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Eberhartinger, Eva; Petutschnig, Matthias

Published: 01/01/2014

Document Version
Publisher's PDF, also known as Version of record

[Link to publication](#)

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Eva Eberhartinger

Matthias Petutschnig

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ABSTRACT

The draft for a Common Consolidated Corporate Tax Base Directive in the European Union includes the suggestion for an apportionment formula which allocates taxable group profits to group member corporations. These allocated profits shall then be taxed in the respective Member States. The draft directive delegates the right to define one factor of the apportionment formula, the term '*Employee*' to the Member States, who are therefore free to choose a *narrow* or a *broad* definition, the latter including also atypical employment schemes. Using a game-theoretic approach the paper shows that the individually rational strategy of any Member State to define '*Employee*' *broadly* so as to maximize the volume of the apportionment factor and thus maximize the allocated share of taxable income is only the best solution when tax rate differences and differences in the volume of atypical employment schemes are disregarded. If such differentials and the corporate groups' reactions to different Member States' definitions are included in modelling the game's pay-offs a *narrow* definition of '*Employee*' yields the highest individual pay-offs to the Member States involved. This change of dominant strategies is triggered by the corporate group's shifting of the employment factor from high-tax to low-tax Member States. Our paper differs from previous research on the economic effects of the CCCTB apportionment formula as it is the first paper identifying and analysing the employment factor and its distorting effects. The paper discusses possible tax minimizing strategies for corporate groups by shifting workforce and develops a model to quantify these potential relocations. Furthermore the paper presents advice to policy makers in their '*Employee*' definition decision and shows how Member States could use this definition to both minimize outward factor shifting and maximize inward factor shifting.

Prof. Dr. Eva Eberhartinger, LLM
Vienna University of Economics and Business
Department Finance, Accounting and Statistics
A-1020 Vienna - Austria
eva.eberhartinger@wu.ac.at
Tel: 0043 1 31336 5700
Fax: 0043 1 31336 731

Dr. Matthias Petutschnig (corresponding author)
Vienna University of Economics and Business
Department Finance, Accounting and Statistics
A-1020 Vienna - Austria
matthias.petutschnig@wu.ac.at
Tel: 0043 1 31336 4597
Fax: 0043 1 31336 731

1. Introduction

The European Commission has published in March 2011 a proposal for a Council Directive on a (optional) Common Consolidated Corporate Tax Base (CCCTB).[1] The basic outline of the proposed EU-wide cross-border corporate tax system contains a consolidated group taxation using formulary apportionment to allocate the consolidated taxable group income among the involved group entities. In a first step each group member separately calculates its taxable income based on the provisions of the CCCTB. The separate profits or losses of every group member will then be consolidated to calculate the Common Consolidated Corporate Tax Base of the group. In a third and last step, this tax base will be allocated to the group entities. Every group member will then be taxed separately by its situs state based on the apportioned income at the situs state's statutory corporate income tax rate. In other words: the taxable profit is determined according to a common set of rules, the tax rates that are applied to the apportioned tax base vary by state. Several benefits are expected from such a group tax system, including among other reduction of compliance costs, cross border loss offset, elimination of interim profits and the irrelevance of transfer pricing (EU Commission 2011). Sceptics doubt in particular the reduction of compliance costs and expect unpredictable company reactions, which might lead to factor shifting instead of profit shifting (Weiner 1994; Klassen and Shackelford 1998; Mintz and Smart 2004; Bettendorf et al. 2010).

The need to allocate the CCCTB to the EU Member States in which the group members are seated, asks for the application of an algebraic formula. The factors included in the apportionment formula as suggested by the EU Commission include *Sales (S), Assets (A)* and *Labour*, based on the assumption that these three factors are causal to the generation of profits. At the current state of discussion, each factor should be weighed equally, notwithstanding future political negotiations. The factor *Sales* represents the demand side of the profit generating process while the factors *Labour* and *Assets* represent the supply side. These factors are already in use in some federally structured jurisdictions (Canada, Germany, Switzerland and the United States) that have a formulary system to allocate the federal tax base (most importantly the US state corporate income tax and the Canadian provincial income tax) to states, provinces and municipalities. However, deviating from the practice in North America (which seemed to have served as a role model to a great extent), the employment apportionment factor does not exclusively rely on *Payroll Costs (P)*, but also takes into account the *Number of Employees (NE)* in the respective Member State. According to the suggested formula, subject to further political debate, the tax base of a particular group

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[1] Cf European Commission, Proposal for a Council Directive on a Common Consolidated Corporate Tax Base (CCCTB), COM(2011) 121; available online using the following link: http://ec.europa.eu/taxation_customs/taxation/company_tax/common_tax_base/index_en.htm

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member (π_i), which is a share in the consolidated group tax base (CTB), would be calculated as follows:

$$\pi_i = \left(\frac{1}{3}\frac{S_i}{S_{grp}} + \frac{1}{3}*\left(\frac{1}{2}\frac{P_i}{P_{grp}} + \frac{1}{2}\frac{NE_i}{NE_{grp}}\right) + \frac{1}{3}\frac{A_i}{A_{grp}}\right)*CTB \qquad (1)$$

According to the CCCTB Working Group (WG-CCCTB), the sharing mechanism should be easy to apply for corporations and tax authorities and difficult to manipulate for taxpayers. It should lead to a fair and equitable distribution of corporate group income to the EU Member States and should not trigger undesirable effects of tax competition.

The use of multiple apportionment factors is seen as being superior to using just one apportionment key, as multiple apportionment keys might be able to capture the profit-generating factors better and thus diminishing volatility and the randomness of the apportionment procedure's outcome (WG-CCCTB 2007a). Multiple factors shall make artificial manipulations more difficult and thus economic distortions less likely to occur (LePan 1984). Further, multiple factors shall enhance a stable apportionment of taxable income over time (Martens-Weiner 2006).

Most importantly the Proposal applies one uniform apportionment scheme and disallows autonomous unilateral factor weightings – contrary to the setting of the U.S. state corporate income tax system. According to Martens-Weiner (2006), the uniformity of the apportionment scheme is of much greater importance than its actual design. Evidence from formulary apportionment approaches in North America evidently shows that Canada is better off with a uniform apportionment scheme than the U.S. states with their differing factor weightings (Weninger 2008).

Contrary to the theory of providing as much uniformity as possible in the formula, the current suggestion of the Commission leaves some leeway of discretion to the Member States with regard to the factor *Number of Employees (NE)*. While the other two factors (*Sales* and *Assets*) are rather well and clearly defined the Council Directive Proposal does not provide one harmonized definition of '*Employee*' but instead proposes that the definition of '*Employee'* should be based on the domestic legislation of the Member State in which the employee performs her services (CCCTB Proposal, Art 90). Therefore each Member State basically has the right to autonomously choose its definition of '*Employee'* when implementing the CCCTB-Directive.[2] To prevent any conflicts stemming from different '*Employee'* definitions the WG-CCCTB suggests a system of mutual recognition of the

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[2] As EU Directives are not directly applicable they have to be transposed into domestic law to become applicable.

various '*Employee*' definitions by the other Member States involved. Narrow definitions along the lines of a full-time permanent worker / employee in one Member State may meet rather liberal definitions which include part-time contracts, leased workforce, or certain self-employed contractors in another Member State.

Using a game-theoretic approach, the paper shows the effects of Member States applying different definitions of '*Employee*'. In a setting where tax rates differ among Member States MNC´s react to state´s definitions by shifting workforce (or by opting out of the CCCTB), and States suffer or benefit from MNC´s relocations. To our knowledge, such analysis of the apportionment formula with a specific focus on the novel element of the '*Number of Employees*', has not been carried out before. The result of our research may be helpful to European policy makers for the further development of the CCCTB and the respective formula apportionment.

The paper proceeds as follows: after providing a quick overview of related literature, especially tax literature using game theoretic approaches in section 2 and giving further institutional and economic information about the employment factor in the apportionment formula (section 3) we first present a simple apportionment game (section 4.1), which serves as the basis for more complex forms of the game (section 4.2). Section 5 discusses the results and possible further extensions of the game and concludes.

2.   Related Literature

This paper uses aspects and elements of Game Theory to evaluate the interactions of EU Member States while implementing an EU Directive. As the '*Employee*' definition of one Member State potentially influences the tax revenues of any other Member State these interactions could be interpreted as a competitive game. Game Theory is frequently used in political science literature and international relations literature to describe and analyse interactions between nation states in different settings of international or supranational, bilateral or multilateral negotiations. A game that is commonly viewed as accurately representing the strategic dependencies in international relations is the so-called prisoner's dilemma (PD). Snidal (1985 at p. 926) describes this game as *"an archetypical example of the disjuncture between individual and group rationality which characterizes many problems of collective action: Pursuit of individual self-interest by states (…) results in their being worse off than if both abstain from pursuit of their narrow self-interest and cooperate (…)"*. Numerous authors apply this PD-framework for analysing different aspects of international taxation (see *e.g.* Dagan 2000; Rixen 2005; Ring 2007). It is, for instance, often argued that limiting tax competition is difficult, because the positions of each country can be modelled as a PD-game where

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defection hampers cooperation (Rixen 2005). When additional economic differences besides tax rate differences are considered, it is argued that both small and big countries have conflicting interests with regard to tax competition (Dehejia and Genschel 1999). As declining tax rates are connected with large welfare losses for big countries, bigger countries are more interested in international coordination in order to prevent a race to the bottom of tax rates. Small countries, contrarily, being able "*to over-compensate the potential welfare loss of lower taxes with the influx of additional tax base from other countries*" would rather welcome tax competition (Rixen 2011 at p 202). Due to this conflict of interests, international tax competition is regarded by some as being better modelled as an asymmetric PD-game.

Dagan (2000) uses the Game Theory framework to analyse methods to eliminate international double taxation. Using a PD-game, she determines whether a country, striving to maximize national welfare would be better off eliminating international double taxation unilaterally or bilaterally by concluding a tax treaty. Dagan concludes that in some constellations unilateral measures against international double taxation could lead to optimal economic results that cannot be reached with tax treaties. Rixen (2008) also models the strategic interactions of two countries in relieving double taxation and preventing tax avoidance using different types of games (PD-Game, Assurance Game). He finds that for the residence country unilaterally providing relief for double taxation is welfare-maximizing. There are further examples where other games are used to analyse issues of international taxation. Dehejia and Genschel (1999), for instance, model tax competition as a "battle of the sexes" game. In their view, it is not so much defection that prevents international tax cooperation but rather distributional issues that make cooperation "controversial". Which game is in the end the most suitable depends on the precise issue to be analysed and on the assumptions made (Rixen 2008). Ohlin (2011) and McAdams (2008) provide extensive and useful overviews of applications of Game Theory and different types of games that that can be used in law and international relations.

Mintz and Weiner (2008) comprehend the whole CCCTB project as a game in which all EU Member States are actors trying to maximize their individual pay-offs. Even though they do not explicitly model the CCCTB negotiations as one type of game and thus without developing pay-off structures they conclude that coordination is necessary and that Member States which are negatively affected by the CCCTB could be compensated by a system of side payments. Mors (2008), Avi-Yonah and Clausing (2008) and Utz (2008) commenting on Mintz and Weiner (2008) support the idea of applying the Game Theory Framework on specifics of the CCCTB project or on the CCCTB project as such. Yet, all three commentaries are highly critical about the limited use of the framework by Mintz

and Weiner and implicitly endorse a deeper and more comprehensive discussion of the CCCTB using game-theoretic methods.

3. The Employment Apportionment Factor

In the apportionment formula, the factor *Employment* is split into two equally weighted sub-factors *Payroll Cost* and *Number of Employees*. The EU Commission's Working Group CCCTB justifies this split with the different wage levels throughout the European Union, especially between the western European Member States (EU-15) and the central and eastern European Member States (EU-12) (WG-CCCTB 2007b para. 16). Higher wage levels and higher ancillary labour costs in the EU-15 would lead to an allocation of a greater share of the group's tax base to the EU-15, which may not correspond to the partial profit generation in these Member States. Thus the EU Commission's Working Group CCCTB considers it appropriate to modify the *Payroll Cost* by including the *Number of Employees* causing this cost. The apportionment factor *Payroll* relates to the payments made to the individual employees included in the factor *Number of Employees*, and consists of the remuneration that is taken into account as a deductible expense in the calculation of the tax base, including fringe benefits, social security contributions, etc (CCCTB Proposal, Art. 91). With the factor *Number of Employees* the European Commission proposes an apportionment factor that has no direct influence on the determination of profit (other than *e.g. Sales* or *Payroll*). The implementation of this factor *Number of Employees* is meant to control for the influences of different wage levels in the various Member States on the apportionment results. This argument however is debatable as it disregards different productivity levels among the involved Member States.

Regarding the definition of the labour apportionment factors *Payroll Cost* and *Number of Employees* two issues arise, where the uniformity of the formula may be undermined: The location of the factor *Payroll Cost* and the definition of '*Employee*'.

For the first issue, the WG-CCCTB suggested that the factor *Payroll Cost* contains only wages that are paid to employees that actually perform services to the respective group entity, regardless of which group entity actually carries the employee on its payroll. Such, to a large extent the uniformity of the formula is safeguarded.

The second and more important issue is the definition of '*Employee*' itself. As stated above, no harmonized definition of '*Employee*' is used; instead the definition should be determined by the national law of the Member State where the employment is exercised (CCCTB Proposal, Art. 90). By adhering to the principle of mutual recognition these domestic definitions will not be challenged by other EU Member States even though each of these decisions potentially influences

other Member States' tax revenues. The principle of mutual recognition is prevalent in several areas of European Union law. Its roots lie in the free movement of goods (ECJ-Case 120/78 *Cassis de Dijon*, *Rewe-Zentral AG*, 1979 ECR 649) and it extends to *e.g.* diplomas and criminal matters. A formal, generally applicable definition is missing. A cross-policy working definition by Jannsens (2013, p. 5) states that "*notwithstanding differences between the various national rules (…) objects, activities or decisions that are lawful in accordance with a Member State´s legal framework must be accepted (…) by one´s own state, and must be allowed to take effect in one´s own sphere of legal influence (…), unless one of the available grounds for non-recognition applies*." The application of the principle of mutual recognition thus undermines the uniformity of the apportionment formula.

The EU Commission Report "*Social protection rights of economically dependent self-employed workers*" (EU 2013) provides a thorough insight in the different '*Employee'* definitions used in EU Member States. The definition of a rather typical employee, who has a formal (written) employment contract, works 35 - 40 hours a week on the premises of the company, uses materials, tools, equipment and know-how provided by the company, will normally not differ heavily among Member States. The Report however identifies a substantial *grey area* between typical employment and typical self-employed. It includes part-time workers, borrowed workforce and economically dependent self-employed who rely on only one client. Within this *grey area* definitions may vary considerably. The EU Commission Report presents some empirical evidence showing that the share of dependent self-employed among the population of employees (age 15-64 years) for the year 2011 ranges between 8% (Estonia) and 35.6% (Greece) with an average for the EU-27 (EU without Croatia) of 15.8%. Even within a country, differing and/or overlapping definitions for different legal purposes (different taxes, social security in different forms, protection of employee`s rights, etc) may exist, let alone between countries. Consequently, Member States enjoy a considerable amount of discretion when defining which concept of employment is considered relevant for the formula.

The definition of '*Employee'* obviously has an impact on the outcome of the apportionment process since it influences both parts of the labour apportionment factor. Not only the immediate effect on *Number of Employees* but also an indirect effect on *Payroll* via wages and ancillary cost paid to the individuals included in the *Number of Employees* can be observed. A broad definition of the *Number of Employees* leads to a larger share in corporate tax base and therefore to a higher tax revenues for the respective Member State. This, as a consequence, reduces other Member States' tax revenues.

4. The Apportionment Game

4.1. Playing the Game simple

The implementation of CCCTB can be viewed as a game where governments of (at maximum) 28 EU Member States are players. In modelling the decision making process it suffices to focus on a game of two Member States as actors, for simplicity reasons. The game is finite in the sense that it ends once the CCCTB directive is implemented in domestic law. It is assumed that the Member States play simultaneously. Such, we consider the time-span after the promulgation date of the directive and before the implementation date of the domestic act transposing the directive into national law. During this time Member States decide independently and simultaneously which definition of '*Employee*' is deemed relevant. We do not include subsequent adaptions of the respective definitions which may result from reactions to other Member States´ decisions. We assume complete information and common knowledge among players.

In a simple view of the game, where tax rate differences as well as general economic differences of the Member States are disregarded, the pay-off (ρ_i) for one Member State i is equal to the tax revenues expressed as allocated tax base (π_i) multiplied by the domestic corporate income tax rate (τ_i).[3]

$$\rho_i = \pi_i * \tau_i \qquad\qquad (2)$$

Governments will try to maximize their pay-offs. This individual rationality (which could also be described as *state-level egoism*[4]) will lead Member States during the process of transforming the CCCTB directive into domestic tax law, in executing option rights and decision freedoms given to them by the directive in a way that maximizes their relative pay-offs. Accordingly, the *Number of Employees* will be defined, as outlined above. The broader the definition the more individuals are potentially covered and thus the volumes of both apportionment factors *Number of Employees* and *Payroll* increase. However if the other Member States also broaden their employment apportionment factor all *broad* definitions would set off against each other so that the benefits of such definition for the individual Member State would vanish.

Under the CCCTB apportionment formula 1/3 of the taxable income is allocated by the employment factor, the rest is allocated by the other apportionment factors (*Sales* and *Assets*). To focus on the employment factor the other factors are assumed to be identical among the involved

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[3] For the simple game, we will not include economic gains.
[4] Cf Utz 2008.

Member States and held constant to allocate the rest of the taxable income equally to the Member States A and B.

For simplicity reasons the players (i.e. the Member States) have only two alternative '*Employee*' definitions: *broad* (including all atypical employment relations) and *narrow* (excluding all atypical employment relations). Playing *broad* while the other Member State plays *narrow* will allocate the share of taxable income that is sensitive to the employment factor definition wholly to the *broad* player and not to the *narrow* player. If both players choose the same strategy the taxable income is allocated equally to both Member States.

Assuming constant *Sales* and *Assets* factors among the players allows focussing all consideration on that third of the tax base which is allocated on the basis of labour (T_i^L) and the part of payoff resulting therefrom (ρ_i^L). Further assuming an equal relation of the (broadly defined) *Employee* factor in both Member States, means that they share equally the tax revenue as it relates to the employment factor, and assuming identical volumes of atypical employment schemes (a) in both Member States. The broad definition therefore takes the value of 1; the narrow definition takes the value of (1-a). The pay-offs for Member State i relating to the labour factor and depending on its definition, can be calculated as follows:

$$\rho_i^L = T_i^L * \left[\frac{1}{2} + x * \frac{a}{2*(2-a)}\right] \qquad (3)$$

With:

$x = 1$ if state *i* plays *broad* while the other state plays *narrow*

$x = -1$ if state *i* plays *narrow* while the other state plays *broad*

$x = 0$ if both states share the same strategy (*narrow/narrow* or *broad/broad)*

and with:

$$T_i^L = \frac{1}{3} CTB * \tau_i \; ; i \in A, B$$

Member State A:

Broad/narrow

$$\rho_A^{L,B/n} = \frac{1}{2-a} * T_A^L \qquad (4a)$$

Narrow/broad

$$\rho_A^{L,N/b} = \frac{1-a}{2-a} * T_A^L \qquad (4b)$$

Broad/broad

$$\rho_A^{L,B/b} = \frac{1}{2} * T_A^L \qquad (4c)$$

Narrow/narrow

$$\rho_A^{L,N/n} = \frac{1}{2} * T_A^L \qquad (4d)$$

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Member State B:

    broad/Narrow

$$\rho_B^{L,b/N} = \frac{1-a}{2-a} * T_B^L \qquad \text{(4e)}$$

    narrow/Broad

$$\rho_B^{L,n/B} = \frac{1}{2-a} * T_B^L \qquad \text{(4f)}$$

    broad/Broad

$$\rho_B^{L,b/B} = \frac{1}{2} * T_B^L \qquad \text{(4g)}$$

    narrow/Narrow

$$\rho_B^{L,n/N} = \frac{1}{2} * T_B^L \qquad \text{(4h)}$$

In a CCCTB scenario in which both Member States are equally alike and employ the same tax rate the pay-offs are only influenced by either Member States decision whether to use a *broad* or *narrow* definition of '*Employee*'. Applying (3) on both Member States, the pay-off (= tax revenues) structure caused by different *Employee* definitions (ρ_i^L) for such a one-shot game can be depicted as follows:

Figure 1: Interactions of Strategies – Basic Game

The pay-off matrix in Figure 1 shows in the lower left cell that Member State A gets an additional pay-off of $+\frac{a}{2(2-a)} * T_A^L$ and Member State B loses pay-off of $-\frac{a}{2(2-a)} * T_B^L$ when they play *broad* and *narrow* respectively, and vice versa. The interaction of different strategies results in different individual pay-offs while the matching of same strategies leads to equal pay-offs ($\frac{1}{2}T_A^L = \frac{1}{2}T_B^L$). The pay-offs are symmetric. Therefore in this basic one-shot game the equilibrium is where both players choose *broad,* and *broad* is the dominant strategy. This equilibrium is Pareto-

optimal as there is no alternative that makes one Member State better off without making the other one worse off. State-level egoism will therefore lead both Member States to adopt a *broad* definition of '*Employee'* that includes not only typical employees but also contains rather atypical forms of employment to enlarge the apportioned share of the CCCTB. From a pure apportionment standpoint a *narrow* definition of '*Employee'* is not an individually rational strategy for any EU Member State.

The following numerical example involving two Member States, that are both subject to a corporate income tax rate ($\tau_A = \tau_B$) of 25% and an overall allocable tax base of 300 illustrates the game above. Under the CCCTB apportionment formula only 1/3 of the taxable income is allocated by the employment factor, the rest is allocated by the other apportionment factors and can thus be disregarded (for simplicity reasons these apportionment factors allocate the rest of the taxable income equally between the Member States A and B, as mentioned above). The tax base allocated on the basis of the employment factor ($\frac{1}{3}CTB$) is thus 100. Within the employment factor, it is difficult, or virtually impossible, to predict to what extent corporate groups will use typical and atypical employment contracts. For the numerical example we refer to the aforementioned findings of the EU Commission Report "*Social protection rights of economically dependent self-employed workers*" (EU 2013) and thus assume that 15% of the employment factor in every Member State and thus the amount of the taxable income that is allocated using the employment factor ($\frac{1}{3}CTB$) is sensitive to the '*Employee*' definition (a = .15). 85% of that tax base are assumed to be apportioned by typical employment relations. We assume that both Member States have the same volume of employed individuals and the same share of atypical employment contracts (a in both countries) that can be included or excluded in the '*Employee*' definition. The application of the CCCTB formula without any definition effects [formula (3) with $x = 0$] leads to pay-offs of 12.5 for each Member State. Simultaneously played different strategies lead to an increase (*broad*) or a decrease (*narrow*) of the respective pay-off of Member States A and B which can be calculated using formula (3) with $x = 1$; $x = -1$:

$$\frac{1}{3}CTB * \frac{a}{2*(2-a)} * \tau_A = \frac{1}{3}CTB * \frac{a}{2*(2-a)} * \tau_B = 100 * \frac{0.15}{2*(2-0.15)} * 0.25 = 1.014$$

The interactions between two Member States adopting these strategies are presented in Figure 2:

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	Member State A	
	broad	narrow
Member State B broad	12.5 12.5	11.486 13.514
Member State B narrow	13.514 11.486	12.5 12.5

Figure 2: Interactions of Strategies –
Basic Game – Numerical Example

In this stylized game both Member States can choose autonomously between a *broad* and a *narrow* definition of the term '*Employee'*. If both Member States choose the same strategies the effects set each other off so that the tax base is distributed equally. Figure 2 shows that a static one-shot game leads to one (pure-strategy) equilibrium. Given the pay-offs, if Member State A selects the strategy *narrow*, Member State B's best response is *broad* (receiving +1.014 additional instead of 0 from playing *narrow*). If Member State A chooses *broad*, then Member State B is better off selecting *broad* (0 instead of losing -1.014 from playing *narrow*). With these payoffs, Member State A has a dominant strategy of playing *broad* regardless of what Member State B does. Because the pay-offs are symmetric Member State B has the same dominant strategy of *broad*. Consequently the only equilibrium is *broad / broad*.

The rather simple static one-shot game presented in Figures 1 and 2 above is based on the assumptions that both Member States are equally alike and the game also does not include any reactions of the involved corporate group and any repercussions on the Member States' tax revenues that may arise from corporate decisions such as relocations of functions, assets and employees. In the following section these elements will be discussed and introduced to the game.

4.2. Making the Game complex

4.2.1. Reactions of Corporate Groups – Some evidence from the literature

The game presented above shall be approximated a little closer to reality by including the following issues: (a) tax rate differences between Member States ($\tau_A \neq \tau_B$), (b) different shares of atypical employment relationships in the local labor force (a $\neq$ b) and (c) reactions of MNCs on

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Member States´ decisions on the employment factor definition and the tax rate, which include (i) shift of employment within the CCCTB-group and (ii) possibly moving out of the CCCTB regime.

The current state of domestic tax systems presents a vast variety of different domestic regulations, procedures and practices. These differences are most obvious when statutory tax rates are concerned. Statutory corporate income tax rates vary heavily across the 28 EU Member States. According to the IBFD database[5] currently 28 EU Member States apply 18 different tax rates with only 5 groups of countries (between 2 and 4 countries per group) applying the same statutory tax rate[6]. Even if these statutory tax rates do not reflect the effective tax burden of corporations, they are an indicator and a policy measure easy to compare for corporate decision makers. Therefore statutory tax rates have an important signaling effect of how "business friendly" a domestic tax system might be and can be regarded as one major location factor. In their perpetual attempts to attract foreign direct investments and business relocations, EU Member States compete with each other not only on the level of statutory tax rates but also and more covert on the level of income determination rules such as depreciation allowances or loss carry forwards. Since the CCCTB draft does explicitly not include a proposal for a harmonized tax rate, the CCCTB regime will not put an end to tax competition among EU Member States, but will rather restrict it to competition on statutory tax rates.

For the further development of our game we assume constant tax rate differentials, with tax rates as exogenously determined. We will not include tax rate convergence, more precisely: a race to the bottom, for a number of reasons. The assumption of a lowering of tax rates, either exclusively for corporations which are subject to the CCCTB, or for all corporations / business entities seems not plausible. In the first case (specific tax rates for CCCTB-corporations) the principle of equality provided for by EU-Treaty and by national constitutional law might be infringed. The freedom of establishment (Art 49 et seq TFEU) in general prohibits taxing EU-wide cross-border transactions at a higher rate than purely domestic transactions. Vice versa, many national constitutions prohibit taxing purely domestic transactions at a higher rate than cross-border transactions (*e.g.* Art 3 German Constitution "*Grundgesetz"*, Art 7 Austrian Constitution "*Bundesverfassungsgesetz*", Art 1 French Constitution "*Constitution Française du 4 Octobre 1958*", Art. 1 Spanish Constitution *Constitución Española*, etc). These two constitutional barriers may prohibit Member States from introducing special tax rates for corporations subject to the CCCTB-

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[5] www.ibfd.org, as per Nov 27, 2013.
[6] Bulgaria and Cyprus: 10%; Germany (excl Trade Tax), Latvia and Lithuania: 15%; Czech Republic, Hungary, Poland and Slovakia: 19%; Croatia and Greece: 20%; Austria, Denmark, Netherlands and Portugal: 25%.

regime. In the second case (general lowering of tax rates, for all corporations / entities) dramatic consequences on Member States' tax revenues are possible. Further, the existing tax rate differences between US states, Canadian provinces, German municipalities and Swiss cantons, where formulary apportionment is used to allocate tax bases for income tax or trade tax purposes, show that such convergence of tax rates is highly unlikely, even in the absence of multilevel constitutional barriers. For these reasons we assume tax rates as exogenously fixed, *i.e.* we assume tax rate differences between EU Member States will persist and, given the lack of competition via tax base, grow in relevance. As a consequence, the game presented above, will benefit from expanding by tax rate differences.

When discussing the real effects of the CCCTB formulary apportionment, it proves useful to refer to research on apportionment formulas used by a number of federalist jurisdictions (Canada, Germany, Switzerland, U.S.) for allocating taxable income between cantons, municipalities, provinces or states. Even though apportionment factors serve as apportionment keys for taxable income and only the latter is taxed, McLure (1977) proves that formulary apportionment has the same economic effects as a separate and additional excise tax on the factors included in the apportionment formula. The corporate income tax thus changes into a sales tax, an assets tax and, most relevant for this evaluation, an employment tax. McLure demonstrates these economic effects against the background of the U.S. sharing mechanism that is used to allocate taxable corporate income among U.S. states for the purposes of state corporate income taxation under which the states are free to design their apportionment schemes, leading to non-uniform apportionment formulas. McLure´s findings however also hold true in a uniform sharing mechanism among the participating jurisdictions, as long as tax rates differ (Edmiston 2002; McIntyre 2002), since a formulary apportionment system is tax-neutral only if there are no tax rate differences among the participating jurisdictions (Gordon and Wilson 1986; Giannini 2002; Riedel 2010). As a consequence, applying the employment apportionment factor leads to an increase in the marginal effective wage rate (Weiner 1994), makes labour more expensive and is thus likely to reduce the wage level in a jurisdiction (Wellisch 2004; Oestreicher 2002). The reason for that is that the total costs of employment equal the direct compensation payments and the marginal apportionment tax (Weiner 1994). In addition, formulary apportionment could distort consumer choices between high-labour-intense and low-labour-intense products (McLure 1986). Edmiston (1998) thus concludes that with regards to the U.S. state corporate income tax, an aggressive reduction of the weight assigned to input factors is perceived to effectively reduce unemployment and/or increase workforce immigration. On the contrary, an increase of the weight assigned to the employment factor could escalate unemployment and might lead to emigration and business relocations out of that jurisdiction.

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There is also some empirical evidence that including payroll cost in the apportionment scheme has a significant impact on the employment level. Goolsbee and Maydew (2000) present empirical evidence that a reduction of the weight assigned to the labour factor in the U.S. apportionment formula from 1/3 to 1/4 in State A resulted in an increase of employed workforce by 1.1% in State A and a decrease of employed workforce in the other States. Anand and Sansing (2000) present similar findings as they show empirically that an increase in the relative weight assigned to the sales factor and a corresponding decrease in the weighting of the assets and labour factors in State A resulted in an increase of production volume in that State at the cost of decreasing production activity in State B.

In Europe, the German Trade Tax system applies a single factor apportionment formula using the amount of wages paid to allocate taxable income among municipalities. Buettner, Riedel and Runkel (2011) as well as Thomsen, Ullmann and Watrin (2013) present empirical results from Germany showing that tax rate differences lead to changes in the organisational structure of the business and to relocations of assets and workforce from high-tax cities to low-taxing municipalities.

Summing up, assigning a higher weight to the input factors can produce negative effects on the jurisdiction's economy – for the CCCTB apportionment mechanism this applies to a *broad* definition of the employment factor. Broadening the definition makes employment more expensive, and corporations will arguably react to that by decreasing the employed workforce or by decreasing the wage level in the respective Member State resulting in an actual reduction of the apportionment factor's volume and negative ancillary effects such as a reduction in wage taxes, private consumption, VAT revenues or an increase of paid-out unemployment benefits.

4.2.2. Modeling the pay-off structure

a) Tax rate differentials and definition differences

Introducing different magnitudes of definition effects and different tax rates in both Member States of the game changes the pay-off structure, links the individual pay-offs to the difference in the magnitudes and opens up some tax minimizing possibilities for the corporate group. Let Member State A be a low-tax country and Member State B a high-tax country ($\tau_A < \tau_B$). Further, based on an identical size of the total (typical and atypical) employees in both states, let the size of definition effects be smaller in Member State A than in Member State B (a $<$ b). In other words, we assume that CCCTB-groups employ an identical number of individuals in both states that are

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composed differently: more typical and less atypical employees in Member State A than in Member State B.

Resulting from the principle of mutual recognition, the different definitions not only affect the size of the employment factor in the respective Member State ($1 - a$ in Member State A and $1 - b$ in Member State B, if they both choose a narrow definition), *i.e.* the nominator of the employment factor. They also affect the total number of group employees, being the sum of all group member´s employees. In other words: a *narrow* employee definition in Member State A/B not only reduces the nominator of the employment factor for Member State A/B, but also the denominator for both states. The assumption of such application of the mutual recognition principle is debatable. On the one hand, from a legal point of view, the ECJ is restrictive on allowing conspicuous abuse or fraud to block the prevalence of the principle of mutual recognition; mere competition between Member States does not suffice to abstain from mutual recognition (in detail Janssens 2013, p. 62 – 66, 86 – 105). From a political point of view, on the other hand, Member States might seek to ensure a large portion of the employment factor, which is not only achieved by a large nominator, but also by – if possible – a small denominator, thus recognizing a *narrow* definition chosen by the other state. Consequently, each Member State might be inclined to assume the other Member State´s number of employees under a *narrow* definition, irrespective of which definition was actually chosen, and possibly disregarding the principle of mutual recognition. If, in this case, the denominator of the employment factors utilized in the two (or more) countries differs, their sum might be higher than 1, leading to double taxation. It can reasonably be assumed that in such case, the group would most likely ask for the application of the Safeguard Clause under Art. 87 of the draft Directive stating that, "*if the principle taxpayer (…) considers that the outcome of the apportionment to a group member does not fairly represent the extent of the business activity of that group member, the principal taxpayer (…) may request the use of an alternative method.*" Such alternative method is subject to agreement by all relevant tax authorities. To summarize: Member States are not free to abstain from the principle of mutual recognition, as the result might be unfair taxation, against which agreement procedures are in place. We therefore assume that mutual recognition of the employee definition is therefore consistently applied.

Corporate reactions (such as the relocation of employment to take advantage of tax rate differentials) are not considered. The pay-offs can be calculated by introducing different volumes of definition effects (a; b) into formulae (4a-h) as follows ($T_i^L = \tau_i * \frac{1}{3} CTB$ and $i \in A, B$):

Member State A:

Broad/narrow

$$\rho_A^{L,B/n} = \frac{1}{2-b} * T_A^L \qquad (5a)$$

Narrow/broad

$$\rho_A^{L,N/b} = \frac{1-a}{2-a} * T_A^L \qquad (5b)$$

Broad/broad

$$\rho_A^{L,B/b} = \frac{1}{2} * T_A^L \qquad (5c)$$

Narrow/narrow

$$\rho_A^{L,N/n} = \frac{1-a}{2-a-b} * T_A^L \qquad (5d)$$

Member State B:

broad/Narrow

$$\rho_B^{L,b/N} = \frac{1-b}{2-b} * T_B^L \qquad (5e)$$

narrow/Broad

$$\rho_B^{L,n/B} = \frac{1}{2-a} * T_B^L \qquad (5f)$$

broad/Broad

$$\rho_B^{L,b/B} = \frac{1}{2} * T_B^L \qquad (5g)$$

narrow/Narrow

$$\rho_B^{L,n/N} = \frac{1-b}{2-a-b} * T_B^L \qquad (5h)$$

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Figure 3: Interactions of Strategies –
Tax Rate and Definition Differences

The pay-off matrix in Figure 3 shows that the individual pay-off of any involved Member State depends on the domestic tax rate, the volume of domestic definition potential and the domestic definition decision but also on the definition potential and decision of the other involved Member State. The individual pay-offs have a cardinal order depending on the different combination of definition decisions ($\rho_A^{L,B/n} > \rho_A^{L,N/n} > \rho_A^{L,B/b} > \rho_A^{L,N/b}$; $\rho_B^{L,n/B} > \rho_B^{L,b/B} > \rho_B^{L,n/N} > \rho_B^{L,b/N}$). The relative order of the various pay-offs is contingent on the difference between the definition potential. For $a > b$ the relative order between $\rho_A^{L,N/n}$ and $\rho_A^{L,B/b}$ changes to $\rho_A^{L,N/n} < \rho_A^{L,B/b}$ and correspondingly the relation between $\rho_B^{L,n/N}$ and $\rho_B^{L,b/B}$ changes to $\rho_B^{L,b/B} < \rho_B^{L,n/N}$. For $a = b$ the pay-offs in both matched strategies outcomes are equal $\rho_A^{L,N/n} = \rho_A^{L,B/b}$ and $\rho_B^{L,b/B} = \rho_B^{L,n/N}$.

Both Member States still have the incentive to play *broad* which would yield the highest individual pay-off if the other Member State plays *narrow*. Both have a dominant strategy in playing *broad* (Nash-equilibrium in pure strategies). Any change in the strategy would only lead to a reduction of the own individual pay-off. The outcome *broad/broad* is also Pareto-optimal. The pay-off in *broad/broad* however is for the Member State with the smaller potential of definition gains only the third best option while it is the second best outcome for the Member State with the higher definition potential.

The corresponding effective tax payment of the corporate group $T_{grp}^{L,j} = \tau_{grp}^{L,j} * \frac{1}{3}CTB$; $j \in \{B/N; N/B; B/B; N/N\}$ is depicted in the middle column of each quadrant of the pay-off

matrix, with $\tau_{grp}^{L,j}$ denoting the effective group tax rate as applies to the employment factor. The group effective tax rate is lowest when the low-tax country (Member State A) plays *broad* and the high-tax country (Member State B) plays *narrow*. The resulting cardinal order between the effective tax rates again depends on the difference between a and b:

$$\text{for a} < \text{b}: \tau_{grp}^{L,B/N} < \tau_{grp}^{L,N/N} < \tau_{grp}^{L,B/B} < \tau_{grp}^{L,N/B}$$

$$\text{for a} > \text{b}: \tau_{grp}^{L,B/N} < \tau_{grp}^{L,B/B} < \tau_{grp}^{L,N/N} < \tau_{grp}^{L,N/B}$$

$$\text{for a} = \text{b}: \tau_{grp}^{L,B/N} < \tau_{grp}^{L,B/B} = \tau_{grp}^{L,N/N} < \tau_{grp}^{L,N/B}$$

The corporate groups would therefore prefer the outcome *broad/narrow* (*i.e.* a *broad* '*Employee*' definition in the low-tax country and a *narrow* definition in the high-tax country, to benefit most of the tax rate differential, irrespective of the share of atypical employment in either state) over any other combinations of strategies.

The numerical example from the simple game in section 4.1 could again be used to illustrate the discussed effects of differing definitions of the employment factor and of tax rate differences. Member State A has the lower tax rate of $\tau_A = 15\%$ and Member State B is the high-tax country ($\tau_B = 25\%$). As before, the allocable tax base attributable to the employment factor ($\frac{1}{3}CTB$) amounts to 100. The share of the allocable tax base that is sensitive to the employment factor definition differs between the two countries. Referring to the aforementioned EU Commission Report "*Social protection rights of economically dependent self-employed workers*" we use the minimum share for such workers for Member State A (a $= 8\%$) and the highest share for Member State B (b $= 36\%$). The other apportionment factors allocate the remaining two thirds of the taxable income equally among the Member States A and B. The pay-offs can be calculated using formulae (5a-h) as follows:

Member State A:
Broad/narrow
$$\rho_A^{L,B/n} = \frac{1}{2-b} * \tau_A * \frac{1}{3}CTB = 9.146$$
Narrow/broad
$$\rho_A^{L,N/b} = \frac{1-a}{2-a} * \tau_A * \frac{1}{3}CTB = 7.188$$
Broad/broad
$$\rho_A^{L,B/b} = \frac{1}{2} * \tau_A * \frac{1}{3}CTB = 7.5$$
Narrow/narrow
$$\rho_A^{L,N/n} = \frac{1-a}{2-a-b} * \tau_A * \frac{1}{3}CTB = 8.846$$

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Member State B:

broad/Narrow

$$\rho_B^{L,b/N} = \frac{1-b}{2-b} * \tau_B * \frac{1}{3} CTB = 9.756$$

narrow/Broad

$$\rho_B^{L,n/B} = \frac{1}{2-a} * \tau_B * \frac{1}{3} CTB = 13.021$$

broad/Broad

$$\rho_B^{L,b/B} = \frac{1}{2} * \tau_B * \frac{1}{3} CTB = 12.5$$

narrow/Narrow

$$\rho_B^{L,n/N} = \frac{1-b}{2-a-b} * \tau_B * \frac{1}{3} CTB = 10.256$$

Figure 4 illustrates the pay-offs for the Member States and the effective group tax rates:

		Member State A low-tax	
		broad	narrow
Member State B high-tax	broad	**7.5** 20.0% **12.5**	7.188 20.2% 13.021
	narrow	9.146 **18.9%** 9.756	8.846 19.1% 10.256

Figure 4: Interactions of Strategies –
Tax Rate and Definition Differences – Numerical Example

b) Corporate reaction: relocation of workforce

These results shall now be extended by corporate reactions which result from the corporate group finding itself in a situation where the Member States each opt for a *broad* definition of the employment factor. In this case, as illustrated, the effective group tax rate is higher than it would be in a situation where the high-tax country opts for a *narrow* definition. The group supposedly reacts by relocating employment from the high-tax country to the low-tax country.

The aforementioned empirical findings from the U.S. and Germany suggest that the employment apportionment factor has a major influence on un/employment. Thus changes in the

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factor could cause business migrations from one country to the other (i.e. reduction of jobs in high-tax countries and creation of additional jobs in low-tax countries). Individually rational corporate managers will try to maximize the after-tax profit of the corporate group. They will thus tend to locate workforce, functions, assets and business premises in jurisdictions where the apportionment factors and especially the employment factor positively influence the after-tax profit. These location decisions also influence the volume of the other apportionment factors.

In order to maximize after tax profit the corporate group could, among other, try to minimize the tax burden of the group (T_{grp}).

$$\arg\min \quad T_{grp} = \Sigma(\pi_i * \tau_i) \tag{6}$$

The overall tax burden however depends on the apportionment outcome of the CCCTB-formula and the applicable tax rates as depicted in expression (7).

$$T_{grp} = \Sigma\left[\left(\frac{1}{3}\frac{S_i}{S_{grp}} + \frac{1}{3}*\left(\frac{1}{2}\frac{P_i}{P_{grp}} + \frac{1}{2}\frac{NE_i}{NE_{grp}}\right) + \frac{1}{3}\frac{A_i}{A_{grp}}\right) * CTB * \tau_i\right] \tag{7}$$

The tax burden can be reduced by manipulating the outcome of the apportionment procedure by influencing the volume and the location of the apportionment factors. *Ceteris paribus* and focusing again on the employment factor a change in the allocation of workforce and personnel expenses among the various group entities leads directly to a change in the group's overall tax burden and in the group's after-tax profit ($\frac{1}{z}$ denotes the share in the total group tax burden which is allocated by the employment factor):

$$\frac{1}{z} * T_{grp} = \Sigma\left[\left(\frac{1}{2}\frac{P_i}{P_{grp}} + \frac{1}{2}\frac{NE_i}{NE_{grp}}\right) * \frac{1}{3} CTB * \tau_i\right] \tag{8}$$

Rearranging expression (8) leads to expression (9) that shows on the one hand that formulary apportionment changes the corporate income tax to an excise taxation of the apportionment factors and on the other hand it shows the direct relation between the location decision of the employment factor (payroll cost and number of employees) and the overall tax burden of the CCCTB group.

$$\arg\min \quad \frac{1}{z} * T_{grp} = \left(\frac{\Sigma P_i * \tau_i}{\Sigma P_i} + \frac{\Sigma NE_i * \tau_i}{\Sigma NE_i}\right) * \frac{1}{6} CTB \tag{9}$$

By using this direct linkage between the location of the employment factor and the tax burden the corporate group can minimize T_{grp} through shifting the employment factor to relatively low-tax Member States. This can be done by either increasing wages in low-tax Member States (and if possible correspondingly decreasing wages in high-tax Member States) or by moving employment

from high-tax to low-tax Member States. As increasing wages in the low-tax country (at least without correspondingly decreasing wages in high-tax jurisdictions) undermines the aim of maximizing the group's after tax profit the MNC will tend to shift employment (jobs) from high to low-tax jurisdictions.[7] The specifics of the applicable '*Employee*' definition will influence the effectiveness of such location decisions of corporate groups.

These foreseeable reactions, that corporate groups will adapt the volume of workforce in one country contingent on the country's '*Employee*' definition and tax rate, change the pay-off structure of the game. The pay-offs after relocation (ρ'_i) are still a combination of tax revenues (Π_i) that are calculated based on the allocated share of the tax base (π_i) multiplied by the domestic corporate income tax rate (τ_i). The movements of workforce (ε^j) from one Member State to the other are contingent on the different definitions of '*Employee*' applied by the Member States, the volume of atypical employment relations and the respective tax rates.[8] As before, we assume that the group's structure of typical vs. atypical employment corresponds to the country's average structure.

Since corporate groups seek to minimize their effective tax rates by shifting the employment factor into low-tax countries their ultimate benchmark for an effective tax rate would be the minimum domestic tax rate in the group. In this extreme (and unrealistic) case, the corporate group would shift all employees (and all activities) to the Member State with the lowest tax rate, but stay within the CCCTB area.

The target effective group tax rate can be defined as $\tau'_{grp} \geq min\ \tau_i$, i.e. $\tau'_{grp} \geq \tau_A$. It can be achieved through factor shifting from the high-tax to the low-tax country. The potential relocations of the employment factor (ε^j) is a function of τ'_{grp}, the tax rates of the involved countries (τ_A; τ_B) and of the domestic potentials for definition gains (a; b).

$$\varepsilon^{B/N} = \left(\tau'_{grp} - \frac{\tau_A + \tau_B*(1-b)}{2-b}\right) * \frac{2-b}{\tau_A - \tau_B} \tag{10}$$

$$\varepsilon^{N/B} = \left(\tau'_{grp} - \frac{(1-a)*\tau_A + \tau_B}{2-a}\right) * \frac{2-a}{\tau_A - \tau_B} \tag{11}$$

$$\varepsilon^{B/B} = \left(\tau'_{grp} - \frac{\tau_A + \tau_B}{2}\right) * \frac{2}{\tau_A - \tau_B} \tag{12}$$

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[7] Note that "shifting employment" refers to the process of reducing jobs in one Member State and creating these jobs anew in the other Member State. This concept does not necessarily imply that individuals actually relocate from one Member State to the other. However it may also include that individuals previously employed via an atypical employment relation receive a typical employment contract (or vice versa).
[8] Other aspects of workforce relocation such as redundancy payments and costs related to the hiring process are disregarded for simplicity reasons.

$$\varepsilon^{N/N} = \left(\tau'_{grp} - \frac{(1-a)*\tau_A + (1-b)*\tau_B}{2-a-b}\right) * \frac{2-a-b}{\tau_A - \tau_B} \qquad (13)$$

ε^j can take on values between 0 and 1. However this range gets reduced by the definition potential in the high-tax country so that for $\varepsilon^{B/N}$ and $\varepsilon^{N/N}$ the absolute values could range from 0 to $1-b$ and for $\varepsilon^{N/B}$ and $\varepsilon^{B/B}$ the absolute values range between 0 and 1. When the calculated value is outside the upper end of that range the targeted benchmark tax rate is not achievable by factor shifting within the CCCTB-countries but maybe by moving out of the geographical CCCTB-area or if possible by opting-out of the CCCTB-regime.

Consequently, the pay-offs for country A and for country B respectively are in all four cases the same. They can be expressed as follows:

Member State A:

Broad/narrow

$$\rho_A^{'L,B/n} = \frac{(1+\varepsilon^{B/N})*\tau_A}{2-b} * \frac{1}{3}CTB \qquad (14a)$$

Narrow/broad:

$$\rho_A^{'L,N/b} = \frac{(1-a+\varepsilon^{N/B})*\tau_A}{2-a} * \frac{1}{3}CTB \qquad (14b)$$

Broad/broad

$$\rho_A^{'L,B/b} = \frac{(1+\varepsilon^{B/B})*\tau_A}{2} * \frac{1}{3}CTB \qquad (14c)$$

Narrow/narrow

$$\rho_A^{'L,N/n} = \frac{(1-a+\varepsilon^{N/N})*\tau_A}{2-a-b} * \frac{1}{3}CTB \qquad (14d)$$

Member State B:

broad/Narrow

$$\rho_B^{'L,b/N} = \frac{(1-b-\varepsilon^{B/N})*\tau_B}{2-b} * \frac{1}{3}CTB \qquad (14e)$$

narrow/Broad:

$$\rho_B^{'L,n/B} = \frac{(1-\varepsilon^{N/B})*\tau_B}{2-a} * \frac{1}{3}CTB \qquad (14f)$$

broad/Broad

$$\rho_B^{'L,b/B} = \frac{(1-\varepsilon^{B/B})*\tau_B}{2} * \frac{1}{3}CTB \qquad (14g)$$

narrow/Narrow

$$\rho_B^{'L,n/N} = \frac{(1-b-\varepsilon^{N/N})*\tau_B}{2-a-b} * \frac{1}{3}CTB \qquad (14h)$$

In general $\varepsilon^{N/B}$ has the largest volume and $\varepsilon^{N/N}$ has the smallest volume ($\varepsilon^{N/B} > \varepsilon^{B/B} > \varepsilon^{N/N} > \varepsilon^{B/N}$). The larger the definition effects (a; b) are, the higher is ε^j. The difference in

the magnitudes of the definition effects (a − b) has varying effects on ε^j. $\varepsilon^{N/B}$ in general increases with an increasing difference between a and b, however this effect is interfered with by the pure volume effect in a way that the larger the definition effect the larger is $\varepsilon^{N/B}$.

The numerical example from above is extended by an assumed effective target tax rate of $\tau'_{grp} = 17\%$. Member State A is defined a low-tax country ($\tau_A = 15\%$) and Member State B is a high-tax country ($\tau_B = 25\%$). Again, $\frac{1}{3}CTB$ amounts to 100. The share of the allocable tax base that is sensitive to the employment factor definition is different in the two involved countries. ε^j has the following values:

For (a = 8%; b = 36%):	For (a = b = 15%):
$\varepsilon^{B/N} = 0.31$	$\varepsilon^{B/N} = 0.48$
$\varepsilon^{N/B} = 0.62$	$\varepsilon^{N/B} = 0.63$
$\varepsilon^{B/B} = 0.6$	$\varepsilon^{B/B} = 0.6$
$\varepsilon^{N/N} = 0.33$	$\varepsilon^{N/N} = 0.51$

In this variation of the game, the pay-off structure is equal in all four combinations and results in the targeted tax rate of $\tau'_{grp} = 17\%$ and applies to all combinations of a and b (therefore to both cases above (a = 8%; b = 36% and a = b = 15%).

In both situations in the numerical example (a > b and a = b) achieving the target tax rate (τ'_{grp}) is possible given the domestic tax rates of the involved Member States (τ_A; τ_B). However the amount of factor shifting, the necessary movement of employees, is rather high. Especially starting from the most likely combination of domestic *Employee* definitions (*broad/broad*), $\varepsilon^{B/B}$ amounts to 60%. If the costs of such movement are too high and the benefits from remaining in the CCCTB-regime or in the geographical CCCTB-area are to small the corporate group would consider moving out of the geographical CCCTB-area altogether.[9]

Alternatively to an exogenous target effective tax rate τ'_{grp} one might also use a benchmark which is developed from the game itself. Such an internal benchmark would be the lowest effective tax rate within the CCCTB-regime that occurs when *ceteris paribus* the largest possible share of the overall tax base (*CTB*) is allocated to and taxed by the low-tax country and the

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[9] If τ'_{grp} is set at the lowest tax rate among the CCCTB Member States in which the group is active (in our case if $\tau'_{grp} = \tau_A = 15\%$), groups will shift all employment to Member State A, the low tax country. ε^j is very high and $\varepsilon^{B/B} = \varepsilon^{N/B} = 1$ and $\varepsilon^{B/N} = \varepsilon^{N/N} = 1 - b$.

smallest possible share is allocated to and taxed by the high-tax country. This benchmark equals the effective tax rate of the group when the low-tax Member State applies a *broad* '*Employee*' definition while the high-tax Member State simultaneously uses a *narrow* '*Employee*' definition ($\tau_{grp}^{L,B/N}$, bottom left in Figures 3 and 4). Within the CCCTB-regime the corporate group will relocate employment from the high-tax country to the low-tax country based on the different '*Employee*' definitions actually chosen by the involved Member States (*broad/narrow; narrow/broad; broad/broad; narrow/narrow*) to arrive at or at least to converge towards that benchmark. Based on expressions (5a) and (5e) $\tau_{grp}^{L,B/N}$ can be expressed as:

$$\tau_{grp}^{L,B/N} = \frac{\tau_A}{2-b} + \frac{(1-b)*\tau_B}{2-b} \tag{15}$$

The magnitude of employment factor shifting (ε^j) necessary to replicate the effective tax rate benchmark ($\tau_{grp}^{L,B/N}$) is contingent on the combinations of '*Employee*' definitions the corporate group is facing (*narrow/broad; broad/broad; narrow/narrow*) and on the volume of the definition effects (a; b). But it is not sensitive to the tax rates or the tax rate differential.

If the corporate group is faced with a combination of *broad/broad* '*Employee*' definitions, which the equilibrium of the above game (Figure 3) would suggest, the volume of necessary employment factor shifting ($\varepsilon^{B/B}$) from the high-tax to the low-tax country can be calculated using (15), (5c) and (5g):[10]

$$\varepsilon^{B/B} : \tau_{grp}^{\prime L,B/B} = \tau_{grp}^{L,B/N}$$

$$\frac{(1+\varepsilon^{B/B})*\tau_A}{2} + \frac{(1-\varepsilon^{B/B})*\tau_B}{2} = \frac{\tau_A}{2-b} + \frac{(1-b)*\tau_B}{2-b}$$

$$\varepsilon^{B/B} = \frac{b}{(2-b)} \tag{16}$$

ε^j again takes on values between 0 and 1. In general $\varepsilon^{N/B}$ has the largest volume and $\varepsilon^{N/N}$ has the smallest volume ($\varepsilon^{N/B} > \varepsilon^{B/B} > \varepsilon^{N/N}$; see footnote 10). The larger the definition effects (a; b) are, the higher is ε^j. The tax rates and the tax rate differences do not directly affect ε^j as long as the benchmark for the minimization of the effective tax rate is a weighted average of the tax rates applicable in the CCCTB-area ($\tau_{grp}^{L,B/N}$). However the combination of tax rate and volume of definition

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[10] If, against the expected outcome, the corporate group is faced with a combination of *narrow/broad* '*Employee*' definitions so that the high-tax country uses a *broad* definition and the low-tax country uses the *narrow* definition, or a *narrow/narrow* outcome the volume of necessary employment factor shifting ($\varepsilon^{N/B}$; $\varepsilon^{N/N}$) from the high-tax to the low-tax country amounts to $\varepsilon^{N/B} = \frac{(b+a-ab)}{(2-b)}$ and $\varepsilon^{N/N} = \frac{(a-ab)}{(2-b)}$.

potentially affects the relocation in a way that $\varepsilon^{B/B}$ (and $\varepsilon^{N/B}$; see footnote 10) decrease with a decrease in the definition potential (b) in the high-tax country. $\varepsilon^{N/N}$ (see footnote 10) increases with the increase of the definition effect (a) in the low-tax country. As a result, $\varepsilon^{N/B} > \varepsilon^{B/B} > \varepsilon^{N/N}$ if $a < \frac{b}{1-b}$, and $\varepsilon^{N/B} > \varepsilon^{N/N} > \varepsilon^{B/B}$ if $a > \frac{b}{1-b}$. These potential movements decrease when $a \rightarrow 0$, $b \rightarrow 0$ and $(a - b) \rightarrow 0$.

c) Economic effects of relocation

Relocation of workforce comes at a cost, not only to the group, but also to the respective (high-tax) Member State's economy. If corporate groups decide to shift the employment factor out of one country, that country suffers from an increase in unemployment or from a decrease in the wage level, a decrease of wage taxes, a decrease of private consumption, etc. Vice versa, the economy of the (low-tax) country which attracts the employment factor benefits from the relocation as wage levels may increase, unemployment decreases, private consumption increases etc. Consequently, the pay-off for the respective Member State should consider not only the tax revenue from CCCTB, but also ancillary effects from corporate reactions, *i.e.* the relocation of workforce.

It is hard and maybe even impossible to determine the amount of these ancillary effects. For our game it suffices to acknowledge that such effect ω is positively related to the size of ε^j; $\omega(\varepsilon^j)$. In other words, the more relocation, the more ancillary effects.

Consequently, the pay-offs from above (14a-h) can be expressed as follows:

Member State A:

$$\rho_A''^{L,j} = \rho_A'^{L,j} + \omega(\varepsilon^j) \qquad\qquad (17a)$$

Member State B:

$$\rho_B''^{L,j} = \rho_B'^{L,j} - \omega(\varepsilon^j) \qquad\qquad (17b)$$

It has been shown above that for the externally defined target effective tax rate τ'_{grp} in general the following relation applies: $\varepsilon^{N/B} > \varepsilon^{B/B} > \varepsilon^{N/N} > \varepsilon^{B/N}$. Consequently, given the positive

relation between ancillary effects and ε^j, the same order applies to these ancillary effects:

$$\omega\big(\varepsilon^{N/B}\big) > \omega\big(\varepsilon^{B/B}\big) > \omega(\varepsilon^{N/N}) > \omega(\varepsilon^{B/N}).[11]$$

The game develops as follows, when pay-offs include not only the tax effects from relocations, but also ancillary effects from relocations (17a-b):

		Member State A low-tax	
		broad	narrow
Member State B high-tax	broad	$\rho_A^{''L,B/b}$ $\tau'_{grp} = \tau'^{B/B}_{grp}$ $\rho_B^{''L,b/B}$	$\rho_A^{''L,N/b}$ $\tau'_{grp} = \tau'^{N/B}_{grp}$ $\rho_B^{''L,n/B}$
	narrow	$\rho_A^{''L,B/n}$ $\tau'_{grp} = \tau'^{B/N}_{grp}$ $\rho_B^{''L,b/N}$	$\boldsymbol{\rho_A^{''L,N/n}}$ $\boldsymbol{\tau'_{grp} = \tau'^{N/N}_{grp}}$ $\boldsymbol{\rho_B^{''L,n/N}}$

Figure 5: Interactions of Strategies –
Corporate Reactions – Ancillary Economic Effects

Introducing ancillary economic effects from the factor shifting into the pay-off structure of the game changes the strategic setting of the game. While a *broad* definition allocates *prima vista* a bigger share of the tax base to the high-tax Member State B, a *broad* definition also initiates a high volume of factor shifting out of the high-tax Member State ($\varepsilon^{N/B} > \varepsilon^{B/B} > \varepsilon^{N/N} > \varepsilon^{B/N}$). A high-tax country is therefore better off choosing a *narrow* definition of '*Employee*' to reduce employment factor emigration. Irrespective of the low-tax Member State A's definition decision, a high-tax Member State B has the dominant strategy of playing *narrow*.

For the low-tax Member State A on the other hand playing *broad* would also allocate *prima vista* a larger share of the overall tax base. A *broad/narrow* interaction of strategies in a way that the low-tax country plays *broad* and the high-tax country uses a *narrow* definition however only attracts minor employment factor migration into the low-tax country. Choosing a *narrow* definition

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[11] For the internally developed benchmark tax rate ($\tau_{grp}^{L,B/N}$) the ancillary economic effects are rather similar with $\varepsilon^{N/B} > \varepsilon^{B/B} > \varepsilon^{N/N}$ if $a < \frac{b}{1-b}$ and $\varepsilon^{N/B} > \varepsilon^{N/N} > \varepsilon^{B/B}$ if $a > \frac{b}{1-b}$.

incentivizes employment factor immigration to the low-tax country and thus maximizes the individual pay-off of the low-tax Member State A.

For both Member States therefore playing *narrow* is the dominant strategy and *narrow/narrow* is the new equilibrium. This equilibrium is a Nash-Equilibrium in pure strategies and it is Pareto-optimal. It does not depend on the relation between a and b.[12]

5. Discussion and Conclusion

The draft CCCTB directive suggests defining a common consolidated corporate tax base, which is then allocated by an apportionment formula to the respective group entities, subject to the corporate tax rate in the respective Member States. The draft directive allows the Member States to autonomously define the term '*Employee*' which is essential to the employment apportionment factor. Individually rational Member States, seeking maximum pay-offs, will use this margin of discretion to increase the volume of the employment factor and thus to maximize the apportioned share of the Common Consolidated Corporate Tax Base. The decision making whether to define the term '*Employee*' rather *broad* so that it captures all different types of work relationships or *narrow* so that atypical employment relations are not included into the apportionment factor is modelled in this paper as a competitive game with two players.

In absence of tax rate differences and differences in the volume of atypical work relationships the interaction of both individually rational strategies of using a *broad* definition of '*Employee*' (*broad/broad*) results in a Pareto-optimal Nash-equilibrium in which both Member States get an equal share of taxable income allocated.

If tax rate differences and different volumes of atypical work relationships that could either be included in or disregarded from the employment factor are introduced to the game the analysis shows that the *broad/broad* equilibrium is not the first-best outcome for corporate groups. The strategy interaction of *broad/narrow* where the low-tax country applies a *broad* and the high-tax country uses a *narrow* definition yields the lowest tax burden for a corporate group and thus the most preferable outcome for corporate groups.

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[12] Also when using the internally developed target benchmark tax rate ($\tau_{grp}^{L,B/N}$) the strategies *narrow* remain dominant and the equilibrium *narrow/narrow* still applies though the order of the amount of relocation and the order of the size of the ancillary effects changes depending on the relation between a and b with $\varepsilon^{N/B} > \varepsilon^{B/B} > \varepsilon^{N/N}$ [$\omega(\varepsilon^{N/B}) > \omega(\varepsilon^{B/B}) > \omega(\varepsilon^{N/N})$] if $a < \frac{b}{1-b}$ and $\varepsilon^{N/B} > \varepsilon^{N/N} > \varepsilon^{B/B}$ [$\omega(\varepsilon^{N/B}) > \omega(\varepsilon^{N/N}) > \omega(\varepsilon^{B/B})$] if $a > \frac{b}{1-b}$.

Empirical evidence shows that corporate groups will use factor shifting to minimize the overall tax burden. The foreseeable reaction of corporate groups is to relocate the employment factor from the high-tax country to the low-tax country. Such, they replicate the tax burden in the most preferable interaction of Member States' '*Employee*' definitions (*broad/narrow*) or influence the factor allocation to achieve an externally defined target effective group tax rate irrespective of the actual definitions applied by the involved Member States.

The magnitude of the factor shifting necessary for the corporate group to circumvent any less preferable definition interactions of the Member States depends on the actual definition interaction and on the volume of atypical employment relations that could either be included in or disregarded from the '*Employee*' definition. The migration of the employment factor produces on the one hand relocation cost for the corporate group but on the other hand also economic gains and losses for the involved Member States' economies. These ancillary economic effects are considered in modelling the pay-offs. The analysis shows that a high-tax Member State could minimize the volume of employment factor emigration by choosing a *narrow* '*Employee*' definition. A low-tax Member State however could maximize the employment factor immigration by also choosing a *narrow* '*Employee*' definition. Thus for both involved Member States *narrow* is the dominant strategy when reactions of corporate groups are considered in the model. The two dominant strategies lead to a Pareto-optimal Nash-equilibrium in pure strategies *narrow/narrow*.

The factor shifting with all its direct tax effects and its indirect ancillary economic effects could be prevented or mitigated if the CCCTB is introduced optionally. The optionality of the CCCTB-regime is under discussion among Member States, however the European Parliament voted for a compulsory introduction of CCCTB in April 2014 (see Press Release Nr 20120418IPR43390[13]). An optional CCCTB would allow corporate groups to decide on their applicable tax regime *i.e.* being taxed according to the CCCTB-Directive and its domestic transformations or being taxed traditionally according to up to 28 domestic corporate income tax laws. The corporate group could therefore opt-out of the CCCTB-regime if its individual tax rate benchmark is not achievable within the CCCTB-regime through factor shifting. Opting-out of the CCCTB-regime however produces additional direct and indirect cost for the corporate group (transitional cost in the event of opting-out, subsequent cost including but not limited to compliance cost of up to 28 national tax regimes involving different tax accounting regimes, transfer pricing regulations, cross-border loss offset, etc) and leaves the corporate group with a non-trivial estimation of benefits and drawbacks of opting-out. If the

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[13] http://www.europarl.europa.eu/pdfs/news/expert/infopress/20120418IPR43390/20120418IPR43390_en.pdf

traditional system is more beneficial to the corporate group the CCCTB-regime will not be applied. Corporate relocations will still be used to capitalize tax rate differences however these corporate location decisions will not be influenced directly by the CCCTB-rules and the discussed *'Employee'* definitions of the Member States.

The games in section 4 involve only two actors. The CCCTB employment factor game however would be played among n actors (with currently $n = 28$[14]). The extension of the two-player game to an n-actor situation is straightforward and can be drawn from theories well-developed in existing literature (Snidal 1985; Ward 1996; Lipson 1984; Axelrod and Keohane 1985); it corresponds to the standard case of externalities where each State imposes costs or benefits on others (in-)dependent of their own behavior (Ward 1996). In terms of ordinal preferences, every Member State is in the same symmetric relation to every other Member State. This extension can be depicted in terms of an n-dimensional "cube" where each dimension represents one of the n Member State's policy alternatives and the outcome is represented by the point in the "cube" (and corresponding pay-offs) determined by the choices of all n Member States. As all n Member States would have the dominant strategies *narrow* the extension to an n-actor game would not change the Pareto-optimal Nash-equilibrium.

In a n-actor game with m corporate groups however the notions of high-tax and low-tax countries cannot be applied consistently anymore. Thus it is hardly possible to consistently identify Member States that always have to play *narrow* to discourage employment factor emigration (high-tax) or that always play *narrow* to incentivize employment factor immigration (low-tax). With the exception of the countries with the absolute highest (France) and lowest (Bulgaria and Cyprus) corporate income tax rates within the EU every Member State can be considered high-tax as well as low-tax, depending on the relating other Member State. A domestic *narrow* '*Employee*' definition which is used to maximize employment factor immigration from one Member State with a higher statutory tax rate could at the same time be helpful in relation to a low-tax country to minimize employment factor emigration. These dichotomous characteristics of simultaneously being a (relatively) low-tax and a (relatively) high-tax country makes it virtually impossible to evaluate which EU Member State would ultimately gain or lose in the Employment Factor Game.

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[14] Or maybe less in case of Enhanced Cooperation, in which case a smaller group of Member Stated could introduce the CCCTB

Appendix

Development of Formula (3)

1. Pay-off in a pure strategy outcome (*broad/broad*):

$$\rho_A^{L,B/b} = \frac{1}{2} * T_A^L$$

2. Pay-off in a mixed strategy outcome (*broad/narrow*):

$$\rho_A^{L,B/n} = \frac{1}{2-a} * T_A^L$$

3. Calculating the additional pay-off (y) in *broad/narrow* ($\rho_A^{L,B/n}$) compared to *broad/broad* ($\rho_A^{L,B/b}$):

$$\frac{1}{2} * T_A^L + y * T_A^L = \frac{1}{2-a} * T_A^L$$

$$y = \frac{1}{2-a} - \frac{1}{2}$$

$$y = \frac{a}{2*(2-a)}$$

Thus:

$$\rho_i^L = T_i^L * \left[\frac{1}{2} + x * \frac{a}{2*(2-a)}\right]$$

Development of formula (10)

$$\tau'_{grp} = \tau_{grp}^{L,B/N'}$$

$$\tau'_{grp} = \frac{1+\varepsilon^{B/N}}{2-b} * \tau_A + \frac{1-b-\varepsilon^{B/N}}{2-b} * \tau_B$$

$$\tau'_{grp} = \frac{\varepsilon^{B/N} * (\tau_A - \tau_B)}{2-b} + \frac{\tau_A + \tau_B * (1-b)}{2-b}$$

Thus:

$$\varepsilon^{B/N} = \left(\tau'_{grp} - \frac{\tau_A + \tau_B * (1-b)}{2-b}\right) * \frac{2-b}{\tau_A - \tau_B}$$

Development of formula (11)

$$\tau'_{grp} = \tau_{grp}^{L,N/B'}$$

$$\tau'_{grp} = \frac{1-a+\varepsilon^{B/N}}{2-a} * \tau_A + \frac{1-\varepsilon^{B/N}}{2-a} * \tau_B$$

$$\tau'_{grp} = \frac{\varepsilon^{B/N} * (\tau_A - \tau_B)}{2-a} + \frac{\tau_A * (1-a) + \tau_B}{2-a}$$

Thus:

$$\varepsilon^{N/B} = \left(\tau'_{grp} - \frac{(1-a) * \tau_A + \tau_B}{2-a}\right) * \frac{2-a}{\tau_A - \tau_B}$$

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Development of formula (12)

$$\tau'_{grp} = \tau_{grp}^{L,B/B'}$$

$$\tau'_{grp} = \frac{1 + \varepsilon^{B/B}}{2} * \tau_A + \frac{1 - \varepsilon^{B/B}}{2} * \tau_B$$

$$\tau'_{grp} = \frac{\varepsilon^{B/N} * (\tau_A - \tau_B)}{2} + \frac{\tau_A + \tau_B}{2}$$

Thus:

$$\varepsilon^{B/B} = \left(\tau'_{grp} - \frac{\tau_A + \tau_B}{2}\right) * \frac{2}{\tau_A - \tau_B}$$

Development of formula (13)

$$\tau'_{grp} = \tau_{grp}^{L,N/N'}$$

$$\tau'_{grp} = \frac{1 - a + \varepsilon^{N/N}}{2 - a - b} * \tau_A + \frac{1 - b - \varepsilon^{N/N}}{2 - a - b} * \tau_B$$

$$\tau'_{grp} = \frac{\varepsilon^{N/N} * (\tau_A - \tau_B)}{2 - a - b} + \frac{\tau_A * (1 - a) + \tau_B * (1 - b)}{2 - a - b}$$

Thus:

$$\varepsilon^{N/N} = \left(\tau'_{grp} - \frac{(1 - a) * \tau_A + (1 - b) * \tau_B}{2 - a - b}\right) * \frac{2 - a - b}{\tau_A - \tau_B}$$

Development of formula (16)

$$\varepsilon_i^{B/B} : \tau_{grp}^{(B/B)'} = \tau_{grp}^{B/N}$$

$$\frac{(1 + \varepsilon_i^{B/B}) * \tau_A}{2} + \frac{(1 - \varepsilon_i^{B/B}) * \tau_B}{2} = \frac{\tau_A}{2 - b} + \frac{(1 - b) * \tau_B}{2 - b}$$

$$(2 - b) * [(1 + \varepsilon_i^{B/B}) * \tau_A + (1 - \varepsilon_i^{B/B}) * \tau_B] = 2 * [\tau_A + (1 - b) * \tau_B]$$

$$\varepsilon_i^{B/B} * (2\tau_A - 2\tau_B - b\tau_A + b\tau_B) = -b\tau_B + b\tau_A$$

$$\varepsilon_i^{B/B} = \frac{-b\tau_B + b\tau_A}{2\tau_A - 2\tau_B - b\tau_A + b\tau_B}$$

$$\varepsilon_i^{B/B} = \frac{b * (\tau_A - \tau_B)}{(2 - b) * (\tau_A - \tau_B)}$$

Thus:

$$\varepsilon_i^{B/B} = \frac{b}{(2 - b)}$$

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