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Abstract

We investigate the impact of subsidiary cross-sectional uncertainty shocks on the future investment decisions of multinational European Global Ultimate Owners during the period 2007 to 2017. We expand on the academic literature by utilizing a novel data set with global coverage and annual ownership links and analyzing publicly-listed, as well as private and smaller companies. We find that Global Ultimate Owners decrease their future investment decisions in response to uncertainty shocks from their subsidiaries. We find that two standard deviations generate a 0.41% reduction in the investment rate of parent companies. More importantly, we explore the multiplying effect of financial constraints in parent companies investment decisions and find that parent-level financial constraints multiply the effect of lagged uncertainty shocks on investment rate by 4.82 times on average. Furthermore, we document that lagged uncertainty shocks also generate a decrease in intangible fixed assets and cash flows.

JEL classification: D22, E22, E44, F23, G32
Keywords: Uncertainty, Investment, Subsidiaries, Ultimate Owner

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Contents

1 Introduction

Over the past decade, uncertainty has received a great deal of attention in the academic and empirical literature. Uncertainty has been deemed one of the most critical drivers of catastrophic economic events with global consequences such as the 2008 financial crisis, as well as the European crisis (Beyer, Coeuré, & Mendicino, 2017). All countries witness unforeseen events that bring negative consequences of different magnitudes. Companies are highly vulnerable to this uncertainty, and their globalized corporate networks exacerbate its effect. Hence, firms need to prepare and adopt effective strategies to tackle uncertainty.

Given its great relevance, uncertainty has been the subject of extensive study in the academic and empirical literature. Early definitions of uncertainty state that it relates to the impossibility of determining the probability of events occurring (Knight, 1921). Based on this definition, reaching a standard definition of uncertainty is a difficult task. Consequently, academics have developed a plethora of proxies to attempt to measure uncertainty, which can be broadly classified in realized volatility and forward-looking dispersion measures. In our thesis, we adopt a similar measure of uncertainty as (Bloom, Floetotto, Jaimovich, Saporta-Eksten, & Terry, 2018) and define it as the cross-sectional dispersion of annual sales growth of all subsidiaries across countries of a given Global Ultimate Owner (GUO). In our study we define the GUO or ultimate parent company as the firm at the top of the corporate structure, whether it be domestic of foreign, with a total ownership greater than fifty percent in a given subsidiary.

The aim of our thesis is to examine the effects of uncertainty in the investment decisions of multinational corporations and then expand these findings and explore the multiplicative effect of parent-level financial constraints on investments. More precisely, we analyze the cross-sectional uncertainty at the subsidiary level within a global scope and its effect on the investment rate of their Global Ultimate Owners. Furthermore, we incorporate a model with interaction effect with different measures of financial constraints. While there are academic papers that deal with the transmission of uncertainty shocks from parent companies to subsidiaries (Cravino & Levchenko, 2017) and transmission of negative shocks from subsidiaries in crisis countries to subsidiaries located in non-crisis countries (Bena, Dinc, & Erel, 2018); to our knowledge, as of this date, there is no study in the academic literature that analyzes this type of uncertainty and the multiplier effect financial constraints have on it. We investigate the following testable hypotheses:

H1: Future real investment decision of GUOs is affected by uncertainty shocks coming from the cross section of its subsidiaries.

H2: The growth in intangible assets of the GUO is affected by the uncertainty shocks coming from the cross section of its subsidiaries.

H3: Incremental cash-flows of the GUO are affected by the uncertainty shocks coming from the cross section of its subsidiaries.

H4: Volatility shocks have an incremental effect on the future investment rate of financially constrained GUOs.

Our main finding is that there is a significant predictive negative effect of subsidiary cross-sectional uncertainty shocks on multinational parents' investment decisions. Moreover, we find that this effect is augmented in the presence of parent-level financial frictions.

Our thesis contributes to the financial literature in three aspects. First, the majority of the literature analyzes uncertainty from a macroeconomic standpoint. In contrast, we adopt a new approach and explore uncertainty from a firm-specific perspective within a global scope. More specifically, we examine uncertainty at the subsidiary level across countries. Second, while the literature has focused on public companies, our analysis contributes to the literature by exploring uncertainty in both public and private firms. Even though information on private firms is more difficult to obtain, they represent a critical part of economic activity, as well as an important component of the operations of multinational corporations. Third, we add to the literature by analyzing the multiplier effects of parent-level financial constraints on uncertainty shocks and their impact on the future investment decisions of parent companies.

We use novel firm-level data to create a panel data set of subsidiaries to compute cross-sectional uncertainty that is later merged into a second data set of GUOs to examine the effect of this uncertainty on investment decisions. Our data comes from Orbis Historical, a firm-level database than provides detailed financial, ownership and descriptive information on more than 300 million firms in more than 200 countries. The data provides three key features. Orbis has an extensive global coverage, and in addition to public firms, Orbis allows to analyze private firms for which data is more difficult to obtain. Furthermore, Orbis provides details on different levels of ownership and how it changes across time. A crucial element of our research is the fact that we use annual ownership updates. This allows us to determine with great accuracy the ultimate owners of each firm at each observation period.

2 Literature Review

Our study mainly refers to the extensive strand of the literature studying uncertainty, its transmission, and its effects on multinational corporations. Our thesis work contributes to the literature in two main aspects. First, most of the literature has focused on uncertainty from a macroeconomic perspective. In contrast, we analyze firm-specific uncertainty at the subsidiary level across countries and its effect on parents' investment decisions. Second, while the literature has almost completely focused on public firms, we also contribute to this strand of research by analyzing both public and private firms.

2.1 Measures of Uncertainty

One of the most prominent sources of business cycle fluctuations is uncertainty, and it can be exemplified as the formation of opinions about the occurrence of future events. Knight (1921) coined the modern definition of uncertainty as the inability to determine the probability distribution of events, contrary to the definition of risk—a known probability distribution of a series of events. Given this definition of uncertainty, it is difficult to measure it directly. However, the literature has developed different proxies to measure it. One of the most recent definitions of uncertainty states that, uncertainty is represented by the difficulty for economic agents to make accurate forecasts (Bloom, 2014; Jurado, Ludvigson, & Ng, 2015). The proxies for uncertainty differ significantly, but measures of realized volatility and forward-looking dispersion are the most prominent throughout literature.

Realized volatility of stock market or GDP are some of the most common uncertainty proxies since as volatility increases, a data series is more difficult to forecast. Bloom (2009) finds that the stock market volatility is highly connected to other measures of productivity and demand uncertainty such as cross-sectional spread of firm- and industry-level earnings and productivity growth.

Uncertainty can also be measured as the cumulative standard deviation of the residuals and be obtained from the regression of sales-to-total assets ratio against firm-specific and year-specific effects (Rashid, 2011).

Another interesting uncertainty proxy in the literature is the volatility of a price of a safe heaven, gold in particular. Piffer & Podstawski (2018) use gold as an uncertainty proxy because its price Granger causes several uncertainty measures and they find it has a stronger relation with the drivers of the data studied in their model. The proxy is computed as a percentage variation of the price of gold around particular events.

In his seminal paper, Bloom (2009) argues that uncertainty has a negative impact in output and employment, and provides different proxies to measure uncertainty. Namely, Bloom uses the standard deviation of firm-level profit growth, firm-level stock returns, industry level total factor productivity (TFP) growth and GDP forecasts. Furthermore, Bloom et al. (2018) measure uncertainty using establishment-level total factor productivity (TFP) shocks and establishment-level growth in employment and sales. Moreover, they use three additional proxies for uncertainty: cross-sectional dispersion of monthly stock returns, sales' growth, and industry production growth. They found that these measures are highly counter cyclical, which implies that the microeconomic uncertainty is higher during recessions. In our study, we will closely follow Bloom's definition of uncertainty using dispersion of sales' growth.

While volatility measures are considered to be good uncertainty proxies, one of their downsides is that they are not directly connected to the economic activity (Moore, 2016). Short-run variation in stock prices is driven by factors that may be related to the economic activity, but their connection is not clear (Shiller, 1981; Cochrane, 2011).

Moreover, while uncertainty proxies based on realized volatility are convenient and widely used due to the availability of the data and ease of computation, they are a less than perfect measure of uncertainty as they are inherently based on past data. Therefore, forward looking measures are conceptually preferred to the backward-looking ones as uncertainty always refers to the future.

Different studies use the implied volatility of equity options as the uncertainty measure of stock market (Bloom, 2009; Caggiano et al., 2014; Bekaert et al., 2013; Nikkinen & Sahlstrom, 2004; Stone & Stein, 2013). This measure relies on the assumption that the market traders predict the volatility correctly led by incentives and concludes that the implied volatility is highly predictive of future realized volatility. The proxy is calculated by inverting the Black-Scholes formula and is consistent with the market price of an exchange-traded option (Stone & Stein, 2013). This measure as an uncertainty proxy is highly convenient, as the data on stock market volatility is readily available to researchers and is quite comparable among countries. However, the data on implied option volatility is shorter than on realized volatility and does, therefore, not cover some important periods such as the early '90s recession (Moore, 2016).

Furthermore, dispersion in analysts' forecasts for 12-month forward earnings for ASX 200 companies is another uncertainty proxy. Other common proxies are forecaster disagreements and mentions of "uncertainty" in news (Bloom, 2014). Dispersion is calculated as the cross-sectional coefficient of variation of analysts' forecasts. This measure differs from other volatility measures as it is more connected to the real economic activity but has a short span of data as a downside. This can lead to the capture of only analyst disagreement and not actual economic uncertainty (Moore, 2016).

Empirical evidence shows that uncertainty shocks come about most often after bad news. Bloom (2014) states that 16 out of 17 uncertainty shocks from 1962 to 2008 based on jumps in the volatility of stock markets happened due to bad news. There are several reasons why recessions do increase uncertainty (Bloom, 2014). Firstly, during recessions, business activities slow down, and forecasting becomes harder as the information flow is reduced. Moreover, recessions prompt uncertain or experimental policies. When the economy is down, politicians experiment with policies and increase economic policy uncertainty (Baker, Bloom, & Davis, 2016; Pastor & Veronesi, 2012). In low states of the economy, it is also less expensive to allocate unused resources to R&D and experiment with new ideas (Bachmann & Moscarini, 2012; D'Erasmo & Moscoso Boedo, 2012).

2.2 Transmission Effects

While uncertainty effects within countries have been increasingly researched since Bloom's 2009 seminal paper, the literature on transmission effects among different countries is quite scarce. As uncertainty is one of the main factors in determining business cycles, the literature on business cycle transmission contains pertinent information for this paper.

Bena et al. (2017) find that negative shocks in multinational companies are transmitted from subsidiaries from countries in financial crisis to subsidiaries in countries without a crisis. They find that in comparison to the industry, multinational companies that have subsidiaries in crisis-countries have a significantly lower investment of 18% than companies that do not have subsidiaries in crisis countries.

Moreover, a strong comovement between multinational affiliates and their parents after controlling for sectoral and aggregate trends capturing the role of linkages within the multinational company was found by Cravino & Levchenko (2017). It is shown that the correlation is present across many sectors (including services). This correlation is significant and robust to different samples, periods, fixed effects, and aggregation methods. Their study shows that the 10% growth in the sales of the parent company results in 2% growth in sales of the subsidiary from a different country.

In addition, it is found that the employment growth rate is negatively affected as well by subsidiaries in crisis countries. The affected subsidiaries exhibit negative or zero employment growth rates, while the unaffected parent-companies have a growth rate of 1.40%

Cravino & Levchenko (2017) find that the degree of contribution to the transmission of shocks is determined by: (1) whether share of the firm's technology shock originates in the source versus destination; (2) distribution of bilateral multinational shares in the economy; (3) general equilibrium effects.

2.3 Effects of Uncertainty

As can be noted from the literature, uncertainty fluctuates significantly over time, especially after important economic or political shocks. To understand the importance of this phenomenon, one must understand the effects of those uncertainty fluctuations.

There are two negative channels through which uncertainty can affect growth of both companies and economy as a whole (Bloom, 2014). Bernanke (2013) states that the first channel is real options because investment choices are a series of options. Firms can delay investment decisions as when uncertainty is high, the value of the option is higher. Hence, firms are cautious about investment decisions. The real options effect requires that adjustment costs are irreversible and that firms sell into imperfectly competitive markets and/or operate with decreasing-returns-to-scale technology. Therefore, the reallocation of resources that causes firms to be more cautious when uncertainty is higher stalls productivity growth, and exacerbates business cycles (Foster, Haltiwanger, & Krizan, 2000).

Uncertainty irreversibly creates areas of inaction in investment and generates a reduction in it (Bloom, Bond, & Van Reenen, 2007). The higher the adjustment costs, the stronger the effect (Dixit & Pindyck, 1994). Baum et al. (2008) also found that CAPM-based uncertainty measures negatively impact investment practices. However, they note a positive connection between market-based uncertainty and investment. As the previous literature widely relies on results from only publicly traded companies, Rashid (2011) confirms that this negative relationship applies to privately held companies as well.

The drop in productivity growth happens because the reallocation activity across units stops in uncertain times (Bloom, 2009). However, this fall in productivity is an outcome of the shock, not the shock itself.

Other channels through which uncertainty can negatively affect growth are risk aversion and risk premia. Since investors want to be compensated for higher risks, greater uncertainty increases risk premia, which in turn raises the cost of finance. Uncertainty increases the probability of default. Hence, it raises the default premium and the cost of bankruptcy (Bloom, 2014). Moreover, uncertainty increases precautionary savings (Bansal & Yaron, 2016), raises borrowing costs and affects macro and micro growth. In the presence of sticky prices, uncertainty leads to recessions since prices do not move enough to clear the markets (Leduc & Liu, 2012; Fernández-Villaverde, Guerrón-Quintana, Kuester, & Rubio-Ramírez, 2015). Furthermore, Basu & Bundick (2017) found that uncertainty shocks generate significant declines in output, consumption, investment and hours worked, and these uncertainty shocks create comovement with countercyclical markups through sticky prices.

Uncertainty can, however, have a positive effect on long-term growth as well. There are two channels through which this happens: growth options and Oi–Hartman–Abel effects (Bloom, 2014). Growth options are achieved through long delays in the completion of projects in which uncertainty can have a positive effect on growth. Examples of such projects are drug developments (Bar-Illan & Strange, 2011). Growth options can also be highly beneficial for R&D-intensive firms (Kraft, Schwartz, & Weiss, 2013).

Oi–Hartman–Abel effects are the second chancel through which uncertainty can have positive effect on growth (Bloom, 2014). If a firm's production is flexible enough in response to good or bad news, uncertainty can boost its growth. Profits, however, need to be convex in demand or costs, and firms should be able to adjust their operations easily in response to news (Oi, 1961; Hartman, 1972; Abel, 1983).

In addition to growth, uncertainty has a significant impact on the overall investment practices. Higher uncertainty decreases investment, especially when CEOs have significant equity stakes in the company Panousi & Papanikolaou (2012). It is also found to decrease hiring and advertising, but to increase Research and Development spending Stone & Stein (2013). The striking finding that the R&D expenditures increase in uncertain times, Stein and Stone explain with high technical uncertainty, and lags between the actual investment in R&D and the end of the projects.

3 Data

Our study mainly refers to the extensive strand of the literature studying uncertainty, its transmission, and its effects on multinational corporations. Our thesis work contributes to the literature in two main aspects. First, most of the literature has focused on uncertainty from a macroeconomic perspective. In contrast, we analyze firm-specific uncertainty at the subsidiary level across countries and its effect on parents' investment decisions. Second, while the literature has almost completely focused on public firms, we also contribute to this strand of research by analyzing both public and private firms.

3.1 Source

Our main data comes from Orbis Historical database of Bureau van Dijk (BvD). Orbis Historical contains detailed financial, ownership, and descriptive information on more than 300 million listed and non-listed firms in more than 200 countries. Orbis collects information from a myriad of sources (e.g. registry filings, annual reports, private correspondence) and utilizes more than fifty providers (e.g. business registrars, tax registries, credit registries, stock exchanges, and regulatory filings) and treats and standardizes it to make it richer and comparable.

Orbis Historical provides several important features for our study. First, Orbis provides extensive global coverage. Moreover, in addition to publicly-listed firms, it covers private and smaller companies for which information is rarely available and difficult to obtain and analyze. More importantly, the most crucial feature for our analysis is that Orbis provides ownership information for all companies across time. Orbis states the direct and ultimate owners of each firm, as well as their nationality, making the distinction between domestic and global owners. Therefore, we can analyze international uncertainty and determine global ownership with a high level of accuracy and comprehensiveness.

A crucial aspect of our research is that unlike most of the studies using the

Orbis database, we use the ownership structure data updates (i.e. ownership links) for each year in our sample. Therefore, we can determine the specific subsidiaries under the control a given Global Ultimate Owner (GUO) in each year. Hence, we can provide a more effective analysis of the implications of uncertainty from only those subsidiaries for which a firm is actively the global ultimate owner at a specific point in time.

Our sample comprehends the period from 2007 to 2017 and we analyze industrial companies. We create two main panels: the first one contains subsidiaries data, which is used to compute uncertainty; the second one contains data for the GUOs and is used to determine real and financial outcomes for the parent firms. Since we are interested in studying international uncertainty, our sample of subsidiaries contains companies in all countries available in the dataset. However, in our final sample we focus only on European GUOs, more specifically we analyze countries in Northern, Southern, Western Europe due to the higher completeness of the data and perform a robustness check on a wider sample of GUOs.

3.2 Structure

The Orbis Historical database is structured in several data sets classified in three broad categories: ownership data, descriptive data, and financial data.

The ownership data is divided into two data sets: *Entities* and *Links*. The former is a master list of all the firms included in the whole database, and it includes the unique identification number (BvD ID number), name, country, and entity type of each company. Orbis Historical tracks ownership through annual data sets titled *Links* which contains all companies and their respective shareholders and owners at a single point in time. Each *Links* data set contains the BvD ID number and the independence indicator of each firm. In addition, it contains the BvD ID number of all the shareholders of the firm, their independence indicators, their direct and total stakes, and their type of relation. Moreover, they specify the four types of ultimate parent company: domestic and global, and with minimum ownership of 25% and 50%.

The descriptive data is broken down into 15 groups of data sets with highly detailed non-financial information on each firm. These groups include data sets on national and international identifiers and names, legal information, addresses, industry classifications, stock exchanges and indices, among others.

The financial data is subdivided into four big categories: (1) *Financial strength Dec text*, (2) *Detailed cash flow and interim Dec text*, (3) *Financials-Global format Dec text*, and (4) *Financials-Global format incl histo for industries Dec text*. The first category contains information regarding the financial strength and risk management of companies, given by a wide variety of providers (e.g. CRIF, Trucost, Vadis, Zanders, among others). The second category provides detailed cash flow items and financial ratios. The structure of the variables follows a standard cash flow statement. This category is further divided into US-industries, non-US industries, and Banks.

The last two groups of financial data include separate data sets with financial information for industrials and for banks and insurance companies. The data sets contain detailed financial information, primarily from accounting statements, at different levels of aggregation. The two data sets provide essentially the same information but differ only in their coverage. While *Financials-Global format incl histo for industries Dec text* contains more financial years, *Financials-Global format Dec text* contains more detailed financial variables for a subset of firms, mainly listed companies.

In terms of the classification of companies, the industrial data set contains information for industrial firms (manufacturing and non-manufacturing) and excludes banks and financial firms, which are contained in the other two data sets. In terms of geographic representation, Orbis Historical provides information on around 200 countries. However, the coverage within each country varies, and countries in central Europe and the United States are the best represented ones. Nevertheless, the European data for private companies is more populated as the United States does not enforce stringent reporting requirements on non-listed firms.

Furthermore, each of the three big categories of financial data sets per type of company has three versions with the same underlying data but presented in different currencies, namely the original currency in which companies file their financial information, Euros, and US dollars. Orbis converts the financial data into the standardized currencies with the spot exchange rate quoted by the IMF on the date the company reported the data. The data sets in a standard currency contain an extra variable that contains the exchange rate used.

3.3 Sample Construction

Our sample construction is broadly divided into two parts, namely building a data set for uncertainty and creating a data set for parent financials. We create both panels by merging different ownership, descriptive, and financial data sets for each year of our sample period and appending additional variables from external sources. We extract the original files from the Orbis Historical FTP server of five different types of data sets: yearly *Links* from 2007 to 2017, *All Subsidiaries first level, Industry classifications, Legal info, Industry-Global financials* and *ratios-EUR* from the *Financials-Global format Dec text* folder.

We begin by creating a time-invariant master data set with different pieces of descriptive information for all companies regardless of the type of consolidation account, which will be used for both the subsidiaries' and the parents' data sets. We merge three different data sets by the subsidiaries' BvD ID number: *All Subsidiaries first level, Industry classifications,* and *Legal info.* From the *All Subsidiaries first level* data set, we obtain the firms' country. From the *Industry* *classifications* data set, we extract the firms' industry four-digit NACE Rev. 2 and three-digit SIC codes. From the *Legal info* data set, we obtain the companies' standardized legal form, date of incorporation, and information on their listing status.

We proceed to prepare the financial data, for which we use the *Financials-Global format Dec text* data set since it comprises a larger subset of companies. We create two panels of financial data, one for subsidiaries and another one for GUOs, each with a different type of consolidation of financial accounts. All the data used in the study is Euro-denominated as per Orbis original dataset.

We restrict the financial data to the period from 2007 to 2017, and we apply the following screens. We drop subsidiary-years and parent-years with missing information in any of the variables in our study. Adapting Kalemli-Ozcan et al. (2015), we drop the firm-years if total assets, tangible fixed assets, or sales are negative in any year. Moreover, we exclude very young and small firms that are likely to introduce noise into our dataset. Adapting Bena et al. (2018), we drop subsidiary-years and parent-years with less than two years from the company's incorporation date and less than 0.25 million Euros in total assets.

In our study, similar to Cravino & Levchenko (2017), we define the Global Ultimate Owner (GUO) as a subsidiary's shareholder, whether domestic or foreign, that has a total stake of more than 50% in the subsidiary. The total stake is the sum of the direct and indirect (through other firms) ownership the GUO has on the subsidiary. We determine the GUO of each firm through the variable *GUO 50* in the annual *Links* data sets that contain the ownership information.

Furthermore, given the great variety of sources, differences in reporting standards, and discrepancies in the coverage of the database, we make a number of choices to tackle the intricacies of the data and construct a consistent and accurate data base while minimizing the loss of observations.

Since the rules for reporting differ across channels and countries, for those companies that report through more than one channel (as indicated by the variable *Filing Type*), the value of the same financial variable can be different in each one of them. Hence, when possible, we prioritize local registry filings over annual reports as they follow the rules and standards of the local registrars.

Furthermore, another important decision we make is regarding the level of detail and aggregation of financial statements with respect to a company's subsidiaries, as indicated by the variable *Consolidation Code*, which is classified in two big categories: companies with limited financial data and those with detailed financial data. For companies with limited financial data, the consolidation code can take one of four forms: *NF* indicates that there is no financial data available, *LF* indicates that the data is based on rounded figures, class levels, or a median value of turnover range and generally only includes the number of employees and operating revenue, *NRF* indicates that the data is more than 48 months old, and *NRLF* indicates that the limited financial data is more than 48 months old. For companies with detailed financial data, the consolidation code is divided in two main categories: Consolidated Statements and Unconsolidated Statements. The former are statements of companies that integrate the information of its subsidiaries and are classified in C1 (when there is no unconsolidated companion in Orbis) and C2 (when there is also an unconsolidated statement in Orbis). Unconsolidated statements are those that do not integrate the information of subsidiaries or branches of a specific company, and they are classified in U1 (statements that do not have a consolidation companion in Orbis) and U2 (those that have a consolidation companion in Orbis).

In our study, we exclude companies with no financial information (NF), no recent financial information (NRF), limited financial information (LF), and no recent limited financial information (NRLF). Moreover, following Bena et al. (2018), we use unconsolidated accounts (U1 and U2) for subsidiaries and the computation of uncertainty shocks, and we use consolidated accounts (C1 and

C2) for GUOs and the computation of financial variables. The objective of using unconsolidated accounts for the subsidiaries is to avoid potential over-counting that could arise from consolidated accounts that include the revenue of foreign subsidiaries.

We divide the financial data sets for subsidiaries and GUOs into individual subsets for each year in our sample. Next, we merge the annual financial data sets of subsidiaries and GUOs and the master descriptive data set into each yearly Links data set to create complete annual data sets for both subsidiaries and GUOs. We finalize our two panels of subsidiaries and parents by appending the yearly subsidiaries' and GUOs' subsets respectively.

We use the subsidiaries' panel to compute cross-sectional subsidiary uncertainty per GUO (as defined above). These results are then merged into the GUOs' panel, which will serve as the basis of our analysis. We compute uncertainty with all subsidiaries in all countries available in our database. With respect to GUOs, we focus on Europe due to the completeness of data. European countries have a largely better representation of data because they require public disclosure for subsidiaries of foreign ultimate owners. Also, in order to have a reliable value of uncertainty, we restrict our sample of GUOs to those for which their uncertainty measure was computed with at least five values of subsidiary sales DHS observations each year. Moreover, following Alfaro et al. (2019), we winsorize level, ratios, and growth rates of all variables in our analysis at the 1^{st} and 99^{th} percentiles.

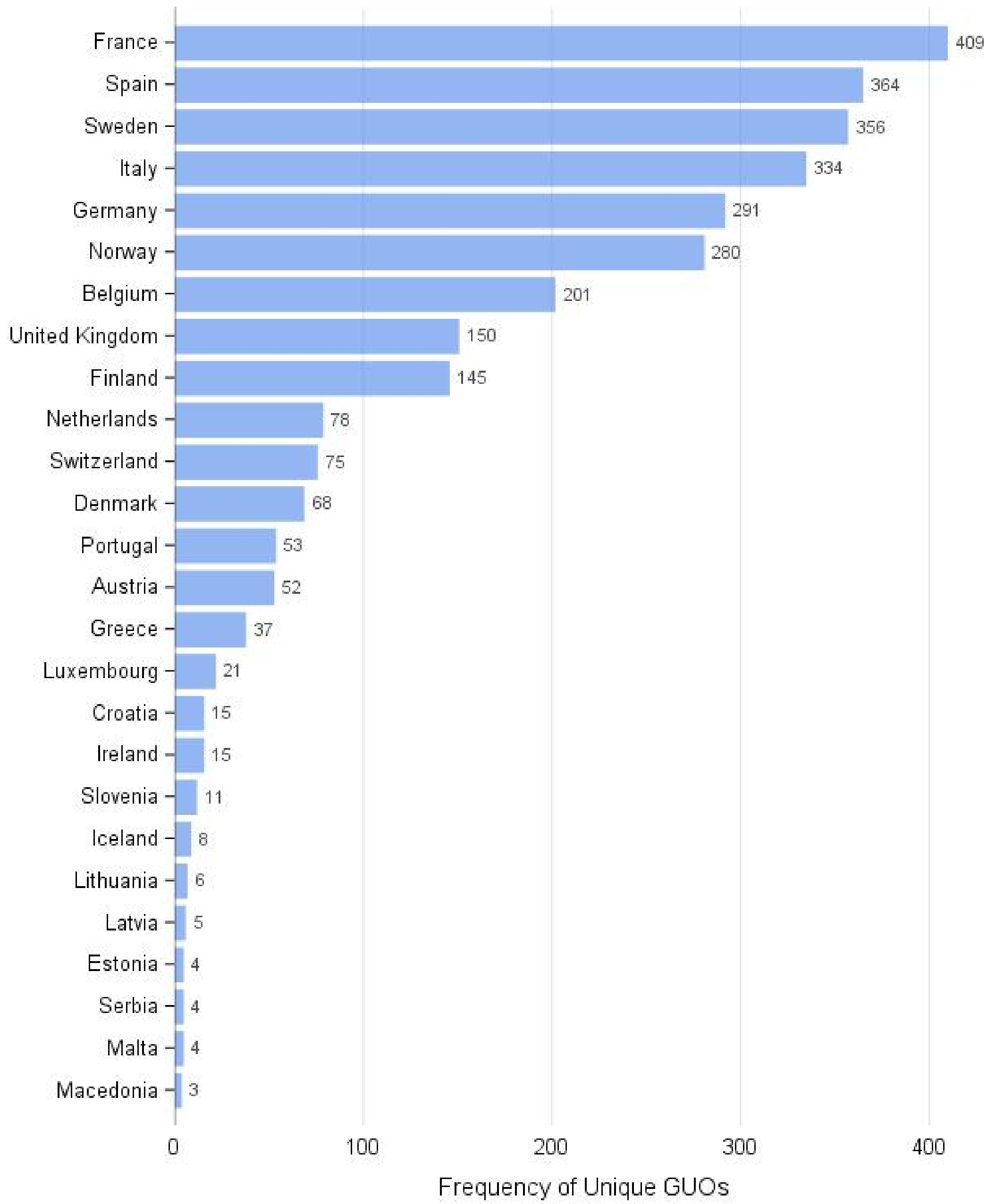

Figure 1 Geographical distribution of unique GUOs

This figure presents the count of unique GUOs per country in our sample. The sample comprehends the period from 2007 to 2017 and consists of European countries in Northern Europe, Western Europe, Southern Europe, excluding Eastern Europe.

3.4 Descriptive Statistics

Figure 1 presents the geographical distribution of unique GUOs per country in our sample. The degree of representation of each country depends on its size, economic development, and filing requirements. We observe that, on average, high income countries have a higher number of observations. For instance, France, Italy, Spain, Germany, Belgium, Norway, and Sweden have more than 200 unique GUOs. On the other hand, Estonia, Serbia, Malta, Latvia, and Macedonia have a total of five or fewer GUOs. Our total sample consists of 2,989 unique parent companies. By further examining the data sample, we note that as expected, the number of GUOs per year per country is relatively stable across the sample.

Table 1 reports descriptive statistics for our dependent and explanatory variables, as well as for the variables we use as controls. We note that all the variables are well-behaved. The average investment rate of GUOs is 6.7%, and the average uncertainty shock 1.4%. We also notice that we have no leverage only until the first percentile, thus not adversely affecting the Ordinary Least Squares (OLS) regressions. Furthermore, the extreme values are within reasonable boundaries.

We report the number of unique GUO's subsidiary firms per country in Table 2. The subsidiary data is more widespread across the world as we do not exclude observations from any country. This data is used for computing the cross-sectional subsidiary volatility per GUO per year. We note that European countries are well populated as the reporting requirements for private companies are more stringent. Furthermore, we observe that the Unites States has only three subsidiary companies entering volatility computations, which we explain again by the lax reporting requirements for non-traded companies. More developed countries account for a larger number of unique subsidiary companies, as one would expect.

Table 1
GUOs' Descriptive Statistics

Variable	Obs	Mean	St. Dev	Min	P1	P5	P10	P25	P50	P75	P90	P95	P99	Max
$Investment\ Rate_t$	14,235	0.067	0.135	-0.350	-0.246	-0.062	-0.020	0.013	0.045	0.093	0.170	0.260	0.638	0.741
$\Delta\sigma_{t-1}$	14,235	0.014	0.713	-1.637	-1.603	-1.187	-0.920	-0.444	-0.005	0.465	0.987	1.266	1.733	1.744
$Log\ Sales_{t-1}$	14,235	19.552	1.906	9.616	15.428	16.668	17.271	18.155	19.385	20.940	22.443	22.933	22.933	22.933
ROA_{t-1}	14,235	0.055	0.077	-0.986	-0.148	-0.040	-0.008	0.023	0.051	0.086	0.129	0.166	0.259	0.525
$Leverage_{t-1}$	14,235	0.272	0.189	0	0	0.003	0.033	0.130	0.250	0.383	0.529	0.620	0.803	1.211
$Tangibility_{t-1}$	14,235	0.266	0.218	0	0.001	0.013	0.027	0.087	0.223	0.388	0.583	0.706	0.911	0.963

This table presents summary statistics for our dependent and explanatory variables, as well as the lagged control variables used in the panel regression analysis. The sample period is annual from 2009 to 2017. *St. Dev.* denotes standard deviation, and P1, P5, P10, P50, P90, P95, P99 stand for the 1, 5, 10, 50, 90, 95, and 99 percentiles. *Investment Rate* is defined as contemporaneous fixed assets minus one-year-lagged fixed assets plus contemporaneous depreciation and amortization normalized by one-year-lagged total assets. *Uncertainty* is measured as the standard deviation of the sales DHS growth rate of all subsidiaries of a given GUO per year. *ROA* is defined as earnings before interest and taxes divided by total assets, *Leverage* is loans plus long-term debt divided by total assets, *Tangibility* is measured as total fixed assets divided by total assets, and *Log Sales* is the natural logarithm of sales.

Table 2
Geographic Distribution of Unique Subsidiaries

Country	Frequency	Country	Frequency
Argentina	8	Lebanon	1
Austria	467	Sri Lanka	3
Australia	97	Lithuania	146
Bosnia and Herzegovina	59	Luxembourg	144
Belgium	796	Latvia	186
Burkina Faso	1	Morocco	186
Bulgaria	208	Monaco	1
Bermuda	1	Moldova	2
Bolivia	1	Montenegro	23
Brazil	138	Macedonia	45
Switzerland	4	Malta	48
Côte d'Ivoire	7	Mauritius	5
Chile	11	Mexico	51
China	424	Namibia	1
Colombia	221	Netherlands	363
Cabo Verde	1	Norway	811
Czechia	574	New Zealand	158
Germany	990	Panama	3
Denmark	320	Peru	16
Ecuador	5	Philippines	51
Estonia	229	Pakistan	16
Egypt	1	Poland	782
Spain	1203	Portugal	503
Finland	540	Romania	462
France	1332	Serbia	206
Gabon	2	Russia	5
United Kingdom	37	Sweden	960
Ghana	1	Singapore	459
Greece	253	Slovenia	168
Guyana	1	Slovakia	359
Croatia	206	Thailand	22
Hungary	392	Tunisia	1
India	422	Trinidad and Tobago	2
Iceland	27	Taiwan	4
Italy	1110	Tanzania	1
Jordan	1	Ukraine	166
Japan	67	United States	3
South Korea	235	Uruguay	6
Kazakhstan	4	Zimbabwe	1

This table presents the count per country of all the subsidiaries of all GUOs in the sample. Our sample includes Northern, Southern, and Western Europe for the period 2007 to 2017.

4 Methodology

4.1 Panel Data

Panel data, also known as cross-sectional time-series data is defined as a dataset that observes entities over time. This type of data has become a commonly used in social sciences and economics literature as it offers far more information than purely cross-sectional or time-series data. Panel data yields a more precise analysis and estimation, and one of the main motivations for using it is because it helps solve the omitted variable bias (Wooldridge, 2016). Panel data allows controlling for unobservable variables or measures such as cultural factors or variables that change with time but not across entities. Therefore, it accounts for individual heterogeneity and can be used for multilevel or hierarchical modelling (Wooldridge, 2010). One of potential drawbacks of this data type that can affect our analysis is the cross-country dependency that we address using country fixed effects.

An ideal, "strongly balanced" data set would contain data for all the companies in question for all of the years. This is not the case in our thesis. Our data is "unbalanced" due different reasons. Some of the companies are missing data because they have gone bankrupt, while some have entered the data set in later years. Moreover, some company years can also be excluded due to poor data quality in certain years. Nevertheless, our tests and regressions account for this problem.

4.2 Panel Regression

Following Wooldridge (2010), we define a basic panel data regression as:

$$y_{i,t} = \alpha + \beta x_{i,t} + u_{i,t}$$

for i=1....N, t=1....T with i denoting entities (cross-section dimension) and t denoting time (time series dimension). α denotes a scalar, β is a Kx1 matrix, and $x_{i,t}$ is the i^{th} observation on K explanatory variables. Panel data applications most often use a one-way error component that accounts for model disturbances:

$$u_{i,t} = \mu_i + v_{i,t}$$

where μ_i stands for the unobservable firm-specific effect and $v_{i,t}$ is the remainder of disturbances. The firm specific effect is not time-varying and accounts for any individual effect by the company that the regression otherwise does not account for.

If unobservable effects impact the explained variable, we would face an omitted variable bias. An example of these unobservable effects are time effects that we account for using the fixed effects model further explained in Appendix A.1.

5 Model

Throughout our study, we define growth as suggested by Davis et al. (1996): for any variable x and time periods t and t-1, the growth rate is defined as:

$$\Delta x_t = \frac{x_t - x_{t-1}}{0.5 \times (x_t + x_{t-1})} \tag{1}$$

The DHS growth rate presents several attractive properties. Namely, it is bounded between -2 and 2, symmetric around 0, and it allows for aggregation. Moreover, it is identical to log changes up to a second-order Taylor Series expansion.

To analyze the response of investment rate to one-year lagged subsidiary cross-sectional uncertainty shock, we estimate the following panel data Ordinary Least Squares (OLS) regression:

$$\begin{aligned} \frac{I_{g,t}}{K_{g,t-1}} &= \alpha + \beta_1 \Delta\sigma_{g,t-1} + \beta_2 ROA_{g,t-1} + \beta_3 Leverage_{g,t-1} + \beta_4 Tangibility_{g,t-1} \\ &\quad + \beta_5 LogSales_{g,t-1} + GUO\ FE_{g,t} + Country \times Year\ FE_{c,t} + \varepsilon_{g,t} \end{aligned} \tag{2}$$

where the sub-indices g, t, and c denote GUO, year, and country respectively, and $CY\ FE$ stands for paired country-year fixed effects. Our main dependent variable is GUO investment rate. Following Bena et al. (2018), we define Investment Rate *(I/K)* as the contemporaneous capital expenditures normalized by lagged Total Assets:

$$\frac{I_{g,t}}{K_{g,t-1}} = \frac{FA_{g,t} - FA_{g,t-1} + DA_{g,t}}{TA_{g,t-1}} \tag{3}$$

where *FA* is Fixed Assets and it is defined as the total amount (after depreciation) of non-current assets (Intangible Assets plus Tangible Assets plus Other Fixed Assets), *DA* stands for Depreciation and Amortization while *TA* is Total Assets.

We adapt Bloom et al. (2018) and define uncertainty $\sigma_{g,t}$ as the cross-sectional standard deviation of annual sales' growth of all the subsidiaries of a given GUO in each year. More specifically our definition of uncertainty is given by:

$$\sigma_{g,t} = \sqrt{\frac{\sum_{s=1}^{N_{t-1}} (\Delta Sales_{s,g,t} - \overline{\Delta Sales}_{s,g,t})^2}{N_{t-1}}} \tag{4}$$

where indices g, s, and t correspond to GUO, subsidiary, and year respectively. Moreover, $\Delta Sales$ represents the DHS growth rate of subsidiary sales. Our main explanatory variable is the volatility shock that we define as the DHS growth of uncertainty. Our specification is predictive and therefore, our measure of uncertainty shock is lagged by one year with respect to the dependent variable.

Furthermore, we apply a set of controls adapting Leary & Roberts (2014). We add parent-level controls for lagged levels of log sales, return on assets, book leverage, tangibility. The controls are defined as follows: $ROA_{g,t} = EBIT_{g,t}/TA_{g,t}$, where $EBIT$ is earnings before interest and taxes, and TA stands for total assets. $Leverage = STD_{g,t} + LTD_{g,t}$, where STD stands for loans, and LTD denotes long-term debt. $Tangibility_{g,t} = TFA_{g,t}/TA_{g,t}$, where TFA is tangible fixed assets. *Log Sales* is the natural logarithm of sales.

In addition, in our specification, we include a set of fixed effects to control for different unobservable factors. Following Bena & Xu (2017), our specification includes fixed effects at the GUO level to control for permanent parent-level differences. We also add country-year fixed effects to control for time-varying macroeconomic characteristics in each country. Moreover, we include cluster effects at the NACE Rev. 2 industry level to control for unobservable industry variables that do not vary over time.

6 Main Results

This section presents the main results of our analysis. We first look at the benchmark specification of GUO investment rate with respect to the lagged subsidiary cross-sectional volatility shocks along with a set of controls, fixed effects, and clustered standard errors. We then proceed to extend our analysis and explore the effect of these volatility shocks on two more variables, namely growth in intangible fixed assets and growth in cash flows. Moreover, we extend the first model specification to account for firm-level financial constraints and their interaction with the volatility shock.

6.1 Benchmark Specification

H1: Real investment decision of GUOs is affected by uncertainty shocks coming from the cross section of its subsidiaries.

To test this hypothesis, we regress the rate of investment on the lagged volatility shock at a yearly frequency with a set of GUO, country, and year fixed effects to account for sectoral, country-specific, and aggregate movements. Following Bloom (2009), we use paired country-year fixed effects for our main specifications, but we also check for robustness and present the results of the regressions using these fixed effects independently. Moreover, we cluster the standard errors at the NACE Rev. 2 industry level. Clustering at this level allows us to be more conservative in our approach, as clustering the standard errors at the parent level yields stronger results. The results of the specification using clustered standard errors at the GUO level are also presented.

Table 3 presents the results of our baseline specification. In column 2, we use paired country-year fixed effects and standard errors clustered at the industry level and find that the single effect of subsidiary cross-sectional volatility shocks is negative and statistically significant at the 10% level in explaining the future investment rate of the GUO, with a point estimate of -0.00313 and a t-stat of -1.89.

These results are robust when we use independent country and year fixed effects presented in column 1 and cluster standard errors at the firm level, presented in column 3.

To account for the heterogeneous firm characteristics in our panel data, we employ a set of controls to account for the differences among the companies. Adapting the method used by Leary & Roberts (2014), we employ this set of lagged controls to account for four parent-level characteristics, namely size, profitability, tangibility, and capital structure. We estimate the following equation:

$$\frac{I_{g,t}}{K_{g,t-1}} = \alpha + \beta_1 \Delta\sigma_{g,t-1} + \beta_2 ROA_{g,t-1} + \beta_3 Leverage_{g,t-1} + \beta_4 Tangibility_{g,t-1} + \beta_5 LogSales_{g,t-1} + GUO\ FE_{g,t} + Country \times Year\ FE_{c,t} + \varepsilon_{g,t}$$

We present the results of this regression in column 5. The coefficient of the volatility shock has a slightly lower magnitude (a coefficient of -0.00287) but a stronger statistical significance (t-stat of -2.23) than the previous specification. In addition, all four controls show statistical significance implying that we are effectively controlling for different types of firm characteristics. Column 4 shows that these results are also robust when we use country and year fixed effects independently. Moreover, in column 6 we see our benchmark specification is also robust when clustering standard errors at the GUO-level. In addition, we present our main robustness test in Appendix A.4 where we test our model for various levels of clustering.

To get a visual perspective, we plot the average lagged cross-sectional subsidiary volatility shock and the average investment rate in Figure 2 and observe a large lagged volatility shock in 2010 as a results of global financial crisis that sharply decreases in 2011. The investment rate continues to decrease further in 2011 even after the corresponding one-year lagged volatility shock has decreased.

However, the lagged volatility shock increases again in 2012 and later in 2013 as a consequence of the European debt crisis, and we see a larger decrease in investment rate in these years. Later, the lagged volatility shock stabilizes, and we observe growing investment rates.

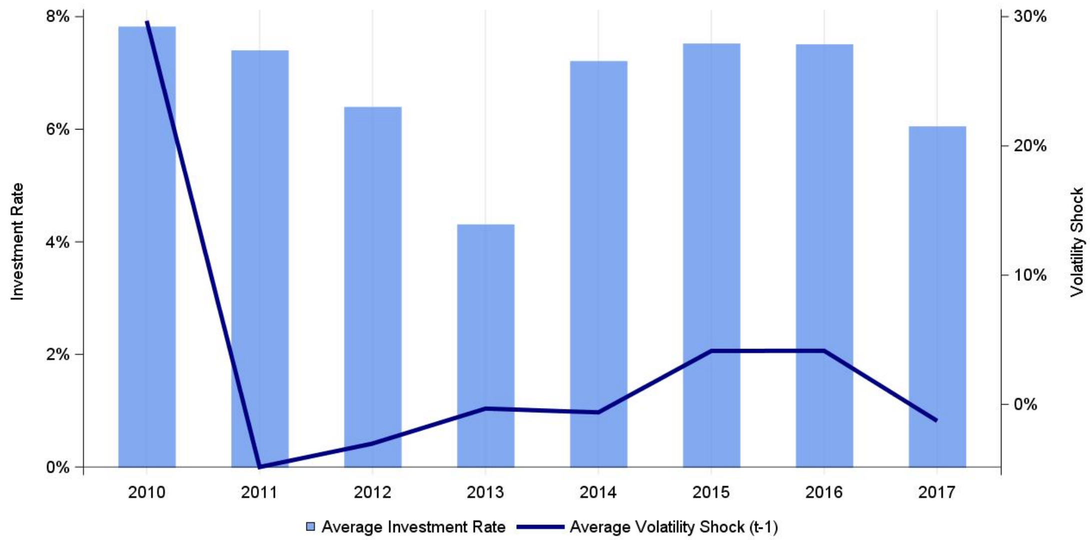

Figure 2 Average Subsidiary Volatility Shock and Average Investment Rate
This figure presents the count of unique GUOs per country in our sample. The sample comprehends the period from 2007 to 2017 and consists of European countries in Northern Europe, Western Europe, Southern Europe, excluding Eastern Europe.

Consistent with previous literature stating that the investment decision is negatively affected by uncertainty Bernanke (2013); Bloom (2014); Bena et al. (2017), our results suggest that the parent companies do decide to reduce their future aggregate investment when they observe an increase in uncertainty on the activity across their global pool of subsidiaries. Moreover, a one standard deviation increase in uncertainty of the cross-section of subsidiaries results in 0.205% decrease in investment rate of the parent company. Following the economic interpretation method by Duchin et al. (2010), we find that the investment rate of global ultimate owners decreases by 4.28% of its unconditional mean following a unit increase in uncertainty shock of the cross section of subsidiaries. More specifically, it decreases by 0.29% in relation to the 6.70% unconditional mean investment rate.

Table 3
OLS Regression Results for Investment Rate

Investment Rate$_t$	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta\sigma_{t-1}$	-0.00278*	-0.00313*	-0.00313*	-0.00233**	-0.00287**	-0.00287**
	(0.00165)	(0.00166)	(0.00161)	(0.00117)	(0.00129)	(0.00121)
Log Sales$_{t-1}$				-0.0890***	-0.0878***	-0.0878***
				(0.00810)	(0.00827)	(0.00885)
ROA$_{t-1}$				0.238***	0.239***	0.239***
				(0.0272)	(0.0278)	(0.0283)
Leverage$_{t-1}$				-0.168***	-0.165***	-0.165***
				(0.0222)	(0.0220)	(0.0229)
Tangibility$_{t-1}$				-0.184***	-0.183***	-0.183***
				(0.0693)	(0.0694)	(0.0516)
Observations	14,444	14,444	14,444	14,235	14,235	14,235
GUO FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	No	No	Yes	No	No
Year FE	Yes	No	No	Yes	No	No
Country-Year FE	No	Yes	Yes	No	Yes	Yes
SE Cluster	NACE-2	NACE-2	GUO	NACE-2	NACE-2	GUO

This table presents the OLS estimates of our main regression specification of GUO investment rate on cross-sectional subsidiary uncertainty shock. The sample period is from 2009 to 2017. The sample consists of GUOs in Northern, Southern, and Western European countries available and with at least five sales DHS growth rates entering into the calculation of uncertainty. Specification 1 is univariate, and specification 2 is multivariate. *Investment Rate* is the change in fixed assets plus depreciation and amortization normalized by one-year-lagged total assets. *Uncertainty shock* is the growth in the cross-sectional standard deviation of annual sales' growth of all the subsidiaries of a given GUO in each year. The control variables are defined as follows: *ROA* is earnings before interest and taxes, *Leverage* is loans plus long-term debt divided by total assets, *Tangibility* is tangible fixed assets divided by Total Assets, and *Log Sales* is the natural logarithm of Sales. We add country-year and GUO fixed effects. Also, we cluster standard errors at NACE Rev. 2 industry level and GUO level as specified in the table. The statistical significance levels are the following: *** p<0.01, ** p<0.05, * p<0.1. Standard Errors are reported in parentheses.

6.1.1 Expansion of GUOs' Sample

In order to confirm that the findings are not exclusive to the set of countries in our initial sample but are valid for a broader set of nations and that the implications of our results apply more generally, we test our main specification for different sets of countries with different characteristics.

We present the results of our main regression for different sets of countries in Table 4. Column 1 is our baseline specification where the sample is comprised of Northern, Southern, and Western Europe. To examine whether our results are robust for all European countries, we add Eastern Europe to our main specification in Column 2. The additional countries are Bulgaria, Czech Republic, Poland, Romania, Russia, and Ukraine. The magnitude and statistically significance of the lagged volatility shock on the investment rate of GUOs is slightly reduced, but the results are still significant at the 10%. Furthermore, to rule out the possibility that GUOs in economically smaller countries are driving the results, we run the main specification only for the European countries members of the OECD and present the results in Column 3. We observe that the magnitude of the lagged volatility coefficient is slightly lower at -0.0027 and significant at the 5%. Finally, to test whether our results are exclusive to European countries, we run the specifications for all the countries members of the OECD and present the results in Column 4. The additional countries in this sample are Australia, Canada, Czech Republic, Japan, Mexico, New Zealand, Poland, and the USA. In this case, the magnitude of the lagged volatility shock goes down to -0.00179, and its statistical significance decreases by a larger amount, but the results remain significant at the 10%.

Even though we observe a slight reduction in the magnitude and some statistical significance of our main specification for different GUOs' countries samples, the results are still robust. We can therefore conclude that subsidiary cross-sectional uncertainty is important across borders with a varying significance across countries.

To further examine whether the negative response on the investment rate of GUOs to lagged cross-sectional volatility shocks is driven by the subsidiaries in marginally less developed countries, we run our baseline specification restricting the subsidiaries that enter the computation of volatility shocks to those located in either European countries or country members of the OECD. These results are presented in Appendix A.3.

Table 4
OLS Regression Results for Investment Rate for Different Sets of GUOs

Investment Rate$_t$	(1)	(2)	(3)	(4)
$\Delta\sigma_{t-1}$	-0.00287**	-0.00216*	-0.00270**	-0.00179*
	(0.00129)	(0.00128)	(0.00130)	(0.00104)
Log Sales$_{t-1}$	-0.0878***	-0.0875***	-0.0868***	-0.0860***
	(0.00827)	(0.00806)	(0.00839)	(0.00785)
ROA_{t-1}	0.239***	0.224***	0.246***	0.263***
	(0.0278)	(0.0282)	(0.0283)	(0.0264)
Leverage$_{t-1}$	-0.165***	-0.165***	-0.165***	-0.165***
	(0.0220)	(0.0215)	(0.0224)	(0.0187)
Tangibility$_{t-1}$	-0.183***	-0.185***	-0.178***	-0.143***
	(0.0694)	(0.0673)	(0.0694)	(0.0609)
Observations	14,235	14,772	14,011	19,754
Sprecification	Baseline	Europe - incl. Eastern Europe	Europe - OECD	OECD
GUO FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes
SE Cluster (NACE-2)	Yes	Yes	Yes	Yes

This table presents the results of our main specification of GUO investment rate on lagged cross-sectional subsidiary uncertainty shocks for different samples of GUOs. Column 1 presents the results of our baseline in which the sample of GUOs is comprised of Northern, Southern, and Western European countries. The sample of GUOs used in Column 2 consists of all European countries, namely those in Northern, Southern, Western, and Eastern Europe. Column 3 presents the results of the main specification in which the sample is those European countries members of the OECD. The sample of the regression in Column 4 consists of all the countries members of the OECD. *Investment Rate* is the change in fixed assets plus depreciation and amortization normalized by one-year-lagged total assets. *Uncertainty shock* is the growth in the cross-sectional standard deviation of annual sales' growth of all the subsidiaries of a given GUO in each year. All the specifications include the control variables defined as follows: *ROA* is earnings before interest and taxes, *Leverage* is loans plus long-term debt divided by total assets, *Tangibility* is tangible fixed assets divided by Total Assets, and *Log Sales* is the natural logarithm of Sales. We add country-year and GUO fixed effects. Also, we cluster standard errors at NACE Rev. 2 industry level. The statistical significance levels are the following: *** p<0.01, ** p<0.05, * p<0.1. Standard Errors are reported in parentheses.

6.2 Growth in Fixed Intangible Assets

H2: The growth in intangible assets of the GUO is affected by the uncertainty shocks coming from the cross section of its subsidiaries.

To have a more comprehensive view on the effect of uncertainty shocks on corporate decisions of multinational GUOs, we decide to extend our analysis and assess the uncertainty shock impact on change in intangible fixed assets of GUOs. We regress the same set of left-hand side variables as in the previous subsection, but we now do it on the change in the level of fixed intangible assets. We employ the following regression:

$$\Delta IFA_{g,t} = \alpha + \beta_1 \Delta\sigma_{g,t-1} + \beta_2 ROA_{g,t-1} + \beta_3 Leverage_{g,t-1} + \beta_4 Tangibility_{g,t-1} + \beta_5 LogSales_{g,t-1} + GUO\ FE_{g,t} + Country \times Year\ FE_{c,t} + \varepsilon_{g,t} \quad (5)$$

where $\Delta IFA_{g,t}$ stands for the change in the level of fixed intangible assets per GUO.

The results presented in Table 5 show that the uncertainty shock has a negative effect on the change in the firm fixed intangible assets, and its coefficient is statistically significant at the 10%. These results effectively suggest that the one standard deviation increase in uncertainty shock of the cross-section of subsidiaries results in 0.350% decrease in fixed intangible assets of the parent company.

Table 5
OLS Regression Results for DHS Growth in Intangible Fixed Assetss

$\Delta Intangible\ Fixed\ Assets_t$	(1)	(2)
$\Delta\sigma_{t-1}$	-0.00454*	-0.00491*
	(0.00271)	(0.00285)
$Log\ Sales_{t-1}$		-0.235***
		(0.0295)
ROA_{t-1}		0.587***
		(0.0839)
$Leverage_{t-1}$		-0.343***
		(0.0690)
$Tangibility_{t-1}$		0.180
		(0.121)
Observations	13,930	13,752
GUO FE	Yes	Yes
Country-Year FE	Yes	Yes
SE Cluster (NACE-2)	Yes	Yes

This table presents the OLS estimates of our main regression specification of GUO DHS growth in Intangible Fixed Assets on cross-sectional subsidiary uncertainty shock. The sample period is from 2009 to 2017. The sample consists of GUOs in Northern, Southern, and Western European countries available and with at least five sales DHS growth rates entering into the calculation of uncertainty. Specification 1 is univariate, and specification 2 is multivariate. *IFA* is the level of intangible fixed assets of GUO. *Uncertainty shock* is the growth in the cross-sectional standard deviation of annual sales' growth of all the subsidiaries of a given GUO in each year. The control variables are defined as follows: *ROA* is earnings before interest and taxes, *Leverage* is loans plus long-term debt divided by total assets, *Tangibility* is tangible fixed assets divided by Total Assets, and *Log Sales* is the natural logarithm of Sales. We add country-year and GUO fixed effects. Also, we cluster standard errors at NACE Rev. 2 industry level. The statistical significance levels are the following: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Standard Errors are reported in parentheses.

6.3 Growth in Cash Flows

H3: Incremental cash-flows of the GUO are affected by the uncertainty shocks coming from the cross section of its subsidiaries.

To further examine the effect of the uncertainty shocks coming from subsidiary companies, we shift our attention to the operational aspect of the GUO business. To do this, we regress the previously constructed independent variables and fixed effects on the growth in cash flows of the GUO defined as profit and loss plus depreciation. We perform the following regression:

$$\Delta CF_{g,t} = \alpha + \beta_1 \Delta\sigma_{g,t-1} + \beta_2 ROA_{g,t-1} + \beta_3 Leverage_{g,t-1} + \beta_4 Tangibility_{g,t-1} + \beta_5 LogSales_{g,t-1} + GUO\ FE_{g,t} + Country \times Year\ FE_{c,t} + \varepsilon_{g,t} \quad (6)$$

where $\Delta CF_{g,t}$ is the growth in cash flows of the parent company. We present the results in Table 6. The multivariate regression reports a lagged volatility shock coefficient of -0.06 that is statistically significant at the 5% level with a t-stat of 2.01. This indicates that the amount of free cash flows available to investors is reduced when there is a significant volatility increase coming from subsidiaries the previous year. Furthermore, a one standard deviation increase in the volatility shock of the cross-subsidiaries results in 4.28% decrease of cash flows available to the GUO.

Table 6
OLS Regression Results for DHS Growth in Cash Flows

Δ *Cash flows*$_t$	(1)	(2)
$\Delta\sigma_{t-1}$	-0.0546*	-0.0600**
	(0.0302)	(0.0298)
$Log\ Sales_{t-1}$		-0.235***
		(0.0603)
ROA_{t-1}		-0.194
		(0.665)
$Leverage_{t-1}$		0.347
		(0.328)
$Tangibility_{t-1}$		0.826**
		(0.357)
Observations	14,444	14,235
GUO FE	Yes	Yes
Country-Year FE	Yes	Yes
SE Cluster (NACE-2)	Yes	Yes

This table presents the OLS estimates of DHS growth in cash flows of the GUO on cross-sectional subsidiary uncertainty shock. The sample period is from 2009 to 2017. The sample consists of GUOs in Northern, Southern, and Western European countries available and with at least five sales DHS growth rates entering into the calculation of uncertainty. Specification 1 is univariate, and specification 2 is multivariate. *Cash flow growth* is the change in profit and loss plus depreciation. *Uncertainty shock* is the growth in the cross-sectional standard deviation of annual sales' growth of all the subsidiaries of a given GUO in each year. The control variables are defined as follows: *ROA* is earnings before interest and taxes, *Leverage* is loans plus long-term debt divided by total assets, *Tangibility* is tangible fixed assets divided by Total Assets, and *Log Sales* is the natural logarithm of Sales. We add country-year and GUO fixed effects. Also, we cluster standard errors at NACE Rev. 2 industry level. The statistical significance levels are the following: *** p<0.01, ** p<0.05, * p<0.1. Standard Errors are reported in parentheses.

7 Financial Constraints and Multiplier Effects

7.1 Financial Constraint Indices

Corporate Finance literature suggests that raising external capital can impose financial constraints on firms due to diverse market frictions. As large companies can reconcile their financing costs with low underwriting fees and relatively lower cost of bankruptcy, the effect of friction is more pronounced for small firms (Hennessy & Whited, 2007). Moreover, Hennessy and Whited show that the financial constraints are connected to companies' decisions on both investment choices and capital structure among others. Given that our research focuses on the impact of uncertainty shocks on investment, it is important to account for the market frictions that could have significant impact on our results.

We estimate financial constraints using three different indices, namely the Financial Constraints for Private firms (FCP) index developed by Schauer et al. (2019), the Size-Age (SA) index created by Hadlock & Pierce (2010), and the Whited-Wu (WW) index by Whited & Wu (2006). While the FCP index is most applicable to our data sample given that it is developed specifically for private firms, we use the other two indices to show robustness of the results. A detailed description of the construction of the indices can be found in Appendix A.2.

7.2 Interaction with Financial Constraints

H4: Volatility shocks have an incremental effect on the investment rate of financially constrained GUOs.

Given the possibility that the dependent variable with respect to an independent variable could be influenced by a different independent variable due to partial effects, elasticity, or semi-elasticity, we also explore the interaction effects in our model (Wooldridge, 2016). We examine whether the measure for financial constraints interacts with our uncertainty shock measure, and if so, how does it affects our results.

We estimate this panel regression with interaction effects using the following equation:

$$\frac{I_{g,t}}{K_{g,t-1}} = \alpha + \beta_1 \Delta\sigma_{g,t-1} + \beta_2 DFC_{g,t-1} + \beta_3 \times \Delta\sigma_{g,t-1} \times DFC_{g,t-1} + \beta_4 \times Controls + FE + \varepsilon_{g,t} \tag{7}$$

where $\Delta\sigma_{g,t-1}$ stands for the lagged volatility shock and $DFC_{g,t-1}$ is a dummy variable that denotes financially constrained firms. To construct this financial constraint dummy variable, we compute the three different financial constraint indices and independently rank the companies based on them. $DFC_{g,t-1}$ equals 1 if the firm the firm lies in the top 25^{th} percentile of the sample, and 0 otherwise. Furthermore, β_3 stands for the coefficient of the interaction effect between the volatility shock and the financial constraints. For simplicity purposes, we present the combination of lagged control variables as *Controls* and the country-year and GUO fixed effects as *FE*.

We run regression (7) for all three financial constraint indices and report the results in Table 7. We find that firms reduce their investment rates in response to the cross-sectional subsidiary volatility shocks (β_1 is negative and significant at the 10% level). Moreover, we learn that they do so even further in the presence of financial constraints (β_3 is negative and significant for all three financial interaction effects between cross-sectional volatility and financial constraint indices). The total effect of cross-sectional uncertainty on financially unconstrained firms is captured with β_1, while the total effect of the cross-sectional uncertainty of financially constrained firms is equals to $\beta_1 + \beta_3$. Following Alfaro et al. (2019), we obtain the multiplier effect of financial constraints in the financial uncertainty multiplier (FUM), where *FUM=*$(\beta_1 + \beta_3)/\beta_1$.

Table 7
OLS Regression Results for Investment Rate Interacted with Financial Constraints

Investment Rate$_t$	(1)	(2)	(3)	(4)
$\Delta\sigma_{t-1}$	-0.00287**	-0.00204*	-0.00181*	-0.00168*
	(0.00129)	(0.00119)	(0.00108)	(0.00101)
Log Sales$_{t-1}$	-0.0878***	-0.0850***	-0.0860***	-0.0803***
	(0.00827)	(0.00929)	(0.00836)	(0.00920)
ROA_{t-1}	0.239***	0.224***	0.239***	0.245***
	(0.0278)	(0.0372)	(0.0277)	(0.0290)
Leverage$_{t-1}$	-0.165***	-0.165***	-0.165***	-0.174***
	(0.0220)	(0.0238)	(0.0219)	(0.0231)
Tangibility$_{t-1}$	-0.183***	-0.153**	-0.186***	-0.204***
	(0.0694)	(0.0729)	(0.0684)	(0.0734)
D. FCP Index$_{t-1}$		-0.0117***		
		(0.00432)		
$\Delta\sigma_{t-1}\times$ *D. FCP Index$_{t-1}$*		-0.00730**		
		(0.00352)		
D. SA Index$_{t-1}$			-0.0311**	
			(0.0147)	
$\Delta\sigma_{t-1}\times$ *D. SA Index$_{t-1}$*			-0.00760**	
			(0.00383)	
D. WW Index$_{t-1}$				-0.0245**
				(0.0110)
$\Delta\sigma_{t-1}\times$ *D. WW Index$_{t-1}$*				-0.00620*
				(0.00366)
Observations	14,235	12,944	14,235	11,980
GUO FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes
SE Cluster (NACE-2)	Yes	Yes	Yes	Yes

This table presents the OLS estimates of our specification of GUO *Investment Rate* (i.e the change in fixed assets plus depreciation and amortization normalized by one-year-lagged total assets) on cross-sectional subsidiary Uncertainty shock (the growth in the cross-sectional standard deviation of annual sales' growth of all the subsidiaries of a given GUO in each year) including interaction effects with three financial constraint indices (FCP, SA, and WW). Specification 1 is our baseline, and specifications 2 to 4 are the regressions with interaction effects with the financial constraint indices. The specifications include the control variables: *ROA*, *Leverage*, *Tangibiliy*, and *Log Sales*. We add country-year and GUO fixed effects and clustered standard errors at NACE Rev. 2 industry level. The statistical significance levels are the following: *** p<0.01, ** p<0.05, * p<0.1. Standard Errors are reported in parentheses.

Column 2 presents the results using the FCP index by Schauer et al. (2019), column 3 presents the SA index by Hadlock & Pierce (2010), while the fourth column presents results that include the WW index by Whited & Wu (2006). We also note that the significance and magnitude of the single subsidiary cross-sectional uncertainty shock coefficient is lower in all equations that include the financial constraint indices in comparison to the baseline regression model shown in column 1.

We start by analyzing classification of financially constrained firms captured with the FCP index and note that the cross-sectional uncertainty shocks negatively affect the investment rate of the parent company. This effect is captured by β_1= -0.00204 that is significant at the 10% level with a t-stat of 1.714 implying that financially unconstrained firms reduce their investment rate by 0.145% with one standard deviation increase in the subsidiary cross-sectional uncertainty shock. When firms are classified as financially constrained, we observe that the effect is magnified as the β_3 coefficient that accounts for the interaction among the uncertainty shock and financial constraints equals -0.0073 and is statistically significant at the 5% level with a t-stat of -2.075. We compute the aggregate effect of uncertainty shocks on the investment rate of financially constrained GUOs by combining β_1 and β_3 coefficients to obtain a value of -0.0934 (= -0.00204 -0.0073), significant at the 5%. Therefore, we find that cross-sectional uncertainty shocks matter much more if the parent company is financially constrained. This effect is considerably magnified by the coefficient of 4.58 (FUM= -0.00934/ -0.00204).

Results reported in column 3 include the Size-Age index as the financial constraint measure and exhibit quite similar effects on the investment rate of the parent company. These findings also imply that cross-sectional uncertainty shocks negatively affect the investment rate of the GUO given the statistically significant β_1 coefficient of -0.00181 at the 10% level. We infer that financially unconstrained firms reduce their investment rate in response to a one standard deviation increase in the subsidiary cross-sectional uncertainty shock by 0.129%. This result is in line with our previous finding using the FCP index. Furthermore, we compute the effect of subsidiary cross-sectional uncertainty shock on financially constrained firms and find that the total drop in investments is accounted by $\beta_1+\beta_3$= -0.00941 significant at the 10% level. Results obtained using the SA index suggest a slightly larger multiplier effect of 5.20. Consequently, the investment reduction in response to a one standard deviation increase in the subsidiary cross-sectional uncertainty shock for financially constrained parent companies is 0.671%.

Column 4 of Table 7 reports the regression results using the WW index. We confirm the previously obtained results that parent companies increase investment as a result of decrease in uncertainty across subsidiaries. The β_1 coefficient of -0.00168 suggests that financially unconstrained GUOs reduce investment by 0.120% with a one-standard deviation increase in subsidiary cross-sectional uncertainty shocks. Moreover, financially constrained parent companies reduce investment even more – by 0.562% with the same increase in subsidiary uncertainty. We compute the FUM to be 4.69 in this case.

We observe that combining different financial constraint measures with our baseline regression model results in slightly different results. This is expected as all three indices are constructed using different measures as shown in A.2. Nevertheless, all results are in line with each other and yield the same conclusion—the investment rate decreases with increasing cross sectional subsidiary uncertainty shocks, and that this effect is magnified by on average 4.82 times for financially constrained parent companies. Furthermore, we find that using volatility levels as a measure of uncertainty in the financial constraint model with interaction effect yields results that are statistically significant in the majority of cases. The results are presented in Table A4 in Appendix A.4.

Next, we extend this interactive specification with an ex-ante classification of financially constraint firms. More specifically, we analyze whether the effect of financial constraints matters if the parent company was constrained in years preceding the subsidiary volatility shocks. Results are presented in Table 8.

Panel I shows the results of the interaction specification with volatility shocks, and Panel II presents the corresponding results using the volatility level. In addition, Section A in each panel shows the results with financial constraints at time *t-1*, and Section B presents the results from specifying financial constraints at time *t-2*. We observe that while the coefficients remain significant, the magnitude of the volatility shock for unconstrained firms increases, and the coefficient of interaction between the volatility shock and the financial constraint decreases for two out of three financial constraint indices. We compute the multiplier effects as in the previous model, and obtain results of 2.56, 3.78, and 1.53 for FCP, SA, and WW indices respectively. This suggests that the multiplier effect of the financial constraints on the investment rate is on average reduced to 2.62 times when the parent company is already financially constrained once the volatility shock in the subsidiary comes about.

To explore the how far in time this relationship holds, we analyze the effect of the third lag of financial constraint indices and note that the effect remains for the third lag as the sign of the coefficients is still negative. However, as expected, for the third lag the effect is no longer significant. Given the large loss of observations in this iteration, further exploration of this relationship with more data is suggested to conclude whether the further lags of financial constraint indices matter for explaining the investment rate of the parent companies.

Our current findings imply that microeconomic variables (i.e. financial constraints) magnify the effect of uncertainty shocks on the investment rate of multinational parents. However, the idea that the macroeconomic environment in which parent companies are headquartered should further exacerbate the impact of volatility shocks arises naturally. To explore this possibility, we further extend our analysis and integrate triple interaction effects to our model adding two different macroeconomic variables separately. More specifically, we explore the case of triple interaction effects with long-term interest rates and also with country-wide costs credit intermediation as given by the financial distress index developed by Romer & Romer (2017). The results we obtain from these two new models are not entirely conclusive. However, they seem to point to a possible and even greater effect of volatility shocks when multinational parents are financially constraint and located in countries with high borrowing costs. Given the great relevance of this possible effect, further research is necessary. We provide details of our analysis for both models in Appendix A.5.

Table 8
OLS Regression Results for Investment Rate interacted with ex-ante financial constraints

Panel I - Volatility Shock	(1)	(2)	(3)	**Panel II - Volatility Level**	(4)	(5)	(6)
Investment Rate$_t$	FCP Index	SA Index	WW Index	*Investment Rate*$_t$	FCP Index	SA Index	WW Index
A: Financial Constraint Indices (t-1)							
$\Delta\sigma_{t-1}$	-0.00204*	-0.00181*	-0.00168*	σ_{t-1}	-0.00492*	-0.00659*	-0.00611*
	(0.00119)	(0.00108)	(0.00101)		(0.00277)	(0.00381)	(0.00362)
$D.\ FC\ Index_{t-1}$	-0.0117***	-0.0311**	-0.0245**	$D.\ FC\ Index_{t-1}$	-0.00371*	-0.0229***	-0.0391***
	(0.00432)	(0.0147)	(0.0110)		(0.00218)	(0.00772)	(0.0102)
$\Delta\sigma_{t-1}\times\ D.\ FC\ Index_{t-1}$	-0.00730**	-0.00760**	-0.00620*	$\sigma_{t-1}\times\ D.\ FC\ Index_{t-1}$	-0.0229**	-0.00711	-0.0363**
	(0.00352)	(0.00383)	(0.00366)		(0.0102)	(0.0114)	(0.0175)
Observations	12,944	14,235	11,980	Observations	14,962	17,191	15,547
B: Financial Constraint Indices (t-2)							
$\Delta\sigma_{t-1}$	-0.00261*	-0.00305*	-0.00431*	σ_{t-1}	-0.0132*	-0.0153*	-0.0185**
	(0.00153)	(0.00181)	(0.00255)		(0.00785)	(0.00861)	(0.00850)
$D.\ FC\ Index_{t-2}$	-0.0136***	-0.0196*	-0.0173*	$D.\ FC\ Index_{t-2}$	-0.00558	-0.00831	-0.00876
	(0.00357)	(0.01010)	(0.00889)		(0.00541)	(0.0136)	(0.0104)
$\Delta\sigma_{t-1}\times\ D.\ FC\ Index_{t-2}$	-0.00407*	-0.00847*	-0.00230*	$\sigma_{t-1}\times\ D.\ FC\ Index_{t-2}$	-0.0152	-0.0132	-0.0198
	(0.00239)	(0.00436)	(0.00138)		(0.0107)	(0.0202)	(0.0190)
Observations	11,315	11,678	10,775	Observations	11,757	12,103	10,846

This table presents the OLS estimates of our specification of GUO *Investment Rate* on cross-sectional subsidiary *Uncertainty shock* in Panel I and *Uncertainty Level* in Panel II with interaction effects with three financial constraint indices (FCP, SA, and WW). The sample period is from 2009 to 2017. The sample consists of GUOs in Northern, Southern, and Western European countries available and with at least five sales DHS growth rates entering into the calculation of uncertainty. Specifications 1 to 3 are the regressions with interaction effects with the financial constraint indices lagged by one and two periods. The specifications include the control variables: *ROA, Leverage, Tangibility*, and *Log Sales*. We add country-year and GUO fixed effects and clustered standard errors at the NACE Rev. 2 industry level. The statistical significance levels are the following: *** p<0.01, ** p<0.05, * p<0.1. Standard Errors are reported in parentheses.

8 Conclusions

Our thesis explores the effect of subsidiary cross-sectional uncertainty shocks on the investment decisions of Global Ultimate Owners (GUOs). We analyze uncertainty at the subsidiary level and its effect on the parent companies headquartered in Northern, Southern, and Western Europe in the period 2007 to 2017. We first construct our definition of uncertainty as the standard deviation of the sales growth of all the subsidiaries of a specific GUO each year. Our first model analyzes the effect of lagged uncertainty shocks—the DHS growth of our uncertainty measure—on the investment rate of GUOs applying a set of firm controls, as well as GUO and country-year fixed effects and standard errors clustered at the NACE Rev. 2 level. We find that a one standard deviation volatility shock has an economic effect of a future reduction of 0.205% on the investment rate. In addition, the investment rate of parent companies decreases by 4.28% of its unconditional mean in response to a one-unit increase in uncertainty shock of the cross section of subsidiaries. More specifically, it decreases by 0.29% in relation to the 6.70% unconditional mean investment rate. Moreover, we find that volatility shocks also have a negative and significant effect on the growth of intangible fixed assets and cash flows.

We then explore whether volatility shocks coupled with microeconomic restrictions, namely parent-specific financial constraints, have an incremental negative effect on investment decisions. To achieve this, we incorporate interaction effects of lagged volatility shocks with dummy variables created based on three different financial constraint indices (e.g. FCP, SA, and WW) to define financially constrained firms. We find that the response of GUOs to uncertainty shocks is on average 4.82 times higher in the presence of parent-specific financial frictions. These results are robust when the second lag of the financial frictions is employed.

Overall, we confirm that uncertainty matters, and we add to the academic financial literature by finding that the understudied uncertainty coming from subsidiaries matters for the future investment decisions of multinational parent companies and the economic activity of countries. Furthermore, we find that this uncertainty matters even more for those multinational parents that are financially constrained.

9 Future Research

While we find an important relation between volatility shocks coming from global subsidiaries on the investment decisions of multinational parent companies, additional research is needed in order to further test the strength and scope of this relationship. First, it is necessary to expand the sample of observations in time to include ownership links previous to 2007. A larger sample would make it possible to assess whether the impact of uncertainty shocks on investments holds true in different time periods and further assess the relationship of lagged financial constraints on the investment rate. In addition, it would allow for the exploration of additional variables of interest. Furthermore, we are aware that since the explanatory variables in our specifications are lagged, we mitigate the effect of endogeneity. However, this is not a full remedy for the problem. For future studies, we propose the use of a 2SLS Model that includes a set of instrumental variables that treat the endogeneity issue as in Alfaro et al. (2019). Finally, in order to reach more conclusive results regarding the multiplier effect of macroeconomic variables joint with parent-level financial constraints on volatility shocks and their effect on the investment rate of parent companies, more proxies for country-specific financial distress should be evaluated.

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A Appendices

A.1 Fixed Effects Model

Fixed effects model should be used if one is only interested in looking into the effect of time-varying variables (Wooldridge, 2016). In this model we assume D_i to be fixed effects estimated with the regression and the rest of disturbances u_i stochastic, independent and identically distributed IID $(0,\sigma_u^2)$. In addition, the X_t variables are assumed to be independent of the u_i for all i and t. If these assumptions do not hold, the fixed effects are not usable for modelling the relationship, and the inferences they give are incorrect.

The fixed effect model is appropriate for analyzing a specific set of N firms and if the results are inferred for this specific set. Thus, inferences are conditional on a particular set of N entities in question (Wooldridge, 2016). It allows us to remove the effect of the time-invariant characteristics and evaluate the net effect of the independent variable.

If we assume homoscedastic errors without serial correlation, we can consistently estimate the asymptotic variance:

$$\widehat{Avar} \times [\widehat{\beta_{FE}}] = \widehat{\sigma_u^2}(X'X)^{-1}$$

where $\widehat{\sigma_u^2} = \frac{u'u}{NT-N}$.

On the other hand, if we have heteroscedastic errors with serial correlation, the asymptotic variance should be valued with the cluster-robust covariance estimator as it treats each entity as a cluster (Stock & Watson, 2008). If serial correlation exists, the standard errors in the fixed effects model are significantly understated (Bertrand, Duflo, & Mullainathan, 2004). To solve for this, one should use cluster-robust standard errors.

A.2 Financial Constraint Indices

A.2.1 FCP Index

A newly published measure of financial constraints applicable to both private and public firms is the FCP index (Schauer, Elsas, & Breitkopf, 2019). This index is constructed based on the Economics & Business Data Center's panel data from 1989 to 2012 of private German manufacturing firms. The survey data from the ifo Investment Survey is combined with the accounting data coming from either Bureau van Dijk's Amadeus database (Amadeus) or Bisnode database to form a comprehensive combination of firms' financial status from both manager's perspective and the supporting financials. Shauer et al. construct the index by using the logit models to arrive at the FCP index computed as:

$$FCP_{i,t} = -0.123 \times Size_{i.t} + 0.024 \times Interest\ Coverage_{i,t}$$
$$- 4.404 \times ROA_{i.t} - 1.716 \times Cash\ Holdings_{i.t}$$

Size is computed as the natural logarithm of total assets, *Interest Coverage* equals to EBIT over interest expenses, *ROA* is the ratio of net income and total assets, and *Cash Holdings* is the ratio of cash holdings and total assets.

Variables used for constructing this financial constraint account for both internal and external constraints and are subject to significant time variation making the index suitable for testing the constraints over time. While FCP index is specifically calibrated for private firms, Schauer et al. (2019) show that it can also be highly applicable for the use of publicly listed companies as well. Furthermore, they perform a very thorough robustness check additionally testing their results on European private companies (excluding financial industry), using a different time period, employing fixed effects, and analyzing several different subsamples of data. All the checks suggest that the FCP index is a robust measure.

A.2.2 SA Index

Hadlock & Pierce (2010) find that size and age are significant variables in predicting constraints, and thus develop the size-age (SA) index. This study is based on public firm data that have existed in Compustat database from 1995 to 2004. Authors eliminate the financial firms, regulated utilities, and firms incorporated outside of the United States from the sample and randomly select a sample of 407 firms from the database. Index is constructed by using the ordered logit estimation to model the financial constraints as a function of both linear and quadratic terms of size and age. Results obtained suggest that the role of these factors is insignificant passed the certain point in size and age values. Thus, Hadlock and Pierce cap the age variable at 37 and size at \$4.5 billion to find that the index is best described by variables size, size squared, and age. Index is calculated as:

$$SA_{i,t} = -0.737 \times Size_{i.t} + 0.043 \times Size_{i.t}^2 - 0.040 \times Age_{i.t}$$

where *Size* is defined as inflation adjusted natural logarithm of book value of assets, while *Age* is computed as the number of years the firm has had a non-missing stock price on Compustat. The study indicates that as young and small firms mature and grow in scope, the financial constraints decrease significantly.

A.2.3 WW Index

Whited & Wu (2006) find that the returns of the financially constrained firm move in tandem with each other, thus indicating the existence of the financial constraints factor not explained by the Fama-French model. They construct financial constraints index using a structural investment model. More specifically, they use the generalized method of moments estimation of investment Euler equation to obtain the WW index that suggests that the financially constrained firms are small, underinvest, do not have rated bonds, and are characterized by low analyst coverage. The study is based on 1975–2002 quarterly firm data from Compustat excluding the financial and regulated firms from the sample. The index is constructed as:

$$WW_{i,t} = -0.733 \times Cash\ Flow_{i.t} - 0.062 \times Dividends_{i.t} + 0.021 \times Leverage_{i.t} - 0.044 \times Size_{i.t} + 0.102 \times ISG_{i.t} - 0.035 \times SG_{i.t}$$

where *Cash Flow* is the ratio of operating income and depreciation to total assets. The *Dividends* variable is a dummy variable indicating whether the firm pays dividends. *Leverage* is calculated as the ratio of long-term debt to overall assets while *Size* is computed as the natural logarithm of the firm's total assets. *SG* is the firm specific sales growth and *ISG* is the sales growth of the three-digit industry the firm belongs to.

The Size-Age and Whited-Wu indices are highly correlated at 0.8. Nevertheless, the size variable accounts for a large portion of this relationship. If excluded, the correlation coefficient would drop to 0.42 (Hadlock & Pierce, 2010).

A.3 Sensitivity of Subsidiaries Sample

To assess whether subsidiaries in marginally less developed countries drive the negative response on the investment rate of GUOs to lagged cross-sectional volatility shocks , we run our baseline specification and restrict the subsidiaries that enter the volatility shocks computation to those located in either European countries or country members of the OECD. We show the results in Table **??** where the specification in Column 1 presents our baseline specification restricting the subsidiaries to countries in Northern, Southern, and Western Europe. In Column 2 the sample of subsidiaries is restricted to country members of the OECD. In both cases we see that the coefficient of lagged volatility shock is significant at the 10%. However, the magnitude of the effect is lower. These results indicate that the response of GUOs investment rate to uncertainty shocks is not limited to presence of subsidiaries in less developed countries, although it increases its magnitude.

Table A1
OLS Regression Results for Investment Rate of GUOs with Different Sets of Subsidiaries

$Investment\ Rate_t$	(1)	(2)
$\Delta\sigma_{t-1}$	-0.00235*	-0.00218*
	(0.00124)	(0.00123)
$Log\ Sales_{t-1}$	-0.0847***	-0.0832***
	(0.00845)	(0.00861)
ROA_{t-1}	0.231***	0.236***
	(0.0267)	(0.0271)
$Leverage_{t-1}$	-0.143***	-0.152***
	(0.0201)	(0.0210)
$Tangibility_{t-1}$	-0.179***	-0.182***
	(0.0664)	(0.0664)
Observations (GUO-years)	14,235	14,235
Location of Subsidiaries	Europe	OECD
GUO FE	Yes	Yes
Country-Year FE	Yes	Yes
SE Cluster (NACE-2)	Yes	Yes

This table presents the OLS estimates of our main regression specification of GUO investment rate on cross-sectional subsidiary uncertainty shock restricting subsidiaries to specific countries. The sample consists of GUOs in Northern, Southern, and Western European countries available and with at least five sales DHS growth rates entering into the calculation of uncertainty. Column 1 presents the results of the specification where the computation of the uncertainty shocks includes only subsidiaries located in Northern, Southern, and Western Europe. Column 2 restricts the subsidiaries to those members of the OECD. The sample period is from 2009 to 2017. We add country-year and GUO fixed effects. Also, we cluster standard errors at NACE Rev. 2 industry level. The statistical significance levels are the following: *** p<0.01, ** p<0.05, * p<0.1. Standard Errors are reported in parentheses.

A.4 Robustness Test

To assess the robustness of our results, we perform several tests changing the variant of the uncertainty measure and changing the clustering of the standard errors.

Table A2 presents the main robustness check, and shows the results of the benchmark specification with and without controls and with varying clustering of standard errors. More specifically, we test the model with clustering at the industry level (NACE Rev. 2), industry and year (NACE Rev. 2 and year), parent level (GUO), and firm and year level (GUO and year). We observe that results are robust to the change in the clustering of standard errors.

To examine whether results hold when we use a different variant of uncertainty measure, we employ volatility level in our model. We define volatility level in equation 4. Table A3 shows the results of this model specification with column 1 presenting the univariate specification without controls, and column 2 presenting the multivariate specification with the controls for firm specific characteristics. We observe that the results hold even when we change the variant of the uncertainty measure.

Table A4 presents the robustness check of the benchmark specification interacted with the financial constraints. To assess whether our results hold for a different uncertainty variant, we run equation 7 and use the volatility level of the cross section of subsidiaries as the uncertainty measure. We find that the results are robust to when we employ a different uncertainty measure.

Table A2
Robustness Test with Multiple SE Clusters

Investment Rate$_t$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta\sigma_{t-1}$	-0.00313*	-0.00278*	-0.00313*	-0.00313*	-0.00287**	-0.00287**	-0.00287**	-0.00287**
	(0.00166)	(0.00163)	(0.00161)	(0.00147)	(0.00129)	(0.000987)	(0.00121)	(0.00119)
$Log\ Sales_{t-1}$					-0.0878***	-0.0878***	-0.0878***	-0.0878***
					(0.00827)	(0.0152)	(0.00885)	(0.0155)
ROA_{t-1}					0.239***	0.239***	0.239***	0.239***
					(0.0278)	(0.0415)	(0.0283)	(0.0423)
$Leverage_{t-1}$					-0.165***	-0.165***	-0.165***	-0.165***
					(0.0220)	(0.0226)	(0.0229)	(0.0235)
$Tangibility_{t-1}$					-0.183***	-0.183*	-0.183***	-0.183**
					(0.0694)	(0.0880)	(0.0516)	(0.0759)
Observations	14,444	14,444	14,444	14,444	14,235	14,235	14,235	14,235
GUO FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE Cluster	NACE-2	NACE-2 & Year	GUO	GUO & Year	NACE-2	NACE-2 & Year	GUO	GUO & Year

This table presents the OLS estimates of our main regression specification of GUO investment rate on cross-sectional subsidiary uncertainty shock restricting subsidiaries to specific countries. The sample consists of GUOs in Northern, Southern, and Western European countries available and with at least five sales DHS growth rates entering into the calculation of uncertainty. Column 1 presents the results of the specification where the computation of the uncertainty shocks includes only subsidiaries located in Northern, Southern, and Western Europe. Column 2 restricts the subsidiaries to those members of the OECD. The sample period is from 2009 to 2017. We add country-year and GUO fixed effects. Also, we cluster standard errors at NACE Rev. 2 industry level. The statistical significance levels are the following: *** p<0.01, ** p<0.05, * p<0.1. Standard Errors are reported in parentheses.

Table A3
OLS Regression with Investment Rate against Volatility Level

Investment Rate$_t$	(1)	(2)
σ_{t-1}	-0.0131***	-0.00909*
	(0.00501)	(0.00467)
Log Sales$_{t-1}$		-0.0786***
		(0.00754)
ROA$_{t-1}$		0.230***
		(0.0272)
Leverage$_{t-1}$		-0.161***
		(0.0199)
Tangibility$_{t-1}$		-0.148***
		(0.0526)
Observations	17,461	17,191
GUO FE	Yes	Yes
Country-Year FE	Yes	Yes
SE Cluster	NACE-2	NACE-2

This table presents the OLS estimates of our specification of GUO investment rate on cross-sectional subsidiary uncertainty level including interaction effects with the three financial constraint indices and long-term interest rates. The sample period is from 2009 to 2017. The sample consists of GUOs in Northern, Southern, and Western European countries available and with at least five sales DHS growth rates entering into the calculation of uncertainty. Specification 1 is our baseline, and specifications 2 to 4 are the regressions with triple interaction effects with the three financial constraint indices and the dummy variable for GUOs in high-interest rate countries. *Investment Rat*e is the change in fixed assets plus depreciation and amortization normalized by one-year-lagged total assets. *Uncertainty shock* is the growth in the cross-sectional standard deviation of annual sales' growth of all the subsidiaries of a given GUO in each year. All the specifications include the control variables defined as follows: *ROA* is earnings before interest and taxes, *Leverage* is loans plus long-term debt divided by total assets, *Tangibility* is tangible fixed assets divided by Total Assets, and *Log Sales* is the natural logarithm of Sales. We add country-year and GUO fixed effects. Also, we cluster standard errors at NACE Rev. 2 industry level. The statistical significance levels are the following: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Standard Errors are reported in parentheses.

Table A4
OLS Regression with Investment Rate against Volatility Level Interacted with Financial Constraints

Investment Rate$_t$	(1)	(2)	(3)	(4)
σ_{t-1}	-0.00909*	-0.00492	-0.00659*	-0.00611
	(0.00467)	(0.00577)	(0.00381)	(0.00792)
Log Sales$_{t-1}$	-0.0786***	-0.0794***	-0.0768***	-0.0768***
	(0.00754)	(0.00775)	(0.00761)	(0.00766)
ROA_{t-1}	0.230***	0.222***	0.230***	0.237***
	(0.0272)	(0.0376)	(0.0272)	(0.0285)
Leverage$_{t-1}$	-0.161***	-0.151***	-0.160***	-0.162***
	(0.0199)	(0.0232)	(0.0200)	(0.0217)
Tangibility$_{t-1}$	-0.148***	-0.134**	-0.147***	-0.169***
	(0.0526)	(0.0574)	(0.0526)	(0.0589)
D. FCP Index$_{t-1}$		-0.00371		
		(0.00578)		
$\Delta\sigma_{t-1}\times$ *D. FCP Index$_{t-1}$*		-0.0229**		
		(0.0102)		
D. SA Index$_{t-1}$			-0.0229***	
			(0.00772)	
$\Delta\sigma_{t-1}\times$ *D. SA Index$_{t-1}$*			-0.00711	
			(0.0114)	
D. WW Index$_{t-1}$				-0.0391***
				(0.0102)
$\Delta\sigma_{t-1}\times$ *D. WW Index$_{t-1}$*				-0.0363**
				(0.0175)
Observations	14,235	14,962	17,191	15,547
GUO FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes
SE Cluster (NACE-2)	Yes	Yes	Yes	Yes

This table presents the OLS estimates of our specification of GUO investment rate on cross-sectional subsidiary uncertainty level including interaction effects with the three financial constraint indices and long-term interest rates. The sample period is from 2009 to 2017. The sample consists of GUOs in Northern, Southern, and Western European countries available and with at least five sales DHS growth rates entering into the calculation of uncertainty. Specification 1 is our baseline, and specifications 2 to 4 are the regressions with triple interaction effects with the three financial constraint indices and the dummy variable for GUOs in high-interest rate countries. *Investment Rat*e is the change in fixed assets plus depreciation and amortization normalized by one-year-lagged total assets. *Uncertainty shock* is the growth in the cross-sectional standard deviation of annual sales' growth of all the subsidiaries of a given GUO in each year. All the specifications include the control variables defined as follows: *ROA* is earnings before interest and taxes, *Leverage* is loans plus long-term debt divided by total assets, *Tangibility* is tangible fixed assets divided by Total Assets, and *Log Sales* is the natural logarithm of Sales. We add country-year and GUO fixed effects. Also, we cluster standard errors at NACE Rev. 2 industry level. The statistical significance levels are the following: *** p<0.01, ** p<0.05, * p<0.1. Standard Errors are reported in parentheses.

A.5 Exploration of Triple Interaction Effects with Costs of Credit Intermediation

First, we use the long-term interest rate of the country represented by each GUO. This allows us to assess whether country-specific borrowing costs have any significance for the investment decisions under the conditions implied by our model. This is of special interest given the recent European Debt Crisis, where the long-term interest rate of various European countries reached very high levels (e.g. Greece's interest rates peaked at 29% in February 2012) as seen in Figure 3.

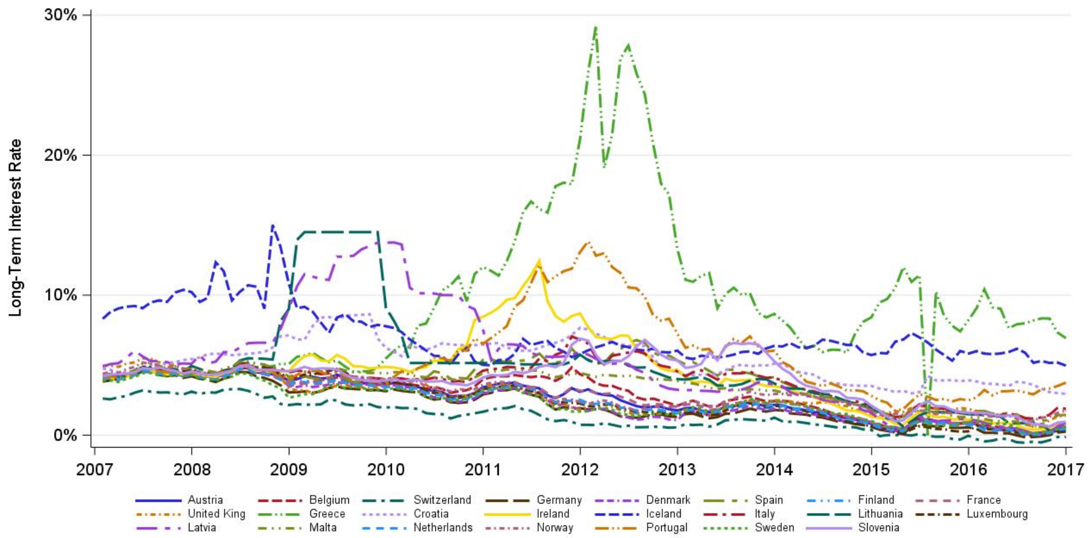

Figure 3 GUOs' Countries Long-Term Interest Rates.
This figure portrays the long-term interest rates of the countries represented by the GUOs in our sample. The GUOs are located in Northern, Southern, and Eastern Europe.

Moreover, we use the series of country financial distress developed by Romer & Romer (2017) to have a more comprehensive indication of the state of the countries in which the GUOs are headquartered. This series assess the health of the countries' financial system and classifies their level of financial distress on a relatively distress. Thus, we construct the hypothesis as follows:

H5: Cross-sectional subsidiary volatility shocks have a more severe effect on the investment rate of financially constrained GUOs when these are located in countries facing high costs of credit intermediation.

A.5.1 The Case of Long-Term Interest Rates

Following Alfaro et al. (2019), we explore the triple interaction effect between subsidiary cross-sectional uncertainty shocks, parent-specific financial constraints, and GUOs' country long-term interest rates with the following equation:

$$\begin{aligned}\frac{I_{g,t}}{K_{g,t-1}} = {} & \alpha + \beta_1 \Delta\sigma_{g,t-1} + \beta_2 DFC_{g,t-1} + \beta_3 \times DIR_{c,t} + \beta_4 \times \Delta\sigma_{g,t-1} \times DFC_{g,t-1} \\ & + \beta_5 \times \Delta\sigma_{g,t-1} \times DIR_{c,t} + \beta_6 \times DFC_{g,t-1} \times DIR_{c,t} \\ & + \beta_7 \times \Delta\sigma_{g,t-1} \times DFC_{g,t-1} \times DIR_{c,t} + \beta_8 \times Controls \\ & + FE + \varepsilon_{g,t} \end{aligned} \tag{8}$$

where $DIR_{c,t}$ is a dummy variable that accounts for GUO firms located in countries with high interest rates. It equals 1 if the country GUO is located in lies in the top 25^{th} percentile of the sample ranked by the magnitude of sovereign long-term interest rates and 0 otherwise. The measure of interest rates is computed as the weighted moving average of monthly long-term interest rates over a one-year window. β_4 is the coefficient of the interaction effect between the uncertainty shock and the financial constraint, β_5 accounts for is the coefficient of the interaction effect between the uncertainty shock and interest rate dummy, β_6 is the coefficient of the interaction effect between the financial constraint dummy and interest rate dummy, and lastly β_7 is the coefficient of triple interaction between uncertainty shock, financial constraint, and interest rates.

To assess the presence of potentially larger multiplier effect on the investment rate of parent companies, we use four different coefficients that incorporate uncertainty shocks. More specifically, the sum of β_1 and β_4 incorporates the total effect of uncertainty shock of financially constrained parent companies. The uncertainty shock effect for GUOs located in high-interest rate countries and thus exposed to higher borrowing costs is captured by $\beta_1 + \beta_5$. In addition, the total uncertainty shock effect on investment rate of parent companies that are financially constrained and exposed to high borrowing costs is reflected by $\beta_1 + \beta_4 + \beta_5 + \beta_7$. Thus, to analyze whether there is an amplified effect of the macroeconomic variable we employ, we need to examine the incremental response of the investment rate to $\beta_5 + \beta_7$.

Table A2 reports the results. We note that the regression using FCP index as a finance uncertainty measure displays a statistically significant β_1 coefficient at the 10% level. The results suggest that financially constrained parent firms have a more pronounced response to the increase in cross-sectional uncertainty shock ($\beta_1 + \beta_4$= -0.00558), which yields an uncertainty multiplier of 1.84 (= -0.00558/ -0.00303). Since the coefficient of volatility shock combined with the financial constraint dummy is not statistically significant, we test the joint significance of the coefficients of $\beta_1 + \beta_4$ with an F-test and find significance at the 10%. We observe that the coefficient of triple interaction is negative and statistically significant, but the coefficient of the interaction between the volatility shock and interest rate is positive and not statistically significant. While we did not expect to obtain a positive value for the β_5 coefficient, we note that the sign is consistent across different financial constraint measures suggesting that given our data sample, this is indeed the direction of interaction among these two variables. To assess the incremental effect of the macroeconomic variable we employ, we compute the FUM of the total volatility effect across both groups: $(\beta_1 + \beta_4 + \beta_5 + \beta_7)/(\beta_1 + \beta_4)$ = -0.01599/ -0.00558 = 2.87 This implies that once the effect of interest rate is incorporated into the model, the effect of the volatility shock magnifies 2.87 times.

The Size-Age index reports similar results. We observe that the statistical significance of the β_1 coefficient increases in this case, while the other coefficients do not exhibit statistical significance but have the sign we would expect. As in the previous results, the effect of uncertainty shocks for financially constrained firms is given by $\beta_1 + \beta_4$= -0.00885 significant at the 5%. Hence, we note that there is an augmented uncertainty shock effect on financially constrained firms: $(\beta_1 + \beta_4)/\beta_1$= (-0.00523 -0.00362)/ -0.00523 = 1.69. However, when the interest rate factor is added to the uncertainty effect, the multiplier we obtain equals to 0.92 (= -0.00814/ -0.00885). This reduction in the multiplier effect with interest rates stems from a low triple interaction coefficient.

In the case of the WW index, the sole coefficient of uncertainty shock is not statistically significant, but the one for the single interaction between the volatility shock and the financial constraint index and the one for the triple interaction are significant. To analyze the incremental impact of interest rates on the investment rate of the parent company, we use the same procedure. We first compute the incremental effect of financial constraints, and conclude that this variable once computed using the WW index has a much higher multiplier effect of 6.61 (= -0.00187 -0.0105)/ -0.00187 significant at the 5%. The FUM of the total volatility effect across both groups is 3.07 (= 0.03793/ -0.01237) suggesting that interest rates do exacerbate the effect of the subsidiary volatility shocks.

Overall, we note a greater deviation in the results using the different indices, and while they are not as conclusive as the ones in the previous section, we still see significant results in the total effect of volatility shocks for financially constrained firms. Furthermore, only with the WW Index we see a significant triple interaction effect including long-term interest rates. Therefore, we cannot conclude with certainty that high borrowing costs at the country level have an incremental effect on the impact of subsidiary cross-sectional uncertainty shocks on multinational GUOs. However, interest rates are just one component of the overall health status of countries' financial systems. Thus, in the next section we analyze a triple interaction with a more comprehensive macroeconomic proxy of financial distress.

Table A5
OLS Regression Results for Investment Rate Interacted with Financial Constraints and Long-Term Interest Rates

Investment Rate$_t$	(1)	(2)	(3)	(4)
	Baseline	FCP Index	SA Index	WW Index
$\Delta\sigma_{t-1}$	-0.00287**	-0.00303*	-0.00523**	-0.00187
	(0.00129)	(0.00177)	(0.00224)	(0.00179)
$\Delta\sigma_{t-1}\times$ *D. FC Index*$_{t-1}$		-0.00255	-0.00362	-0.0105*
		(0.00397)	(0.00323)	(0.00580)
$\Delta\sigma_{t-1}\times$ *D. IR*$_t$		0.00869	0.00455	0.00134
		(0.00753)	(0.00751)	(0.00544)
$\Delta\sigma_{t-1}\times$ *D. FC Index*$_{t-1}\times$ *D. IR*$_t$		-0.0191*	-0.00384	-0.0269*
		(0.0107)	(0.0119)	(0.0140)
Observations	14,235	11,364	12,566	11,902
GUO FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes
SE Cluster (NACE-2)	Yes	Yes	Yes	Yes

This table presents the OLS estimates of our specification of GUO investment rate on cross-sectional subsidiary uncertainty shocks including interaction effects with the three financial constraint indices and long-term interest rates. The sample period is from 2009 to 2017. The sample consists of GUOs in Northern, Southern, and Western European countries available and with at least five sales DHS growth rates entering into the calculation of uncertainty. Specification 1 is our baseline, and specifications 2 to 4 are the regressions with triple interaction effects with the three financial constraint indices and the dummy variable for GUOs in high-interest rate countries. *Investment Rat*e is the change in fixed assets plus depreciation and amortization normalized by one-year-lagged total assets. *Uncertainty shock* is the growth in the cross-sectional standard deviation of annual sales' growth of all the subsidiaries of a given GUO in each year. All the specifications include the control variables defined as follows: *ROA* is earnings before interest and taxes, *Leverage* is loans plus long-term debt divided by total assets, *Tangibility* is tangible fixed assets divided by Total Assets, and *Log Sales* is the natural logarithm of Sales. We add country-year and GUO fixed effects. Also, we cluster standard errors at NACE Rev. 2 industry level. The statistical significance levels are the following: *** p<0.01, ** p<0.05, * p<0.1. Standard Errors are reported in parentheses.

A.5.2 Country Financial Distress

In this section, similar to the previous one, we want to answer the question whether the macroeconomic environment augments the effect of subsidiary cross-sectional uncertainty shocks on financially constrained parent companies. To do so, we use the measure of financial distress by Romer & Romer (2017). This measure defines financial distress as increases in the cost of credit intermediation as coined by Bernanke (2013). This cost relates to the costs of funds for financial institutions as well as their cost to screen, monitor, and manage different types of financing. A rise in these costs reduces the supply of credit for individuals and firms. The authors do not rely purely on a statistical measure to construct their index but also factor in qualitative evidence on the health of each country. More specifically, they use a single real-time narrative (the OECD Economic Outlook) to determine when the cost of credit determination rises. Moreover, the index is not a binary measure, but it assigns countries an integer score from 0 to 15, with 15 being the most financially constrained countries.

To test our hypothesis that financially distressed GUOs in financially distressed countries are countries react more severely to cross-sectional uncertainty coming from their subsidiaries, we employ the following equation:

$$
\begin{aligned}
\frac{I_{g,t}}{K_{g,t-1}} = {} & \alpha + \beta_1 \Delta\sigma_{g,t-1} + \beta_2 DFC_{g,t-1} + \beta_3 \times FD_{c,t} + \beta_4 \times \Delta\sigma_{g,t-1} \times DFC_{g,t-1} \\
& + \beta_5 \times \Delta\sigma_{g,t-1} \times FD_{c,t} + \beta_6 \times DFC_{g,t-1} \times FD_{c,t} \\
& + \beta_7 \times \Delta\sigma_{g,t-1} \times DFC_{g,t-1} \times FD_{c,t} + \beta_8 \times Controls \\
& + FE + \varepsilon_{g,t} \qquad (9)
\end{aligned}
$$

where $FD_{c,t}$ represents the Country Financial Distress Index of the country represented by the GUO. The index ranges from 0 to 15, with 15 denoting the most distressed countries. β_4 is the coefficient of the interaction effect between the uncertainty shock and the financial constraint, β_5 relates to the coefficient of the interaction effect between the uncertainty shock and country financial distress index, β_6 is the coefficient of the interaction effect between the financial constraint dummy and the country financial distress index, and lastly β_7 is the coefficient of triple interaction between uncertainty shock, financial constraint, and country financial distress.

The results of this specification are presented in Table A3. Except for the case in which we use the WW Index, we lose significance in all the coefficients, including the sole volatility shock. With the WW Index, we see a negative and statistically significant coefficient at the 5% of the sole uncertainty shock. It is also higher in magnitude than the baseline and any of the sole uncertainty shocks coefficients with financial constraint indices. Moreover, the triple interaction coefficient is negative and statistically significant at the 5%. Here, the incremental effect of uncertainty shocks on financially constrained firms is minor at 1.07 (= -0.00959 - 0.000669)/ -0.00959) significant at the 10%. Furthermore, the total incremental effect of financial distress in the country of GUOs is 1.11 (= -0.00959 - 0.000669 + 0.00218 - 0.00326)/ (-0.00959 - 0.000669). These results imply that subsidiary cross-sectional uncertainty shocks have a larger impact on the investment rate of financially constrained GUOs (measured by WW index) the higher the credit intermediation costs of the country in which they are located.

Even though our prior was that higher costs of credit intermediation had a multiplier effect on the effect of uncertainty shocks coupled with parent-specific financial constraints, we do not find robust results with the use of financial constraint indices. Besides the fact that the various indices measure different aspects of firm-specific financial tightness, we found that a possible explanation for the divergence and poor robustness in the results is an important point discussed by Romer & Romer (2017). They find that the average decline in output triggered by a financial crisis is sensitive to the specification and sample, and that the effects vary across cases. Moreover, part of the correlation between financial distress and economic activity does not reflect a causal impact. Therefore, we cannot conclude that country-specific financial distress augments the impact of subsidiary cross-sectional uncertainty shocks on the investment decisions of multinational parent companies.

Table A6
OLS Regression Results for Investment Rate Interacted with Financial Constraints and Country Financial Distress

Investment Rate$_t$	(1)	(2)	(3)	(4)
	Baseline	FCP Index	SA Index	WW Index
$\Delta\sigma_{t-1}$	-0.00287**	-0.00251	-0.00135	-0.00959**
	(0.00129)	(0.00233)	(0.00224)	(0.00410)
$\Delta\sigma_{t-1}\times$ *D. FC Index*$_{t-1}$		-0.000466	-0.00506	-0.000669
		(0.00394)	(0.00470)	(0.00150)
$\Delta\sigma_{t-1}\times$ *FD*$_t$		0.00212	-0.000186	0.00218
		(0.000819)	(0.000536)	(0.00140)
$\Delta\sigma_{t-1}\times$ *D. FC Index*$_{t-1}\times$ *FD*$_t$		-0.000163	-0.000671	-0.00326**
		(0.000954)	(0.00130)	(0.00154)
Observations	14,235	12,750	14,011	13,252
GUO FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes
SE Cluster (NACE-2)	Yes	Yes	Yes	Yes

This table presents the OLS estimates of our specification of GUO investment rate on cross-sectional subsidiary uncertainty shocks including triple interaction effects with the three financial constraint indices and the country financial distress index. The sample period is from 2009 to 2017. The sample consists of GUOs in Northern, Southern, and Western European countries available and with at least five sales DHS growth rates entering into the calculation of uncertainty. Specification 1 is our baseline, specifications 2 to 4 are the regressions with triple interaction effects with the three financial constraint indices and the country financial distress index. *Investment Rate* is the change in fixed assets plus depreciation and amortization normalized by one-year-lagged total assets. *Uncertainty shock* is the growth in the cross-sectional standard deviation of annual sales' growth of all the subsidiaries of a given GUO in each year. All the specifications include the control variables defined as follows: *ROA* is earnings before interest and taxes, *Leverage* is loans plus long-term debt divided by total assets, *Tangibility* is tangible fixed assets divided by Total Assets, and *Log Sales* is the natural logarithm of Sales. We add country-year and GUO fixed effects. Also, we cluster standard errors at NACE Rev. 2 industry level. The statistical significance levels are the following: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Standard Errors are reported in parentheses.