations and agricultural policy may generate instruments for punishing defecting countries. Moreover, the feasibility of punishing defecting countries within federations that may already exist for other reasons of common interests may explain the formation of "tax harmonized areas".²

A third issue relating to tax harmonization is whether a group of countries as a whole can gain from harmonizing their capital income taxes if the rest of the world does not follow suit. In this paper we take the group of countries that may form a tax harmonized area as given and pursue the question of whether tax harmonization is beneficial for this group. The gain from tax harmonization depends on the response from countries outside the harmonized area as well as on the size of the harmonized

¹In contrast, competition for foreign direct investments may favor large countries due to their market size if there are transaction costs between markets (Hauser and Wooton [10]).

²Credibility of punishing defectors as a criterion for the formation of tax harmonized areas may explain why such heterogeneous countries as the members of the EU form a harmonized VAT tax area, whereas countries not tied together by other joint political infrastructure do not.

area relative to the global economy. In particular, we show that tax harmonization among a subset of countries increases welfare for all countries (both within and outside the federation) if tax rates are strategic complements. To bring forward these results we use the model of Wildasin [15], and modify his framework by assuming that a subset of countries form a coalition and jointly maximize the welfare of this group.

The present analysis relates closely to discussions on the profitability of mergers of firms in the industrial organization literature (see, e.g., Deneckere and Davidson [7], Perry and Porter [13], and Gaudet and Salant [9]), and, analogously to the literature on the profitability of splitting up firms into a number of independent profit centers producing close substitutes (Baye, Crocker and Ju [1]). The payoff function differs from that in the merger literature. For the case of source base capital tax competition (as opposed to the case of oligopoly) the function consists of several elements such as tax revenue (and the public goods it finances), rent income, and capital income earned by a country's residents. These factors are intertwined making the analysis less straightforward than in the oligopoly context.

The rest of this paper is organized as follows. In section 2 we outline the model, in section 3 we analyze the benefits of collusion and in section 4 we offer some concluding remarks.

2 The Model

This section describes the basic elements of a tax competition model for source based capital income taxation. Using essentially the Wildasin [15] model, we modify his framework by allowing a subset of countries to form a coalition subgroup which jointly maximizes the welfare of this group. The total number of countries is N and, for simplicity, all countries are perfectly symmetric.³ A single (representative) household resides in each country. We consider a 1-period model. Production in country i is described by a production function $f(k_i)$ with capital k_i used in country i as the only variable input. Capital has positive but decreasing returns: $f' > 0$, $f'' < 0$. Output occurs in units of a homogenous and universal good that can be used as capital, for private consumption, or as a public good.

The total amount of capital at the beginning of the period is \bar{k} and, due to symmetry, \bar{k}/N is the amount of capital owned by the (representative) household in country i . The market for capital is characterized by perfect competition and capital is assumed perfectly mobile. Capital flows between the countries until the marginal returns net of tax are equalized between countries. That is,

³Symmetry will also simplify the problem of the choice of tax rates within the coalition, since the countries' preferences regarding a common tax rate are uniform. Departure from symmetry is discussed in the related paper by Burbidge et al. [4]. They analyse the rationale for the endogenous formation of tax-harmonizing coalitions and country differences are of major importance in this context.

$$f'(k_i) - t_i = \frac{1}{2} = f'(k_j) - t_j \quad (1)$$

for all $i, j \in \{1, \dots, N\}$. Here, $\frac{1}{2}$ is the equilibrium return on capital, and t_i and t_j are taxes per unit of capital that is employed in country i (resp. j).

Country i 's payoff is simply the income received by the representative household residing in country i , i.e.,

$$U_i = f(k_i) - f'(k_i)k_i + u(t_i k_i) + \frac{1}{2}k_i \quad (2)$$

Countries care about income and (local) public goods. Here, $f(k_i) - f'(k_i)k_i$ is the rent income accruing from an amount of capital k_i employed in the country. $u(t_i k_i)$ is the utility of the representative consumer from governmental revenue $t_i k_i$ which government uses for providing a public good, and $\frac{1}{2}k_i$ is the representative household's capital income, net of taxes.

The Nash equilibrium in tax rates is well understood. It is characterized by the marginal conditions

$$u'(t_i k_i) - k_i + t_i \frac{\partial k_i}{\partial t_i} = f''(k_i)k_i \frac{\partial k_i}{\partial t_i} - \left(\frac{1}{2}k_i\right) \frac{\partial \frac{1}{2}}{\partial t_i} \quad (3)$$

For the symmetric case, in the equilibrium we have;

$$\frac{\partial k_i}{\partial t_i} = \frac{1}{f''(k^*)} \frac{N-1}{N} \quad (4)$$

$$\frac{\partial k_i}{\partial t_j} = \frac{1}{f''(k^*)} \frac{1}{N} \quad (5)$$

and

$$\frac{\partial \frac{1}{2}}{\partial t_i} = \frac{1}{N} \quad (6)$$

with $k^* = \frac{1}{2}k_i$ the equilibrium capital employed in each country and t^* the equilibrium tax rate. Hence, the first-order condition becomes

$$u'(t^* k^*) - k^* + t^* \frac{N-1}{N} \frac{1}{f''(k^*)} = k^* \quad (7)$$

For $N = 1$, equation (7) reduces to the Samuelson rule for provision of a public good in a one-consumer economy, $u'(tk) = 1$. When several countries compete for capital (i.e., $N \geq 2$), equation (7) implies $u'(t^* k^*) > 1$ which reproduces the well known result that tax competition leads to underprovision of the public good in the Nash-equilibrium (see Zodrow and Mieszkowski [19]).

We now turn to the question whether a subgroup of countries can improve its welfare by forming a coalition.

3 Collusion

Suppose now that some countries decide to cooperate. We do not make explicit the forces that lead to coalition formation. Burbidge et al. [4] provide an equilibrium concept for coalition formation, if the coalition stability problem is solved. More generally, the formation of a given coalition may also be founded on historical, social, political and economic factors outside the model. Such factors may determine whether a coalition can credibly threaten to punish defectors, which is a necessary condition for making the coalition stable. Thinking about the EU as a possible prototype application of this model, it could be the mutual dependence of these countries or their cooperation on many other economic and social issues that makes cooperation on taxes stable. The question that is to be considered here is whether it could be beneficial for these countries to choose their common tax rate jointly and cooperatively even though a number of other countries still plays non-cooperatively.

Consider a situation with N identical countries. A number of $S < N$ countries collude by jointly choosing a common tax rate. This choice is made simultaneously with the choices of tax rates by the $N - S$ countries that are not part of this subgroup. By symmetry, there is a general agreement among the cooperating countries about the size of the tax rate which they all choose. The behavior of the colluders is anticipated by the non-colluders (i.e., the group of $N - S$ countries). For notational convenience, let countries be numbered such that $S = \{1, \dots, S\}$ is the set countries of the coalition, and $N - S = \{S + 1, \dots, N\}$ be the set of countries outside the coalition.

To determine the welfare effects of collusion we compare the Nash equilibrium without subgroup collusion with that of the Nash equilibrium with subgroup collusion. We start, however, with an easier procedure by asking the following question; can the countries from set S gain if they can credibly commit themselves to choosing a tax rate $t_j = t_S$ for all $j \in S$, with t_S slightly higher than the symmetric Nash equilibrium tax rate t^* ? In an equilibrium this commitment is anticipated and observed by the countries outside the subgroup. Hence, the answer to this question is that tax rate harmonization increases country i 's utility for $i \in S$, if

$$\frac{dU_i}{dt_S} = [i \cdot f''(k_i)k_i + u'(t_i k_i)t_i] \left(\frac{\partial k_i}{\partial t_i} + \sum_{j \in N - S} \frac{\partial k_i}{\partial t_j} + \sum_{n \in N - S} \frac{\partial k_i}{\partial t_n} \frac{\partial t_n}{\partial t_S} \right) + u'(t_i k_i)k_i + \frac{k_i}{N} \left[\frac{\partial \frac{1}{2}}{\partial t_S} + \sum_{n \in N - S} \frac{\partial \frac{1}{2}}{\partial t_n} \frac{\partial t_n}{\partial t_S} \right] \quad (8)$$

is strictly positive evaluated at Nash equilibrium values $t_1 = \dots = t_N = t^*$. In (8), $\frac{\partial t_n}{\partial t_S} = \sum_{j \in S} \frac{dt_n}{dt_j}$ is the optimal adjustment of the tax rate of each country $n \in N - S$ outside the federation to the anticipated change of the federation's tax rate, and $\frac{\partial \frac{1}{2}}{\partial t_S} = \sum_{j \in S} \frac{d\frac{1}{2}}{dt_j}$ is the equilibrium reaction of the net rate of return to the change of the federation's tax rate.

Condition (8) shows that three effects have to be considered. The first effect - given by the first line in (8) - pertains to what is commonly known in the tax

competition literature as the fiscal externality effect (see Wildasin [16]). It describes how tax harmonization changes the tax base of country i . In particular, it shows that country i loses some capital due to the increase in its own tax rate (first term, right-hand side), and gains some capital due to the tax rate increase in the other member countries (second term). In addition, the anticipated tax rate change of countries in set S induces non-members to change their tax rates as well, which induces more capital movement (last term). The second effect (first term in line 2 of (8)) is the direct tax rate effect: for unchanged capital allocation, country i 's tax revenue goes up if its tax rate increases. The third effect (second term in line 2 of (8)) relates to what is known as the factor terms of trade effect in the tax competition literature (DePater and Myers [5]). It describes the impact of the direct effects of the coalition's tax rate changes for the net rate of return of capital plus the indirect effects due to the induced equilibrium changes of tax rates of non-member countries.

In the fully non-cooperative Nash equilibrium some of these effects cancel. In particular, at $t_1 = \dots = t_N = t^*$, a marginal change in country i 's tax rate does not change i 's utility. However, the change in the tax rate of the other countries in S , and the induced changes of tax rates in countries not belonging to S change i 's utility. Using (4), (5), (6) and the first-order condition (7), equation (8) becomes

$$\frac{dU_i}{dt_S} = [u^0(t^*k^*)t^*] \left[\frac{i-1}{Nf''(k^*)} \right] [(S-i-1) + (N-i-S) \frac{\partial t_n}{\partial t_S}]; \quad (9)$$

The change in i 's utility consists of the product of three terms. The first term measures the additional utility from increased tax revenue from an additional unit of capital employed in country i . The second term equals $\frac{\partial k_i}{\partial t_j}$, the additional capital that becomes employed in country i if one country $j \in i$ increases its tax rate by one marginal unit, starting from the tax rates in the symmetric fully non-cooperative Nash equilibrium. The third term describes the marginal tax rate increases in the other $(S-i-1)$ countries belonging to set S , and the induced tax rate changes by the countries not belonging to S . Since the cooperation of the countries in S is known to the countries in $N-i-S$, they react to a change in the tax rate of the colluders by $\frac{\partial t_n}{\partial t_S}$. Depending on the sign of $\frac{\partial t_n}{\partial t_S}$; the reaction of the non-cooperating countries to the anticipated increase in the cooperating subgroup's tax rate increase may strengthen or weaken the direct effect. For a symmetric situation, the size of $\frac{\partial t_n}{\partial t_S}$ depends on the number of countries outside the coalition. The sign of $\frac{\partial t_n}{\partial t_S}$ depends on the type of competition. Since tax competition basically resembles Bertrand competition, the effect $\frac{\partial t_n}{\partial t_S}$ is typically positive: tax rates of different countries are strategic complements.⁴

This result is summarized in

⁴At this point it is useful to compare this framework with Gaudet and Salant [9]. They consider an oligopoly with N symmetric firms and ask whether a subgroup of $S < N$ firms could gain from joint contraction of output if the other $N-i-S$ firms anticipate this contraction and continue to behave fully non-cooperatively. In their framework, the reaction of the $N-i-S$ firms to an anticipated quantity contraction by the S cooperating firms is to expand output. In Cournot

Proposition 1: If a subgroup of countries colludes and commits to choose a tax rate that is marginally higher than the tax rate in the fully non-cooperative Nash equilibrium, utility of each country in the subgroup (and outside this subgroup) is increased if tax rates are strategic complements.

The intuition of this result can be rephrased as follows. In a fully non-cooperative situation each country can attract capital by lowering its tax rate. However, if a country attracts capital, the capital stock is reduced in other countries due to the fiscal externality of the country's tax rate change. When forming a coalition, the members of the coalition overcome the externality problem among members of the coalition. However, the externality problem between members and the non-members continues to exist. If the non-member countries still choose the tax rates of the fully non-cooperative Nash equilibrium, $\frac{\partial t_n}{\partial t_s} = 0$; then tax harmonization is unambiguously beneficial for coalition members. Whenever non-members react to the tax harmonization effort and tax rates are strategic complements in tax competition (that is, $\frac{\partial t_n}{\partial t_s} > 0$), the beneficial effect is reinforced by the induced tax rate increases of the non-members.

Another result that emerges from (9) is that the size of the coalition affects the utility gain of each member of the coalition as follows:

Corollary 1: Under collusion, the utility gain of a cooperating country from a joint marginal increase of the tax rate compared to the tax rate in the symmetric fully non-cooperative Nash equilibrium is increasing or decreasing in S , depending on whether $1 + \frac{\partial}{\partial S}((N - S)\frac{\partial t_n}{\partial t_s})$ is positive or negative.

Corollary 1 follows from differentiating (9) with respect to S , where k^a and t^a are independent of S .

In order to compare the fully non-cooperative Nash equilibrium with the Nash equilibrium if the countries forming the coalition jointly choose a tax rate and play Nash against the $N - S$ non-cooperating countries, a few assumptions are needed.

Let $t = (t_1; t_2; \dots; t_N)$ be a vector of tax rates from the set T of all feasible tax vectors which is a subset of \mathbb{R}^N , and $t_{-i} = (t_1; t_2; \dots; t_{i-1}; t_{i+1}; \dots; t_N)$. Let $\sigma_i(t) = \text{argmax}_{t_i} U_i(t_i; t_{-i})$ be the reaction correspondence of country i . Although defined on the full vector of all tax rates, it is clear that $\sigma_i(t) = \sigma_i(\hat{t})$ if $t_{-i} = \hat{t}_{-i}$. That is, although defined on the whole vector of tax rates for notational convenience, a country's reaction correspondence depends only on the tax rates of the other countries.

Assumption 1: The reaction correspondence is singleton-valued on T . It can be represented by a well defined reaction function $\sigma_i(t)$ that maps elements of T to the country's optimal tax rate.

Assumption 2: The reaction function $\sigma_i(t)$ is continuously differentiable and globally non-decreasing in each component of t for a set $T \subset T$ of tax vectors that

competition output choices are strategic substitutes. Hence, in Gaudet and Salant the general equilibrium repercussions of coordination among a subgroup reduce the gains from coordination. In the tax competition framework, choice variables are strategic complements and this makes it more likely that cooperation among a subgroup pays off for members of the subgroup.

is closed and convex to the origin. That is, $\frac{\partial^2 u_j(t)}{\partial t_j^2} > 0$ for all j for all $t \in T$.

Assumption 3: If countries choose their tax rates non-cooperatively, the Nash equilibrium tax vector t^* exists and is unique. The slope of reaction functions at the equilibrium fulfills $\prod_{j=1}^N \frac{\partial^2 u_j}{\partial t_j^2} < 1$.

These assumptions are not innocent, but are well known from the tax competition literature. Assumption 1 is standard in the tax competition literature. For some discussion see, e.g., Wilson [18], p. 433. Assumption 2 states that the tax rates are strategic complements. That is, reaction functions are upward sloping. This is also a standard feature in many seminal papers of the tax competition literature.⁵ The assumption of existence, uniqueness and stability of the Nash equilibrium (Assumption 3) is certainly not innocent, but it is needed to allow for any meaningful comparative static analysis. Since we consider identical countries, the uniqueness of equilibrium implies that the equilibrium is symmetric.

Consider a different characterization of the Nash equilibrium in section 1 that reduces complexity of the problem to two dimensions. For this purpose we introduce the concept of Nash subgroup equilibrium. As before, the set of countries is divided into the coalition set $S = \{1, \dots, S\}$ and the set $N \setminus S = \{S+1, \dots, N\}$ of non-members of the coalition. Let t_S and $t_{N \setminus S}$ be vectors of tax rates chosen by the countries from these sets. A vector t_S^* is a Nash subgroup equilibrium for given $t_{N \setminus S}$ if, for each $s \in S$, $t_s^* = \arg \max_{t_s} U_s(t_1^*, t_2^*, \dots, t_{s-1}^*, t_s, t_{s+1}^*, \dots, t_N^*; t_{N \setminus S})$: By symmetry, if a subgroup equilibrium exists, for each given vector $t_{N \setminus S}$, a subgroup equilibrium exists in which all members of the subgroup choose the same tax rate. This defines the symmetric subgroup equilibrium tax rate as a function $\phi_S(t_{N \setminus S})$ of the vector of tax rates chosen by the non-members of the subgroup. Furthermore, if all non-members of the subgroup choose the same tax rate, say, $t_{N \setminus S}$, this concept yields a symmetric optimal choice of each country from the subgroup such that each member's choice of tax rate is an optimal response to the tax rates then chosen by all other countries. We denote these functions as $r_S(t_{N \setminus S})$ and $r_{N \setminus S}(t_S)$ for the sets S and $N \setminus S$ respectively.

By Assumption 2, then, $\phi_S(t_{N \setminus S})$ is increasing in each component of $t_{N \setminus S}$, implying that $r_S(t_{N \setminus S})$ and $r_{N \setminus S}(t_S)$ are increasing functions of the tax rate chosen by the countries in the respective other group, and by Assumptions 2 and 3 their slopes at t^* are $0 < r_S'(t_{N \setminus S}) < 1$ and $0 < r_{N \setminus S}'(t_S) < 1$: The functions $r_S(t_{N \setminus S})$ and $r_{N \setminus S}(t_S)$ must of course intersect in the symmetric Nash equilibrium in $t_S = t_{N \setminus S} = t^*$. This is depicted in Figure 1 (cf. point E).

[Figure 1 about here]

So far we have just rephrased the non-cooperative situation without a coalition. Consider now a coalition of countries in set S . The countries in the S -group jointly choose their tax rate $t_j = t_S$, $j \in S$. The optimal (uncoordinated but symmetric)

⁵E.g., Kanbur and Keen [11]; and Wilson [18]. Wildasin [17] also provides some parametric examples and some microeconomic underpinning.

response of the countries of the $N \setminus S$ group to a given choice of t_S continues to be $r_{N \setminus S}(t_S)$. However, the optimal uniform choice of the tax rate in the S group in response to an anticipated choice of $t_{N \setminus S}$ by all countries in the set $N \setminus S$ is not $r_S(t_{N \setminus S})$. The reaction of the group of countries from the set S under coalition formation is $R_S(t_{N \setminus S}) = \text{argmax}_{t_S} U_s(t_S; t_S; \dots; t_S; t_{N \setminus S}; t_{N \setminus S}; \dots; t_{N \setminus S})$ for $s \in S$. In a coalition subgroup S , each country has Nash conjectures only with respect to the tax rate choices by countries from the set $N \setminus S$. The tax rates of all group members, however, are jointly determined.

In Figure 1, $\hat{U}_s(t_S; t_{N \setminus S})$ depicts the indifference curve of a country that is a member of the S -group in the fully non-cooperative Nash equilibrium. If the S -group consists of only one country, the slope of this indifference curve in the Nash equilibrium E is vertical. If the S -group consists of more than one country, the indifference curve $\hat{U}_s(t_S; t_{N \setminus S})$ has a negative slope in $E = (t^n; t^n)$: for given t_n the utility of country s increases if t_S increases as can be seen from (9). By definition, $R_S(t_{N \setminus S})$ is the locus of all combinations of tax vectors $t_S = (t_S; t_S; t_S; \dots; t_S)$, and $t_{N \setminus S} = (t_{N \setminus S}; t_{N \setminus S}; \dots; t_{N \setminus S})$ for which the indifference curves $\hat{U}_s(t_S; t_{N \setminus S})$ have exactly vertical slope. The crucial property that follows directly is that $R_S(t^n) > r_S(t^n)$. It implies that the intersection of $R_S(t_{N \setminus S})$ and $r_{N \setminus S}(t_S)$ is to the upper right of the fully non-cooperative Nash equilibrium. Hence, the intersection of $R_S(t_{N \setminus S})$ and $r_{N \setminus S}(t_S)$ characterizing the new Nash equilibrium \hat{E} must be on $r_{N \setminus S}(t_S)$ to the right of the indifference curve $\hat{U}_s(t_S; t_{N \setminus S})$. This means that all members of the S -group enjoy higher utility than in the fully non-cooperative Nash equilibrium E .

We summarize this as

Proposition 2: Suppose assumptions 1-3 hold. Let a subgroup $S \subseteq 2$ of countries jointly choose the same tax rate, and let the non-cooperative equilibrium and the new equilibrium be in the set T of tax rates in which assumption 2 holds. The countries enjoy higher utility in the resulting Nash equilibrium. Incentives therefore exist for a subgroup of countries to coordinate their policies through tax harmonization.

4 Conclusions

Capital taxation and tax harmonization have been at the forefront of the discussion among economists and policy makers the last decades. The rationale for tax harmonization has been to avoid the adverse effects of tax competition. The underlying premise for the discussion and for research in this area, has been that tax harmonization could be achieved world wide. As argued in this paper, world wide harmonization is for many reasons a difficult task, and tax harmonization among a subgroup of countries may have different implications for welfare among the harmonizing countries than world wide harmonization would. It is therefore important to examine the impact of partial harmonization of capital taxes among a subset of countries. That has been the aim of this paper.

In particular, we have shown that partial cooperation among a subgroup of

countries is beneficial to these countries under very general conditions. The central property needed for the result is that tax rates in the initial fully non-cooperative Nash equilibrium are strategic complements. The implications of this result for the various federations considering coordination of capital taxation is that such coordination would lead to gains, not only for the countries not part of these federations, but also for the countries of the federation.

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