Discussion Paper No. 15-052

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ZEW
Zentrum für Europäische
Wirtschaftsforschung GmbH
Centre for European
Economic Research

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Olena Dudar[1]

(ZEW Mannheim)

Christoph Spengel

(University of Mannheim)

Johannes Voget

(University of Mannheim)

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Abstract

In 2013 the OECD introduced its Action Plan on base erosion and profit shifting (BEPS). One of the major concerns of this Plan is a strategic use of intangible assets as an instrument for profit shifting. The main purpose of this paper is to test whether multinational enterprises use intangibles as an important BEPS channel by empirically analysing the relationship between taxation and bilateral royalty flows. We employ the OECD data on 3,660 country-pairs for the time period of 1990-2012 and apply the Poisson pseudo-maximum likelihood estimator in a fixed-effects framework. The main results point to a negative impact of taxation on bilateral royalty flows. Moreover, we find that tax differentials, which represent a relative level of taxation in a recipient state compared to other potential royalty recipients, have a significant influence on royalty payments as well. For tax policy considerations, the paper provides various insights to the ongoing work on BEPS by the G20, the OECD, and the European Commission. For example, we find that such reform suggestions of the OECD Action Plan as an enforcement of the Nexus Approach, as well as an introduction of strict Controlled Foreign Company rules and transfer pricing regulations are likely to reduce international royalty flows.

Keywords: royalty; intangible assets; tax planning; corporate taxation

JEL-Classification: H25, F23, H26, H3

[1] Corresponding Author: Centre for European Economic Research (ZEW Mannheim), e-mail: dudar@zew.de, phone: +49 (0) 621-1235-141. P.O. Box: ZEW Mannheim, L7,1, 68161 Mannheim, Germany.
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1. Introduction

In recent years, the issue of base erosion and profit shifting has gained importance in the tax policy agenda of the OECD[2], the G20[3], and the European Commission[4]. These organisations have formally recognized the harmfulness of BEPS and developed an Action Plan to combat it. A special focus of this plan lies on restricting a strategic use of intangible assets for profit shifting purposes. To be more precise, multinational enterprises (MNEs) are thought to be strategically re/allocating their intangible assets to group members in low-tax jurisdictions, which then receive royalty payments from the affiliates that are located in high-tax countries. The main goal of this paper is therefore to address the question of whether intangibles constitute an important BEPS channel by empirically analysing the role of corporate taxation in determining the direction and amounts of international royalty flows.

The contribution of this study to previous literature is twofold. First of all, we extend empirical research on the relationship between taxation and intangibles' location by introducing a different identification strategy. In contrast to the numerous earlier papers, such as Huizinga et al. (2008), Dischinger and Riedel (2011), Karkinsky and Riedel (2012), Griffith et al. (2014) this study analyses not an impact of taxation on stocks of intangibles, but rather its influence on royalty payments. Secondly, we contribute to the ongoing work on the OECD Action Plan by analysing its several reform suggestions and quantifying their potential outcomes. For example, this paper provides an empirical investigation of how an enforcement of the Nexus Approach[5], along with an introduction of strict Controlled Foreign Company (CFC) rules and transfer pricing (TP) regulations[6] could affect international royalty flows.

In this study, bilateral royalty flows data from the OECD are used to empirically test the link between taxation and royalty payments. Figure 1 presents some interesting insights into the data on royalty flows by showing the top worldwide recipients of royalties in 2012. As one can see, royalty payments seem to be flowing not only in the typical research and development (R&D)-intensive countries, such as the United States, Japan or Germany, but also in states with low tax rates, such as the Netherlands, Switzerland, and Ireland.

[2] See the Organisation for Economic Co-operation and Development (OECD), Action Plan on Base Erosion and Profit Shifting, 2013, http://www.oecd.org/ctp/BEPSActionPlan.pdf

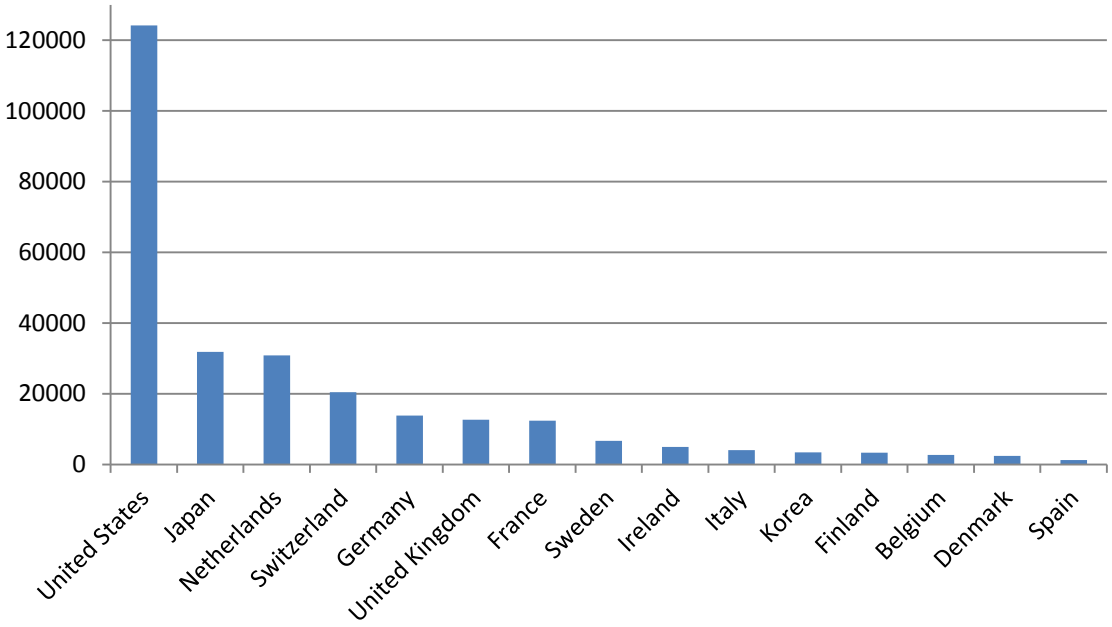
[3] See the OECD/G20 Explanatory Statement – 2014 Deliverables, 2014, http://www.oecd.org/ctp/beps-2014-deliverables-explanatory-statement.pdf

[4] See the Communication from the European Commission on BEPS, 2015, http://ec.europa.eu-/taxation_customs/resources/documents/taxation/company_tax/fairer_corporate_taxation/com_2015_302_en.pdf

[5] For more information see the OECD/G20 Action 5: Agreement on Modified Nexus Approach for IP Regimes, 2015, http://www.oecd.org/ctp/beps-action-5-agreement-on-modified-nexus-approach-for-ip-regimes.pdf

[6] The Nexus Approach, which is relevant for IP Boxes, along with CFC rules, and TP regulations lie in focus of respectively Actions 5, 3, and 7 of the OECD Action Plan on BEPS.

Figure 1. Top Fifteen Recipients of Royalty Payments (in millions of US Dollars) and their Effective Tax Rates (in percent), 2012



Country	Tax Rate	Country	Tax Rate, %
United States	35.0[1]	Ireland	12.5
Japan	41.0	Italy	27.5
Netherlands	25.0	Korea	22.0
Switzerland	21.2[2]	Finland	24.5
Germany	30.2[2]	Belgium	33.9
United Kingdom	24.0	Denmark	25.0
France	34.4	Spain	30.0
Sweden	26.3		

Note: [1] In addition, some states levy income or capital-based taxes.[2] Tax rates vary across municipalities; a given rate represents the capital city.

The empirical analysis presented in this paper is based on estimating an impact of the net taxation of royalty payments on the country-to-country royalty flows. The final sample includes 3,660 country-pairs for the time period of 1990-2012. The Poisson pseudo-maximum likelihood estimator in fixed-effects framework is used in the baseline model. According to our results, on average a one percentage point decrease in the net tax rate on royalty payments from one country to another leads to a 6.0% increase in their bilateral royalty flows, holding other factors constant. In order to quantify the results, one could look at Figure 1. For instance, in 2012 total royalty inflows into the United States amounted to $124.2 billion. This would imply that if the US together with its partner countries managed to decrease the net taxation of its royalty inflows by one percentage point, it could receive $7.4 billion of additional royalty payments.

There are several ways, in which a multinational could take advantage of intangible assets in order to minimize its global tax liability. The most effective one is to separate the place, where research and development is carried out, from the location, where the income from resulting intellectual property (IP) is taxed afterwards. The first country would usually be a high-tax jurisdiction, while the second one is typically a low-tax state. Endres and Spengel (2015) describe a few strategies that could lead to this outcome. For example, a multinational might choose to implement a contract R&D, under which one affiliate conducts R&D activities, whereas the other one agrees to bear their financial risks and consequently becomes the owner of resulting intangibles. Besides, the more valuable an IP is, the greater amounts of royalties will be re-located to the owner of an intangible in a low-tax state. Equivalent outcomes might be achieved through a cost sharing agreement. Furthermore, some types of IP Box regimes might also provide an opportunity for multinationals to use intangible assets as a BEPS channel. This is especially the case in such countries as Cyprus, France, Hungary, Liechtenstein, Malta and Switzerland (Nidwalden), where not only self-developed IP, but also acquired intangibles are allowed to take advantage of lower IP Box tax rates. Along with contract R&Ds and cost-sharing agreements, these types of IP Boxes seem to facilitate BEPS.

Alternatively, an intangible asset might be sold from an affiliate in a high-tax country to another affiliate located in a low-tax jurisdiction. This strategy could nevertheless trigger not only a high selling price, but an exit tax in some cases as well. Finally, a multinational might also decide to carry out its real research and development activity in a low-tax country. However, since the most important input of R&D is human capital, this strategy will probably trigger high costs of re-locating domestic researchers or training the local ones.

An empirical analysis of royalty payments as a channel for profit shifting clearly constitutes a research gap in the literature on BEPS. To our best knowledge, there are only a few empirical studies that employ data on royalty payments. For example, Grubert (1998), Collins and Shackelford (1998) and Mutti and Grubert (2009) conduct cross-section analyses using firm-level royalties data on US parent companies and their subsidiaries. The authors apply different identification strategies, but all of them eventually argue in favour of a negative correlation between taxation and the amount or direction of royalty flows. Collins and Shackelford (1998)[7], for instance, use a framework similar to the one applied in this study. They aggregate firm-level data on royalty flows at the country-pair level and calculate the effective taxation

[7] Grubert (1998) and Mutti and Grubert (2009) also find some significant outcomes, but they use different identification strategies and provide insufficient statistical information to interpret the economic significance of their results or make them comparable to other studies.

of these bilateral royalty payments. The authors find the semi-elasticity of royalty flows with respect to taxation, when estimated at the sample mean, to be equal to -9.5. This estimate is significantly higher than the semi-elasticities of other potential profit-shifting channels that the authors test. For example, tax semi-elasticities of dividend and interest payments in the same framework are smaller than 1.0. Therefore, their results are consistent with our findings and confirm the assumption that intangibles are used by multinationals as an important instrument of response to tax changes.

Our contribution to the papers that employ data on royalty payments lies in introducing a different methodology and addressing some new research questions. For example, we exploit not only data on the royalty payments between US parent firms and their subsidiaries, but rather incorporate sixty-one countries into our analysis. Besides, in comparison to previous studies, this one is carried out in a panel-data rather than a cross-section framework. Moreover, we examine not only the relationship between net taxation of royalties and bilateral royalty flows, but also analyse to which extent royalty payments are affected by the tax rate differentials between a given recipient state and other potential royalties' recipients. In addition, we test the influence of some other factors, such as IP Box regimes, R&D tax incentives, CFC rules, and transfer pricing regulations on bilateral royalty flows.

This study also relates to the empirical literature on the impact of taxation on patent applications. Ernst and Spengel (2011), Ernst et al. (2014), Griffith et al. (2014) etc. analyse the connection between the taxation of royalty income and the quantity or quality of patent applications by multinationals. These authors usually find semi-elasticities comparable to the findings of Karkinsky and Riedel (2012), who argue that a one percentage point increase in tax rate leads to a 3.5-3.8% decrease in the number of patent applications in a given country. However, these results might only be the lower bound of the true magnitude of profit shifting through intangible assets, when considering some other empirical studies, such as Ernst et al. (2014). They show that multinationals are not just likely to locate all their intangibles in tax havens, but rather to place their most valuable ones there in the first place. Thus, the 6.0 semi-elasticity of royalties with respect to tax that we find could result from the combination of both effects, because royalty flows reflect information on the location of patents as well as their quality. Royalty payments may even capture information on other strategies used by multinationals to re-locate their intangibles into low-tax jurisdictions[8].

[8] For example, the above-mentioned studies on patent applications are not able to track the change of ownership in registered patents. If, however, a patent was eventually sold to a low-tax subsidiary, its royalty inflows would increase and it should be reflected in our data. Besides, previous studies only investigated the usage of patents as

In order to understand the significance of the effects that we find, it is important to compare our findings on the use of intangibles as a BEPS instrument with flows of literature that analyse other potential BEPS channels. Dharmapala (2014) reviews a broad range of empirical studies on profit shifting and concludes that the primary channels of BEPS are generally thought to be a strategic use of inter-affiliate debt and transfer pricing. Indeed empirical literature on the effects of taxation on firms' leverage includes numerous thorough studies, such as Desai et al. (2004), Buettner et al. (2012), Buettner and Wamser (2013) etc. Their results provide some evidence that a semi-elasticity of the internal debt ratio with respect to tax lies between 0.6 and 1.0, which is also consistent with the meta-analysis of this literature by Feld et al. (2013). This implies that increasing a tax rate by one percentage point leads to a 0.6-1.0% increase in a company's internal debt ratio. Empirical studies on a strategic use of transfer prices for goods and services comprise Clausing (2003), Bernard et al. (2006), Davies et al. (2015) etc. These authors usually agree that a one percentage point increase in a tax rate leads to a 0.5-1.9% fall in intra-firm transfer prices.

The range tax semi-elasticity of the literature on such BEPS channels as leverage and transfer pricing are significantly lower than the ones found in the studies on the strategic use of intangible assets. As argued before, Karkinsky and Riedel (2012), for example, argue that a one percentage point increase in a tax rate leads to a 3.5-3.8% decrease in the number of patent applications in a given country. This comparison leads to the conclusion that multinationals use intangibles as one of the primary instruments of response to changes in taxation.

There are a few reasons why our findings suggest even greater values of tax semi-elasticity than patent-applications literature. Frist of all, our results reflect the impact of taxation not only on the location of intangibles, but capture the quality of intangible assets as well. Since higher royalties are paid for the use of more valuable intangibles, multinationals have an incentive to re-locate primarily more valuable IP to low-tax countries. The analysis using data on royalty payments captures therefore both effects, the tax elasticity of intangibles' location and the tax elasticity of their quality. Besides, the difference in the magnitude of the effects might be caused by the fact that we conduct an analysis on a country level, while the authors of patent-applications literature implement their investigation on a firm level. However, this variation in estimation approaches should not be essential to the results. For example,

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an instrument for profit shifting. Data on royalties, on the other hand, reflect payments for the right to use not only patents, but also trademarks, copyrights, industrial processes, know-how, and other intangibles, which might even have higher tax elasticity than patents.

literature on the impact of taxation on the amount of profits reported by multinational companies includes numerous empirical studies on a country- and firm level. While the authors who work on the country level, such as Hines and Rice (1994), Clausing (2009) etc. find the tax semi-elasticity of reported profits to lie around -2.3, the ones that carry out analysis on a firm level, such as Huizinga and Leaven (2008), Grubert (2012) etc. argue in favour of approximately -1.3. Therefore, even though aggregated data usually seems to lead to greater economic significance of the empirical outcomes, the difference should not be crucial if a proper set of control variables and fixed effects is included into estimations.

The paper is organized as follows. Section 2 describes the main data sources and the construction of key variables. The next part presents a detailed description of our identification strategy. Section 4 gives a summary of the key findings followed by a few robustness checks and a couple of extensions to primary estimation. Section 5 concludes.

2. Data Description

2.1 Data Sources

The final sample includes sixty-one countries and a time span from 1990 to 2012. Since the empirical analysis is carried out on a country-pair level, there are 3,660 country-pairs, which enter the final panel dataset. Figure 2 presents a map of states that are covered in this study and specifies the number of observations that is available for each jurisdiction. One can see that the majority of data points come from the United States and Western Europe.

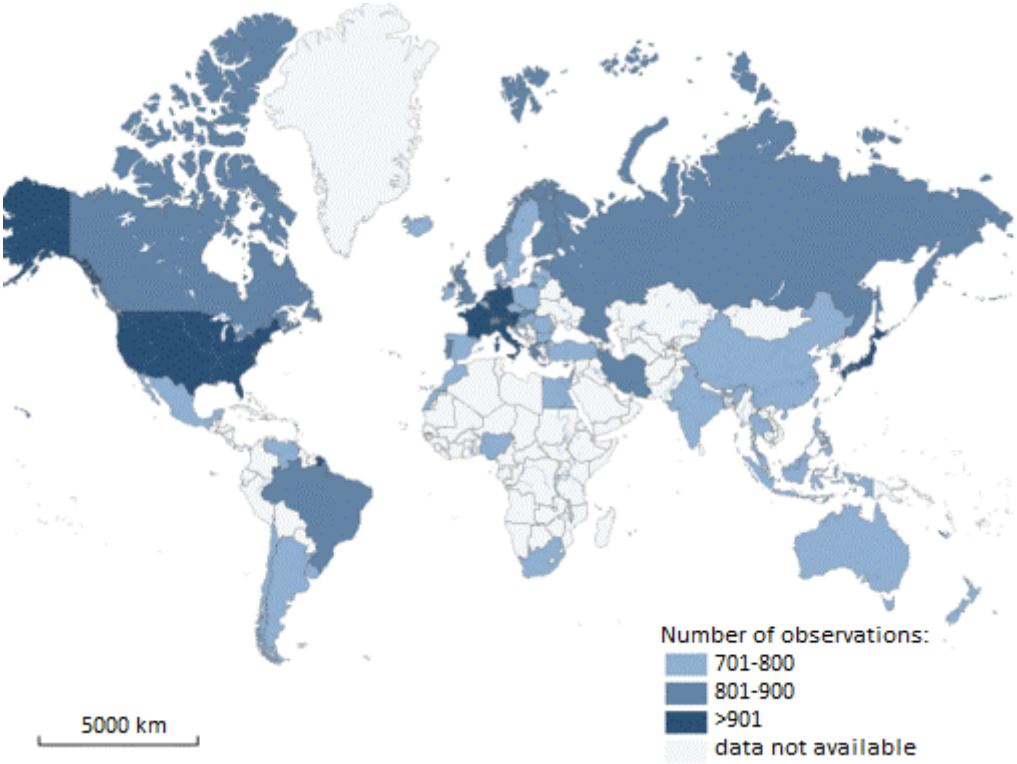
The dependent variable was constructed using statistics on bilateral royalty flows, which were obtained from the OECD database called *Trade in Services - EBOPS 2002*[9]. Data on taxation, which constitutes the main independent variable of interest, come from a few different sources. For example, information on domestic withholding tax rates as well as on corporate income tax (CIT) rates and the tax credit systems for royalty payments comes from a series of the International Bureau of Fiscal Documentation (IBFD) Global Corporate Tax Handbook[10]. Statistics on bilateral withholding taxes, as well as details on tax treaties between country-pairs are taken from the IBFD Research Platform[11].

[9] Available at: http://www.oecd-ilibrary.org/trade/data/oecd-statistics-on-international-trade-in-services_tis-data-en

[10] See International Bureau of Fiscal Documentation (IBFD) (1990-2012), Global Corporate Tax Handbook, Amsterdam: IBFD.

[11] Available at: http://www.ibfd.org/

Figure 2. Coverage Map



Besides, information on total R&D expenditures comes from the OECD database called *Gross domestic expenditure on R-D by sector of performance and source of funds*.[12] Data on GDP per capita and countries' population were collected from the World Bank's Development Indicators[13]. Information on *Property Rights* was obtained from the Heritage Foundation[14]. Furthermore, statistics on bilateral trade are publicly available from the OECD. A relevant dataset in this case is called *STAN Bilateral Trade in Goods*[15]. Micro-level data on the structure of multinational enterprises in different countries were gathered from the *Orbis* database provided by Bureau van Dijk and eventually aggregated at the country level. Finally, details on Foreign Direct Investment (FDI) stocks were collected from the OECD database *FDI Positions by Partner Country*[16].

[12] Available at: http://stats.oecd.org/Index.aspx?DataSetCode=GERD_FUNDS
[13] Available at: http://data.worldbank.org/data-catalog/world-development-indicators
[14] Available at: http://www.heritage.org/index/
[15] Available at: http://stats.oecd.org/Index.aspx?DataSetCode=BTDIXE_i3#
[16] Available at: https://stats.oecd.org/Index.aspx?DataSetCode=FDI_POSITION_PARTNER

2.2 Definition of Main Variables

Royalty Flows is the dependent variable measured in millions of US Dollars. It represents the total of royalty payments from source country *S* to recipient state *R*. Since between many states there is no exchange of royalties at all, this variable is concentrated at zero.

The main independent variable of interest is *Royalty Tax*, which denotes the effective tax rate on royalty transfers from country *S* to state *R*. The value of this variable depends on the way double taxation is avoided between both countries. In order to calculate *Royalty Tax*, formulas summarized in the Table 1 were used.

Table 1. Effective Taxation of Royalty Payments

Exemption		$\tau_s^{local} + w_s$
Ordinary Tax Credit	if $w_s \geq t_r$	$\tau_s^{local} + w_s$
	if $w_s < t_r$	$\tau_s^{local} + t_r$
Deduction		$\tau_s^{local} + w_s + (1 - w_s)\, t_r$

For example, in case of an exemption, the effective tax on royalty payments from *S* to recipient state *R* is calculated as the sum of the local tax on royalties τ_s^{local} [17] and the withholding tax w_s. If an ordinary-credit system applies to the transaction, then *Royalty Tax* will consist either of τ_s^{local} and the withholding tax or τ_s^{local} and the corporate income tax in the recipient state t_r. The final value of *Royalty Tax* in this case depends on whether the withholding or corporate tax rate is higher. If taxes on royalty income abroad can be deducted in a recipient country, the effective tax rate on royalties will comprise a special local tax, a withholding tax, as well as t_r on the income after deduction of a withholding tax.

The calculation of *Royalty Tax* can also be demonstrated using an example. Take a transaction of royalty payments from Germany to Poland in 2012. According to the tax treaty between both countries, an ordinary credit applies to the taxes paid on royalties at source. The withholding tax on royalties flowing out of Germany to Poland is 0% due to the EU Interest and Royalties Directive (2003)[18]. However, starting from 2008 royalties that are flowing out of Germany are not fully deductible from the tax base of the local business tax on income. This implies that royalties are partially taxed with the business tax in case of payments going

[17] τ_s^{local} represents any other taxes on royalty outflows in a source state except for the withholding tax.
[18] See http://ec.europa.eu/taxation_customs/taxation/company_tax/interests_royalties/index_en.htm

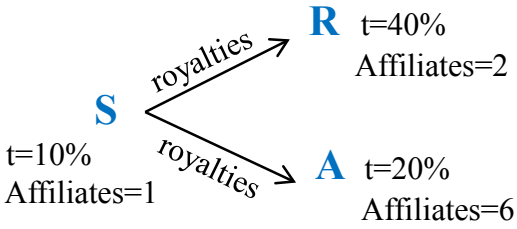
out of the country. In other words, the German local special tax on royalties τ_s^{local} is 0.897%[19]. The statutory corporate income tax rate in Poland equals to 19%. Since $w_s < t_r$, the effective tax rate on royalties in this case corresponds to the sum of τ_s^{local} and t_r or 19.897%. It is expected that a greater value of *Royalty Tax* on a transaction from *S* to *R* is negatively associated with total royalty flows that are actually transferred between these states.

Another important independent variable of interest is *Tax Difference*. It was built following the ideas of Huizinga et al. (2008), Karkinsky and Riedel (2012), Ernst et al. (2014) and is meant to indicate a profit shifting incentive for multinationals. To be more exact, this variable captures the relative level of taxation in a given recipient country compared to the taxation levels in other potential royalty recipients. The *Tax Difference* is formulated as follows:

$$Tax\ Difference_r = \sum_{j \neq r}^{n} (t_r - t_j)\rho_j \quad (1)$$

In Equation 1, t_r denotes the tax rate on royalty income in the recipient country *R*, while t_j stands for the corresponding tax in each of the alternative locations represented by *J*. For example, let's assume that the source country *S* pays royalties only to two states, namely *R* and *A*, as shown in Figure 3.

Figure 3. International Royalty Flows and Company Structure



If the tax on royalty income is 40% in *R,* while it is 10% in *S*, and 20% in *A,* and if we ignore the weighting factor ρ_j for a moment, *Tax Difference* $_r$ will amount to 50% (i.e. (40%-10%)+(40%-20%)). A positive value of this variable indicates that there is an incentive for firms that are located in *S* and transfer royalty payments to *R* to change their business in a way that more royalties are staying in *S* or flowing to *A* instead.

Of course, not all countries are equally important potential royalty recipients for firms located in *S*. Therefore, we introduce ρ_j which is a weighting factor and is constructed using firm-level data on the structures of multinational companies. For example, assume there is a

[19] According to Section 8 No. 1(f) of GewStG, 6.25% of royalties should be added to the tax base of business tax on income. The business tax rate is different in each German municipality. However, following calculation of OECD effective corporate income tax rates, the business tax rate in Berlin (i.e. 14.35%, which is also close to the average of all federal states) is taken as a representative value for this calculation. The local special tax rate in Germany was then computed as follows: 6.25%*14.35%=0.89688%.

multinational company, which has one affiliate in *S*, two affiliates in *R,* and six affiliates in *A*. In this step it is irrelevant, which of the firms are parents and which ones are subsidiaries. *Tax Difference (affiliates)* $_r$ will then amount to 22.5% (i.e. (40%-10%)*2/8+(40%-20%)*6/8). Note that since the analysis undertaken in this study is implemented on a country level, we aggregate firm-level information on the international structures of multinationals in order to calculate the number of their affiliates in each country in our sample. This approach allows us to make our results more comparable to Huizinga et al. (2008) and other recent micro-level studies on profit-shifting.

Alternatively, we attempt to compare the level of taxation in country *R* not with the states in which its partner *S* has affiliates, but rather with the ones in which *S* carries out real economic activity. In order to do this, another control variable *Tax Difference (fdi)* $_r$ is calculated and represents a measure identical to *Tax Difference (affiliates)* $_r$, but with a different weighting factor ρ_j. To be more precise, this variable is weighted rather by the amount of FDI stocks in a partner country then by the number of affiliates in it. For example, assume that neither *R* nor *A* has any FDI stocks in *S*, however, the FDI position of country *S* in *R* equals 50 and in *A* it amounts to 10. *Tax Difference (fdi)* $_r$ will then be 28.3% (i.e. (40%-10%)*50/60+(40%-20%)*10/60). Now the tax rate in *A* gains greater weight, as in this country there are more direct investments of state *S*' firms and therefore more real economic activity is assumed to take place.

As for other control variables that enter our baseline specification, *CIT in S* is one of them. This variable represents the tax rate on royalty income in source country *S*. It is expected to be positively correlated with the dependent variable, taken that companies use royalty payments to decrease their tax base in high-tax source countries. Besides, in line with Dischinger and Riedel (2011), Karkinsky and Riedel (2012), Griffith et al. (2014) etc., we also attempt to control for the level of innovation in a recipient state. *Log(Country's R&D Exp.)* is used as a proxy for this factor and measures the total amount of a country's expenditures on R&D. Including this variable into the estimation equation is essential, since more innovative states should be receiving more royalties in the absence of taxes. Thus, the influence of this factor on royalty flows is predicted to be positive.

Moreover, following literature on the impact of taxation on patent applications (see e.g. Dischinger and Riedel (2011), Ernst and Spengel (2011), Karkinsky and Riedel (2012), Ernst et al. (2014), Griffith et al. (2014) etc.), we control for the market size in a recipient state, its wealth, and governance situation by including respectively *Log(Population),*

Log(GDP/capita), and *Property Rights* into the regression estimations. Furthermore, in line with Collins and Shackelford (1998), *Log(Trade)* is added to our baseline model as another independent variable. It denotes the sum of total exports and imports between two countries[20] and is taken as a proxy for the strength of their economic partnership. One could expect that country-pairs with greater exchange of goods, and therefore a closer economic partnership, are going to exchange more royalties with each other as well.

2.3 Descriptive Statistics

Before proceeding to the regression estimations, it might be useful to look at some descriptive statistics of variables generated in the previous section. Table 2 briefly summarizes main variables and shows, for example, that *Log(Country's R&D Exp.)* slightly restricts the sample because of a limited number of years covered by this variable. Furthermore, all tax controls are strictly positive and, as specified earlier, the dependent variable *Royalty Flows* is centred at zero (to be exact, around 40% of its values equal to zero).

Table 2. Descriptive Statistics of Main Variables

	Obs.	Mean	Std. Dev.	Min	Max
Royalty Flows	50413	46.12	413.10	0.00	15562.45
Royalty Tax	50413	0.29	0.09	0.00	0.61
Tax Difference(affiliates)	48129	-0.04	0.12	-0.38	0.32
CIT in S	50413	0.27	0.09	0.00	0.55
Log(Country's R&D Exp.)	31003	8.72	1.71	4.15	12.89
Log(GDP/capita)	49159	9.43	1.22	5.99	11.67
Log(Population)	49469	16.60	1.93	10.27	21.02
Property Rights	46752	65.94	23.16	5.00	95.00
Log(Trade btw.S and R)	47603	13.11	2.52	0.12	20.24

Note: *Royalty Flows* is measured in millions of US Dollars. *Property Rights* is an index and ranges from 0 to 100.

Table 3 presents additional details on the main independent variable of interest *Royalty Tax* and its components. The values of this variable range from 0% to 61% and its average lies at around 29%. Generally, higher rates of *Royalty Tax* can be observed in the 1990's, especially between countries that avoid double taxation with the help of a deduction method, which proves to be less favourable for companies than such double taxation relief systems as an ordinary credit or an exemption. Furthermore, Table 3 shows that the final withholding tax,

[20] Since the dependent variable *Royalty Flows* is actually a part of trade in services, only exports and imports of goods are considered for the construction of *Trade*.

which enters the calculation of *Royalty Tax,* comprises either a unilateral domestic rate or bilateral rate of a treaty or taxation according to the EU Interest and Royalties Directive (2003)[21].

Table 3. Descriptive Statistics of *Royalty Tax* and its Components

	Obs.	Mean	Std. Dev.	Min	Max
Royalty Tax	50413	0.29	0.09	0.00	0.61
Final WHT in country *S*	50413	0.11	0.09	0.00	0.40
Unilateral WHT in *S*	50413	0.18	0.10	0.00	0.40
Bilateral WHT between *S* and *R*	30534	0.08	0.05	0.00	0.40
EU-Level WHT in *S*	5564	0.03	0.04	0.00	0.10
Additional Local Tax in country *S*	6342	0.00	0.00	0.00	0.01
CIT in country *R*	50413	0.28	0.08	0.10	0.55

Note: all variables in the table are measured in percent from 0 to 1. WHT stands for withholding tax (on royalties) and CIT denotes corporate income tax. Countries *S* and *R* represent a source country and a recipient state respectively.

Table 4 provides some details on various systems of double taxation relief in the sample. In around 85% of cases, an ordinary credit is granted in a recipient state on withholding taxes, which were paid in a source country. Around 10% of country-pairs in our sample have not agreed upon specific rules on the provision of double taxation relief. However, the corresponding recipient states either exempt or allow a deduction of taxes on royalty inflows paid at source.

Table 4. Main Types of Double Taxation Relief (DTR)

	Freq.	Percent	Cum.
Ordinary Credit	43100	85.49	85.49
Deduction Method	2390	4.74	90.23
Have No Specific DTR Rules,	4923	9.77	100
but exempt royalties income	3211	65.22	65.22
but usually allow deduction	1412	34.78	100
Total	50413	100	

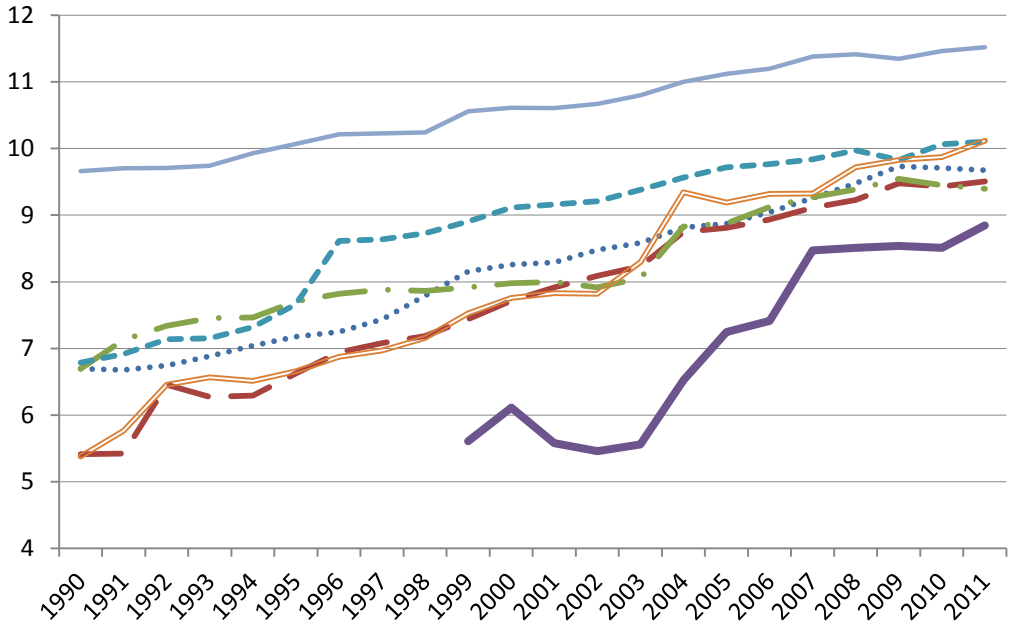
Finally, some information about the development of the total *Royalty Flows* and the average *Royalty Tax* over the years is shown in Figure 4. Only a few countries such as Germany, France, the UK, Ireland, Japan, the Netherlands, and the United States are analysed here. Panel A of Figure 4 shows a general increase of the total *Royalty Flows* between these states and their partners over time. This trend seems to be steadier in such states as Germany, the United States, Japan, or France and significantly steeper during recent years in the

[21] It is therefore assumed that the conditions, under which EU Interest and Royalties Directive (2003) applies, are fulfilled between all countries in our dataset.

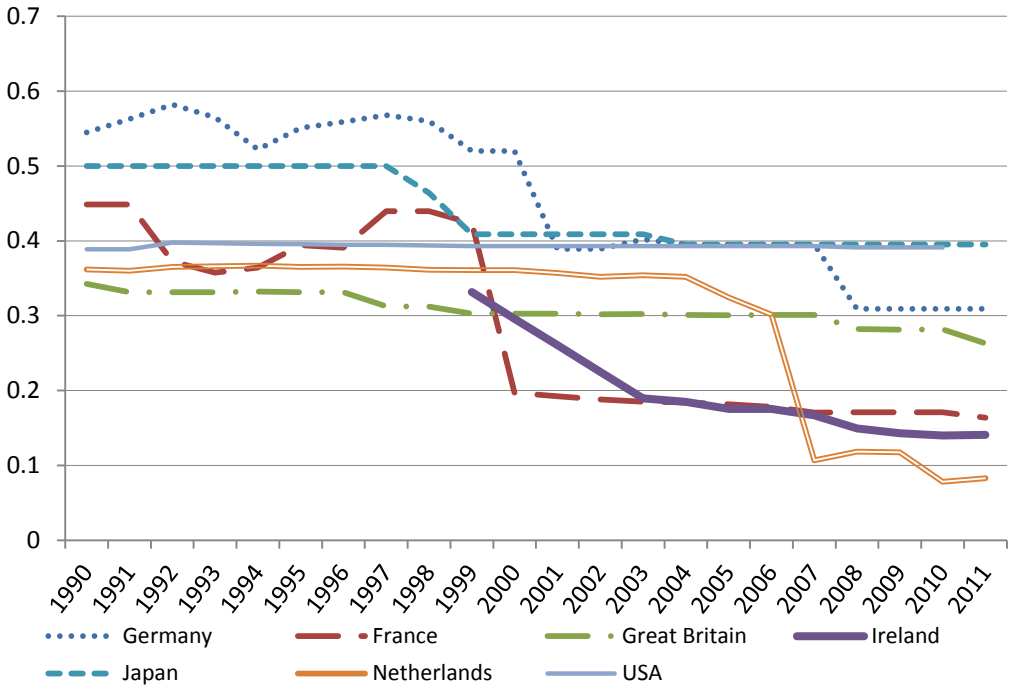
Netherlands and Ireland. Panel B of Figure 4 provides some details on the average *Royalty Tax* between the selected countries and their partners during a given time frame. A gradual decline of the *Royalty Tax* over time can be observed in all states. This is due to a steady decrease of its main components such as withholding tax rates and corporate income tax rates all over the world, as well as because of the introduction of double taxation relief systems, the EU Interest and Royalties Directive (2003) etc.

Figure 4. Panel A: Total Royalty Flows of Selected Countries (logarithm of Millions of US Dollars); Panel B: their Average *Royalty Tax* Rates (in percent), 1990-2011

A:



B:



3. Estimation Strategy

A higher net tax rate on royalties is expected to be negatively correlated with royalty flows from country *S* to state *R*. Besides, a greater difference between the tax rate on royalty income in a recipient country *R* and at alternative locations is predicted to be negatively associated with the amount of royalty flows from *S* to *R*. In order to test these ideas, the following model of estimation was applied:

$$Royalty\ Flows_{srt} = \beta_0 + \beta_1 \boldsymbol{Tax}_{srt} + \beta_2\ CIT_{st} + \beta_3\ \boldsymbol{X'}_{rt} + \\ + \beta_4\, Trade_{srt} + \mu_{sr} + \vartheta_t + \varepsilon_{srt} \quad (2)$$

In Equation 2, *Royalty Flows*$_{sr}$ is the dependent variable and denotes flows of royalty payments from country *S* to state *R* in year *t*. $\boldsymbol{Tax_{sr}}$ is the main independent variable of interest and is represented by *Royalty Tax*$_{sr}$, which denotes the effective tax rate on a royalty payment between a source state and a recipient country, or by either *Tax Difference(affiliates)*$_r$ or *Tax Difference(fdi)*$_r$, which stand for the weighted average of tax differentials between *R* and all alternative recipients of royalty payments. *CIT*$_s$ represents the corporate income tax rate in source country *S* in year *t*. $\boldsymbol{X'}_r$ is the vector of the recipient country's characteristics such as *Log(Country's R&D Exp.), Log(Population), Log(GDP/capita), Property Rights* etc. $Trade_{sr}$ denotes the log of all exports and imports of goods between two states in a given year. μ_{sr} and ϑ_t are country-pair and time fixed effects respectively. ε_{sr} is an error term.

The dependent variable *Royalty Flows* is centred at zero. A common approach of dealing with such issues in trade literature is to take a logarithm of this variable, which, however, leads to eliminating zero-values from the sample and might cause a bias if those are non-random. Therefore, the identification strategy of this empirical analysis follows the suggestions of Wooldridge (2002), Westerlund and Wilhelmsson (2011) etc., who use the Poisson pseudo-maximum likelihood (PPML) estimator in a fixed-effects panel framework to address a non-linear form of the model and avoid deleting zeroes at the same time. In addition, Silva and Tenreyro (2006) argue that using the PPML estimator in an analogous framework helps to deal with heteroskedasticity, which is often observed in this type of data.

4. Results

4.1 Baseline Results

The outcomes of the regression analysis described in section 3 are presented in Tables 5. In all estimations *Royalty Flows* is the dependent variable and country-pair as well as time fixed effects

are included. Column I presents the results of the estimation with *Royalty Tax* being the only independent variable, while column II adds further controls. The findings presented in this table imply that on average a one percentage point decrease in the net tax rate on bilateral royalty payments leads to a 6.0% increase in their bilateral royalty flows, holding other factors constant.

Column III shows the results with a one-year lag of *Royalty Tax* as the main independent variable of interest. This modification to the baseline estimation does not seem to have an important effect on economic or statistical significance of the main findings. Column IV represents a regression estimation, where instead of *Royalty Tax* its two main components are included, namely *Withholding Tax* at source and *CIT* in a recipient state *R*. The latter appears to have a greater economic and statistical significance for the determination of *Royalty Flows*, which is not surprising considering that in approximately 86% of country-pairs the income tax rate in a recipient state exceeds the withholding tax levied on royalty outflows at source. Therefore, taxation in a recipient country seems to be decisive for the net taxation of royalty flows, no matter what type of double taxation relief applies.

The next columns of Table 5 show the results of the estimations in which tax differences are the main independent variables of interest. For instance, columns V and VII present regression outcomes where *Tax Difference(affiliates)* and *Tax Difference(fdi)* are the only controls, while Columns VI and VIII add other independent variables to the estimations. According to these findings, on average a one percentage point decrease in the tax differential between a given recipient country and alternative recipient locations leads to a 2.7-3.2% increase in royalty flows from a source state to this recipient. Hence, multinationals seem not only to consider tax rates on royalty income in their absolute form, but also see their relative levels compared to other potential royalty recipients.

As for other independent variables, the results seem to be in line with previous literature. For example, consistent with Dischinger and Riedel (2011), Karkinsky and Riedel (2012), Griffith et al. (2014) etc., who analyse patent-applications data, we also find an economically and statistically significant association between a country's level of innovation, represented by *Log(Country's R&D Exp.),* and its total royalty inflows. Moreover, a higher level of property rights protection also seems to contribute positively to royalty inflows into this state. Besides, growing trade volumes between two given countries, which indicate a growing economic cooperation, are likely to trigger greater amounts of royalties flowing between them. Market size, represented by a country's population, does not seem to play a role in the determination of royalty flows. Besides, GDP per capital as a proxy for a country's wealth seems to be negatively correlated with royalty payments.

Table 5. Regression Results: Royalty Flows and Tax Rates

	I	II	III	IV	V	VI	VII	VIII
Royalty Tax	-6.001***	-6.085***						
	(1.540)	(1.665)						
Royalty Tax t-1			-5.938***					
			(1.670)					
Withholding Tax in S				0.613				
				(0.937)				
Tax Difference(affiliates)					-3.180***	-3.209***		
					(0.924)	(0.998)		
Tax Difference(fdi)							-2.787***	-2.728***
							(0.812)	(0.900)
CIT in R				-6.080***				
				(1.686)				
CIT in S		-0.190	-0.181	-0.164		-0.165		-0.503
		(0.592)	(0.578)	(0.585)		(0.595)		(0.685)
Log(Country's R&D Exp.)		0.986***	0.920***	0.968***		0.953***		1.063***
		(0.360)	(0.353)	(0.359)		(0.368)		(0.384)
Log(GDP/capita)		-1.381**	-1.316**	-1.401**		-1.342**		-0.909
		(0.665)	(0.634)	(0.659)		(0.675)		(0.773)
Log(Population)		0.195	0.305	0.132		0.0244		-0.304
		(1.287)	(1.293)	(1.289)		(1.312)		(1.541)
Property Rights		0.00979**	0.0108**	0.00999**		0.0102**		0.0119**
		(0.00461)	(0.00450)	(0.00469)		(0.00478)		(0.00606)
Log(Trade btw.S and R)		0.506***	0.515***	0.502***		0.530***		0.326
		(0.138)	(0.134)	(0.133)		(0.142)		(0.241)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Pair Fixed Eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	28,165	18,909	18,909	18,909	27,190	18,147	18,808	11,851
No. of country pairs	1,871	1,504	1,504	1,504	1,799	1,440	1,337	1,024

Note: Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Observational units are country pairs. The Poisson pseudo-maximum likelihood model is applied in all estimations. The dependent variable is *Royalty Flows,* which measures the total of royalty payments from a source country *S* to a recipient state *R. Royalty Tax* is the effective tax on royalty flows from *S* to *R*. *Withholding Tax in S* denotes a withholding tax on royalty payments in a source country. *CIT in R* and *CIT in S are* effective income tax rates on royalties in *R* and *S* respectively. *Tax Difference(affiliates)*and *Tax Difference(fdi)* are weighted averages of tax differences between royalty taxation in *R* and alternative recipient countries; the first term uses company-structure data, while the second one uses FDI information for constructing the weights. *Log (Country's R&D Exp.)* denotes a logarithm of total expenditures on R&D in a recipient *R*. *Log (GDP/capita)* measures GDP per capita in a recipient state. *Log (Population)* represents a logarithm of country *R*'s total population. *Property Rights* is an index that ranges from 0 to 100 and represents the level of recipient country's property rights' protection. *Log(Trade btw.S and R)* denotes a logarithm of trade in goods between a source country and a recipient state.

4.2 Robustness Checks and Extensions

Table 6 presents results of a few robustness checks that were implemented within the scope of this study. For example, Columns I and II show results of the final sample's division in two time periods, namely the ones of 1990-2001 and 2002-2012. It should be noted that the first estimation includes considerably less observations compared to the second one, because data on royalty flows as well as some country controls are often limited for the 1990's. As for the impact of taxation on bilateral royalty flows, it turns out to be economically and statistically stronger in more recent years. Another interesting difference between these two time periods is the effect of taxation levels in a source country on royalty payments. It seems that in the first time period there was a positive association between taxation at source and royalty outflows from a country, however, this effect disappears in the more recent time span.

Column III of Table 6 shows the outcomes of the regression estimations without time fixed effects, while column IV displays results of the additional exclusion of country-pair fixed effects. These changes to the baseline identification strategy do not seem to influence the statistical significance of the main results. However, they play a role in the determination of the effect's size. Column V presents regression outcomes after clustering observations on a recipient-country level. This modification does not seem to be relevant for the significance of our main findings.

Columns VI and VII present the results of Ordinary Least Squares (OLS) estimations used in the same framework as the baseline model. In these specifications, the impact of *Royalty Tax* on the dependent variable stays statistically significant. However, it appears to lose its economic importance. This difference can be explained through changes in the dependent variable. Namely, using the PPML estimator allows keeping zero-values in the dependent variable, while the OLS estimator requires taking a logarithm of *Royalty Flows*, which leads to the exclusion of its zero-valued observations and is therefore likely to cause biased results.

Table 6. Robustness Checks

	I	II	III	IV	V	VI	VII
	1990-2001	2002-2012	No Fixed Eff.	No Fixed Eff.	Clustering	OLS	OLS
Royalty Tax	-3.230*	-5.753***	-7.917***	-3.972**	-6.494***	-1.398***	-1.048***
	(1.838)	(2.015)	(1.968)	(1.683)	(1.400)	(0.307)	(0.304)
CIT in S	1.706**	-0.551	-0.335	-0.387	-0.101		0.369
	(0.674)	(0.709)	(0.594)	(1.634)	(0.472)		(0.356)
Log(Country's R&D Exp.)	1.741*	1.039***	1.227***	0.889***	1.086***		0.371*
	(0.901)	(0.322)	(0.323)	(0.253)	(0.400)		(0.225)
Log(GDP/capita)	1.038	-1.522**	-0.820	2.090***	-1.521*		-0.667*
	(2.045)	(0.647)	(0.655)	(0.425)	(0.795)		(0.397)
Log(Population)	-6.432	2.053	3.901***	-0.406	0.122		-1.246
	(4.807)	(2.114)	(1.301)	(0.315)	(1.355)		(0.998)
Property Rights	0.0389***	0.0127**	0.00299	-0.00604	0.00891**		0.00658*
	(0.0134)	(0.00555)	(0.00548)	(0.0101)	(0.00439)		(0.00354)
Log(Trade btw.S and R)	0.0283	0.269	0.685***	0.790***	0.534***		0.593***
	(0.256)	(0.175)	(0.121)	(0.0544)	(0.0534)		(0.0723)
Constant				-30.13***	-3.811	-0.218	16.01
				(5.532)	(21.31)	(0.150)	(17.46)
Time Fixed Effects	Yes	Yes	No	No	Yes	Yes	Yes
Country-Pair Fixed Eff.	Yes	Yes	Yes	No	Yes	Yes	Yes
Cluster at recipient *R* level					✓		
Observations	2,954	13,577	18,909	27,385	27,385	16,360	12,032
No. of country pairs	661	1,487	1,504			1,871	1,505

Note: Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Observational units are country pairs. The Poisson pseudo-maximum likelihood model is applied in estimations I-II, the Ordinary Least Squares (OLS) estimator is used in columns VI-VII. The dependent variable is *Royalty Flows,* which measures the total of royalty payments from a source country *S* to a recipient state *R*; for the estimations in columns VI-VII, a natural logarithm of *Royalty Flows* was used as the dependent variable. *Royalty Tax* is the effective tax on royalty flows from *S* to *R*. *CIT in S* is an effective corporate income tax rate on royalties in a source country *S*. *Log (Country's R&D Exp.)* denotes a logarithm of total expenditures on R&D in a recipient country. *Log (GDP/capita)* measures GDP per capita in a recipient state. *Log(Population)* represents a logarithm of country R's total population. *Property Rights* is an index that ranges from 0 to 100 and represents the level of a recipient country's property rights' protection. *Log(Trade btw.S and R)* denotes a logarithm of trade in goods between a source country and a recipient state.

In addition to the baseline results, this study also provides an empirical analysis of the implementation of a few important reform ideas that are currently discussed within the scope of the OECD Action Plan on BEPS. For example, Action 5 of the Plan stresses the significance of following a so-called Nexus Approach, according to which the profits from transfer or use of intangible assets should be taxed in the place of their creation. This issue is especially relevant in the context of IP Box regimes. On the one hand, there are IP Boxes that allow an application of the favourable rules only in case a company have developed intangibles itself. On the other hand, there are IP Boxes that permit an application of adventurous regimes to acquired IP as well. The letter type of IP Boxes is not consistent with the Nexus Approach, since it encourages firms to develop intangibles in high-tax countries and re-locate them in a way that the profits that these assets are generating are taxed in low-tax jurisdictions. A worldwide overview of the IP Box regimes is given in Table 7.

Table 7. Countries with IP Box Regime in Place in 2012

Country	IP Box Tax Rate	Statutory Tax Rate	Type of IP allowed	
			Acquired	Existing
Belgium	6.8	33.99	N	N
China	0-12.5[a]	25	N[b]	N
Cyprus	2.5	10	Y	Y
France	16.245	34.43	Y	Y
Hungary	9.5	19	Y	Y
Liechtenstein	2.5	12.5	Y	N
Luxembourg	5.78	28.9	Y[c]	Y
Malta	0	35	Y	N
Netherlands	5	25	N	N
Spain	12	30	N	Y

Source: Evers et al. (2014) and own research. Abbreviations: Y: Yes, N: No. Notes: The statutory tax rates correspond to the corporate income tax including any surcharge (Belgium, France and Luxembourg), local taxes (Luxembourg) and other taxes. [a] The exact rate depends on the income size. [b] IP that was developed outside of China is not included into the IP Box. [c] In Luxembourg acquired IP is only eligible for the IP Box under certain circumstances.

Columns I and II of Table 8 show the outcomes of incorporating IP Box regimes into the baseline model[22]. Column I, for instance, presents the results of integrating reduced IP Box tax rates into *Royalty Tax*. This change to the baseline specification does not seem to alter the significance of our main results.

[22] The information on IP Boxes was collected from Evers et al. (2014) and own research.

Table 8. Extensions

	I	II	III	IV	V	VI	VII
Royalty Tax	-6.085***	-5.147***	-7.590***	-5.331***	-6.681***	-5.222***	-6.091***
	(1.665)	(1.421)	(1.957)	(1.390)	(1.632)	(1.731)	(1.670)
IP_BoxAcq in S		0.301					0.287
		(0.308)					(0.257)
IP_BoxAcq in R		0.741**					0.667**
		(0.312)					
IP_Box in S		-0.320					
		(0.332)					
IP_Box in R		-0.00678					
		(0.240)					
B_index in S			0.891**				0.592*
			(0.410)				(0.337)
B_index in R			0.440				0.495
			(0.579)				(0.524)
CFC Rules btw. S and R					-0.402**		-0.461***
					(0.167)		(0.164)
TP Rules in S						0.237**	0.231*
						(0.107)	(0.129)
TP Rules in R						0.278***	0.271***
						(0.0799)	(0.101)
*TP Rules in S*TP Rules in R*						-0.0634**	-0.0585*
						(0.0261)	(0.0326)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Pair Fixed Eff.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,909	18,909	11,269	18,909	18,580	16,122	10,505
No. of country pairs	1,504	1,504	940	1,504	1,474	1,399	939

Note: Robust standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Observational units are country pairs. The Poisson pseudo-maximum likelihood model is applied. The dependent variable is *Royalty Flows,* which measures the total of royalty payments from a source country *S* to a recipient state *R*. *Royalty Tax* is the effective tax on royalty flows from *S* to *R; RL Tax* in column I incorporates IP Box tax rates; *RL Tax* in column IV accounts for the presence of CFC rules between *S* and *R*. *IP_BoxAcq in S* and *in R* are dummy variables, which show a presence of an IP Box regime that is applicable to acquired IPs in state *S* and *R* respectively. *IP_Box in S* and *in R* are dummy variables which show the presence of an IP Box regime that is applicable to self-developed IPs only in state *S* and R respectively. *B_index in S* and *in R* represent B-indices in a source and a recipient country respectively; the lower the B-index, the more attractive is the tax system for R&D investments. *CFC Rules btw. S and R* is binary and equals one if CFC Rules apply between *S* and *R*; zero otherwise. *TP Rules in S* and *in R* are indices ranging from 0 to 5 and representing strictness of transfer pricing rules in *S* and *R* respectively. *Controls* include *CIT in S, Log(Country's R&D Exp.), Log (GDP/capita), Log(Population), Property Rights,* and *Log(Trade btw.S and R).*

Besides, it is interesting to see whether IP Boxes serve as an additional factor in attracting royalty flows. In order to test this idea, binary variables that capture the existence of IP Boxes were added to the baseline model. To be more exact, *IP_Box* is a dummy variable, which equals one, if an IP Box regime for self-developed intangibles is implemented in a given country and zero otherwise. *IP_BoxAcq* is also a dummy variable. It, however, equals one if acquired IPs are also eligible for the IP Box taxation privileges. If the opposite is the case, then it takes the value zero. In our sample, these two variables differ mainly throughout such countries as Belgium, China[23], the Netherlands, and Spain. In these states, IP that qualifies for a lower IP Box tax rate include only self-developed and not acquired intangible assets. Column II of Table 8 shows that an introduction of an IP Box that is applicable to acquired intangibles and therefore does not follow the Nexus Approach will likely attract some additional royalty inflows into a recipient country. This is, however, not the case if a given IP Box applies exclusively to self-developed IPs.

IP Boxes can be described as output-oriented R&D tax incentives, since their main objective lies in offering a favourable tax treatment of the profits generated by intangible assets[24]. It might, therefore, be interesting to compare the effect that IP Boxes have on royalties with the impact of the input-oriented R&D tax incentives. The letter type of R&D incentives usually includes tax credits and allowances and is typically measured in empirical literature by a so-called B-index[25]. It was first developed by Warda (2001) and is defined as follows:

$$B\_index = \frac{1-(A \cdot t)}{(1-t)} \tag{3}$$

In Equation 3, t denotes the corporate income tax rate in a country, while A represents the combined net present value of allowances and credits applying to R&D expenses. If an R&D investment is fully expensed in a given fiscal year, then A is equal to one and so is the B_index. However, if, for example, a super deduction is available, which allows to deduct the double of the actual R&D expenses, then A will be greater than one, which leads to B_index being smaller than one. Therefore, lower values of the B-index correspond to a more attractive tax system for R&D investments. An overview of the B-index in different countries all over the world is given in Table 9.

[23] In China, an intangible asset that was developed abroad is not eligible for the IP Box.
[24] There are, however, also IP Boxes that provide favorable treatment not only for IP income, but R&D expenses as well.
[25] Data on the B-index were taken from Ernst and Spengel (2011), Thomson (2013) and Chen and Dauchy (2013) and completed through own calculations.

Table 9. B-index in 2012

Country	B-index	Country	B-index
Australia	0.808	Luxembourg	1.008
Austria	0.887	Mexico	1.013
Belgium	0.798	Netherlands	0.917
Canada	0.823	New Zealand	0.827
Chile	1.011	Norway	0.790
Czech Republic	0.798	Poland	1.011
Denmark	0.789	Portugal	0.498
Finland	1.009	Slovakia	1.008
France	0.944	Slovenia	0.915
Greece	0.994	Spain	0.485
Hungary	0.708	Sweden	1.013
Iceland	1.014	Switzerland	1.007
Ireland	0.944	Turkey	0.762
Italy	0.819	UK	0.915
Japan	0.864	USA	0.959
Korea	0.900		

Source: Chen und Dauchy (2013) and own calculations.

As for the empirical impact of the B-index on royalty flows, Column III of Table 8 shows that the value of this factor in a recipient country does not seem to affect royalty payments. However, the level of B-index in a source state appears to have a statistically significant influence on royalty flows. Note that the lower values of B-index actually indicate more favourable R&D tax incentives. This implies that an introduction of more advantageous R&D incentives in a country prompts multinationals to invest more into R&D in this state and thus leads to a decrease in the amount of royalty outflows. This result is not surprising, since a lot of input-oriented R&D tax incentives are designed in line with the Nexus Approach and thus are applicable only to intangibles that stay in the country of their development. In comparison to IP Box regimes that are allowed for acquired IP, input-oriented incentives do not seem to attract some extra royalty inflows into recipient countries and are therefore unlikely to facilitate profit shifting.

In addition, we analyse two further proposals of the OECD Action Plan on BEPS, which are formulated in Action 3 and 7. The main idea behind both suggestions lies in increasing the effectiveness of international rules that aim at restricting profit shifting. These rules primarily include regulations concerning controlled foreign companies and transfer pricing. First of all, we augment our empirical analysis by including CFC[26] rules into the estimations. A summary of

[26] The data on CFC rules were collected from Karkinsky and Riedel (2012) and the International Bureau of Fiscal Documentation.

countries that have already introduced this type of regulations is shown in the Table 10. CFC rules usually apply to foreign affiliates of multinationals. Namely, if a tax rate of a subsidiary's country falls below a certain threshold, the tax rate of a parent's state applies to the passive income generated by this subsidiary.

Table 10. Countries with CFC Rules in Place in 2012

Country	Conditions, under which CFC Rules are Binding
Argentina	Countries that are not on the "Cooperative States" list
Australia	Countries that are not on the "Cooperative States" list
Brazil	Always binding
Canada	Always binding
China	Effective tax rate is <50% of Chinese tax and a country is not on the "White List"
Denmark	Always binding
Egypt	Effective tax rate is <75% of the Egyptian tax
Estonia	Effective tax rate is <33% of Estonian tax and a country is not on the "White List"
Finland	Effective tax rate is <60% of Finnish tax or a country is on the "Grey List"
France	Effective tax rate is <50% of French tax
Germany	Effective tax rate is <25%
Iceland	Effective tax rate is <66% of Icelandic tax
Israel	Effective tax rate is <15%
Italy	Effective tax rate is <50% of Italian tax or a country is on the "Black List"
Japan	Effective tax rate is <20%
Korea	Average effective tax rate is <15% for most recent consecutive three years
Lithuania	Effective tax rate is <75% of Lithuanian tax or a country is on the "Black List"
Mexico	Effective tax rate is <75% of Mexican tax
New Zealand	Countries that are on the "Grey List"
Norway	Effective tax rate is <66% of Norwegian tax or a country is on the "Black List"[1]
Portugal	Effective tax rate is <60% of Portuguese tax or a country is on the "Black List"
South Africa	Effective tax rate is <75% of South African tax
Spain	Effective tax rate is <75% of the Spanish tax
Sweden	Effective tax rate is <55% of Swedish tax, except a country is on the "White List"
Turkey	Effective tax rate is <10%
UK	Effective tax rate is <75% of British tax
Uruguay	Effective tax rate is <12%
USA	Effective tax rate is <75% of the US tax

Source: Karkinsky and Riedel (2012) and own research. Notes: [1] the rules do not apply if a tax treaty exists

First of all, following Karkinsky and Riedel (2012) and Griffith et al. (2014) we incorporate CFC rules into the calculation of *Royalty Tax* and present the corresponding results in Column IV of Table 8[27]. This modification almost does not influence the results of the baseline estimation.

[27] In order to do so, we have to assume that a parent company is located in a source country and its subsidiary lies in a recipient state and that CFC rules apply to all royalty payments that flow from a given source country to the recipient state.

However, it is also interesting to see whether an introduction of CFC rules between a country-pair has an additional effect on its bilateral royalty flows. Thus, as a second step, a binary variable *CFC Rules btw. S and R* is added to the baseline model. It equals one if CFC regulations apply to a given country-pair in a given year and zero otherwise. The outcomes of this estimation are reported in Column V of Table 8. The dummy variable seems to have a negative impact on bilateral royalty flows; the effect is significant on a five-percent level.

As the next step, the impact of transfer pricing regulations on royalty flows is also analysed in this study. Since royalties are transfer prices that are paid for the usage of intangible assets, TP regulations are expected to influence bilateral royalty flows. There are a few papers that investigate the correlation between TP rules and multinational' profits or location decisions (see e.g. Lohse and Riedel (2012), Saunders-Scott (2013) etc.). However, to the best of our knowledge, this is the first study that aims at determining the correlation between this type of regulations and royalty flows.

Table 11. Overview of International Transfer Pricing Regulations in 2012

Country	TP Rules	Country	TP Rules	Country	TP Rules
Argentina	5	Hungary	4	Norway	4
Australia	4	Iceland	1	Philippines	2
Austria	2	India	5	Poland	4
Belgium	2	Indonesia	5	Portugal	4
Brazil	5	Ireland	3	Romania	3
Bulgaria	2	Israel	4	Russia	3
Canada	4	Italy	4	Singapore	2
Chile	1	Japan	4	Slovakia	3
China	5	Korea	4	Slovenia	4
Cyprus	0	Latvia	2	South Africa	3
Czech Republic	2	Liechtenstein	1	Spain	3
Denmark	4	Lithuania	3	Sweden	3
Egypt	3	Luxembourg	2	Switzerland	2
Estonia	4	Malaysia	4	Thailand	2
Finland	4	Malta	0	Turkey	4
France	3	Mexico	5	UK	3
Germany	3	Netherlands	4	USA	4
Greece	4	New Zealand	2		

Source: Zinn et al. (2014) and own research. Notes: 0: no transfer pricing regulations; 1: arm's length principle was introduced in national tax law; 2: TP documentation requirement is not introduced, but documentation is required to exist in practice; 3: documentation requirement is introduced in national tax law, but full documentation must be available only upon request; 4: a short disclosure of TP documentation is required; 5: a long disclosure of TP documentation is required.

An index that was suggested by Zinn et al. (2014) was extended to cover more country-year observations[28] and included into our baseline estimation model. Table 11 presents a worldwide overview of this measurement, which varies from 0 to 5 and reflects not only the mere existence, but also the strictness of transfer pricing regulations. As shown in Column VI of Table 8, implementing stricter TP rules in both, source country and recipient state, leads to a reduction of bilateral royalty flows between them. Finally, Column VII of Table 8 presents the outcomes of an estimation that incorporates all previously discussed additional control variables into the baseline model. It can be seen that the effects, which were found through a stepwise analysis stay mostly unchanged.

5. Conclusions

In comparison to other assets, intangibles have been rapidly gaining importance in the production process over the last few decades. However, intangibles are not just any assets. They do not only lead to an increase in firm's competitiveness and profitability, but might also be strategically used for tax planning purposes. First of all, intangibles are highly mobile and thus may be relatively easily re-located among members of a multinational enterprise. Secondly, their true price is often hard to determine because of their unique nature. Hence, intangibles could be used for shifting profits between affiliated companies with a goal of minimizing global tax liability of a multinational group. The main goal of this study is to test whether intangibles constitute an important channel of profit-shifting by empirically analysing the role of corporate taxation in determining the direction and amounts of international royalty flows.

The empirical analysis presented in this paper is carried out using panel data on 3,660 country-pairs for the time period of 1990-2012. The Poisson pseudo-maximum likelihood estimator in a fixed-effects framework is applied in the baseline model, where bilateral royalty flows serve as the dependent variable and a net tax rate on these payments constitutes the main independent variable of interest. According to our main results, on average a one percentage point decrease in the net tax rate on royalty payments from one country to another leads to a 6.0% increase in their bilateral royalty flows, holding other factors constant. Consistent with the literature on patent applications (e.g. Karkinsky and Riedel (2012), Griffith et al. (2014), Ernst et al. (2014) etc.), these findings suggest that multinationals use intangible assets as an important instruments of response to tax changes.

[28] The research was done with the help of Ernst & Young Transfer Pricing Global Reference Guide 2005-2012, KPMG Global Transfer Pricing Review 2005, 2007, 2009, 2011-2013, and PricewaterhouseCoopers International Transfer Pricing 2008-2012.

The contribution of this study to previous literature is twofold and lies in introducing a new methodology as well as addressing some innovative research questions. First of all, comparing to most previous papers in this area of research, we do not investigate the impact of taxation on stocks of intangibles, but rather look directly at how it affects international flows of royalty payments. In addition, we study not just an effect of net royalties' taxation on the actual royalty flows from one country to another, but also calculate tax differentials, which represent a relative level of taxation in a recipient state compared to all other potential royalty recipients. Consequently, our findings show that on average a one percentage point decrease in the tax differential between a given recipient country and alternative recipient locations leads to a 2.7-3.2% increase in royalty flows from a source state to this recipient.

Furthermore, we contribute to previous literature by analysing how an implementation of the OECD Action Plan on BEPS could affect bilateral royalty flows. This Plan includes several reform suggestions that aim at restricting the use of intangibles as an instrument for BEPS. These proposals embrace, for example, an implementation of the Nexus Approach as well as increasing the effectiveness of rules and regulations that insure an arm's length principle and increase transparency of multinational's global operations. For example, an enforcement of the Nexus Approach implies the elimination of IP Boxes that are applicable to acquired intangibles and allows only the self-developed assets to benefit from favourable tax regimes. According to our findings, this step is likely to trigger a decrease in royalty inflows into the countries, which currently have IP Boxes that are applicable to acquired IP. In addition, implementing stricter CFC rules and transfer pricing regulations in both partner states seems to lead to a fall in bilateral royalty flows between them as well. Therefore, it follows from our findings that an implementation of the Action Plan's suggestions that are relevant for intangible assets has a potential to restrict the flows of non-legitimate royalty flows and is thus likely to limit the use of intangibles as a channel of profit shifting.

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