The use of tax havens as a real option

Alcino Azavedo[1]
Aston University

Nigel Driffield
University of Warwick

Chris Jones
Aston University

Izidin El Kalak
Cardiff University

Jeffrey J. Reuer
University of Colorado Boulder

Abstract

This paper develops a real options model which shows the theoretical effect of business uncertainty and of having (or not having) a tax haven (TH) affiliate on the timing of foreign direct investments (FDI). It assumes that a multinational firm has a monopoly over the FDI decision, which is seen as a real option and, if it is optimally exercised, leads to an enhancement of the firm's pre-tax profits. In line with the real options literature, we conclude that business uncertainty delays the FDI decision irrespective of whether the multinational firm has a TH affiliate or not, but multinational firms with a TH affiliate invest earlier. This runs counter to the existing literature which indicates that the use of tax havens deters investment. We test this theoretical finding using a firm-level dataset that covers the time period 2009 to 2017 and includes information on 22,703 multinational firms. Using a range of empirical models, we find robust evidence to corroborate our theoretical predictions.

Keywords: Business uncertainty, Foreign Direct Investment, Multinational Firm, Real Options, Tax Haven.

[1] The corresponding author: a.azevedo@aston.ac.uk

1. INTRODUCTION

In recent years international business scholars have become more interested in the use of tax havens by multinational firms and what this means for our understanding of, for example, investment decisions, and the contribution that international business can make to economic development and the lowering of inequality. A recent concern, for example, was that the existence of tax havens essentially increases the opportunity cost of capital in terms of "real investment" and as a result reduces the volume of international investment, and with it, the beneficial effects for locations, particularly in developing countries, of being able to attract certain elements of the global value chain that generate spillovers and productivity growth. These issues are discussed in detail in the JIBS point/counterpoint by Foss et al (2019), Mcgaughey and Raimondos (2019) and Ting and Gray (2019).

The essential argument, on which all three discussants essentially agree, is that with the decline in the tangible components of capital, and more specifically the contribution that tangible capital makes to firm specific advantages, then the use of intangible assets, in particular in a digital form, offers firms the opportunity to both relocate income generating assets to low tax locations and away from large markets that encompass an extensive industrial and consumer base. Building on the traditional analysis of the multinational enterprise, Foss et al. (2019) for example argue, that economic liberalisation has increased capital mobility, and that as a result, low tax locations have become more popular at the expense of more traditional locations. Indeed, as Tørsløv, Wier and Zucman (2022) show, 36 percent of multinational profits are shifted to tax havens globally. In that sense, the current literature posits that capital flowing into tax havens versus capital flowing into traditional locations are seen as substitutes. However, in this paper, we view things differently and show theoretically, through real options theory, and empirically that capital flowing into tax havens is complementary to foreign direct investment.

We show that one needs to view the use of tax havens within the setting of two emerging themes in international business: (1) the distinction between spatially bounded and unbounded firm-specific assets within internalization theory (Narula et al. 2019); and (2) the distinction between endogenous and exogenous risk in terms of FDI entry choice (Buckley et al. 2020). These two themes are seldom considered together, and where they are, it is in the context of the importance of institutions for explaining emerging market FDI (see for

example Barnard, 2021 and Hejazi, Tang, and Wang. 2021). We argue that viewing the use of tax havens based on these two themes generates the following important considerations.

Firstly, that one can view the use of tax havens as part of a MNEs strategy for creating firm specific advantages. Consider the following point: Wei and Nguyen (2020), building on the analysis of Narula *et al.* (2019), posit a hierarchy of firm-specific advantages that are typically augmented by country-specific advantages, which by definition are spatially bounded. However, some firms are able to generate FSAs that are not spatially bounded, and as such those with these "higher order" firm-specific advantages will be better placed to gain from internationalization. The use of tax havens is one form of unbounded firm-specific advantage.

Secondly, Yong and Driffield (2021) highlight the importance of firms being able to deploy assets in a timely manner, and to be agile in terms of their ability to maximise the returns of FDI. A firm's ability to manage and deploy sources of FSAs across locations is a perquisite for sustaining competitive advantages (Sirmon, Hitt, Ireland, Gilbert 2011), and building on Buckley et al (2020), we argue that both exogenous and endogenous uncertainty render this more problematic. A key pre-requisite for deploying resources is therefore flexibility and we argue that tax havens can help provide firms with this enabling them to shift capital across locations to minimise risk. For this reason, Real Options Theory (ROT) is a natural framework to use when explaining the complementarity between capital flowing into tax havens and capital flowing into traditional locations. Our rationale is that firms use tax havens as a "holding position" in the face of uncertainty both at home and abroad and argue that this is particularly pertinent in the "new normal" of policy uncertainty, even in those developed countries seen as having traditionally stable institutional environments.

Tong and Reuer (2007a) outline the advantages that ROT offers in terms of evaluating different investment strategies, particularly in the context of understanding a firm's positioning of itself across different distinct environments. The essential premise is that by becoming multinational, a firm is "buying" certain options which it can then exercise in the future, in response to changing environments or risk profiles. Tong and Reuer (2007a) then argue that ROT offers a better approach with which to evaluate these alternatives. Similar points are made by Brouthers et al. (2008) who argue that ROT is particularly applicable under conditions of high uncertainty, where firms may seek to delay investments but secure an option at a later date

once uncertainties can be re-evaluated. They note that "making decisions using real options theory provides the opportunity to gain knowledge about a market while postponing much of the resource commitment" (Brouthers et al 2008, pp 944). Belderbos and Zhou (2009) extend this argument by making a clear distinction between the growth and switching options that multi-nationality presents, linking this to issues such as exchange rate uncertainty when evaluating divestment decisions.

Theoretically, we contribute to the real options literature by building a model that shows that firm option value is higher to an MNE when it owns a tax haven affiliate. Hence, the optimal FDI threshold is lower for a firm with a tax haven affiliate compared to a firm without a tax haven affiliate, therefore indicating that conventional FDI and FDI into a tax haven are complementary to one another as opposed to being substitutional. We show this formally through our mathematical model and then run a simulation, with assumed parameters, to demonstrate the model graphically to demonstrate the intuition behind our findings. Following this we are then able to generate a number of additional hypotheses from our model that focuses on the role of intangible assets, firm-specific uncertainty, and country-specific uncertainty.

Following our theoretical model, we then apply the model to a rich dataset. We combine firm-level data on tax haven subsidiary ownership with data that identifies whether a firm has or has not engaged in an FDI project during our sample period (2009-2017). This allows us to directly test the complementarity relationship between conventional FDI and the ownership of a tax haven affiliate. Across a number of specifications, using both hazard and logistic models we find strong and robust evidence for the complementary relationship this whilst controlling for a number of confounding factors and the possibility of sample selection by using a matched sample. In addition, we also include a number of tests that examine potential mediating factors that impact on tax haven use and lead to conventional FDI.

This paper proceeds as follows. In section 2 we outline our theory and hypotheses by reviewing the relevant real options literature and applying it to the FDI/tax haven context. We then run a simulation, with predetermined parameters to show the complementary relationship between FDI and tax haven use. In section 3, we explain how our theoretical predictions can be tested using firm level data at the FDI project level and how this relates to tax haven ownership. We also explain the construction of our sample to mitigate sample selection. In section 4 we report our results and robustness tests as well as additional findings that may be

relevant to future research. In section 5 we discuss our results and how they relate to theory, management practice and policy.

2. THEORY AND HYPOTHESES

Kogut and Kulatilaka (1994) provide a formal discrete-time real options model for the option value associated with multinational status. The key idea behind the model is that firms, once they become multinational, are able to learn about the international markets in which they are operating in and are therefore better able to deal with future business uncertainties, such as volatile labour costs, labour market shortages, and unexpected inefficiencies in the supply chain, by expanding the business internationally. Hence, exercising the growth option they had gained when they became a multinational firm. Notice that, the value of the growth option associated with the firms first FDI project might be higher than that associated with all subsequent FDI projects, since the learning benefits from operating internationally may increase at a decreasing rate as they become more international.

In this paper, we develop a theoretical model that guides multinational enterprises (MNEs) on the optimal time to exercise a FDI real option, considering the effect of business uncertainty and the existence (or absence) of a tax haven (TH) affiliate. We show that, *ceteris paribus*, MNEs with a TH affiliate engage earlier in FDI projects compared to MNEs without a TH affiliate. This finding is important, and somewhat counterintuitive, since it contradicts the conventional wisdom that sees the use of a tax haven affiliates and conventional FDI as substitutes. It may explain why, a high and growing proportion of the FDI conducted by MNEs is executed through tax haven subsidiaries (Hines and Rice, 1994, Jones and Temouri, 2016).

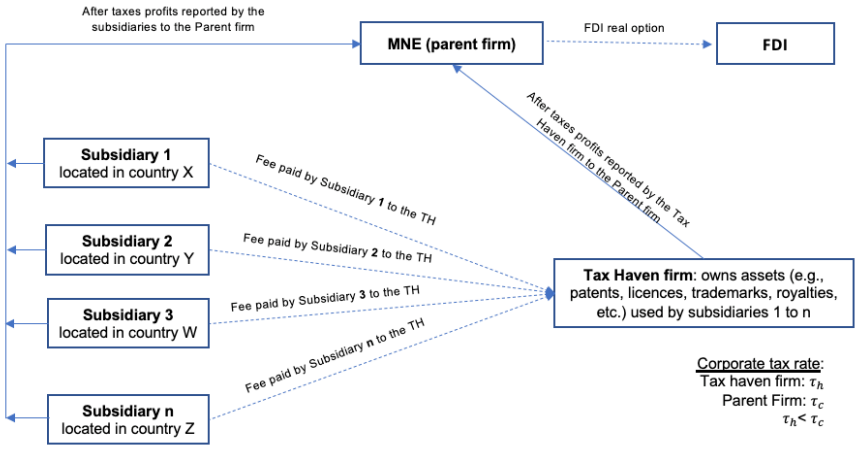
It is a popular practice among MNEs to engage in transfer pricing across domestic and foreign owned affiliates (Gravelle, 2009; Eden, 2009; and Foss et al., 2009). This, is in-part driven by the rise in intangible assets as a growing share of the overall value of MNE output. Since intangibles are often unique to the firm, comparable prices from the external market often do not exist. This allows firms to shift profits from high tax to low tax jurisdictions, and with it avoid corporate income tax. Indeed, the complexity of these transactions

make it more difficult for tax auditors to judge the reasonableness of the pricing transfers[2] and the sophisticated ability of an MNE to "fine-slice the value chain and disperse it geographically" makes it very difficult for policy makers to optimize the corporate tax system (Foss et al., 2019).

A well-known advantage of being a MNE relates to the possibility of hedging risks through their presence in multiple geographic locations, each of which has its own economic environment and associated economic dynamics. Notice that, firms who operate in the domestic market only, before the decision to expand internationally, hold two mutually exclusive options: (1) the option to scale up the domestic business; and (2) the option to engage in FDI. Additionally, while considering FDI, purely domestic firms take into account additional costs such as the liability of foreignness, compared to the decision to expand the business in the domestic market (e.g., monitoring costs and agency costs increase with the distance), so purely domestic firms engage in FDI because the expected value of the firm's growth option, which is embedded in the FDI decision, more than offsets those additional costs.

How do we interpret the above rather unconventional theoretical finding that owning a tax haven subsidiary enhances (or complements) FDI rather than acting as a substitute? Figure 2 illustrates the economic rationale underlying our main finding (see Jones and Temouri, 2015, p. 3).

Figure 2: this figure shows the mechanism through which being present in a tax haven facilitates FDI.



[2] Notice that, by setting the appropriate prices for intra-firm trade, MNE can reduce their tax liabilities.

Let's assume that a parent MNE fully owns a series subsidiaries (1,2…,n) outside of its home location that engage in real economic activity (X, Y, W, Z) and has the capability to invest in a pipeline of FDI projects. The parent firm also owns a subsidiary in a tax haven that happens to own firm specific assets that are in an intangible form such as patents, licenses and trademarks that have been generated by the multinational group. The parent firm also holds cash in the tax haven that it can use to finance FDI projects. Royalty payments flow from the subsidiaries in to the tax haven in order to utilise the intangible assets. The "price" of the royalties is set by the parent, therefore, being present in a tax haven gives the parent firm the option to smooth out the profits generated by its subsidiaries (by increasing/decreasing the royalty payments) as well as the respective tax payments because tax rates may differ across the subsidiaries.

This (tax haven) strategy is more effective if: (i) a relatively significant proportion of the annual turnover of the parent firm comes from countries where taxation policy uncertainty is high (taxes can increase significantly and unexpectedly), (ii) the royalties paid by the subsidiaries to the tax haven firm, which owns the intangible assets, account for a relatively high proportion of the overall price of the product or service sold by the subsidiaries. In such cases, if there is a corporate tax increase in one country, affecting significantly the net profits of a given subsidiary, the parent firm can easily offset the adverse effect on tax payments by increasing the royalty paid by that subsidiary to the tax haven firm - there is a profits shift from the subsidiary, where the corporate tax has increased, to the tax haven where the corporate tax is lower. The tax haven enables the parent firm the option to shift wealth from its subsidiaries to the tax haven firm, being used, therefore, as a taxation policy risk hedging mechanism.

Our formal model above shows that being present in a tax haven reduces the uncertainty underlying a multinational firm's business (ceteris paribus), by reducing taxation policy uncertainty. Therefore, the use of a tax haven complements rather than substitutes for FDI.

2.1 THE MODEL

Let us assume that a MNE (the parent firm) is considering an FDI project that involves an upfront sunk cost (k) and generates an expected pre-tax profit flow (x), on which it pays a corporate tax rate τ_c. The parent firm has a tax haven (TH) affiliate which owns a given proportion (ψ), with $\psi \in (0,1)$, of the parent firm's assets

(cash and intangible assets) and generates a given pre-tax profits flow ψ.x on which it pays a corporate tax rate τ_h , with $0 \leq \tau_h < \tau_c$.[3] Additionally, let us assume that x is uncertain and fluctuates randomly over time according to a Geometric Brownian Motion (GBM) process, given by: [4]

$$dx(t) = \alpha x(t)dt + \sigma x(t)dw(t), \qquad x(0) = 0 \tag{1}$$

where $\alpha < r$, σ and dw are the drift under the risk-neutral measure, the volatility, and the increment of the Wiener process of variable x, respectively; r is the risk-free interest rate.

Following standard real options procedures (see, e.g., Kogut and kulatilka, 1994), we determine the firm's value and the optimal FDI thresholds for a parent firm with (and without) a TH affiliate. Our goal is to investigate whether having a TH affiliate delays or accelerates FDI. We start by defining the firm's value functions, $F_i(x)$, with $i \in (TH, NTH)$, where TH means that the parent firm has a TH affiliate and NTH means that the parent firm does not have a tax haven affiliate

Notice that the differential equation (2) below is similar to the differential Equation (13) in Kogut and Kulatilaka (1994) and, in both cases, describes the evolution over time of the option value. In our case, it is a FDI option, whereas in the case of Kugot and Kulatilak (1994) it is a switch option.

$$\frac{1}{2}\sigma^2 x^2 \frac{\partial^2 F_i(x)}{\partial x^2} + \alpha x \frac{\partial F_i(x)}{\partial x} - rF_i(x) = 0. \tag{2}$$

In the next step of our analytical derivations, we determine the expression for the value of the FDI option and the optimal FDI threshold using the appropriate boundary conditions.[5] It is important to note that the optimal FDI threshold is the value that x (the option's underlying variable) must reach to trigger the FDI decision.[6]

[3] Since the assets that are typically parked in tax havens are cash and intangible assets, in our model derivations, it is assumed that there are no costs in shifting assets from a parent firm to a tax haven firm, and vice-versa.

[4] In this assumption, we follow (Appendix B of) Kogut and kulatilka (1994).

[5] These are the so-called "value-matching" and "smooth-pasting" conditions used in real options models (Dixit and Pindyck, 1994)

[6] Notice that, the FDI option that is held by the parent firm is treated here as a "Perpetual American Call Option". It means that, the parent firm has a perpetual option (not the obligation) to go ahead with the FDI project and should exercise this option if (and only if) the pre-tax profit (x) increases sufficiently reaching the optimal FDI threshold. Hence, the payoff

2.1.1 WITHOUT TAX HAVEN

We begin by calculating the firm value for the case where it does not have a tax haven affiliate (NTH), which is given by:

$$F_{NTH}(x) = \begin{cases} \frac{x(1-\tau_c)}{r-\alpha} + A_1 x^{\beta_1} & if\ x < x_A \\ \frac{x(1+\eta)(1-\tau_c)}{r-\alpha} - k & if\ x \geq x_A \end{cases} \quad (3)$$

where A_1 is the option coefficient; x_A is the optimal FDI threshold, $\eta \in (0, \infty)$ accounts for the magnitude of the pre-tax profit value enhancement caused by the FDI, and β_1 is given by:[7]

$$\beta_1 = \frac{1}{2} - \frac{\alpha}{\sigma^2} + \sqrt{\left(-\frac{1}{2} + \frac{\alpha}{\sigma^2}\right)^2 + \frac{2r}{\sigma^2}} > 1 \quad (4)$$

Specifically, the first row of (3) represents the firm's value for when x_A (the FDI threshold) has not yet been reached: the first term represents the present value of the firm's after-tax profits and second term represents the FDI option value; the second row represents the firm's value for after x_A (the FDI threshold) has been reached: the first term is the present value of the after-tax profits, and the second term is the investment sunk cost (k). Using the appropriate real options framework (boundary conditions), we obtain the constant A_1 (option coefficient) and the threshold x_A.

Notice that our goal is to obtain mathematical expressions for the value of the FDI option and the optimal FDI threshold.[8] These expressions are obtained through the use of the so-called the value-matching and the smooth-pasting conditions, as follows:

$$\frac{x(1-\tau_c)}{r-\alpha} + A_1 {x_A}^{\beta_1} - \frac{x_A(1+\eta)(1-\tau_c)}{r-\alpha} + k = 0 \quad (5)$$

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of this FDI option is similar to that of a call option. When an investment threshold is reached by the option's underlying variable from above, the payoff of the option is similar to that of a put option. For instance, Fisher (2011) assumes that the payoff of the "options to enlarge foreign subsidiaries" is similar to that of a call option.

[7] For the sake of simplicity, we let η be a deterministic factor. In reality, however, it is a function of k, since the larger the invest cost (k), the higher is the pre-tax profit (x) value enhancement caused by the FDI.

[8] For a discussion on the timing of the exercise of a real option, see Kogut (1991) and Miller and Folta (2002).

$$\frac{(1-\tau_c)}{r-\alpha} + \beta_1 A_1 x_A{}^{(\beta_1-1)} - \frac{(1+\eta)(1-\tau_c)}{r-\alpha} = 0 \quad (6)$$

The value-matching condition (5) is obtained by equalizing the first row of the value function (3) with the second row, with the following economic interpretation: the parent firm should exercise the FDI option as soon as the value it obtains from operating its current ongoing business, $\frac{x(1-\tau_c)}{r-\alpha}$, plus the option value to go ahead with a FDI project, $A_1 x^{\beta_1}$, equals the value it will obtain from operating the business after exercising the FDI option discounted of the investment cost, $\frac{x(1+\eta)(1-\tau_c)}{r-\alpha} - k$. The smooth-pasting condition (6) is a first-order condition (the first derivative of (5) in order to x) and ensures that the parent firm's value is maximized when the FDI option is exercised.

Equations (5) and (6) form a system of two equations with two unknown variables, A_1 and x_A, from which we obtain closed-form solutions for the unknown variables, given by:

$$A_1 = \frac{1-\tau_c}{\beta_1(r-\alpha)x_A{}^{(\beta_1-1)}} \quad (7)$$

$$x_A = \frac{-\beta_1(r-\alpha)k}{(1-\tau_c)-\beta_1(1-\tau_c)} \quad (8)$$

2.1.2 WITH TAX HAVEN

Now, let us assume that the multinational firm is considering a FDI project and has a tax haven affiliate which owns a given proportion (ψ) of the firm's assets and is in a location where $0 \leq \tau_h < \tau_c$. In this case, the overall value of the multinational firm is given by:

$$F_{TH}(x) = \begin{cases} \frac{x(\psi(1-\tau_h)+(1-\psi)(1-\tau_c))}{r-\alpha} + A_2 x^{\beta_1} & if\ x < x_B \\ \frac{x(1+\eta)(\psi(1-\tau_h)+(1-\psi)(1-\tau_c))}{r-\alpha} - k & if\ x \geq x_B \end{cases} \quad (9)$$

where A_2 is the option coefficient, and x_B is the optimal FDI threshold. More, specifically, the first row of (9) represents the firm's value for when x_B (the FDI threshold) has not yet been reached: the first term represents the present value of the after-tax profits and the second term represents the FDI option value; the second row represents the firm's value for after x_B has been reached: the first term is the present value of the after-tax

profits, and the second term is the investment cost. Using the appropriate value-matching and smooth-pasting conditions, we obtain the constant A_2 (option coefficient) and the threshold x_B.

The value-matching and the smooth-pasting conditions for this case are the following:

$$\frac{x(\psi(1-\tau_h)+(1-\psi)(1-\tau_c))}{r-\alpha} + A_2 x^{\beta_1} - \frac{x(1+\eta)(\psi(1-\tau_h)+(1-\psi)(1-\tau_c))}{r-\alpha} - k = 0 \quad (10)$$

$$\frac{(\psi(1-\tau_h)+(1-\psi)(1-\tau_c))}{r-\alpha} + \beta_1 A_2 x^{(\beta_1-1)} - \frac{(1+\eta)(\psi(1-\tau_h)+(1-\psi)(1-\tau_c))}{r-\alpha} = 0 \quad (11)$$

The value-matching condition (10) is obtained by equalizing the first row of the value function (9) with the second, with the following economic interpretation: the parent firm should exercise the FDI option the first moment the value it obtains from operating its current ongoing business, $\frac{x(\psi(1-\tau_h)+(1-\psi)(1-\tau_c))}{r-\alpha}$, plus the option value to go ahead with a FDI project, $A_2 x^{\beta_1}$, equals the value it obtains from operating the business after the exercise the FDI option discounted of the investment cost, $\frac{x(1+\eta)(\psi(1-\tau_h)+(1-\psi)(1-\tau_c))}{r-\alpha} - k$. The smooth-pasting condition (11) is a first-order condition (the first derivative of (10) in order to x) and ensures that the parent firm's value is maximized when the FDI option is exercised.

Equations (10) and (11) form a system of two equations with two unknown variables, A_2 and x_B, from which we obtain closed-form solutions for both of the unknown variables, given by:

$$A_2 = \frac{x_B{}^{(1-\beta_1)}\eta(1+\tau_c(-1+\psi)-\tau_h\psi)}{(r-\alpha)\beta_1} \quad (12)$$

$$x_B = \frac{k(r-\alpha)\beta_1}{(-1+\beta_1)\eta(1-\tau_c+\tau_c\psi-\tau_h\psi)} \quad (13)$$

2.1.3 MODEL SIMULATION

In order to study the effect on the FDI threshold of changes in market conditions (model inputs), with and without a TH affiliate, we show a full sensitivity analysis.[9] Table 1 shows the model inputs for the base case:

[9] To save space, here we show our most relevant results only, further results on the sensitivity analysis are provided in Appendix A.

we assume that the multinational (parent) firm pays a corporate tax rate of 25%, whereas the tax haven firm pays a corporate tax rate of 5% only – these inputs should be estimated for each specific case, relying on empirical data. Figure 1 shows our main theoretical findings, that is, how both the value of the FDI real option and the FDI threshold changes with business uncertainty, σ, for both the case where the firm has a TH affiliate and the case where it does not have a TH affiliate.

<Insert Table 1 Here>

<insert Figure 1 Here>

In Figure 1(a), we show that the FDI option value increases with business uncertainty (σ) for both cases, with and without TH, as it is expected. This finding is in line with the international business and the standard real option literature (Dixit and Pindyck, 1994). It also shows that the FDI option value is higher when the firm is present in a TH. Therefore, being present in a tax haven enhances the overall value of the multinational firm, by increasing the FDI option value. Somewhat surprisingly, the relationship between the business uncertainty and the value of the FDI option is not monotonic: when business uncertainty is relatively low, a further decrease in the uncertainty may increase the FDI option value. Figure 1 (b) shows that both FDI thresholds increase with the business uncertainty. Therefore, higher business uncertainty delays FDI investment, as it is expected. The FDI threshold for the "with tax haven" case is, however, lower for the whole range of business uncertainty (σ) values. Therefore, being present in a tax haven enhances FDI.

2.1.4 Theoretical Predictions

From the above theoretical finding, we can formulate the following propositions:

Proposition 2.1: *Ceteris paribus, MNEs with tax haven affiliates invest earlier in FDI than MNEs without tax haven affiliates.*

Proof: see Appendix.

Proposition 2.2: *Higher business uncertainty defers the FDI decision for both MNEs with tax haven affiliates and MNEs without tax haven affiliates.*

Proof: see Appendix.

Proposition 2.3: *Ceteris paribus, as the business uncertainty increases, it defers the FDI decision of MNEs without tax haven affiliates slightly more than the FDI decision of MNEs with a tax haven affiliates.*

Proof: see Appendix.

3. HYPOTHESIS TESTING

3.1 Statistical approach

To examine the link between a firm's tax haven use and the probability of its FDI decision, we employ a survival analysis methodology. Using this method provides two main advantages over a standard logit or probit models. First, the survival analysis is designed to incorporate any variation of the variables under investigation over time (Shumway, 2001; El Kalak and Hudson, 2016). This feature allows us to explicitly model the FDI probability as a function of tax haven use. Second, survival analysis helps in dealing with censored data (Shumway, 2001; Azevedo et al., 2021). Right censored data is one of these issues. That is, at the end of our sample period, there are some firms that do not make an FDI decision, even though there is a positive probability that they may do so in the future.

To test the association between a firm's tax haven ownership and the probability of an FDI decision, we use non-parametric and semi-parametric survival analyses approaches. The non-parametric approach allows us to compare the failure risks and survival rates of firms with a tax haven subsidiary and those without a tax haven affiliate, thereby determining whether tax haven alters the firms' probability of FDI. To this end, we estimate both the hazard function and the survival function.

The hazard function is defined as the conditional probability of failure (i.e., exercising the option to invest in FDI) given that the firm has survived (i.e., did not yet exercised the FDI option) up to a specified time. If ownership of a tax haven affiliate enhances (reduces) the failure risk, the hazard function for firms with a tax haven affiliate will remain below (above) that for firms without a tax haven subsidiary. We estimate the hazard function for firms with and without tax haven subsidiary, separately, using the Nelson-Aalen estimator as per the following:

$$\widehat{H}(t) = \sum_{t_i \leq t} \frac{d_i}{n_i} \tag{14}$$

Where d_i is the number of FDI investments at time t_i, and n_i is the number of firms at risk of having an FDI project at time t_i.

The survival function is defined as the probability that the firm survives (i.e., not exercising its option to invest in FDI) up to a particular time. If the ownership of a tax haven subsidiary increases (decreases) the firms' probability of surviving, the survival function for firms with a tax haven will be above (below) that of firms without tax haven. We estimate the survival function for firms with and without tax haven subsidiaries, separately, using the Kaplan-Meier estimator as per the following:

$$\hat{S}(t) = \prod_{t_i \leq t} \frac{n_i - d_i}{n_i} \quad (15)$$

Where d_i is the number of FDI projects at time t_i, and n_i is the number of firms at risk of having an FDI project at time t_i. Furthermore, we use the log-rank test to examine the difference between the estimated survival curves of firms with tax haven subsidiaries and those without tax haven subsidiaries.

Using the semi-parametric approach, we estimate the effect of tax haven use on the firm's FDI project probability using the Cox proportional hazard model (Cox, 1972). The model is estimated using a panel data structure as per the following:

$$h(t|X_{i,t}) = h(t|0) * e^{\beta_1 \text{TaxHaven}_{i,t} + \beta_j X_{i,t} + \text{Industry dummies} + \text{Country dummies}} \quad (16)$$

where the $h(t|X_{I,t})$ is the hazard rate of firm i conditional on the firm not exercising its option to invest in an FDI project until time t. $h(t|0)$ is the baseline hazard rate when all the covariates are equal to zero. Compared to parametric models who impose a restricted structure on the distribution of survival time, the semi-parametric model allows us not to specify any functional form for the baseline hazard function $H_o(t)$ (Allison, 2010). Further, the results obtained from this semi-parametric model remain robust regardless of how the survival time is distributed (Iwasaki, 2014; Baumöhl et al., 2019). We use the Efron approximation to deal with the right-censoring that refers to firms that have not exercised their option to invest in FDI during the entire observation period. Standard errors of the coefficients are corrected for possible firm-level clustering using a robust-variance estimation method. Furthermore, the models include industry and country fixed-effects using NACE two-digit industry and country dummy controls, respectively.

The sign of the estimated coefficient (β) on an explanatory variable in the above model should be interpreted as follows: a positive (negative) β estimate represents a shorter (longer) duration in time to exercise the option to invest in an FDI project. For example, a positive (negative) (β) estimate on an explanatory variable indicates that this variable speeds up (slows down) the time to exercise the option to invest in an FDI project. Alternatively, we can interpret β as an indication of the partial impact of a given characteristic of the firm on the likelihood of exercising its option to invest in an FDI project, holding the duration constant. The hazard ratio is determined by computing the e^{β}, which reveals how much the probability of exercising the option to invest in FDI increases with a unit change in the independent variable. If an estimate of a hazard ratio is over (below) one for a certain variable, we interpret this variable to be a risk factor (preventing factor), increasing (decreasing) the likelihood of a firm exercising the option to invest in FDI.

3.2 Sample Selection

Our sample is constructed using several sources. First, we obtain international firm-level accounting information from the ORBIS database, which is published by Bureau Van Dijk. Second, we obtain data on FDI investment projects from ORBIS Crossborder Investment. The initial full sample consists of 1,310,565 firm-year observations representing 164,169 firms.[10]

Further, we require total assets and long-term debt to have positive values. We limit our sample to firm-year observations with available data to construct our variables of interests as per equation (16) below. Finally, to obtain meaningful estimates, we restrict our sample to firms with at least three years of observations. Applying these criteria reduces our initial sample to 371,232 firm-year observations representing 57,232 firms.

There may be latent and permanent differences between firms with or without tax haven subsidiaries. Therefore, under the unobserved heterogeneity assumption, having an unmatched sample could lead to biased results in the estimation model. Hence, to mitigate this concern, we utilize a propensity score matching (PSM) procedure, following Drucker and Puri (2005), to match firms with tax haven subsidiaries (treatment group) with firms without tax haven subsidiaries (control group) in the same industry. If there are latent permanent

[10] In this paper, we use the term "firms" to represent "Multinational Enterprises" as all the firms in our sample are multinational enterprises.

differences between firms who own tax haven subsidiaries and firms who don't own tax haven subsidiaries, then those differences should be muted with the matched firms.

Specifically, we estimate a logistic regression modelling the incidence of having a tax haven as a function of firm size and age within the same industry. Using the estimated propensity scores, we apply a nearest-neighbour method. To ensure the adequacy of the matching estimation method, we require that the absolute difference in propensity scores among pairs does not exceed 0.001. If there are more firms-years without a tax haven that meet this criterion, we retain the firm-year with the smallest difference in the propensity scores. The final sample consists of 119,322 firm-year observations representing 22,703 firms for the period from 2009 to 2017.

3.3 Variables and measures

Panel A of Table 1 provides a breakdown of our sample by year, showing the number of firms by FDI (with and without FDI) and tax haven (with and without tax haven). In 2009, the total number of firms is 11,270 firms. Then, it drops to 3,523 firms in 2010. The high number of firms in 2009 relates to the fact that many firms entered the sample before 2009, however, we only start observing their characteristics from 2009 onwards (left censoring). Hence, these 11,270 firms represent firms that were incorporated before 2009 along with firms incorporated in 2009. Also, in 2016 and 2017 we do not have any new incorporated firms. This is because we impose firms to have at least three years of observations to be included in our sample. Despite having zero firms in these two years, we have a representative number of firm-year observations. In general, our sample is highly skewed towards firms without FDI investments. In total, we have 875 firms with FDI investments compared to 21,828 firms without FDI investments. The number of firms by tax haven is relatively comparable across years. In total, we have 11,846 firms with tax haven compared to 10,857 firms without tax haven.

Panel B of Table 1 provides a sample breakdown following the NACE two-digit industry codes as defined by Eurostat. Our sample covers a wide range of industries. The top five industries with the highest number of firms, respectively, are Manufacturing (5,633 firms), Professional (3,705 firms), Financial (3,511 firms), Wholesale retail (2,561 firms), and Others (1,945 firms). The distribution of firms across industries by FDI and Tax haven is consistent with the total sample of firms. For example, among firms with FDI

investments, the highest number of firms operate in Manufacturing (268 firms), Professional (129 firms), Wholesale retail (123 firms), Financial (95 firms), and Others (51 firms).

<Insert Table 2 Here>

Comprehensive definitions of the variables used in our analysis are in Table A1 in the Appendix and descriptive statistics for each variable used are reported in Table 2 .

3.3.1 Dependent Variable

Our dependent variable is an indictor variable that takes the value of one if the firm exercises its option to invest in an FDI project in a particular year, and zero otherwise. Given that we use a survival analysis methodology, in particular, the Cox semi-parametric hazard model,[11] the time to exercise the option is taken into consideration. Under the Cox model estimation, the dependent variable is time-sensitive, hence, it is defined as the time to exercise the real option to invest in FDI, which measures the time between the incorporation date of the firm and the FDI investment event in years. The full sample mean of the number of FDI investments (*FDI*) is 0.9%. On average, a firm has around 1.65 FDI projects activity during the sample period with an average value of $USD 43 million.

3.3.2 Explanatory variables

The main explanatory variable relates to identifying whether a firm has a subsidiary located in a tax haven location. We provide two ways of measuring this. The first variable, TaxHaven1, is defined as an indicator variable that takes the value of one if a parent firm has at least one subsidiary located in a tax haven during the sample period and zero otherwise. The second measure, TaxHaven2, differs from TaxHaven1 in the sense that it is contemporaneous. Hence, it takes the value of one if a parent firm has at least one subsidiary located in a tax haven in a specific year, and zero otherwise.

The definition of a tax haven location is not a simple task. Numerous authors have complied various lists, some of which distinguish between “dot” tax haven which are places like the Cayman Islands and

[11] See section 3.3. for further discussion.

Bermuda versus the bigger "sink" jurisdictions such as Ireland, the Netherlands and Switzerland. In our analysis we use the lists complied by Jones & Temouri (2016), Jones, Temouri and Cobham (2018) and a more conservative approach based on the EU blacklist published in 201? We acknowledge that the latter may have been influenced by significant political pressure. According to both tax haven measures (*TaxHaven1* and *TaxHaven2*), on average, approximately, half of our sample observations have tax haven subsidiaries.

3.3.3 Control Variables

The control variables used in equation (3) are: the level of *Intangibility*, *Profitability*, *ProfitGrowth*, *Profit Growth Uncertainty*, *Corporate Tax rate*, *Cash*, Firm *Size*, *Leverage*, *Ln(FirmAge + 1)*, *Fixed Assets*, and *Tangibility*.

<Insert Table 3 Here>

4. RESULTS

4.1 Non-Parametric Analysis

We estimate the hazard and survival functions for both groups of firm-year observations with tax haven subsidiaries and those without tax haven subsidiaries using the *TaxHaven1* measure. Figure 2 plots both the Nelson-Aalen cumulative hazard estimates (hazard function) and the Kaplan-Meier survival estimates (survival function). The Nelson-Aalen estimates show that the hazard curve for firms with a tax haven is above that for firms without a tax haven subsidiary. The gap between both curves widens as the length of time increases. On the contrary, the Kaplan-Meier estimates show that the survival curve for firms with a tax haven subsidiary is below that of firms without a tax haven subsidiary. Further, the log- rank test for the equality of survival functions shows that the estimated survival curves of the two groups (with and without tax haven) are different at the 1% significance level. Based on these findings, we show that firms with tax haven subsidiaries have a higher risk profile of exercising their option to invest in FDI and lower survival profile compared to firms without tax haven.[12] This provides initial support for hypotheses 1 such that firms who own tax haven

[12] We run the same test using our second measure of tax haven (TaxHaven2) and find similar results.

subsidiaries are much more likely to engage in FDI earlier than those firms who do no own tax haven subsidiaries. Hence, capital flows into tax havens complement capital flows into traditional markets.

4.2| Non-Parametric Analysis

Table 3 reports the estimation results of the Cox proportional hazards model of the probability of a firm exercising its option to invest in FDI as per equation (16). Models (1) and (2) report the results (i.e., coefficient and hazard rate) for different tax haven measures namely: *TaxHaven1* and *TaxHaven2*, respectively. The coefficients in both models are positive and statistically significant (at the 1% level). These results provide further support for our hypothesis that firms owning a tax haven subsidiary play a positive and significant role in affecting the probability of firm exercising its option to invest in an FDI project. Hence building on our findings for the parametric analysis.

Models (3) and (4) report the results (i.e., coefficient and hazard rate) for tax haven measures namely: *TaxHaven1* and *TaxHaven2*, respectively, along with all the control variables reported in equation (3). The coefficients in models (3) and (4) are positive and statistically significant (at the 1% level). This suggests that firms with a tax haven subsidiary have a higher probability of investing in an FDI project compared to firms who don't own a tax haven subsidiary. As per model (16), the hazard rate of 1.636 indicates that the probability of FDI investment is 63.6% (= (1.636 – 1) * 100) higher for firms with a tax haven subsidiary compared to those without a tax haven subsidiary.

<Insert Figure 2 Here>

In addition, we find that the coefficient of firm's intangible assets (*Intangibility*) to be positive and significant in both models (3) and (4). This shows that a firm's intangible assets are positively associated with the firm's probability of FDI investment. In model (3), the hazard rate of 3.094 indicates that a one unit increase in intangible assets increases the probability of FDI investment by a multiple of 2 relative to the normal hazard rate value of one.

Most of the results for our control variables are consistent with the previous literature. For example, firm's profitability (*Profitability*) is positively associated with the firm's probability of an FDI investment, while the firm's uncertainty about its profitability growth is negatively associated with the probability of FDI

investment. As per the results in model (3), the hazard rate of 2.219 (0.974) indicates that a one-unit increase (decrease) in firm's profitability (uncertainty of growth profitability) increases (decreases) the probability of FDI investment by a multiple of 2.2 (2.6%) relative to the normal hazard rate value of one. Also, we find that firm's cash holding ratio, size, and tangibility ratio are positively associated with the probability of FDI investment, whereas fixed assets ratio is negatively associated with FDI investment.

<Insert Table 4 Here>

4.3| Robustness Tests

We present the results of several robustness tests in Tables 5 and 6. First, we re-estimate our main model using different measures of tax havens. Following Jones and Temouri (2016), Jones, Temouri and Cobham (2018) and the EU Blacklist. Table 5 reports the results. For brevity, only the estimates for the variables of interest are reported. The coefficients of all models are positive and statistically significant (at the 1% level). These findings are all qualitatively similar to those in Table 4.

<Insert Table 5 Here>

Our second robustness test considers an alternative estimation model. As logistic models are equivalent to hazard models, but without considering the time to event, we re-do the analysis using a logisitc model estimation. Model (1) of Table 6 provides the estimation results of a logistic regression model.

The specification includes the same set of control variables as well as year, industry, and country dummies which are used in equation (3). The dependent variable is an indicator variable equals one if the firm have a tax haven subsidiary, and zero otherwise. The results support our hypothesis. The coefficient of the variable of interest (i.e., *TaxHaven1*) is positive and statistically significant (at the 1% level). The marginal effect of *TaxHaven1* is 0.008. Given that the standard deviation of *TaxHaven1* is 0.494, a one standard deviation increase in tax haven use increases the likelihood of exercising the option to invest in FDI by 0.395% (=0.008 * 0.494).

The third robustness test aims to address the left censoring issue. Left censoring issue arises due to the inability to observe the entire duration of a firm as several firms enter the sample after their incorporation date. The estimation results could be biased if this issue is not addressed (Ongena and Smith, 2001). If the results are sensitive to left censored observations, a change in the first observed year creates instability among the parameter estimates. Hence, we change the starting date of our sample period from 2009 to 2010 and estimate our main model once again. The results are reported in model (2) of Table 6. The coefficient of *TaxHaven1* is positive and statistically significant (at the 1% level) despite the change in the starting year. These results are qualitatively similar to our main findings.

Our final robustness test is to exclude firms with multiple FDI investments (i.e., recurring events) during the sample period. As per Table A.3. in the Appendix, we have 199 firms that exercised their option to invest in FDI more than once during the sample period from 2009 to 2017. Our model handles recurring events by assuming a dependence across observations from the same firm. However, failure times (i.e., times to exercises the option to invest in FDI) may be correlated within the same firm. Therefore, to ascertain that our main results are robust to the existence of recurring events, we drop firms with more than one FDI investment during the sample period. Model (3) or Table 5 shows that the coefficient of *TaxHaven1* is positive and statistically significant (at the 1%). This is in line with our main estimation results in Table 3.

<Insert Table 6 Here>

4.4| The Role of External and Internal Uncertainty

Based on our theoretical model, we show that firms with tax haven subsidiaries have a higher propensity to exercise their option to invest in an FDI project. In this section, we examine whether external (at the country-level) and internal (at the firm-level) uncertainties can affect certain firms and make it optimal for them to exercise their option to invest in FDI. In other words, we want to test whether external (i.e., economic policy uncertainty, regulatory quality, and industrial/technological disaster) and internal (i.e., business risk) uncertainties affect the firms' propensity to have a tax haven subsidiary which, in turn, leads to changes in the probability of an FDI investment. Therefore, we follow prior studies (e.g., Azevedo et al. (2021) and El Kalak

et al. (2022)) and perform a four-step procedure and a series of Sobel tests to examine this mediation relationship.

Figure 3 illustrates the mediation relation. Path A indicates the association between the causal variable (external and internal uncertainties) and the mediating variable (tax haven ownership). Path B shows the link between the mediating variable (tax haven ownership and the outcome variable (the probability of an FDI investment project). In Path B, if the causal variable (external and internal uncertainties) is significant while the use of a tax haven subsidiary is significant in explaining the probability of an FDI investment, the mediation effect can be viewed as complete. Otherwise, if both the causal and mediating variables are both significant in explaining the probability of FDI investment, the mediation effect would only be partial (El Kalak et al., 2022).

<Insert Figure 3 Here>

We perform formal tests of the mediation effect of tax haven use following Sobel (1982). Specifically, the Sobel test statistics are computed as follows:

$$Sobel\ Test = \frac{\alpha_a \alpha_b}{\sqrt{\alpha_b^2 \delta_a^2 + \alpha_a^2 \delta_b^2}} \tag{17}$$

where α_a and δ_a are the estimated coefficient and standard error for *internal and external uncertainties (EPU, RoL, NumCasulties*, and *BusinessRisk)* in the Path A analysis; α_b and δ_b are the estimated coefficient and standard error for the tax haven proxy (*TaxHaven1*) in the Path B analysis.

Table 7 reports the estimation results. Panel A of Table 6 reports the estimation results for Path A analysis. In this step, we regress tax haven (*TaxHaven1*) (mediator), separately, on each of the four variables representing uncertainty namely, Economic Policy Uncertainty (*EPU*), Rule of Law (*RoL*), Number of casualties resulting from technological-related incident per country (*NumCasulties*), and firm's business risk (*BusinessRisk*). The results show that *EPU*, *RoL* and *BusinessRisk* are positively and significantly associated with using a tax haven. This indicates that higher external and internal uncertainties lead to a higher propensity to have tax haven subsidiaries. The marginal effects for each model's parameters are reported. A one standard

deviation increases in *EPU*, *RoL*, and *BusinessRisk* leads to an increase in the propensity of owning a tax haven subsidiary by 0.528% (=0.014 * 0.377), 3.546% (=0.059 * 0.601), and 0.182% (=0.009 * 0.202), respectively.

Panel B of Table 7 reports the results for the Path B analysis that includes both the tax haven and an uncertainty proxy. Across the four models, we find that the coefficients for *TaxHaven1* are positive and statistically significant (at the 1% level). Moreover, the coefficient of *EPU* is negative and statistically significant (at the 10% level). However, the coefficients for the remaining uncertainty measures are insignificant. More importantly, the results from the Sobel tests in Panel C of Table 7 show that the mediating effect of uncertainty is significant in the *EPU*, *RoL*, and *BusinessRisk* models. These findings provide evidence to support our theoretical predication that internal and external uncertainties intensify the propensity to have tax haven subsidiaries, which partially explains the increase in the probability of FDI investment over time.

<Insert Table 7 Here>

To offer further evidence of the mediating role of tax haven, we follow El Kalak et al., (2022) and formulate an alternative, two-stage approach. In the first stage, we regress the tax haven proxy (*TaxHaven1*) on each of the internal and external uncertainties proxies, separately. Then, in the second stage, we regress the time to FDI investment, using a Cox proportional hazard model, on the predicted value of the channel variable in the first stage, that is on the variation in tax haven explained by each proxy of internal and external uncertainties, separately. The control variables and fixed effects identical to those in the baseline models are included in both stages; except that in the first stage, we additionally control for time fixed effects. Note that this two-stage approach is similar to an instrumental variable approach, except that internal and external uncertainties proxies are not treated as the instruments for the tax haven proxy, since internal and external uncertainties may affect the probability of FDI investment through channels other than changes in tax haven.

Models (1), (3), (5), and (7) report the first stage estimation results using a logistic regression model where the dependent variable is *TaxHaven1*. The results show that *EPU*, *RoL*, and *BusinessRisk* have positive and statistically significant association with the propensity to tax haven subsidiaries. In models (2), (4), (6), and (8), the second stage estimation results are provided using the Cox proportional hazard rate where the dependent variable is the time to exercise the option to invest in FDI. We find that the predicted *EPU*, *RoL*,

and *BusinessRisk* are significantly associated with having lower tax haven subsidiaries. Overall, these results provide further evidence to the role of internal and external uncertainties in affecting tax haven which plays a mediating role in explaining the changes in the probabilities of FDI investments.

<Insert Table 8 Here>

5. DISCUSSION

The purpose of our analysis is to highlight the trade-off between the need for firms to be flexible, and the need to spread risk, and in turn the role that the use of tax havens, both as locations from which to exploit FSAs that are not spatially bounded, and also as temporary homes of investment capital from which to exploit future options.

Firstly, our results demonstrate, in contrast to previous comments, that multinationals use tax havens as springboards for FDI. This offers a more dynamic perspective on what firms use tax havens for. Previous analysis has suggested that the existence of tax havens effectively increases the opportunity cost of capital and reduces the probability of a firm engaging in a particular investment project. While we do not necessarily take issue with this, we argue that an alternative effect dominates: firms who have non-spatially bounded FSAs use tax havens as locations from which to exploit these in other countries, obviously with the intention of minimising the tax liable on these returns. This we demonstrate the link between firms' specific assets, tax haven presence and FDI. The opacity offered by tax havens here must not however be under-stated. Most countries offer significant tax incentives to encourage firms to generate intellectual property, on the assumption that not only are such investments beneficial for growth and productivity, but also that such public support will be repaid in the form of tax on the profits these assets generate. Our results however suggest that the use of tax havens reduces it, but rather allows to firms to exploit these benefits through FDI in a relatively low tax environment.

Secondly, we illustrate the interaction between the effects outlined above and business uncertainty. Increased business risk at home increases the likelihood of firms locating assets in tax havens, and in turn

investing in FDI. Thus, we are able to better understand the relationships between for example risk and FDI, and the role that tax havens play in firms mitigating risk.

Taken together therefore, our results offer a different critique on the use of tax havens by international business to that offered by the current literature. We do not find that the existence of tax havens removes investment capital from the real economy in the way suggested by the previous literature, but rather simply reduces the tax liability for firms on the returns generated by their firm specific assets. In other words, tax havens increase the returns to FDI at the expense of the home country taxpayer, and also potentially the host country tax payer, through license payments for example, but they do not reduce the propensity for FDI.

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FIGURES & TABLES

Figure 1: this figure shows the effect of the business uncertainty (σ) on both the FDI option value (figure at the top) and the FDI threshold (figure at the bottom).

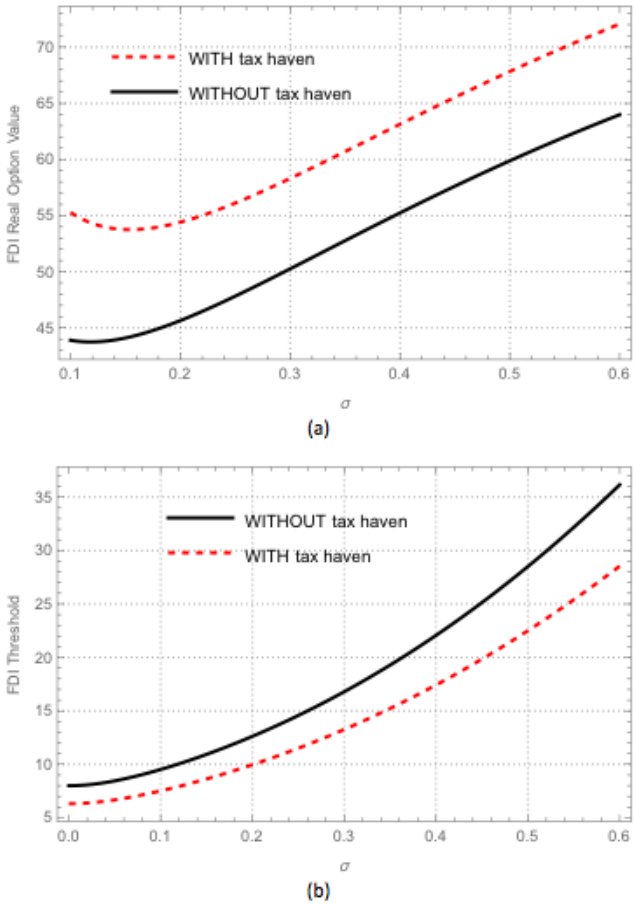

Figure 2: The hazard and survival functions

This figure presents the hazard functions (plots of Nelson-Aalen Cumulative hazard estimates) and the survival functions (plots of Kaplan-Meier survival estimates) The hazard and survival functions are estimated for both sub-samples of firms with tax haven and without tax haven subsidiary using the variable *TaxHaven1*. Variable definition is given in table A.1., appendix.

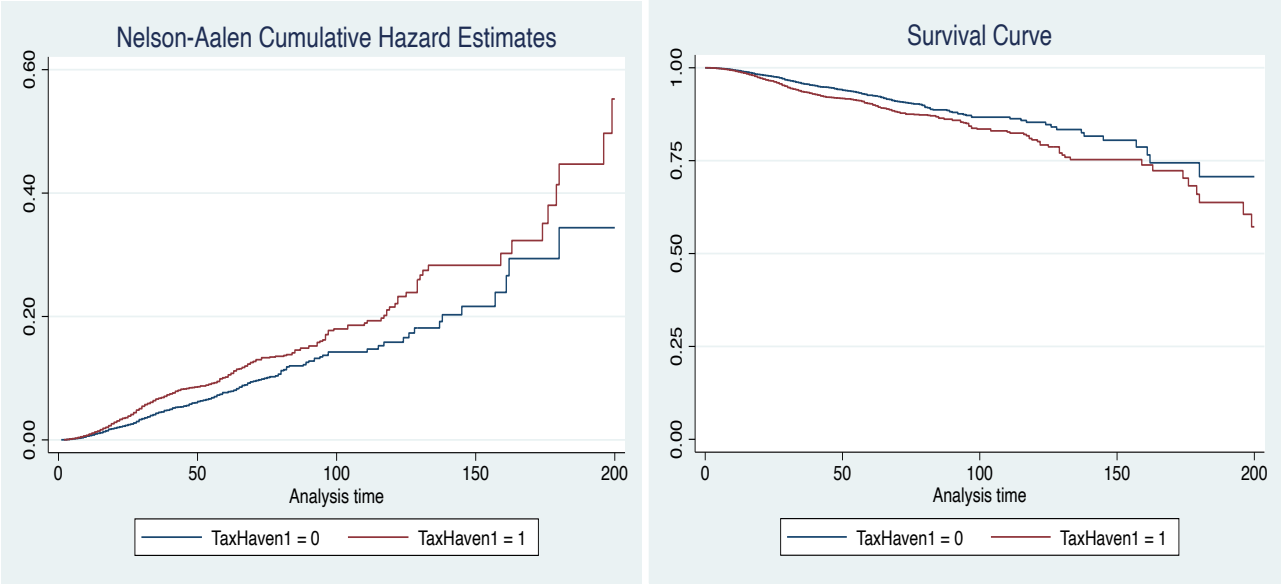

Figure 3: Mediation Link

This figure shows how external and internal uncertainties affect parent firm's propensity to have a subsidiary in a tax haven location, which, in turn, affects its probability to exercise the real option to engage in foreign direct investments.

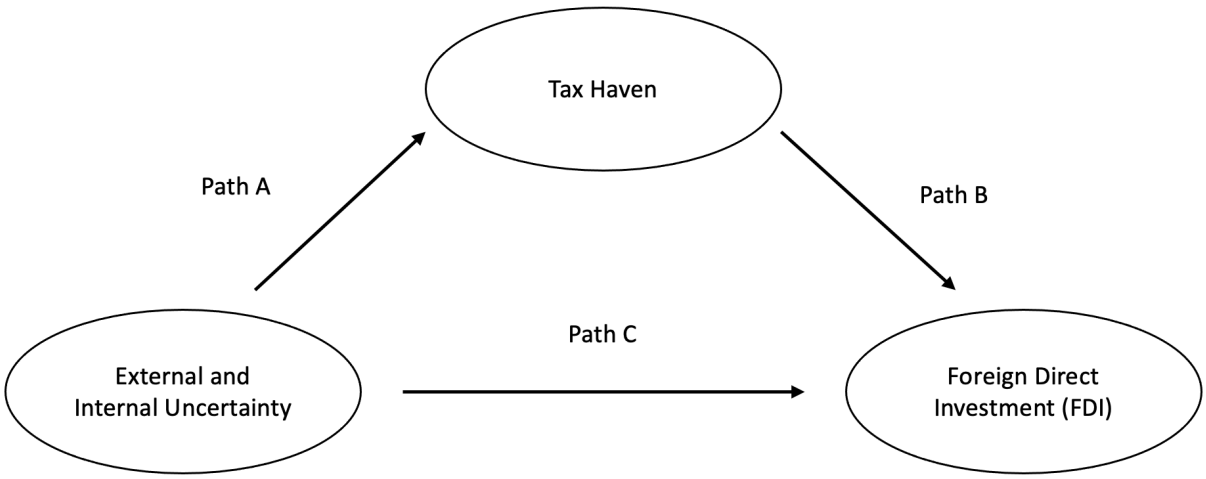

Table 1: Model Inputs

This table displays the model inputs for the base case.

VARIABLE DESCRIPTION	NOTATION	VALUE
Pre-tax profit	x	10
Risk-free interest rate	r	0.06
Pre-tax profit growth rate	α	0.02
Pre-tax profit volatility	σ	0.30
% of pre-tax profit parked in a tax haven (TH)	ψ	0.40
% of pre-tax profit enhancement due to FDI	η	0.50
Corporate tax rate: tax haven	τ_h	0.05
Corporate tax rate: outside the tax haven	τ_c	0.25
Foreign Direct Investment sunk cost	k	50

Table 2: Descriptive statistics

Panel A reports the sample distribution by year. Panel B reports the sample breakdown by industry. The total number of firms, firms per FDI and Tax haven are reported. The number of firms come from a sample that consists of 119,322 firm-year observations from 22,703 unique firms listed on exchanges across 46 countries over the period from 2009 to 2017. FDI is an indicator variable equals one if a firm exercise the option to invest in FDI at least once during the sample period, and zero otherwise. Tax haven is an indicator variable, constructed following Jones and Temouri (2018), equals one if a firm has a tax have in a particular year, and zero otherwise. We restrict at least three firm-year observations for a firm to be included in our sample; hence, years 2016 and 2017 have zero new entrants.

Panel A: Distribution by year

	Total	by FDI		by Tax Haven	
		With FDI	Without FDI	With Tax Haven	Without Tax Haven
2009	11,270	463	10,807	6,520	4,750
2010	3,523	120	3,403	1,421	2,102
2011	2,342	72	2,270	993	1,349
2012	2,330	81	2,249	1,154	1,176
2013	1,919	88	1,831	1,020	899
2014	1,048	36	1,012	593	455
2015	271	15	256	145	126
2016	0	0	0	0	0
2017	0	0	0	0	0
Total	22,703	875	21,828	11,846	10,857

Panel B: Distribution by industry

	Total	by FDI		by Tax Haven	
		With FDI	Without FDI	With Tax Haven	Without Tax Haven
Accommodation	158	7	151	77	81
Administration	879	31	848	462	417
Agriculture	76	1	75	43	33
Arts	50	1	49	29	21
Construction	656	6	650	349	307
Education	28	0	28	16	12
Energy	236	20	216	121	115
Financial	3,511	95	3,416	1,762	1,749
Human Health	59	0	59	26	33
Information	1,514	95	1,419	772	742
Manufacturing	5,633	268	5,365	2,879	2,754
Mining	157	4	153	72	85
Professional	3,705	129	3,576	1,834	1,871
Real Estate	727	13	714	383	344
Transportation	772	30	742	409	363
Water	36	1	35	22	14
Wholesale Retail	2,561	123	2,438	1,429	1,132
Others	1,945	51	1,894	1,161	784
Total	22,703	875	21,828	11,846	10,857

Table 3: Summary statistics

This table reports summary statistics for our main variables. All variables come from a sample that consists of 119,322 firm-year observations from 22,703 unique firms listed on exchanges across 46 countries over the period from 2009 to 2017. Statistics of the *NumFDI* and *ValueFDI* are based on the number of observations for which there is an FDI event, i.e., 1,074 firm-year observations representing 875 firms. Monetary values are reported in home country's currency. Variable definitions are in Table A.1 in the Appendix.

	Mean	Std. Dev.	25%	Median	75%
FDI	0.009	0.094	0	0	0
NumFDI	1.650	1.823	1	1	2
ValueFDI (in millions)	43.017	168.673	3.17	10.665	44.590
TaxHaven1	0.58	0.494	0	1	1
TaxHaven2	0.498	0.5	0	0	1
Intangibility	0.071	0.135	0.001	0.01	0.068
Profitability	0.043	0.145	0.002	0.038	0.09
ProfitGrowth	-0.046	3.355	-0.576	0.009	0.455
ProfitGrowthUncertainty	1.851	3.874	0.001	0.397	1.535
CorporateTax	0.306	0.058	0.263	0.309	0.344
Cash	0.114	0.146	0.015	0.06	0.154
Size	11.819	1.886	10.749	11.985	13.042
Leverage	0.138	0.195	0	0.06	0.2
Ln(FrimAge+1)	3.152	0.815	2.639	3.178	3.714
FirmAge (in years)	31.033	27.634	13	23	40
FixedAssets	0.467	0.269	0.254	0.441	0.67
Tangibility	0.182	0.199	0.019	0.112	0.284

Table 4: Estimation of Cox proportional hazards model

This table reports the results from the Cox proportional hazards model examining the association between tax haven and probability of FDI investment. The sample includes 119,322 observations of which 1,074 observations of FDI investments. The full sample period is between 2009 and 2017. The dependent variable is the time to exercise the real option to invest in FDI, which measures the time between the IPO date and the FDI investment event in years. The independent variables of interest are two tax haven measures following Jones and Temouri (2018) namely (*TaxHaven1*) and (*TaxHaven2*). Control variables include intangible assets ratio (*Intangibility*), profitability ratio (*Profitability*), the 3 years rolling window of growth rate of profitability (*ProfitGrowth*), the 3 years rolling window of the standard deviation of profitability growth rate (*ProfitGrowthUncertainty*), annual corporate tax rate at the country level (*CorporateTax*), cash holdings ratio (*Cash*), the natural logarithm of total assets (*Size*), total long term debt ratio (*Leverage*), the natural logarithm of firm age plus one (Ln(FirmAge+1)), fixed assets ratio (*FixedAssets*), and tangible assets ratio (*Tangibility*). The Coefficients (Coeff.) measure the partial impact of each variable on the likelihood of FDI investment, conditional on duration. The Hazard Ratio (HR) gives an estimate of how much the hazard of FDI investment increases for a unit change in the variable of interest. Variable definitions are given in Table A.1, Appendix. Country and Industry fixed effects are included. Standard errors are clustered by firms. Standard errors are shown in parentheses below coefficient estimates. Wald Chi-squared and log pseudolikelihood (LL) are provided. The ***, **, * indicate statistical significance at the 1%, 5%, and 10% level.

	Without Controls				**With Controls**			
	(1)		(2)		(3)		(4)	
	Coeff.	HR	Coeff.	HR	Coeff.	HR	Coeff.	HR
TaxHaven1	0.347***	1.415			0.492***	1.636		
	(0.077)				(0.075)			
TaxHaven2			0.316***	1.372			0.423***	1.526
			(0.074)				(0.073)	
Intangibility					1.129***	3.094	1.150***	3.159
					(0.248)		(0.248)	
Profitability					0.797**	2.219	0.797**	2.218
					(0.341)		(0.342)	
ProfitGrowth					-0.007	0.993	-0.006	9.9
					(0.013)		(0.013)	
ProfitGrowthUncertainty					-0.026***	0.974	-0.026***	0.974
					(0.010)		(0.010)	
CorporateTax					1.654	5.227	1.520	4.571
					(2.917)		(2.914)	
Cash					0.909***	2.481	0.928***	2.529
					(0.243)		(0.241)	
Size					0.405***	1.499	0.398***	1.489
					(0.023)		(0.023)	
Leverage					-0.298	0.742	-0.295	0.744
					(0.222)		(0.221)	
Ln(FrimAge+1)					-0.060	0.941	-0.056	0.946
					(0.051)		(0.051)	
FixedAssets					-0.925***	0.397	-0.916***	0.400
					(0.198)		(0.197)	
Tangibility					0.612***	1.845	0.591**	1.806
					(0.234)		(0.233)	
Country FE	Yes		Yes		Yes		Yes	
Industry FE	Yes		Yes		Yes		Yes	
Observations	119,322		119,322		119,322		119,322	
Chi-squared	1,413.44		1,333.32		2,997.33		3,580.70	
LL	-10,108.63		-10,110.92		-9,865.353		-9,872.555	

Table 5: Robustness tests – Alternative tax haven definitions

This table reports the results from our robustness tests using different definitions of our independent variable of interest. Following Jones and Temouri (2016), we use TaxHaven16, *Big8, and EUTaxHaven* . The dependent variable is the time to exercise the real option to invest in FDI, which measures the time between the IPO date and the FDI investment event in years. Control variables include intangible assets ratio (*Intangibility*), profitability ratio (*Profitability*), the 3 years rolling window of growth rate of profitability (*ProfitGrowth*), the 3 years rolling window of the standard deviation of profitability growth rate (*ProfitGrowthUncertainty*), annual corporate tax rate at the country level (*CorporateTax*), cash holdings ratio (*Cash*), the natural logarithm of total assets (*Size*), total long term debt ratio (*Leverage*), the natural logarithm of firm age plus one (Ln(FirmAge+1)), fixed assets ratio (*FixedAssets*), and tangible assets ratio (*Tangibility*). For brevity, we only report the independent variables of interest. The Coefficients (Coeff.) measure the partial impact of each variable on the likelihood of FDI investment, conditional on duration. The Hazard Ratio (HR) gives an estimate of how much the hazard of FDI investment increases for a unit change in the variable of interest. Variable definitions are given in Table A.1, Appendix. Country and Industry fixed effects are included. Standard errors are clustered by firms. Standard errors are shown in parentheses below coefficient estimates. Wald Chi-squared and log pseudolikelihood (LL) are provided. The ***, **, * indicate statistical significance at the 1%, 5%, and 10% level.

	(1)		(2)		(3)	
	Coeff.	HR	Coeff.	HR	Coeff.	
TaxHaven16	0.271***	1.311				
	(0.084)					
Big8			0.833***	2.299		
			(0.084)			
EUTaxHaven					0.409***	1.505
					(0.083)	
Controls	Yes		Yes		Yes	
Year	No		No		No	
Country FE	Yes		Yes		Yes	
Industry FE	Yes		Yes		Yes	
Observations	119,322		119322		119322	
Chi^2	1,963.41		2028.5		2272.96	
LL	-9,887.98		-9819.92		-9879.473	

Table 6: Additional robustness tests

This table reports the results from our robustness tests. The results in model (1) are estimated using a logit model where the dependent variable is an indicator variable equals to one if the firm exercises the real option to invest in FDI in a given year, and zero otherwise. The results in model (2) are estimated using the Cox proportional hazards model after addressing the left censoring problem that may arise in the sample. The results in model (3) are estimated using the Cox proportional hazards model after excluding firms with multiple FDI investments during the sample period. The independent variable of interest is TaxHaven1 measured following Jones and Temouri (2018). For model (1), we include year fixed effects in addition to country and industry fixed effects. Standard errors are clustered by firms. Standard errors are shown in parentheses below coefficient estimates. Marginal Errors (ME) are provided for each variable. For models (2) and (3), the model specifications, fixed effects, and standard error adjustment of the robustness tests follow those in the model (3) reported in Table XX. The ***, **, * indicate statistical significance at the 1%, 5%, and 10% level.

	Logit		**Left Censoring**		**Without Multiple FDIs**	
	(1)		(2)		(3)	
	Coeff.	ME	Coeff.	HR	Coeff.	HR
TaxHaven1	0.546***	0.008	0.492***	1.636	0.421***	1.523
	(0.079)		(0.075)		(0.077)	
Intangibility	1.252***	0.019	1.129***	3.094	1.447***	4.251
	(0.255)		(0.248)		(0.254)	
Profitability	0.828**	0.013	0.797**	2.219	0.423	1.526
	(0.345)		(0.341)		(0.330)	
ProfitGrowth	-0.009	-0.0001	-0.007	0.993	-0.009	0.991
	(0.013)		(0.013)		(0.013)	
ProfitGrowthUncertainty	-0.025***	-0.0004	-0.026***	0.974	-0.008	0.992
	(0.010)		(0.010)		(0.010)	
CorporateTax	-8.363***	-0.129	1.654	5.227	-2.156	0.116
	(2.993)		(2.917)		(3.715)	
Cash	0.992***	0.015	0.909***	2.481	0.838***	2.311
	(0.249)		(0.243)		(0.249)	
Size	0.454***	0.007	0.405***	1.499	0.363***	1.438
	(0.025)		(0.023)		(0.024)	
Leverage	-0.267	-0.004	-0.298	0.742	-0.218	0.804
	(0.225)		(0.222)		(0.219)	
Ln(FrimAge+1)	-0.025	-0.0004	-0.060	0.941	-0.051	0.950
	(0.052)		(0.051)		(0.050)	
FixedAssets	-0.942***	-0.015	-0.925***	0.397	-0.844***	0.430
	(0.202)		(0.198)		(0.199)	
Tangibility	0.614***	0.009	0.612***	1.845	0.467*	1.596
	(0.238)		(0.234)		(0.241)	
Constant	-9.928***					
	(1.562)					
Year FE	Yes		No		No	
Country FE	Yes		Yes		Yes	
Industry FE	Yes		Yes		Yes	
Observations	66,338		95,849		118,343	
Chi-squared	1,039.24		2,997.25		4,018.9	
LL	-4,877.771		-9,865.352		-6,655.953	
Pseudo-R^2	0.1121					

Table 7: Mediation analysis – The impact of external and internal uncertainty

This table reports results of our mediation tests examining whether external and internal uncertainties affect tax haven, which in turn, affects the probability of FDI. Our mediation test comprises three steps (see section ??? for further details). Panel A, reports the findings of our first step (Path A). In this step, we regress tax haven (*TaxHaven1*) (mediator), separately, on each of the four variables representing uncertainty namely, Economic Policy Uncertainty (*EPU*), Rule of Law (*RoL*), Number of casualties resulting from technological-related incident per country (*NumCasulties*), and firm's business risk (*BusinessRisk*). Then, we take the coefficient and standard errors of each uncertainty variable (Aa, Ba). We use a logit model estimation where the dependent variable is Tax Haven (*TaxHaven1*), which is an indicator variable equals to one if the firm exercises the real option to invest in FDI in a given year, and zero otherwise. We report the marginal effects (ME) for the logit models in Step one. Panel B, reports the results of our second step (Path B). We estimate the baseline Cox proportional hazards model. In this model, we regress the time to exercise the real option to invest in FDI, which measures the time between the IPO date and the FDI investment event in years on the causal variable (i.e., external and internal uncertainty) and the mediating variable (i.e., *TaxHaven1*), simultaneously. We report Hazard Rates (HR) for the Cox models estimated in step two. In panel C, we report the estimated coefficients and standard errors of interest from the baseline models for the two paths. Then, we report the computed values of the Sobel test. Variable definitions are given in Table A.1, Appendix. The standard errors are reported below the coefficients in between brackets and are corrected for firm-level clustering effects. Wald Chi-squared and log pseudolikelihood (LL) are provided. The ***, **, * indicate statistical significance at the 1%, 5%, and 10% level.

Panel A: Path A- The association between tax haven and external and internal uncertainties.

	TaxHaven1							
	(1)		(2)		(3)		(4)	
	Coeff.	ME	Coeff.	ME	Coeff.	ME	Coeff.	ME
EPU	0.068***	0.014						
	(0.023)							
RoL			0.280***	0.059				
			(0.072)					
NumCasulties					-0.0003	-0.0001		
					(0.001)			
BusinessRisk							0.045**	0.009
							(0.022)	
Intangibility	0.427***	0.090	0.427***	0.090	0.407***	0.086	0.347***	0.074
	(0.115)		(0.115)		(0.118)		(0.130)	
Profitability	0.245***	0.052	0.243***	0.051	0.229***	0.048	0.119	0.025
	(0.079)		(0.079)		(0.081)		(0.092)	
ProfitGrowth	-0.004	-0.001	-0.004	-0.001	-0.005*	-0.001	-0.001	-0.0001
	(0.003)		(0.003)		(0.003)		(0.003)	
ProfitGrowthUncertainty	0.002	0.000	0.001	0.000	0.001	0.000	0.004	0.001
	(0.002)		(0.002)		(0.003)		(0.003)	
CorporateTax	0.673*	0.142	0.487	0.103	0.755**	0.159	1.544***	0.327
	(0.354)		(0.355)		(0.365)		(0.382)	
Cash	0.927***	0.196	0.923***	0.195	0.872***	0.184	0.930***	0.197
	(0.112)		(0.112)		(0.115)		(0.125)	
Size	-0.348***	-0.073	-0.348***	-0.073	-0.350***	-0.074	-0.346***	-0.073
	(0.010)		(0.010)		(0.010)		(0.011)	
Leverage	-0.087	-0.018	-0.087	-0.018	-0.101	-0.021	-0.003	-0.001
	(0.070)		(0.070)		(0.072)		(0.083)	
Ln(FrimAge)	0.137***	0.029	0.137***	0.029	0.136***	0.029	0.166***	0.035
	(0.020)		(0.020)		(0.021)		(0.022)	
FixedAssets	0.386***	0.081	0.386***	0.081	0.379***	0.080	0.354***	0.075
	(0.065)		(0.065)		(0.067)		(0.076)	
Tangibility	-1.126***	-0.237	-1.126***	-0.237	-1.116***	-0.235	-1.145***	-0.242
	(0.084)		(0.084)		(0.086)		(0.095)	
Constant	5.250***		5.200***		5.245***		4.845***	
	(0.573)		(0.574)		(0.582)		(0.584)	
Time FE	Yes		Yes		Yes		Yes	
Industry FE	Yes		Yes		Yes		Yes	
Country FE	Yes		Yes		Yes		Yes	
Observations	119,271		119,271		114,314		101,700	
Chi-squared	2,912.930		2,940.400		2,760.270		2,518.140	
LL	-7,257.885		-7,257.318		-6,945.376		-6,2091.252	
Pseudo-R^2	0.105		0.106		0.105		0.104	

Table 8: Mediation analysis – The impact of external and internal uncertainty (Cont.)

Panel B: Path B: - The association between both tax haven and uncertainties and the probability of FDI

	Time to FDI							
	(1)		(2)		(3)		(4)	
	Coeff.	HR	Coeff.	HR	Coeff.	HR	Coeff.	HR
TaxHaven	0.487***	1.627	0.484***	1.622	0.530***	1.699	0.442***	1.555
	(0.074)		(0.074)		(0.076)		(0.077)	
EPU	-0.244*	0.784						
	(0.125)							
RoL			-0.373	0.689				
			(0.490)					
NumCasulties					-0.004	9.9		
					(0.004)			
BusinessRisk							0.016	1.016
							(0.085)	
Intangibility	1.130***	3.095	1.129***	3.093	1.216***	3.372	0.732***	2.079
	(0.243)		(0.244)		(0.251)		(0.263)	
Profitability	0.775**	2.170	0.777**	2.175	0.802**	2.230	0.801**	2.227
	(0.334)		(0.334)		(0.351)		(0.372)	
ProfitGrowth	-0.006	0.994	-0.006	0.994	-0.007	0.993	-0.006	0.994
	(0.013)		(0.013)		(0.014)		(0.014)	
ProfitGrowthUncertainty	-0.026***	0.975	-0.026***	0.975	-0.027***	0.974	-0.022**	0.978
	(0.009)		(0.009)		(0.010)		(0.010)	
CorporateTax	1.560	4.759	1.597	4.938	1.743	5.713	0.988	2.686
	(2.813)		(2.849)		(2.878)		(2.922)	
Cash	0.893***	2.441	0.898***	2.455	0.864***	2.372	0.895***	2.448
	(0.239)		(0.239)		(0.248)		(0.258)	
Size	0.398***	1.489	0.398***	1.489	0.398***	1.489	0.385***	1.470
	(0.022)		(0.022)		(0.023)		(0.025)	
Leverage	-0.278	0.757	-0.283	0.754	-0.306	0.737	-0.362	0.696
	(0.217)		(0.217)		(0.226)		(0.240)	
Ln(FrimAge)	-0.057	0.945	-0.057	0.944	-0.048	0.953	-0.040	0.961
	(0.050)		(0.050)		(0.052)		(0.053)	
FixedAssets	-0.908***	0.403	-0.911***	0.402	-0.936***	0.392	-0.627***	0.534
	(0.195)		(0.195)		(0.202)		(0.213)	
Tangibility	0.597***	1.816	0.596***	1.814	0.664***	1.943	0.291	1.337
	(0.230)		(0.230)		(0.236)		(0.246)	
Industry FE	Yes		Yes		Yes		Yes	
Country FE	Yes		Yes		Yes		Yes	
Observations	119,271		119,271		114,314		101,700	
Chi-squared	3,912.05		4,285.88		8,186.66		3,122.58	
LL	-9,884.129		-9,886.004		-9,398.522		-9,023.867	

Panel C. Mediation tests using Sobel tests

	EPU		*RoL*		*NumCasulties*		*BusinessRisk*	
Path	A	B	A	B	A	B	A	B
Coefficient	0.068	0.487	0.280	0.484	-0.0003	0.530	0.045	0.442
Standard Error	0.023	0.074	0.072	0.074	0.001	0.076	0.022	0.077
Sobel Test	2.687***		3.345***		-0.300		1.911*	
p-value	0.007		0.001		0.764		0.056	

Appendix A

Table A.1: Definition of Variables

Name	Definition
Main variables	
FDI	Indicator variable: One if a firm exercise the real option to make a Foreign Direct Investment (FDI) at least once during any year of the sample period, and zero otherwise.
NumFDI	The number of FDI projects in a given year.
ValueFDI (in millions)	The monetary value of the FDI project in a given year. Monetary values are reported in home country's currency in millions of the monetary unit.
TaxHaven1	Indicator variable: One if a parent firm has at least one subsidiary located in one of the following tax havens during any year of the sample period and zero otherwise. Following Jones and Temouri (2018), Tax Haven locations are: Andorra, Anguilla, Antigua, Aruba, Bahamas, Bahrain, Barbados, Barbuda, Belize, Bermuda, Botswana, British Virgin Islands, Brunei Darussalam, Cayman Islands, Cook Islands, Curacao, Cyprus, Dominica, Ghana, Gibraltar, Grenada, Guatemala, Guernsey, Hong-Kong, Isle of Man, Jersey, Lebanon, Liberia, Liechtenstein, Luxembourg, Macao, Macedonia, Malaysia, Marshall Islands, Mauritius, Monaco, Montserrat, Nauru, Netherlands Antilles, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent, Samoa, San Marino, Seychelles, Singapore, Turks and Caicos Islands, UAE, Uruguay, and Vanuatu.
TaxHaven2	Indicator variable: One if a parent firm has at least one subsidiary located in one of the following tax havens in a specific year, and zero otherwise. Tax Haven locations are similar to those of TaxHaven1.
Control variables	
Intangibility	Intangible assets divided by total assets. Intangible assets include expenditure such as formation expenses, research expenses, goodwill, development expenses and all other expenses with a long-term effect.
Profitability	Pre-tax profit divided by total assets. Pre-tax profit …??
ProfitGrowth	The three years average rolling window of the firm's profit growth rate which is defined as the annual change in pre-tax profit.
ProfitGrowthUncertainty	The three years average rolling window of the firm's profit growth uncertainty which is defined as the standard deviation of the firm's profit growth (ProfitGrowth).
CorporateTax	This is obtained from a number of sources including the Ernst & Young Worldwide Corporate Tax Guide; IBFD Tax Research Platform; IBFD Global Corporate Tax Handbook; European Tax Handbook; ZEW Intermediate Report; Deloitte Tax Highlights and International Tax and Business Guide; KPMG Tax Rate Survey; and the PKF Worldwide Tax Guide.
Cash	Cash and cash equivalent divided by total assets.
Size	Natural logarithm of total assets.

Leverage	Long-term debt divided by total assets. Long-term debt is defined as loans and financial obligations owed for a period exceeding 12 months. This can include bank loans, mortgage bonds, debentures, or other obligations not due for 12 months.
Ln(FrimAge+1)	Natural logarithm of firm's age plus one. The age of the firm is calculated since the incorporation year.
FixedAssets	Fixed assets divided by total assets. Fixed assets include ….??
Tangibility	Tangible assets divided by total assets. Tangible assets include …??
Alternative Tax haven variables	
TaxHaven2016	Indicator variable: One if a parent firm has at least one subsidiary located in one of the following tax havens during any year of the sample period and zero otherwise. Following Jones and Temouri (2016), Tax Haven locations are: Andorra, Anguilla, Antigua, Barbados, Bahrain, Bermuda, Bahamas, Belize, British Virgin Islands, Cayman Islands, Cook Islands, Cyprus, Isle of Man, Jersey, Gibraltar, Grenada, Guernsey, Liechtenstein, Luxembourg, Macao, Malta, Monaco, Netherlands Antilles, Saint Kitts and Nevis, Saint Lucia, Saint Vincent, Seychelles, and Turks and Caicos Islands.
Big8	Indicator variable: One if a parent firm has at least one subsidiary located in one of the following tax havens during any year of the sample period and zero otherwise. Tax Haven locations are: Hong-Kong, Ireland, Lebanon, Liberia, Panama, Singapore, Switzerland, and Netherland.
EUTaxHaven	Indicator variable: One if a parent firm has at least one subsidiary located in one of the following tax havens during any year of the sample period and zero otherwise. Tax Haven locations are: American Samoa, Bahrain, Barbados, Grenada, Guam, Korea (Rep), Monaco SAR, Marshall Islands, Mongolia, Namibia, Palau, Panama, Staint Lucia, Samoa, Trinidad and Tobago, Tunisia, and UAE.
Uncertainty variables	
EPU	Economic Policy Uncertainty index. This measure is downloaded from Baker, Bloom, and Davis economic policy uncertainty database.
RoL	Reverse of the "Rule of Law" dimension. High values indicate higher risk. This measure is downloaded from the World Governance Indicator (WGI) published by the World Bank.
NumCasulties	Number of casualties from industrial and technical disasters. This measure is constructed using data from EM-DAT.
BusinessRisk	The three years average rolling window of the firm's business risk which is defined as the standard deviation of the firm's growth rate (GrowthRate).
GrowthRate	The three years average rolling window of the firm’s growth rate which is defined as the annual change in total sales

Table A.2: Distribution by country
This table reports firms' distribution per country, FDI investment, and tax haven. The number of firms come from a sample that consists of 119,322 firm-year observations from 22,703 unique firms listed on exchanges across 46 countries over the period from 2009 to 2017. FDI is an indicator variable equals one if a firm exercise the option to invest in FDI at least once during the sample period, and zero otherwise. Tax haven is an indicator variable, constructed following REFERENCE, equals one if a firm has a tax have in a particular year, and zero otherwise.

	Total Sample	Per FDI		Per Tax Haven	
		With FDI	Without FDI	With Tax Haven	Without Tax Haven
Argentina	24	8	24	19	5
Australia	393	0	385	227	166
Austria	465	20	445	166	299
Belgium	1,691	38	1,653	1,172	519
Brazil	65	0	65	31	34
Bulgaria	33	0	33	23	10
Canada	90	6	84	40	50
Chile	30	0	30	14	16
China	486	14	472	366	120
Croatia	76	1	75	39	37
Czech Republic	48	1	47	5	43
Denmark	664	50	614	359	305
Estonia	23	1	22	5	18
Finland	393	15	378	132	261
France	2,530	83	2,447	1,460	1,070
Germany	2,276	83	2,193	823	1,453
Greece	152	3	149	111	41
Hungary	36	0	36	9	27
Iceland	24	0	24	9	15
India	335	16	319	262	73
Indonesia	39	0	39	34	5
Ireland	220	7	213	84	136
Israel	76	3	73	35	41
Italy	2,801	75	2,726	1,370	1,431
Japan	1,743	52	1,691	1,149	594
Korea, Rep.	103	2	101	27	76
Luxembourg	240	15	225	126	114
Mexico	29	1	28	11	18
Netherlands	1,076	48	1,028	432	644
New Zealand	27	0	27	13	14
Norway	611	16	595	349	262
Poland	112	4	108	44	68
Portugal	223	7	216	104	119
Romania	16	0	16	4	12
Russian Federation	59	1	58	23	36
Saudi Arabia	11	0	11	9	2
Serbia	45	1	44	27	18
Slovenia	88	1	87	52	36
South Africa	81	2	79	66	15
Spain	1,880	62	1,818	825	1,055
Sweden	1,022	51	971	457	565
Switzerland	116	19	97	76	40
Turkey	44	2	42	13	31
Ukraine	7	0	7	0	7
United Kingdom	1,527	78	1,449	868	659
United States	673	89	584	376	297
Total	22,703	875	21,828	11,846	10,857

Table A.3: FDIs distribution per firm

This table reports the number of instances a firm exercised its real option to make a foreign direct investment during our sample period from 2009 to 2017.

Number of FDIs	Number of Firms
1	875
2	161
3	28
4	9
5	1
Total	1,074

Appendix B

B1. Proposition Proofs

To be completed…