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Impressum:

ifo Working Papers

Publisher and distributor: ifo Institute – Leibniz Institute for Economic Research at the University of Munich

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Abstract

This paper develops a model of tax competition with three countries, which initially form a union where countries refrain from using different tax rates in different sectors of the economy. We study the impact of one country leaving the union. We show that the introduction of discriminatory taxation in one country increases tax policy heterogeneity within the remaining union. Moreover, the incentives for the two remaining countries to harmonize their tax rates decline. We discuss these results in the context of the debate about the tax policy implications of Brexit.

JEL-Codes: H20, H73.

Keywords: International taxation, tax competition, preferential tax regimes.

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January 23, 2018

* We thank Andreas Haufler, Mohammed Mardan and participants at the 10th Norwegian-German Seminar on Public Economics 2017 for helpful comments and discussions.

1 Introduction

The decision of the UK to leave the EU has given rise to a lively debate about the implications of this move for corporate tax competition in Europe. In this debate, two predictions are widespread. The first is that the UK might become a large tax haven in the immediate neighborhood of the EU, which tries to lure investment and jobs away from other countries by offering low tax rates. The second prediction is that, once the UK has left, the remaining EU member states will finally take steps toward more tax harmonization.

The issue with the first prediction is that there is currently nothing that stops the UK from cutting taxes to attract investment, certainly not EU membership. There is no minimum corporate income tax rate in the EU. In fact, the UK has used this strategy extensively. It has repeatedly reduced its tax rate in recent years and currently has a much lower rate than comparable countries like Germany, France or Italy (see Figure 1).

[Figure 1 here]

The trouble with the second prediction is that the presence of the UK and its reluctance to give up sovereignty in taxation does not prevent the other EU member states to engage in tax harmonization if they want to do so. For instance, they could use the instrument of enhanced cooperation, which allows a subset of EU member states to act jointly in different policy areas, including taxation.

In this paper we focus on another aspect of the tax policy implications of Brexit: The fact that after leaving the EU, the UK will no longer be subject to EU state aid regulations and the EU code of conduct for business taxation. While these regulations do not prevent national governments from cutting headline tax rates, they do prevent them from offering different tax rates to different companies or sectors. This form of tax discrimination plays an important role in international tax policy. The relevance of the issue is exemplified by the recent opening of in-depth investigations by the EU Commission into the UK tax scheme for multinationals.¹ Since 2013 the UK allows for an exemption to its Controlled Foreign Company (CFC) rules, the *Group Financing Exemption*. It states that financing income received by the offshore subsidiary of a UK-based multinational from a foreign group company is exempted from reallocation to the UK. Hence, the UK parent company is able to pay little or no tax on the financing income generated via that scheme. The EU Commission doubts whether the Group Financing Exemption complies with EU state aid rules, as an exemption to an anti-avoidance provision, such as CFC rules, can amount to a selective advantage for certain companies (EU Commission, 2017). If the UK leaves the EU and starts to target its corporate tax policy to

¹Similarly, the EU Commission has concluded in 2016 that Ireland's tax benefits to Apple were illegal under EU state aid rules and recently has reached the same conclusion about tax benefits granted to Amazon in Luxembourg.

specific firms or sectors even more aggressively, this may have consequences for corporate tax competition throughout Europe.

To investigate the implications of a policy shift towards tax discrimination, we set up a simple three-country model with competition for internationally mobile capital. There are three sectors in the economy, each of which connects two of the three countries. This implies that each country hosts two sectors. Since these sectors are different, for example regarding size, countries have incentives to treat them differently for tax purposes. We start by analyzing a situation where the three countries form a ‘union’ which shares the norm that there is only uniform taxation, meaning that there is no discrimination in the tax burden within countries. We compare the outcome of tax competition and the incentives for two of the three countries to harmonize their taxes to a situation where the third country leaves the union and introduces discriminatory taxation.

The analysis leads to three key results. First, the introduction of tax discrimination in one country, while the two other countries stick to uniform taxation but set their tax rates independently, leads to increasing tax heterogeneity regarding rates as well as revenue within the remaining union. Second, if the two countries remaining in the union harmonize their tax rates, the introduction of tax discrimination in the third country redistributes tax revenue between the countries remaining in the union. The country with lower taxes before harmonization loses while the high tax country benefits. Third and most importantly, the incentives for tax harmonization among the countries remaining in the union decline as the third country introduces discriminatory taxation. This also holds if transfers across countries to share gains from harmonization are possible.

These results are important for several reasons. First, the fact that one country leaves the union does not generally intensify tax competition, it puts the low tax countries remaining in the union under stronger competitive pressure and eases pressures on high tax countries in our model. Second, the fact that exit of one country makes harmonization among the other countries less attractive does not rely on the argument that tax coordination or harmonization becomes less effective if the number of participating countries falls and leakage effects grow (Konrad and Schjelderup, 1999). We compare situations where there is always an outsider who does not participate. More generally, the intuition that the deviation of one country from a common tax policy norm – uniform tax rates – increases the willingness to harmonize taxes within the group of the remaining countries complying with the norm, does not hold in our model. The opposite is true. This questions the widespread view that Brexit will make tax coordination or harmonization among the remaining EU countries more likely.

This paper is related to the literature on tax competition, coordination and preferential regimes, which started to develop in the late 80s as the internationalization of economic activity strained national tax structures (Zodrow and Mieszkowski, 1986).² Most evidently this was true for the European Community. In the academic literature there is an ongoing debate about

²See Keen and Konrad (2013) for a complete discussion of the literature.

the benefits of tax coordination versus discrimination. Keen (2001) analyzes a situation of two symmetric countries and concludes that the introduction of preferential tax regimes can hamper tax competition. He assumes that both countries are able to discriminate. In contradiction to Keen (2001), Janeba and Peters (1999) conclude that a uniform tax regime is preferable to tax discrimination as it allows governments to exploit the mobile tax base. Janeba and Smart (2003) show that the benefits of tax discrimination depend on the elasticity of the aggregate tax bases, reconciling the seemingly contradictory findings of Keen (2001) and Janeba and Peters (1999). In a model with imperfect competition and trade costs, Gagné and Wooton (2011) derive the Nash equilibrium tax regimes. Depending on whether trade costs are high, a uniform tax regime is preferred. Otherwise countries will choose to discriminate between mobile and immobile firms.

We also contribute to the literature on asymmetric tax competition. In a simple two-country model, Kanbur and Keen (1993) analyze how tax competition and coordination are affected by differences in country size. They conclude that the small country loses in terms of tax revenue from harmonization. But they also find that both countries benefit from the introduction of a minimum tax rate. Bucovetsky and Haufler (2007) extend Keen (2001)'s model to the case of asymmetric countries. They arrive at similar results as in the symmetric case. Similarly Bucovetsky (1991) and Stöwhase (2005) analyze tax competition when countries differ in size. Our analysis is also related to the literature on partial tax coordination, where only a subset of countries participates in tax coordination or harmonization agreements (Konrad and Schjelderup (1999), Conconi et al. (2008) and Haufler and Lülfsmann (2015)).

Finally, this paper can be linked to the literature on tax havens (Desai et al. (2004), Hong and Smart (2010), Slemrod and Wilson (2009), Johannesen (2010) as well as Becker and Fuest (2012)), where one of the central issues is whether tax havens mitigate tax competition among non-haven countries.

This paper extends the literature by analyzing the effects of tax discrimination on tax competition and harmonization in a three-country model. We consider a situation where some countries are allowed to discriminate while others are not and where only a subset of countries harmonizes taxes.

The rest of the paper is set up as follows. In Section 2 we present the model. In Section 3 we analyze various tax competition equilibria with and without discrimination. Section 4 focuses on tax harmonization and Section 5 concludes.

2 The Model

There are three countries A, B and C. Each country hosts two sectors. Each of these sectors links the country to one of the two other countries. The companies in all sectors operate under perfect competition in input and output markets, and the number of firms per sector is

normalized to unity. Each firm is endowed with a sector specific factor of production which is mobile across borders but not across sectors (Keen, 2001). We refer to this factor as capital. Sector A has its headquarter in country A and employs firm specific but internationally mobile capital either in country A or in its subsidiary in country B, sector B has its headquarter in country B and a subsidiary in country C. Accordingly, sector C resides in country C and has a subsidiary in A. The profit of the representative firm in sector A is given by

$$P_A = F_A^A(K_A) + F_A^B(S_A - K_A) - T_A K_A - T_{BA}(S_A - K_A), \quad (1)$$

where $F_A^A(K_A) + F_A^B(S_A - K_A)$ is the firm's revenue generated in countries A and B, S_A is the firm's endowment with sector specific capital and K_A is investment in country A. Thus, the only choice the firm makes is to allocate its capital stock across the two production locations in countries A and B. T_A is the corporate tax country A levies per unit of capital employed in sector A and T_{BA} is the corporate tax on sector A investment levied by country B. Profit maximizing investment is given by the first order condition

$$F_A^{A'} - T_A = F_A^{B'} - T_{BA}. \quad (2)$$

Figure 2 visualizes how countries A, B and C are connected by the different sectors and their respective production functions.

[Figure 2 here]

The tax revenue of country A is given by

$$R_A = T_A K_A + T_{AC}(S_C - K_C).$$

Accordingly, the tax revenue of countries B and C is given by

$$R_B = T_B K_B + T_{BA}(S_A - K_A)$$

and

$$R_C = T_C K_C + T_{CB}(S_B - K_B).$$

We consider two types of tax regimes for each country: Uniform taxation, where both sectors operating in the countries are taxed at the same rate, i.e. for country A this would imply $T_A = T_{AC}$, and discriminatory taxation, where the two tax rates may differ.

Following Keen (2001), we assume that countries maximize their tax revenue and take the behavior of the companies and the tax rates of the other countries as given. The focus of our analysis is how the ability of countries to tax the two sectors differently affects the tax competition equilibria and the incentives for tax harmonization between two of the three

countries.

To make the following analysis tractable, we follow Bucovetsky (1991) as well as Bucovetsky and Haufler (2007) in assuming that the production technology is quadratic:

$$F_i^j(K_i^j) = \alpha K_i^j - \frac{1}{4}(K_i^j)^2, \quad i, j = A, B, C. \quad (3)$$

Note that the factor determining asymmetries between the three countries is the endowment with sector specific capital $S_i, i = A, B, C$.

The first-order condition for firm A's optimal investment can be written as

$$K_A = \frac{S_A}{2} + T_{BA} - T_A \quad (4)$$

and the tax revenue of country A is

$$R_A = T_A\left(\frac{S_A}{2} + T_{BA} - T_A\right) + T_{AC}\left(\frac{S_C}{2} + T_C - T_{AC}\right). \quad (5)$$

For B and C we get, accordingly

$$R_B = T_B\left(\frac{S_B}{2} + T_{CB} - T_B\right) + T_{BA}\left(\frac{S_A}{2} + T_A - T_{BA}\right)$$

and

$$R_C = T_C\left(\frac{S_C}{2} + T_{AC} - T_C\right) + T_{CB}\left(\frac{S_B}{2} + T_B - T_{CB}\right).$$

3 Tax Competition

As mentioned above, we assume that governments use the available tax instruments to maximize their tax revenue. We consider two types of equilibria. First, we assume that all countries tax the two sectors uniformly, that is they operate under uniform taxation. Second, we consider the situation where A and B do not discriminate but C does.³

3.1 Uniform taxation in all countries

Denote the uniform tax rate of country j by $T_j, j=A,B,C$. Under uniform taxation in all countries the tax rate which maximizes the revenue of country A, given the tax rates of B and C, is given by the equation

$$4T_A - T_B - T_C = \frac{S_A + S_C}{2}.$$

³The equilibrium tax rates and revenues in the case where all countries discriminate can be found in the Appendix.

Accordingly, the ‘reaction functions’ of countries B and C are given by

$$4T_B - T_A - T_C = \frac{S_A + S_B}{2}$$

and

$$4T_C - T_B - T_A = \frac{S_B + S_C}{2}.$$

These three equations can be solved for the equilibrium tax rates which emerge under a regime of uniform taxation in all countries. This leads to

$$T_A^u = \frac{1}{10}(2S_A + 2S_C + S_B), \quad (6)$$

$$T_B^u = \frac{1}{10}(2S_A + 2S_B + S_C), \quad (7)$$

$$T_C^u = \frac{1}{10}(2S_B + 2S_C + S_A). \quad (8)$$

Substituting into the revenue functions yields

$$R_j^u = 2(T_j^u)^2, \quad j = A, B, C. \quad (9)$$

Unsurprisingly, the tax rates emerging in the tax competition equilibrium depend on the capital endowment of the different sectors. For instance, country A hosts activities of sectors A and C but not of B. This is why the capital endowments of sectors A and C play a greater role for its tax rate than the capital endowment of sector B. The latter is relevant for country A only indirectly because it determines the tax rates of the other countries, which do compete with country A for activities of sectors A and C.

3.2 Country C discriminates while A and B employ uniform taxation

We now consider the asymmetric situation where countries A and B levy uniform tax rates but country C discriminates between the two sectors. In this case, the tax competition equilibrium changes. Country C’s ‘tax reaction functions’ are now given by $T_C = \frac{S_C}{4} + \frac{T_A}{2}$ and $T_{CB} = \frac{S_B}{4} + \frac{T_B}{2}$. Reaction functions for countries A and B are the same as in the previous subsection.

Inserting the reaction functions of country C and solving for the tax rates of A and B yields:

$$T_A^{udc} = \frac{1}{30}(7S_C + 6S_A + 2S_B), \quad (10)$$

where the superscript *udc* stands for the equilibrium in which A and B have uniform tax rates and country C discriminates. For country B we get

$$T_B^{udc} = \frac{1}{30}(7S_B + 6S_A + 2S_C). \quad (11)$$

With these results, one can now derive the equilibrium values of T_C as well as T_{CB} :

$$T_C^{udc} = \frac{1}{30}(S_B + 3S_A + 11S_C), \quad (12)$$

$$T_{CB}^{udc} = \frac{1}{30}(11S_B + 3S_A + S_C). \quad (13)$$

For tax revenue we get

$$R_j^{udc} = 2(T_j^{udc})^2, \quad j = A, B \quad (14)$$

and

$$R_C^{udc} = (T_C^{udc})^2 + (T_{CB}^{udc})^2. \quad (15)$$

For the following analysis note that C will discriminate only if $S_B \neq S_C$.

3.3 How does discrimination in C affect equilibrium tax rates and revenues?

A key issue is how the introduction of discrimination in country C affects tax rates and revenues in the other countries. In this section we compare the tax rates and revenues in countries A and B for the situation of uniform taxation in all countries to the scenario where only country C discriminates. For country A the relevant tax rates are given by equations (6) and (10). Subtraction leads to

$$T_A^u - T_A^{udc} = \frac{1}{30}(S_B - S_C). \quad (16)$$

For country B the same procedure leads to:

$$T_B^u - T_B^{udc} = \frac{1}{30}(S_C - S_B). \quad (17)$$

Note also that, under uniform taxation, the difference between the tax rates of A and B is given by⁴:

$$T_A^u - T_B^u = \frac{1}{10}(S_C - S_B). \quad (18)$$

These results may be summarized as

Result 1: Tax Rates

If $S_B \neq S_C$, the tax rates of countries A and B differ under the regime of uniform taxation

⁴Note also that under discriminatory taxation in C, the tax rate difference between A and B is given by $T_A^{udc} - T_B^{udc} = \frac{1}{6}(S_C - S_B)$, which is larger than the tax rate difference under uniform taxation

within all countries. If country C switches to discriminatory taxation while A and B stick to uniform taxation, the tax rates of A and B always move into opposite directions. Thus, the tax rate difference between A and B increases.

How can this be explained? Consider for example the case where $S_C > S_B$, so that country A levies a higher tax rate than B: $T_A^u > T_B^u$. In this case, country C would like to levy a higher tax on sector C than on B but nondiscrimination forces country C to choose a uniform rate. The optimal uniform tax rate in country C will be between the rates that would be optimal for sectors B and C. When country C switches to tax discrimination, it will compete less fiercely for sector C investment and more fiercely for sector B investment. This in turn will induce country A to increase its tax rate as well while country B responds by cutting its rate. The growing tax rate divergence between A and B mirrors the tax rate divergence within country C. Therefore discrimination in country C will drive the tax rates in countries A and B further apart.

As the previous results have shown, C will use its ability to discriminate if and only if $S_B \neq S_C$. For the following analysis we therefore make

Assumption 1: Sector Sizes $S_C > S_B$

It is important to note that, given the setup of our model, Assumption 1 has two implications. The first is that country A will want to levy higher taxes than country B. The second is that, if country C discriminates, it will want to tax sector C at a higher rate than B because rents in sector C are larger. This drives many of the results in the following sections. Theoretically it would be possible to use a different setup, where the tax rate difference between countries A and B is not determined by the size of the rents in the sector which links these two countries to country C. For instance, there could be a very profitable and immobile fourth sector operating in country B only, which drives up taxes there. We will come back to this issue in the discussion of the results.

Consider next the impact on tax revenue. It follows directly from equations (9) and (14) that the regime switch of country C will increase tax revenue for the high tax country and reduces the tax rate for the low tax country among A and B:

$$R_A^{udc} - R_A^u = \frac{1}{450} [5(S_C^2 - S_B^2) + (12S_A + 8S_C)(S_C - S_B)], \quad (19)$$

$$R_B^{udc} - R_B^u = \frac{1}{450} [5(S_B^2 - S_C^2) + (12S_A + 8S_B)(S_B - S_C)]. \quad (20)$$

However, aggregate tax revenue of A and B will increase due to the regime switch: Adding up equations (19) and (20) yields

$$R_A^{udc} - R_A^u + R_B^{udc} - R_B^u = \frac{4}{225}(S_B - S_C)^2 > 0. \quad (21)$$

How about country C? It is straightforward to show that the following holds

$$R_C^{udc} - R_C^u = (T_C^{udc})^2 + (T_{CB}^{udc})^2 - 2(T_C^u)^2 = \frac{1}{18}(S_B - S_C)^2 > 0. \quad (22)$$

We may thus state the following:

Result 2: Tax Revenue

A switch from uniform to discriminatory taxation by country C, while A and B continue to levy uniform rates, increases the tax revenue of country C. Country A's tax revenue increases while B's tax revenue decreases. Aggregate tax revenue of A and B increases.

The impact on tax revenue in the different countries is a consequence of the tax rate changes explained in the context of Result 1. It is interesting to note that the low tax country B is negatively affected by the regime change in C, not the high tax country A. The result that the tax revenue of C and as well as the aggregate tax revenue of A and B increases, can be seen as an extension of Keen (2001) and Bucovetsky and Haufler (2007). While these papers shows that the introduction of tax discrimination in all countries mitigates tax competition with symmetric and asymmetric countries, our analysis shows that the introduction of tax discrimination in *one* country only also mitigates tax competition in terms of revenue raised in a setting with three asymmetric countries.

4 Tax Harmonization

What are the implications of the regime change in country C for corporate tax harmonization? We consider tax harmonization of the following type: Countries A and B set a common tax rate to maximize the sum of their tax revenues.⁵ The focus of our interest is whether the incentives for countries A and B to engage in tax harmonization change as a result of introducing tax discrimination in country C.

4.1 Tax harmonization with uniform taxation in country C

Assume that C levies a uniform tax rate and countries A and B choose the harmonized tax rate which maximizes their aggregate tax revenue. Both sides take the tax rate set by the other side as given. The tax rates emerging under these assumptions are given by

⁵One could think of alternative forms of tax harmonization or tax coordination. For instance, countries A and B could bargain over the harmonized tax rate or they could coordinate their tax rates without harmonizing them.

$$T_H^{huc} = \frac{1}{12}(4S_A + 3(S_B + S_C)) \quad (23)$$

and

$$T_C^{huc} = \frac{1}{12}(2S_A + 3(S_B + S_C)), \quad (24)$$

where T_H^{huc} is the harmonized tax rate levied by countries A and B, given that C has a uniform tax rate (T_C^{huc}).

Tax revenues are now given by

$$R_A^{huc} = (T_H^{huc})^2 + \frac{T_H^{huc}}{12}3(S_C - S_B), \quad (25)$$

$$R_B^{huc} = (T_H^{huc})^2 + \frac{T_H^{huc}}{12}3(S_C - S_B), \quad (26)$$

and

$$R_C^{huc} = 2(T_C^{huc})^2. \quad (27)$$

4.2 Tax harmonization with discriminatory taxation in country C

Consider next the equilibrium where country C discriminates. Here the emerging tax rate for A and B is:

$$T_H^{hdc} = \frac{1}{12}(4S_A + 3(S_B + S_C)). \quad (28)$$

The tax rates of country C are

$$T_C^{hdc} = \frac{1}{24}(4S_A + 6S_C + 3(S_B + S_C)) \quad (29)$$

and

$$T_{CB}^{hdc} = \frac{1}{24}(4S_A + 6S_B + 3(S_B + S_C)). \quad (30)$$

Note that the switch of C to tax discrimination leaves the harmonized tax rate of A and B unchanged, i.e. $T_H^{hdc} = T_H^{huc} \equiv T_H$. The reason is that C cuts its tax on sector B and increases its tax on sector C. The optimal response for A and B, given that they are not able to discriminate, is to do nothing.

For tax revenues, we get

$$R_A^{hdc} = \frac{T_H}{24}(8S_A + 12S_C + 3(S_C - S_B)), \quad (31)$$

$$R_B^{hdc} = \frac{T_H}{24}(8S_A + 12S_B + 3(S_B - S_C)) \quad (32)$$

and

$$R_C^{hdc} = (T_C^{hdc})^2 + (T_{CB}^{hdc})^2. \quad (33)$$

4.3 How does the regime switch in C affect tax revenues in the presence of tax harmonization?

How does the switch of country C to tax rate discrimination affect tax revenues? Analyzing the effect of the regime switch on tax revenue under harmonization for A and B separately, we get

$$R_A^{hdc} - R_A^{huc} = \frac{T_H}{8}(S_C - S_B) \quad (34)$$

and

$$R_B^{hdc} - R_B^{huc} = \frac{T_H}{8}(S_B - S_C). \quad (35)$$

Given Assumption 1, i.e. $S_C > S_B$, a switch to discrimination increases the tax revenue of A and reduces that of B. The reason is that C has incentives to increase its tax on the larger sector C and compete more aggressively for investment of the smaller sector B. This will increase investment and, hence, tax revenue in country A. The impact on country B is the opposite. Equations (34) and (35) also show that the aggregate tax revenue of countries A and B does not change. Discrimination in C only redistributes revenue from B to A.

What happens to the tax revenue in country C due to its switch to tax discrimination? Comparing tax revenue in the two equilibria for country C shows

$$R_C^{hdc} > R_C^{huc}. \quad (36)$$

This means that country C benefits in terms of tax revenue by discriminating. We again compare this result to the findings in Keen (2001). In a two-country model Keen (2001) shows that tax discrimination by both countries mitigates tax competition. Our results show that introducing discrimination in one country only, also mitigates tax competition in the sense that it increases aggregate tax revenue. But the distribution of these gains between the three countries in our model is highly asymmetric. While C and A gain revenue, B loses.

We summarize these findings in

Result 3: One-sided Tax Discrimination

If country C switches from uniform taxation to discriminatory taxation, and given that countries A and B levy a uniform harmonized tax rate, countries A and C gain tax revenue while country B loses. Aggregate tax revenue of A, B and C increases.

4.4 How does the regime switch in C affect incentives for countries A and B to harmonize taxes?

If country C gives up the rule of uniform taxation and introduces discrimination, how does this affect the incentives for A and B to engage in corporate tax harmonization? To investigate this, we compare the gains from tax harmonization between A and B under uniform taxation in all countries to the gains from tax harmonization between A and B in the case where C discriminates. It continues to hold that C does not enter the tax harmonization agreement in either case. We start by considering countries A and B individually.

Formally, by defining

$$\Delta R_j^{uc} = R_j^{huc} - R_j^u, \quad j = A, B \quad (37)$$

and

$$\Delta R_j^{dc} = R_j^{hdc} - R_j^{udc}, \quad j = A, B, \quad (38)$$

the differences in the revenue gains from harmonization for countries A and B can be expressed as

$$\Delta R_A^{dc} - \Delta R_A^{uc} = \frac{1}{72}[0.17(S_C^2 - S_B^2) + (1.08S_A + 1.28S_B)(S_C - S_B)] \quad (39)$$

and

$$\Delta R_B^{dc} - \Delta R_B^{uc} = \frac{1}{72}[0.17(S_B^2 - S_C^2) + (1.08S_A + 1.28S_C)(S_B - S_C)]. \quad (40)$$

As one would expect, the harmonization gains are equal with and without discrimination (i.e. the right hand side of (39) and (40) is equal to zero) if $S_B = S_C$, as tax discrimination by C is irrelevant in that case.⁶

But in the presence of asymmetries, things are different. If $S_C > S_B$, as stated by Assumption 1, the switch to discrimination in C increases the benefit of country A ($\Delta R_A^{dc} - \Delta R_A^{uc} > 0$) but decreases B's gains from harmonization ($\Delta R_B^{dc} - \Delta R_B^{uc} < 0$). The reason is that discrimination increases the heterogeneity in tax policy between countries A and B (see Result 1). This means that, in the absence of harmonization between A and B, B's tax rate declines and A's tax rate increases as a result of discrimination in C. In this situation harmonization means that B increases its tax rate considerably while A actually lowers it. This has the effect that B loses capital to the other two countries. For country A the opposite holds, which is why A gains more from harmonization in the regime where C discriminates.

This can be summarized as

Result 4: Benefits from Tax Harmonization for Individual Countries

Introducing tax discrimination in C reduces the benefits from tax harmonization in country B

⁶Note also that the tax revenue effect of harmonization for A and B is positive both if C levies a uniform tax rate (i.e. $\Delta R_j^{uc} > 0$) or if C discriminates (i.e. $\Delta R_j^{dc} > 0$) as long as they are not too asymmetric regarding sector sizes. The proof is available from authors upon request.

and increases the benefits from harmonization in country A.

4.5 Are transfers between A and B sufficient to maintain incentives for tax harmonization?

Clearly Result 4 implies that, due to the regime switch in country C, it will become more difficult to convince at least one of the two countries remaining in the union to agree to tax harmonization. But this problem could be overcome if side payments between A and B are possible. In this case it would be enough that the regime change at least does not reduce the *aggregate* tax revenue gain for countries A and B.

Under uniform taxation in all countries the aggregate tax revenue gains from tax harmonization for countries A and B are given by

$$\Delta R_{A+B}^{uc} = (R_A^{huc} + R_B^{huc}) - (R_A^u + R_B^u). \quad (41)$$

In the case where country C discriminates, the gains from tax harmonization for A and B are given by

$$\Delta R_{A+B}^{dc} = (R_A^{hdc} + R_B^{hdc}) - (R_A^{udc} + R_B^{udc}). \quad (42)$$

Combining equations (41) and (42) and using the revenue equations for the different equilibria yields

$$\Delta R_{A+B}^{uc} - \Delta R_{A+B}^{dc} = \frac{4}{225}(S_B - S_C)^2 > 0. \quad (43)$$

We may thus state the following:

Result 5: Benefits from Tax Harmonization for Union

If country C switches from uniform taxation to discriminatory taxation and countries A and B levy a uniform tax rate, the aggregate revenue gains for countries A and B from harmonizing their tax rates decline.

What is the economic explanation for Result 5? The reason that discrimination undermines the incentives for A and B to harmonize their taxes is that, in the absence of harmonization, the introduction of tax discrimination in C mitigates tax competition in the sense that the tax revenue gain in country A exceeds the loss in country B, so that aggregate tax revenue in A and B increases. In the equilibrium with harmonized taxes, revenue for countries A and B is the same with and without discrimination in C. Therefore, the revenue gain that can be achieved through harmonization is smaller if C discriminates.⁷

⁷More formally, from the derivation of equations (34) and (35), we know that the regime switch of C, given that A and B have harmonized their tax rate, does not change the aggregate tax revenue of A and B. Thus, it

The result that the incentives for countries A and B to harmonize their corporate tax rates will be smaller if country C discriminates compared to a situation where country C levies a uniform tax is noteworthy for two reasons. First, it does not rely on the fact that tax coordination or harmonization becomes less attractive if the number of participating countries falls, because leakage effects grow. We compare situations where there is always an outsider, country C, who does not participate. Second, the intuition that the deviation of one country from a common tax policy norm – uniform tax rates – increases the willingness to harmonize taxes in the group of the remaining countries complying with the norm, does not hold in our model. Instead, the opposite is true.

5 Conclusion

In this paper we have used a stylized model of tax competition to study the implications of a regime change where one of three countries gives up a common tax policy norm, the norm of levying uniform tax rates on all sectors in the economy. It turns out that this regime change increases tax policy heterogeneity among the remaining countries which continue to comply with the norm. We also show that the regime change discourages tax harmonization among the remaining countries. If applied to the case of the EU, these results question the widely held view that the remaining EU countries will be more likely to take steps towards more corporate tax harmonization. Interestingly, our model predicts that the low tax countries will be those who lose as the country leaving the union introduces discriminatory taxation. This holds both for the case of harmonization and non-harmonization in the union.

Of course, the results of our theoretical analysis should be seen in the context of the highly stylized nature of the model from which they have been derived. Most importantly, our model implies that tax rate differences within the union are determined by size differences in the sectors which link countries A and B to country C, which leaves the union. This assumption is critical for the result that tax discrimination in C increases tax rate heterogeneity within the union. Moreover, the finding that incentives for tax harmonization are reduced is driven by the effect of tax discrimination on the intensity of tax competition which turns out to be the same as in Keen (2001). As mentioned in the introduction, the literature on tax discrimination has pointed out that models can be constructed where tax discrimination intensifies tax competition (Janeba and Peters (1999) and Janeba and Smart (2003)). Therefore our model should not be interpreted as showing *generally* that tax harmonization becomes less likely as a result of one country introducing discrimination. Rather, the contribution of our analysis is that this *may* actually happen.

There are more limitations of our model which should be taken into account. There is no capital mobility across sectors, countries focus on revenue maximization, issues like profit shifting and other types of tax avoidance are ignored. In addition, Brexit will not just free the

follows from equations (41), (42) and (43) that $(R_A^{udc} + R_B^{udc}) > (R_A^u + R_B^u)$ must hold.

UK from the restrictions of EU state aid, it will also most likely increase trade costs between the UK and the rest of the EU. This will have an impact on location decisions and, hence, on corporate tax competition. This aspect is entirely absent from the model considered here, which has focused on the tax discrimination issue. Clearly, more work that incorporates these aspects needs to be done to improve our understanding of how Brexit will change corporate tax competition in Europe.

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Appendix

A Discriminatory taxation in all countries

If all countries discriminate, country A's tax rates are given by

$$T_A = \frac{S_A}{4} + \frac{T_{BA}}{2}$$

and

$$T_{AC} = \frac{S_C}{4} + \frac{T_C}{2}.$$

Accordingly, the tax rates for B and C are given by

$$T_B = \frac{S_B}{4} + \frac{T_{BC}}{2}, T_{BA} = \frac{S_A}{4} + \frac{T_A}{2} \text{ and } T_C = \frac{S_C}{4} + \frac{T_{AC}}{2}, T_{CB} = \frac{S_B}{4} + \frac{T_B}{2}.$$

Inserting leads to:

$$T_A^d = \frac{S_A}{2}; T_B^d = \frac{S_B}{2}; T_C^d = \frac{S_C}{2}$$
$$T_{AC}^d = \frac{S_C}{2}; T_{BA}^d = \frac{S_A}{2}; T_{CB}^d = \frac{S_B}{2}.$$

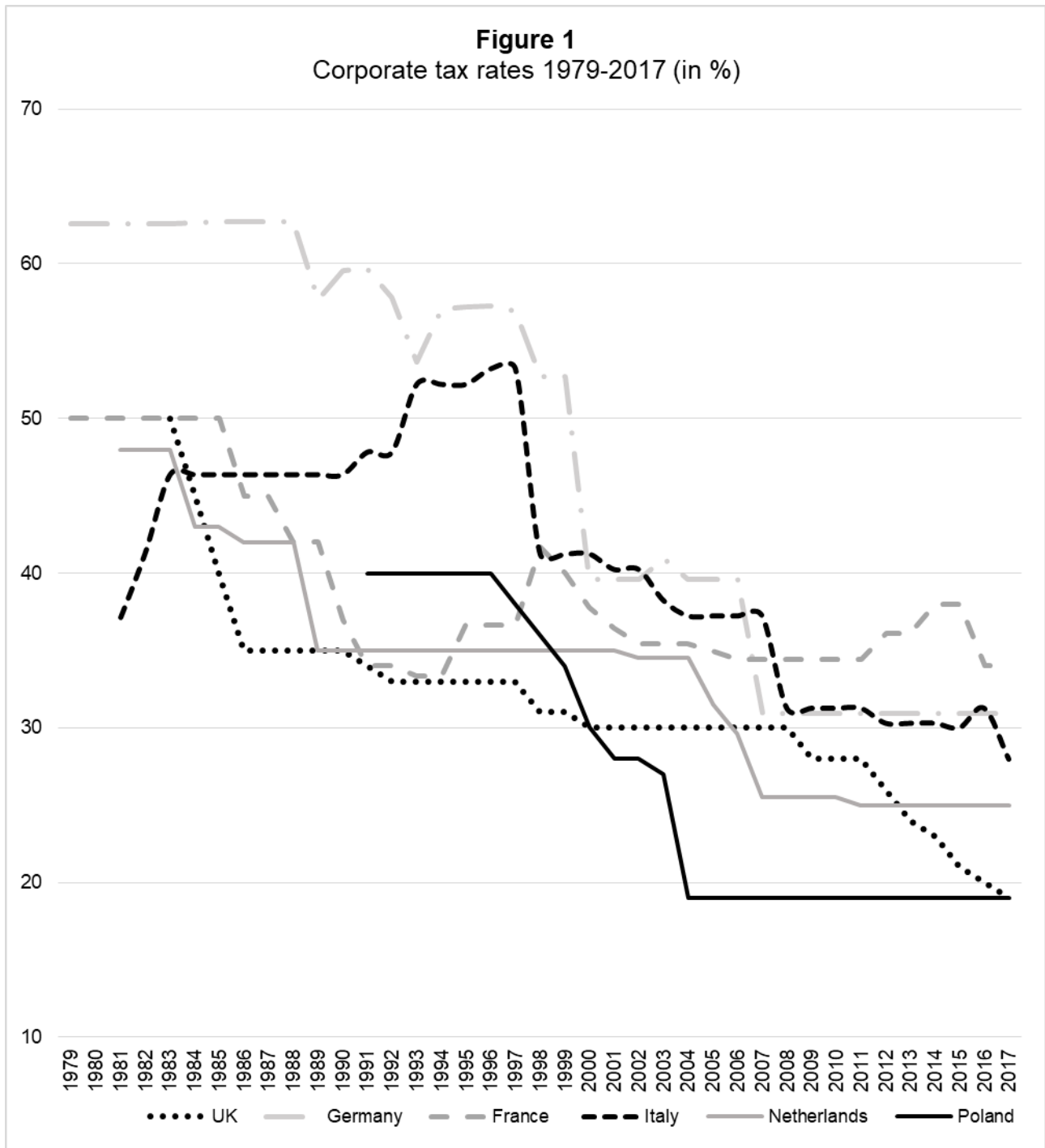
For tax revenue we get

$$R_A^d = \frac{S_A^2 + S_C^2}{4};$$
$$R_B^d = \frac{S_B^2 + S_A^2}{4};$$
$$R_C^d = \frac{S_C^2 + S_B^2}{4}.$$

Under discrimination each country can target its tax rates to the two specific sectors, which explains why the capital endowments of other sectors play no role. Put differently, the number of policy instruments for each country equals the number of targets. Interestingly, the result of discrimination by all, is a form of tax harmonization by sectors.

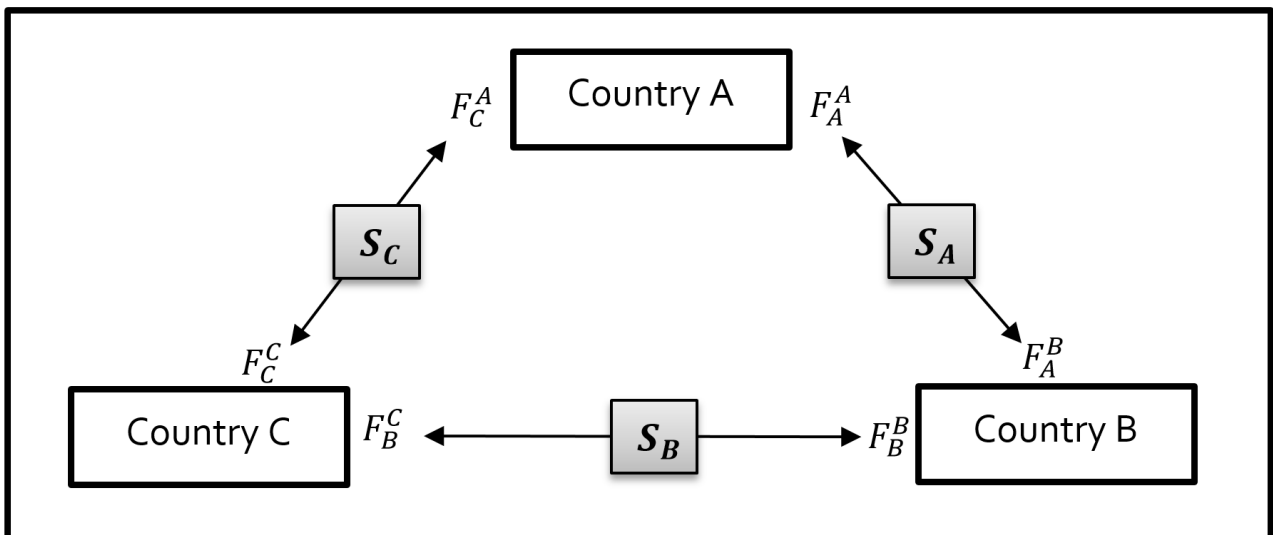
B Figures

Figure 1: Corporate tax rates 1979-2017



Notes: This figure shows the development in corporate tax rates across Europe for the time period 1979-2017. The data is retrieved from various sources such as EY Tax Reports and the OECD.

Figure 2: The Model



Notes: This figure shows how countries A, B and C are connected by the different sectors S_A , S_B and S_C and the respective production functions.

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