Multinationals and Uncertainty: The Role of Internal Capital Markets*

Jianlin Wang
Leavey School of Business
Santa Clara University

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Abstract

My paper studies how different external lenders interact through the internal capital markets of multinational enterprises (MNEs). I first theoretically demonstrate that agency problems can make MNEs allocate external debt at the subsidiary level for delegated monitoring. When local shocks strengthen the monitoring incentive of subsidiary-level external lenders, MNEs can substitute subsidiary-level external debt with cheaper parent-level external debt to stabilize local shocks' deleveraging pressure, without destroying the monitoring incentive. Using a special period of Brexit as a natural experiment, I provide evidence on the stabilizing effect of the external debt substitution at both the parent and subsidiary levels.

Keywords: multinational enterprises, internal capital markets, debt structure, uncertainty shocks, Brexit

JEL Codes: F23, F34, D81, G30

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1 Introduction

How do multinational enterprises (MNEs) connect external lenders through their internal capital markets (ICMs)? ICMs play a vital role in the interaction of MNEs with external capital markets. They allow MNEs to borrow globally with the cash flows of their subsidiaries and enable the reallocation of capital internally to substitute external debt. Understanding how the ICMs connect different external lenders of MNEs is important as this connection shapes the funding capacity of MNEs, which are a prominent force in the global economy.[1]

Despite its importance, how MNEs interact with different external lenders through their ICMs has not been fully understood. The existing literature has studied whether domestic business groups use their ICMs to allocate assets efficiently (e.g., Santioni, Schiantarelli, and Strahan 2020), how MNEs respond to global credit supply shocks binding the borrowing constraint of the entire business group (Biermann and Huber 2023), and how MNEs utilize ICMs to improve the performance of their subsidiaries in emerging markets (e.g., Kalemli-Ozcan et al. 2016) or to maximize tax benefits (e.g., Goldbach et al. 2021). So far, little attention has been paid to the interconnection of external lenders through the ICMs of MNEs, especially among developed countries. My paper fills this gap by studying how the external lenders at the parent (group) level interact with those at the subsidiary level, and the unique role of subsidiary-level external lenders in the response of MNEs to local shocks.

Compared with domestic firms, multinational parents have a financing advantage since an MNE's cash flows in different countries are exposed to different shocks. Such international diversification can allow the parent company to use cross-subsidization across countries to lower its default risk and the overall volatility of cash flows (Erel, Jang, and Weisbach 2020). While the diversification benefit grants a financing advantage to multinational parents, MNEs still use a substantial amount subsidiary-level external debt without a parent-level guarantee

[1]Multinational parents and their subsidiaries account for around one-third of global output, 50% of international trade, and 25% of global employment (Cadestin et al. 2018). In the US, about half of the publicly traded firms are MNEs, which account for 57% of the market value of the equity market and have 40% of their aggregate sales as foreign sales (Erel, Jang, and Weisbach 2020). In the EU, intra-group debt accounts for about one-third of non-financial corporate debt, while the intra-group debt-to-GDP ratio stands at 47% and is trending upwards, according to the OECD as of 2020.

(Chowdhry and Nanda 1994).[2] In fact, the significant usage of subsidiary-level external debt is the case even among domestic subsidiaries (Kolasinski 2009). Existing studies have largely purpose that subsidiary-level external debt can serve as a device to mitigate agency problems between a parent company and its subsidiaries.[3]

Given the reasons for borrowing external debt at both parent and subsidiary levels, the first contribution of my paper is to derive the optimal mix of parent- and subsidiary-level external debt, which can help explain how MNEs respond to local country-level shocks. Specifically, subsidiary-level external lenders are important to the debt structure of an MNE for at least two reasons. First, as local lenders, they can have advantages in monitoring subsidiaries over (foreign) shareholders. Thus, an MNE can use them for delegated monitoring to lower the risk premium of parent-level external debt because the delegated monitoring can act as a commitment device to discipline the behavior of subsidiaries. Secondly, to convince the parent-level external lenders that the subsidiary-level external lenders will monitor and discipline the subsidiaries ex post, an MNE needs to give the subsidiary-level external lenders enough skin in the game. Effectively, MNEs can use subsidiary-level external debt as informed capital, following Holmstrom and Tirole (1997). The informed capital is expensive due to monitoring cost and, in this context, the standalone default risk. As a result, if an MNE opts to use the informed capital, it is optimal to allocate a minimum portion of their external debt at the subsidiary level to incentivize the delegated monitoring. Then the parent company can utilize its diversification benefit and finance the rest of the subsidiary using uninformed capital at the parent level, including parent-level external debt.

With the optimal debt structure in equilibrium, the second contribution of my paper is to demonstrate how the parent- and subsidiary-level external debt of MNEs interconnect through the ICM when facing local country-level shocks. A key insight of my arguments is that subsidiary-level informed capital providers are important. When a local shock enhances the monitoring incentive of subsidiary-level external lenders, MNEs will have an incentive to

[2]Henceforth, subsidiary-level external debt refers to the standalone external debt of a subsidiary.

[3]For example, firms can use subsidiary-level external debt as a commitment device to reduce rent-seeking and inefficient cash flow diversification among subsidiaries (Jensen 1986; Scharfstein and Stein 2000; Rajan et al. 2000), or to prevent subsidiary-level excessive risk-taking (Flannery et al. 1993; Kahn and Winton 2004). See Kolasinski (2009) for empirical evidence supporting these arguments.

activate their ICMs and use additional parent-level external debt to stabilize the impact of the shock. For example, following a country-level increase in uncertainty, lenders can have a stronger incentive to monitor their borrowers in the country, as the misbehavior of the latter can lead to a higher increase in the probability of default.[4] As a result, a MNE can afford to lower the portion of external debt allocated at the subsidiary level without destroying the lenders' incentive to monitor. This effectively enables an MNE to improve its debt structure by substituting subsidiary-level external debt with parent-level external debt, which lowers the overall cost of funds as the latter can benefit from diversification.

Without the usage of subsidiary-level informed capital, a contractionary shock that lowers a firm's expected return will cause it to deleverage, as the firm seeks to equalize its expected marginal return to its marginal cost of funds in equilibrium. This point applies to MNEs in that a local contractionary shock will create deleveraging pressure on both the unconsolidated balance sheet of a subsidiary and the consolidated balance sheet of its parent company. Admittedly, compared with independent firms, the deleveraging pressure for subsidiaries of MNEs in the same country can be smaller as MNEs can divert cash flows through their ICMs to support the subsidiaries. However, asides from the reallocation of cash flows, there is little reason for a MNE to increase parent-level external debt so that the *consolidated* leverage of the business group remains stable. After all, a negative shock to a subsidiary is a negative shock to its parent company since the latter is the shareholder of the former.

While MNEs can have incentives to substitute external debt across ICMs following local country-level shocks, whether such substitution can significantly affect their debt structure and mitigate any deleveraging pressure is fundamentally an empirical question. The third contribution of my paper is to answer this question. To do this, I perform two Difference-in-Differences (DID) analyses, based on the consolidated financial statements of US MNEs and the unconsolidated financial statements of their UK subsidiaries, using the uncertainty shock during the Brexit interregnum as a natural experiment.

There are several reasons why I investigate the substitution of external debt through the lens of uncertainty shocks. First, uncertainty shocks are a natural candidate for studying

[4]Following an uncertainty shock, a borrower can also have a higher probability of earning greater profits, though this will benefit the shareholders, not the lenders who receive fixed interest rate payments.

shocks that change the monitoring incentive of external lenders, especially in a non-crisis environment. Intuitively, given any default threshold and the distribution of a borrower's returns ex ante, a lender has incentives to monitor the borrower ex post if the misbehavior of the latter can sufficiently increase the default probability by deteriorating the return distribution. A positive uncertainty shock enhances the monitoring incentive because it redistributes probability density towards the tails of the distribution, making any deterioration caused by the misbehavior more costly.

Secondly, the study of uncertainty shocks is important as uncertainty has been at the forefront of discussions among policymakers, academics, and investors for at least the past two decades.[5] Understanding how uncertainty shocks interconnect external lenders through the ICMs of MNEs adds a novel channel through which uncertainty can impact the economy and financial markets, especially internationally.

Thirdly, uncertainty shocks are relevant in both crisis and non-crisis environments. The existing literature tends to focus on the role of ICMs during crises (Desai et al. 2008; Kalemli-Ozcan et al. 2016; Santioni, Schiantarelli, and Strahan 2020). However, just like monetary policy shocks, uncertainty shocks are also applicable in a non-crisis environment. As uncertainty shocks can affect the monitoring incentive that drives the portion of external debt allocated at the subsidiary level, they allow me to investigate the substitution of external debt by MNEs across ICMs in a more generalized context.

To identify a country-level uncertainty shock, I use the period between the announcement of the Brexit vote and the first Brexit proposal by the UK government as a natural experiment. This period, which I call the Brexit interregnum (6/23/2016-12/31/2018), offers me a valuable natural experiment for at least three reasons. First of all, there has been a large, broad, and persistent rise of uncertainty in the UK during the interregnum, following the mostly unexpected Brexit vote, with relatively little other change (Bloom et al. 2019). Notably, the UK remained inside the EU during the interregnum, meaning no real changes

[5]The Federal Open Market Committee (FOMC) minutes repeatedly highlighted uncertainty as a crucial factor in every recession since 2000. Recent macroeconomics and finance research studies the role of policy uncertainty in business cycles and its effect on financial markets (Pastor and Veronesi 2012; Baker, Bloom, and Davis 2016; Ozdagli and Wang 2024).

caused by the actual Brexit had occurred. Bloom et al. (2019) use detailed surveys to show that, except for the strong initial reaction after the Brexit vote for a few months, the interregnum was dominated by severe uncertainty about the Brexit negotiations, while the expected Brexit outcome was a soft Brexit.[6] Hassan et al. (2024) confirm that the Brexit shock predominantly affects firms through uncertainty, as opposed to sentiment, even though there was negative sentiment, especially after the rejection of a soft Brexit. To minimize the impact of a negative first-moment shock, I therefore stop my sample at the end of 2018, before the first Brexit proposal by the UK government signalling a soft Brexit was rejected and a no-deal Brexit became an increasingly real concern.[7]

The second reason why the Brexit interregnum is a valuable natural experiment is that the credit supply in the UK was well stabilized by the Bank of England (BoE) (Broadbent 2017; BoE 2017; BoE 2018). The interregnum thus offers me an opportunity to identify a country-level uncertainty shock, without a credit supply shock, which usually tangles with uncertainty shocks, especially during crises. The stable credit market in the UK also helps rule out the possibility that MNEs were substituting external debt due to local credit stress.

The third reason why the natural experiment is appealing is that the UK plays a significant role in the activities of MNEs. It is one of the top 5 countries that hosts inward production of foreign MNEs' majority-owned subsidiaries (Cadestin et al. 2018). It is also one of the most important countries for US MNEs in terms of the output and value added by their majority-owned foreign subsidiaries (BEA 2021). As a result, the UK uncertainty shock can impose sizable impacts on MNEs, including US MNEs.

Using the UK uncertainty shock during the Brexit interregnum as a natural experiment, I perform my first DID analysis at the parent level, utilizing detailed information on the *consolidated* capital and debt structures that publicly traded US MNEs are required to disclose. Based on the data from Capital IQ and Compustat, together with the complete

[6] A soft Brexit means the UK's relationship with the EU would be as close as possible to what it was before Brexit.

[7] Note that my natural experiment does not require a zero first-moment shock since the substitution of external debt across the ICMs only requires the uncertainty shock that changes the monitoring incentive of subsidiary-level external lenders. A negative first-moment shock creates a deleveraging pressure for MNEs, as does a rise in uncertainty. Thus, a negative first-moment shock will make it more difficult for MNEs to stabilize their leverage, at least at the consolidated level, via the substitution of external debt.

ownership structure from Orbis, I examine how US parent companies with UK subsidiaries respond to the UK uncertainty shock, relative to those without a UK subsidiary.[8] I find that US MNEs with UK subsidiaries raise more parent-level external debt, where the lenders are less informed about the operations of their subsidiaries, during the Brexit interregnum. Meanwhile, the consolidated book leverage (total external debt over total assets) of the affected MNEs remains stable relative to the other group. Thus, the increase in the parent-level external debt reflects a change in the debt structure, conditioning on the book leverage. This change is also significant. On the consolidated balance sheet, I estimate that the affected US MNEs raise the ratio of parent-level external debt to total assets by 1.8 percentage points, or 9 percent, on average in response to the UK uncertainty shock. These findings are in line with the argument that MNEs can substitute external debt to stabilize their book leverage when a country-level uncertainty shock allows them to lower the portion of external debt allocated at the subsidiary level as informed capital.

To further investigate whether the substitution of external debt can be observed among the UK subsidiaries, I perform my second DID analysis at the subsidiary level, utilizing information from the *unconsolidated* balance sheets that UK firms are required to disclose. Based on regulatory data from the UK Companies House and the complete ownership structure from Orbis, I examine how the non-financial UK subsidiaries of US MNEs respond to the UK uncertainty shock during the Brexit interregnum, relative to those of UK business groups. As the US parent companies should be less affected by the UK uncertainty shock, they should be able to better support their UK subsidiaries by raising parent-level external debt to substitute the subsidiary-level external debt through the ICMs. Consistent with this argument, I find that the UK subsidiaries of US MNEs lower their ratio of external debt to total assets by around 7 percentage points on average in their unconsolidated balance sheets. Meanwhile, there is an almost equivalent increase in the ratio of internal debt to total assets. Neither of these changes can be explained by leverage, defined as the ratio of total debt to

[8] As will be clear later, my analysis focuses on non-financial US parent companies and non-financial UK subsidiaries. A US parent company without a UK subsidiary may not have any foreign subsidiary. As a result, in addition to comparing US parent companies with UK subsidiaries with those without a UK subsidiary, I also compare them with the parent companies of US domestic business groups and US MNEs without a UK subsidiary separately. My results are robust across these analyses.

total assets. Thus, in line with the results at the parent level, there is indeed a corresponding substitution within the subsidiary-level unconsolidated debt structure.

The findings from both of my DID analyses hold after a battery of robustness tests. For the parent-level analysis, my results are robust after controlling for various characteristics of the business groups, such as measures of their size, growth opportunities, and liquidity. The results cannot be explained by time-varying trends at the industry level. The results also cannot be explained by shocks that affect US MNEs without UK subsidiaries, as a placebo test between these MNEs and US domestic business groups yields no time-varying differences. In addition, my results cannot be explained by changes in the EU27, since using US MNEs with non-financial subsidiaries in the EU27 but without UK subsidiaries as a placebo treatment group also shows no differences. The results of my parent-level analysis further hold after a series of robustness checks in the appendix to rule out alternative explanations. These include testing for pre-trends, matching the (multinational) US parent companies with and without UK subsidiaries in various ways to balance the sample, and accounting for policy changes that may differentially impact the debt structure of US MNEs with UK subsidiaries, such as the corporate bond purchase programs of the BoE and European Central Bank (ECB).

For the subsidiary-level analysis, my results are robust after controlling for subsidiaries' characteristics commonly available in my data from the unconsolidated balance sheets, such as size and leverage. Similar to my parent-level results, my subsidiary-level results also cannot be explained by time-varying trends at the industry level. They further hold after a series of additional robustness checks in the appendix to rule out alternative explanations. These include testing for pre-trends, accounting for provisions for other liabilities that are not internal debt, and generalizing my results from the UK subsidiaries of US MNEs to those of non-UK MNEs to confirm that my results are not driven by factors unique to US MNEs. Overall, my empirical findings provide evidence that there are important interactions between parent- and subsidiary-level external debt through the ICMs of MNEs in response to local country-level shocks. When facing local shocks that can increase the monitoring incentive of subsidiary-level external lenders, MNEs can improve their debt structure by substituting external debt across ICMs to stabilize their consolidated book leverage.

The rest of my paper is organized as follows: Section 2 outlines the related literature. Section 3 describes the model that derives the optimal mix of parent- and subsidiary-level external debt of an MNE, given its ICM, and shows how the MNE would respond to local shocks. Sections 4 and 5 present the empirical evidence of my parent- and subsidiary-level analysis, respectively. Section 6 concludes.

2 Related Literature

My paper relates to several strands of the literature, beginning with the one studying the asset reallocation within the ICMs of business groups. There are multiple papers that show domestic business groups can use their ICMs efficiently to reallocate assets when facing external credit stress, especially during crises. For example, Gopalan et al. (2007), Almeida et al. (2015), Santioni, Schiantarelli, and Strahan (2020), and Kim et al. (2020). Recently, Biermann and Huber (2023) document consistent evidence for German MNEs that faced a binding borrowing constraint during the 2008 financial crisis. Buchuk et al. (2020) further demonstrates that the asset allocation within ICMs is coordinated by ownership, not by other linkages, such as input-output linkages. My paper contributes to the literature by showing that when MNEs substitute subsidiary-level external debt with internal capital, the internal capital can be financed by parent-level external debt. Thus, the reallocation within the ICMs of MNEs can reflect significant interactions across external capital markets, even in a non-crisis environment.

Consistent with the efficient usage of ICMs, a branch of research has shown that MNEs can benefit from ICMs by supporting their subsidiaries during financial crises, especially in emerging markets. For instance, Kalemli-Ozcan et al. (2016) find that foreign-owned firms in Latin American countries outperform domestically-owned firms in investments when there is a banking crisis, while they do not find a differential performance when there is a pure currency crisis. Desai et al. (2008) document similar findings and conclude that ICMs can help foreign subsidiaries of US MNEs overcome financial constraints in emerging markets. Another branch of research reports that MNEs can benefit from ICMs by maximizing tax benefits (e.g., Chowdhry and Nanda 1994; Desai et al. 2006; Egger et al. 2010, 2014; Goldbach et al. 2021). My paper adds to this line of research by providing evidence that MNEs can

benefit from ICMs through a substitution of external debt when facing local country-level shocks, such as uncertainty shocks, even for their subsidiaries in developed countries.

My paper also relates to the literature studying uncertainty shocks. Many existing works in the literature have found that higher uncertainty can generate countercyclical credit spreads, procyclical leverage, and depress output, consumption, and investment, among other impacts (e.g., Bloom 2009; Julio and Yook 2012; Christiano et al. 2014; Gilchrist et al. 2014; Basu and Bundick 2017; Bloom et al. 2018; Arellano et al 2019). Fernandez-Villaverde and Guerron-Quintana (2020) highlight the role of agency problems and financial frictions in the transmission of uncertainty shocks. My paper contributes to this literature by showing that uncertainty shocks can transmit internationally through the ICMs of MNEs as they interconnect external lenders in different capital markets due to frictions faced by MNEs caused by agency problems. In addition, since a local uncertainty shock can prompt MNEs to improve their debt structure by substituting subsidiary-level external debt with parent-level external debt, my paper provides evidence that the ICMs of MNEs can stabilize the deleveraging pressure of uncertainty shocks, at least among firms owned by MNEs.

Last but not least, my paper pertains to the literature underlining the important role of external lenders as informed capital providers. Holmstrom and Tirole (1997) demonstrate that external lenders can be used as informed capital providers for delegated monitoring to mitigate agency problems of firms. A rich body of research has shown that external lenders, in particular banks, can specialize in monitoring (e.g., Stiglitz and Weiss 1983; Diamond 1984, 1991; Fama 1985; Rajan 1992; Hoshi et al. 1993; Denis and Mihov 2003; Mehran and Thakor 2011; Lin et al. 2013). My paper expands this literature to the usage of subsidiary-level external debt by MNEs for delegated monitoring, since local lenders, such as local banks, can have advantages in monitoring subsidiaries over (foreign) shareholders. Generally speaking, this is consistent with the evidence that subsidiary-level external debt can be used to mitigate agency problems faced by business groups (e.g., Jensen 1986; Scharfstein and Stein 2000; Rajan et al. 2000; Kahn and Winton 2004; Kolasinski 2009). My paper is different with the existing studies in that I highlight delegated monitoring as a reason why subsidiary-level external debt can benefit MNEs, instead of investigating the different types of agency problems that can be prevented with the presence of subsidiary-level exter-

nal lenders. In addition, I provide evidence that the usage of subsidiary-level external debt by MNEs transmits local shocks internationally because subsidiary-level informed lenders are connected with parent-level uninformed lenders in different capital markets through the ICMs. Furthermore, my finding that MNEs can stabilize the deleveraging pressure of uncertainty shocks by substituting subsidiary-level informed capital with parent-level uninformed capital adds to the evidence that banks can play a special role in damping the negative impact of uncertainty shocks (Ozdagli and Wang 2024).

3 Model

To study how MNEs interact with external lenders, I first derive the equilibrium debt structure and discuss the optimal mix of external debt at the parent and subsidiary levels. I then develop testable predictions on how different levels of external debt interconnect through the ICM in response to local country-level shocks.

3.1 Setup

Consider an economy with two countries: Home and Foreign, where a representative MNE has a parent company in Home, holding a majority-owned subsidiary in Foreign. At the current period t, the parent company can invest I_t in its domestic projects and I_t^* in the foreign subsidiary as its shareholder. The expected returns of I_t and I_t^* are $E_t(\omega_{t+1})I_tR_t$ and $E_t(\omega_{t+1}^*)I_t^*R_t^*$, respectively, where R_t and R_t^* are publicly-known components of the returns that can be viewed as country-level fundamentals. To realize the return, both entities also need to exert *private* management effort, represented by the private productivity draws ω_{t+1} and ω_{t+1}^* that are log-normally distributed with $E_t(\omega_{t+1}) = e^{\mu_t+\frac{1}{2}\sigma_t^2} = 1$ and $E_t(\omega_{t+1}^*) = e^{\mu_t^*+\frac{1}{2}\sigma_t^{*2}} = 1$. The shape parameters, μ_t, σ_t, μ_t^*, and σ_t^*, are publicly known at t and can also be viewed as country-level fundamentals for the MNE.[9]

Given the expected returns and available capital A_t, the parent company maximizes its expected profit for the MNE by choosing I_t, I_t^*, and the issuance of external debt D_t and D_t^*. As the parent company is the majority shareholder of the foreign subsidiary, the subsidiary's

[9]Bernanke et al. (1999) discuss the generality of independent, log normally distributed productivity draws. For further applications, see, e.g., Dorofeenko et al. (2008), Christiano et al. (2014), and Akinci (2021).

equity can serve the parent-level external debt D_t.[10] Meanwhile, D_t^* denotes the stand-alone external debt of the foreign subsidiary, if any. With the intra-firm transfer through the ICM T_t, the parent company faces the budget constraint:

$$I_t + T_t \leq D_t + A_t. \tag{1}$$

While the foreign subsidiary's budget constraint is:

$$I_t^* \leq D_t^* + \frac{T_t}{S_t}, \tag{2}$$

where S_t is the spot exchange rate of Foreign's currency per unit of Home's currency.[11]

When lending to the MNE, risk-neutral lenders in Home and Foreign face their respective risk-free interest rates, $1 + r_t^{rf}$ and $1 + r_t^{rf*}$, as their opportunity cost. I further assume the CIP holds to prevent risk-free arbitrage:

$$(1 + r_t^{rf}) = \frac{F_{t+1}}{S_t}(1 + r_t^{rf*}), \tag{3}$$

where F_{t+1} is the (risk-adjusted) forward exchange rate quoted in the same manner of S_t. As a result, the lenders' opportunity cost is equivalent in the same currency, and the costs of D_t and D_t^* differ by the premiums of lending to the parent company and foreign subsidiary.

3.2 Agency Problems and Debt Contracts

When compensating the external lenders, the premiums of D_t and D_t^* need to address two concerns: 1) Both the parent company and foreign subsidiary can costly default, depending on the outcome of the productivity draws. 2) Potential agency problems between the parent company and foreign subsidiary can prevent the parent from fully collecting the subsidiary's equity. Before discussing the second point, however, it is useful to explain the contractual

[10] According to the BEA annual survey, US MNEs fully own more than 80% of their subsidiaries.

[11] Equity transfers and intra-firm loans are equivalent in the absence of a corporate income tax differential since the parent company is the majority shareholder of the foreign subsidiary. Further, subsidiary-level external debt guaranteed by the parent company can be represented by D_t with T_t. See Chowdhry and Nanda (1994) and Chowdhry and Coval (1998) for further discussion. As will soon be explained in Section X, the income tax differential is not a concern in my context.

structure of D_t and D_t^*, and why it is optimal to issue them as debt contracts.

3.2.1 Costly Defaults: Parent- and Subsidiary-Level Debt Contracts

Without agency problems between the parent company and foreign subsidiary, the parent company can observe the private productivity draw ω_{t+1}^*, in addition to its own ω_{t+1}. However, there can be agency problems between borrowers and lenders so that the parent company may misreport ω_{t+1}^* and ω_{t+1} to its external lenders. Likewise, the foreign subsidiary may misreport ω_{t+1}^* to the subsidiary-level external lenders. Following the theoretical framework of Bernanke et al. (1999) and Christiano et al. (2014), I assume external lenders can verify a reported return, though part of it will be lost during the process. For D_t^*, whose suppliers can costly verify ω_{t+1}^*, Townsend (1979) shows that the optimal contract is a standard debt contract. That is, the optimal contract specifies a fixed threshold $\bar{\omega}_{t+1}^*$. If $\omega_{t+1}^* \geq \bar{\omega}_{t+1}^*$, the subsidiary pays $\bar{\omega}_{t+1}^* I_t^* R_t^*$ to the suppliers of D_t^*. If $\omega_{t+1}^* < \bar{\omega}_{t+1}^*$, the subsidiary defaults, and the suppliers of D_t^* costly verify ω_{t+1}^* to receive part of the return, $(1-\nu^*)\omega_{t+1}^* I_t^* R_t^*$.[12]

Given any $\bar{\omega}_{t+1}^*$, the parent company can use both $\mathbf{1}(\omega_{t+1}^* \geq \bar{\omega}_{t+1}^*)\left(\omega_{t+1}^* - \bar{\omega}_{t+1}^*\right) I_t^* R_t^*$ and $\omega_{t+1} I_t R_t$ to pay the suppliers of D_t, who can costly verify the parent company's balance sheet. For any profit maximizing parent company, Townsend's (1979) framework implies that the optimal contract for D_t is a debt contract depending on ω_{t+1} and ω_{t+1}^*.[13] Specifically, one can describe the parent-level debt contract with three thresholds. Let r_t be the equilibrium interest rate of D_t, there exists a fixed non-default threshold $\hat{\omega}_{t+1}$, independent of ω_{t+1}^*, such that the parent company can serve D_t if $\omega_{t+1} \geq \hat{\omega}_{t+1}$ with:

$$\hat{\omega}_{t+1} I_t R_t = D_t(1+r_t). \tag{4}$$

Similarly, there exists a fixed non-default threshold $\hat{\omega}_{t+1}^*$, independent of ω_{t+1}, such that the parent company can serve D_t if $\omega_{t+1}^* \geq \hat{\omega}_{t+1}^*$ with:

$$F_{t+1}\left(\hat{\omega}_{t+1}^* - \bar{\omega}_{t+1}^*\right) I_t^* R_t^* = D_t(1+r_t). \tag{5}$$

[12] The verification cost, $\nu^* \omega_{t+1}^* I_t^* R_t^*$, can also be interpreted as the cost of default.
[13] Appendix A explains the proof with details.

When $\omega_{t+1} < \hat{\omega}_{t+1}$ and $\omega^*_{t+1} < \hat{\omega}^*_{t+1}$, one can define a default threshold $\bar{\omega}_{t+1}$ contingent on ω^*_{t+1} such that the parent company can serve D_t if $\omega_{t+1} \geq \bar{\omega}_{t+1}$ with:

$$\bar{\omega}_{t+1} I_t R_t + F_{t+1} \mathbf{1}(\omega^*_{t+1} \geq \bar{\omega}^*_{t+1}) \left(\omega^*_{t+1} - \bar{\omega}^*_{t+1}\right) I^*_t R^*_t = D_t(1 + r_t) \tag{6}$$

$$\iff \bar{\omega}_{t+1} = \hat{\omega}_{t+1} \left[1 - \frac{(\omega^*_{t+1} - \bar{\omega}^*_{t+1})}{(\hat{\omega}^*_{t+1} - \bar{\omega}^*_{t+1})} \mathbf{1}(\omega^*_{t+1} \geq \bar{\omega}^*_{t+1})\right]. \tag{7}$$

Otherwise, the parent company defaults, and the suppliers of D_t costly verify the parent company's balance sheet to receive $(1-\nu)\left[\omega_{t+1} I_t R_t + F_{t+1} \mathbf{1}(\omega^*_{t+1} \geq \bar{\omega}^*_{t+1}) \left(\omega^*_{t+1} - \bar{\omega}^*_{t+1}\right) I^*_t R^*_t\right]$.[14]

Figure 1 visually summarizes the parent- and subsidiary-level debt contracts, together with the default and non-default regions for the parent company.[15] Given the contractual thresholds, for any D^*_t, the subsidiary-level debt contract needs to promise its lenders enough expected return to cover $D^*_t(1 + r^{rf*}_t)$. Thus, the participation constraint for the subsidiary-level external lenders is:

$$\left[\int_{\bar{\omega}^*_{t+1}}^{+\infty} \bar{\omega}^*_{t+1} dF(\omega^*_{t+1}) + \int_0^{\bar{\omega}^*_{t+1}} (1 - \nu^*) \omega^*_{t+1} dF(\omega^*_{t+1})\right] I^*_t R^*_t = D^*_t(1 + r^{rf*}_t). \tag{8}$$

Likewise, the participation constraint for the parent-level external lenders is:

$$\Omega^h(\hat{\omega}_{t+1}, \hat{\omega}^*_{t+1}, \bar{\omega}^*_{t+1}) I_t R_t + \Omega^f(\hat{\omega}_{t+1}, \hat{\omega}^*_{t+1}, \bar{\omega}^*_{t+1}) F_{t+1} I^*_t R^*_t = D_t(1 + r^{rf}_t), \tag{9}$$

where $\Omega^h(\hat{\omega}_{t+1}, \hat{\omega}^*_{t+1}, \bar{\omega}^*_{t+1})$ and $\Omega^f(\hat{\omega}_{t+1}, \hat{\omega}^*_{t+1}, \bar{\omega}^*_{t+1})$ represent the expected shares of $I_t R_t$ and $F_{t+1} I^*_t R^*_t$ promised to the lenders by the parent-level debt contract, respectively.[16]

As the parent company can pledge both $\Omega^h(\hat{\omega}_{t+1}, \hat{\omega}^*_{t+1}, \bar{\omega}^*_{t+1}) I_t R_t$ and $\Omega^f(\hat{\omega}_{t+1}, \hat{\omega}^*_{t+1}, \bar{\omega}^*_{t+1})$

[14] I assume the MNE can use F_{t+1} to cover at least $\left(\hat{\omega}^*_{t+1} - \bar{\omega}^*_{t+1}\right) I^*_t R^*_t$, consistent with the observation that both non-financial MNEs and banks are dominant players in the foreign exchange and cross-currency swaps market for debt issuance (BNP Paribas, 2014). As will soon become clear, the results of the model hold even if the subsidiary is domestic.

[15] Writing the default threshold in terms of ω^*_{t+1} contingent on ω_{t+1} is equivalent to the expression in Equation 7, as both describe the same state-contingent default threshold, marked by the red solid line in Figure 1, with the same default and non-default regions for the parent company.

[16] According to the parent-level debt contract, $\Omega^h(\hat{\omega}_{t+1}, \hat{\omega}^*_{t+1}, \bar{\omega}^*_{t+1}) = \int_{\hat{\omega}_{t+1}}^{+\infty} \hat{\omega}_{t+1} dF(\omega_{t+1}) + \int_0^{\hat{\omega}^*_{t+1}} \int_{\bar{\omega}_{t+1}}^{\hat{\omega}_{t+1}} \bar{\omega}_{t+1} dF(\omega_{t+1}) dF(\omega^*_{t+1}) + \int_0^{\hat{\omega}^*_{t+1}} \int_0^{\bar{\omega}_{t+1}} (1-\nu) \omega_{t+1} dF(\omega_{t+1}) dF(\omega^*_{t+1})$, and $\Omega^f_t = \int_0^{\hat{\omega}_{t+1}} \int_{\hat{\omega}^*_{t+1}}^{+\infty} \left(\hat{\omega}^*_{t+1} - \bar{\omega}^*_{t+1}\right) dF(\omega^*_{t+1}) dF(\omega_{t+1}) + \int_{\bar{\omega}_{t+1}}^{\hat{\omega}_{t+1}} \int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}} \left(\omega^*_{t+1} - \bar{\omega}^*_{t+1}\right) dF(\omega^*_{t+1}) dF(\omega_{t+1}) + \int_0^{\bar{\omega}_{t+1}} \int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}} (1-\nu) \left(\omega^*_{t+1} - \bar{\omega}^*_{t+1}\right) dF(\omega^*_{t+1}) dF(\omega_{t+1})$.

$F_{t+1}I_t^*R_t^*$ to the parent-level external lenders, when $I_t > 0$, it has an incentive to finance any $I_t^* > 0$ with parent-level external debt, given the existence of the non-default region when $\omega_{t+1}^* < \hat{\omega}_{t+1}^*$. When $I_t = 0$, of course, the parent-level debt contract becomes the subsidiary-level debt contract, and there is effectively no difference between parent- and subsidiary-level external lenders. As a result, when we allow agency problems between the MNE and its external lenders, but not between the parent company and foreign subsidiary, the parent company has an incentive to use parent-level external debt to benefit from cross-subsidization, consistent with the observation of Erel et al. (2020).

3.2.2 Subsidiary-Level External Debt as Informed Capital

While parent companies of MNEs enjoy the benefit of a cross-border cash-flow diversification, the diversification usually comes with complex operations that limit the internal monitoring capacity of a parent company. The complexity faced by MNEs includes at least three dimensions. First, MNEs have organizational complexity. A parent company usually has multiple layers of subsidiaries. The records of subsidiary-level activities can be complicated by intermediate holding companies that own a network of subsidiaries, which can own other subsidiaries at a lower level. The accounting of subsidiary-level activities can be further clouded by the usage of tax heavens and special purpose vehicles. When there are agency problems between a parent company and its subsidiaries, it can be difficult for the parent company to judge if the underperformance of a front-line operation is due to local managerial misbehavior or bad luck. Secondly, a MNE faces geographical complexity, where each country of its operations can have a different set of rules and regulations. The best practice of a proprietary technology in the parent company's country may violate regulations in another country and thus need to be adjusted in a way foreign to the parent company. Without detailed local knowledge, a parent company may not be able to monitor its foreign subsidiaries effectively. Thirdly, MNEs can be confronted with business complexity. As a MNE expands across industries, the parent company will inevitably need to manage subsidiaries from less familiar business lines. This can further reduce the power of monitoring from the parent company. When the three dimensions of complexity compound, parent companies can have a limited internal monitoring capacity and suffer losses from subsidiary-level manage-

rial misbehavior, including frauds, the materialization of other operational risk, bad business decisions, or a lack of due diligence.

The significance of the limited internal monitoring capacity, together with the associated losses, has been documented by the growing literature of operational risk. For instance, recent studies have pointed out the importance of operational losses due to managerial misbehavior among US bank holding companies as complex financial MNEs (Cetorelli and Goldberg 2014, Chernobai, Ozdagli, and Wang 2021, Berger et al. 2022). MNEs with complex intra-group transfers also face a higher group-level risk premium due to concerns over weak corporate governance and low managerial ability (Richardson, Taylor, and Obaydin 2020). The limited internal monitoring capacity is further consistent with studies that argue internal agency problems related with ICMs can destroy values (Lamont 1997, Whited 2001, Schoar 2002, Villalonga 2004).

I model the agency problem between the parent company and foreign subsidiary as moral hazard ex-ante the realization of ω^*_{t+1}. While the parent company maximizes its expected profits at time t by choosing the investments and debt structure, the objective of the foreign subsidiary, as the manager of the foreign project, is to maximize its private benefit at the end of $t+1$. Concretely, the foreign subsidiary can privately choose to behave or not after observing the private productivity draw ω^*_{t+1} at the beginning of $t+1$. If the foreign subsidiary behaves, it will receive a private benefit of 0 and its return will be fully realized as $\omega^*_{t+1} I^*_t R^*_t$. If the foreign subsidiary does not behave, it can shrink the productivity draw to $(1-\psi^*)\omega^*_{t+1}$ for a private benefit of $\psi^*\omega^*_{t+1} I^*_t R^*_t$ with $\psi^* \in [0,1]$. In this case, the foreign subsidiary's return will only be partially realized as $(1-\psi^*)\omega^*_{t+1} I^*_t R^*_t$. Finally, I make the tie-breaking assumption that the foreign subsidiary always behaves with a 0 private benefit.

The private benefit can be interpreted as the opportunity cost for the foreign subsidiary to be diligent. Broadly speaking, it can reflect any loss of the foreign return that won't be received by the parent company due to its limited internal monitoring capacity. Examples of such loss include losses from the materialization of operational risk (e.g., frauds and embezzlement), tunneling activities by managers or shareholders, consequences of poor business decisions (e.g., overborrowing), or additional compensations the parent company has to offer

to the foreign subsidiary to prevent a larger shrinkage.[17] I assume the private benefit equals $\psi^*\omega^*_{t+1}I^*_tR^*_t$ for simplicity. In general, it can take any form that rises with ψ^* to induce the shrinkage of the productivity draw to $(1-\psi^*)\omega^*_{t+1}$. I also assume only a fraction of foreign productivity draw can be lost with $\psi^* \in [0,1]$ by limited liability.[18] The magnitude of ψ^* reflects the internal monitoring capacity of the parent company. When the parent company has a perfect internal monitoring capacity, it can eliminate the private benefit with $\psi^* \to 0$. When the parent company has no internal monitoring capacity, it will lose the foreign return entirely with $\psi^* \to 1$, in which case the parent company behaves as if it only has the home project at time t.

With a limited internal monitoring capacity, $\psi^* > 0$ and the parent company can find it optimal to reduce ψ^* with additional resources. Consistent with the seminal work of Holmstrom and Tirole (1997), which captures the critical role of monitoring in understanding financial intermediation, I assume that the parent company can use subsidiary-level debt as informed capital for local delegated monitoring. Specifically, both the home and foreign lenders can provide lending as uninformed capital with only the CSV technology. They can also provide lending as informed capital with monitoring in an attempt to reduce the shrinkage of a firm's productivity draw by lowering the firm's private benefit. When lending informed capital to the foreign subsidiary, the foreign lender has a comparative advantage in accessing local private information and monitoring efficiency, making him/her the cheapest and most effective informed capital supplier that can further decrease ψ^*.

For simplicity and without loss of generality, I assume the parent company always behaves when managing the home project. Since an informed lender monitors the firm they will take over in default by the debt contract, the parent company will only demand informed capital at the subsidiary level. The difference between a lender providing uninformed and informed capital can be interpreted as a bank investing corporate bonds (uninformed capital) vs. granting bank loans with detailed collateral and covenant requirements (informed capital). This interpretation is consistent with the literature on the comparative advantage of banks

[17] "Regular" compensations for managing I^*_t, such as wages, are included in the technology R^*_t.

[18] If $\psi^* > 1$, it is possible for the parent company to experience a net loss as a result of the foreign subsidiary's actions, such as legal expenses of a subsidiary-level fraud.

in accessing private information as insiders and preventing moral hazard via monitoring.[19]

To formalize the monitoring incentive of the foreign lender as an informed lender, I propose that the foreign lender can take two actions at time $t+1$ after signing a subsidiary-level debt contract at t: Monitoring the foreign subsidiary properly or only securing its share of the return without lowering the private benefit of the foreign subsidiary. To begin with, the foreign lender can reduce the private benefit of the foreign subsidiary through proper monitoring with a per-unit monitoring cost $c^* + s^* > 0$. The per-unit monitoring cost captures the idea that monitoring is privately costly in the same way of Holmstrom and Tirole (1997). The total monitoring cost is therefore $(c^* + s^*) I_t^*$. When the foreign lender properly monitors, I assume that ψ^* can be diminished to 0 so that the foreign subsidiary will behave.

Instead of proper monitoring, the foreign lender can shirk themselves to only secure their share of the return from the debt contract with a per-unit cost $s^* \geq 0$ without lowering the private benefit of the foreign subsidiary. In this case, the foreign subsidiary will misbehave and the productivity draw will shrink to $(1-\psi^*)\omega_{t+1}^*$. The per-unit cost $s^* \geq 0$ is paid to ensure the foreign lender's seniority on the foreign return due to the moral hazard between the MNE and its lenders in the case of a subsidiary-level default, which allows a transfer of the foreign return to the parent company before the CSV. After paying the per-unit cost $s^* \geq 0$, the optimal contract for the foreign subsidiary is the standard debt contract, as explained in Section 3.2.1.

Let $\bar{\omega}_{t+1}^*$ be the default threshold of the standard debt contract. The participation constraint for the foreign lender with proper monitoring in equilibrium is:

$$D_t^*(1+r_t^{m*}) = \left(\int_{\bar{\omega}_{t+1}^*}^{+\infty} \bar{\omega}_{t+1}^* F(\omega_{t+1}^*) + \int_0^{\bar{\omega}_{t+1}^*} (1-\nu^*)\omega_{t+1}^* F(\omega_{t+1}^*) \right) I_t^* R_t^*, \tag{10}$$

where ν^* is the per-unit default cost of the foreign lender and $1+r_t^{m*}$ is the required rate of

[19] See, for instance, Stiglitz and Weiss (1983), Diamond (1984, 1991), Fama (1985), Rajan (1992), Hoshi et al. (1993), Denis and Mihov (2003), Mehran and Thakor (2011), Lin et al. (2013).

return of the informed capital D_t^* with:

$$D_t^*(1+r_t^{m*}) = D_t^*(1+r_t^{rf*}) + (c^*+s^*)I_t^* > D_t^*(1+r_t^{rf*}). \tag{11}$$

To sustain proper monitoring, the incentive constraint for the foreign lender satisfies:

$$\begin{aligned}
&\left(\int_{\bar{\omega}_{t+1}^*}^{+\infty} \bar{\omega}_{t+1}^* F(\omega_{t+1}^*) + \int_0^{\bar{\omega}_{t+1}^*} (1-\nu^*)\omega_{t+1}^* F(\omega_{t+1}^*)\right) I_t^* R_t^* \\
&\geq \left(\int_{\frac{\bar{\omega}_{t+1}^*}{1-\psi^*}}^{+\infty} \bar{\omega}_{t+1}^* F(\omega_{t+1}^*) + \int_0^{\frac{\bar{\omega}_{t+1}^*}{1-\psi^*}} (1-\nu^*)(1-\psi^*)\omega_{t+1}^* F(\omega_{t+1}^*)\right) I_t^* R_t^* + c^* I_t^*.
\end{aligned} \tag{12}$$

Note that the productivity draw must be $\omega_{t+1}^* = \bar{\omega}_{t+1}^*/(1-\psi^*)$ for the realized productivity to meet $\bar{\omega}_{t+1}^*$ when the foreign subsidiary misbehaves.

Because proper monitoring is expensive, it follows that the foreign lender requires a minimum share of R_t^* in expectation to sustain the incentive constraint.[20] The optimal way to use the informed capital with proper monitoring is thus to borrow just enough so that the incentive constraint binds and finance the rest of I_t^* via funds with a cheaper required rate of return. Whether the leverage for the rest of I_t^* is made of the parent-level debt depends on the frictions associated with the subsidiary-level debt, notably s^*. When s^* is sufficiently high, only the parent-level debt will be used to externally fund I_t^*, conditioning on the usage of the informed capital with proper monitoring. When s^* and other frictions are low, the parent company might even use the subsidiary-level informed capital without proper monitoring to further decrease the risk-premium of the parent-level debt by making it more state contingent.[21] This gives the parent company another incentive to raise uninformed debt and internally finance the foreign subsidiary with $T_t > 0$.

[20] Appendix B.1 details the proof.

[21] The subtle reason for this improvement is that the expected default loss of the parent-level debt could be reduced by allowing the possibility of a parent-level default after the subsidiary-level lender getting paid in full, where the home lender can know from the informed subsidiary-level lender that the realized foreign productivity draw is at least above $\bar{\omega}_{t+1}^*$. When the reduction of the expected default loss from the greater state contingency is larger than the additional stand-alone default risk of the subsidiary-level debt, it is optimal to use the additional informed capital to reduce the risk-premium of the parent-level debt. See Appendix B.2 for details.

Since the usage of the informed capital without proper monitoring reinforces the parent company's incentives to active the ICM with $T_t > 0$, while it does not affect the private benefit of the foreign subsidiary, the additional informed capital helps form the mechanism of the model associated with $T_t > 0$, but is not required for this cause. To underline the full mechanism of the model in a simple setup, I make the simplifying assumption that the frictions associated with the subsidiary-level debt is large enough so that the local informed capital will be used with proper monitoring (i.e., s^* is large enough). The simplifying assumption is convenient without giving up generality for my purpose because adding the additional informed capital leads to the same empirical predictions, as will be explained in Section 3.4. The simplifying assumption is also consistent with the literature on informed capital that emphasizes the role of monitoring in reducing the private benefit associated with managerial misbehavior (e.g., Holmstrom and Tirole 1997, Antras, Desai, and Foley 2009, Mehran and Thakor 2011, etc.). The details of the simplifying assumption, along with the usage of the additional informed capital, are described in Appendix B.2.

Given the international setup of the model, it is also helpful to discuss the potential differences between the home and foreign default costs, ν and ν^*, and the two countries' tax environments. To start with, the empirical focus of this paper is US MNEs with subsidiaries in developed economies, especially the UK, where the financial industries share a similar degree of development. I therefore assume that $\nu = \nu^*$ to reflect the similar institutional background.[22] For US MNEs in general with subsidiaries that face a less developed financial industry, one can assume there is $\nu \leq \nu^*$ (e.g., Desai, Foley, and Forbes, 2008). Such setup will additionally enhance a parent company's incentives to borrow for their subsidiaries due to the lower default cost.

As the focus of this paper is how the ICMs of MNEs respond to country-level uncertainty shocks from non-tax-related origins, I abstract any cross-border corporate income tax differential from my framework and assume that the tax environment remains stable during time t and $t+1$, when a foreign uncertainty shock occurs at time t. For my empirical analysis that examines the UK subsidiaries of US MNE before and after the the Brexit referendum,

[22]The frictions associated with the nature of a subsidiary-level debt is captured by the per-unit cost s^*.

the corporate income tax is higher in the US. This can provide the US parents with further incentives to borrow for their UK subsidiaries as interest expenses are tax deductible.

3.3 Equilibrium

At time t, the objective of the parent company is to maximize its expected profits, $E_t(\Phi_{t+1})$, by choosing its home and foreign investments, I_t and I_t^*, and debt structure, D_t and D_t^*, given the endogenously decided lending rates, r_t and r_t^*. Let $\Upsilon_t^h = \Upsilon^h(\hat{\omega}_{t+1}, \hat{\omega}_{t+1}^*, \bar{\omega}_{t+1}^*)$ and $\Upsilon_t^f = \Upsilon^f(\hat{\omega}_{t+1}, \hat{\omega}_{t+1}^*, \bar{\omega}_{t+1}^*)$ denote the parent company's expected share of $I_t R_t$ and $F_{t+1} I_t^* R_t^*$, respectively, from the optimal contract.[23] The optimization problem is:

$$\max_{\{I_t, T_t, I_t^*, r_t, r_t^*\}} E_t(\Phi_{t+1}) = \max_{\{I_t, T_t, I_t^*, r_t, r_t^*\}} \Upsilon_t^h I_t R_t + \Upsilon_t^f F_{t+1} I_t^* R_t^*,$$

subjecting to:

$$\bar{\omega}_{t+1}^* = \frac{D_t^*(1+r_t^*)}{I_t^* R_t^*}, \tag{13}$$

$$\hat{\omega}_{t+1} = \frac{D_t(1+r_t)}{I_t R_t}, \tag{14}$$

$$\hat{\omega}_{t+1}^* = \frac{D_t(1+r_t)}{F_{t+1} I_t^* R_t^*} + \bar{\omega}_{t+1}^*, \tag{15}$$

$$\bar{\omega}_{t+1} = \hat{\omega}_{t+1}\left[1 - \frac{(\omega_{t+1}^* - \bar{\omega}_{t+1}^*)}{(\hat{\omega}_{t+1}^* - \bar{\omega}_{t+1}^*)} \mathbf{1}(\omega_{t+1}^* \geq \bar{\omega}_{t+1}^*)\right], \forall \omega_{t+1}^* < \hat{\omega}_{t+1}^*, \tag{16}$$

$$\int_{\bar{\omega}_{t+1}^*}^{\frac{\bar{\omega}_{t+1}^*}{1-\psi^*}} \left[\bar{\omega}_{t+1}^* - (1-\nu^*)(1-\psi^*)\omega_{t+1}^*\right] dF(\omega_{t+1}^*) + \int_0^{\bar{\omega}_{t+1}^*} (1-\nu^*)\psi^* \omega_{t+1}^* dF(\omega_{t+1}^*) = \frac{c^*}{R_t^*}, \tag{17}$$

$$D_t^*(1+r_t^{m*}) = \left(\int_{\bar{\omega}_{t+1}^*}^{+\infty} \bar{\omega}_{t+1}^* F(\omega_{t+1}^*) + \int_0^{\bar{\omega}_{t+1}^*} (1-\nu^*)\omega_{t+1}^* F(\omega_{t+1}^*)\right) I_t^* R_t^*, \tag{18}$$

$$D_t(1+r_t^{rf}) = \Omega_t^h I_t R_t + \Omega_t^f F_{t+1} I_t^* R_t^*. \tag{19}$$

Condition 13 describes the default threshold of the subsidiary-level debt contract. Conditions 14-16 define the contractual thresholds of the parent-level debt contract. Condition 17 is the binding incentive constraint for the foreign lender to reduce the private benefit of the foreign

[23] See Appendix **??** for details on Υ_t^h and Υ_t^f.

subsidiary via local monitoring when providing informed capital. Conditions 18 and 19 are the participation constraints for the foreign and home lenders, correspondingly, to break even with their cost of funds.

To decide whether the subsidiary-level deb, D_t^*, should be used as local informed capital in equilibrium, the parent company solves the optimization problem with and without D_t^* before choosing the equilibrium debt structure that yields the highest expected profits, $E_t(\Phi_{t+1})$. Without D_t^* in equilibrium, $\bar{\omega}_{t+1}^* = 0$. Conditions 13, 17, and 18 are dropped from the optimization, while the foreign productivity draw, ω_{t+1}^*, shrinks to $(1-\psi^*)\omega_{t+1}^*$ as the foreign subsidiary pursues its private benefit.

With D_t^* in equilibrium, all foreign variables except for I_t^* are solved through Conditions 13, 17, and 18. Let $M(\bar{\omega}_{t+1}^*)$ denote the expected payoff to the foreign lender per unit of I_t^* from reducing the private benefit of the foreign subsidiary through monitoring (the left hand side of Condition 17):

$$M(\bar{\omega}_{t+1}^*) = \int_{\bar{\omega}_{t+1}^*}^{\frac{\bar{\omega}_{t+1}^*}{1-\psi^*}} \left[\bar{\omega}_{t+1}^* - (1-\nu^*)(1-\psi^*)\omega_{t+1}^*\right] dF(\omega_{t+1}^*) + \int_0^{\bar{\omega}_{t+1}^*} (1-\nu^*)\psi^*\omega_{t+1}^* dF(\omega_{t+1}^*). \quad (20)$$

The incentive constraint (Condition 17) determines the minimum $\bar{\omega}_{t+1}^*$ in equilibrium given the distribution of ω_{t+1}^*:

$$M(\bar{\omega}_{t+1}^*) = \frac{c^*}{R_t^*}. \quad (21)$$

The foreign contractual threshold, $\bar{\omega}_{t+1}^*$, regulates the minimum portion of I_t^* that needs to be funded by D_t^* in equilibrium, D_t^*/I_t^*, to sustain the incentive constraint for monitoring through Condition 18. By deciding D_t^*/I_t^*, $\bar{\omega}_{t+1}^*$ also solves the foreign lending rate r_t^* through the optimal contract, Condition 13. Substituting Condition 13 to the budget constraint in equilibrium:

$$D_t^* + \frac{T_t}{S_t} = I_t^*, \quad (22)$$

I_t^* becomes a function of the internal transfer T_t with:

$$I_t^* = \frac{T_t}{S_t \Lambda\left(\bar{\omega}_{t+1}^*\right)} \Longleftrightarrow T_t = S_t I_t^* \Lambda\left(\bar{\omega}_{t+1}^*\right), \quad (23)$$

where $\Lambda\left(\bar{\omega}^*_{t+1}\right)$ denotes the share of I^*_t that can be financed by funds cheaper than the local informed capital, D^*_t, with:

$$\Lambda\left(\bar{\omega}^*_{t+1}\right) = 1 - \frac{\bar{\omega}^*_{t+1} R^*_t}{1 + r^*_t\left(\bar{\omega}^*_{t+1}\right)}. \tag{24}$$

Conditions 21 and 23 illustrate an important interaction between the local capital market in Foreign and the international capital market in Home. Each unit of the internal funding, T_t, which is leveraged by the parent-level debt, D_t, needs to be blended with a minimum share of the local informed capital, D^*_t, to sustain the incentive constraint for monitoring. This mixture exists as long as the parent company wants to complement its limited internal monitoring capacity with local monitoring from the foreign lender to reduce the private benefit of the foreign subsidiary. If a rise in foreign uncertainty improves the incentive of the foreign lender to monitor the foreign subsidiary, the minimum share of D^*_t/I^*_t can be reduced for each unit of I^*_t without destroying the foreign lender's incentive constraint for monitoring. As a result, the parent company can effectively lower the cost of funds by financing the same level of I^*_t with additional parent-level debt, which is cheaper since the parent-level debt is backed by a diversified cash flow. In this way, the existence of D^*_t in the equilibrium debt structure can induce an inflow of capital, or external debt, from Home to Foreign when the uncertainty in Foreign becomes higher. The inflow of international capital through the ICM can offset at least some of the negative effect from the rise in foreign uncertainty. Intuitively, while the parent company experiences an increase in the cost of funds because the foreign subsidiary becomes riskier, the parent company can also decrease the cost of funds by improving its debt structure with a smaller minimum share of D^*_t/I^*_t for each unit of I^*_t. The intuition that the existence of D^*_t in the equilibrium debt structure can act as stabilizer for foreign uncertainty shocks via a change in the debt structure forms a keystone for my empirical results, which will be elaborated in the next section.

With the equilibrium conditions of the foreign variables, the lending rate of the parent-level debt, r_t, together with the parent company's decision rules on I_t and T_t, are determined

by the following three equations:

$$\lambda = -\frac{\Upsilon^h_{\hat{\omega}_{t+1}} + \Upsilon^h_{\hat{\omega}^*_{t+1}} \frac{I_t R_t}{F_{t+1} I^*_t R^*_t} + \Upsilon^f_{\hat{\omega}_{t+1}} \frac{F_{t+1} I^*_t R^*_t}{I_t R_t} + \Upsilon^f_{\hat{\omega}^*_{t+1}}}{\Omega^h_{\hat{\omega}_{t+1}} + \Omega^h_{\hat{\omega}^*_{t+1}} \frac{I_t R_t}{F_{t+1} I^*_t R^*_t} + \Omega^f_{\hat{\omega}_{t+1}} \frac{F_{t+1} I^*_t R^*_t}{I_t R_t} + \Omega^f_{\hat{\omega}^*_{t+1}}} > 1, \tag{25}$$

$$\Upsilon^h_t R_t + \delta^I_t = \lambda \left[(1 + r^{rf}_t) - \Omega^h_t R_t \right], \tag{26}$$

$$\Upsilon^f_t \frac{F_{t+1}}{S_t \Lambda\left(\bar{\omega}^*_{t+1}\right)} R^*_t + \delta^T_t = \lambda \left[(1 + r^{rf}_t) - \Omega^f_t \frac{F_{t+1}}{S_t \Lambda\left(\bar{\omega}^*_{t+1}\right)} R^*_t \right]. \tag{27}$$

Appendix C.1 provides the details of their derivations.

λ is the Lagrange multiplier associated with r_t. Consistent with BGG (1999), λ reflects the risk premium generated by the costly default with $\nu > 0$. It prescribes the additional shares of the returns the parent company needs to compensate the home lender in the optimal contract to cover their expected default loss. Appendix C.1 demonstrates this point in details.

Conditions 26 and 27 are the equilibrium conditions for I_t and T_t, where δ^I_t and δ^T_t capture a diversification effect from a marginal increase in I_t and T_t, respectively. Though a marginal increase in I_t or T_t affects the expected default loss through both changing the relative size of the projects (the diversification effect) and lifting the leverage, Appendix C.2 shows that the marginal impact of any diversification benefit diminishes as the parent company's leverage rises. Thus, by keeping building up the leverage, a marginal increase in I_t or T_t eventually raises the cost of funds because of the costly default. Appendix C.2 documents the details on how a marginal increase in I_t or T_t affects the expected default loss.

When $T_t \to 0$, the equilibrium converges to an one-project equilibrium similar to that of BGG (1999) with:

$$\lambda = -\frac{\Upsilon^h_{\hat{\omega}_{t+1}}}{\Omega^h_{\hat{\omega}_{t+1}}} = -\frac{\Upsilon^h_{\bar{\omega}_{t+1}}}{\Omega^h_{\bar{\omega}_{t+1}}} = \frac{1 - F(\bar{\omega}_{t+1})}{1 - F(\bar{\omega}_{t+1}) - \nu \bar{\omega}_{t+1} f(\bar{\omega}_{t+1})}, \tag{28}$$

$$\Upsilon^h_t R_t = \lambda \left[(1 + r^{rf}_t) - \Omega^h_t R_t \right]. \tag{29}$$

In this case, Appendix C.3 proves that it is optimal for the parent company to have $T_t > 0$

when the foreign project has a large enough R_t^*:

$$\int_{\bar{\omega}_{t+1}^*}^{+\infty}(\omega_{t+1}^*-\bar{\omega}_{t+1}^*)dF(\omega_{t+1}^*)\frac{F_{t+1}}{S_t\Lambda\left(\bar{\omega}_{t+1}^*\right)}R_t^*>\frac{(1+r_t^{rf})}{1-\nu F(\hat{\omega}_{t+1})-\nu\hat{\omega}_{t+1}f(\hat{\omega}_{t+1})}. \tag{30}$$

Similarly, when $I_t \to 0$, the equilibrium converges to an one-project equilibrium close to that of BGG (1999), conditioning on the potential usage of the local informed capital, with:

$$\lambda=-\frac{\Upsilon^f_{\hat{\omega}_{t+1}^*}}{\Omega^f_{\hat{\omega}_{t+1}^*}}=\frac{1-F(\hat{\omega}_{t+1}^*)}{1-F(\hat{\omega}_{t+1}^*)-\nu\left(\hat{\omega}_{t+1}^*-\bar{\omega}_{t+1}^*\right)f(\hat{\omega}_{t+1}^*)}, \tag{31}$$

$$\Upsilon_t^f\frac{F_{t+1}}{S_t\Lambda\left(\bar{\omega}_{t+1}^*\right)}R_t^*=\lambda\left[(1+r_t^{rf})-\Omega_t^f\frac{F_{t+1}}{S_t\Lambda\left(\bar{\omega}_{t+1}^*\right)}R_t^*\right]. \tag{32}$$

In this case, Appendix C.3 proves that it is optimal for the parent company to have $I_t > 0$ when the home project has a large enough R_t:

$$R_t>\frac{(1+r_t^{rf})}{1-\nu F(\hat{\omega}_{t+1}^*)-\nu(\hat{\omega}_{t+1}^*-\bar{\omega}_{t+1}^*)f(\hat{\omega}_{t+1}^*)}. \tag{33}$$

3.4 Local Uncertainty Shocks and International Debt Substitution

The theoretical framework has so far characterized how the MNE utilizes the ICM in equilibrium with two main features: 1) The parent company has a comparative advantage in raising uninformed debt due to the benefit of a cross-border cash-flow diversification by the virtue of ownership. 2) The local informed capital can be used at the foreign subsidiary for delegated monitoring. The local informed capital can complement the parent company's internal monitoring capacity due to the local lender's comparative advantage in addressing agency problems locally. Such comparative advantage can be especially helpful when the parent company faces a limited capacity in preventing the managerial misbehavior of the foreign subsidiary because of the MNE's operational, geographical, or business complexity.

Based on the framework, this section discusses how a foreign uncertainty shock affects the MNE's borrowing decisions globally by interacting with the ICM. Admittedly, a surge of uncertainty in Foreign can yield negative spillovers through the ICM as the uncertainty shock

can raise the risk premium of any debt supported by the foreign return. However, the debt structure of the MNE matters during periods of heightened uncertainty. A key mechanism of my framework is that local informed capital, such as local bank debt, can play a special role in stabilizing uncertainty shocks through monitoring. A surge of foreign uncertainty can enhance the local lender's incentives for proper monitoring to protect their own returns from the foreign project. As a result, when the local informed capital is used in equilibrium, the parent company can raise additional parent-level debt globally to substitute the more expensive local informed capital without destroying the incentive constraint for monitoring. Such cross-border external debt substitution improves the debt structure of the MNE, which offsets the negative impact of the uncertainty shock at least partially. The usage of the local informed capital can therefore help anchor foreign capital in an economy during periods of heightened uncertainty via the ICMs of MNEs. I now explain these mechanisms in details with testable predictions.

3.4.1 The Impact of a Foreign Uncertainty Shock on $\bar{\omega}^*_{t+1}$

To highlight the role of the debt structure in response to local uncertainty shocks, I start by examining the impact of a foreign uncertainty shock on the foreign contractual threshold, $\bar{\omega}^*_{t+1}$. $\bar{\omega}^*_{t+1}$ plays a central role in the debt structure of the MNE since it regulates the usage of the local informed capital in equilibrium. As established in Section 3.1, a foreign uncertainty shock at time t, which affects the MNE's investment decisions, can be described as an exogenous, mean-preserving shock to σ^*_t, consistent with Dorofeenko, Lee, and Salyer (2008) and Akinci (2021).[24] Because the incentive constraint for monitoring (Condition 21) determines $\bar{\omega}^*_{t+1}$ in equilibrium, a starting point to investigate the effect of the uncertainty shock is:

$$\frac{dM\left(\bar{\omega}^*_{t+1}, \sigma^*_t\right)}{d\sigma^*_t} = 0 \tag{34}$$

following Condition 21.

Equation 34 holds because the per-unit expected payoff to the home lender from proper

[24] A mean-shifting shock to σ^*_t can represent a combination of two shocks: An uncertainty shock to σ^*_t with $E_t(\omega^*_{t+1}) = 1$ and a first-moment shock that shifts R^*_t.

monitoring, $M(\bar{\omega}^*_{t+1})$, is pinned down by the cost of the monitoring technology, c^*, and the country-specific technology, R^*_t. Both c^* and R^*_t are independent with the foreign uncertainty shock. I write $M\left(\bar{\omega}^*_{t+1}\right) = M\left(\bar{\omega}^*_{t+1}, \sigma^*_t\right)$ to indicate that the distribution of the foreign productivity draw, ω^*_{t+1}, depends on the parameter σ^*_t. Applying the definition of $M(\bar{\omega}^*_{t+1})$ according to Equation 20, Equation 34 implies:

$$\frac{\partial M(\bar{\omega}^*_{t+1}, \sigma^*_t)}{\partial F(\bar{\omega}^*_{t+1}, \sigma^*_t)} \frac{\partial F(\bar{\omega}^*_{t+1}, \sigma^*_t)}{\partial \sigma^*_t} + \frac{\partial M(\bar{\omega}^*_{t+1}, \sigma^*_t)}{\partial \left(F(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}, \sigma^*_t) - F(\bar{\omega}^*_{t+1}, \sigma^*_t)\right)} \frac{\partial \left(F(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}, \sigma^*_t) - F(\bar{\omega}^*_{t+1}, \sigma^*_t)\right)}{\partial \sigma^*_t}$$
$$= -\frac{\partial M(\bar{\omega}^*_{t+1}, \sigma^*_t)}{\partial \bar{\omega}^*_{t+1}} \frac{\partial \bar{\omega}^*_{t+1}}{\partial \sigma^*_t}. \tag{35}$$

Consider an exogenous, mean-preserving shock to σ^*_t that raises the default probability of the foreign subsidiary with $\partial F(\bar{\omega}^*_{t+1}, \sigma^*_t)/\partial \sigma^*_t > 0$, and that the due diligence of the foreign subsidiary will not worsen the increase, $\partial F(\bar{\omega}^*_{t+1}, \sigma^*_t)/\partial \sigma^*_t \leq \partial F(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}, \sigma^*_t)/\partial \sigma^*_t$. There will be:

$$\frac{\partial M(\bar{\omega}^*_{t+1}, \sigma^*_t)}{\partial \bar{\omega}^*_{t+1}} \frac{\partial \bar{\omega}^*_{t+1}}{\partial \sigma^*_t} < 0 \tag{36}$$

since $\partial M(\bar{\omega}^*_{t+1}, \sigma^*_t)/\partial F(\bar{\omega}^*_{t+1}, \sigma^*_t) > 0$ and $\partial M(\bar{\omega}^*_{t+1}, \sigma^*_t)/\partial \left(F(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}, \sigma^*_t) - F(\bar{\omega}^*_{t+1}, \sigma^*_t)\right) > 0$ following Equation 20. The impact of the foreign uncertainty shock on $\bar{\omega}^*_{t+1}$ can then be signed as:

$$\frac{\partial \bar{\omega}^*_{t+1}}{\partial \sigma^*_t} < 0 \tag{37}$$

due to $\partial M(\bar{\omega}^*_{t+1})/\partial \bar{\omega}^*_{t+1} > 0$, as proved by Appendix B.1.

The condition $\partial F(\bar{\omega}^*_{t+1}, \sigma^*_t)/\partial \sigma^*_t > 0$ implies the foreign uncertainty shock is contractionary. It is consistent with the theoretical and empirical evidence from Bloom et al. (2018), Christiano, Motto, and Rostagno (2014), Julio and Yook (2012), Fernandez-Villaverde et al. (2011), Bloom (2009), etc. It is true in my model when R^*_t is not extremely low so that $\bar{\omega}^*_{t+1}$ is not extremely high. The fact that $\bar{\omega}^*_{t+1}$ decreases in R^*_t can be seen from Condition 21 in the equilibrium with $\partial M(\bar{\omega}^*_{t+1})/\partial \bar{\omega}^*_{t+1} > 0$. It should also be noted that $\bar{\omega}^*_{t+1}$ cannot be extraordinarily high. This is because if R^*_t is too low, a $\bar{\omega}^*_{t+1}$ does not exist in the equilibrium

as the foreign lender cannot meet their participation constraint. Appendix B.1 explains the concavity of the expected payoff to the foreign lender with respect to $\bar{\omega}^*_{t+1}$ in details, which tracks the framework of BGG (1999).

Though it is reasonable to assume that the increase in the default probability rises with the managerial misbehavior, whether, and to what extend, $\partial F(\bar{\omega}^*_{t+1}, \sigma^*_t)/\partial\sigma^*_t \leq \partial F(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}, \sigma^*_t)/\partial\sigma^*_t$ is an empirical question since the answer depends on the value of ψ^* for a given R^*_t. If there is somehow $\partial F(\bar{\omega}^*_{t+1}, \sigma^*_t)/\partial\sigma^*_t > F(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}, \sigma^*_t)/\partial\sigma^*_t$, the value of $\partial\bar{\omega}^*_{t+1}/\partial\sigma^*_t$ will grow toward being positive based on Equation 35. This will work against me in finding any empirical result associated with $\partial\bar{\omega}^*_{t+1}/\partial\sigma^*_t < 0$.[25] The same argument goes if the exogenous shock to σ^*_t has a mean-shifting component that depresses R^*_t, which will make the value of $\partial M(\bar{\omega}^*_{t+1})/\partial\bar{\omega}^*_{t+1}$ grow toward being negative following Condition 21.

Condition 37 reveals that the usage of the local informed capital, D^*_t, in the equilibrium debt structure can act as a stabilizer during periods of heightened uncertainty. Intuitively, the foreign lender is incentivized to reduce the private benefit of the foreign subsidiary via local monitoring in order to avoid the default state, in which the foreign subsidiary misbehaves. When a rise in foreign uncertainty makes it easier for the foreign subsidiary to default with the managerial misbehavior, the foreign lender's incentive to monitor becomes stronger, which relaxes their incentive constraint for monitoring with $\partial\bar{\omega}^*_{t+1}/\partial\sigma^*_t < 0$. As explained in Section 3.3, the foreign contractual threshold, $\bar{\omega}^*_{t+1}$, regulates the minimum share of D^*_t/I^*_t to sustain the incentive constraint for monitoring. The relaxed incentive constraint thus allows the parent company to improve its debt structure by funding each unit of I^*_t with additional parent-level debt, which is cheaper due to the diversification benefit, without losing the local

[25] Empirically speaking, however, $\partial F(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}, \sigma^*_t)/\partial\sigma^*_t \geq \partial F(\bar{\omega}^*_{t+1}, \sigma^*_t)/\partial\sigma^*_t > 0$ is almost always true even if R^*_t is low and ψ^* is substantially large. Using the sample period of 2016-2018 of my Brexit natural experiment as an example for back-of-the-envelope calculations. The subsidiary-level debt ratio in the UK, D^*_t/I^*_t, can be estimated as around 0.3 according to Table 1. Approximating the local risky lending rate, r^*_t, using the effective interest rate of bank loans with a fixed rate to UK private non-financial corporations according to the BoE, $1 + r^*_t = 1.045$ (https://www.bankofengland.co.uk/statistics/visual-summaries/effective-interest-rates). $1 + r^*_t$ is around 1.03 for the bank loans with a floating rate or 1.04 based on the yield of the UK non-investment-grade corporate bonds from Capital IQ. Approximating the MNE's country-specific technology R^*_t using the UK GDP growth, $R^*_t = 1.015$. The value is likely to be an underestimation if the UK subsidiaries of non-UK, non-financial MNEs tend to be more productive. With $\bar{\omega}^*_{t+1} = 0.31$, $\partial F(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}, \sigma^*_t)/\partial\sigma^*_t \geq \partial F(\bar{\omega}^*_{t+1}, \sigma^*_t)/\partial\sigma^*_t > 0$ is true even if ψ^* is as large as 0.5, meaning half of ω^*_{t+1} would be lost due to managerial misbehavior. See Figure 2 for a demonstration of this example.

monitoring of the foreign lender. As a result, while the rise in foreign uncertainty can increase the cost of funds since the foreign subsidiary is riskier, the substitution of parent-level debt for subsidiary-level debt as local informed capital can also decrease the cost of funds via improving the debt structure.

The external debt substitution between the parent company and foreign subsidiary and the associated stabilization effect can be summarized by the following empirical predictions:

> **Prediction 1:** Given a higher country-level uncertainty, if MNEs with foreign subsidiaries operating in the country respond with a substitution of external debt between the foreign subsidiaries and their parent companies, there should be an increase in the ratio of parent-level debt to total assets, conditioning on the ratio of total debt to total assets, in the consolidated financial statements of the MNEs.

> **Prediction 2:** If the improvement of the debt structure through the external debt substitution can substantially offset the contractionary impact of the uncertainty shock, there should not be a significant decrease in the ratio of total debt to total assets in the consolidated financial statements of the MNEs.

With the predictions about the external debt substitution between the parent company and foreign subsidiary based on the consolidated financial statements, the next section discusses the detailed effects of the country-level uncertainty shock on the unconsolidated balance sheet of the foreign subsidiary.

3.4.2 The Impact of a Foreign Uncertainty Shock on D_t^*/I_t^*

Because $\partial\bar{\omega}_{t+1}^*/\partial\sigma_t^* < 0$, the foreign uncertainty shock will decrease the ratio of subsidiary-level debt to total assets, D_t^*/I_t^*, through two forces that affect I_t^* in the opposite directions. Combining the participation constraint for the foreign lender (Condition 18) with the foreign contractual threshold (Condition 13), D_t^*/I_t^* in equilibrium is:

$$\frac{D_t^*}{I_t^*} = \frac{\Omega^*(\bar{\omega}_{t+1}^*)R_t^*}{1+r_t^{rf*}} - \frac{c^*+s^*}{1+r_t^{rf*}}, \tag{38}$$

where $\Omega^*(\bar{\omega}^*_{t+1}) = \Omega^*(\bar{\omega}^*_{t+1}, \sigma^*_t)$ denotes the expected share of $I^*_t R^*_t$ for the foreign lender from the subsidiary-level debt contract.

For the mean-preserving shock to σ^*_t, there is:

$$\frac{d(D^*_t/I^*_t)}{d\sigma^*_t} = \frac{R^*_t}{1+r^{rf*}_t}\left[\frac{\partial\Omega^*(\bar{\omega}^*_{t+1},\sigma^*_t)}{\partial\bar{\omega}^*_{t+1}}\frac{\partial\bar{\omega}^*_{t+1}}{\partial\sigma^*_t} + \frac{\partial\Omega^*(\bar{\omega}^*_{t+1},\sigma^*_t)}{\partial F(\bar{\omega}^*_{t+1},\sigma^*_t)}\frac{\partial F(\bar{\omega}^*_{t+1},\sigma^*_t)}{\partial\sigma^*_t}\right]. \tag{39}$$

The first term in the squared brackets, $\left(\partial\Omega^*(\bar{\omega}^*_{t+1},\sigma^*_t)/\partial\bar{\omega}^*_{t+1}\right)\left(\partial\bar{\omega}^*_{t+1}/\partial\sigma^*_t\right) < 0$, represents the expansionary impact from the relaxation of the incentive constraint for monitoring. It enables the MNE to improve its debt structure via the external debt substitution, as explained in the previous section. The term is negative since $\partial\bar{\omega}^*_{t+1}/\partial\sigma^*_t < 0$ and $\partial\Omega^*(\bar{\omega}^*_{t+1},\sigma^*_t)/\partial\bar{\omega}^*_{t+1} > 0$. Appendix B.1 provides the details on $\partial\Omega^*(\bar{\omega}^*_{t+1},\sigma^*_t)/\partial\bar{\omega}^*_{t+1} > 0$.

The second term in the squared brackets, $\left(\partial\Omega^*(\bar{\omega}^*_{t+1},\sigma^*_t)/\partial F(\bar{\omega}^*_{t+1},\sigma^*_t)\right)\left(\partial F(\bar{\omega}^*_{t+1},\sigma^*_t)/\partial\sigma^*_t\right) < 0$, represents the contractionary impact from the higher default probability of the foreign subsidiary. It creates an upward pressure in the risk premium of the MNE and, consequently, a downward pressure in I^*_t through deleveraging (i.e., a fall in the debt-to-equity ratio, conditioning on the debt structure, of the MNE). The term is negative since $\partial F(\bar{\omega}^*_{t+1},\sigma^*_t)/\partial\sigma^*_t > 0$ and $\partial\Omega^*(\bar{\omega}^*_{t+1},\sigma^*_t)/\partial F(\bar{\omega}^*_{t+1},\sigma^*_t) < 0$.[26]

Without the relaxation of the incentive constraint for monitoring, the foreign uncertainty shock would only be contractionary for any subsidiary-level debt used in equilibrium due to the higher default probability.[27] With the relaxation of the incentive constraint, however, the external debt substitution can lower the subsidiary-level debt ratio, D^*_t/I^*_t, without decreasing I^*_t as the substitution reduces the cost of funds for the MNE by improving its debt structure. When the expansionary impact of the external debt substitution substantially

[26] $\partial\Omega^*(\bar{\omega}^*_{t+1})/\partial F(\bar{\omega}^*_{t+1}) < 0$ due to $\Omega^*(\bar{\omega}^*_{t+1}) = \bar{\omega}^*_{t+1}\left(1-F(\bar{\omega}^*_{t+1})\right) + \int_0^{\bar{\omega}^*_{t+1}}(1-\nu^*)\omega^*_{t+1}dF(\omega^*_{t+1})$ and $(1-\nu^*)\omega^*_{t+1} < \bar{\omega}^*_{t+1}\forall\,\omega^*_{t+1} \in [0,\bar{\omega}^*_{t+1}]$.

[27] I have assumed that the exogenous foreign uncertainty shock does not affect the local risk-free interest rate, r^{rf*}_t. If the uncertainty shock additionally raises r^{rf*}_t, the contractionary impact will be amplified due to a larger opportunity cost of the foreign lender. The rise in r^{rf*}_t, along with the contractionary impact from the higher default probability of the foreign subsidiary, can be answered by the foreign central bank, at least partially, via lowering r^{rf*}_t. The movements in the risk-free interest rate do not affect my empirical predictions about the external debt substitution originated from $\partial\bar{\omega}^*_{t+1}/\partial\sigma^*_t < 0$. This is because $\bar{\omega}^*_{t+1}$ is determined by the incentive constraint for monitoring, which is independent with r^{rf*}_t, as shown by Condition 21. As a result, $\partial\bar{\omega}^*_{t+1}/\partial\sigma^*_t$ does not rely on r^{rf*}_t, following Equation 35.

offsets the contractionary impact of the foreign uncertainty shock, it is possible for D_t^*/I_t^* to decline, while I_t^* remains relatively stable. As a result, the effect of the external debt substitution on the subsidiary-level unconsolidated balance sheet can be summarized by the following empirical predictions:

> **Prediction 3:** Given a higher country-level uncertainty, if MNEs with foreign subsidiaries operating in the country respond with a substitution of external debt between the foreign subsidiaries and their parent companies, there should be a decrease in the ratio of external debt to total assets in exchange for an increase in the ratio of internal debt to total assets, conditioning on I_t^*, on the unconsolidated balance sheet of the foreign subsidiaries.

> **Prediction 4:** If the expansionary impact of the external debt substitution can substantially offset the contractionary impact of the uncertainty shock, the ratio of total debt to total assets should remain relatively stable on the unconsolidated balance sheet of the foreign subsidiaries.

3.4.3 The Impact of a Foreign Uncertainty Shock on the Parent Company

Consistent with the contractionary impact on I_t^* through the subsidiary-level debt, the foreign uncertainty shock would yield a downward pressure on the parent company's global investments, I_t and T_t, via $\partial F(\bar{\omega}_{t+1}^*, \sigma_t^*)/\partial \sigma_t^* > 0$. The downward pressure exists because the higher default probability of the foreign subsidiary reduces the expected payoff to the home lender from the parent-level debt contract, ceteris paribus. Specifically, the higher default probability decreases the expected return of the home lender from the foreign project, $\Omega_t^f F_t I_t^* R_t^*$, as $\Omega_t^f = 0 \; \forall \omega_{t+1}^* \leq \bar{\omega}_{t+1}^*$. It also lowers the home lender's expected return from the home project, $\Omega_t^h I_t R_t$, by increasing the probability density of the states $\int_0^{\bar{\omega}_{t+1}^*} 0 dF(\omega_{t+1}^*) I_t R_t$ and $\int_0^{\bar{\omega}_{t+1}^*} \int_0^{\hat{\omega}_{t+1}} (1-\nu)\omega_{t+1} dF(\omega_{t+1}) dF(\omega_{t+1}^*) I_t R_t$. See Equations **??** and **??** for the definitions of Ω_t^f and Ω_t^h, respectively, from Appendix **??**. Overall, the reduced expected payoff to the home lender from the parent-level debt contract raises the risk premium of the parent-level debt. This creates a downward pressure in the leverage of the parent company, $D_t/(I_t + T_t)$, given the minimum share of D_t^*/I_t^* determined by the foreign contractual threshold, $\bar{\omega}_{t+1}^*$.

It is worth noting that the deleverage pressure exists whenever the subsidiary-level debt is used in equilibrium to support the parent-level debt. When the subsidiary-level debt is used without the incentive constraint for monitoring, the uncertainty shock only generates deleverage pressures through the subsidiary- and parent-level debt. When the local informed capital is used with the incentive constraint for monitoring, the expansionary impact from the external debt substitution can offset the deleverage pressures at least partially. Whether, and to what extent, MNEs perform the external debt substitution to stabilize a country-level uncertainty shock so that Predictions 2 and 4 hold is an empirical question explored in Sections 4 and 5.

In the equilibrium where only the parent-level debt is used, $\bar{\omega}^*_{t+1} = 0$. The foreign uncertainty shock would operate entirely through the leverage of the parent company without triggering adjustments in the debt structure by construction. Similar to the case of $\partial F(\bar{\omega}^*_{t+1}, \sigma^*_t)/\partial\sigma^*_t > 0$, the uncertainty shock will still contract the parent company's global investments, I_t and T_t, via deleveraging with $\partial F(\hat{\omega}^*_{t+1}, \sigma^*_t)/\partial\sigma^*_t > 0$. The conclusions associated with $\bar{\omega}^*_{t+1} = 0$ cannot be supported by my empirical findings, however, as will be clear in Sections 4 and 5. The lack of subsidiary-level debt in equilibrium is also not consistent with the existing evidence that subsidiaries have external debt (e.g., Desai, Foley, and Forbes 2008, Santioni, Schiantarelli, and Strahan 2020, Kim, Wilcox, and Yasuda 2020, etc.), and that it is normal for MNEs to have subsidiary-level defaults (e.g., Chowdhry and Coval 1998). Section 3.2.1 provides more recent examples on subsidiary-level defaults due to underperformance.[28]

[28]Though not the focus of this project, my framework incorporates the possibility that the parent company funds the foreign subsidiary internally without primarily using it for the diversification benefit. An example can be the parent company establishes the foreign subsidiary for risky R&D activities. The foreign non-default threshold, $\hat{\omega}^*_{t+1}$, can be high under such circumstance as the foreign return is not meant to serve the parent-level debt in the first place. With $\bar{\omega}^*_{t+1} = 0$, it is then possible that a mean-preserving increase in σ^*_t benefits the parent company via an improved upside potential, $\partial F(\hat{\omega}^*_{t+1}, \sigma^*_t)/\partial\sigma^*_t < 0$. This will lead to an expansion of the parent company's global investments with a rise in its leverage, $D_t/(I_t + T_t)$. Such conclusion cannot be supported by my empirical findings either. The scenario is also more applicable for activities of individual subsidiaries, but less so for activities of MNEs at the country level, especially when the country hosts significant non-financial subsidiaries' activities for the MNEs. The latter case is the focus of my theoretical framework with the representative MNE.

3.4.4 The Role of the Exchange Rate

Though my framework highlights the interaction between the local informed capital and parent-level debt in response to a foreign uncertainty shock per se, it is useful to understand how the uncertainty shock may affect the MNE via the spot and forward exchange rates. To begin with, the key mechanism of my framework does not depend on the exchange rate. Specifically, the impact of the foreign uncertainty shock on the incentive constraint for monitoring and subsidiary-level debt ratio, D_t^*/I_t^*, does not depend on the exchange rate. This is because the incentive constraint for monitoring is decided entirely by the local parameters in Foreign, as shown by Condition 21. Since the incentive constraint pins down the foreign contractual threshold, $\bar{\omega}_{t+1}^*$, while $\bar{\omega}_{t+1}^*$ regulates D_t^*/I_t^* in the equilibrium, the responses of both $\bar{\omega}_{t+1}^*$ and D_t^*/I_t^* to the foreign uncertainty shock are independent with the exchange rate without additional assumptions, following Equations 35 and 39.

Furthermore, the ratio of parent-level debt to total assets on the consolidated balance sheet, $D_t/(I_t + S_t I_t^*)$, is not affected by the spot exchange rate per se in equilibrium because:

$$S_t I_t^* = \frac{T_t}{\Lambda\left(\bar{\omega}_{t+1}^*\right)} \tag{40}$$

by Condition 23. This theoretical outcome is consistent with my empirical findings in Section 4, where I observe a persistently higher $D_t/(I_t + S_t I_t^*)$ during periods of heightened foreign uncertainty, even when there is a depreciation of the Home's currency (i.e., S_t rises).

The parent company's investments, I_t and T_t, are connected with the forward premium $F_{t+1}/S_t = (1+r_t^{rf})/(1+r_t^{rf*})$ through Condition 27 and the CIP in equilibrium, where F_{t+1} is the risk-adjusted forward exchange rate. Therefore, movements in the risk-free interest rates can amplify or dampen the impact of the foreign uncertainty shock on the leverage of the parent company, $D_t/(I_t + T_t)$, via F_{t+1}/S_t. However, movements in the risk-free interest rates do not affect my empirical predictions about the external debt substitution originated from $\partial\bar{\omega}_{t+1}^*/\partial\sigma_t^* < 0$, which improves the MNE's debt structure by lowering the minimum share of D_t^*/I_t^*, as explained in Section 3.4.2. If the forward exchange rate is not risk adjusted, while the country-level uncertainty shock in Foreign induces a CIP deviation with a foreign risk

premium, the contractionary impact of the uncertainty shock on the leverage of the parent company will be amplified through a decline in F_{t+1}/S_t. This will increase the challenge in finding empirical evidence consistent with Prediction 2.[29]

4 Parent-Level Analysis

While MNEs can have incentives to substitute external debt across ICMs following local shocks that enhance the monitoring incentive of subsidiary-level external lenders, whether such substitution can significantly affect their debt structure and mitigate any deleveraging pressure is fundamentally an empirical question. The following sections answer this question with data from both parent and subsidiary levels, utilizing the rise of uncertainty in the UK during an early period of Brexit as a natural experiment.

4.1 The Brexit Interregnum as a Natural Experiment

To identify an exogenous shock that enhances the monitoring incentive of subsidiary-level external lenders, I utilize the special environment in the UK after the announcement of the Brexit vote on June 23, 2016, but before the first Brexit proposal by the UK government at the end of 2018 to perform two DID analyses, which will be described in detail momentarily. This period, which I call the Brexit interregnum (6/23/2016-12/31/2018), provides me a valuable natural experiment for at least three reasons.

First of all, there has been a large, broad, and persistent rise of uncertainty in the UK during the interregnum, following the mostly unexpected Brexit vote, with relatively little other change (Bloom et al. 2019). Thus, the Brexit interregnum can be used to identify a country-level uncertainty shock, which is a natural candidate for studying shocks that change the monitoring incentive of external lenders as highlighted by the model. Notably, the UK remained inside the EU during the interregnum, meaning no real changes caused by the actual Brexit had occurred. Bloom et al. (2019) use detailed surveys to show that, except

[29] When the parent company optimizes in period t with $E_t(S_{t+1})$, instead of using the forward contract, its investments are similarly connected with the exchange rate. In this case, movements in the risk-free interest rates can interact with the impact of the foreign uncertainty shock on the leverage of the parent company in an equivalent manner via the UIP, $E_t(S_{t+1})/S_t = (1 + r_t^{rf})/(1 + r_t^{rf*})$. The contractionary impact of the foreign uncertainty shock on the leverage of the parent company will also be amplified through a decline in $E_t(S_{t+1})/S_t$ when the country-level uncertainty shock induces an UIP deviation with a foreign risk premium.

for the strong initial reaction after the Brexit vote for a few months, the interregnum was dominated by severe uncertainty about the Brexit negotiations, while the expected Brexit outcome was a soft Brexit, where the UK's relationship with the EU would be as close as possible to what it was before Brexit. Hassan et al. (2024) confirm that the Brexit shock predominantly affects firms through uncertainty, as opposed to sentiment, even though there was negative sentiment, especially after the rejection of a soft Brexit. To minimize the impact of a negative first-moment shock, I therefore stop my sample at the end of 2018, before the first Brexit proposal by the UK government signalling a soft Brexit was rejected and a no-deal Brexit became an increasingly real concern.[30]

The second reason why the Brexit interregnum is a valuable natural experiment is that the credit supply in the UK was well stabilized by the BoE (Broadbent 2017; BoE 2017; BoE 2018). The interregnum thus offers me an opportunity to identify a country-level uncertainty shock, without a credit supply shock, which usually tangles with uncertainty shocks, especially during crises. The stable credit market in the UK also helps rule out the possibility that MNEs were substituting external debt across ICMs due to local credit stress.

The third reason why the natural experiment is appealing is that the UK plays a significant role in the activities of MNEs. It is one of the top 5 countries that hosts inward production of foreign MNEs' majority-owned subsidiaries (Cadestin et al. 2018). It is also one of the most important countries for US MNEs in terms of the output and value added by their majority-owned foreign subsidiaries (BEA 2021). As a result, the UK uncertainty shock can impose sizable impacts on MNEs, including US MNEs.

4.2 Data

To investigate if MNEs response to the natural experiment with a substitution of external debt, I merge detailed parent- and subsidiary-level data on US MNEs, together with their complete ownership structure, from multiple sources. For my parent-level analysis, I utilize

[30]Note that my natural experiment does not require a zero first-moment shock since the substitution of external debt across the ICMs only requires the uncertainty shock that changes the monitoring incentive of subsidiary-level external lenders. A negative first-moment shock creates a deleveraging pressure for MNEs, as does a rise in uncertainty. Thus, a negative first-moment shock will make it more difficult for MNEs to stabilize their leverage, at least at the consolidated level, via the substitution of external debt.

the disclosure requirements on US public firms that allows one to observe rich characteristics of US MNEs from their consolidated financial statements. In particular, aside from the usual disclosure requirements for public firms, Regulations S-X and S-K of the Securities Act of 1933 further require US public firms to disclose the detailed composition of their debt structure. This information has been systematically collected by Capital IQ after reviewing each company's regulatory filings and financial footnotes. From 2002 onward, Capital IQ's coverage has been comprehensive (Rauh and Sufi 2010; Colla, Ippolito, and Li 2013; Gurkaynak et al. 2021). Thus, I use Capital IQ to decompose US MNEs' consolidated debt structure and merge it with Compustat for other parent-level characteristics. To ensure data quality, I drop the quarterly observations where the discrepancy in total debt between Capital IQ and Compustat exceeds 10% of Compustat's total debt, following Colla, Ippolito, and Li (2013).

The decomposition of the consolidated debt structure is important for my parent-level analysis because not all types of debt instruments are equally utilized at the operating subsidiary and parent/group levels. Specifically, the vast majority of US non-financial bond debt, especially senior bond debt, has been issued at the parent level over the past two decades (Kolasinski 2009; Altieri et al. 2019). Meanwhile, recent empirical evidence reveals that operating subsidiaries primarily use bank debt, instead of bonds (Santioni, Schiantarelli, and Strahan 2020; Kim et al. 2020). A rich body of research has also shown that banks have comparative advantages and specialize in local monitoring relative to bondholders.[31] Therefore, to test if US MNEs respond to the natural experiment by substituting subsidiary-level external debt (informed capital) with parent-level external debt (uninformed capital) within their consolidated debt structure, one can first check if there is a substitution of bank debt with bond debt, conditioning on the level of book leverage.

There are naturally several caveats regarding this test. To begin with, a rise in the parent-level external debt may not take the form of a rise in bond debt. For instance, an MNE can substitute subsidiary-level bank loans with parent-level syndicated loans without changing bond issuance. In this case, my parent-level analysis will not detect any external debt substitution. In addition, even if US MNEs respond to the UK uncertainty shock with

[31] E.g., Stiglitz and Weiss 1983; Diamond 1984, 1991; Fama 1985; Rajan 1992; Hoshi et al. 1993; Denis and Mihov 2003; Mehran and Thakor 2011; Lin et al. 2013.

a rise in bond debt within the consolidated debt structure, the increase may not reflect a substitution of the subsidiary-level external debt for their UK subsidiaries. To address these concerns, I conduct an additional analysis at the subsidiary level to directly test for the substitution of external debt with internal capital on the unconsolidated balance sheets of the UK subsidiaries, as described in Section 5, alongside a battery of robustness checks in the parent-level analysis to rule out alternative mechanisms.

It should be noted that the evidence from the combined analysis at both the parent and subsidiary levels is valuable because it is difficult to trace internal transactions that can pass through several related parties. By focusing only on the unconsolidated balance sheets of the subsidiaries, one cannot tell if a substitution of external debt is caused by a reallocation of capital within the MNE, while the MNE is deleveraging at the consolidated level, or if there is a substitution of subsidiary-level external debt with parent-level external debt, while the MNE maintains its consolidated leverage.

With the parent-level data from Capital IQ and Compustat, I then merge it with the ownership links from Orbis to identify which US MNEs are exposed to the UK uncertainty shock via UK non-financial operating subsidiaries. Specifically, I map out the complete ownership structure of US MNEs up to 10 levels of subsidiaries — the maximum level of ownership available in Orbis. To reflect a parent company's control over a subsidiary's equity, I define all subsidiaries based on majority ownership, which can be established through either a direct or indirect ownership link. I start my sample with the parent companies of US non-financial MNEs that owned at least one non-financial subsidiary in the US within the first three levels of ownership during the Brexit interregnum.[32] I then identify the US parent companies with the UK exposure as those that owned at least one non-financial subsidiary in the UK within the first three levels of ownership during the Brexit interregnum. To identify the US parent companies that are not exposed to the UK uncertainty shock through the ICMs, I require the US parent company to have no subsidiary in the UK during the same period.

Since my parent-level analysis tests the substitution of external debt through a rise in

[32] Around 90% of the subsidiaries are within the first three levels of ownership in my sample. I include the level restriction to ensure that all US non-financial MNEs have a relevant operating subsidiary in the US within their ownership structure.

bond debt, particularly senior bond debt, within the debt structure, I focus on leveraged US parent companies that use senior bonds in my sample. I further exclude parent companies in the financial and utility sectors by convention. My final sample for the parent-level analysis includes a balanced panel of 1,008 US non-financial MNEs.

4.3 Identification Strategy: Difference-in-Differences Estimation

To test if the US MNEs exposed to the UK uncertainty shock through their ICMs responded by increasing parent-level external debt within their consolidated debt structure during the Brexit interregnum, I conduct the following parent-level DID estimation:

$$Y_{i,t} = \alpha_i + \beta After_t + \gamma After_t \times UK_i + \sum_{k=1}^{K} \varphi_k X_{k,i,t} + \epsilon_{i,t}. \tag{41}$$

The dependent variables, $Y_{i,t}$, include the ratio of senior bonds and notes from Capital IQ to total assets from Compustat, as well as book leverage, defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. The senior bond ratio serves as a proxy for the usage of parent-level external debt (uninformed capital) within the consolidated debt structure, while the book leverage measures the usage of debt versus equity.[33] The time dummy, $After_t$, equals 1 for the quarters during the Brexit interregnum (2016Q3-2018Q4). The time dummy equals 0 for the before period, which I define as a period of equal length before the interregnum (2014Q1-2016Q2).[34] The treatment dummy, UK_i, indicates if a parent company is exposed to the UK uncertainty shock through its non-financial UK subsidiaries. Variables $\{X_{k,i,t,}\}_{k=1}^{K}$ contain additional controls known to be relevant to the activities of the ICMs of non-financial business groups (Buchuk et al. 2020). They include the logarithm of total assets from Compustat as a measure for size, Tobin's Q as a measure for growth opportunities, and the quick ratio as a measure for liquidity. Tobin's Q is calculated using Compustat variables as the sum of the market value of equity and the

[33] I use the senior bond debt in my main analysis as it is more likely to be issued at the parent company level, though my results are highly robust when I define the bond ratio using the sum of senior bonds and notes, subordinate bonds and notes, and commercial papers from Capital IQ instead. These results are shown in Table D3 in the appendix.

[34] My results are robust to the definition of the before period, including alternative start dates for the before period and treating 2016Q2 as part of the after period.

book value of debt, divided by total assets. The quick ratio is calculated using Compustat variables as cash and short-term investments divided by total assets. To address any bias in standard errors when performing DID estimations on potentially serially correlated data, I follow Bertrand et al. (2004) and average the observations for each parent company over the before and after periods.[35]

While US MNEs in general may respond to a variety of shocks during the Brexit interregnum, and the US MNEs with and without the UK exposure can have many persistent differences, these concerns — along with other differences between the two groups that are time-invariant or share a parallel trend — can be accounted for by the DID estimation. Specifically, the identification assumption of my analysis is that the bond ratio and book leverage of the two groups would follow a parallel trend in the absence of the UK uncertainty shock. Figures 3 and 4 provide suggestive evidence for the identification assumption. As shown in Figure 3, Panels A and B, the bond ratio and book leverage of the two groups track each other closely on average during the four years before the Brexit interregnum, with no noticeable time-varying pre-trend. This pattern persists until around the end of 2016Q2 (the beginning of the interregnum), after which the bond ratio of the US parent companies exposed to the UK uncertainty shock becomes noticeably higher relative to those without the UK exposure (Figure 4, Panel A). Interestingly, the book leverage of the two groups continues to track each other closely during the Brexit interregnum (Figure 4, Panel B). These observations are consistent with the prediction that US MNEs exposed to the UK uncertainty shock respond with a rise in parent-level external debt within their consolidated debt structure to stabilize their book leverage, compared to those without such exposure.

Before discussing the main results, Table 1 presents the summary statistics for my parent-level analysis. Panel A shows that the US parent companies in my sample during the full sample period (2014Q1-2016Q2 & 2016Q3-2018Q4) have an average logarithm of total assets of 7.28 ($1.45 billion in level), with a standard deviation of 2.42 ($11.25 million in level). The averages (standard deviations) of the bond ratio and book leverage are 0.18 (0.17) and 0.34 (0.20), respectively. The averages (standard deviations) of Tobin's Q and the quick ratio are

[35]Bertrand et al. (2004) present this approach as the most robust of the alternatives, including bootstrapping and asymptotic approximation of the variance-covariance matrix.

1.73 (1.15) and 0.77 (1.29), respectively. Panel B compares the US parent companies with and without the UK exposure during the before period (2014Q1-2016Q2). The panel shows that the two groups are similar in terms of the bond ratio, book leverage, Tobin's Q, and the quick ratio, although the parent companies with the UK exposure tend to be larger. To ensure that my results are not affected by the size difference, I address the issue in multiple ways, including directly controlling for size and conducting several matching analyses to form balanced samples where the two groups show no significant differences.

4.4 Results

Table 2 presents the main results of my parent-level DID analysis. The analysis begins by using the book leverage as the dependent variable to test if the UK uncertainty shock causes a significant change in the equity and debt structure of the US parent companies with the UK exposure relative to those without. A particular concern is whether the UK uncertainty shock causes a significant deleverage. As column 1 shows, in response to the UK uncertainty shock, there is no significant change in the book leverage.

Given that the consolidated equity and debt structure remains relatively stable, column 2 uses the bond ratio as a proxy to test if there is a significant increase in the parent-level external debt in response to the UK uncertainty shock. As column 2 suggests, there is a significant 2.5 percentage point (around 13 percent) relative increase in the bond ratio by the US parent companies with the UK exposure in response to the uncertainty shock.

Since the DID coefficient in column 1 is positive, albeit insignificant, one would expect it to explain some of the positive DID coefficient in column 2. Column 3 addresses this concern by confirming the controlled direct effect of the UK uncertainty shock on the bond ratio, conditioning on the book leverage. As column 3 shows, conditioning on the book leverage, there is still a significant 1.6 percentage point (around 8.4 percent) relative increase in the bond ratio, consistent with the argument that the uncertainty shock induces a substitution towards parent-level external debt within the consolidated debt structure.

The substitution effect observed in column 3 is robust after controlling for size in column 4. The result is also robust after further controlling for Tobin's Q as a measure for growth

opportunities, the quick ratio as a measure for liquidity, and time-varying trends at the industry level in column 5.[36]

So far, the parent-level DID analysis compares the US parent companies with the UK exposure with those without the exposure. One may be concerned that the relative change within the debt structure during the Brexit interregnum is not driven by the UK uncertainty shock, but by other shocks that somehow cause a relative difference in the debt structure, without creating a relative difference in the book leverage. One such concern is that there could be shocks that differentially affect US parent companies that are more "international." To address this concern, I perform an additional robustness check by using the parent companies of MNEs among the US parent companies without the UK exposure as a placebo treatment group. As Table 2, column 6 indicates, the main DID estimate remains robust ($After \times UK$). Meanwhile, the DID estimate for the placebo treatment group ($After \times MNE$) is statistically insignificant and close to zero.[37] As a result, my findings cannot be explained by shocks that also affect US MNEs without the UK exposure.

To further address the concern that the US parent companies with the UK exposure can be more "European" in nature, I perform another robustness check by using the parent companies that owned non-financial subsidiaries in the EU27 countries during the Brexit interregnum among the US parent companies without the UK exposure as a placebo treatment group.[38] As Table 2, column 7 shows, the main DID estimate remains robust ($After \times UK$). Meanwhile, the DID estimate for the placebo treatment group ($After \times EU27$) is statistically insignificant and close to zero.[39] As a result, my findings cannot be explained by confounding factors in mainland Europe that may be correlated with the UK uncertainty shock.

The results of my parent-level analysis also hold after a battery of additional robustness checks to rule out alternative explanations. These include testing for pre-trends, matching

[36]The result on the book leverage in column 1 is robust when using the book leverage as the dependent variable in the other columns of Table 2. The result on the bond ratio in column 2 is also robust when using the bond ratio without conditioning on the book leverage in the other columns of Table 2. Tables D1 and D2 in the appendix present these results, respectively.

[37]The difference between $After \times UK$ and $After \times MNE$ is statistically significant with a P-value of 0.01.

[38]My results are robust when using alternative definitions for the placebo treatment group, such as adding Switzerland or members of the European single market to the list of the EU27 countries.

[39]The difference between $After \times UK$ and $After \times EU27$ is statistically significant with a P-value of 0.06. The lower significance is likely caused by a smaller number of firms in the placebo treatment group.

the characteristics of the US parent companies with and without the UK exposure in multiple ways to balance the sample, and accounting for policy changes that may differentially impact the bond ratio of the US parent companies with the UK exposure, such as the corporate bond purchase programs by the BoE and ECB. Appendix D details these analyses.[40]

Overall, my parent-level analysis provides evidence that the UK uncertainty shock induces US MNEs with the UK exposure to substitute external debt within their consolidated debt structure. The substitution takes the form of a rise in the bond ratio, as a proxy for parent-level external debt, without a significant change in the book leverage. These findings support my theoretical predictions about changes within the consolidated debt structure.

5 Subsidiary-Level Analysis

While my parent-level analysis provides evidence of a rise in parent-level external debt within the consolidated debt structure, this change may not indicate direct capital flows to the UK subsidiaries as a substitute for their external debt. For example, US parent companies may raise external debt to reallocate their activities out of the UK, which could mask the deleveraging pressure of the UK uncertainty shock in their consolidated financial statements. To check whether US parent companies activated their ICMs to substitute the external debt of their UK subsidiaries, I perform a subsidiary-level analysis, using the unconsolidated balance sheets of UK subsidiaries, which will be explained in this section.

5.1 Data

Although US regulations do not require the disclosure of unconsolidated financial statements, the UK Companies Act requires all limited liability firms in the UK, including subsidiaries, to disclose their unconsolidated balance sheets annually. Importantly, the UK firms are required to report their unconsolidated external and internal liabilities separately, where external liabilities are equivalent to external debt (liabilities owed to external creditors), and internal liabilities primarily include intragroup debt/payables (liabilities not owed to exter-

[40] Additionally, the results of my parent-level analysis are robust when I define the bond ratio as the sum of senior bonds and notes, subordinate bonds and notes, and commercial papers from Capital IQ to total assets from Compustat. The results using this more general bond ratio are shown by Table D3 in the appendix.

nal creditors).[41] Failures to accurately disclose their records to the UK Companies House will result in a criminal offence.

Using the data on the unconsolidated balance sheets, I then construct the sample for my subsidiary-level analysis based on the complete ownership structure from Orbis. For each UK firm, Orbis allows me to identify whether the firm is a (majority-owned) subsidiary of US MNEs or UK business groups through either direct or indirect ownership links during the Brexit interregnum. Since subsidiaries of a business group can access ICMs in response to local shocks, their behavior is typically not comparable to that of standalone firms. Thus, to ensure comparability, I compare the subsidiaries of US MNEs with those of UK business groups when examining the response to the UK uncertainty shock in the UK tradable sector. As US parent companies should be less affected by the UK uncertainty shock, they should be able to better support their UK subsidiaries by raising parent-level external debt, especially when the uncertainty shock allows for an improvement in the consolidated debt structure by substituting subsidiary-level external debt with parent-level external debt. Therefore, my subsidiary-level analysis should still reveal that US MNEs activated their ICMs to substitute the external debt of their UK subsidiaries.[42]

To prepare the final sample for my subsidiary-level analysis, I ensure that the subsidiaries in my sample form a balanced panel and have observations with positive liabilities, which is expected for active, operating subsidiaries.[43] This process yields a balanced panel of 1,349 UK subsidiaries of US MNEs and 7,414 UK subsidiaries of UK business groups. The summary statistics of my sample, and my identification strategy, will be described in the next section.

[41] Although liabilities not owed to external creditors primarily include intragroup debt/payables, they also include liabilities related to pension contributions and social security, corporate income tax or value-added tax liabilities, and deferred revenues. These items should not be a concern since, to the best of my knowledge, no major changes affecting pension contributions, social security, or tax liabilities occurred in the UK during the Brexit interregnum, prior to the actual Brexit. In addition, my results are robust after directly accounting for the provisions for these liability items.

[42] It should be noted that UK business groups include UK MNEs, and it is possible for a UK MNE to have only shell holding companies in the UK with the majority of its operations abroad. To capture the operating UK subsidiaries of genuinely UK-based business groups, I require in my analysis that their UK subsidiaries are not intermediate parent companies of non-UK subsidiaries, and that the UK subsidiaries are not majority-owned by non-UK intermediate parent companies.

[43] In fact, most, if not all, subsidiaries in the data have positive liabilities.

5.2 Identification Strategy: Difference-in-Differences Estimation

To examine whether US MNEs activated their ICMs to substitute the external debt of their UK subsidiaries in response to the UK uncertainty shock, I conduct the following subsidiary-level DID estimation using data from the unconsolidated balance sheets:

$$Y_{i,t} = \alpha_i + \beta After_t + \gamma After_t \times Foreign_i + \sum_{k=1}^{K} \varphi_k X_{k,i,t} + \epsilon_{i,t}. \tag{42}$$

The dependent variables, $Y_{i,t}$, include the ratio of internal liabilities to total assets, the ratio of external liabilities to total assets, and the ratio of total (internal + external) liabilities to total assets. The internal and external liabilities ratios can directly test whether US MNEs activated their ICMs to substitute the external debt of their UK subsidiaries with internal debt. The total liabilities ratio checks whether such substitution can be explained by deleveraging. The time dummy, $After_t$, equals 1 for the period of Brexit interregnum (2017-2018). The time dummy equals 0 for the before period, which is define as a period of equal length before the interregnum (2014-2015), in line with my parent-level analysis.[44] The treatment dummy, $Foreign_i$, indicates if a subsidiary is owned by US MNEs, instead of UK business groups. Variables $\{X_{k,i,t,}\}_{k=1}^{K}$ contain additional controls for robustness checks. They include variables that are commonly available for privately-owned subsidiaries in the data, such as the logarithm of total assets as a measure for size and the interaction term between the time dummy and NACE codes to account for industry-level time-varying trends. Consistent with my parent-level analysis, I follow Bertrand et al. (2004) and average the observations for each subsidiary over the before and after periods to address any bias in standard errors when performing DID estimations on potentially serially correlated data.

It should be noted that, while many factors can affect the UK subsidiaries of US MNEs during the Brexit interregnum, the DID estimation can account for all such factors that also affect the UK subsidiaries of UK business groups, together with any time-invariant differences between the two groups. Hence, the identification assumption of my analysis

[44] I exclude 2016 from the after period since the Brexit vote occurred in the middle of the year, although my results are robust to whether including 2016 in the after period or not.

is that the liability ratios of the two groups would follow a parallel trend in the absence of the UK uncertainty shock. Figure 5 provides suggestive evidence for the identification assumption. As shown in Panel A, the two groups share a comparable growth rate in the ratio of equity to total assets (1 - the total liabilities ratio) on average during the four years before the Brexit interregnum. Meanwhile, Panel B shows that the internal and external liabilities ratios of the two groups remain remarkably stable relative to each other. However, during the Brexit interregnum, Panel A shows that the equity ratio of the UK subsidiaries of US MNEs seems to increase, which could reflect a deleveraging pressure or a substitution of external debt with internal equity. As will be clarified in the next section, this difference turns out to be insignificant. Meanwhile, Panel B shows a much more substantial substitution of external liabilities with internal liabilities. Overall, these observations seem to support the argument that US MNEs activated their ICMs to substitute the external debt of their UK subsidiaries in response to the UK uncertainty shock.

Before discussing the regression results, Table 3 presents the summary statistics for my subsidiary-level analysis. Panel A shows that the UK subsidiaries in my sample during the full sample period (2014-2015 & 2017-2018) have an average logarithm of total assets of 7.9 (2.7 million GBP in level), with a standard deviation of 2.2 (9.03 thousand GBP in level). The averages (standard deviations) of the internal and external liabilities ratio are 0.31 (0.41) and 0.29 (0.30), respectively. The average (standard deviation) of the total liabilities ratio (leverage) is 0.63 (0.52). In addition, among the subsidiaries with available data, the average (standard deviation) of the ratio of provisions for other liabilities to total assets is 0.02 (0.07), where other liabilities are liabilities not owed to external creditors (internal liabilities) that are not intra-group debt/payables. These include liabilities related to pension contributions and social security, corporate income tax or value-added tax liabilities, and deferred revenues. Panel B compares the UK subsidiaries of US MNEs and UK business groups during the before period (2014-2015). The panel shows that, although the two groups have relatively similar leverage and provisions for other liabilities, the UK subsidiaries of US MNEs tend to be larger. However, the concern about the size difference can be alleviated, as my results remain almost unchanged when I explicitly control for size in multiple robustness checks, which will be explained in the following section.

5.3 Results

Table 4 presents the main results of my subsidiary-level DID analysis. The analysis begins by using the internal liabilities ratio as the dependent variable to test whether, in response to the UK uncertainty shock, the UK subsidiaries of US MNEs indeed increase the usage of internal debt on their unconsolidated balance sheets, while the US parent companies increase the usage of parent-level external debt in their consolidated debt structure, as shown by my parent-level analysis. Column 1 demonstrates that this is the case. Compared with those of UK business groups, the UK subsidiaries of US MNEs raise their internal liabilities ratio significantly by 6.6 percentage points.

Given the rise in internal liabilities, I then investigate whether the rise reflects US MNEs using their ICMs to substitute the external debt on their UK subsidiaries' unconsolidated balance sheets. Column 5 confirms that this is the case. Compared with those of UK business groups, the UK subsidiaries of US MNEs simultaneously lower their external liabilities ratio significantly by 8.3 percentage points. Column 9 further shows that the relative changes in the liability structure cannot be explained by changes in the structure of debt and equity (deleveraging). As the column indicates, although it has a negative sign, the DID estimate for the total liabilities ratio (leverage) is substantially closer to zero and statistically insignificant.

My results on the internal and external liabilities ratios are robust after accounting for size (columns 2 and 6), time-varying trends at the industry level (columns 3 and 7), and leverage (columns 4 and 8). Similarly, the result on leverage is robust after accounting for size (column 10) and time-varying trends at the industry level (column 11). My results also hold after a series of additional robustness checks to rule out alternative explanations. These include testing for pre-trends, directly accounting for the provisions for other liabilities, and generalizing my results to the UK subsidiaries of any non-UK MNEs to verify if they are driven by time-varying factors unique to US MNEs. Appendix E details these analyses.

Overall, the results of subsidiary-level analysis are complementary to those of my parent-level analysis. While my parent-level analysis provides evidence that US MNEs raise parent-level external debt in response to the UK uncertainty shock, my subsidiary-level analysis shows that US MNEs indeed activate their ICMs to substitute the external debt in the

unconsolidated balance sheets of their UK subsidiaries. Together, the data at both the parent and subsidiary levels indicate that the ICMs of MNEs can interconnect different external capital markets through a significant substitution of external debt, which helps stabilize the deleveraging pressure of local shocks, at least at the group level.

6 Conclusion

In this paper, I study how MNEs connect external lenders through their ICMs. ICMs allow MNEs to borrow globally with the cash flows of their subsidiaries and enable the reallocation of capital internally to substitute external debt. By facilitating interactions with different external lenders, ICMs help shape the funding capacity of MNEs, which are a prominent force in the global economy. Despite its importance, the nature of this interaction has not been fully understood. My paper fills this gap by studying how the external lenders at the parent level interact with those at the subsidiary level, and the unique role of subsidiary-level external lenders in the response of MNEs to local shocks.

Overall, my paper makes three contributions. My first contribution is to theoretically derive the optimal mix of parent- and subsidiary-level external debt, where parent-level external debt enjoys a diversification benefit that grants a financing advantage to multinational parents, while subsidiary-level external lenders can provide informed capital to reduce agency problems between a parent company and its subsidiaries through delegated monitoring.

Given the optimal debt structure in equilibrium, my second contribution is to theoretically demonstrate how the parent- and subsidiary-level external debt of MNEs interconnect through ICMs when facing local country-level shocks. When a local shock enhances the monitoring incentive of subsidiary-level external lenders, I show that MNEs can afford to lower the stake of these lenders without destroying their incentives to monitor. This enables MNEs to improve their debt structure by substituting subsidiary-level external debt with parent-level external debt to lower their cost of funds as the latter can benefit from diversification.

While there is a theoretical incentive for MNEs to substitute external debt between parent- and subsidiary-level lenders, my third contribution is to empirically test this substitution through the lens of uncertainty shocks, which serve as a natural proxy for shocks

that change the monitoring incentive of external lenders. Utilizing the uncertainty shock in the UK during the Brexit interregnum as a natural experiment, I find evidence consistent with my theoretical predictions from the consolidated financial statements of US MNEs and the unconsolidated financial statements of their UK subsidiaries. Specifically, based on DID analyses at both the parent and subsidiary levels, I find that US MNEs respond to the UK uncertainty shock by significantly substituting the external debt of their UK subsidiaries with parent-level external debt to stabilize the MNEs' consolidated book leverage.

Collectively, the findings of my paper support the argument that the ICMs of MNEs interconnect external capital markets, especially in terms of lenders at the parent and subsidiary levels. When facing a local shock that enhances the monitoring incentive of subsidiary-level external lenders, MNEs can substitute external debt across their ICMs, which helps stabilize the deleveraging pressure of the shock, at least at the group level.

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Figure 1: Parent- and Subsidiary-Level Debt Contracts

This figure visually summarizes the parent- and subsidiary-level debt contracts for all sets of productivity draws $(\omega_{t+1}, \omega^*_{t+1})$. ω_{t+1} represents the private productivity draw of the parent company, and ω^*_{t+1} represents the private productivity draw of the foreign subsidiary. Both draws come from independent log-normal distributions with a mean of one. The blue dashed lines mark the fixed non-default thresholds of the parent-level debt contract ($\hat{\omega}_{t+1}$ and $\hat{\omega}^*_{t+1}$). The red solid line marks the state-contingent default threshold of the parent-level debt contract ($\bar{\omega}_{t+1}$). The black dashed line marks the fixed default threshold of the subsidiary-level debt contract ($\bar{\omega}^*_{t+1}$). D and ND describe the default and non-default regions, respectively, for the parent company.

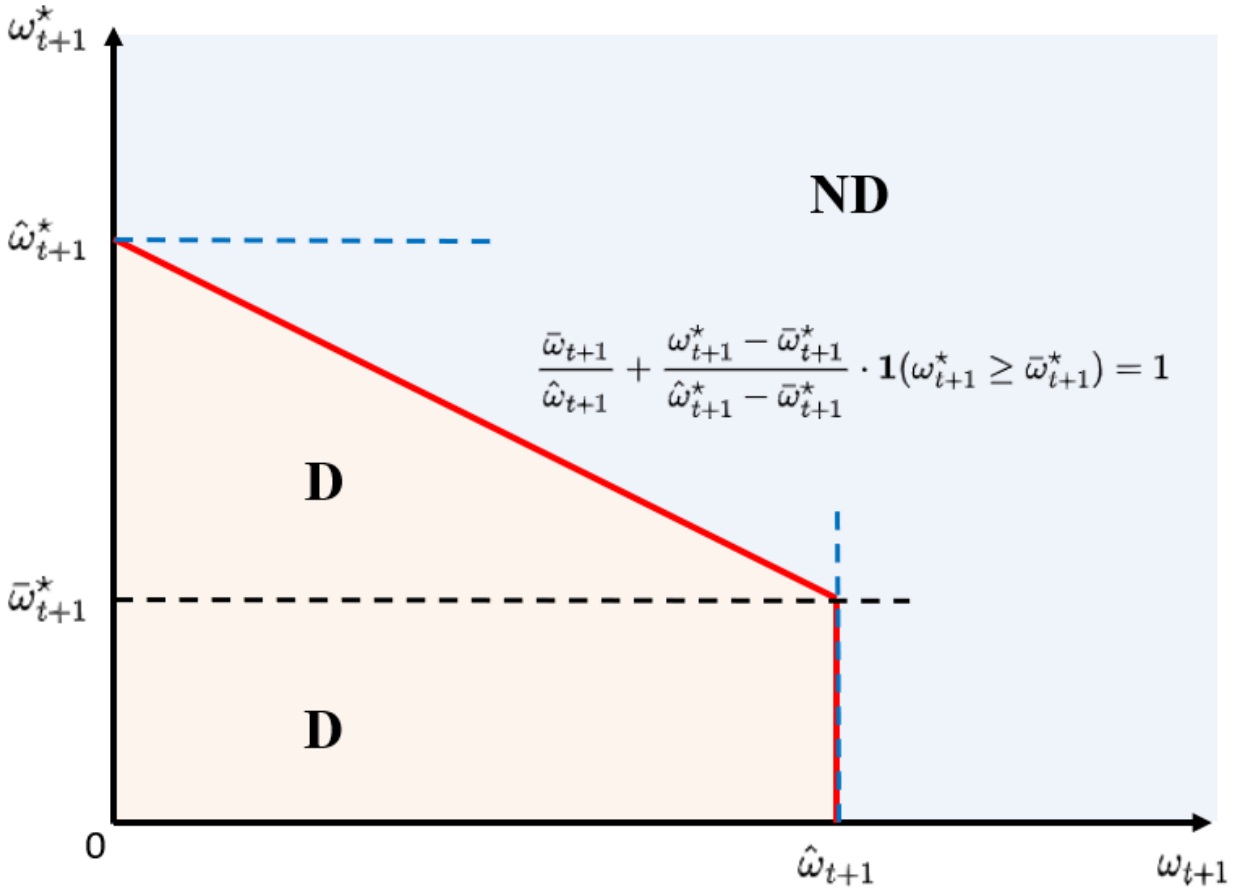


Figure 2: The Log-Normal CDF of the Productivity Draw

This figure demonstrates the change in the CDF of the productivity draw in response to an uncertainty shock. The productivity draw, labelled as Omega, is log-normally distributed with a unit mean. The uncertainty shock is a mean-preserving shock to the standard deviation of the productivity draw's natural logarithm. The standard deviation is labelled as sigma and can be set to around 0.28 as a point of reference. Sigma is estimated to be around 0.28 for the US with a standard deviation of around 0.2 (see, e.g., Carlstrom and Fuerst 1997, BGG 1999, Dorofeenko, Gabriel, and Salyer 2008, etc.).

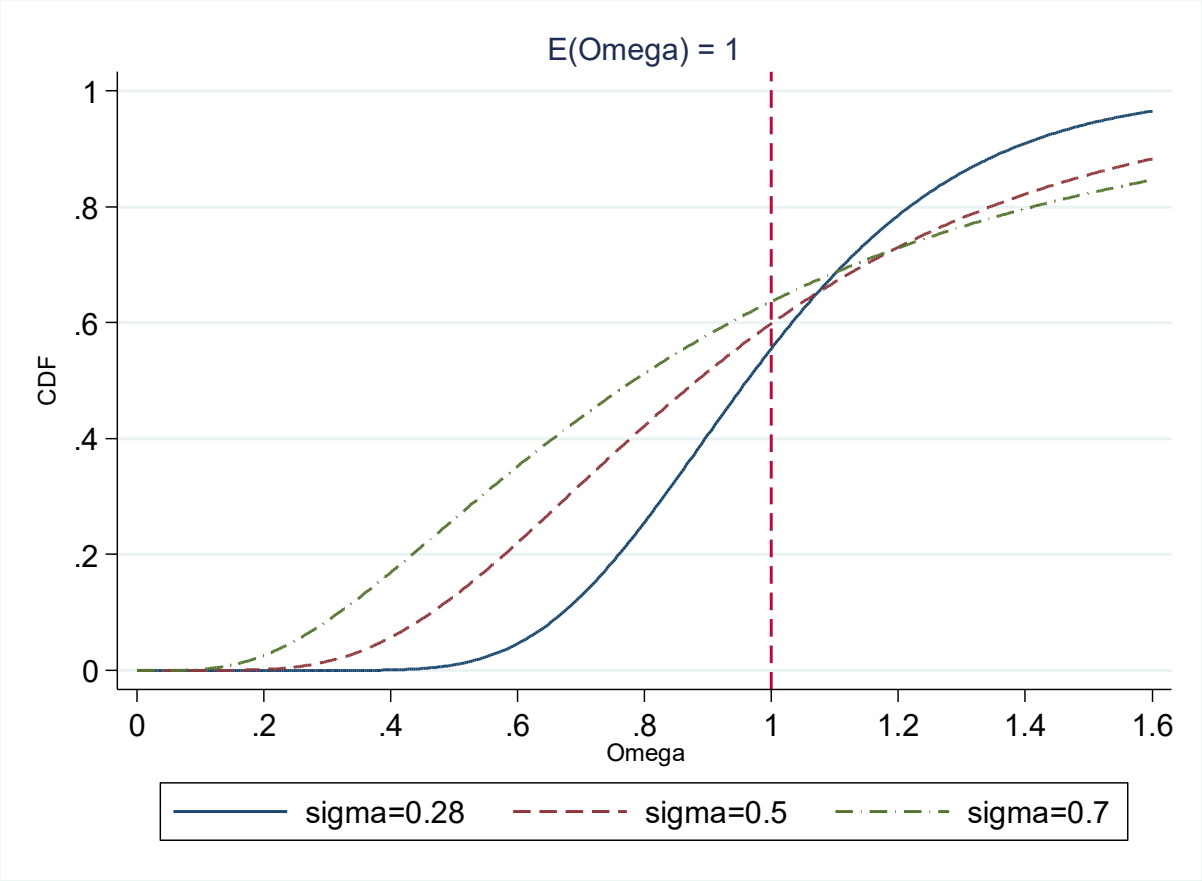
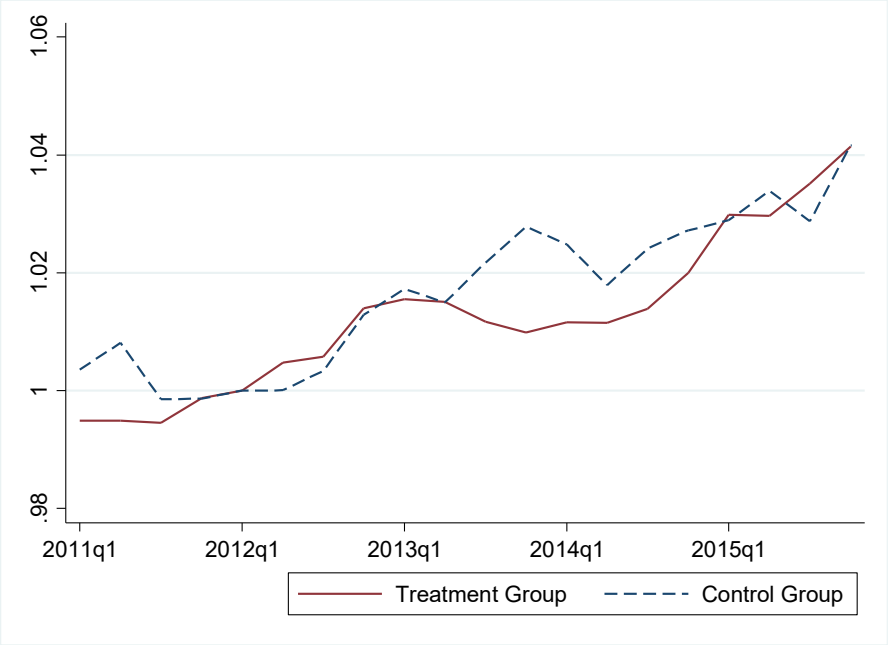


Figure 3: Consolidated Bonds-to-Assets Ratio and Book Leverage, Pre-Trend

This figure plots the quarterly averages of the consolidated bonds-to-assets ratio and book leverage for the US parent companies with and without the exposure to the UK uncertainty shock during 2011Q1-2015Q4. The bonds-to-assets ratio is defined as the ratio of senior bonds and notes from Capital IQ to total assets from Compustat. The book leverage is defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. All variables are normalized with their values in 2012Q1 set to 1 for easier comparability.

Panel A: Bonds-to-Assets Ratio, Normalized



Panel B: Book Leverage, Normalized

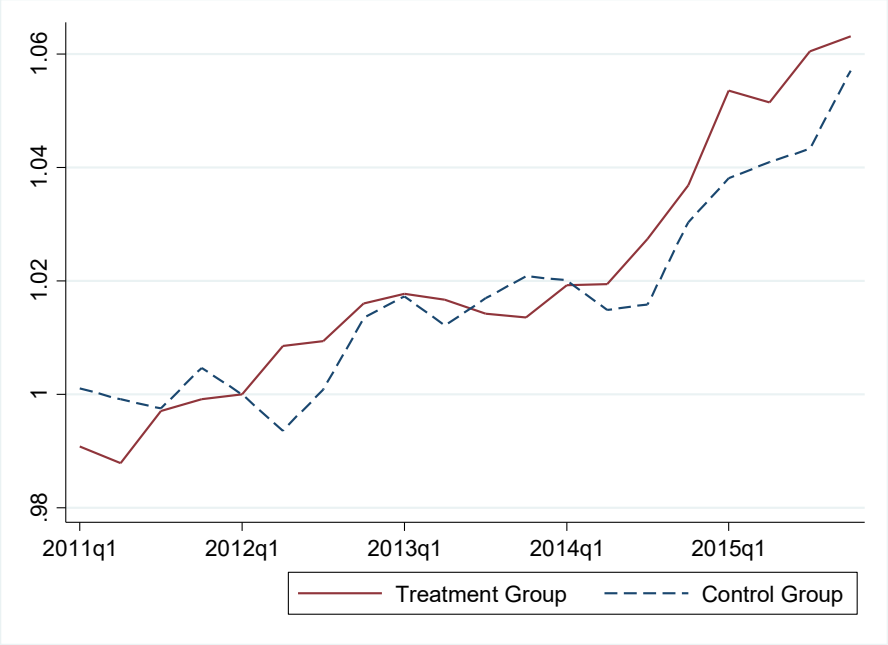
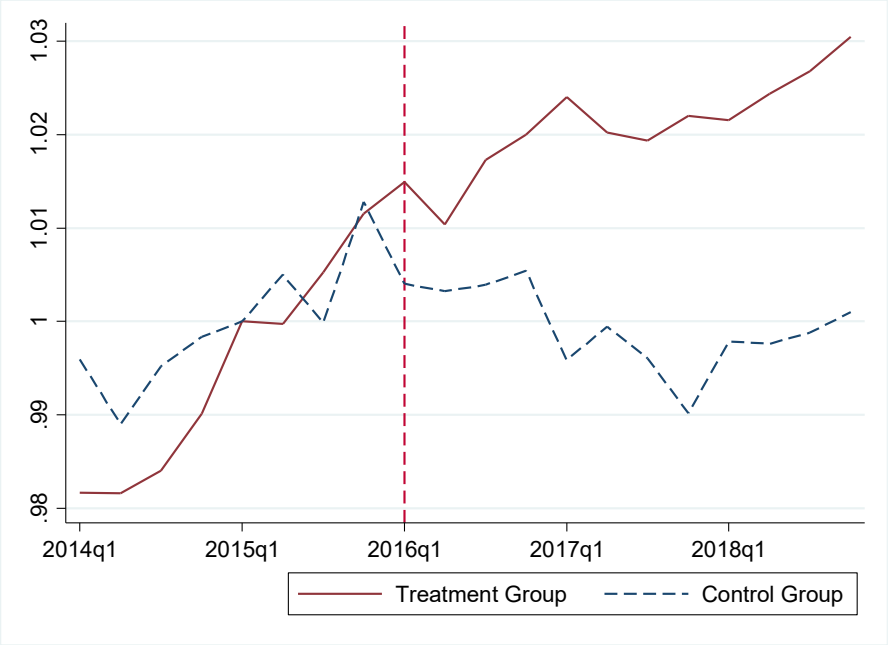


Figure 4: Consolidated Bonds-to-Assets Ratio and Book Leverage

This figure plots the quarterly averages of the consolidated bonds-to-assets ratio and book leverage for the US parent companies with and without the exposure to the UK uncertainty shock during 2014Q1-2018Q4. The bonds-to-assets ratio is defined as the ratio of senior bonds and notes from Capital IQ to total assets from Compustat. The book leverage is defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. All variables are normalized with their values in 2015Q1 set to 1 for easier comparability.

Panel A: Bonds-to-Assets Ratio, Normalized



Panel B: Book Leverage, Normalized

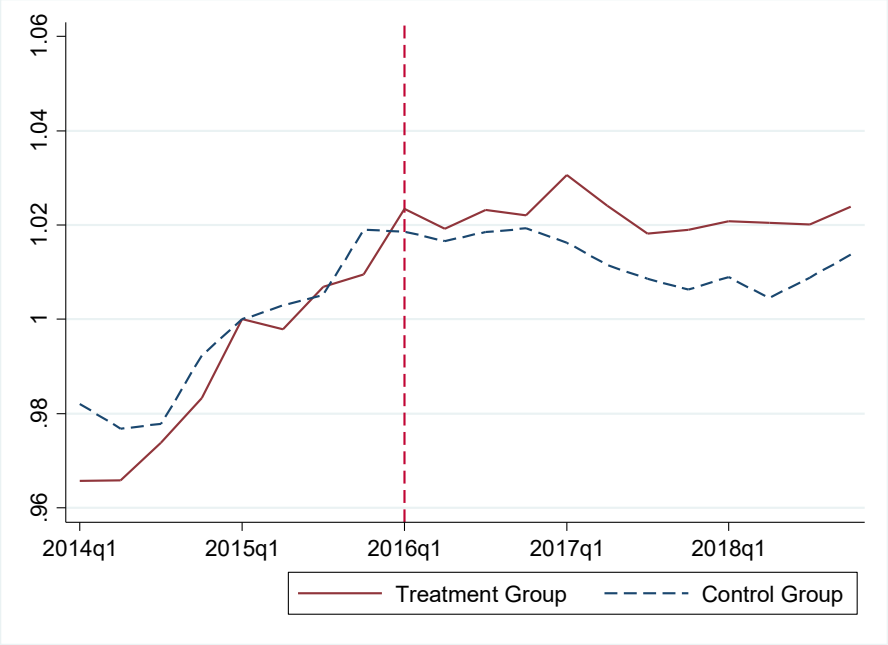
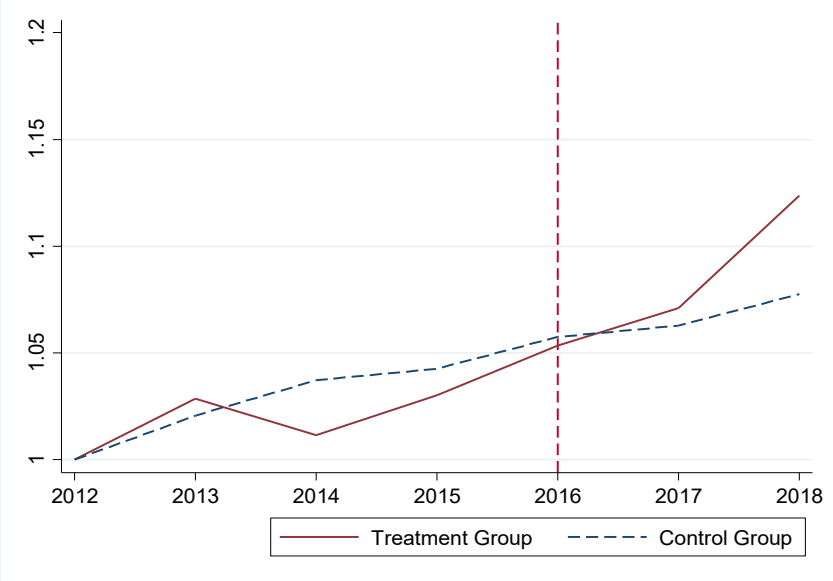


Figure 5: Unconsolidated Liability Ratios

This figure plots the annual averages of the liability ratios of the UK subsidiaries of US MNEs and UK business groups during 2012-2018. All data are based on the unconsolidated balance sheets reported to the UK Companies House by UK firms. Panel A plots the ratio of equity to total assets, which is one minus the ratio of the sum of internal and external liabilities to total assets. The ratio is normalized with its values in 2012 set to 1 for easier comparability. Panel B plots the difference in the ratio of internal liabilities to total assets and the difference in the ratio of external liabilities to total assets between the UK subsidiaries of US MNEs and those of UK business groups (US MNEs – UK business groups).

Panel A: Equity-to-Assets Ratio, Normalized



Panel B: Internal-Liabilities-to-Assets Ratio vs. External-Liabilities-to-Assets Ratio, Differences

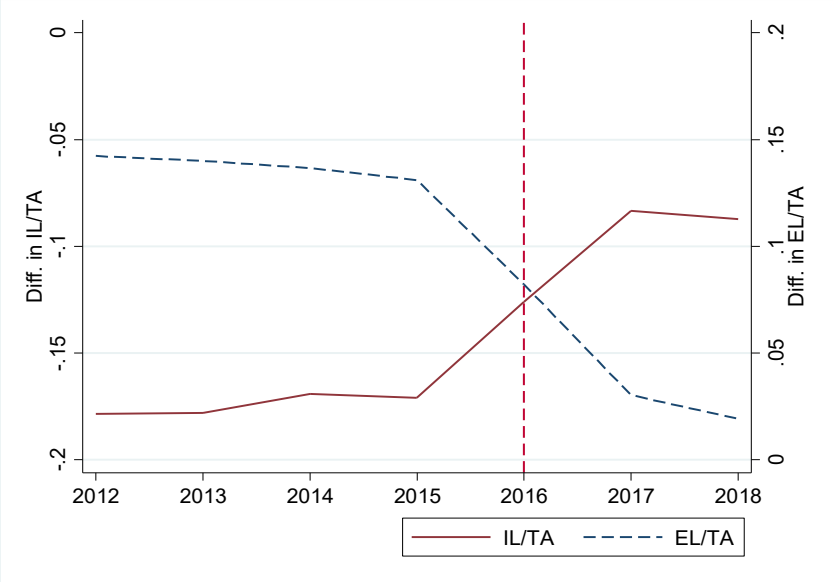


Table 1: Summary Statistics for Parent-Level DID Analysis

This table presents the summary statistics for my parent-level DID analysis based on the consolidated financial statements. Each observation is the average for the before (2014Q1-2016Q2) or after (2016Q3-2018Q4) period of a US parent company. SnrBond/TA is the bonds-to-assets ratio, defined as the ratio of senior bonds and notes from Capital IQ to total assets from Compustat. BookLeverage is defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. LnTA is the logarithm of total assets in millions of US dollars from Compustat. Tobin'sQ is calculated using Compustat variables as the sum of the market value of equity and the book value of debt, divided by total assets. Quick is the quick ratio calculated using Compustat variables as cash and short-term investments divided by total assets.

Panel A: Full Sample

	Before Period (2014Q1-2016Q2)						Full Period (2014Q1-2016Q2 & 2016Q3-2018Q4)					
	Mean	SD	Median	P1	P99	Num Obs	Mean	SD	Median	P1	P99	Num Obs
SnrBond/TA	.18	.17	.15	0	.79	1,008	.18	.17	.16	0	.74	2,016
BookLeverage	.33	.20	.30	.01	.91	1,008	.34	.20	.31	.009	.93	2,016
LnTA	7.21	2.42	7.63	.79	11.79	1,008	7.28	2.42	7.69	0.84	11.93	2,016
Tobin'sQ	1.76	1.19	1.40	.52	5.96	1,008	1.73	1.15	1.37	.51	5.96	2,016
Quick	.81	1.38	.41	.01	6.82	1,008	.77	1.29	.39	.01	5.94	2,016

Panel B: US Parent Companies with and without the UK Exposure during the Before Period (2014Q1-2016Q2)

	US Parent Companies with the UK Exposure						US Parent Companies without the UK Exposure					
	Mean	SD	Median	P1	P99	Num Obs	Mean	SD	Median	P1	P99	Num Obs
SnrBond/TA	.19	.16	.17	0	.71	539	.16	.18	.10	0	.81	469
BookLeverage	.32	.18	.29	.01	.88	539	.33	.22	.31	.004	0.91	469
LnTA	8.26	1.76	8.32	2.91	12.22	539	6.01	2.53	6.62	-.11	10.42	469
Tobin'sQ	1.81	1.10	1.49	.60	5.96	539	1.71	1.28	1.28	.51	5.96	469
Quick	.79	1.11	.47	.04	4.66	539	.83	1.64	.34	.005	7.28	469

Table 2: Main Results of Parent-Level DID Analysis

This table presents the main results of my parent-level DID analysis. The dependent variables are book leverage in column (1) and the bond ratio in columns (2) to (7). The book leverage is defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. The bond ratio is defined as the ratio of senior bonds and notes from Capital IQ to total assets from Compustat. Each observation in the sample is the average of the before (2014Q1-2016Q2) or after (2016Q3-2018Q4) period for a given US parent company. All models include firm fixed effects, which subsume the effect of the standalone dummies for different groups of the parent companies. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the parent company level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	(1) BookLev	(2) SnrBond/TA	(3) SnrBond/TA	(4) SnrBond/TA	(5) SnrBond/TA	(6) SnrBond/TA	(7) SnrBond/TA
After	0.017**	-0.003	-0.014***	-0.015***	-0.022*	-0.021	-0.022*
	(2.463)	(-0.411)	(-2.936)	(-2.998)	(-1.755)	(-1.554)	(-1.756)
After×UK	0.013	0.025***	0.016***	0.016***	0.018***	0.017**	0.018***
	(1.572)	(3.063)	(2.727)	(2.698)	(2.913)	(2.094)	(2.636)
After×MNE						-0.002	
						(-0.184)	
After×EU27							0.001
							(0.144)
BookLeverage			0.709***	0.710***	0.719***	0.719***	0.719***
			(14.902)	(14.920)	(15.040)	(15.019)	(15.046)
LnTA				0.003	0.003	0.003	0.003
				(0.307)	(0.240)	(0.236)	(0.243)
Tobin'sQ					0.003	0.003	0.003
					(0.473)	(0.473)	(0.471)
Quick					0.002	0.002	0.002
					(0.663)	(0.665)	(0.670)
Firm-Level FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	No	No	Yes	Yes	Yes
Observations	2016	2016	2016	2016	2016	2016	2016
R-squared	0.035	0.016	0.502	0.502	0.527	0.527	0.527

Table 3: Summary Statistics for Subsidiary-Level Analysis

This table presents the summary statistics for my subsidiary-level DID analysis based on the unconsolidated balance sheets reported to the UK Companies House by UK firms. Each observation is the average for the before (2014-2015) or after (2017-2018) period of a UK subsidiary. IntlLiabRatio is the ratio of internal liabilities to total assets. ExtlLiabRatio is the ratio of external liabilities to total assets. LnTA is the logarithm of total assets in thousands of British pounds sterling. Leverage is the ratio of total (internal + external) liabilities to total assets. ProvisionRatio is the ratio of provisions for other liabilities to total assets, where other liabilities are liabilities not owed to external creditors (internal liabilities) that are not intra-group debt/payables. These include deferred revenues, liabilities related to pension contributions and social security, and corporate income tax or value-added tax liabilities. All ratios are winsorized at 1% in each tail to avoid extreme values.

Panel A: Full Sample

	Before Period (2014-2015)						Full Period (2014-2015 & 2017-2018)					
	Mean	SD	Median	P1	P99	Num Obs	Mean	SD	Median	P1	P99	Num Obs
IntlLiabRatio	.35	.42	.22	0	1.99	8763	.31	.41	.17	0	2.07	17526
ExtlLiabRatio	.26	.29	.16	0	1.12	8763	.29	.30	.21	0	1.12	17526
LnTA	7.85	2.18	7.99	1.81	13.27	8763	7.90	2.20	8.05	1.70	13.30	17526
Leverage	.64	.51	.56	.009	2.93	8763	.63	.52	.55	.007	3.03	17526
ProvisionRatio	.02	.06	.005	0	.18	7738	.02	.07	.005	0	.19	15476

Panel B: UK Subsidiaries of US MNEs vs. UK Subsidiaries of UK Business Groups during the Before Period (2014-2015)

	UK Subsidiaries of US MNEs						UK Subsidiaries of UK Business Groups					
	Mean	SD	Median	P1	P99	Num Obs	Mean	SD	Median	P1	P99	Num Obs
IntlLiabRatio	.19	.30	.11	0	1.55	1349	.38	.43	.25	0	2.02	7414
ExtlLiabRatio	.34	.30	.26	0	1.12	1349	.25	.29	.14	0	1.12	7414
LnTA	9.50	1.98	9.51	4.16	14.18	1349	7.55	2.08	7.73	1.61	12.69	7414
Leverage	.56	.51	.44	.002	2.96	1349	.65	.50	.58	.02	2.89	7414
ProvisionRatio	.02	.06	.002	0	.25	1226	.02	.06	.006	0	.17	6512

Table 4: Main Results of Subsidiary-Level DID Analysis

This table presents the main results of my subsidiary-level DID analysis. The dependent variables are the ratio of internal liabilities to total assets from columns (1) to (4), the ratio of external liabilities to total assets from columns (5) to (8), and leverage from columns (9) to (11), where leverage is the ratio of total (internal + external) liabilities to total assets. All variables are from the unconsolidated balanced sheets reported to the UK Companies House by UK firms. Each observation in the sample is the average of the before (2014-2015) or after (2017-2018) period for a given UK subsidiary. All models include firm fixed effects, which subsume the effect of the standalone dummy for the UK subsidiaries of US MNEs. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the subsidiary level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	IL/TA	IL/TA	IL/TA	IL/TA	EL/TA	EL/TA	EL/TA	EL/TA	Leverage	Leverage	Leverage
After	-0.101***	-0.090***	-0.098***	-0.104***	0.080***	0.078***	0.100***	0.096***	-0.010**	0.004	0.015
	(-23.744)	(-19.679)	(-7.294)	(-8.490)	(27.208)	(25.645)	(8.702)	(8.626)	(-2.179)	(0.755)	(1.434)
After×Foreign	0.066***	0.066***	0.063***	0.070***	-0.083***	-0.083***	-0.078***	-0.075***	-0.019	-0.019	-0.016
	(7.887)	(8.299)	(7.848)	(8.816)	(-11.049)	(-11.059)	(-10.154)	(-11.401)	(-1.517)	(-1.546)	(-1.313)
LnTA		-0.108***	-0.107***	-0.050***		0.014**	0.014**	0.044***		-0.133***	-0.133***
		(-6.696)	(-6.696)	(-5.382)		(2.159)	(2.119)	(5.875)		(-7.218)	(-7.194)
Leverage				0.428***				0.228***			
				(14.383)				(17.177)			
Firm-Level FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes
Observations	17526	17526	17526	17526	17526	17526	17526	17526	17526	17526	17526
R-squared	0.066	0.110	0.116	0.332	0.078	0.079	0.084	0.202	0.001	0.054	0.059

Appendices

A Parent-Level Debt Contract: Proof

This appendix derives the optimal contract for the parent company based on the setup from Section 3.1 and the CSV problem described in Section 3.2.1. Since the derivation of the optimal contract takes the return available to the parent company at the end of $t+1$ as given, I make the following assumptions to simplify notations without loss of generality. First, I assume that all returns are denominated in the same currency. Secondly, I assume that $\bar{\omega}^*_{t+1} = 0$ so that the total return available to the parent company at the end of $t+1$ before paying the home lender is $\omega_{t+1} I_t R_t + \omega^*_{t+1} I^*_t R^*_t$ (i.e., there is no enforceable contractual threshold by the foreign lender). The same argument applies when $\bar{\omega}^*_{t+1} > 0$ with the adjustment that the total return available to the parent company becomes $\omega_{t+1} I_t R_t + \left(\omega^*_{t+1} - \bar{\omega}^*_{t+1}\right) \mathbf{1}(\omega^*_{t+1} \geq \bar{\omega}^*_{t+1}) I^*_t R^*_t$.

Following the CSV problem, the parent company can freely observe the total return available on its balance sheet at the end of $t+1$, $\omega_{t+1} I_t R_t + \omega^*_{t+1} I^*_t R^*_t$, and report $\tilde{\omega}_{t+1} I_t R_t + \tilde{\omega}^*_{t+1} I^*_t R^*_t$ to the investor. Given the reported return, the investor can decide whether to audit the parent company or not. If the investor does not audit, the parent company obtains a payoff of $R^p_0(\tilde{\omega}_{t+1}, \tilde{\omega}^*_{t+1})$ and the investor collects a payoff of $R^I_0(\tilde{\omega}_{t+1}, \tilde{\omega}^*_{t+1})$. Alternatively, the investor can verify the parent company's balance sheet through an audit after paying $\nu(\omega_{t+1} I_t R_t + \omega^*_{t+1} I^*_t R^*_t)$ as the audit cost. Consistent with Section 3.2.1, the audit cost can be interpreted as the cost of default. In the case of an audit, the parent company obtains a payoff of $R^p_1(\omega_{t+1}, \omega^*_{t+1})$ and the investor collects a payoff of $R^I_1(\omega_{t+1}, \omega^*_{t+1})$ before paying the audit cost.

By the revelation principle (Myerson 1979), the optimal contract for the parent company induces truthful reporting, meaning there are $\tilde{\omega}_{t+1} = \omega_{t+1}$ and $\tilde{\omega}^*_{t+1} = \omega^*_{t+1}$ under the optimal contract. Let $y(\tilde{\omega}_{t+1}, \tilde{\omega}^*_{t+1}) = \{1, 0\}$ indicate whether there is an audit, where $y(\tilde{\omega}_{t+1}, \tilde{\omega}^*_{t+1}) = 1$ represents the action that the investor audits, the parent company's payoff under the optimal contract can be written as:

$$R^p(\omega_{t+1}, \omega^*_{t+1}) = R^p_1(\omega_{t+1}, \omega^*_{t+1}) y(\omega_{t+1}, \omega^*_{t+1}) + R^p_0(\omega_{t+1}, \omega^*_{t+1}) \left(1 - y(\omega_{t+1}, \omega^*_{t+1})\right). \quad \text{(A.1)}$$

Similarly, the payoff to the investor can be written as:

$$R^I(\omega_{t+1}, \omega^*_{t+1}) = R^I_1(\omega_{t+1}, \omega^*_{t+1}) y(\omega_{t+1}, \omega^*_{t+1}) + R^I_0(\omega_{t+1}, \omega^*_{t+1}) \left(1 - y(\omega_{t+1}, \omega^*_{t+1})\right) \quad \text{(A.2)}$$

with $R^p(\omega_{t+1}, \omega^*_{t+1}) + R^I(\omega_{t+1}, \omega^*_{t+1}) = \omega_{t+1} I_t R_t + \omega^*_{t+1} I^*_t R^*_t$ and $R^p(\omega_{t+1}, \omega^*_{t+1}) \geq 0$.

Let D_t be the amount of external funds the parent company seeks to raise from the investor. The optimal contract solves for a schedule of $\{y(\omega_{t+1}, \omega^*_{t+1}), R^p(\omega_{t+1}, \omega^*_{t+1})\}$ that maximizes the expected payoff to the parent company, subject to the incentive constraint of truthful reporting (IC) and the individual rationality constraint of the investor (IR). The IR requires that the contract's expected payoff to the investor must at least equals their opportunity cost. The optimization problem can be written as:

$$\max_{y(\omega_{t+1}, \omega^*_{t+1}), R^p(\omega_{t+1}, \omega^*_{t+1})} \int_0^{+\infty} \int_0^{+\infty} R^p(\omega_{t+1}, \omega^*_{t+1}) dF(\omega_{t+1}) dF(\omega^*_{t+1}) \quad \text{(A.3)}$$

such that:

$$\begin{aligned} &\int_0^{+\infty} \int_0^{+\infty} \left(1 - y(\omega_{t+1}, \omega^*_{t+1})\nu\right) \left(\omega_{t+1} I_t R_t + \omega^*_{t+1} I^*_t R^*_t\right) dF(\omega_{t+1}) dF(\omega^*_{t+1}) \\ &- \int_0^{+\infty} \int_0^{+\infty} R^p(\omega_{t+1}, \omega^*_{t+1}) dF(\omega_{t+1}) dF(\omega^*_{t+1}) \geq D_t(1 + r^{rf}_t). \end{aligned} \quad \text{(A.4)}$$

The focus of this paper is leveraged MNEs. Thus, I focus on cases the where the IR holds in equilibrium with $R^p(\omega_{t+1}, \omega^*_{t+1}) \geq 0$. Otherwise, the parent company is "rationed" from the external capital market under limited liability.

Since the IR binds by the optimal contract, there is:

$$\begin{aligned} &\int_0^{+\infty} \int_0^{+\infty} R^p(\omega_{t+1}, \omega^*_{t+1}) dF(\omega_{t+1}) dF(\omega^*_{t+1}) = \\ &\int_0^{+\infty} \int_0^{+\infty} \left(1 - y(\omega_{t+1}, \omega^*_{t+1})\nu\right) \left(\omega_{t+1} I_t R_t + \omega^*_{t+1} I^*_t R^*_t\right) dF(\omega_{t+1}) dF(\omega^*_{t+1}) - D_t(1 + r^{rf}_t). \end{aligned} \quad \text{(A.5)}$$

Substituting Equation A.5 to Condition A.3 shows that the optimal contract minimizes the

expected audit cost:

$$\min_{y(\omega_{t+1},\omega^*_{t+1}),R^p(\omega_{t+1},\omega^*_{t+1})} \int_0^{+\infty}\int_0^{+\infty} \nu y(\omega_{t+1},\omega^*_{t+1})\left(\omega_{t+1}I_tR_t+\omega^*_{t+1}I^*_tR^*_t\right)dF(\omega_{t+1})dF(\omega^*_{t+1}). \tag{A.6}$$

The proposed optimal contract for the parent company is described as follows:

1. For any given $D_t > 0$ such that the IR can hold with $R^p(\omega_{t+1},\omega^*_{t+1}) \geq 0$, the optimal contract is a debt contract with a fixed income, $D_t(1+r_t)$, for the investor.

2. $y(\omega_{t+1},\omega^*_{t+1}) = 0$ if $\omega_{t+1}I_tR_t+\omega^*_tI^*R^*_t \geq D_t(1+r_t)$.

3. $y(\omega_{t+1},\omega^*_{t+1}) = 1$ if $\omega_{t+1}I_tR_t+\omega^*_tI^*R^*_t < D_t(1+r_t)$.

4. $R^p(\omega_{t+1},\omega^*_{t+1}) = \max\{\omega_{t+1}I_tR_t+\omega^*_tI^*R^*_t - D_t(1+r_t), 0\}$.

5. $R^I(\omega_{t+1},\omega^*_{t+1}) = \min\{D_t(1+r_t), \omega_{t+1}I_tR_t+\omega^*_tI^*R^*_t\}$.

To prove that the proposed debt contract is the optimal contract, I start by proving the following two lemmas.

Lemma A.1. *For any $\left(\omega_{t+1},\omega^*_{t+1}\right)$, where $y(\omega_{t+1},\omega^*_{t+1}) = 0$, $R^I(\omega_{t+1},\omega^*_{t+1}) = c$ must be a constant in the optimal contract.*

Proof. Let $\left(\omega_{t+1},\omega^*_{t+1}\right)$ and $\left(\omega'_{t+1},\omega^{*\prime}_{t+1}\right)$ be any two pairs of realized productivity draws, where $y(\omega_{t+1},\omega^*_{t+1}) = y(\omega'_{t+1},\omega^{*\prime}_{t+1}) = 0$ in an arbitrary contract. If there is $R^I(\omega_{t+1},\omega^*_{t+1}) > R^I(\omega'_{t+1},\omega^{*\prime}_{t+1})$, then with $\left(\omega_{t+1},\omega^*_{t+1}\right)$, the parent company can be strictly better off by reporting $\left(\tilde{\omega}_{t+1},\tilde{\omega}^*_{t+1}\right) = \left(\omega'_{t+1},\omega^{*\prime}_{t+1}\right)$, which breaks the IC. Thus, for a contract to be optimal, A.1 must hold. □

Lemma A.2. *For any $\left(\omega_{t+1},\omega^*_{t+1}\right)$, where $y(\omega_{t+1},\omega^*_{t+1}) = 1$, there must be $R^I(\omega_{t+1},\omega^*_{t+1}) \leq c$ in the optimal contract, where c is the constant payoff from A.1.*

Proof. Let $\left(\omega_{t+1},\omega^*_{t+1}\right)$ and $\left(\omega'_{t+1},\omega^{*\prime}_{t+1}\right)$ be any two pairs of realized productivity draws. If there are $y(\omega_{t+1},\omega^*_{t+1}) = 1$ and $y(\omega'_{t+1},\omega^{*\prime}_{t+1}) = 0$ in an arbitrary contract with $R^I(\omega_{t+1},\omega^*_{t+1}) > c$, but $R^I(\omega'_{t+1},\omega^{*\prime}_{t+1}) = c$, then with $\left(\omega_{t+1},\omega^*_{t+1}\right)$, the parent company can be strictly

better off by reporting $\left(\tilde{\omega}_{t+1}, \tilde{\omega}^*_{t+1}\right) = \left(\omega'_{t+1}, \omega^{*\prime}_{t+1}\right)$, which breaks the IC. Thus, for a contract to be optimal, A.2 must hold. □

For any contract satisfying the payoff rules described by Lemmata A.1 and A.2 such that the IC holds and the IR binds, one can show that a debt contract with the following structure dominates the arbitrary contract in minimizing the expected audit cost:

1. For any realized $\left(\omega_{t+1}, \omega^*_{t+1}\right)$ such that $\omega_{t+1} I_t R_t + \omega^*_{t+1} I^*_t R^*_t \geq c$: $y(\omega_{t+1}, \omega^*_{t+1}) = 0$ and $R^I\left(\omega_{t+1}, \omega^*_{t+1}\right) = c$.

2. For any realized $\left(\omega_{t+1}, \omega^*_{t+1}\right)$ such that $\omega_{t+1} I_t R_t + \omega^*_{t+1} I^*_t R^*_t < c$: $y(\omega_{t+1}, \omega^*_{t+1}) = 1$ and $R^I\left(\omega_{t+1}, \omega^*_{t+1}\right) = \omega_{t+1} I_t R_t + \omega^*_{t+1} I^*_t R^*_t$.

To see this, define set $S_1 = \left\{\left(\omega_{t+1}, \omega^*_{t+1}\right)\right\}$ such that $\omega_{t+1} I_t R_t + \omega^*_{t+1} I^*_t R^*_t \geq c$ and $S_2 = \left\{\left(\omega_{t+1}, \omega^*_{t+1}\right)\right\}$ such that $\omega_{t+1}(h) I_t(h) R_{t+1} + \omega^*_{t+1}(j) I^*_t(j) R^*_{t+1} < c$. There are $S_1 \cap S_2 = \oslash$ and $S_1 \cup S_2 = \left\{\left(\omega_{t+1}, \omega^*_{t+1}\right)\right\}$ $\forall\ \omega_{t+1}, \omega^*_{t+1} \in (0, +\infty)$. For any $\left(\omega_{t+1}, \omega^*_{t+1}\right) \in S_1$, switching from the arbitrary contract to the debt contract will minimize the expected audit cost since, under the debt contract, there will be no audit. The switch also maximizes the investor's payoff because $R^I\left(\omega_{t+1}, \omega^*_{t+1}\right) \leq c$ by A.1 and A.2, meaning the debt contract sustains the IR. Similarly, for any $\left(\omega_{t+1}, \omega^*_{t+1}\right) \in S_2$, switching from the arbitrary contract to the debt contract minimizes the expected audit cost and maximizes the investor's payoff as $R^p\left(\omega_{t+1}, \omega^*_{t+1}\right) \geq 0$. Therefore, the debt contract dominates the arbitrary contract in minimizing the expected audit cost, while sustaining the IC and IR. To find the optimal contract, one needs to find the debt contract that binds the IR.

Since the expected surplus payoff to the investor under the debt contract with the constant c is:

$$\int_{\omega_{t+1} \in S_1} \int_{\omega^*_{t+1} \in S_1} c dF(\omega_{t+1}) dF(\omega^*_{t+1}) +$$
$$\int_{\omega_{t+1} \in S_2} \int_{\omega^*_{t+1} \in S_2} (1-\nu)\left(\omega_{t+1} I_t R_t + \omega^*_{t+1} I^*_t R^*_t\right) dF(\omega_{t+1}) dF(\omega^*_{t+1}) - D_t(1 + r^{rf}_t) \geq 0, \qquad \text{(A.7)}$$

the expected surplus payoff is continuous in c. Because when $c = 0$, the surplus payoff is:

$$-D_t(1 + r_t^{rf}) < 0, \tag{A.8}$$

there exists $c \geq c' > 0$ such that the IR binds.[1] As a result, setting the fixed income $D_t(1 + r_t) = c'$, the proposed debt contract is the optimal contract.

B Subsidiary-Level Debt Contract

B.1 The Binding Incentive Constraint

This appendix shows that, when the local informed capital with proper monitoring is used in equilibrium, the expected payoff to the foreign lender from monitoring increases in the foreign contractual threshold, $\bar{\omega}^*_{t+1}$. As a result, there is a minimum $\bar{\omega}^*_{t+1}$ to bind the incentive constraint for monitoring (Condition 12). The argument largely follows the framework of BGG (1999).

From Condition 12, let:

$$M(\bar{\omega}^*_{t+1}) = \Omega^*(\bar{\omega}^*_{t+1}) - \widetilde{\Omega}^*(\bar{\omega}^*_{t+1}) \tag{B.1}$$

be the expected payoff to the foreign lender from proper monitoring per unit of I^*_t with:

$$\Omega^*(\bar{\omega}^*_{t+1}) = \int_{\bar{\omega}^*_{t+1}}^{+\infty} \bar{\omega}^*_{t+1} dF(\omega^*_{t+1}) + \int_0^{\bar{\omega}^*_{t+1}} (1 - \nu^*)\omega^*_{t+1} dF(\omega^*_{t+1}), \tag{B.2}$$

$$\widetilde{\Omega}^*(\bar{\omega}^*_{t+1}) = \int_{\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}}^{+\infty} \bar{\omega}^*_{t+1} dF(\omega^*_{t+1}) + \int_0^{\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}} (1 - \nu^*)(1 - \psi^*)\omega^*_{t+1} dF(\omega^*_{t+1}). \tag{B.3}$$

[1] It is implicit that $c > 0$ in the optimal contract when the investor faces a positive opportunity cost. Since $R^I\left(\omega_{t+1}, \omega^*_{t+1}\right) \leq c$ in the optimal contract by A.1 and A.2, the IR can never be sustained with $c \leq 0$ and $D_t(1 + r_t^{rf}) > 0$.

There is:

$$\begin{aligned}\frac{\partial M(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} &= \frac{\partial \Omega^*(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} - \frac{\partial \widetilde{\Omega}^*(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} \\ &= \nu^* \frac{\bar{\omega}^*_{t+1}}{1-\psi^*} f(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}) - \nu^* \bar{\omega}^*_{t+1} f(\bar{\omega}^*_{t+1}) + F(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}) - F(\bar{\omega}^*_{t+1}) \end{aligned} \tag{B.4}$$

with:

$$\frac{\partial \Omega^*(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} = 1 - F(\bar{\omega}^*_{t+1}) - \nu^* \bar{\omega}^*_{t+1} f(\bar{\omega}^*_{t+1}), \tag{B.5}$$

$$\frac{\partial \widetilde{\Omega}^*(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} = \frac{\partial \Omega^* \left(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}\right)}{\partial \left(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}\right)} = 1 - F(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}) - \nu^* \frac{\bar{\omega}^*_{t+1}}{1-\psi^*} f(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*}). \tag{B.6}$$

Equation B.5 implies that a rise in $\bar{\omega}^*_{t+1}$ has two opposite effects on the lender's expected return. A higher $\bar{\omega}^*_{t+1}$ increases the lender's payoff when the foreign subsidiary does not default, as reflected by the term $1 - F(\bar{\omega}^*_{t+1}) > 0$. Meanwhile, a higher $\bar{\omega}^*_{t+1}$ raises the probability of default, which reduces the lender's expected payoff due to the default loss, as reflected by the term $-\nu^* \bar{\omega}^*_{t+1} f(\bar{\omega}^*_{t+1}) < 0$. To discuss when $\partial \Omega^*(\bar{\omega}^*_{t+1})/\partial \bar{\omega}^*_{t+1} > 0$, one can rewrite Equation B.5 as:

$$\frac{\partial \Omega^*(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} = \left(1 - F(\bar{\omega}^*_{t+1})\right) \left[1 - \nu^* \bar{\omega}^*_{t+1} h(\bar{\omega}^*_{t+1})\right], \tag{B.7}$$

where the hazard rate $h(\bar{\omega}^*_{t+1}) \equiv f(\bar{\omega}^*_{t+1}) / \left(1 - F(\bar{\omega}^*_{t+1})\right)$.

Because the log-normally distributed productivity draw satisfies the regularity condition:

$$\frac{\partial \left(\bar{\omega}^*_{t+1} h(\bar{\omega}^*_{t+1})\right)}{\partial \bar{\omega}^*_{t+1}} > 0, \tag{B.8}$$

there exists a $\bar{\omega}^{*\max}_{t+1}$ such that:

$$\left(1 - F(\bar{\omega}^*_{t+1})\right) \left[1 - \nu^* \bar{\omega}^*_{t+1} h(\bar{\omega}^*_{t+1})\right] \underset{<}{\overset{\geq}{=}} 0 \text{ for } \bar{\omega}^*_{t+1} \underset{>}{\overset{\leq}{=}} \bar{\omega}^{*\max}_{t+1}. \tag{B.9}$$

Condition B.9 indicates that $\Omega^*(\bar{\omega}^*_{t+1})$ reaches a global maximum at an unique, interior value

of $\bar{\omega}^*_{t+1}$.[2] If the foreign project has an insufficient R^*_t, with which no $\bar{\omega}^*_{t+1}$ exists to meet the foreign lender's required rate of return, the foreign subsidiary is rationed from the capital market and there will be $D^*_t = 0$ in the equilibrium. To allow a possible usage of the informed capital with proper monitoring, I focus on the case where the foreign project is productive enough so that there is $\bar{\omega}^*_{t+1} < \bar{\omega}^{*\max}_{t+1}$ in the equilibrium, consistent with BGG (1999).

Taking the derivative of Equation B.7 yields:

$$\frac{\partial^2 \Omega^*(\bar{\omega}^*_{t+1})}{\left(\partial \bar{\omega}^*_{t+1}\right)^2} = -f(\bar{\omega}^*_{t+1})\left(1 - \nu^* \bar{\omega}^*_{t+1} h(\bar{\omega}^*_{t+1})\right) - \left(1 - F(\bar{\omega}^*_{t+1})\right)\nu^* \frac{\partial\left(\bar{\omega}^*_{t+1} h(\bar{\omega}^*_{t+1})\right)}{\partial \bar{\omega}^*_{t+1}}. \quad \text{(B.10)}$$

It follows that $\Omega^*(\bar{\omega}^*_{t+1})$ is increasing and strictly concave for $\bar{\omega}^*_{t+1} \leq \bar{\omega}^{*\max}_{t+1}$. Therefore, when $\bar{\omega}^*_{t+1} < \frac{\bar{\omega}^*_{t+1}}{1-\psi^*} \leq \bar{\omega}^{*\max}_{t+1}$, there is:

$$\frac{\partial \Omega^*(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} > \frac{\partial \Omega^*(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*})}{\partial \frac{\bar{\omega}^*_{t+1}}{1-\psi^*}} = \frac{\partial \widetilde{\Omega}^*(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} \quad \text{(B.11)}$$

by the strict concavity. When $\bar{\omega}^*_{t+1} \leq \bar{\omega}^{*\max}_{t+1} < \frac{\bar{\omega}^*_{t+1}}{1-\psi^*}$, there is:

$$\frac{\partial \Omega^*(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} > 0 > \frac{\partial \Omega^*(\frac{\bar{\omega}^*_{t+1}}{1-\psi^*})}{\partial \frac{\bar{\omega}^*_{t+1}}{1-\psi^*}} = \frac{\partial \widetilde{\Omega}^*(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} \quad \text{(B.12)}$$

by the global maximum. In conclusion, when the local informed capital with proper monitoring is used in equilibrium:

$$\frac{\partial M(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} = \frac{\partial \Omega^*(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} - \frac{\partial \widetilde{\Omega}^*(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} > 0. \quad \text{(B.13)}$$

There is a minimum $\bar{\omega}^*_{t+1}$ required by the foreign lender to satisfy the incentive constraint so that it binds.

[2] The regularity condition is generally applicable to any monotonically increasing transformation of the normal distribution.

B.2 Informed Capital without Proper Monitoring

This appendix explains the potential optimal usage of the subsidiary-level informed capital without proper monitoring, and how it can enhance the incentives to use the parent-level debt with $T_t > 0$. To start with, consider any case where the home and foreign projects are productive enough so that the parent company would like to use the parent-level debt to fund $I_t > 0$ and $I_t^* > 0$.[3] The question is whether it could be optimal for the parent company to substitute some parent-level debt with the subsidiary-level debt to fund the same I_t and I_t^*. Since the substitution will not affect the private benefit of the foreign subsidiary, we can simplify the notations by assuming $\psi^* = 0$. This can save us from carrying the additional default threshold of the informed capital with proper monitoring when applying the same argument.

Let $\hat{\omega}_{t+1}$, $\hat{\omega}^*_{t+1}$, and $\bar{\omega}_{t+1}$ be the contractual thresholds of the original parent-level debt contract. A substitution is optimal when the joint expected payoff to the parent company and home lender experience a net increase after substituting the subsidiary-level debt for D_t^{u*} units of the parent-level debt in Foreign's currency without changing the original parent-level debt contract offered to the home lender to fund the same I_t and I_t^*. Define the net gain from this substitution as $G(\bar{\omega}^*_{t+1})$, we have:

$$G(\bar{\omega}^*_{t+1}) = D^{u*}_{t+1}(1 + r^{rf*}_{t+1}) - L(\bar{\omega}^*_{t+1}). \tag{B.14}$$

$\bar{\omega}^*_{t+1}$ is the default threshold of the newly added subsidiary-level debt. $L(\bar{\omega}^*_{t+1})$ denotes the loss of the expected payoff from the original parent-level debt contract after adding the subsidiary-level debt. $D^{u*}_{t+1}(1 + r^{rf*}_{t+1})$ is the gain for the home lender from lending D_t^{u*} units less but being offered the same contract. Note that $\hat{\omega}_{t+1}$, $\hat{\omega}^*_{t+1}$, and $\bar{\omega}_{t+1}$ are the contractual thresholds of the original parent-level debt contract contract. They are independent with the default threshold of the newly added subsidiary-level debt, $\bar{\omega}^*_{t+1}$.

The newly added subsidiary-level debt will be priced according to the participation con-

[3] Appendix **??** explains that if the parent company uses only the parent-level debt or the subsidiary-level informed capital without proper monitoring to fund I_t and I_t^*, the parent-level debt is always preferred.

straint for the foreign lender in equilibrium as:

$$\left(\int_0^{\bar{\omega}^*_{t+1}}(1-\nu^*)\omega^*_{t+1}dF(\omega^*_{t+1})+\int_{\bar{\omega}^*_{t+1}}^{+\infty}\bar{\omega}^*_{t+1}dF(\omega^*_{t+1})\right)I^*_tR^*_t=D^{u*}_t(1+r^{rf*}_{t+1})+s^*I^*_t. \quad \text{(B.15)}$$

When substituting the subsidiary-level debt for D^{u*}_t units of the parent-level debt so that $\bar{\omega}^*_{t+1}\leq\hat{\omega}^*_{t+1}$, the loss of the expected payoff from the original parent-level debt contract is:

$$\begin{aligned}L(\bar{\omega}^*_{t+1})=&\left[\int_0^{\bar{\omega}^*_{t+1}}\int_{\bar{\omega}_{t+1}}^{+\infty}\omega^*_{t+1}dF(\omega_{t+1})dF(\omega^*_{t+1})+\int_0^{\bar{\omega}^*_{t+1}}\int_0^{\bar{\omega}_{t+1}}(1-\nu)\omega^*_{t+1}dF(\omega_{t+1})dF(\omega^*_{t+1})\right]I^*_tR^*_t+\\&\left[\int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}}\int_{\bar{\omega}_{t+1}}^{+\infty}\bar{\omega}^*_{t+1}dF(\omega_{t+1})dF(\omega^*_{t+1})+\int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}}\int_0^{\bar{\omega}_{t+1}}(1-\nu)\bar{\omega}^*_{t+1}dF(\omega_{t+1})dF(\omega^*_{t+1})\right]I^*_tR^*_t+\\&\int_{\hat{\omega}^*_{t+1}}^{+\infty}\bar{\omega}^*_{t+1}dF(\omega^*_{t+1})I^*_tR^*_t. \quad \text{(B.16)}\end{aligned}$$

By Equation B.15, there is:

$$\begin{aligned}L(\bar{\omega}^*_{t+1})=&\left[\int_0^{\bar{\omega}^*_{t+1}}\nu^*\omega^*_{t+1}dF(\omega^*_{t+1})-\int_0^{\bar{\omega}^*_{t+1}}\int_0^{\bar{\omega}_{t+1}}\nu\omega^*_{t+1}dF(\omega_{t+1})dF(\omega^*_{t+1})\right]I^*_tR^*_t\\&+D^{u*}_t(1+r^{rf*}_{t+1})+s^*I^*_{t+1}-\int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}}\int_0^{\bar{\omega}_{t+1}}\nu\bar{\omega}^*_{t+1}dF(\omega_{t+1})dF(\omega^*_{t+1})I^*_tR^*_t. \quad \text{(B.17)}\end{aligned}$$

The net gain from the substitution is therefore:

$$\begin{aligned}G(\bar{\omega}^*_{t+1})=&\int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}}\int_0^{\bar{\omega}_{t+1}}\nu\bar{\omega}^*_{t+1}dF(\omega_{t+1})dF(\omega^*_{t+1})I^*_tR^*_t-s^*I^*_t\\&-\left[\int_0^{\bar{\omega}^*_{t+1}}\nu^*\omega^*_{t+1}dF(\omega^*_{t+1})-\int_0^{\bar{\omega}^*_{t+1}}\int_0^{\bar{\omega}_{t+1}}\nu\omega^*_{t+1}dF(\omega_{t+1})dF(\omega^*_{t+1})\right]I^*_tR^*_t. \quad \text{(B.18)}\end{aligned}$$

The first term of Equation B.18 reflects a subtle benefit from the substitution. In the case of a parent-level default based on the original contract after the foreign lender getting paid in full, the default loss of the home lender can be reduced because they can know from the informed foreign lender that the realized productivity draw ω^*_{t+1} is at least above $\bar{\omega}^*_{t+1}$. Without this informational benefit, it would never be optimal to substitute the parent-level debt due to its diversification benefit. The remaining terms in Equation B.18 describe the frictions associated with the subsidiary-level debt. Specifically, the second line captures the negative tradeoff in credit risk from substituting the subsidiary-level debt with a standalone

default risk for the parent-level debt with a diversification benefit. With $\nu \leq \nu^*$, there is:

$$\left[\int_0^{\bar{\omega}^*_{t+1}} \nu^* \omega^*_{t+1} dF(\omega^*_{t+1}) - \int_0^{\bar{\omega}^*_{t+1}} \int_0^{\bar{\omega}_{t+1}} \nu \omega^*_{t+1} dF(\omega_{t+1}) dF(\omega^*_{t+1})\right] I^*_t R^*_t > 0. \tag{B.19}$$

As Section 3.2.2 explains, the empirical focus of this paper is US MNEs with subsidiaries in developed economies, especially the UK, where the financial industries share a similar degree of development. I therefore assume that $\nu = \nu^*$ to reflect the similar institutional background. For US MNEs in general with subsidiaries that face a less developed financial industry, one can assume there is $\nu \leq \nu^*$ (e.g., Desai, Foley, and Forbes, 2008).

Equation B.18 suggests that it is not always optimal to substitute the subsidiary-level debt for the parent-level debt, even when the foreign lender can freely prevent a balance sheet shrinkage due to the moral hazard between the MNE and its lenders (i.e., $s^* = 0$). In fact, a substitution will not be optimal if the additional cost from taking on the standalone default risk is larger than the informational benefit drawn from the state of a parent-level default after the foreign lender getting paid in full. When the MNE has a strong diversification benefit so that a parent-level default is much less likely, which is already reasonable in reality, the usage of the additional subsidiary-level debt is not optimal. With additional frictions due to the moral hazard between the MNE and its lenders, it is clear that the MNE will not use the additional subsidiary-level debt when s^* is sufficiently high.

When the frictions associated with the subsidiary-level debt are low, the optimal level of substitution can be decided as the net gain function is strictly concave in $\bar{\omega}^*_{t+1}$. To see this, the first derivative of net gain function is:

$$\frac{\partial G(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} = \left[\int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}} \int_0^{\bar{\omega}_{t+1}} \nu dF(\omega_{t+1}) dF(\omega^*_{t+1}) - \nu^* \bar{\omega}^*_{t+1} f(\bar{\omega}^*_{t+1})\right] I^*_t R^*_t. \tag{B.20}$$

When $\bar{\omega}^*_{t+1} \to 0$, $\partial G(\bar{\omega}^*_{t+1})/\partial \bar{\omega}^*_{t+1} > 0$. When $\bar{\omega}^*_{t+1} \to \hat{\omega}^*_{t+1}$, $\partial G(\bar{\omega}^*_{t+1})/\partial \bar{\omega}^*_{t+1} < 0$.

The second derivative of the net gain function is:

$$\frac{\partial^2 G(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^{*2}_{t+1}} = \left[-\int_0^{\bar{\omega}_{t+1}} \nu f(\bar{\omega}^*_{t+1}) dF(\omega) - \nu^* \frac{\partial \left[\bar{\omega}^*_{t+1} f(\bar{\omega}^*_{t+1})\right]}{\partial \bar{\omega}^*_{t+1}}\right] I^*_t R^*_t < 0. \tag{B.21}$$

Therefore, $G(\bar{\omega}^*_{t+1})$ is strictly concave in $\bar{\omega}^*_{t+1}$ when $\bar{\omega}^*_{t+1} \leq \hat{\omega}^*_{t+1}$. For any given I_t and I^*_t funded by the parent-level debt, it is optimal to substitute the subsidiary-level debt for D^{u*}_t units of the parent-level debt so that:

$$\int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}} \int_0^{\bar{\omega}_{t+1}} \nu dF(\omega_{t+1}) dF(\omega^*_{t+1}) = \nu^* \bar{\omega}^*_{t+1} f(\bar{\omega}^*_{t+1}) \tag{B.22}$$

with:

$$\bar{\omega}^*_{t+1} I^*_t R^*_t = D^{u*}_t (1 + r^{u*}_t) \tag{B.23}$$

and $G(\bar{\omega}^*_{t+1}) > 0$. $1 + r^{u*}_t$ denotes the risky return for the subsidiary-level informed capital without proper monitoring.

It can also be shown that it is not optimal to substitute the subsidiary-level debt for the parent-level debt till $\bar{\omega}^*_{t+1} > \hat{\omega}^*_{t+1}$. In this case, the net gain from the substitution is:

$$\begin{aligned} G(\bar{\omega}^*_{t+1}) = &- \left[\int_0^{\bar{\omega}^*_{t+1}} \nu^* \omega^*_{t+1} dF(\omega^*_{t+1}) - \int_0^{\hat{\omega}^*_{t+1}} \int_0^{\bar{\omega}_{t+1}} \nu \omega^*_{t+1} dF(\omega_{t+1}) dF(\omega^*_{t+1}) \right] I^*_t R^*_t \\ &- s^* I^*_t < 0. \end{aligned} \tag{B.24}$$

So far I have discussed the optimal usage of the subsidiary-level debt. I now explain its impact on the parent company's incentives to utilize the ICM. When it is optimal to substitute the subsidiary-level debt for the parent-level debt, the risk premium of the parent-level debt can be further reduced due to the informational benefit from the greater state contingency. Such benefit gives the parent company another incentive to active the ICM and internally finance the foreign subsidiary.

To best demonstrate this point, consider the case where the parent company only has the foreign project (i.e., $I^*_t > 0$ and $I_t = 0$) and is funding it with the parent-level debt. Since there is no diversification benefit, the parent- and subsidiary-level debt are equivalent except for the additional friction $s^* \geq 0$ and default costs. In this case, the net gain from

the substitution becomes:

$$G(\bar{\omega}^*_{t+1}) = \left[\int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}} \nu\bar{\omega}^*_{t+1} dF(\omega^*_{t+1}) - \int_0^{\bar{\omega}^*_{t+1}} (\nu^* - \nu)\,\omega^*_{t+1} dF(\omega^*_{t+1})\right] I^*_t R^*_t - s^* I^*_t \tag{B.25}$$

with $\bar{\omega}^*_{t+1} \leq \hat{\omega}^*_{t+1}$.[4]

Assuming for the moment that the parent- and subsidiary-level debt are identical with $s^* = 0$ and $\nu = \nu^*$, funding $I^*_t > 0$ using the parent-level debt is the same with using only the subsidiary-level debt without activating the ICM.[5] However, now there is:

$$G(\bar{\omega}^*_{t+1}) = \int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}} \nu\bar{\omega}^*_{t+1} dF(\omega^*_{t+1}) I^*_t R^*_t > 0. \tag{B.26}$$

It is therefore better to active the ICM with $T_t > 0$ and use the additional subsidiary-level debt to obtain the informational benefit for the parent-level debt by making it more state contingent.

In general, the first derivative of net gain function with only the foreign project takes a similar form:

$$\frac{\partial G(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^*_{t+1}} = \left[\int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}} \nu dF(\omega^*_{t+1}) - \nu^*\bar{\omega}^*_{t+1} f(\bar{\omega}^*_{t+1})\right] I^*_t R^*_t. \tag{B.27}$$

When $\bar{\omega}^*_{t+1} \to 0$, $\partial G(\bar{\omega}^*_{t+1})/\partial\bar{\omega}^*_{t+1} > 0$. When $\bar{\omega}^*_{t+1} \to \hat{\omega}^*_{t+1}$, $\partial G(\bar{\omega}^*_{t+1})/\partial\bar{\omega}^*_{t+1} < 0$.

[4]Given that there is only the foreign project, the default threshold $\hat{\omega}^*_{t+1}$ of the parent-level debt contract is the default threshold of a standard debt contract. By offering the home lender the original parent-level debt contract after substituting the subsidiary-level debt for D^{u*}_t units of the parent-level debt, the joint expected payoff to the parent company and home lender cannot experience an increase if the default threshold of the newly added subsidiary-level debt, $\bar{\omega}^*_{t+1}$, is already above $\hat{\omega}^*_{t+1}$, provided $\nu \leq \nu^*$. The net gain from the substitution in this case is:

$$G(\bar{\omega}^*_{t+1}) = -\left[\int_0^{\bar{\omega}^*_{t+1}} \nu^*\omega^*_{t+1} dF(\omega^*_{t+1}) - \int_0^{\hat{\omega}^*_{t+1}} \nu\omega^*_{t+1} dF(\omega^*_{t+1})\right] I^*_t R^*_t - s^* I^*_t < 0$$

with $\bar{\omega}^*_{t+1} > \hat{\omega}^*_{t+1}$.

[5]Recall that the opportunity costs of the parent- and subsidiary-level debt are equivalent in the same currency under the CIP condition (Condition 3).

The second derivative of net gain function is:

$$\frac{\partial^2 G(\bar{\omega}^*_{t+1})}{\partial \bar{\omega}^{*2}_{t+1}} = \left[-\nu f(\bar{\omega}^*_{t+1}) - \nu^* \frac{\partial \left[\bar{\omega}^*_{t+1} f(\bar{\omega}^*_{t+1}) \right]}{\partial \bar{\omega}^*_{t+1}} \right] I^*_t R^*_t < 0. \tag{B.28}$$

For any given $I^*_t > 0$ with $I_t = 0$ funded by the parent-level debt, it is optimal to substitute the subsidiary-level debt for D^{u*}_t units of the parent-level debt so that:

$$\int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}} \nu dF(\omega^*_{t+1}) = \nu^* \bar{\omega}^*_{t+1} f(\bar{\omega}^*_{t+1}) \tag{B.29}$$

and $G(\bar{\omega}^*_{t+1}) > 0$.

Fixing the same $I^*_t > 0$, for any given $I^*_t > 0$ and $I_t > 0$ funded by the parent-level debt, D^{u*}_t still satisfies the participation constraint by Equation B.15. But now there is $\partial G(\bar{\omega}^*_{t+1})/\partial \bar{\omega}^*_{t+1} < 0$, instead of $\partial G(\bar{\omega}^*_{t+1})/\partial \bar{\omega}^*_{t+1} = 0$, since $\partial G(\bar{\omega}^*_{t+1})/\partial \bar{\omega}^*_{t+1}$ is reduced because of the diversification benefit from the home project by Equation B.20. Therefore, D^{u*}_t will become lower relative to the case with only $I^*_t > 0$. In other words, the existence of a diversification benefit will reduce the incentive to substitute the subsidiary-level debt for the parent-level debt due to the negative tradeoff associated with the standalone default risk, maintaining the point that there is $T_t > 0$ in equilibrium. In conclusion, the parent company has incentives to active the ICM with $T_t > 0$ when there is a diversification benefit or an informational benefit by making the parent-level debt more state contingent.

C Equilibrium Conditions

This section derives the equilibrium conditions for the lending rate of the parent-level debt, r_t, and the parent company's choices on I_t and T_t. The section also examines the impact of a marginal increase in I_t or T_t on the expected default loss and the conditions for the parent company to have a two-project equilibrium.

C.1 First Order Conditions

Given the equilibrium conditions for the foreign variables, the Lagrangian of the optimization problem from Section 3.3 is:

$$\boldsymbol{L} = \Upsilon_t^h I_t R_t + \Upsilon_t^f F_{t+1} I_t^* R_t^* + \lambda \left[\Omega_t^h I_t R_t + \Omega_t^f F_{t+1} I_t^* R_t^* - D_t(1 + r_t^{rf}) \right].$$

Appendix **??** provides details on $\Upsilon_t^h = \Upsilon^h(\hat{\omega}_{t+1}, \hat{\omega}_{t+1}^*, \bar{\omega}_{t+1}^*)$, $\Upsilon_t^f = \Upsilon^f(\hat{\omega}_{t+1}, \hat{\omega}_{t+1}^*, \bar{\omega}_{t+1}^*)$, $\Omega_t^h = \Omega^h(\hat{\omega}_{t+1}, \hat{\omega}_{t+1}^*, \bar{\omega}_{t+1}^*)$, and $\Omega_t^f = \Omega^f(\hat{\omega}_{t+1}, \hat{\omega}_{t+1}^*, \bar{\omega}_{t+1}^*)$.

The first order condition (FOC) for r_t is:

$$\begin{aligned} \frac{\partial \boldsymbol{L}}{\partial r_t} =& \Upsilon^h_{\hat{\omega}_{t+1}} + \Upsilon^h_{\hat{\omega}^*_{t+1}} \frac{I_t R_t}{F_{t+1} I_t^* R_t^*} + \Upsilon^f_{\hat{\omega}_{t+1}} \frac{F_{t+1} I_t^* R_t^*}{I_t R_t} + \Upsilon^f_{\hat{\omega}^*_{t+1}} \\ &+ \lambda \left(\Omega^h_{\hat{\omega}_{t+1}} + \Omega^h_{\hat{\omega}^*_{t+1}} \frac{I_t R_t}{F_{t+1} I_t^* R_t^*} + \Omega^f_{\hat{\omega}_{t+1}} \frac{F_{t+1} I_t^* R_t^*}{I_t R_t} + \Omega^f_{\hat{\omega}^*_{t+1}} \right) = 0. \end{aligned} \tag{C.1}$$

Consistent with BGG (1999), λ reflects the increase of the cost of funds due to the expected default loss. It prescribes the additional shares of the returns the parent company needs to compensate the home lender due to the existence of the default cost ν:

$$\lambda = -\frac{\Upsilon^h_{\hat{\omega}_{t+1}} + \Upsilon^h_{\hat{\omega}^*_{t+1}} \frac{I_t R_t}{F_{t+1} I_t^* R_t^*} + \Upsilon^f_{\hat{\omega}_{t+1}} \frac{F_{t+1} I_t^* R_t^*}{I_t R_t} + \Upsilon^f_{\hat{\omega}^*_{t+1}}}{\Omega^h_{\hat{\omega}_{t+1}} + \Omega^h_{\hat{\omega}^*_{t+1}} \frac{I_t R_t}{F_{t+1} I_t^* R_t^*} + \Omega^f_{\hat{\omega}_{t+1}} \frac{F_{t+1} I_t^* R_t^*}{I_t R_t} + \Omega^f_{\hat{\omega}^*_{t+1}}} > 1. \tag{C.2}$$

with:

$$\Upsilon^h_{\hat{\omega}_{t+1}} + \Omega^h_{\hat{\omega}_{t+1}} = -\nu \int_0^{\hat{\omega}^*_{t+1}} \bar{\omega}_{t+1} f(\bar{\omega}_{t+1}) \frac{\partial \bar{\omega}_{t+1}}{\partial \hat{\omega}_{t+1}} dF(\omega^*_{t+1}) < 0, \tag{C.3}$$

$$\begin{aligned}\Upsilon^h_{\hat{\omega}^*_{t+1}} + \Omega^h_{\hat{\omega}^*_{t+1}} =& -\nu f(\hat{\omega}^*_{t+1}) \int_0^{\bar{\omega}_{t+1}} \omega_{t+1} dF(\omega_{t+1}) \\ & -\nu \int_0^{\hat{\omega}^*_{t+1}} \bar{\omega}_{t+1} f(\bar{\omega}_{t+1}) \frac{\partial \bar{\omega}_{t+1}}{\partial \hat{\omega}^*_{t+1}} dF(\omega^*_{t+1}) < 0,\end{aligned} \tag{C.4}$$

$$\Upsilon^f_{\hat{\omega}_{t+1}} + \Omega^f_{\hat{\omega}_{t+1}} = -\nu \int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}} (\omega^*_{t+1} - \bar{\omega}^*_{t+1}) f(\bar{\omega}_{t+1}) \frac{\partial \bar{\omega}_{t+1}}{\partial \hat{\omega}_{t+1}} dF(\omega^*_{t+1}) < 0, \tag{C.5}$$

$$\begin{aligned}\Upsilon^f_{\hat{\omega}^*_{t+1}} + \Omega^f_{\hat{\omega}^*_{t+1}} =& -\nu \int_0^{\bar{\omega}_{t+1}} (\hat{\omega}^*_{t+1} - \bar{\omega}^*_{t+1}) f(\hat{\omega}^*_{t+1}) dF(\omega_{t+1}) < 0 \\ & -\nu \int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}} (\omega^*_{t+1} - \bar{\omega}^*_{t+1}) f(\bar{\omega}_{t+1}) \frac{\partial \bar{\omega}_{t+1}}{\partial \hat{\omega}^*_{t+1}} dF(\omega^*_{t+1}) < 0,\end{aligned} \tag{C.6}$$

where:

$$\frac{\partial \bar{\omega}_{t+1}}{\partial \hat{\omega}_{t+1}} = 1 - \frac{(\omega^*_{t+1} - \bar{\omega}^*_{t+1})}{(\hat{\omega}^*_{t+1} - \bar{\omega}^*_{t+1})} \mathbf{1}(\omega^*_{t+1} \geq \bar{\omega}^*_{t+1}) > 0, \forall \omega^*_{t+1} < \hat{\omega}^*_{t+1}, \tag{C.7}$$

$$\frac{\partial \bar{\omega}_{t+1}}{\partial \hat{\omega}^*_{t+1}} = \frac{\hat{\omega}_{t+1}(\omega^*_{t+1} - \bar{\omega}^*_{t+1})}{(\hat{\omega}^*_{t+1} - \bar{\omega}^*_{t+1})^2} \mathbf{1}(\omega^*_{t+1} \geq \bar{\omega}^*_{t+1}) \geq 0, \forall \omega^*_{t+1} < \hat{\omega}^*_{t+1}. \tag{C.8}$$

When $\nu = 0$:

$$\begin{aligned}&-\left(\Upsilon^h_{\hat{\omega}_{t+1}} + \Upsilon^h_{\hat{\omega}^*_{t+1}} \frac{I_t R_t}{F_{t+1} I^*_t R^*_t} + \Upsilon^f_{\hat{\omega}_{t+1}} \frac{F_{t+1} I^*_t R^*_t}{I_t R_t} + \Upsilon^f_{\hat{\omega}^*_{t+1}}\right) \\ &= \left(\Omega^h_{\hat{\omega}_{t+1}} + \Omega^h_{\hat{\omega}^*_{t+1}} \frac{I_t R_t}{F_{t+1} I^*_t R^*_t} + \Omega^f_{\hat{\omega}_{t+1}} \frac{F_{t+1} I^*_t R^*_t}{I_t R_t} + \Omega^f_{\hat{\omega}^*_{t+1}}\right) > 0.\end{aligned} \tag{C.9}$$

The FOC for I_t is:

$$\frac{\partial \boldsymbol{L}}{\partial I_t} = \Upsilon^h_t R_t + \delta^I_t - \lambda \left[(1 + r^{rf}_t) - \Omega^h_t R_t\right] = 0. \tag{C.10}$$

δ_t^I captures the diversification effect from a marginal increase in I_t with:

$$\delta_t^I = \left[(\Upsilon^h_{\hat{\omega}_{t+1}} + \lambda\Omega^h_{\hat{\omega}_{t+1}}) \frac{\partial \hat{\omega}_{t+1}}{\partial I_t} + (\Upsilon^h_{\hat{\omega}^*_{t+1}} + \lambda\Omega^h_{\hat{\omega}^*_{t+1}}) \frac{\partial \hat{\omega}^*_{t+1}}{\partial I_t} \right] I_t R_t$$
$$+ \left[(\Upsilon^f_{\hat{\omega}_{t+1}} + \lambda\Omega^f_{\hat{\omega}_{t+1}}) \frac{\partial \hat{\omega}_{t+1}}{\partial I_t} + (\Upsilon^f_{\hat{\omega}^*_{t+1}} + \lambda\Omega^f_{\hat{\omega}^*_{t+1}}) \frac{\partial \hat{\omega}^*_{t+1}}{\partial I_t} \right] F_{t+1} I_t^* R_t^*, \tag{C.11}$$

where:

$$\frac{\partial \hat{\omega}_{t+1}}{\partial I_t} = -\frac{(T_t - A_t)(1 + r_t)}{I_t^2 R_t}, \tag{C.12}$$
$$\frac{\partial \hat{\omega}^*_{t+1}}{\partial I_t} = \frac{(1 + r_t)}{F_{t+1} I_t^* R_t^*}. \tag{C.13}$$

Similarly, the FOC for T_t is:

$$\frac{\partial \boldsymbol{L}}{\partial T_t} = \Upsilon^f_t \frac{F_{t+1}}{S_t \Lambda\left(\bar{\omega}^*_{t+1}\right)} R_t^* + \delta_t^T - \lambda \left[(1 + r_t^{rf}) - \Omega^f_t \frac{F_{t+1}}{S_t \Lambda\left(\bar{\omega}^*_{t+1}\right)} R_t^* \right] = 0. \tag{C.14}$$

δ_t^T captures the diversification effect from a marginal increase in T_t with:

$$\delta_t^T = \left[(\Upsilon^h_{\hat{\omega}_{t+1}} + \lambda\Omega^h_{\hat{\omega}_{t+1}}) \frac{\partial \hat{\omega}_{t+1}}{\partial T_t} + (\Upsilon^h_{\hat{\omega}^*_{t+1}} + \lambda\Omega^h_{\hat{\omega}^*_{t+1}}) \frac{\partial \hat{\omega}^*_{t+1}}{\partial T_t} \right] I_t R_t$$
$$+ \left[(\Upsilon^f_{\hat{\omega}_{t+1}} + \lambda\Omega^f_{\hat{\omega}_{t+1}}) \frac{\partial \hat{\omega}_{t+1}}{\partial T_t} + (\Upsilon^f_{\hat{\omega}^*_{t+1}} + \lambda\Omega^f_{\hat{\omega}^*_{t+1}}) \frac{\partial \hat{\omega}^*_{t+1}}{\partial T_t} \right] F_{t+1} I_t^* R_t^*. \tag{C.15}$$

where:

$$\frac{\partial \hat{\omega}_{t+1}}{\partial T_t} = \frac{(1 + r_t)}{I_t R_t}, \tag{C.16}$$
$$\frac{\partial \hat{\omega}^*_{t+1}}{\partial T_t} = -\frac{(I_t - A_t)(1 + r_t) S_t \Lambda\left(\bar{\omega}^*_{t+1}\right)}{F_{t+1} T_t^2 R_t^*}. \tag{C.17}$$

C.2 Investments and the Expected Default Loss

Conditions C.10 and C.14 suggest that a marginal increase in I_t or T_t affects the expected default loss through both changing the relative size of the projects (the diversification effect)

and lifting the leverage. Let η_t denote the expected default loss of the home lender:

$$\eta_t = \int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}} \int_0^{\bar{\omega}_{t+1}} \nu \left(\omega^*_{t+1} - \bar{\omega}^*_{t+1}\right) dF(\omega_{t+1}) dF(\omega^*_{t+1}) F_{t+1} I^*_t R^*_t + \int_0^{\hat{\omega}^*_{t+1}} \int_0^{\bar{\omega}_{t+1}} \nu \omega_{t+1} dF(\omega_{t+1}) dF(\omega^*_{t+1}) I_t R_t. \tag{C.18}$$

The impact of a marginal increase in I_t on η_t is:

$$\frac{d\eta_t}{dI_t} = \frac{\partial \eta_t}{\partial \hat{\omega}_{t+1}} \frac{\partial \hat{\omega}_{t+1}}{\partial I_t} + \frac{\partial \eta_t}{\partial \hat{\omega}^*_{t+1}} \frac{\partial \hat{\omega}^*_{t+1}}{\partial I_t} + \frac{\partial \eta_t}{\partial I_t R_t} \frac{\partial I_t R_t}{\partial I_t} \tag{C.19}$$

with:

$$\frac{\partial \eta_t}{\partial \hat{\omega}_{t+1}} = -\left(\Upsilon^f_{\hat{\omega}_{t+1}} + \Omega^f_{\hat{\omega}_{t+1}}\right) F_{t+1} I^*_t R^*_t - \left(\Upsilon^h_{\hat{\omega}_{t+1}} + \Omega^h_{\hat{\omega}_{t+1}}\right) I_t R_t > 0, \tag{C.20}$$

$$\frac{\partial \eta_t}{\partial \hat{\omega}^*_{t+1}} = -\left(\Upsilon^f_{\hat{\omega}^*_{t+1}} + \Omega^f_{\hat{\omega}^*_{t+1}}\right) F_{t+1} I^*_t R^*_t - \left(\Upsilon^h_{\hat{\omega}^*_{t+1}} + \Omega^h_{\hat{\omega}^*_{t+1}}\right) I_t R_t > 0, \tag{C.21}$$

$$\frac{\partial \eta_t}{\partial I_t R_t} \frac{\partial I_t R_t}{\partial I_t} = \int_0^{\hat{\omega}^*_{t+1}} \int_0^{\bar{\omega}_{t+1}} \nu \omega_{t+1} dF(\omega_{t+1}) dF(\omega^*_{t+1}) R_t > 0. \tag{C.22}$$

The first term in Equation C.19, $\left(\partial \eta_t / \partial \hat{\omega}_{t+1}\right)\left(\partial \hat{\omega}_{t+1} / \partial I_t\right)$, can reflect a diversification benefit. The diversification benefit exists when $\partial \hat{\omega}_{t+1} / \partial I_t < 0$ following Equation C.12, assuming the foreign project is productive enough so that $T_t - A_t > 0$ in equilibrium for the capital constrained MNE. Equation C.12 also shows that the diversification benefit from expanding I_t is large when the home project is relatively small compared with the foreign project (i.e., $\left(T_t - A_t\right) / I_t$ is large). More importantly, Equation C.12 demonstrates that the diversification benefit diminishes in I_t, conditioning on $\left(T_t - A_t\right) / I_t$.

The rest of the terms in Equation C.19 contribute to a rise in η_t. The second term $\left(\partial \eta_t / \partial \hat{\omega}^*_{t+1}\right)\left(\partial \hat{\omega}^*_{t+1} / \partial I_t\right) > 0$ as $\partial \hat{\omega}^*_{t+1} / \partial I_t > 0$ from Equation C.13. It captures the effect that a larger I_t makes it more difficult to use the foreign return to serve D_t. The last term $\left(\partial \eta_t / \partial I_t R_t\right)\left(\partial I_t R_t / \partial I_t\right) > 0$ reflects the impact of enlarging I_t from lifting the leverage. Since the diversification benefit diminishes in I_t, conditioning on $\left(T_t - A_t\right) / I_t$, a marginal increase in I_t eventually raises the cost of funds via $d\eta_t / dI_t > 0$.

The impact of a marginal increase in T_t on η_t can also be examined as:

$$\frac{d\eta_t}{dT_t} = \frac{\partial \eta_t}{\partial \hat{\omega}_{t+1}} \frac{\partial \hat{\omega}_{t+1}}{\partial T_t} + \frac{\partial \eta_t}{\partial \hat{\omega}^*_{t+1}} \frac{\partial \hat{\omega}^*_{t+1}}{\partial T_t} + \frac{\partial \eta_t}{\partial F_{t+1} I^*_t R^*_t} \frac{\partial F_{t+1} I^*_t R^*_t}{\partial T_t} \tag{C.23}$$

with $\partial \eta_t / \partial \hat{\omega}_{t+1} > 0$ and $\partial \eta_t / \partial \hat{\omega}^*_{t+1} > 0$ by Equations C.20 and C.21, and:

$$\begin{aligned} \frac{\partial \eta_t}{\partial F_{t+1} I^*_t R^*_t} \frac{\partial F_{t+1} I^*_t R^*_t}{\partial T_t} = & \int_{\bar{\omega}^*_{t+1}}^{\hat{\omega}^*_{t+1}} \int_0^{\bar{\omega}_{t+1}} \nu \left(\omega^*_{t+1} - \bar{\omega}^*_{t+1} \right) dF(\omega_{t+1}) dF(\omega^*_{t+1}) \\ & \frac{F_{t+1} R^*_t}{S_t \Lambda \left(\bar{\omega}^*_{t+1} \right)} > 0. \end{aligned} \tag{C.24}$$

Similar to the case of I_t, the second term in Equation C.23, $\left(\partial \eta_t / \partial \hat{\omega}^*_{t+1} \right) \left(\partial \hat{\omega}^*_{t+1} / \partial T_t \right)$, can reflect a diversification benefit. The diversification benefit exists when $\partial \hat{\omega}^*_{t+1} / \partial T_t < 0$ following Equation C.17, assuming the home project is productive enough so that $I_t - A_t > 0$ in equilibrium for the capital constrained MNE. Like the previous case, the diversification benefit from expanding T_t is large when the foreign project is relatively small compared with the home project. The diversification benefit also diminishes in T_t, conditioning on the relative size of the projects.

The first term in Equation C.23 captures the effect that a larger T_t makes it more difficult to use the home return to serve D_t with $\partial \hat{\omega}_{t+1} / \partial T_t > 0$ from Equation C.16. The last term in Equation C.23 reflects the impact of enlarging T_t with a higher leverage. Since the diversification benefit diminishes in T_t, conditioning on the relative size of the projects, a marginal increase in T_t eventually raises the cost of funds via $d\eta_t / dT_t > 0$.

C.3 Conditions for a Two-Project Equilibrium

Based on the equilibrium conditions, I now study when it is optimal for the parent company to have $I_t > 0$ and $T_t > 0$ in equilibrium. To begin with, when $T_t \to 0$ for a given $I_t > 0$, there are $\hat{\omega}^*_{t+1} \to +\infty$ and $\hat{\omega}_{t+1} = \bar{\omega}_{t+1}$ by the parent-level debt contract. Appendix

?? provides the definitions of Υ_t^h, Υ_t^f, Ω_t^h, and Ω_t^f, from which one can derive:

$$\Upsilon^h_{\hat{\omega}_{t+1}} \to F(\hat{\omega}_{t+1}) - 1, \quad \Omega^h_{\hat{\omega}_{t+1}} \to 1 - F(\hat{\omega}_{t+1}) - \nu\hat{\omega}_{t+1} f(\hat{\omega}_{t+1}), \tag{C.25}$$

$$\Upsilon^h_{\hat{\omega}^*_{t+1}} \to 0, \quad \Omega^h_{\hat{\omega}^*_{t+1}} \to 0, \tag{C.26}$$

$$\Upsilon^f_{\hat{\omega}^*_{t+1}} \to 0, \quad \Omega^f_{\hat{\omega}^*_{t+1}} \to 0. \tag{C.27}$$

Conditions C.26 and C.27, combined with $T_t \to 0$, imply that the Lagrangian multiplier, λ, becomes:

$$\lambda = -\frac{\Upsilon^h_{\hat{\omega}_{t+1}}}{\Omega^h_{\hat{\omega}_{t+1}}} = -\frac{\Upsilon^h_{\bar{\omega}_{t+1}}}{\Omega^h_{\bar{\omega}_{t+1}}} = \frac{1 - F(\hat{\omega}_{t+1})}{1 - F(\hat{\omega}_{t+1}) - \nu\hat{\omega}_{t+1} f(\hat{\omega}_{t+1})} > 1, \tag{C.28}$$

which is equivalent to that of BGG (1999) with only one project in the equilibrium.[6]

Applying the changes to Equations C.11 and C.15, it follows that $\delta_t^I \to 0$ and $\delta_t^T \to 0$ when the equilibrium converges to a one-project equilibrium.[7] The FOC for I_t becomes:

$$\Upsilon_t^h R_t = \lambda \left[(1 + r_t^{rf}) - \Omega_t^h R_t \right]. \tag{C.29}$$

The FOC for T_t becomes:

$$\Upsilon_t^f \frac{F_{t+1}}{S_t \Lambda\left(\bar{\omega}^*_{t+1}\right)} R_t^* = \lambda \left[(1 + r_t^{rf}) - \Omega_t^f \frac{F_{t+1}}{S_t \Lambda\left(\bar{\omega}^*_{t+1}\right)} R_t^* \right], \tag{C.30}$$

where the expected shares of the return for any $T_t > 0$ converges to:

$$\Upsilon_t^f = \Upsilon^f(\hat{\omega}_{t+1}, \bar{\omega}^*_{t+1}) = \int_{\bar{\omega}^*_{t+1}}^{+\infty} \left(\omega^*_{t+1} - \bar{\omega}^*_{t+1}\right) dF(\omega^*_{t+1})(1 - F(\hat{\omega}_{t+1})), \tag{C.31}$$

$$\Omega_t^f = \Omega^f(\hat{\omega}_{t+1}, \bar{\omega}^*_{t+1}) = \int_{\bar{\omega}^*_{t+1}}^{+\infty} (1 - \nu) \left(\omega^*_{t+1} - \bar{\omega}^*_{t+1}\right) dF(\omega^*_{t+1}) F(\hat{\omega}_{t+1}). \tag{C.32}$$

Substituting Equations C.31 and C.32 to Equation C.30, it is thus optimal for the parent

[6] I focus on the case where the home project won't be individually rationed from the capital market, which entails that $\Omega^h_{\hat{\omega}_{t+1}} = 1 - F(\hat{\omega}_{t+1}) - \nu\hat{\omega}_{t+1} f(\hat{\omega}_{t+1}) > 0$, as explained by BGG (1999).

[7] Specifically, as $T_t \to 0$, $I_t^* \to 0$ by Condition 23, $\Upsilon^h_{\hat{\omega}_{t+1}} + \lambda\Omega^h_{\hat{\omega}_{t+1}} \to 0$, $\Upsilon^h_{\hat{\omega}^*_{t+1}} \to 0$, and $\Omega^h_{\hat{\omega}^*_{t+1}} \to 0$.

company to have $T_t > 0$ in this case when the foreign project has a large enough R_t^*:

$$\int_{\bar{\omega}_{t+1}^*}^{+\infty} \left(\omega_{t+1}^* - \bar{\omega}_{t+1}^*\right) dF(\omega_{t+1}^*) \frac{F_{t+1} R_t^*}{S_t \Lambda\left(\bar{\omega}_{t+1}^*\right)} > \frac{\left(1 + r_t^{rf}\right)}{1 - \nu F(\hat{\omega}_{t+1}) - \nu \hat{\omega}_{t+1} f(\hat{\omega}_{t+1})}. \tag{C.33}$$

The analysis when $I_t \to 0$ for a given $T_t > 0$ is similar. As $I_t \to 0$, $\hat{\omega}_{t+1} \to +\infty$ by the parent-level debt contract. It can be derived from the definitions of Υ_t^h, Υ_t^f, Ω_t^h, and Ω_t^f that:

$$\Upsilon_{\hat{\omega}_{t+1}^*}^f \to -1 + F(\hat{\omega}_{t+1}^*), \quad \Omega_{\hat{\omega}_{t+1}^*}^f \to 1 - F(\hat{\omega}_{t+1}^*) - \nu\left(\hat{\omega}_{t+1}^* - \bar{\omega}_{t+1}^*\right) f(\hat{\omega}_{t+1}^*), \tag{C.34}$$

$$\Upsilon_{\hat{\omega}_{t+1}}^h \to 0, \quad \Omega_{\hat{\omega}_{t+1}}^h \to 0, \tag{C.35}$$

$$\Upsilon_{\hat{\omega}_{t+1}}^f \to 0, \quad \Omega_{\hat{\omega}_{t+1}}^f \to 0. \tag{C.36}$$

Conditions C.35 and C.36, combined with $I_t \to 0$, imply that the Lagrangian multiplier, λ, becomes:

$$\lambda = -\frac{\Upsilon_{\hat{\omega}_{t+1}^*}^f}{\Omega_{\hat{\omega}_{t+1}^*}^f} = \frac{1 - F(\hat{\omega}_{t+1}^*)}{1 - F(\hat{\omega}_{t+1}^*) - \nu\left(\hat{\omega}_{t+1}^* - \bar{\omega}_{t+1}^*\right) f(\hat{\omega}_{t+1}^*)} > 1, \tag{C.37}$$

which is consistent to that of BGG (1999) with only one project in the equilibrium, conditioning on the potential usage of the local informed capital.[8]

Applying the changes to Equations C.11 and C.15, it also follows that $\delta_t^I \to 0$ and $\delta_t^T \to 0$ when the equilibrium converges to a one-project equilibrium.[9] As a result, The FOC for T_t becomes Condition C.30. The FOC for I_t becomes Condition C.29, where the expected shares of the return for any $I_t > 0$ converges to:

$$\Upsilon_t^h = \Upsilon^h\left(\hat{\omega}_{t+1}^*(\bar{\omega}_{t+1}^*)\right) = 1 - F(\hat{\omega}_{t+1}^*), \tag{C.38}$$

$$\Omega_t^h = \Omega^h\left(\hat{\omega}_{t+1}^*(\bar{\omega}_{t+1}^*)\right) = (1 - \nu) F(\hat{\omega}_{t+1}^*). \tag{C.39}$$

Substituting Equations C.38 and C.39 to Equation C.29, it is thus optimal for the parent

[8] Consistent with the previous analysis, I focus on the case where the foreign project won't be individually rationed from the capital market, which entails that $1 - F(\hat{\omega}_{t+1}^*) - \nu \hat{\omega}_{t+1}^* f(\hat{\omega}_{t+1}^*) > 0$ following BGG (1999). This, of course, implies that $1 - F(\hat{\omega}_{t+1}^*) - \nu\left(\hat{\omega}_{t+1}^* - \bar{\omega}_{t+1}^*\right) f(\hat{\omega}_{t+1}^*) > 0$.

[9] Specifically, as $I_t \to 0$, $\Upsilon_{\hat{\omega}_{t+1}^*}^f + \lambda \Omega_{\hat{\omega}_{t+1}^*}^f \to 0$, $\Upsilon_{\hat{\omega}_{t+1}}^f \to 0$, and $\Omega_{\hat{\omega}_{t+1}}^f \to 0$.

company to have $I_t > 0$ in this case when the home project has a large enough R_t:

$$R_t > \frac{1 + r_t^{rf}}{1 - \nu F(\hat{\omega}_{t+1}^*) - \nu \left(\hat{\omega}_{t+1}^* - \bar{\omega}_{t+1}^*\right) f(\hat{\omega}_{t+1}^*)}. \tag{C.40}$$

In conclusion, this appendix has shown that it would be optimal for the parent company to have $I_t > 0$ and $T_t > 0$ in equilibrium when both the home and foreign projects are productive enough (i.e., R_t and R_t^* are large enough).

D Parent-Level Additional Robustness Checks

D.1 Pre-Trend Analysis

The identification assumption of my parent-level DID analysis is that the bond ratio and book leverage of the US parent companies with and without the UK exposure would follow a parallel trend in the absence of the UK uncertainty shock. To test whether my results are driven by pre-trends, I conduct a placebo DID analysis by moving the quarter of the UK uncertainty shock 2 years earlier, from 2016Q2 to 2013Q2, to form placebo before and after periods (2011Q1-2013Q2 vs. 2013Q3-2015Q4) of equal length, compared to those of the main analysis.[10] Since there was no major uncertainty shock in the UK during the placebo before and after periods, my pre-trend analysis should not capture any significant substitution of external debt. Table D4 confirms this point by showing that all of the DID estimates are much closer to zero and statistically insignificant. If anything, the DID estimates for the bond ratio are insignificantly negative, opposite to the results of the main analysis.[11]

D.2 Matching Analyses

As the results of my parent-level analysis are not driven by pre-trends, I now investigate if they could be affected by the imbalance between the US parent companies with and without the UK exposure during the Brexit interregnum. Table D7, Panel A compares the US parent

[10] I can only shift the before period up to 2011Q1 as it is the starting point of my vintage of the Orbis data. I also choose to not conduct any "placebo" test using periods after 2018Q4 due to the uncertainty associated with the no-deal Brexit and COVID-19 pandemic.

[11] The results of my pre-trend analysis are also robust when using the book leverage as the dependent variable or the bond ratio as the dependent variable without conditioning on the book leverage in the other columns of Table D4. These results are shown in Tables D5 and D6.

companies with and without the UK exposure during the before period (2014Q1-2016Q2) in the main DID analysis. The panel shows that the parent companies with the UK exposure tend to be larger, although the two groups are similar in terms of the book leverage, Tobin's Q, and quick ratio. It should be noted that the DID estimator already accounts for differences between the two groups that are time-invariant or share a parallel trend. In addition, any persistent non-parallel trends should have been detected by my pre-trend analysis. Despite these, I address the issue of imbalance directly with additional matching analyses.

My first matching analysis uses Mahalanobis matching as it is a popular method in practice. Despite its popularity, I acknowledge its shortcomings in achieving a balanced sample (Mielke and Berry 2007; Iacus, King, and Porro 2012). Therefore, I also complement my first matching analysis by using coarsened exact matching (CEM), following Iacus, King, and Porro (2009, 2012), which will be explained soon.

To emphasize the size difference between the two groups of parent companies when using Mahalanobis matching, I first calculate the Mahalanobis distance between the parent companies of the two groups based on the logarithm of total assets. I then match each parent company with the UK exposure to the top three parent companies without the UK exposure by the shortest distance. I conduct the matching with replacement so that each selection of the top three parent companies is independent of the others to improve matching quality. The results of my matching analysis are robust when I calculate the Mahalanobis distance based on all of the parent-level characteristics or match each parent company with the UK exposure to different numbers of the parent companies without the UK exposure. I choose to match the top three parent companies by size in the main analysis since this produces the most balanced sample, while maximizing the sample size.

Table D7, Panel B describes the summary statistics for the matched sample. As the panel shows, the means (standard deviations) of the book leverage, logarithm of total assets, Tobin's Q, and quick ratio for the US parent companies with the UK exposure in the sample are 0.32 (0.18), 8.26 (1.76), 1.81 (1.10), and 0.79 (1.11), respectively. Table D7, Panel A shows that the means (standard deviations) of the book leverage, logarithm of total assets, Tobin's Q, and quick ratio for the US parent companies without the UK exposure before

the matching are 0.33 (0.22), 6.01 (2.53), 1.71 (1.28), and 0.83 (1.64), respectively. Table D7, Panel B shows that these statistics in the matched sample are 0.35 (0.20), 7.00 (2.00), 1.46 (0.90), and 0.69 (1.35), respectively. Thus, the Mahalanobis matching reduces the size difference between the two groups, at the expense of a larger difference in the book leverage and Tobin's Q. The reduction in the size difference is also not sufficient to eliminate the statistical significance of the mean difference. To improve the sample balance, I further use CEM as a second matching analysis, following Iacus, King, and Porro (2009, 2012).[12]

When implementing the CEM, per standard practice, I use more bins to coarsen the variables that tend to display a significant difference between the means, and fewer bins for other variables when possible to maximize the size of the matched sample. I also weigh the matched sample following Iacus, King, and Porro (2012) to adjust for the different number of US parent companies with and without the UK exposure in each stratum formed by the bins. For the best matched sample in terms of balance and sample size, I coarsen the logarithm of total assets and Tobin's Q by their 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles, and the book leverage and quick ratio by their 50th percentile in the sample of the main analysis during the before period. The results of my matching analysis are robust to alternative ways of coarsening, including using different sets of the variables and different numbers of bins. Table D7, Panel C describes the summary statistics for the best matched sample. As the panel demonstrates, the sample is balanced across all the parent-level characteristics.

Table D8 presents the results of my matching analyses, where columns 1 and 2 show the results from the main parent-level DID analysis with the full set of controls, columns 3 and 4 show the results from the matched sample using Mahalanobis matching, and columns 5 and 6 show those using CEM. Compared with columns 1 and 2, the rest of the columns confirm that my results from the matching analyses are robust, despite the differences in the matching methods. Specifically, columns 1, 3, and 5 show that, in response to the UK uncertainty shock, the US parent companies with the UK exposure stabilize their book leverage, relative to those without the UK exposure. Meanwhile, columns 2, 4, and 6 show that the UK uncertainty shock induces a significant substitution within the consolidated debt

[12]Iacus, King, and Porro (2009, 2012) show that CEM can improve other commonly used matching methods in its ability to reduce imbalance, model dependence, estimation error, bias, among other criteria.

structure of the US parent companies with the UK exposure, as reflected by a significant rise in the bond ratio, conditioning on the book leverage. If anything, the substitution effect from the matching analyses is slightly stronger.

The main parent-level DID analysis has demonstrated that there is no significant difference in the DID estimates between the parent companies of MNEs and domestic business groups among the US parent companies without the UK exposure. Nevertheless, to further check the balance of the sample, I repeat my matching analyses after excluding the US domestic business groups. Table D9 describes the summary statistics for the additional matching analyses. As Panel A suggests, the US parent companies with the UK exposure are still larger in size. They also tend to have a higher Tobin's Q, though the two groups are similar in terms of the book leverage and quick ratio. Panel B shows that the Mahalanobis matching can reduce the size difference. However, as before, the reduction is not sufficient to eliminate the statistical significance of the mean difference. Panel C describes the summary statistics for the best matched sample using CES. As before, the matched sample can achieve balances across all the parent-level characteristics.[13]

Table D10 presents the results of my matching analyses in a manner equivalent to Table D8. Columns 1 and 2 show that the results of my main parent-level DID analysis are robust, if not stronger, after excluding the US domestic business groups. The US parent companies with the UK exposure still experience no significant change in their book leverage, relative to those without the UK exposure. Meanwhile, there is a significant 2 percentage point (around 11.11 percent) relative increase in the bond ratio, conditioning on the book leverage. Columns 3 to 6 show that these results are robust in the matched samples, despite the differences in the matching methods. To conclude, the results of my matching analyses directly alleviate the concern that the results of parent-level DID analysis may be affected by sample imbalances.

[13]The best matched sample in terms of balance and sample size is obtained by coarsening the variables in a very similar way. Specifically, I coarsen the logarithm of total assets and Tobin's Q by their 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles, and the quick ratio by its 50th percentile in the sample of the main analysis during the before period. The results of my matching analysis are also robust to alternative ways of coarsening, including using different sets of the variables and different numbers of bins.

D.3 Other Policy Changes

In addition to pre-trends and sample imbalances, one may be concerned that the timing of the Brexit interregnum happens to be correlated with other policy changes that specifically affect the bond ratio of the US parent companies with the UK exposure. Notably, the BoE and ECB implemented corporate bond purchase programs around this period as parts of their unconventional monetary policy to stabilize credit markets. However, it should be emphasized that if the corporate bond purchases cause the significant change in the bond ratio, it should have also induced a significant change in the book leverage. In addition, the effect of the corporate bond purchases by the ECB should have at least been captured by the placebo treatment group formed by the US parent companies with the EU27 exposure, but without the UK exposure. Nevertheless, I directly address the concerns associated with the corporate bond purchases by manually reviewing the records of the BoE and ECB that document every corporate debt instrument eligible to be purchased during the Brexit interregnum. For each debt instrument, I check whether the issuer can be linked to the US parent companies in my sample either directly or indirectly using the complete ownership structure from Orbis.[14] I then drop the US parent companies in my sample if any of their debt instruments were eligible to be purchased during the Brexit interregnum.

Table D11 presents the results of my robustness check, where columns 1 to 3 report the results on the bond ratio from the main analysis, and columns 4 to 6 report the results after dropping the eligible US parent companies. As the table demonstrates, only 13 out of the 1008 US parent companies in the main analysis have debt instruments eligible to be purchased. The results of my main analysis remain robust after excluding the exposure to the corporate bond purchase programs. Tables D12 and D13 show that my results on the book leverage and bond ratio without conditioning on the book leverage are also robust. Therefore, my robustness check further reduces the concern that the results of my parent-level analysis may be driven by policy changes of the BoE and ECB during the Brexit interregnum.

[14]Consistent with the argument that bond debt tends to be specialized at the parent level, nearly all the corporate bonds eligible to be purchased are issued by corporate headquarters or financial subsidiaries acting as a corporate treasury.

E Subsidiary-Level Additional Robustness Checks

E.1 Pre-Trend Analysis

Similar to my parent-level analysis, my subsidiary-level analysis achieves identification through a DID estimation, where the identification assumption is that the liabilities ratios of the UK subsidiaries of US MNEs and UK business groups would follow a parallel trend in the absence of the UK uncertainty shock. To test whether my results are driven by pre-trends, I conduct a placebo DID analysis by shifting the timing of the UK uncertainty shock 2 years earlier, making the before period (2014-2015) in my main analysis a placebo after period. I then form a placebo before period of equal length as 2012-2013.[15] Since there was no major uncertainty shock in the UK during the placebo before and after periods, my pre-trend analysis should not capture any significant substitution effect in the unconsolidated balance sheets. Table E1 confirms this point by showing that all of the DID estimates are much closer to zero and statistically insignificant. If anything, the signs of the DID estimates are opposite to those of my main analysis.

E.2 Effect of Provisions for Other Liabilities

While the results of my subsidiary-level analysis are not driven by pre-trends, one potential concern is that the increase in the internal liabilities of UK subsidiaries (liabilities not owed to external creditors) during the Brexit interregnum can be affected by other liabilities that are not internal debt. As mentioned in Section 5.1, although liabilities not owed to external creditors primarily include intragroup debt/payables, they also include liabilities related to pension contributions and social security, corporate income tax or value-added tax liabilities, and deferred revenues. In terms of my DID estimation, I believe these items should not be a concern since, to the best of my knowledge, no major changes affecting pension contributions, social security, or tax liabilities occurred in the UK during the Brexit interregnum, prior to the actual Brexit. In addition, changes in these items reflect changes in

[15] I choose to not conduct any "placebo" test using years after 2018 due to the uncertainty associated with the no-deal Brexit and COVID-19 pandemic. The results of my pre-trend analysis are robust when including 2011 into the before period, which is the starting point of my vintage of the Orbis data.

production costs, which would affect subsidiaries' leverage (total liabilities ratio). However, this is the opposite of what the data indicates.

Nevertheless, to further reduce the concern, I conduct a robustness check by utilizing the available data on provisions for these other liabilities reported by UK firms to the UK Companies House. Some UK subsidiaries' data is missing on this variable. However, among the subsidiaries with available data in my sample, Table E2 shows that my results on the substitution of external debt with internal debt remain highly stable after subtracting the provisions from the internal liabilities. Compared with the result of my main analysis, the decline in the total liabilities ratio achieves statistical significance in the reduced sample. Due to the nature of unconsolidated balance sheets, this decline can reflect a remaining deleveraging pressure, or a substitution of external debt with internal equity from the ICM. But overall, the DID coefficient for the total liabilities ratio is small. More importantly, the DID estimates for the internal and external liabilities ratios are robust after accounting for leverage, as demonstrated by columns (4) and (8). Similar to my main analysis, Table E3 shows that my results after adjusting for the provisions are not driven by pre-trends.

E.3 Generalized Subsidiary-Level Analysis with Non-UK MNEs

My main subsidiary-level analysis focuses on US MNEs since it complements my parent-level analysis, where the US disclosure requirements allow me to decompose the consolidated debt structure of US MNEs using publicly available data. However, like US MNEs, the parent companies of non-UK MNEs in general should be less affected by the UK uncertainty shock. Thus, comparing with the UK business groups, they should also be able to better support their UK subsidiaries by substituting their external debt through the ICMs. As a result, I perform a robustness check by generalizing the group of UK subsidiaries of US MNEs to include the UK subsidiaries of non-UK MNEs. This check also helps to rule out the concern that my results are driven by factors unique to US MNEs.

Table E4 reports the results from my generalized subsidiary-level analysis. As the table indicates, the results from my main analysis remain robust. Similar to my main analysis, Table E5 shows that the results of my generalized analysis are also not driven by pre-trends.

Table D1: Parent-Level DID Analysis, Book Leverage

This table presents the results of my parent-level DID analysis using book leverage as the dependent variable. The book leverage is defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. Each observation in the sample is the average of the before (2014Q1-2016Q2) or after (2016Q3-2018Q4) period for a given US parent company. All models include firm fixed effects, which subsume the effect of the standalone dummies for different groups of the parent companies. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the parent company level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)
	BookLev	BookLev	BookLev	BookLev	BookLev
After	0.017**	0.019***	0.015	0.009	0.015
	(2.463)	(2.793)	(0.789)	(0.393)	(0.785)
After×UK	0.013	0.013	0.011	0.017	0.013
	(1.572)	(1.635)	(1.177)	(1.397)	(1.304)
After×MNE				0.012	
				(0.868)	
After×EU27					0.009
					(0.544)
LnTA		-0.020	-0.019	-0.018	-0.019
		(-1.112)	(-0.958)	(-0.942)	(-0.950)
Tobin'sQ			0.001	0.001	0.001
			(0.071)	(0.072)	(0.062)
Quick			-0.019***	-0.019***	-0.019***
			(-3.025)	(-3.052)	(-3.030)
Firm-Level FE	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	Yes	Yes	Yes
Observations	2016	2016	2016	2016	2016
R-squared	0.035	0.040	0.113	0.114	0.114

Table D2: Parent-Level DID Analysis, Unconditional Bond Ratio

This table presents the results of my parent-level DID analysis using the bond ratio as the dependent variable without conditioning on the book leverage. The bond ratio is defined as the ratio of senior bonds and notes from Capital IQ to total assets from Compustat. Each observation in the sample is the average of the before (2014Q1-2016Q2) or after (2016Q3-2018Q4) period for a given US parent company. All models include firm fixed effects, which subsume the effect of the standalone dummies for different groups of the parent companies. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the parent company level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)
	SnrBond/TA	SnrBond/TA	SnrBond/TA	SnrBond/TA	SnrBond/TA
After	-0.003	-0.001	-0.012	-0.015	-0.012
	(-0.411)	(-0.189)	(-0.915)	(-1.012)	(-0.922)
After×UK	0.025***	0.025***	0.026***	0.029**	0.028***
	(3.063)	(3.077)	(2.870)	(2.524)	(2.830)
After×MNE				0.007	
				(0.507)	
After×EU27					0.008
					(0.569)
LnTA		-0.011	-0.011	-0.011	-0.011
		(-0.576)	(-0.522)	(-0.515)	(-0.517)
Tobin'sQ			0.004	0.004	0.003
			(0.357)	(0.358)	(0.349)
Quick			-0.012**	-0.012**	-0.012**
			(-2.324)	(-2.334)	(-2.333)
Firm-Level FE	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	Yes	Yes	Yes
Observations	2016	2016	2016	2016	2016
R-squared	0.016	0.018	0.070	0.070	0.070

Table D3: Parent-Level DID Analysis, General Bond Ratio

This table presents the results of my parent-level DID analysis, where the dependent variables are book leverage in column (1) and the general bond ratio in columns (2) to (7). The book leverage is defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. The general bond ratio is defined as the ratio of the sum of senior bonds and notes, subordinate bonds and notes, and commercial papers from Capital IQ to total assets from Compustat. Each observation in the sample is the average of the before (2014Q1-2016Q2) or after (2016Q3-2018Q4) period for a given US parent company. All models include firm fixed effects, which subsume the effect of the standalone dummies for different groups of the parent companies. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the parent company level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	BookLev	Bond/TA	Bond/TA	Bond/TA	Bond/TA	Bond/TA	Bond/TA
After	0.017**	-0.006	-0.018***	-0.018***	-0.027*	-0.028*	-0.027*
	(2.574)	(-0.911)	(-3.961)	(-3.945)	(-1.899)	(-1.875)	(-1.907)
After×UK	0.012	0.026***	0.017***	0.017***	0.017***	0.018**	0.019***
	(1.535)	(3.189)	(2.992)	(2.975)	(2.869)	(2.302)	(2.836)
After×MNE						0.001	
						(0.160)	
After×EU27							0.009
							(0.919)
BookLeverage			0.723***	0.723***	0.721***	0.721***	0.721***
			(16.846)	(16.863)	(16.604)	(16.581)	(16.660)
LnTA				0.001	0.007	0.007	0.007
				(0.131)	(0.589)	(0.590)	(0.618)
Tobin'sQ					0.002**	0.002**	0.002**
					(2.463)	(2.464)	(2.454)
Quick					-0.000	-0.000	0.000
					(-0.014)	(-0.015)	(0.025)
Firm-Level FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	No	No	Yes	Yes	Yes
Observations	2112	2112	2112	2112	2112	2112	2112
R-squared	0.013	0.530	0.530	0.556	0.556	0.556	0.556

Table D4: Parent-Level Pre-Trend Analysis

This table presents the results of my parent-level pre-trend analysis. The dependent variables are book leverage in column (1) and the bond ratio in columns (2) to (7). The book leverage is defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. The bond ratio is defined as the ratio of senior bonds and notes from Capital IQ to total assets from Compustat. Each observation in the sample is the average of the placebo before (2011Q1-2013Q2) or after (2013Q3-2015Q4) period for a given US parent company. All models include firm fixed effects, which subsume the effect of the standalone dummies for different groups of the parent companies. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the parent company level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	(1) BookLev	(2) SnrBond/TA	(3) SnrBond/TA	(4) SnrBond/TA	(5) SnrBond/TA	(6) SnrBond/TA	(7) SnrBond/TA
After	0.031***	0.034***	0.014**	0.009*	-0.018	-0.020	-0.020
	(4.194)	(5.050)	(2.567)	(1.731)	(-0.670)	(-0.755)	(-0.792)
After×UK	0.002	-0.007	-0.009	-0.008	-0.004	-0.002	-0.002
	(0.246)	(-0.915)	(-1.507)	(-1.384)	(-0.534)	(-0.176)	(-0.244)
After×MNE						0.004	
						(0.381)	
After×EU27							0.008
							(0.729)
BookLeverage			0.656***	0.655***	0.646***	0.646***	0.646***
			(14.049)	(14.827)	(14.221)	(14.210)	(14.207)
LnTA				0.021**	0.021*	0.021*	0.021*
				(2.022)	(1.873)	(1.871)	(1.870)
Tobin'sQ					-0.006	-0.006	-0.006
					(-0.963)	(-0.977)	(-0.978)
Quick					0.001	0.001	0.001
					(1.047)	(1.036)	(1.047)
Firm-Level FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	No	No	Yes	Yes	Yes
Observations	1964	1964	1964	1964	1964	1964	1964
R-squared	0.060	0.060	0.509	0.515	0.544	0.544	0.544

Table D5: Parent-Level Pre-Trend Analysis, Book Leverage

This table presents the results of my parent-level pre-trend analysis using book leverage as the dependent variable. The book leverage is defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. Each observation in the sample is the average of the placebo before (2011Q1-2013Q2) or after (2013Q3-2015Q4) period for a given US parent company. All models include firm fixed effects, which subsume the effect of the standalone dummies for different groups of the parent companies. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the parent company level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	(1) BookLev	(2) BookLev	(3) BookLev	(4) BookLev	(5) BookLev
After	0.031***	0.030***	0.119***	0.117***	0.120***
	(4.194)	(3.774)	(4.556)	(4.462)	(4.436)
After×UK	0.002	0.002	0.014	0.016	0.013
	(0.246)	(0.266)	(1.320)	(1.183)	(1.134)
After×MNE				0.005	
				(0.323)	
After×EU27					-0.004
					(-0.197)
LnTA		0.004	0.006	0.006	0.006
		(0.175)	(0.238)	(0.237)	(0.238)
Tobin'sQ			-0.007	-0.007	-0.007
			(-0.552)	(-0.563)	(-0.551)
Quick			-0.002	-0.002	-0.002
			(-0.643)	(-0.647)	(-0.643)
Firm-Level FE	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	Yes	Yes	Yes
Observations	1964	1964	1964	1964	1964
R-squared	0.060	0.061	0.130	0.130	0.130

Table D6: Parent-Level Pre-Trend Analysis, Unconditional Bond Ratio

This table presents the results of my parent-level pre-trend analysis using the bond ratio as the dependent variable without conditioning on the book leverage. The bond ratio is defined as the ratio of senior bonds and notes from Capital IQ to total assets from Compustat. Each observation in the sample is the average of the placebo before (2011Q1-2013Q2) or after (2013Q3-2015Q4) period for a given US parent company. All models include firm fixed effects, which subsume the effect of the standalone dummies for different groups of the parent companies. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the parent company level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)
	SnrBond/TA	SnrBond/TA	SnrBond/TA	SnrBond/TA	SnrBond/TA
After	0.034***	0.029***	0.059	0.055	0.057
	(5.050)	(3.853)	(1.423)	(1.376)	(1.428)
After×UK	-0.007	-0.006	0.005	0.009	0.006
	(-0.915)	(-0.811)	(0.546)	(0.652)	(0.597)
After×MNE				0.007	
				(0.510)	
After×EU27					0.006
					(0.390)
LnTA		0.024	0.025	0.025	0.025
		(1.058)	(1.079)	(1.077)	(1.077)
Tobin'sQ			-0.011	-0.011	-0.011
			(-0.952)	(-0.971)	(-0.959)
Quick			-0.000	-0.000	-0.000
			(-0.114)	(-0.122)	(-0.113)
Firm-Level FE	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	Yes	Yes	Yes
Observations	1964	1964	1964	1964	1964
R-squared	0.060	0.067	0.140	0.140	0.140

Table D7: Summary Statistics for Parent-Level Matching Analysis

This table presents the summary statistics for my matching analyses between the US parent companies with and without the UK exposure. Each observation is the average for the before (2014Q1-2016Q2) or after (2016Q3-2018Q4) period of a US parent company. BookLeverage is defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. LnTA is the logarithm of total assets in millions of US dollars from Compustat. Tobin'sQ is calculated using Compustat variables as the sum of the market value of equity and the book value of debt, divided by total assets. Quick is the quick ratio calculated using Compustat variables as cash and short-term investments divided by total assets.

Panel A: Original Sample of the Main Parent-Level DID Analysis

	US Parent Companies with the UK Exposure (N = 539)					US Parent Companies without the UK Exposure (N = 469)					T-Test
	Mean	SD	Median	P1	P99	Mean	SD	Median	P1	P99	P-Value
BookLeverage	.32	.18	.29	.01	.88	.33	.22	.31	.004	.91	0.244
LnTA	8.26	1.76	8.32	2.91	12.22	6.01	2.53	6.62	-.11	10.42	0.000
Tobin'sQ	1.81	1.10	1.49	.60	5.96	1.71	1.28	1.28	.51	5.96	0.337
Quick	.79	1.11	.47	.04	4.66	.83	1.64	.34	.005	7.28	0.584

Panel B: Mahalanobis Matching on Size, Top 3 Matches with Replacements

	US Parent Companies with the UK Exposure (N = 539)					US Parent Companies without the UK Exposure (N = 336)					T-Test
	Mean	SD	Median	P1	P99	Mean	SD	Median	P1	P99	P-Value
BookLeverage	.32	.18	.29	.01	.88	.35	.20	.34	.03	.88	0.013
LnTA	8.26	1.76	8.32	2.91	12.22	7.00	2.00	7.36	1.26	10.46	0.000
Tobin'sQ	1.81	1.10	1.49	.60	5.96	1.46	.90	1.25	.52	4.78	0.000
Quick	.79	1.11	.47	.04	4.66	.69	1.35	.35	.005	5.67	0.239

Panel C: Coarsened Exact Matching

	US Parent Companies with the UK Exposure (N = 432)					US Parent Companies without the UK Exposure (N = 352)					T-Test
	Mean	SD	Median	P1	P99	Mean	SD	Median	P1	P99	P-Value
BookLeverage	.32	.18	.29	.01	.88	.34	.21	.30	.03	.82	0.380
LnTA	7.87	1.54	7.98	2.49	10.96	7.82	1.62	7.94	2.12	10.86	0.704
Tobin'sQ	1.65	.86	1.43	.60	5.16	1.65	.90	1.46	.58	5.96	0.995
Quick	.78	1.04	.48	.04	4.53	.76	1.16	.48	.005	4.59	0.846

Table D8: Results of Parent-Level Matching Analysis

This table presents the results of my matching analyses between the US parent companies with and without the UK exposure. The dependent variables are book leverage in column (1), (3), and (5) and the bond ratio in columns (2), (4), and (6). The book leverage is defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. The bond ratio is defined as the ratio of senior bonds and notes from Capital IQ to total assets from Compustat. Each observation in the sample is the average of the before (2014Q1-2016Q2) or after (2016Q3-2018Q4) period for a given US parent company. All models include firm fixed effects, which subsume the effect of the standalone dummies for different groups of the parent companies. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the parent company level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	Original		Mahalanobis		CEM	
	(1)	(2)	(3)	(4)	(5)	(6)
	BookLev	SnrBond/TA	BookLev	SnrBond/TA	BookLev	SnrBond/TA
After	0.015	-0.022*	-0.008	-0.019	0.003	-0.007
	(0.789)	(-1.755)	(-0.384)	(-1.125)	(0.171)	(-0.777)
After×UK	0.011	0.018***	-0.005	0.020***	-0.001	0.022**
	(1.177)	(2.913)	(-0.525)	(2.750)	(-0.093)	(2.331)
BookLeverage		0.719***		0.710***		0.636***
		(15.040)		(12.091)		(11.761)
LnTA	-0.019	0.003	0.021	0.026*	-0.006	0.021*
	(-0.958)	(0.240)	(0.956)	(1.871)	(-0.290)	(1.715)
Tobin'sQ	0.001	0.003	-0.011	0.002	-0.022**	0.005
	(0.071)	(0.473)	(-0.844)	(0.188)	(-1.979)	(0.562)
Quick	-0.019***	0.002	-0.015**	0.001	-0.018**	0.007
	(-3.025)	(0.663)	(-2.014)	(0.302)	(-2.354)	(1.492)
Firm-Level FE	Yes	Yes	Yes	Yes	Yes	Yes
After×Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2016	2016	1750	1750	1568	1568
R-squared	0.113	0.527	0.149	0.507	0.194	0.461

Table D9: Summary Statistics for Parent-Level Matching Analysis among Multinational Parents

This table presents the summary statistics for my matching analyses between the US multinational parent companies with and without the UK exposure. Each observation is the average for the before (2014Q1-2016Q2) or after (2016Q3-2018Q4) period of a US parent company. BookLeverage is defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. LnTA is the logarithm of total assets in millions of US dollars from Compustat. Tobin'sQ is calculated using Compustat variables as the sum of the market value of equity and the book value of debt, divided by total assets. Quick is the quick ratio calculated using Compustat variables as cash and short-term investments divided by total assets.

Panel A: Original Sample of the Main Parent-Level DID Analysis

	US Parent Companies with the UK Exposure (N = 539)					US Multinational Parents without the UK Exposure (N = 231)					T-Test
	Mean	SD	Median	P1	P99	Mean	SD	Median	P1	P99	P-Value
BookLeverage	.32	.18	.29	.01	.88	.32	.19	.31	.001	.82	0.904
LnTA	8.26	1.76	8.32	2.91	12.22	6.68	2.31	7.09	-.04	10.46	0.000
Tobin'sQ	1.81	1.10	1.49	.60	5.96	1.61	1.12	1.28	.52	5.96	0.023
Quick	.79	1.11	.47	.04	4.66	.79	1.32	.35	.008	6.66	0.938

Panel B: Mahalanobis Matching on Size, Top 3 Matches with Replacements

	US Parent Companies with the UK Exposure (N = 539)					US Multinational Parents without the UK Exposure (N = 207)					T-Test
	Mean	SD	Median	P1	P99	Mean	SD	Median	P1	P99	P-Value
BookLeverage	.32	.18	.29	.01	.88	.33	.18	.32	.01	.77	0.601
LnTA	8.26	1.76	8.32	2.91	12.22	7.06	2.04	7.33	1.92	10.46	0.000
Tobin'sQ	1.81	1.10	1.49	.60	5.96	1.49	.90	1.27	.52	4.66	0.000
Quick	.79	1.11	.47	.04	4.66	.69	1.17	.34	.008	6.20	0.292

Panel C: Coarsened Exact Matching

	US Parent Companies with the UK Exposure (N = 429)					US Multinational Parents without the UK Exposure (N = 211)					T-Test
	Mean	SD	Median	P1	P99	Mean	SD	Median	P1	P99	P-Value
BookLeverage	.33	.18	.30	.02	.91	.34	.19	.34	.03	.81	0.324
LnTA	7.99	1.51	8.08	2.91	10.66	7.93	1.56	8.11	2.77	10.59	0.650
Tobin'sQ	1.60	.77	1.41	.60	4.98	1.60	.79	1.40	.60	4.56	0.993
Quick	.73	.98	.46	.03	4.11	.72	.97	.46	.01	5.19	0.895

Table D10: Results of Parent-Level Matching Analysis among Multinational Parents

This table presents the results of my matching analyses between the US multinational parent companies with and without the UK exposure. The dependent variables are book leverage in column (1), (3), and (5) and the bond ratio in columns (2), (4), and (6). The book leverage is defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. The bond ratio is defined as the ratio of senior bonds and notes from Capital IQ to total assets from Compustat. Each observation in the sample is the average of the before (2014Q1-2016Q2) or after (2016Q3-2018Q4) period for a given US parent company. All models include firm fixed effects, which subsume the effect of the standalone dummies for different groups of the parent companies. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the parent company level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	Original		Mahalanobis		CEM	
	(1)	(2)	(3)	(4)	(5)	(6)
	BookLev	SnrBond/TA	BookLev	SnrBond/TA	BookLev	SnrBond/TA
After	-0.023***	-0.007	-0.030***	-0.011	-0.028***	-0.007
	(-3.769)	(-0.352)	(-4.311)	(-0.556)	(-4.703)	(-0.676)
After×UK	0.004	0.020***	-0.008	0.021***	-0.005	0.017**
	(0.352)	(2.699)	(-0.793)	(2.699)	(-0.433)	(2.134)
BookLeverage		0.749***		0.729***		0.708***
		(12.118)		(10.713)		(9.690)
LnTA	-0.005	-0.006	0.019	0.005	0.028	0.017
	(-0.198)	(-0.487)	(0.724)	(0.364)	(1.088)	(1.290)
Tobin'sQ	-0.001	-0.004	0.000	-0.004	0.015	0.002
	(-0.057)	(-0.486)	(0.007)	(-0.567)	(0.785)	(0.234)
Quick	-0.018**	0.004	-0.020**	0.003	-0.012	0.011*
	(-2.170)	(0.948)	(-2.059)	(0.688)	(-1.469)	(1.958)
Firm-Level FE	Yes	Yes	Yes	Yes	Yes	Yes
After×Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1540	1540	1492	1492	1280	1280
R-squared	0.140	0.543	0.168	0.522	0.132	0.545

Table D11: Effect of the Corporate Bond Purchase Programs

This table presents the results of my robustness check on the corporate bond purchase programs implemented by the BoE and ECB during the Brexit interregnum. The dependent variable is the bond ratio, defined as the ratio of senior bonds and notes from Capital IQ to total assets from Compustat. Each observation in the sample is the average of the before (2014Q1-2016Q2) or after (2016Q3-2018Q4) period for a given US parent company. All models include firm fixed effects, which subsume the effect of the standalone dummies for different groups of the parent companies. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the parent company level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	Original			No Exposure to the BoE and ECB		
	(1)	(2)	(3)	(4)	(5)	(6)
	SnrBond/TA	SnrBond/TA	SnrBond/TA	SnrBond/TA	SnrBond/TA	SnrBond/TA
After	-0.022*	-0.021	-0.022*	-0.022*	-0.021	-0.022*
	(-1.755)	(-1.554)	(-1.756)	(-1.741)	(-1.565)	(-1.742)
After×UK	0.018***	0.017**	0.018***	0.019***	0.018**	0.019***
	(2.913)	(2.094)	(2.636)	(3.043)	(2.229)	(2.751)
After×MNE		-0.002			-0.001	
		(-0.184)			(-0.137)	
After×EU27			0.001			0.002
			(0.144)			(0.155)
BookLeverage	0.719***	0.719***	0.719***	0.724***	0.724***	0.723***
	(15.040)	(15.019)	(15.046)	(15.253)	(15.231)	(15.260)
LnTA	0.003	0.003	0.003	0.003	0.003	0.003
	(0.240)	(0.236)	(0.243)	(0.282)	(0.278)	(0.285)
Tobin'sQ	0.003	0.003	0.003	0.004	0.004	0.004
	(0.473)	(0.473)	(0.471)	(0.630)	(0.629)	(0.628)
Quick	0.002	0.002	0.002	0.002	0.002	0.002
	(0.663)	(0.665)	(0.670)	(0.615)	(0.617)	(0.623)
Firm-Level FE	Yes	Yes	Yes	Yes	Yes	Yes
After×Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2016	2016	2016	1990	1990	1990
R-squared	0.527	0.527	0.527	0.533	0.533	0.533

Table D12: Effect of the Corporate Bond Purchase Programs, Book Leverage

This table presents the results of my robustness check on the corporate bond purchase programs implemented by the BoE and ECB during the Brexit interregnum. The dependent variable is the book leverage, defined as the ratio of total debt (short-term debt + long-term debt) to total assets from Compustat. Each observation in the sample is the average of the before (2014Q1-2016Q2) or after (2016Q3-2018Q4) period for a given US parent company. All models include firm fixed effects, which subsume the effect of the standalone dummies for different groups of the parent companies. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the parent company level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)
	BookLev	BookLev	BookLev	BookLev	BookLev
After	0.017**	0.019***	0.015	0.009	0.014
	(2.463)	(2.787)	(0.785)	(0.399)	(0.780)
After×UK	0.012	0.013	0.010	0.016	0.012
	(1.466)	(1.532)	(1.068)	(1.294)	(1.198)
After×MNE				0.011	
				(0.838)	
After×EU27					0.009
					(0.540)
LnTA		-0.020	-0.019	-0.019	-0.019
		(-1.097)	(-0.973)	(-0.957)	(-0.965)
Tobin'sQ			0.000	0.000	-0.000
			(0.001)	(0.003)	(-0.009)
Quick			-0.019***	-0.019***	-0.019***
			(-3.007)	(-3.033)	(-3.013)
Firm-Level FE	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	Yes	Yes	Yes
Observations	1990	1990	1990	1990	1990
R-squared	0.033	0.038	0.110	0.111	0.110

Table D13: Effect of the Corporate Bond Purchase Programs, Unconditional Bond Ratio

This table presents the results of my robustness check on the corporate bond purchase programs implemented by the BoE and ECB during the Brexit interregnum. The dependent variable is the bond ratio, defined as the ratio of senior bonds and notes from Capital IQ to total assets from Compustat. Each observation in the sample is the average of the before (2014Q1-2016Q2) or after (2016Q3-2018Q4) period for a given US parent company. All models include firm fixed effects, which subsume the effect of the standalone dummies for different groups of the parent companies. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the parent company level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)
	SnrBond/TA	SnrBond/TA	SnrBond/TA	SnrBond/TA	SnrBond/TA
After	-0.003	-0.001	-0.011	-0.015	-0.011
	(-0.411)	(-0.186)	(-0.905)	(-1.009)	(-0.912)
After×UK	0.025***	0.025***	0.026***	0.030**	0.028***
	(3.031)	(3.046)	(2.856)	(2.529)	(2.819)
After×MNE				0.007	
				(0.523)	
After×EU27					0.008
					(0.577)
LnTA		-0.011	-0.011	-0.010	-0.010
		(-0.583)	(-0.515)	(-0.507)	(-0.510)
Tobin'sQ			0.004	0.004	0.004
			(0.403)	(0.404)	(0.395)
Quick			-0.012**	-0.012**	-0.012**
			(-2.342)	(-2.352)	(-2.350)
Firm-Level FE	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	Yes	Yes	Yes
Observations	1990	1990	1990	1990	1990
R-squared	0.016	0.017	0.070	0.071	0.070

Table E1: Subsidiary-Level Pre-Trend Analysis

This table presents the results of my subsidiary-level pre-trend analysis. The dependent variables are the ratio of internal liabilities to total assets from columns (1) to (4), the ratio of external liabilities to total assets from columns (5) to (8), and leverage from columns (9) to (11), where leverage is the ratio of total (internal + external) liabilities to total assets. All variables are from the unconsolidated balanced sheets reported to the UK Companies House by UK firms. Each observation in the sample is the average of the placebo before (2012-2013) or after (2014-2015) period for a given UK subsidiary. All models include firm fixed effects, which subsume the effect of the standalone dummy for the UK subsidiaries of US MNEs. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the subsidiary level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	IL/TA	IL/TA	IL/TA	IL/TA	EL/TA	EL/TA	EL/TA	EL/TA	Leverage	Leverage	Leverage
After	-0.000	0.009**	0.016	0.010	-0.021***	-0.023***	-0.018**	-0.020**	-0.020***	-0.006	0.013
	(-0.127)	(2.169)	(1.430)	(0.995)	(-10.075)	(-10.448)	(-2.043)	(-2.435)	(-4.494)	(-1.105)	(1.267)
After×Foreign	-0.003	-0.004	-0.002	-0.005	0.002	0.003	0.002	0.001	0.008	0.006	0.006
	(-0.449)	(-0.664)	(-0.359)	(-0.784)	(0.496)	(0.540)	(0.299)	(0.125)	(0.827)	(0.639)	(0.562)
LnTA		-0.094***	-0.093***	-0.027**		0.017***	0.017***	0.042***		-0.148***	-0.147***
		(-6.087)	(-6.015)	(-2.357)		(2.706)	(2.679)	(6.286)		(-6.365)	(-6.393)
Leverage				0.454***				0.175***			
				(12.669)				(13.957)			
Firm-Level FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes
Observations	14902	14902	14902	14902	14902	14902	14902	14902	14902	14902	14902
R-squared	0.000	0.032	0.038	0.351	0.016	0.018	0.024	0.145	0.003	0.051	0.062

Table E2: Effect of Provisions for Other Liabilities

This table presents the results of my analysis after subtracting provisions for other liabilities from internal liabilities. The dependent variables are the ratio of adjusted internal liabilities to total assets from columns (1) to (4), the ratio of external liabilities to total assets from columns (5) to (8), and adjusted leverage from columns (9) to (11), where the adjusted leverage is the ratio of adjusted internal liabilities plus external liabilities to total assets. All variables are from the unconsolidated balanced sheets reported to the UK Companies House by UK firms. Each observation in the sample is the average of the before (2014-2015) or after (2017-2018) period for a given UK subsidiary. All models include firm fixed effects, which subsume the effect of the standalone dummy for the UK subsidiaries of US MNEs. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the subsidiary level. Superscripts ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	IL/TA	IL/TA	IL/TA	IL/TA	EL/TA	EL/TA	EL/TA	EL/TA	Leverage	Leverage	Leverage
After	-0.092***	-0.082***	-0.106***	-0.106***	0.077***	0.075***	0.104***	0.104***	-0.009*	0.004	-0.002
	(-23.100)	(-19.404)	(-7.802)	(-8.342)	(25.351)	(23.808)	(8.312)	(8.732)	(-1.868)	(0.802)	(-0.142)
After×Foreign	0.062***	0.062***	0.057***	0.065***	-0.088***	-0.088***	-0.082***	-0.076***	-0.027**	-0.027**	-0.024*
	(8.185)	(8.587)	(7.653)	(8.847)	(-11.567)	(-11.570)	(-10.371)	(-11.664)	(-2.087)	(-2.142)	(-1.858)
LnTA		-0.096***	-0.095***	-0.051***		0.013*	0.012*	0.044***		-0.125***	-0.124***
		(-6.208)	(-6.211)	(-5.316)		(1.780)	(1.742)	(5.479)		(-6.772)	(-6.763)
Leverage				0.354***				0.256***			
				(11.430)				(15.173)			
Firm-Level FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes
Observations	15476	15476	15476	15476	15476	15476	15476	15476	15476	15476	15476
R-squared	0.071	0.116	0.123	0.302	0.077	0.078	0.085	0.236	0.002	0.052	0.058

Table E3: Effect of Provisions for Other Liabilities, Pre-Trends

This table presents the results of my pre-trend analysis after subtracting provisions for other liabilities from internal liabilities. The dependent variables are the ratio of adjusted internal liabilities to total assets from columns (1) to (4), the ratio of external liabilities to total assets from columns (5) to (8), and adjusted leverage from columns (9) to (11), where the adjusted leverage is the ratio of adjusted internal liabilities plus external liabilities to total assets. All variables are from the unconsolidated balanced sheets reported to the UK Companies House by UK firms. Each observation in the sample is the average of the placebo before (2012-2013) or after (2014-2015) period for a given UK subsidiary. All models include firm fixed effects, which subsume the effect of the standalone dummy for the UK subsidiaries of US MNEs. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the subsidiary level. Superscripts ∗∗∗, ∗∗, and ∗ indicate statistical significance at 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	IL/TA	IL/TA	IL/TA	IL/TA	EL/TA	EL/TA	EL/TA	EL/TA	Leverage	Leverage	Leverage
After	-0.003	0.003	0.008	0.007	-0.020***	-0.022***	-0.015*	-0.016*	-0.022***	-0.010**	0.004
	(-1.026)	(0.954)	(0.765)	(0.685)	(-9.210)	(-9.569)	(-1.735)	(-1.945)	(-4.964)	(-2.107)	(0.337)
After×Foreign	-0.001	-0.003	-0.001	-0.002	0.002	0.002	0.002	0.001	0.006	0.004	0.002
	(-0.271)	(-0.528)	(-0.176)	(-0.316)	(0.404)	(0.468)	(0.327)	(0.284)	(0.677)	(0.439)	(0.226)
LnTA		-0.071***	-0.070***	-0.027**		0.017***	0.017**	0.041***		-0.118***	-0.118***
		(-4.939)	(-4.868)	(-2.352)		(2.607)	(2.530)	(5.677)		(-5.504)	(-5.547)
Leverage				0.364***				0.203***			
				(9.463)				(14.102)			
Firm-Level FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes
Observations	13368	13368	13368	13368	13368	13368	13368	13368	13368	13368	13368
R-squared	0.000	0.025	0.033	0.275	0.015	0.018	0.024	0.174	0.004	0.040	0.051

Table E4: Generalized Subsidiary-Level DID Analysis – Non-UK MNEs vs. UK Business Groups

This table presents the results of my generalized subsidiary-level DID analysis, using the UK subsidiaries of non-UK MNEs and UK business groups. The dependent variables are the ratio of internal liabilities to total assets from columns (1) to (4), the ratio of external liabilities to total assets from columns (5) to (8), and leverage from columns (9) to (11), where leverage is the ratio of total (internal + external) liabilities to total assets. All variables are from the unconsolidated balanced sheets reported to the UK Companies House by UK firms. Each observation in the sample is the average of the before (2014-2015) or after (2017-2018) period for a given UK subsidiary. All models include firm fixed effects, which subsume the effect of the standalone dummy for the UK subsidiaries of non-UK MNEs. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the subsidiary level. Superscripts ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels.

	(1) IL/TA	(2) IL/TA	(3) IL/TA	(4) IL/TA	(5) EL/TA	(6) EL/TA	(7) EL/TA	(8) EL/TA	(9) Leverage	(10) Leverage	(11) Leverage
After	-0.101***	-0.090***	-0.097***	-0.107***	0.080***	0.078***	0.103***	0.098***	-0.010**	0.004	0.022**
	(-23.745)	(-20.227)	(-7.825)	(-9.383)	(27.209)	(25.916)	(9.723)	(9.499)	(-2.179)	(0.848)	(2.145)
After×Foreign	0.061***	0.062***	0.059***	0.056***	-0.061***	-0.061***	-0.057***	-0.058***	0.004	0.005	0.005
	(9.919)	(10.364)	(9.272)	(10.210)	(-13.037)	(-13.079)	(-11.692)	(-13.168)	(0.470)	(0.660)	(0.664)
LnTA		-0.107***	-0.106***	-0.050***		0.015***	0.014**	0.047***		-0.137***	-0.136***
		(-8.041)	(-7.959)	(-6.324)		(2.655)	(2.542)	(7.540)		(-8.799)	(-8.743)
Leverage				0.413***				0.242***			
				(17.098)				(20.959)			
Firm-Level FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes
Observations	24536	24536	24536	24536	24536	24536	24536	24536	24536	24536	24536
R-squared	0.054	0.099	0.103	0.320	0.059	0.061	0.066	0.205	0.000	0.054	0.058

Table E5: Generalized Subsidiary-Level Pre-Trend Analysis – Non-UK MNEs vs. UK Business Groups

This table presents the results of my generalized subsidiary-level pre-trend analysis, using the UK subsidiaries of non-UK MNEs and UK business groups. The dependent variables are the ratio of internal liabilities to total assets from columns (1) to (4), the ratio of external liabilities to total assets from columns (5) to (8), and leverage from columns (9) to (11), where leverage is the ratio of total (internal + external) liabilities to total assets. All variables are from the unconsolidated balanced sheets reported to the UK Companies House by UK firms. Each observation in the sample is the average of the before (2012-2013) or after (2014-2015) period for a given UK subsidiary. All models include firm fixed effects, which subsume the effect of the standalone dummy for the UK subsidiaries of non-UK MNEs. Firm fixed effects are also not included in the calculation of R-squared. The t-statistics reported in parentheses are based on robust standard errors clustered at the subsidiary level. Superscripts ***, **, and * indicate statistical significance at 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	IL/TA	IL/TA	IL/TA	IL/TA	EL/TA	EL/TA	EL/TA	EL/TA	Leverage	Leverage	Leverage
After	-0.000	0.009**	0.008	0.007	-0.021***	-0.023***	-0.018**	-0.018**	-0.020***	-0.006	0.000
	(-0.127)	(2.364)	(0.710)	(0.782)	(-10.076)	(-10.825)	(-2.265)	(-2.427)	(-4.494)	(-1.352)	(0.025)
After×Foreign	-0.001	-0.003	-0.004	-0.005	0.004	0.005	0.005	0.005	0.006	0.003	0.003
	(-0.121)	(-0.532)	(-0.738)	(-1.156)	(1.258)	(1.398)	(1.417)	(1.383)	(0.891)	(0.470)	(0.392)
LnTA		-0.099***	-0.099***	-0.039***		0.023***	0.023***	0.051***		-0.138***	-0.138***
		(-7.496)	(-7.408)	(-4.090)		(4.195)	(4.189)	(8.583)		(-7.182)	(-7.271)
Leverage				0.436***				0.202***			
				(14.902)				(17.952)			
Firm-Level FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
After×Industry	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes
Observations	21238	21238	21238	21238	21238	21238	21238	21238	21238	21238	21238
R-squared	0.000	0.035	0.040	0.338	0.013	0.017	0.021	0.170	0.003	0.043	0.051