Consequences of the New UK Tax Exemption System: Evidence from Micro-level Data*

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Abstract

Until 2009, the United Kingdom operated a system of worldwide taxation. Taxation of foreign income was deferred until repatriated as dividends, leaving UK-owned multinational firms the possibility of avoiding UK taxation by delaying dividend payments and keeping earnings abroad. In 2009, the UK switched to a system under which all foreign-earned income is exempted from taxation. This fundamental change had a number of straightforward implications for UK-owned multinational firms and particularly changed incentives to repatriate profits. This paper assesses the effects of the reform on the foreign affiliates of UK-owned multinational firms. We use data provided by Bureau van Dijk on 61,738 foreign affiliates located in one of 29 European countries to estimate the impact of the reform on the repatriation pattern and other outcomes of UK-owned affiliates. We use an identification approach that quasi-randomizes over the country of residence of the ultimate firm owners, allowing us to compare outcomes of *treated* UK-owned foreign affiliates to *control* non-UK-owned foreign affiliates. Our results suggest that the switch to tax exemption not only changed dividend repatriation behaviour of firms but also the conditions under which foreign entities operate in general, for instance, with regard to investment behaviour.

Key words: UK Tax Reform 2009; Tax Exemption System; Dividend Exemption; Foreign Direct Investment

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1 Introduction

The debate about efficiency aspects of international taxation has been dominated by two basic concepts: capital export neutrality (CEN) and capital import neutrality (CIN). Both concepts were formulated by Peggy Musgrave in 1963 and 1969, respectively (see Brewer Richman, 1963; Musgrave, 1969). In her model, CEN ensures an efficient international allocation of capital and has therefore been considered for many years as a benchmark for evaluating international tax systems. The concepts of CEN and CIN are reflected in the distinction between tax systems following a residence-based or a source-based approach of taxation. A residence-based system aims at guaranteeing CEN, because an investor faces only the tax imposed by her residence country so that the decision about which country to invest in is not affected. As the most prominent example, the United States generally follow this approach by taxing worldwide income of its residents while providing a foreign tax credit (*tax credit system*) for the amount of taxes paid to foreign countries.[1] CIN, on the other hand, ensures that all investors in a market are subject to the same tax and, therefore, there is no distortion of competition between firms active in the same market. At the same time, since taxes differ between jurisdictions, CIN does not satisfy global optimality criteria. In practice, a source-based system, which is the most common approach used by the majority of countries, aims at guaranteeing CIN. In such a system, investors are taxed in the source country and exempted in the residence country (*tax exemption system*).

Since the contributions of Musgrave (1963, 1969), other aspects of CEN and CIN as well

[1] In practice, the observed residence-based systems are *limited* credit systems, since the tax credit granted for foreign tax paid is limited to the home-country tax liability due on foreign-earned income. Another difference to a real residence-based system is that profits are only taxed upon repatriation.

as alternative systems of taxation and their optimality properties have been discussed in a by now large body of literature (for a survey, see Devereux, 2008a).[2] For instance, it has been pointed out that CEN was consistent with the production efficiency concept of Diamond and Mirrlees (1971). While recognizing the limitations of the production efficiency theorem, Devereux (2008b) argues that it remains a useful benchmark to evaluate tax systems. Others emphasize that production efficiency is not directly applicable in an international setting (Keen and Wildasin, 2004). Some tax experts deny the applicability of CEN in a world with increased international integration (Frisch, 1990; Hufbauer, 1992), while others object this view (Grubert and Mutti, 1995). The very recent discussion in the literature on optimal systems of taxation, and the many different concepts of neutrality (see also Desai and Hines, 2003; Becker and Fuest, 2008, 2010, 2011a,b), show that eventually too little is known about how investors organize their activities in response to the tax regime under which they operate in order to draw firm conclusions about the optimality of one or the other system.

We contribute to this literature by evaluating how a switch from a tax credit system to a system of tax exemption affects the behaviour of multinational firms. Relative to the large body of normative work, there is little positive evidence on the matter. One reason for the latter is that countries rarely change their system of taxation, and most countries implemented their system at times before good data were available. One exception is the study of Altshuler and Grubert (2001) who investigate how the introduction of dividend exemption would affect location incentives of US corporations. Their findings imply that

[2]Several models account for new challenges associated with the increased international integration and/or consider further dimensions of neutrality (national neutrality, Musgrave, 1969; capital ownership neutrality, Desai and Hines, 2003; market neutrality, Devereux, 1990, 2000; global portfolio neutrality, Desai and Dharmapala, 2009).

dividend exemption would not significantly alter the location decisions of US firms. Desai, Foley, and Hines (2001) find that repatriation taxes reduce dividend repatriations by US foreign affiliates and quantify the induced efficiency losses. Smart (2010) exploits variation in dividend repatriation taxes faced by Canadian MNEs and shows that tax exemption of dividend repatriation (through new tax treaties concluded with foreign countries) is associated with an increase in outbound foreign direct investment (FDI) by about 80%.

This paper utilizes a reform of the United Kingdom's tax system in 2009, when the country switched from tax credit to tax exemption, in an attempt to quantify the behavioral responses of foreign affiliates of UK-owned multinational firms (MNEs). This reform provides a unique opportunity to examine the (short-run) impact of such a fundamental change in the taxation of foreign income.[3] Since only repatriated profits were subject to taxation in the UK under the credit system, one obvious implication of the tax reform was that MNEs with foreign affiliates faced new incentives with respect to dividend repatriation after the reform relative to the outset. Empirically, a challenge lies in the identification of the true effects of the reform. For this, we use an identification approach that quasi-randomizes over the location of residence of ultimate firm owners. Such an approach allows us to compare outcomes of *treated* UK-owned foreign affiliates to *control* non-UK-owned foreign affiliates. We construct a control group of non-treated (non-UK-owned) foreign affiliates that have the same propensity to be UK-owned as the treated (UK-owned) foreign affiliates. For the empirical investigation, we use the Amadeus database provided by Bureau van Dijk. This

[3]Note that also Germany introduced general tax exemption in 2001. However, foreign income of German-owned MNEs was virtually exempt through the country's extensive bilateral tax treaty network that existed already prior to 2001. The conclusions that could be drawn from the German experiment are therefore limited.

micro-level database includes balance-sheet information on MNEs in European countries. The data provide information on a number of outcome variables and allow us to identify parent firms (ultimate owners) as well as affiliates before and after the tax reform. We investigate effects primarily on dividend policy but also on firms' foreign sales-to-fixed-asset ratios and investment.[4] The latter two variables may be indirectly affected by the fundamental reform of the UK tax system through their relationship to dividend payments as well. Our results suggest that the reform induced firms to pay out significantly more dividends, as expected. The average UK-owned affiliate is estimated to have paid out about US$ 2.15mn more dividends (immediately after the reform) than the counterfactual affiliate in the absence of the reform. Another remarkable finding is that the average UK-owned affiliate cut investment by about US$ 3.05mn in response to the reform. The investment effect implies that the reform indirectly affected real outcomes via the change in incentives for profit repatriation. Additional specifications provide evidence for heterogeneous repatriation behaviour depending on tax incentives and on different firm characteristics. Particularly interesting are the results of placebo treatments for which we introduce a hypothetical reform in 2008. The respective estimated treatment effects are virtually zero and statistically highly insignificant, which makes us confident that our empirical approach does not capture spurious correlations. Further tests relating to variations of treatment and control group

[4]Although distributed dividends are not directly observed in the data, we can calculate them from balance-sheet information by comparing shareholder funds available for distribution (a firm's equity including accumulated retained earnings) over time. This approach follows Bellak and Leibrecht (2010) who show by comparing dividends calculated from balance-sheet data with dividend payments directly observed that this method leads to reliable measures of dividend payments. The latter data are not available for a sample of European multinationals as needed for the purpose of our study. Another shortcoming of our data is that we cannot directly observe the recipients of dividends. This might be the parent firm but also a related firm entity.

demonstrate that estimates of the average treatment effects are very robust.

The remainder of the paper is structured in the following way. Section 2 summarizes the main aspects of the UK tax reform and its expected effects on UK-owned foreign affiliates. In Section 3, we present the empirical approach and describe the data utilized. Section 4 offers an overview of the results including various robustness tests, and the last section concludes with a summary of the key findings.

2 Aims and Expected Effects of UK's Reform of Taxing Foreign-earned Profits

Until 2009, the UK operated a worldwide tax credit system. Under this system, UK residents were taxed on their worldwide income while, for taxes paid in foreign countries, a foreign tax credit was provided to avoid double taxation. Taxation of foreign income was deferred until repatriated as dividends, leaving UK-owned MNEs the possibility of avoiding UK taxation by delaying dividend payments and keeping earnings abroad.[5] In 2009, the UK abolished the system of worldwide taxation and established a tax exemption system, under which all foreign-earned income is exempted from UK tax.[6]

This fundamental change of the tax system has a number of straightforward implications

[5]However, the UK "controlled foreign company" (CFC) rule might prevent firms from doing so by apportioning undistributed profits of the CFC to the parent, where they are taxed with the UK tax. The UK CFC rule applies to foreign affiliates if the local tax rate is less than 75% of the UK tax rate (beside the low-tax requirement, some further conditions have to be met). See the International Bureau of Fiscal Documentation (2007) for more details on the UK CFC rule before 2009.

[6]See Carr, Hoerner, and Martinez (2009) for more details on the introduction of the exemption system in the UK in 2009 and the International Bureau of Fiscal Documentation (2009) for more details on the UK tax system in general.

for UK-based MNEs – particularly for their incentives to repatriate profits.[7] As of 2008, UK companies were subject to a statutory corporation tax rate of 28%. Thus, until 2008, repatriated foreign-source income was taxed at 28% and a tax credit was provided for taxes paid at the foreign locations up to the limit of the UK tax of 28%. Assume, for example, that a UK-owned affiliate located in Poland, where the corporate income tax rate was 19% in 2008, generated a profit of £100 there, so that £19 of tax were due in Poland. Had it repatriated the remaining £81 as dividends to the UK, it would have faced the UK corporate tax rate of 28% on the £100 gross profits and gotten a credit of £19 for the foreign tax, having had to pay £9 of tax in the UK. The total tax burden equalled the UK corporate tax rate of 28%, and net dividend income amounted to £72. In this example, the repatriation of the dividends brought about a tax obligation of £9, which could have been avoided by leaving the profits abroad. Thus, under the tax-credit system, UK-owned firms located in foreign countries where the local tax rate was *lower* than in the UK faced an additional tax upon repatriating profits to the UK. UK-owned foreign affiliates located in countries with a local tax rate that was *higher* than in the UK did not face such an additional tax upon repatriating dividends to the UK.[8]

As of 2009, foreign dividends received by UK companies are exempt from taxation in the UK. The tax burden is determined by the foreign corporate tax rate. In the example above, the tax burden amounts to the Polish corporate tax rate of 19%, and the UK parent receives

[7]Of course, tax incentives changed in a different way for UK multinationals which had implemented tax planning strategies prior to the reform – such as the use of mixer companies (Deuchar and Hulsen, 2001).

[8]Those firms got a tax credit equal to 28% of the foreign profits. Unlike in the US, which also has a tax credit system, UK-owned firms were not allowed to average their worldwide foreign income tax payments to claim a tax credit. On-shore pooling of dividends and using excess tax credit against other foreign dividends received by the company were allowed only to some extent.

now a net dividend income of £81. Under the new exemption system, UK companies investing in countries with a *lower* tax rate than in the UK no longer face an additional tax upon dividend repatriation and exhibit higher after-tax returns on their investments. Besides, under the credit system, UK-based MNEs investing in low-tax countries had a disadvantage against MNEs based in countries with an exemption system (Griffith, Hines, and Sørensen, 2010). This disadvantage vanished with the switch to foreign dividend exemption.

When the first proposal of the reform was presented in 2007 by the UK Treasury, it stated explicitly that the goal of the tax reform was to make UK firms more competitive by simplifying the tax regime for foreign dividends. The government's objective "*that the tax system should not distort commercial decisions*" would be achieved by exempting foreign dividends so that firms would no longer leave profits off-shore for tax reasons and could use repatriated profits to fund other foreign investment from the UK. Further, the switch to exemption would also make firms investing in high-tax countries more competitive by reducing compliance costs, since even in the absence of an additional tax liability upon repatriating highly taxed foreign profits, "*the administrative costs for multinational business of complying with the credit regime can be material*" (HM Treasury, 2007, p. 13). In particular, the government concluded that the old system reduced the competitiveness of UK businesses and resulted in a significant administrative burden for both businesses and HM Revenue & Customs, while it produced only a modest amount of direct tax yield (HM Treasury, 2009, p. 4). As part of the European Union, where most countries operate an exemption system, policy makers as well as economists argued in favor of this move, which was expected

to equalize the terms on which UK-owned firms were competing with foreign-owned ones (Griffith, Hines, and Sørensen, 2010).

It is important to mention that all arguments from above are not necessarily inconsistent with work demonstrating that dividend taxes are neutral with respect to the dividend repatriation decision. For example, Hartman (1985) or Sinn (1987) come to the conclusion that within one regime of taxing foreign dividends – tax exemption or tax credit – repatriation taxes are neutral and do not distort the repatriation vs. reinvestment abroad decision.[9] The neutrality result does not apply, however, to a discontinuous switch from one system to another inducing a one-time change in incentives. Hence, even in a Hartman (1985) world without anticipation effects, we might expect the switch to tax exemption to have an immediate effect on dividend repatriation and taxes to be neutral again thereafter. While the research suggesting neutrality is generally based on the assumption that taxes on dividends are constant over time, Altshuler, Newlon, and Randolph (1995) argue that firms may repatriate relatively more (less) profits from subsidiaries if taxes due upon repatriation are not constant over time and the tax cost of repatriation is temporarily lower (higher) than normal.[10] Since their empirical findings show that variation in repatriation behaviour is only driven by transitory variation in tax prices over time, rather than permanent taxes, the authors conclude that this is consistent with the predictions of the Hartman model. Against this view, other authors (e.g., Foley, Hartzell, Titman, and Twite, 2007) have argued that,

[9]This "new view" result applies to mature subsidiaries financed through retained earnings. Subsidiaries choose between either (i) repatriating today, paying the repatriation tax today and investing at home or (ii) investing abroad, repatriating tomorrow and paying the repatriation tax tomorrow. Since the repatriation tax has to be paid irrespective of this choice, it does not affect the repatriation decision in the Hartman-Sinn model.

[10]Normal referring to a permanent long-run average tax.

once numerous real world complexities and imperfections are taken into account, repatriation taxes are generally not neutral and do not only change timing behaviour. Irrespective of different theories, firms might have postponed their 2008 repatriations until 2009. This might show in an anticipation effect, which is possible since the first reform proposal was published already in 2007 (HM Treasury, 2007).

Table 1 lists and describes the various outcomes of a foreign affiliate i we examine in the empirical analysis. We broadly distinguish between outcomes affecting the *repatriation pattern* of firms and *other indicators*, capturing likely indirect reform effects. The latter may not only be related to a new repatriation policy but also to the removal of compliance costs by introducing a simpler system of taxation "*enabling multinational business to operate more effectively*" in general (HM Treasury 2009, p. 5).

As for the repatriation pattern, we expect the reform to have induced firms to repatriate foreign-source income that had been kept abroad to avoid taxation. The magnitude of this effect depends on the foreign tax burden relative to the UK and on the availability of profitable investment opportunities abroad. In fact, to the extent that UK companies deferred UK taxation and kept profits abroad for reasons not related to the tax credit system in the pre-reform period, the reform did not change the actual tax burden of foreign affiliates in the short run (see Gammie, Griffith, and Miller, 2008). Of course, this is an argument that does not apply to all firms.[11] Another point worth mentioning is that firms could have structured

[11]While an increase in the flow of repatriated dividends seems to be a natural prediction as the tax system (tax credit vs. tax exemption) of the ultimate owner affects repatriation policy of firms directly, it is not clear for which purposes hitherto deferred foreign-earned income is used in the ultimate owner country in case of repatriation. Although, for example, US MNEs have been pressing the government for a tax break – in which case, so their claim, they would repatriate income accumulated at foreign subsidiaries to the US for investment purposes (see New York Times, June 19, 2011,

their activities under the tax credit system such that repatriation taxes were avoided prior to the reform. For example, intercompany loans might have been used instead of dividends to repatriate profits (see Weichenrieder, 1996). If this is the case, we would rather underestimate the effect of a repatriation tax, ceteris paribus. But if firms abandoned their tax planning strategies immediately after the reform and returned to repatriation through dividends, the effect of the repatriation tax would rather be overestimated. Note that we are not able to observe any alternative repatriation channels (internal debt, royalty payments) in our data.

– Table 1 –

As for other indicators, we might expect indirect effects of the reform. On the one hand, dividend repatriation may affect real outcomes because financing funds are withdrawn from foreign affiliates. This, on the other hand, may improve efficiency of foreign affiliates, since less cash flow is available and over-investment is reduced (see Jensen, 1986). Efficiency may also be improved through the reduction in compliance costs associated with the simpler tax exemption system. To capture these two aspects, we investigate possible effects of the reform on investment and the sales-to-fixed-asset ratio of foreign entities.[12]

http://www.nytimes.com/2011/06/20/business/20tax.html?hp) – Dharmapala, Foley, and Forbes (2011) show that the 2005 US one-time tax holiday for the repatriation of foreign income did not lead to more real domestic activity (investment, employment, or R&D) but, instead, "*a $1 increase in repatriations was associated with an increase of almost $1 in payouts to shareholders*" (Dharmapala, Foley, and Forbes, 2011). Our data-set does not permit a rigorous investigation of outcomes at the level of owners in the UK, but it supports an analysis of outcomes at the level of foreign affiliates by identified ultimate owners in the UK.

[12]Of course, efficiency is a rather abstract concept and it is not clear how to measure it in the present context. We have chosen the sales-to-fixed-asset ratio, since we believe that this is the best available efficiency indicator from affiliate-level data.

3 Empirical Approach

3.1 Some Notation and Concepts

To estimate *treatment* effects of the UK tax reform, we aim at comparing outcomes of *treated* affiliates where the ultimate shareholder, i.e. the parent firm, is actually located in the UK with *control* affiliates held by non-UK shareholders. Since ultimate owners (and ultimate owner countries) are not randomly assigned to affiliates, the goal of the empirical investigation is to evaluate UK-owned firms relative to non-UK-owned ones that exhibit the same propensity to be UK-owned but whose ultimate owner is actually located somewhere else.

We approach this empirical problem by adopting an approach of *selection on observables* based on matching on the propensity score. In a first step, we estimate the propensity of an affiliate to be UK-owned from a *location choice* model.[13] Let us denote affiliates by $i = 1, \ldots, N$ and countries these affiliates may be held from by $j = 1, \ldots, J$. Each affiliate i may principally be owned ultimately in one of the J countries in the data. For convenience, let us refer to ownership in the UK by $j = 1$ and to all other locations (where at least some ultimate owners are located) by $j = 2, \ldots, J$. In general, we focus on the choice of ultimate owner location for affiliate i in the year 2008 and on outcome effects of the tax reform measured in 2009. For the sake of simplicity, we abstract from using a time index. Location choice is modelled as a function of observables as of the year 2008.

[13]Note that MNEs are faced with two types of location choices, one about affiliates and one about headquarters (or the ultimate owner). Here, we focus on the latter. This seems plausible against the strong evidence of mergers and acquisitions as the dominant form of (foreign and domestic) ownership of affiliates.

Let us denote the actual country location of the ultimate owner in 2008 of affiliate i by $C_i \in \Lambda$, where Λ refers to the set of countries that could be chosen in the sample. Define the propensity score for affiliate i to be ultimately owned in country 1 by $p_i^1 \equiv Pr(C_i = 1|\mathbf{X} = \mathbf{x}_i^j)$. Furthermore, define the scalar D_i^j which is unity if i's owner is located in j ($C_i = j$) and zero else. Each potential ownership location in J for affiliate i involves a potential outcome $\tilde{y}_i^j$. The latter should be distinguished from actual outcome. Suppose affiliate i is actually owned in j. Then, its actual outcome can be denoted by y_i^j. Hence, no matter where i's owner actually resides, we can determine a potential (hypothetical or imputed) outcome associated with ownership in j.

Our goal is to estimate the average effect of the adoption of the tax exemption system by the UK on UK-owned affiliates ($j = 1$) relative to non-UK-owned affiliates ($j \neq 1$) – an *average treatment effect on the treated* (ATT) – on outcome, conditional on observables:[14]

$$ATT^{1j} = E(y_i^1 - \tilde{y}_i^j | D_i^1 = 1, \mathbf{X} = \mathbf{x}_i^1).$$

3.2 Implementation

There is a number of options for modelling the multinomial choice problem determining p_i^j in general and p_i^1 in particular through nonlinear multinomial probability models. Examples thereof are the classes of multinomial probit-type models and multinomial logit-type mod-

[14]This implies invoking the assumptions of conditional mean independence and balancing condition (see, for example, Wooldridge 2002). The former means that, after conditioning on observable characteristics $\mathbf{x}_i^j$, treatment (UK-ownership) is independent of actual or potential outcome. The latter implies that outcome with treatment state *UK ownership*, y_i^1, and outcome with counterfactual state *non-UK ownership*, y_i^j for $j = 2, \ldots, J$, are independent of assignment of UK ownership given the propensity score of being UK-owned, p_i^1.

els. With a huge number of foreign affiliates N each with an ultimate owner in one of J potential parent countries, it is natural to resort to multinomial logit-type models due to their tractability and numerical stability.[15] In the class of logit-type models, the mixed-logit or random-coefficients logit is a natural candidate since it allows for heteroskedasticity and correlation across alternatives.[16]

We postulate that affiliate i would receive latent net benefits π_i^j from having an ultimate owner located in country j according to

$$\pi_i^j = \mathbf{x}^j \boldsymbol{\beta}_i + \alpha_i^j, \quad i = 1, ..., N, \; j = 1, ..., J, \tag{1}$$

where the $1 \times L$ vector $\mathbf{x}^j$ contains determinants of profits which are alternative-(country-)specific. α_i^j represent unobservable variables affecting the choice. The $L \times 1$ vector of random weights $\boldsymbol{\beta}_i$ on $\mathbf{x}^j$ are unknown and vary in the population. We postulate them to depend on both observables and unobservables in the following way

$$\boldsymbol{\beta}_i = \boldsymbol{\Gamma} \mathbf{y}_i' + \boldsymbol{\delta}_i, \tag{2}$$

where the $1 \times M$ vector $\mathbf{y}_i$ contains determinants of profits which are affiliate specific, $\boldsymbol{\Gamma}$ is a $L \times M$ matrix of unknown coefficients and $\boldsymbol{\delta}_i$ is unobserved and normally distributed over

[15] Multivariate probit-type models require integrating numerically a multivariate normal whose dimensions are determined by the number of possible choices. In spite of the efficient simulation algorithms available nowadays, it is computationally extremely demanding to estimate p_i^j by multinomial probit-type models in a choice problem that is as large as the one here.

[16] The computationally more convenient conditional logit is restrictive due to the well-known property of independence from irrelevant alternatives. This means that the choices taken with regard to alternatives j versus ℓ are not affected when adding further alternatives, and the model predicts that a change in an attribute of alternative j will change the probabilities of all other alternatives in the same proportion.

firms. Then, we specify latent profits as $\pi_i^j = \mathbf{x}^j \Gamma \mathbf{y}_i' + \mathbf{x}^j \boldsymbol{\delta}_i + \alpha_i^j$ with fixed coefficients $\boldsymbol{\Gamma}$ on interactions of country-affiliate-specific variables and random coefficients $\boldsymbol{\delta}_i$ on country-specific variables $\mathbf{x}^j$.

The actual choice $C_i \in \{1, ..., J\}$ is based on the maximum attainable profit, $\arg\max(\pi_i^1, ..., \pi_i^J)$. Assuming that the α_i^j are independently distributed across alternatives with a type I extreme value distribution, that the $\boldsymbol{\delta}_i$ are normally distributed, and using the functional form of the logit model, we obtain the probability of the actual choice to be $C_i = j$ as

$$p_i^j = \int \frac{\exp(\mathbf{x}^j \Gamma \mathbf{y}_i' + \mathbf{x}^j \boldsymbol{\delta}_i)}{\sum_{j=1}^{J} \exp(\mathbf{x}^j \Gamma \mathbf{y}_i' + \mathbf{x}^j \boldsymbol{\delta}_i)} \phi(\boldsymbol{\delta}_i | \mu, \Omega) d\boldsymbol{\delta}_i, \quad \text{for all } i, j, \tag{3}$$

where $\phi(.)$ is the normal density with mean μ and covariance Ω.

The mixed logit model in (1) is estimated by simulated maximum likelihood (see Train, 2009) and delivers estimates $\hat{p}_i^1$ for being owned by an ultimate owner in the UK. Notice that these choice probabilities depend in part on country-(i.e., UK-)specific observables in $\mathbf{x}_i^1$ and in part on ones specific to affiliate i which is actually or potentially (but, in any case, likely) owned in the UK.

Note that we are mainly interested in using the propensity scores as a compact, scalar-valued metric of all the determinants behind the ultimate-owner-location choice to find comparable UK owners and non-UK owners by affiliate. An interpretation of the estimated coefficients of the interaction terms is of secondary interest. In terms of the matching algorithm to construct the control group, we employ radius matching with a radius of one percent – a special form of kernel matching based on a uniform kernel with the radius as the

bandwidth.[17]

3.3 Data

We use data on $N = 61,738$ affiliates which are located in one of 29 European countries as provided by Bureau van Dijk's Amadeus database. The data contain information not only about the country of location of the affiliate and associated balance-sheet data but also on the nationality of their ultimate owner. The ultimate owners in the data locate in one of $J = 72$ countries. As said before, we utilize information about the location of ultimate owners in 2008 and measure observables determining this location as in (1) in the same year.

The vector $\mathbf{x}_i^j$ contains the following observable regressors determining ultimate owner location choice. *Statutory tax rate*$_j$ is the statutory corporate profit tax rate in country j. The tax data are collected from databases provided by the International Bureau of Fiscal Documentation (IBFD) and tax surveys provided by Ernst&Young, PricewaterhouseCoopers, and KPMG. *log GDP per capita*$_j$ and *log GDP*$_j$ measure real GDP per capita and real GDP in country j in 2008 at constant US dollars (base year 2000) and are taken from the World Bank's World Development Indicators 2009. These variables measure aggregate market size and demand characteristics at market j. Moreover, we include a number of variables measuring the perceived quality of governance in country j as available from the World Bank's Worldwide Governance Indicators 2011. *Voice and accountability*$_j$ captures

[17] Provided that the balancing condition holds, this ensures a certain quality of matching, because it requires the estimated propensities of control units to lie within a specific radius around the estimated propensity of a treated unit. Formally, for estimating the ATT^{1j} we require for every affiliate i' with an ultimate owner in $j \neq 1$ which is matched onto affiliate i with an ultimate owner in $j = 1$ that $|\hat{p}_i^{1,j=1} - \hat{p}_{i'}^{1,j\neq 1}| \leq 0.01$.

the extent to which citizens are able to participate in selecting their government, as well as freedom of expression, association, and press. *Control of corruption*$_j$ measures the perceived extent to which public power is exercised for private gain. *Government effectiveness*$_j$ captures the perceived quality of public and civil services and the independence of the latter from political pressures, the quality of policy formulation, and implementation and the credibility of the government's commitment to such policies. *Political stability*$_j$ measures the perceived likelihood of a coup or government destabilization by unconstitutional or violent means. *Regulatory quality*$_j$ measures perceived government ability to formulate and implement sound policies and regulations that permit and promote the development of a private sector. *Rule of law*$_j$ captures perceptions of the extent to which agents have confidence in and abide the rules of society, in particular, the quality of contract enforcement, property rights, police, and courts. *Common language*$_{lj}$ and *Colony*$_{lj}$ are indicators for common language and former colonial ties between countries l (the host country of the affiliate) and j (the potential residence of the ultimate owner), and *log Distance*$_{lj}$ is the log of the distance (in kilometers) between the most populated cities in countries l and j. These bilateral geographical and cultural variables are published by the Centre d'Études Prospectives et d'Informations Internationales. Finally, our location choice model includes interaction terms of the listed country-j-specific variables with affiliate-i-specific characteristics to improve the precision of the propensity score estimates. To capture affiliate characteristics, we employ the total assets (TA$_i$) of foreign affiliates. The reason for why we use total assets as an explanatory variable at the affiliate level is that it is not only available for most units but

it is also highly correlated with many affiliate-specific characteristics (such as productivity, innovation, financial constraints, etc.). Hence, it helps reducing latent differences between UK-owned and non-UK-owned affiliates. Most obviously, the variable captures affiliate size and capital stock well, which is crucial. For instance, if the average affiliate held by a UK-owned parent company would be larger than the average non-UK-owned affiliate, one might fail to match UK-owned affiliates well onto non-UK-owned ones when disregarding total assets from the selection model. In choosing one affiliate-specific variable for the interactive terms, we respect that each such variable would generate nine additional covariates. We did not find other firm-specific variables beyond total assets that would have justified the additional loss of degrees of freedom from both missing data and a larger model. It should finally be mentioned that the model implicitly includes affiliate-specific fixed effects so that the parsimony is relevant only with the interactive terms.

Beyond the observables (summarized in Table 2) determining ultimate ownership location and, hence, treatment status after adoption of tax exemption, the Amadeus data-set also contains information on outcomes of interest as listed in Table 3. Dividends are not directly observable in the data. We therefore approximate dividend payments from the liability side of the balance sheets (see Bellak and Leibrecht, 2010, for this approach). Any reduction in shareholder funds available for distribution should be due to dividend payments. However, in some rare cases, such a reduction could also be due to capital decreases. See the notes underneath Table 1 for a precise description of how we calculate dividend payments.

– Tables 2 and 3 –

4 Effects of the 2009 UK Tax Reform

4.1 Nonparametric Conditional Average Treatment Effects on the Treated

The remainder of the paper is concerned with ensuring a better comparability of treated and untreated units than in unconditional or parametric conditional mean comparisons.[18] Comparability is established by a nonparametric identification strategy for ATTs implemented by a matching approach as described in Section 3. Matching is based on predicted probabilities (or propensities) from ownership-location-choice-model estimates. We always enforce a common probability support of the treated and control units in order to ensure better comparability of matched units.

– Table 12 –

Table 12 reports ownership-location-choice-model estimates for the mixed logit model. Compared to a conditional logit model, the mixed logit model relaxes the independence of irrelevant alternatives assumption by allowing for correlation in unobserved factors over alternatives. Hence, the mixed logit model is less restrictive than the conditional logit. As indicated before, the specification presented in Table 12 includes three types of covariates: country-pair (between any potential owner residence country j and the foreign affiliate's host country l) specific covariates; parent (owner) country j-specific covariates; and interactive terms be-

[18] We may refer to an earlier version of the paper reporting parametric unconditional and conditional treatment effects (see Egger, Merlo, Ruf, and Wamser, 2012)

tween affiliate i-specific characteristics and parent country j-specific variables.[19] Among the parent-country-specific regressors, there are *Statutory tax rate*$_j$, *log GDP per capita*$_j$, *log GDP*$_j$, *Voice and accountability*$_j$, *Control of corruption*$_j$, *Government effectiveness*$_j$, *Political stability*$_j$, *Regulatory quality*$_j$, and *Rule of law*$_j$, as introduced in Subsection 3.3. All of those are – in addition to entering as main effects – interacted with the affiliate i-specific total assets (TA_i). Finally, the ownership location choice models include three potential parent-by-host (l-by-j) country specific variables: *Common language*$_{lj}$, *Colony*$_{lj}$, and *log Distance*$_{lj}$.[20]

For estimating the location choice models, it is elemental to construct a data-set which allows each affiliate to be principally owned in any one of the 72 ownership countries in the sample. With $61,738$ affiliates, this leads to $72 \cdot 61,738 = 4,445,136$ location choice options. It turns out that the relaxation of the assumption of independence of the estimated propensities of irrelevant alternatives does not have an important impact on the findings here. For instance, Spearman's rank correlation coefficient between the propensities as estimated from the mixed logit model and a conditional logit amounts to 0.77, and Kendall's τ amounts to 0.58 (conditional logit estimates are available upon request). Hence, there is a high correlation of propensities which leads to similar control groups for the treated selected from one or the other model (see Footnote 29 for further evidence on this matter). However, we

[19]The location choice model used is per se an alternative-specific estimation approach. Therefore, the specifications include country (alternative-specific) variables as well as interaction terms thereof with affiliate-specific variables, but not affiliate-specific variables on their own. While we do not aim at interpreting coefficients, the controls are useful to obtain precise estimates for the location probabilities used in the matching approach.

[20]We have estimated more parsimonious models than the ones in Table 12. However, we suppress them for the sake of brevity here.

will base our main findings on propensities estimated from the mixed logit model since it is less restrictive than the conditional logit model.

– Table 4 –

ATTs derived from matching-based conditional mean comparisons are presented in Table 4 for the four different outcomes as of 2009: dividends paid in 2009 ($DIV_{i,2009}$); the dividend payout ratio ($DIVREL_{i,2009}$); the sales-to-fixed-asset ratio ($SA/FA_{i,2009}$); and net investments in fixed assets ($INV_{i,2009}$). The findings indicate that a randomly chosen foreign affiliate with a UK owner distributes about US$ 2.15mn more on dividends in 2009 ($DIV_{i,2009}$) than a comparable counterfactual affiliate with an ultimate owner outside of the UK.[21] This margin over the untreated of about 35% is an economically significant effect when considering that these funds are withdrawn from foreign entities in response to a change in tax policy in the home country. The effect is statistically significant at conventional levels. There is also a positive and significant effect of the UK reform on the dividend payout ratio $DIVREL_{i,2009}$. The coefficient implies that UK-ownership is associated with a five percentage points higher ratio than non-UK-ownership after the reform (but, as we will see, not prior to it). Again, this is a sizeable effect when considering that the average value of $DIVREL_{i,2009}$ for the whole sample equals 13%. Hence, as expected, the new incentives generated by the reform seem to have induced firms to adjust their repatriation policy. As argued in Section 2, effects beyond those on dividend policy are likely. On the one hand, new repatriation incentives may translate into real investment effects since financial funds

[21] We allow the control group to consist of affiliates with ultimate owners resident in tax credit or tax exemption countries at this stage. Section 4.4 presents results, where we distinguish between control units with ultimate owners from tax credit countries and ones with ultimate owners from exemption countries.

are withdrawn from foreign affiliates (with less attractive investment opportunities than ones in the UK). This is a short-run effect. On the other hand, in the long run, this may reduce inefficiencies at the level of foreign affiliates, especially, if the reform reduced compliance costs associated with the old tax credit system in a significant way. Considering the sales-to-fixed-assets ratio as one efficiency measure, we find a positive and statistically significant ATT of about 82 on that outcome.

Such efficiency gains should be expected to translate into investment effects. The estimated ATT on real investment of foreign entities implies that UK-owned foreign affiliates invested on average about US$ 3mn (or about 88%) less than their counterfactual affiliates in 2009. In combination with the finding for dividend repatriation, this indicates that tax incentives indeed may have induced firms to avoid repatriation so that free cash flow was available for investments in unproductive projects.[22]

4.2 Heterogeneous Conditional Average Treatment Effects on the Treated with Respect to the Tax Rate

While the previous subsection focused on *average* treatment effects on the treated across *all* comparable treated and untreated control units, one would expect the effects to vary (rise in magnitude) with the tax incentives in place. This subsection is devoted to shed light on this conjecture. Before doing so, recall that the nonparametric propensity score matching approach could be cast as a weighted linear regression that regresses outcome on a constant

[22]This argument is aligned with Jensen (1986), who argues that free cash flow may be used to invest below the cost of capital.

and a binary treatment indicator for UK ownership of foreign affiliates with the weights being the Kernel weights from the matching procedure (see Robins and Rotnitzky, 1995; Hirano and Imbens, 2002; Blundell and Costa Dias, 2009).[23] If the ATT would vary systematically with the host country's corporate tax rate, one could use this weighted least squares approach to propensity score matching and regress outcome on a constant, the tax variable, a binary treatment indicator for UK ownership of foreign affiliates, and an interactive term between that binary treatment indicator and the *demeaned* corporate tax rates. The latter would subtract the average corporate tax rate among the treated from the original value of the corporate tax rate to ensure that the parameter on the uninteracted treatment indicator variable still measures the ATT (see Wooldridge, 2002, p. 613; Blundell and Costa Dias, 2009; Abadie and Imbens 2011; Fitzenberger, Sommerfeld, and Steffes, 2012). Again, the weights of this regression model are the Kernel weights from the matching procedure.

– Figure 1 –

Figure 1 illustrates the variability of ATTs across affiliate-country tax rates as estimated by the aforementioned weighted regression approach (using the mixed logit regression model as in Table 12 and uniform Kernel weights corresponding to radius matching with a radius of 0.01). The solid flat line indicates the ATT on dividends for the average affiliate and applied corporate tax rate in a host country. This ATT amounts to about US$ 2.13mn which is statistically indistinguishable from the ATT of about US$ 2.15mn based on propensity score

[23] In principal, that weighted regression could condition on the observables as included in the ownership location choice model. However, this appears to be unnecessary and only would lead to an efficiency loss here, since there is no indication of a violence of the balancing property, by which the treated and matched control units do not differ (on average) in any of the dimensions of the included vector of observables.

matching and reported in Table 4. The negatively-sloped line indicates how the ATT varies across host country statutory corporate tax rates. Notice that the two lines cross at a value of the corporate tax rate of about 0.28 (28%). With the UK's corporate tax rate of 28%, this is exactly the point where foreign tax incentives to repatriate remained unchanged (zero) before and after the reform. To the left of that point, the treatment effect on dividends is *higher than the average* for affiliates located in lower-tax countries. For affiliates located in countries with a higher tax rate than the UK, the treatment effect is also positive albeit *lower than the average*. The latter finding is in line with arguments that a tax exemption system tends to reduce compliance costs in general. However, we should admit that this interpretation does not pay attention to details regarding the actual tax status of parent firms in the UK.

We add to the previous result by estimating the ATTs separately for countries whose corporate tax rate is lower than the one in the UK. To some extent, this is similar to the question asked above. However, above we enforced linearity in the variability of ATTs with corporate tax rates so that the ATT for below-UK corporate tax rates may have been driven by affiliates in countries with quite high tax rates. This problem can be avoided by relaxing the assumption of poolability of data for affiliates with below-UK and above-UK corporate tax rates. In other words, let us look at those foreign affiliates where the tax disincentive of the tax credit system was particularly high before the introduction of tax exemption of corporate profits. Although we do not know the exact tax status of multinational firms – for example, whether firms had unused foreign tax credit before the reform, whether firms could

offset losses, whether dividend payments were channelled through intermediate entities, or whether affiliates operated under preferential tax regimes – we would expect that the ATT was more pronounced for this subgroup.

– Table 5 –

Table 5 presents the estimated ATTs suggesting that treatment effects on $DIV_{i,2009}$ and $DIVREL_{i,2009}$ are indeed bigger for affiliates located in lower-tax countries than the UK. Note, however, that the number of treated entities is now less than half of what it was before. Consequently, the confidence intervals are overlapping between the subsample in Table 5 and the overall sample in Table 4, akin to the result in Figure 1.

4.3 Sensitivity Analysis with Respect to the Variation in Repatriation Behaviour

While our empirical approach accounts for self-selection of affiliates into UK-ownership, foreign entities may still differ in their dividend repatriation behaviour. Such heterogeneity in repatriation may be driven by either tax incentives (see Section 4.2 for some evidence on this) or other affiliate characteristics. Our next robustness check relates to these affiliate characteristics and aims at finding out whether the average treatment effect on the treated is unaffected when additional affiliate-specific regressors are included post matching. If our empirical approach suffices to control for selection into treatment, and treatment per se is orthogonal to these characteristics, then estimated ATTs should be unaffected by an inclusion of control variables.

Using the same weighted regression approach as in Section 4.2, we first obtain weights from propensity score matching and then run weighted regressions including not only the treatment indicator but also a number of affiliate-specific characteristics as well as a set of industry indicator variables on the right-hand side of the model. The affiliate variables used are the $AGE_{i,2008}$ of the foreign entity i measured as 2011 minus year of incorporation; $CASH_{i,2008}$, measuring cash and cash equivalent assets (the amount of cash at bank and in hand of the company) of entity i in 2008 relative to its total assets; $INTANG_{i,2008}$, measuring the intangible assets held by entity i in 2008 relative to total assets; and $PROFIT_{i,2008}$, measuring profits and loss of entity i in 2008 relative to total assets.[24] The results in Table 6 are organized such that each column refers to one of our outcome variables. The table shows that treatment effects, which can be read off from the first line, remain fully unaffected. To see this, compare the ATTs of Table 4 to the ones of Table 6: an ATT for dividends of 2,150.574 compares to one of 2,183.357; an ATT for the payout ratio of 0.051 compares to one of 0.047; an ATT for the sales-to-asset ratio of 82.559 compares to one of 92.450; and one of -3,050.042 for investment compares to one of -2,981.567.

In showing that the estimates of the average ATTs remain unaffected by an inclusion of further covariates, we gain confidence in the proposed selection-on-observables approach. However, treatment effects might vary in some of the additional control dimensions. Akin to the analysis in Section 4.2, we therefore check whether there is noticeable heterogeneity in ATTs in the affiliate-specific characteristics introduced above. The findings are presented

[24]Descriptive statistics on these variables show the following numbers. Mean (Std. Dev.): 21.064 (18.361); 0.110 (0.613); 0.032 (0.131); 0.019 (0.999) (variables appear in the same order as mentioned in the text).

in Table 7 and can be summarized as follows. First, we do not find significant effects of $UK \times \overline{AGE}_{i,2008}$ (where $\overline{AGE}_{i,2008}$ is the demeaned affiliate-specific age using the sample average of $AGE_{i,2008}$ for demeaning). The age of treated affiliate has no effect on repatriation behaviour. The heterogeneity associated with $CASH_{i,2008}$ and $PROFIT_{i,2008}$, respectively, is particularly interesting. For $CASH_{i,2008}$ a one-standard-deviation increase in the cash ratio (from the mean) is associated with a 5-percentage point higher treatment effect on $DIVREL_{i,2008}$. On the contrary, we find a negative effect on $DIV_{i,2008}$. Given that $CASH_{i,2008}$ is measured as a ratio (relative to total assets), this means that firms with an above-average cash ratio have non-tax reasons to keep funds abroad. The heterogeneity in $PROFIT_{i,2008}$ is far more pronounced. For example, a 10-percentage point deviation from its mean value (a 10-percentage point higher profit ratio relative to the mean) is associated with a US$ 1.1mn larger treatment effect on $DIV_{i,2008}$. Of course, this result does not come as a surprise as affiliates with high profits have the means to distribute these funds. For $INTANG$, the findings are mixed. Treated intangible-intensive firms repatriate more dividends when looking at the dividend level, but significantly less than they could have when looking at $DIVREL_{i,2008}$. Finally, regarding effects on investment, the (negative) treatment effect on $INV_{i,2008}$ does not significantly vary with AGE, $CASH$, $PROFIT$ and $INTANG$.

4.4 Sensitivity Analysis with Respect to the Control Group

The above estimates include all firms on probability support, irrespective of whether they are operated from tax exemption or tax credit countries. Generally, our approach compares

treated entities, which experienced a tax reform, with untreated ones (conditional on the propensity score). However, to evaluate how UK affiliates would have behaved if they were not treated (in the absence of the tax reform), control affiliates operated from tax credit countries might be better suited as control units. Accordingly, Table 8 presents results that exclude all affiliates with ultimate owners located in countries with tax exemption systems, which reduces the number of potential control units significantly.[25]

The resulting estimates are very similar to our basic estimates. For $DIVREL_{i,2009}$, we even estimate an ATT of almost the same magnitude as in Table 4. The other effects are slightly smaller compared to the ones from above. Coefficients are naturally estimated with less precision owed to the reduced sample size.

Alternatively, we may focus on affiliates with ultimate owners from countries using the tax exemption system. Such a control group guarantees that outcomes of UK affiliates in 2009 are compared to a counterfactual group that operates under the same conditions in that year (tax exemption). The crucial point here is that tax incentives of the control group remained constant over time and, in this sense, control units have been operating under 'normal' conditions. Table 9 reports results where control affiliates with ultimate owners located in countries that apply a tax credit system are excluded from the sample.[26] Again, this leads to a reduction in potential control units on which we can match treated units in Table 9.

– Table 9 –

[25]We also exclude Japan since this country also abolished the tax credit system in 2009.
[26]The list of such countries is reported in the notes to Table 9.

However, the results in Table 9 show that all ATTs have the same sign as the benchmark results in Table 4, with slightly larger point estimates of the ATTs in absolute value.

4.5 Sensitivity Analysis with Respect to Placebo Treatments

A number of further issues are of particular interest when thinking about the sensitivity of the above results. First, the most important consideration here is the question of whether the results on endogenous UK ownership may indeed be interpreted as reform effects. Notice that we have estimated ATTs as of the year 2009 when the reform took place, but it could be that the same effect had occurred already in 2008, so that the ATTs do not fully capture the reform effect. We shed light on this question by illustrating that there is no evidence of significant ATTs (of UK ownership) in the pre-reform year, 2008. The corresponding set of results is presented for all outcomes in Table 10.

– Table 10 –

Clearly, the table suggests that the *placebo* treatment in 2008 does not lead to significant ATTs with the same sign in Table 10 as in Table 4.[27] Hence, the ATT may indeed be interpreted as a UK ownership times reform treatment ATT as proposed rather than just an ATT for UK ownership per se.

[27] An interesting finding is the positive ATT for $INV_{i,2009}$, which is in line with the above argument about inefficient investment when free cash flows are available.

4.6 Long-run vs. Short-run Effects

Since the estimates above are based on 2009 data (except for the placebo treatment analysis), we may refer to these findings as short-run effects. Given the theoretical considerations in Section 2 and the Hartman-Sinn considerations in particular, repatriation behaviour may be unchanged in the long-run relative to the outset. If, however, the reform has an effect on compliance cost or competitiveness of UK multinationals, we would expect this to take more than one year to materialise. Of course, questions related to long- vs. short-run effects are to some extent testable. Using the same approach as above, we have done so by investigating outcomes for the year 2010.[28]

The results presented in Table 11 do not point to a medium-to-long-run effect when the level of dividends is analyzed. We also find a positive but insignificant treatment effect on $DIVREL_{i,2010}$. This may be interpreted in two ways. First, the reform did not significantly change medium-to-longer-run incentives such that generally more dividends are repatriated. Second, the reform did not lead to a statistically significant reduction in compliance costs which facilitates dividend repatriation in the medium to the long run. Furthermore, Table 11 shows that there is neither a long-run response with respect to SA/FA nor with respect to INV. Whether this finding is consistent with the hypothesis that inefficiencies were removed by the tax reform needs to be tested with a longer time series of data. Besides, competitiveness and efficiency may materialise in many dimensions, so a more in-depth analysis is required to come to reliable conclusions.

[28] 2010 was the most recent year for which the data were available.

– Table 11 –

4.7 More Sensitivity Tests

Complementary to the statistics and tests presented in the previous sections, we provide an online Appendix with additional sensitivity checks and descriptive statistics. In particular, the Appendix includes (i) more detailed information on the number of control units (affiliates) per country and the number of parents of the control units per country, (ii) some evidence on the macroeconomic environment at the time of the reform (evidence on aggregate dividend income of UK residents, exchange rates, long-term interest rates), and (iii) some sensitivity checks beyond the ones contained in the main text (relating to the heterogeneity of the effect with respect to affiliate, country, and industry characteristics).[29]

5 Conclusions

This paper evaluates how the 2009 UK tax reform affected the behaviour of foreign affiliates of UK-owned multinational firms immediately after the reform. One key element of the reform was to introduce a new *tax exemption system*, replacing the *tax credit system* which was in place before. This change had fundamental implications for the tax incentives for

[29] Let us finally note that we have additional evidence on the insensitivity of the results when a conditional logit ownership location choice model, instead of the mixed logit model, is used. As mentioned above, the rank correlation coefficient between the two propensity score vectors is quite high (Spearman's rank correlation coefficient amounted to 0.77 and Kendall's τ was 0.58). While this makes similar results for conditional logit based and mixed logit based propensity score matching likely, it does not ensure such similarity. We do not report the matching results for the sake of brevity here, but they are available upon request. The ATT estimates based on conditional logit confirm all findings presented in Table 4. Magnitudes of ATTs seem to be slightly underestimated when using conditional logit propensity scores compared to the benchmark ATTs in Table 4.

multinational firms' behaviour: while foreign earnings of UK-owned firms were taxed under the tax credit system, the tax exemption system entails that foreign income is taxed at foreign entities but repatriated income remains tax-exempt in the UK under the new regime.

We suggest an identification strategy to assess the impact of the tax reform on foreign affiliates of UK-owned multinational firms that relies on matching on observables based on propensity scores that are estimated from a multivariate location choice model. This approach allows comparing outcomes of *treated* foreign affiliates which are ultimately owned in the UK with imputed outcomes of counterfactual *control* foreign affiliates which are ultimately owned outside of the UK but exhibit a propensity to be UK-owned which is very similar to the treated units.

Our results imply that foreign affiliates of UK owners responded to the reform by repatriating more foreign dividends than without the reform. The responses are not only statistically but also economically significant with an average effect on the treated firms' dividends of more than US$ 2mn. Apart from dividend repatriation, which was directly affected by the reform, other economic outcomes are found to be affected too. For example, the reform affected affiliate-level investment negatively and the affiliate-level sales-to-fixed-assets ratio positively. However, the latter are only examples of indirect effects of the reform. While our results may be interpreted as short-run effects, a more encompassing (short-and-long-run) analysis thereof would require an in-depth theoretical analysis (as well as more data, as these effects take longer to materialise) to provide more-thoroughly informed empirical work as we can deliver here. Placebo treatments using the same approach in the year prior to the

reform provide statistically insignificant estimates for different outcomes, confirming that the identified effects do not represent statistical artifacts. Further robustness tests (some of which can be found in an online Appendix) are reassuring and suggest that measured firm responses are indeed caused by the implementation of the tax reform. These sensitivity results mainly relate to variations in the control group and also test (by including a large number of affiliate, industry, and country controls) whether our selection-into-UK-ownership model guarantees that a genuine switch-to-tax-exemption effect can be isolated.

In a counterfactual experiment based on our results we may provide a measure for the effective cost of the tax credit system. In particular, our results suggest that the effective tax burden (in terms of tax revenue lost) of the tax credit system amounts to about 2.07 percentage points (formally, this is calculated as $\sum_i (Tax_{j=1} - Tax_i) \cdot DIV_i / \sum_i DIV_i$, i.e., the sum over UK-taxed (minus foreign tax) dividends relative to the sum of gross-of-tax dividend payments). This rough estimate is based on the behavioural assumption that firms repatriated dividends as in the event of the reform, but under the hypothetical assumption that the UK taxed foreign income as under a tax credit system.

Future research should focus not only on how the change in repatriation policy of UK multinationals affected their operations in the home market in general but in particular whether firms became more competitive (in the home and foreign markets). The latter would be interesting since UK tax authorities emphasized this as one important goal of the reform. But of course, while the reform changed repatriation incentives in a fundamental way, it is not clear how productivity or real investment behaviour at home is affected by such a reform and how this is to be measured in a reliable way.

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Tables and Figures

Table 1: Outcome Variables

	Repatriation Pattern:
$DIV_{i,2009}$	is dividends (DIV) paid in 2009
$DIVREL_{i,2009}$	is defined as the ratio of the actual dividends paid in 2009 relative to the maximum amount that could have been distributed in 2009
	Other Indicators:
$SA/FA_{i,2009}$	is defined as the sales-to-fixed-asset ratio of affiliate i
$INV_{i,2009}$	is affiliate i's investment in fixed assets

Notes: Since dividend payments are not directly observed in the data, we follow Bellak and Leibrecht (2010) and calculate $DIV_{i,2009}$ as the difference between available shareholder funds for distribution (equity) after current profits in the 2008 financial statement (Amadeus codes: $SHFD_{i,2008} + PL_{i,2008}$) and available shareholder funds for distribution before current profits in the 2009 financial statement ($SHFD_{i,2009}$). In case we observe negative values, $DIV_{i,2009}$ is set to zero. $DIVREL_{i,2009}$ is defined as the ratio of the actual dividends paid in 2009 ($DIV_{i,2009}$) relative to the maximum amount that could have been distributed in 2009 (Amadeus codes: $SHFD_{i,2008} + PL_{i,2008}$). In case we observe negative values, $DIVREL_{i,2009}$ is set to zero. $SA/FA_{i,2009}$ is defined as the sales-to-fixed-asset ratio of affiliate i (Amadeus codes: $TURN_{i,2009}/FIAS_{i,2009}$). Investment $INV_{i,2009}$ is defined as the change in the fixed assets from 2008 to 2009 (Amadeus codes: $FIAS_{i,2009} - FIAS_{i,2008}$). Both DIV and INV are measured in 1,000 US$

Table 2: Determinants of Ultimate Owner Location

	Mean	Std. Dev.	Min.	Max.
Statutory tax rate$_j$	0.263	0.084	0.100	0.550
log GDP per capita$_j$	9.657	0.856	7.169	11.326
log GDP$_j$	26.177	1.580	22.934	30.182
Voice and accountability$_j$	0.431	0.960	-1.889	1.568
Control of corruption$_j$	0.544	1.075	-1.337	2.421
Government effectiveness$_j$	0.656	0.930	-1.236	2.194
Political stability$_j$	0.223	0.896	-2.756	1.444
Regulatory quality$_j$	0.656	0.857	-1.689	1.835
Rule of law$_j$	0.565	0.968	-1.586	1.937
Common language$_{lj}$	0.037	0.188	0	1
Colony$_{lj}$	0.031	0.147	0	1
log Distance$_{lj}$	7.995	1.083	1.900	9.883
TA$_i$ × Statutory tax rate$_j$	3.438	37.419	-0.282	6,532.679
TA$_i$ × *log* GDP$_j$	342.077	3,550.793	-15.516	358,490.800
TA$_i$ × *log* GDP per capita$_j$	126.201	1,312.758	-5.823	134,529.500
TA$_i$ × Voice and accountability$_j$	5.640	143.161	-22,440.860	18,623.990
TA$_i$ × Control of corruption$_j$	7.117	163.755	-15,875.910	28,758.940
TA$_i$ × Government effectiveness$_j$	8.573	152.659	-14,686.230	26,059.570
TA$_i$ × Political stability$_j$	2.921	125.688	-32,739.400	17,146.470
TA$_i$ × Regulatory quality$_j$	8.575	146.605	-20,059.380	21,797.330
TA$_i$ × Rule of law$_j$	7.389	152.422	-18,835.240	23,006.310

Notes: Descriptive statistics for all variables based on 4,445,136 observations used in the location choice model (see Table 12); TA denotes the total assets of affiliate i in 10mn US$; for a detailed description of the variables used (including data sources), see Section 3.3.

Table 3: Descriptive Statistics (Outcome Variables)

Whole Sample

	All affiliates			UK-owned (Treated)			Non-UK-owned (Control)		
	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Mean	Std. Dev.	N
$DIV_{i,2009}$	6,290.806	116,736.800	58,345	8,097.743	73,683.920	2,393	6,213.526	118,228.800	55,952
$DIVREL_{i,2009}$	0.132	0.233	58,331	0.181	0.267	2,393	0.129	0.231	55,938
$SA/FA_{i,2009}$	125.986	1,879.337	60,044	202.652	2,207.152	2,517	122.632	1,863.628	57,527
$INV_{i,2009}$	5,956.385	288,649.600	61,620	2,470.110	129,624.600	2,585	6,109.041	293,651.100	59,035

Matched Sample

	All affiliates			UK-owned (Treated)			Non-UK-owned (Control)		
	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Mean	Std. Dev.	N
$DIV_{i,2009}$	4,022.099	55,816.830	58,050	6,064.583	37,399.970	2,382	3,934.702	56,469.620	55,668
$DIVREL_{i,2009}$	0.132	0.233	58,036	0.182	0.267	2,382	0.129	0.231	55,654
$SA/FA_{i,2009}$	126.532	1,884.266	59,723	203.613	2,212.390	2,505	123.157	1,868.535	57,218
$INV_{i,2009}$	3,443.149	97,963.31	61,292	430.031	38,082.610	2,573	3,575.181	99,766.710	58,719

Notes: Dividends and Investment are measured in 1,000 US$.

Table 4: Average Effects of the Introduction of Tax Exemption on UK-owned Affiliates

Outcome	ATT	Std. Error	# Treated	# Untreated
$DIV_{i,2009}$	2,150.574***	(804.009)	2,382	55,668
$DIVREL_{i,2009}$	0.051***	(0.005)	2,382	55,654
$SA/FA_{i,2009}$	82.559*	(44.913)	2,505	57,218
$INV_{i,2009}$	-3,050.042***	(859.802)	2,573	58,719

Notes: Coefficients correspond to the average treatment effect on the treated (ATT); # Treated is the number of treated firms and # Untreated the number of matched untreated firms; Matching is on the propensity score from the mixed logit model for the ultimate owner's location choice reported in Table 12; The balancing condition is fulfilled for each outcome; ***, **, and * indicate significance at 1, 5, and 10 percent, respectively.

Table 5: Average Effects of the Introduction of Tax Exemption on UK-owned Affiliates ($Tax_j > Tax_i$)

Outcome	ATT	Std. Error	# Treated	# Untreated
$DIV_{i,2009}$	3,153.790**	(1,368.667)	902	50,872
$DIVREL_{i,2009}$	0.055***	(0.008)	902	50,861
$SA/FA_{i,2009}$	88.773	(101.461)	878	52,586
$INV_{i,2009}$	-3,210.492***	(972.145)	903	53,923

Notes: Coefficients correspond to the average treatment effect on the treated (ATT); # Treated is the number of treated firms and # Untreated the number of matched untreated firms; Matching is on the propensity score from the mixed logit model for the ultimate owner's location choice reported in Table 12; The balancing condition is fulfilled for each outcome; ***, **, and * indicate significance at 1, 5, and 10 percent, respectively.

Table 6: Weighted Regressions Additionally Conditioning on Affiliate-specific Variables

	$DIV_{i,2009}$	$DIVREL_{i,2009}$	$SA/FA_{i,2009}$	$INV_{i,2009}$
$UK\ \ TREAT$	2,183.357**	0.047***	92.450*	-2,981.567**
	(894.019)	(0.006)	(53.227)	(1,200.510)
$AGE_{i,2008}$	117.753***	-0.000	-2.653***	8.844
	(27.131)	(0.000)	(0.800)	(23.738)
$CASH_{i,2008}$	-2,422.289*	0.026	46.668	47.657
	(1,248.370)	(0.026)	(52.598)	(2,542.113)
$INTANG_{i,2008}$	7,239.813	-0.086***	-366.830***	-5,093.129*
	(4,910.615)	(0.032)	(137.731)	(2,873.725)
$PROFIT_{i,2008}$	3,299.065	0.030*	17.343	5,461.269
	(2,231.507)	(0.018)	(14.450)	(6,413.286)

Notes: Coefficient on UK Treatment corresponds to the average treatment effect on the treated (ATT); All estimations include industry dummies; $AGE_{i,2008}$ is the age of the foreign entities i measured as 2011 minus year of incorporation; $CASH_{i,2008}$ is defined as cash and cash equivalent (part of current assets, which is at bank and in the hand of the entity) relative to total assets; $INTANG_{i,2008}$ are the intangible assets held by entity i in 2008 relative to total assets; $PROFIT_{i,2008}$ is profitability of entity i in 2008 measured as profits and loss for a period relative to total assets; Columns refer to the different outcomes; Weighted regressions based on kernel weights from propensity score matching in Table 4; Standard errors in parenthesis; ***, **, and * indicate significance at 1, 5, and 10 percent, respectively.

Table 7: Heterogeneity in Treatment Effects

	$DIV_{i,2009}$	$DIVREL_{i,2009}$	$SA/FA_{i,2009}$	$INV_{i,2009}$
$UK\ \ TREAT$	1,987.953**	0.041***	87.893*	-2,829.975**
	(849.529)	(0.006)	(52.260)	(1,207.080)
$UK \times \overline{AGE}_{i,2008}$	28.385	-0.000	-2.171	-69.002
	(54.814)	(0.000)	(1.660)	(48.816)
$UK \times \overline{CASH}_{i,2008}$	-11,374.309***	0.082**	145.447	2,666.120
	(2,938.596)	(0.038)	(242.171)	(4,012.892)
$UK \times \overline{INTANG}_{i,2008}$	20,152.057*	-0.086*	-461.437**	-10,629.049
	(11,327.844)	(0.045)	(199.187)	(6,890.944)
$UK \times \overline{PROFIT}_{i,2008}$	11,158.585***	0.306***	292.136	-6,744.615
	(4,014.740)	(0.041)	(204.684)	(6,817.448)
$AGE_{i,2008}$	100.830***	0.000	-1.691***	44.129*
	(12.509)	(0.000)	(0.329)	(23.127)
$CASH_{i,2008}$	-712.843	0.011	22.193	-338.953
	(717.646)	(0.012)	(23.842)	(2,796.079)
$INTANG_{i,2008}$	-65.818	-0.035*	-175.683*	-1,463.096
	(651.231)	(0.018)	(92.030)	(1,063.165)
$PROFIT_{i,2008}$	2,653.623	0.013	3.320	5,834.484
	(2,058.911)	(0.009)	(2.391)	(6,691.661)

Notes: Coefficient on UK Treatment corresponds to the average treatment effect on the treated (ATT); All estimations include industry dummies; $\overline{AGE}_{i,2008}$ is the demeaned affiliate-specific variable using the sample average of AGE_{2008}; $\overline{CASH}_{i,2008}$ is the demeaned affiliate-specific variable using the sample average of $CASH_{2008}$; $\overline{INTANG}_{i,2008}$ is the demeaned affiliate-specific variable using the sample average of $INTANG_{2008}$; $\overline{PROFIT}_{i,2008}$ is the demeaned affiliate-specific variable using the sample average of $PROFIT_{2008}$; Columns refer to the different outcomes; Weighted regressions based on kernel weights from propensity score matching in Table 4; Standard errors in parenthesis; ***, **, and * indicate significance at 1, 5, and 10 percent, respectively.

Table 8: Average Effects of the Introduction of Tax Exemption on UK-owned Affiliates (Excluding affiliates from owner countries applying a tax exemption system)

Outcome	ATT	Std. Error	# Treated	# Untreated
$DIV_{i,2009}$	1,448.255*	(854.445)	2,382	8,176
$DIVREL_{i,2009}$	0.052***	(0.006)	2,382	8,175
$SA/FA_{i,2009}$	53.945	(63.645)	2,505	8,381
$INV_{i,2009}$	-2,529.849**	(1,178.355)	2,573	8,592

Notes: Coefficients correspond to the average treatment effect on the treated (ATT); # Treated is the number of treated firms and # Untreated the number of matched untreated firms; ***, **, and * indicate significance at 1, 5, and 10 percent, respectively; All estimations additionally condition on affiliate-specific variables as in Table 6; The results exclude affiliates whose ultimate owner is located in a tax exemption country and Japan, as Japan also switched from a tax credit system to a tax exemption system in 2009.

Table 9: Average Effects of the Introduction of Tax Exemption on UK-owned Affiliates (Excluding affiliates from owner countries applying a tax credit system)

Outcome	ATT	Std. Error	# Treated	# Untreated
$DIV_{i,2009}$	2,307.044**	(911.143)	2,382	47,492
$DIVREL_{i,2009}$	0.046***	(0.006)	2,382	47,479
$SA/FA_{i,2009}$	101.271*	(52.798)	2,505	48,837
$INV_{i,2009}$	-3,019.858**	(1,232.975)	2,573	50,128

Notes: Coefficients correspond to the average treatment effect on the treated (ATT); # Treated is the number of treated firms and # Untreated the number of matched untreated firms; ***, **, and * indicate significance at 1, 5, and 10 percent, respectively; All estimations additionally condition on affiliate-specific variables as in Table 6; The results exclude affiliates whose ultimate owner is located in the following countries, which apply a tax credit system in 2009: Brazil, Chile, China, Colombia, India, Ireland, Korea, Malaysia, Malta, Mexico, New Zealand, Poland, Romania, Singapore, Thailand, and United States.

Table 10: Placebo Treatments 2008

Outcome	ATT	Std. Error	# Treated	# Untreated
$DIV_{i,2008}$	-676.653	(2,223.027)	2,191	52,079
$DIVREL_{i,2008}$	0.003	(0.006)	2,191	52,055
$SA/FA_{i,2008}$	32.151	(62.737)	2,444	55,534
$INV_{i,2008}$	2,662.972**	(1,355.641)	2,395	55,264

Notes: Coefficients correspond to the average treatment effect on the treated (ATT); # Treated is the number of treated firms and # Untreated the number of matched untreated firms; Matching is on the propensity score from the mixed logit model for the ultimate owner's location choice reported in Table 12; The balancing condition is fulfilled for each outcome; ***, **, and * indicate significance at 1, 5, and 10 percent, respectively; All estimations additionally condition on affiliate-specific variables as in Table 6.

Table 11: Treatments 2010

Outcome	ATT	Std. Error	# Treated	# Untreated
$DIV_{i,2010}$	1,681.262	(1,316.742)	1,028	21,931
$DIVREL_{i,2010}$	0.013	(0.009)	1,027	21,926
$SA/FA_{i,2010}$	160.336	(130.224)	992	20,836
$INV_{i,2010}$	-11.012	(2,330.846)	1,047	21,935

Notes: Coefficients correspond to the average treatment effect on the treated (ATT); # Treated is the number of treated firms and # Untreated the number of matched untreated firms; Matching is on the propensity score from the mixed logit model for the ultimate owner's location choice reported in Table 12; The balancing condition is fulfilled for each outcome; ***, **, and * indicate significance at 1, 5, and 10 percent, respectively; All estimations additionally condition on affiliate-specific variables as in Table 6.

Table 12: Ultimate Owner Location Decision

	Mixed logit	
	Mean	Standard Deviation
Statutory tax rate$_j$	-1.236***	-9.507***
	(0.203)	(0.273)
log GDP per capita$_j$	0.938***	-0.004
	(0.031)	(0.039)
log GDP$_j$	1.273***	0.496***
	(0.010)	(0.012)
Voice and accountability$_j$	1.693***	0.001
	(0.039)	(0.024)
Control of corruption$_j$	0.317***	0.011
	(0.043)	(0.021)
Government effectiveness$_j$	1.781***	-0.013
	(0.058)	(0.032)
Political stability$_j$	-0.259***	0.009
	(0.023)	(0.030)
Regulatory quality$_j$	-1.903***	0.004
	(0.049)	(0.022)
Rule of law$_j$	-0.937***	-0.001
	(0.064)	(0.020)
Common language$_{lj}$	-0.369***	0.097
	(0.024)	(0.063)
Colony$_{lj}$	-0.209***	0.098
	(0.028)	(0.062)
log Distance$_{lj}$	-2.664***	1.926***
	(0.015)	(0.016)
TA$_i$ × Statutory tax rate$_j$	-0.003	
	(0.002)	
TA$_i$ × *log* GDP$_j$	0.001***	
	(0.000)	
TA$_i$ × *log* GDP per capita$_j$	0.001**	
	(0.000)	
TA$_i$ × Voice and accountability$_j$	0.001*	
	(0.000)	
TA$_i$ × Control of corruption$_j$	-0.001	
	(0.001)	
TA$_i$ × Government effectiveness$_j$	0.003***	
	(0.000)	
TA$_i$ × Political stability$_j$	0.000	
	(0.000)	
TA$_i$ × Regulatory quality$_j$	-0.001**	
	(0.000)	
TA$_i$ × Rule of law$_j$	-0.002**	
	(0.001)	

Notes: 4,445,136 observations; TA denote the total assets of affiliate i; Standard errors reported in parenthesis; For the mixed logit model, the estimated standard deviation of the coefficient is reported for those variables with random coefficients; ***, **, and * indicate significance at 1, 5, and 10 percent, respectively.

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Figure 1: Allowing for Heterogeneous Tax Effects