Economic Modelling 42 (2014) 373–381

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/ecmod

The signaling effect of tax rates under fiscal competition: A (Shannonian) transfer entropy approach

Bogdan Dima [1], Ştefana Maria Dima *, Flavia Barna [1]

Faculty of Economics and Business Administration, West University of Timisoara, J.H. Pestalozzi Street, No. 16, 300115, Timişoara, Romania

ARTICLE INFO

Article history:
Accepted 7 July 2014
Available online xxxx

Keywords:
Tax competition
(Shannonian) transfer entropy
European Union

ABSTRACT

The present paper argues that if the production factors are mobile, then the countries engaged in fiscal competition are less able to choose fully autonomously a taxation regime, since they have to prevent capital and labor migration. One significant consequence is that changes in neighbor states' fiscal policies may trigger asymmetric information flows between them. We used the (Shannonian) transfer entropy in describing such flows. This measure of information exchanges is useful given that it may be used to detect various types of asymmetry in the interaction among two systems and, thus, distinguishes between driving and responding forces. We examine the European Union's case for a time span between 1995 and 2011 and conclude that Northern Europe, the Germanic countries, the United Kingdom and Ireland are generating the dominant net information outflows.

1. Introduction

States engage themselves in competition for resources, foreign investments and brain drain. Such processes take place in an increasingly globalized world, with a complex web of goods, services, capital and labor movements. A powerful tool in gaining a competitive advantage is represented by the overall tax rates, as well as by their components related to corporate and personal taxation. However, tax competition may be a two-edge sword. On one hand, it can generate efficiency gains from attracting production factors and stimulating economic integration. On the other hand, it might reduce the capacity of the national authorities to pursue their redistributive policies. Hence, it may contribute to an increase in domestic inequalities.

A bulk of the literature is dealing with the effects of the fiscal competition in the context of the international mobility of production factors. For instance, Kessler et al. (2002) propose a model according to which if either capital or labor is internationally mobile, the countries engage in fiscal competition and the partial integration of capital or labor markets is detrimental to the countries' redistributive ability. They conclude that a shift from partial to full integration may alleviate rather than intensify fiscal competition, especially if the two countries display similarities in their economic and political conditions.

Baicker (2005) estimates, in the case of the United States, the extent to which state spending is influenced by the spending of neighboring states, by considering several different metrics of neighborliness. Hauptmeier et al. (2009) find that, if the neighbors are cutting taxes, the local jurisdictions are trying to restore competitiveness by lowering their own taxes and by increasing spending on public inputs. Devereux et al. (2008) reveal that OECD countries compete with each other over corporate taxes, and such competition can explain the 1980s and 1990s' fall in statutory tax rates. Accordingly, the reductions in equilibrium tax rates can be explained almost entirely by a more intense competition generated by the relaxation of capital controls. In the model of Perroni and Scharf (2001), fiscal competition leads to an enlargement of jurisdictional boundaries and to welfare improvement. Fuest (1995) argues that the outcome of limited fiscal policies' coordination may be worse than no coordination at all.

Building on this literature, we argue that if countries are engaged in fiscal competition and the production factors are mobile, then there may occur a signaling effect of the changes in the level/structure of tax rates. In our theoretical model, the fiscal authorities have an incentive to systematically observe the tax rates practiced by neighbor countries and adjust the level of tax rate differential to prevent the capital or labor emigration. Hence, the factors' mobility tends to limit the capacity of national authorities to autonomously design the fiscal policies. One testable consequence is that changes in domestic policies may trigger asymmetric information flows between competing countries. We use the (Shannonian) transfer entropy as a model-free measure in order to quantify such flows and construct the net information flows, with the purpose of determining the dominant and subordinate flows. We illustrate some features of our model for the 27 Member States of the European Union (EU 27), as components of a heterogeneous common economic community, and we find evidences documenting such signaling effect. It appears that Northern Europe, the Germanic countries, the United Kingdom and Ireland are generating net information outflows,

* Corresponding author. at: West University of Timisoara, Faculty of Economics and Business Administration, East-European Center for Research in Economics and Business (ECREB), J.H. Pestalozzi Street, No. 16, 300115, Timişoara, Romania. Tel.: +40 256 592 556.
E-mail addresses: bogdandima2001@gmail.com (B. Dima), stefana.dima@gmail.com (Ş.M. Dima), flaviabarna@yahoo.com (F. Barna).
[1] Tel.: +40 256 592 556.

http://dx.doi.org/10.1016/j.econmod.2014.07.007
0264-9993/

while other countries, especially some new Member States, are net receivers of these flows.

The paper is organized as follows. The next section describes the conceptual framework. Section 3 provides information on the transfer entropy methodology. Section 4 analyzes the European data, whereas Section 5 provides some concluding remarks.

2. The model

We employ a framework which addresses fiscal competition and international mobility of production factors. We consider the effects induced in the choice of a certain level of taxation by these, when the fiscal authority does not "instantaneously" adjust the tax rates to prevent emigration and associated shocks. Thus, a certain degree of inertia in the fiscal policy-making decisions is considered.

Some basic rationales for such inertia may be found in the *endowment effect* argument (Tversky and Kahneman, 1991) which highlights the issues related to the so-called *status quo bias*: the fiscal decisions adopted in previous periods and seen as risky, according to the economic, social and politic objectives of the fiscal authority, weigh more in the current period than in the risk-free ones. However, the core of our argumentation is more directly linked to the existence of some *structural adjustment costs*. Such costs imply a certain incentive to preserve a specific and already selected design of the fiscal policy (see the model developed by Castrén and Takalo (2000) for the role played by such decisional costs in maintaining previous decisions in a different analytical context).

Our main argument is that if there is a fiscal competition between country i and country j, then the fiscal authority from country i is not able to choose a taxation regime in a completely autonomous manner, since it accounts for this regime's characteristics in country j. Otherwise, there will be an incentive for the owners of the production factors to migrate from i to j as long as the features of the fiscal policy design in country i are perceived as more disadvantageous than in country j. One simple way to describe these inter-jurisdictional spillovers is to presume that the fiscal authority is selecting not the absolute level of the internal tax rates, but rather a certain level of tax rate differential.

We suppose that, in each period t, the fiscal authority from country i observes the tax rate in country j and selects the tax rate differential, ${\tau_t}^{i/j} = {\tau^i}_t - {\tau^j}_t$ according to the following reaction function:

$$\begin{cases} {\tau_t}^{i/j} = {\tau_t}^{i/j}{}_{\min} + {\rho^i}_t {\tau_{t-1}}^{i/j} + {\mu^i}_t \left({R^i}_t - {R^{i*}}_t\right) + {\varepsilon^i}_t, \\ {\rho^i}_t = {\rho^i}_{t-1} + {\varepsilon^{\rho^i}}_t, \\ {\mu^i}_t = {\mu^i}_{t-1} + {\varepsilon^{\mu^i}}_t. \end{cases} \quad (1)$$

Hence ${\tau_t}^{i/j}{}_{\min} = {\tau_t}^i{}_{\min} - {\tau_t}^j{}_{\min}$ is the differential of the minimal tax rates (i.e. that level of taxation that is required by the current functioning of the public authority), ${R^i}_t - {R^{i*}}_t$ is the difference between current and expected levels of the risks associated with a change in the chosen level of taxation (such risks may refer to the potential distortions induced in the economy) and $\varepsilon^i, {\varepsilon^{\rho^i}}_t, {\varepsilon^{\mu^i}}_t$ are stochastic shocks uniformly distributed.

There are several arguments for the logic of this reaction function. Firstly, the fiscal authority needs to cover a minimal level of basic expenditures in order to support its own activity. Secondly, the autoregressive term ${\rho^i}_t {\tau_{t-1}}^{i/j} (0<{\rho^i}_t<1)$ denotes the degree of persistence in the tax rate's pattern. Such persistence is related to the existence of the cyclical features of fiscal policies and may be driven by "long-run" economic conditions. Thirdly, the fiscal authority displays certain risk aversion in conditions of imperfect information related to the changes in taxation.

According to the relation (1), there are several sources of potential changes in tax rate differential: a) an increase/decrease in the size of the fiscal authority; b) changes in the fiscal policy cycles; c) exogenous shocks in the relative importance of autoregressive pattern and/or risk aversion and d) exogenous shocks perturbing the economy.

If there is a perfect mobility of factors between country i and country j and the respective fiscal authorities display the same level of risk aversion, ${\mu^i}_t = {\mu^j}_t = {\mu_t}^{i,j}$, then the tax differential will be close to the differential of the minimal tax rates (and the time risks premium):

$${\tau_t}^{i/j} \approx {\tau_t}^{i/j}{}_{\min} + {\mu_t}^{i,j}\left({R^i}_t - {R^{i*}}_t\right). \quad (2)$$

If there are significant differences between public sector' sizes in those two countries, then this differential will be non-null.

Furthermore, we suppose that the fiscal authority seeks to minimize a loss function supposed to be quadratic in both the deviations of the tax rates from a certain target level, ${\tau_t}^{i/j^{\text{target}}}$ and risks involved, by choosing a new level of internal tax rate:

$${L^i}_t = \frac{1}{2}\left[{\lambda_t}^i {R^i}^2{}_t + \left({\tau_t}^{i/j} - {\tau_t}^{i/j^{\text{target}}}\right)^2\right] + K\left({R^i}_t\right). \quad (3)$$

Here ${\lambda_t}^i$ is the relative weight assigned by the fiscal authority to the various risks implied by a shift in the current level of tax rate in the loss function. ${\tau_t}^{i/j^{\text{target}}}$ may be viewed as the level of tax rate which ensures "full employment" and is compatible with a number of social objectives. To reflect the time-inconsistency problem, we assume that the target level of tax rate differential is higher than the differential of the minimal tax rates. Thus, ${\tau_t}^{i/j^{\text{target}}} > {\tau_t}^{i/j}{}_{\min} > 0$. In such conditions, there are some incentives for the fiscal authority to modify the tax rate differential and assume a different level of the associated risks. In practice, there are several costs involved by such adjustments. These costs can be objective (quantifiable in monetary and fiscal terms), social or political. Their existence, as it is captured in the loss function by the term $K\left({R^i}_t\right)$ will lead to a partial commitment of the fiscal authority from country i to the preservation of the current tax rate over several successive decisional periods. However, if the fiscal authority has not a "pure" risk aversion (is neither exclusively trying to minimize the risk, nor to maximize the tax rate differential, but rather to balance the return-to-risk ratio), there are costs associated with the increase/decrease of the assumed level of risks. The main reason is that any shift in the level of the assumed risks is translated in a pay-off consisting in the corresponding adjustments in the levels of expected differentials. Hence, an increase in the level of the assumed risks will involve a cost, ${k^i}_u$ while a decrease has a cost, ${k^i}_d$. The existence of such costs may be related to the potential shifts caused by a change in the tax rate on the relative "net" factors' scale returns and modulated by the degree of these factors' mobility.

The timing of the model is as follows: 1) initially, at $t = 0$, the fiscal authority i observes the level of tax rate in country j, ${\tau^j}_t$, and forms the expectations about future risks, considering the costs ${k^i}_u$ and ${k^i}_d$; 2) in $t = 1$, an exogenous shock strikes the economy and alternatively, there may be a shift in the risk aversion of the fiscal authority; 3) as a consequence of such shocks, the fiscal authority from i faces the decision to modify or not the tax rate differential; and 4) the optimal level of the assumed risks is estimated. In other words, the fiscal authority sets the level of the assumed risks after forming the expectations and observing the exogenous shocks. During all these sequences, we suppose that the fiscal authority from country j does not proceed to a change in the tax rate, ${\tau^j}_t$.

In such a framework, the strategy of the fiscal authority from country i, U^i, can be expressed as a function of the previous level of tax rate differential. Thus, the inter-temporal decision function takes the following formal description:

$$U^i\left({\tau_{t-1}}^{i/j}\right) = E_{t-1} \min_{R^i}\left[L_t + {\delta_t}^i U\left({\tau_t}^{i/j}\right)\right]. \quad (4)$$

When the fiscal authority decides to modify the tax regimes, it considers that such modification should be accompanied by a corresponding adjustment in the current expectations on future risks, $U^{i/j}\left({\tau_t}^{i/j}\right)$.