No 2020-03 – March

Working Paper

CEPII

Cross-border Investments and Uncertainty Firm-level Evidence*

Rafael Cezar[†], Timothée Gigout[††] & Fabien Tripier[‡]

Highlights

- We study the impact of uncertainty on cross-border investments.
- We build a novel country and time-varying proxy for uncertainty based on FDI returns of French Multinational Firms.
- A rise in uncertainty has a direct negative short-term impact on cross-border investment flows to the affected country.
- Multinational firms with low ex-ante performance never recover while after a rise in uncertainty while higher performing multinational firms over compensate in the following periods.
- A model based on financial frictions explain the effect of uncertainty shocks on foreign investments and the heterogeneous responses of multinational firms.

* Acknowledgement: We thank Philippe Aghion, Joshua Aizenman, Jean-Charles Bricongne, Matthieu Bussière, Anne-Célia Disdier, Ludovic Gauvin, Jérôme Hericourt, Jean Imbs, Isabelle Méjean, Gianluca Orefice, Matthias Schoen, Farid Toubal and participants of the Banque de France Phd seminar, CEPII seminar, Paris-Sud Seminar, 23rd Conference on Theories and Methods in Macroeconomics (T2M), 34th SUERF Colloquium/Banque de France, 23rd Annual International Conference on Macroeconomic Analysis and International Finance (ICMAIF), AFSE 2017 and RIEF 2017 conferences. Fabien Tripier acknowledges the financial support of the Labex MME–DII's grant ANR–11–LBX–00023–01. The views expressed herein are those of the authors and do not necessarily reflect the positions of the institutions they belong to.

† Banque de France, Email: rafael.cezar@banque-france.fr.

†† CEPII & Collège de France, Email: timothee.gigoutmagiorani@gmail.com.

‡ Université Paris-Saclay, Univ Evry, EPEE, 91025, Evry, France & CEPII, Email: fabien.tripier@univ-evry.fr.

Abstract

This paper studies the impact of uncertainty on cross-border investments. We build a data-set of firm-level outward Foreign Direct Investments between 2000 and 2015. We create a time and country varying measure of uncertainty based on the dispersion of idiosyncratic investment returns. An increase in uncertainty delays cross-border flows to the affected country. Yet, this average effect hides strong heterogeneity. Firms with low ex-ante performance durably reduce their foreign investments. Meanwhile high-performing firms increase their investments after the initial shock. We interpret these results as the evidence of a cleansing effect of uncertainty shocks among multinational firms in the presence of financial frictions.

Keywords

Uncertainty, Asymmetric Uncertainty, FDI Flows, FDI Returns, Volatility, Multinational Firms.

JEL

D81, F23, G10, G15.

Working Paper

CEPII

CEPII (Centre d'Etudes Prospectives et d'Informations Internationales) is a French institute dedicated to producing independent, policy-oriented economic research helpful to understand the international economic environment and challenges in the areas of trade policy, competitiveness, macroeconomics, international finance and growth.

CEPII Working Paper
Contributing to research in international economics

Editorial Director:
Sébastien Jean

Production: Laure Boivin

Published on March 31, 2020

No ISSN: 1293-2574

CEPII
20, avenue de Ségur
TSA 10726
75334 Paris Cedex 07
+33 1 53 68 55 00
www.cepii.fr
Press contact: presse@cepii.fr

RESEARCH AND EXPERTISE
ON THE WORLD ECONOMY

1 Introduction

"Brexit fear hits foreign direct investment." Financial Times, 2016

"This uncertainty on where we are going in regards to trade policy and Nafta has put some international investment in a holding pattern." C. Camacho, President and CEO of the Greater Phoenix Economic Council. Financial Times, 2017

Foreign investors fear uncertainty. This widespread view is repeatedly invoked in the media and political circles during turbulent times as in the current context of Brexit and trade wars. In this paper, we build a measure of uncertainty based on FDI returns of French Multinational Firms (MNF or firms hereafter) to document how FDI react to a rise in uncertainty of FDI returns in the host country. A striking result of our empirical analysis is the great heterogeneity of the effect of return uncertainty on FDI decision. A slightly negative and short-lived *average* effect hides a strong negative and persistent effect for low-performing MNF which turns out to be positive for high-performing ones. Therefore, besides its moderate effects on average, FDI uncertainty appears as a key driver of reallocation of foreign direct investments between MNF.

The starting point of our paper, and our first contribution to the literature, is to build a micro-data based measure of uncertainty for FDI returns. While investigations on the impact of uncertainty on FDI in the literature rely upon global measures of uncertainty as the electoral cycle (e.g. Julio and Yook (2016)), the stock market volatility (e.g. Gourio et al. (2016)) or the exchange rate uncertainty (e.g. Jeanneret (2016)), we investigate herein a measure of uncertainty which is specific to FDI. Our measure presents the advantage of being more directly connected with the FDI's decision. To build this measure, we construct a novel affiliate-level data-set of French outward FDI flows and assets abroad.[1] This data-set allows us to compute the entire distribution of FDI returns for almost all French MNF over the 2000-2015 sample period.

The standard deviation of FDI returns distribution is informative about the realized risk of FDI, but it cannot be used directly as a measure of exogenous FDI uncertainty. As emphasized by Bloom (2014), exogenous fluctuations in uncertainty are not directly observable and

[1] Vicard (2018) also uses the Banque de France databases to measure FDI returns to study the role of corporate tax avoidance.

we therefore have to rely on necessarily imperfect proxies. By looking at the width of the distribution of the reasonably unpredictable component of those outcomes, we get closer to the true notion of uncertainty as Jurado et al. (2015) point out. To get a more accurate measure of uncertainty, we then consider the dispersion of FDI returns which are not predicted by relevant factors. The selected factors are borrowed from the literature in finance on idiosyncratic volatility of returns. Whereas Ang et al. (2006) and Ang et al. (2009) use a multiple French and Fama Factors model to predict idiosyncratic returns, it is also possible to employ a more parsimonious model as in Anderson et al. (2009) and Boutchkova et al. (2012). In that set-up, firms' returns are typically regressed over two indexes of country and global returns with some fixed effects accounting for firm invariant characteristics. We also borrow to the literature on uncertainty measures based on firm-level data exposed in Bloom (2014) and more precisely Bloom et al. (2018) who apply auto-regressive models to the establishment-level measure of productivity to identify uncertainty shocks on firm productivity. Therefore, our measure of uncertainty is defined as the standard deviation of the component of FDI returns which is unexplained by the lagged value of FDI returns, the indexes of world and country FDI returns, and an estimated structure of fixed effects.

Our measure of uncertainty is time-varying with cross-country and cross-sectoral dimensions.[2] The highest uncertainty is observed in 2008 in Thailand, a year marked by a very serious political crisis.[3] We also observe high values during the Great Recession for several emerging countries (South Africa, India and Romania) and the famous 2001 financial crises in Argentina and Turkey, as well as in Russia (in 2002 and 2006, a year of tensions with Ukraine and international sanctions). Our measurement is therefore a synthetic indicator of the several dimensions of uncertainty (economic, political and financial).

We then estimate how FDI react to uncertainty by regressing the individual FDI outflows by French MNF on our measure of uncertainty together with a set of relevant control variables and

[2]We do not find any effect of sectoral uncertainty, so we focus herein on the consequences of host-country uncertainty.

[3]The ranking of values above 30 (the average is 18.03) is as follows: Thailand (2008) 35.06, South Africa (2007) 33.92, India (2008) 33.74, Argentina (2001) 33.38, Romania (2008) 31.93, Russia 2002 (31.61053), Russia (2006) 30.27. Turkey (2001) 30.84.

fixed effects. We supplement our results with the Local Projection method of Jordà (2005) to assess the persistence of the adverse effect of uncertainty on FDI.[4] Following a one interquartile range increase in uncertainty in one country, French MNF decrease the rate of their direct investments to the affected country by as much as 0.904 points of percentage. Using split-sample analysis, we show that this figure hides a strong heterogeneity among MNF. Parent companies with low ex-ante performance bear the brunt of the losses from uncertainty and do not experience any recovery in the following years contrary to parent companies with high ex-ante performance. Indeed, the fall of 0.904 points of percentage of FDI growth on average is associated with a gap of 5.98 points of percentage three years after between parent companies with the highest and the lowest ex-ante performance. In fact, the rise in uncertainty has a positive effect for high-performing parent companies (2.60 ppt) while low-performing firms experienced a dramatic fall in FDI (-3.38 ppt). The small and short-living average effect hides strong and persistent heterogeneous effects of uncertainty on FDI.

We propose an illustrative model to explain the effect of uncertainty shocks on foreign investments and to account for heterogeneous responses of multinational firms. The model is based on the costly-state verification setup originally developed by Townsend (1979) and Bernanke et al. (1999) extended by Christiano et al. (2014) to make uncertainty time-varying as the outcome of "Risk shocks". An increase in uncertainty leads to a fall in investment by foreign investors who support an increase in external finance costs as a consequence of the increase in risk in the destination country. In the context of firm heterogeneity, with respect to the importance of costly-state verification, we observe however an increase of investment by foreign investors with low verification costs who get back market shares from those with high verification costs.

Our results contribute to the large literature on the relation between FDI and uncertainty. This literature has emerged after the collapse of Bretton-Woods agreements with a focus on the choice by MNF between investments or exports to serve foreign markets in the new context

[4]The use of local projections has recently been introduced for micro data where they provide a parsimonious and tractable alternative to VAR models to compute impulse response functions in the presence of potential non-linearities – see Favara and Imbs (2015) and Crouzet et al. (2017).

of floating exchange rates – see Helpman et al. (2004) for a seminal contribution on this topic and Fillat and Garetto (2015) for a treatment of this choice under uncertainty. Theoretical and empirical results have been provided to support either a positive impact of exchange rate uncertainty on FDI (Fernández-Arias and Hausmann, 2001; Cushman, 1985; Goldberg and Kolstad, 1995) or a negative impact (Aizenman and Marion, 2004; Ramondo et al., 2013; Lewis, 2014) – and even more recently a non-linear relationship in Jeanneret (2016), which is negative for low uncertainty levels and positive otherwise.[5] The complexity of the FDI–uncertainty relation has been reinforced by the evidence on the important role of another source of uncertainty, namely political uncertainty, in shaping foreign investment (Rodrik, 1991; Julio and Yook, 2016). Our results confirm the importance of the effect of uncertainty not only on the aggregate level of FDI flows, but also on the composition of the MNF at the origin of those flows. Moreover, the great heterogeneity of uncertainty effects highlighted in this paper may explain the difficulty in this literature to reach a clear cut conclusion on the FDI-uncertainty relation.

Our results contribute also to literature on the heterogeneous effects of uncertainty shocks. Heterogeneity was identified in the earlier studies on investment dynamics: the negative impact of uncertainty on investment is much greater in industries dominated by smaller firms in Ghosal and Loungani (2000), in more concentrated sectors in Patnaik (2016) and for firms with substantial market power in Guiso and Parigi (1999). More recently, Barrero et al. (2017) finds that more financially constrained firms drive most of the negative effect of uncertainty on firm domestic growth. For trade, Handley and Limao (2015) and Handley and Limão (2017) demonstrate the importance of firm heterogeneity to quantify the consequence of trade policy uncertainty in the context of Portugal accession to European community and the China's WTO accession, respectively. De Sousa et al. (2018) find that more productive firms are more affected by expenditure volatility in the destination country while Héricourt and Nedoncelle (2018) show that multi-destination firms loose market share to mono-destination ones. Our contribution is to extend this set of results to FDI and to identify the role of returns as a key source of heterogeneous responses of firms to uncertainty.

[5] See Table 2 in Russ (2012) for a synthetic review of these results.

Finally, it is worth emphasizing that heterogeneity concerns the sign of the impact and not only its magnitude: the impact of uncertainty is positive for high performing firms. It is interesting to mention that such a stimulating effect of uncertainty on investment has also been identified for R&D by Atanassov et al. (2018) and Stein and Stone (2013). Similarly, Mohn and Misund (2009) conclude that uncertainty has a stimulating effect on investment in oil and gas sectors and Marmer and Slade (2018) show that greater uncertainty encourages the opening of new mines for the U.S. copper mining market. The authors explain this result by the timing of these specific investments; consistently with Bar-Ilan and Strange (1996) who show that investment lags reverse the standard result of the literature on adverse effects of uncertainty on investment surveyed by Dixit (1992) and Pindyck (1991). FDI may share some features with these types of investment which would explain why they react positively with uncertainty for the most performing firms in our sample.

The remainder of the paper is organized as follows. Section 3 describes the construction of our novel affiliate-level data-set of French outward FDI flows and assets abroad and detail the methodology used to compute an uncertainty proxy based on the dispersion of the idiosyncratic performance of French Multinational Firms (MNF). Section 4 provides our empirical results concerning the effects of uncertainty on FDI and Section 5 a set of robustness tests. The model is presented and simulated in the Section B of the Appendix. Section 6 concludes.

2 Data

This section presents the data and the methodology to construct the measure of uncertainty.

2.1 Direct Investment Assets and Income data

Our data on Foreign Direct Investments come from highly disaggregated data available at the Banque de France. Those databases are provided by the Direct Investment Unit of the Statistical General Directorate with the primary goal of producing and publishing each year the Balance of Payment and International Investment Position.

Most of the information is obtained from an annual survey performed by the regional branches of the Banque de France. It covers French companies with assets, in France or abroad over €10M, and a direct financial link (at least 10 % of the invested firm's capital) to at least one foreign company. The parent company then has to report assets for every subsidiary for which it owns more than €5M in capital or whose acquisition cost was greater than €5M. The Direct Investment Service estimates that the uncollected data below the threshold represent less than 0.5 % of total stocks. In addition to this annual survey, the parent company must systematically report flows to and from its affiliate no later than 20 days after each transaction. We discard Direct Investment debt and cash instruments, for which income data became available only in 2012, to consider only investment in equity capital.[6]

This process generates two separate databases for flows and assets, each with a slightly different level of granularity and without an explicit identifier for the affiliates abroad. To merge them together, we match any flows and assets from a given French parent company into a given sector-country as if they belonged to the same national foreign affiliate. Sectors are defined using the 4-digit NAF code. Holdings are assigned, whenever available, the NAF equivalent of their Industrial Classification Benchmark (ICB).

To compute our measure of dispersion, we restrict the sample to countries where at least 15 French MNF are active every year. We do so to reduce the influence of potential outliers when computing the standard-deviations. The final data-set includes over 41000 observations in 38 countries between 2000 and 2015. On average, we follow about 1300 French parent companies and 3800 affiliates every year.

2.2 Direct Investment Returns

Thereafter, the letter $t = \{1, ..., T\}$ corresponds to the year, the letter $s = \{1, ..., S\}$ to the French parent firm, the letter $j = \{1, ..., J\}$ to the country, and the letter $k = \{1, ..., K\}$ to the sector. The

[6]Moreover, Blanchard and Acalin (2016) detail the strong correlation between the flows of FDI coming in and out of a country. They show that this high correlation represents flows that are just passing through rather than the acquisition of a lasting interest in a resident enterprise according to the IMF definition of a FDI. Focusing only on equity flows should give us a better measure of MNFs exposure to country-specific uncertainty.

intersection of those last three groups is the affiliate indexed with the letter $a = \{s, j, k\}$ – since there is a single affiliate a of the parent s in the country j and the sector k.

In order to build our measure of uncertainty, we compute the Returns On Investment (ROI, hereafter) of the foreign affiliates of French firms. We use the income paid (I, hereafter) by the affiliate a to its parent company in year t. We include both dividends paid to the parent company and earnings re-invested into the affiliate (D42 and D43 in the System of National Account 2008 respectively). We normalize the income over the amount of equity invested into the affiliate by the parent company up to year $(t-1)$:

$$ROI_{a,t} = \frac{I_{a,t}}{COF_{a,t-1}} \tag{1}$$

where the denominator COF stands for the Cumulative sum of Out-Flows from the parent firm to its affiliate, which is itself constructed as follows:

$$COF_{a,t} = FA_{a,0} + \sum_{\tau=1}^{t} NOF_{a,\tau} \tag{2}$$

where $FA_{a,0}$ corresponds to the initial market value of the stock of equity of affiliate a, i.e. the *Financial Assets*, and $NOF_{a,\tau}$ to the Net Out-Flows as of time τ. Those variables includes all equity labeled with an F511 or F512 SNA2008 code (acquisition of equity, listed and unlisted respectively). $NOF_{a,\tau}$ also includes disinvestment & repatriation that appear as a negative FDI flow. The market value of equity is used only to get the initial value of the stock. Any fluctuations in COF originates from changes in FDI decisions by the parent firm and not in valuation effects. Finally, we exclude cases of negative assets and non plausible rate of returns, which are any rates below -100% and above 100%.[7] Table 1 provides summary statistics of our database.

[7]This threshold also happens to be in line with the most common practice in the finance literature. For example, the threshold is 25% in Morck et al. (2000), 75% in Boutchkova et al. (2012), and 200% in Dang et al. (2015).

Table 1: Summary Statistics

	N	Mean	P10	P50	P90	Std.Dev.
Panel A Affiliate-level						
Affiliate Assets$_{a,t}$ (Mn.)	55021	180.47	0.90	15.65	254.98	1009.58
Affiliate Flows$_{a,t}$ (Mn.)	55021	8.30	-3.30	0.17	12.22	229.08
$ROI_{a,t}$ (%)	55021	9.90	-8.94	5.23	39.81	24.66
Δ COF$_{a,t}$ $\times$ 100	49869	3.37	-19.39	2.15	30.94	45.40
Panel B Firm-level						
Affiliates per firm	19387	2.97	1.00	2.00	7.00	3.43
Parent Firm Assets$_{s,k,t}$ (Mn.)	19387	521.94	2.52	37.31	818.76	2567.50
Parent Firm Flows$_{s,k,t}$ (Mn.)	19387	33.00	-5.34	0.66	46.61	426.55
Panel C Country-level						
Affilates per country	570	102.48	27.00	62.00	267.50	95.57
French Assets$_{j,t}$ (Bn.)	570	17.89	0.72	3.92	50.73	33.19
French Flows$_{j,t}$ (Bn.)	570	1.26	-0.01	0.29	3.04	3.54
Panel D Year-level						
Affilates per year	15	3894.27	2931.00	3782.00	4690.00	909.63
French Assets$_t$ (Bn.)	15	679.83	430.22	688.85	957.81	210.41
French Flows$_t$ (Bn.)	15	47.83	30.48	48.42	68.65	16.39

NOTE: Banque de France FDI databases, authors' computation. Mn. indicates millions of Euros and Bn. billions of euros.

2.3 Measuring Uncertainty on FDI Return

Our estimate of uncertainty is based on the following two-step procedure. The first step consists in removing the forecastable component of the variation of affiliates' returns. The forecasting model of returns merge the portfolio approach of Boutchkova et al. (2012) for returns and the methodology implemented by Bloom et al. (2018) for productivity. We break returns into a first component explained by a set of regressors and a second unexplained component, the residuals, as follows

$$ROI_{a,t} = \gamma_1 ROI_{a,t-1} + \gamma_2 ROI_t + \gamma_3 ROI_{j,t} + \gamma_j \times \gamma_k + \gamma_s + u_{a,t} \quad (3)$$

where $ROI_{a,t}$ is the yearly return of affiliate $a = \{s, j, k\}$ as of time t; $\gamma_j \times \gamma_k$ capture time invariant country-sector specific heterogeneity while γ_s capture firm characteristics of the parent company. The variables ROI_t and $ROI_{j,t}$ are, respectively, the average world and country$-j$

returns of French MNF in period t. We compute them as follows:

$$ROI_t = \frac{1}{A_t} \sum_{a \in t}^{A_t} ROI_{a,t}, \tag{4}$$

and

$$ROI_{j,t} = \frac{1}{A_{j,t}} \sum_{a \in j}^{A_{j,t}} ROI_{a,t} \tag{5}$$

where A_t and $A_{j,t}$ are counters for the total number of affiliates in year t and country j in year t, respectively.

We present the results of this first stage, equation (3), in Table 2. As expected, returns are persistent (the coefficient of lagged returns is equal to 0.330 and significantly different form zero) and highly correlated with the aggregate country and world returns. The systematic component explains 28% of the variance of returns. We interpret the residuals as the idiosyncratic returns (Boutchkova et al., 2012).

Table 2: 1st Stage Results

	$ROI_{a,t}$ (%)
$ROI_{a,t-1}$ (%)	0.330***
	(0.00)
Country average ROI	0.277***
	(0.00)
World average ROI	0.252***
	(0.00)
Constant	0.653
	(0.34)
Sector X Country FE	Yes
Parent Firm FE	Yes
Observations	44018
Adjusted R^2	0.283

p statistics in parentheses, with robust SE.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In the second step, we calculate the country-specific moments of French affiliates idiosyncratic returns as follows:

$$\texttt{MEAN}_{j,t} = \frac{1}{A_{j,t}} \sum_{a \in j}^{A_{j,t}} \hat{u}_{a,t} \tag{6}$$

where $\hat{u}_{a,t}$ denotes the residuals from the estimation of equation (3), and

$$\texttt{DISP}_{j,t} = \left[\frac{1}{A_{j,t} - 1} \times \sum_{a \in j}^{A_{j,t}} (\hat{u}_{a,t} - \texttt{MEAN}_{j,t})^2 \right]^{1/2} \tag{7}$$

where $\texttt{DISP}_{j,t}$ measures the dispersion of the residuals, e.g. how widely uninformative fundamentals are to predict firm specific returns. Throughout this paper, we will use $\texttt{DISP}_{j,t}$ as our proxy for time varying uncertainty over the idiosyncratic returns of French MNF in country j. In Section 5.1, we will extend our analysis to the third moment of the residual distributions, namely the skewness, defined as follows

$$\texttt{SKEW}_{j,t} = \frac{\frac{1}{A_{j,t}} \times \sum_{a \in j}^{A_{j,t}} (\hat{u}_{a,t} - \texttt{MEAN}_{j,t})^3}{\left[\frac{1}{A_{j,t}-1} \times \sum_{a \in j}^{A_{j,t}} (\hat{u}_{a,t} - \texttt{MEAN}_{j,t})^2 \right]^{3/2}} \tag{8}$$

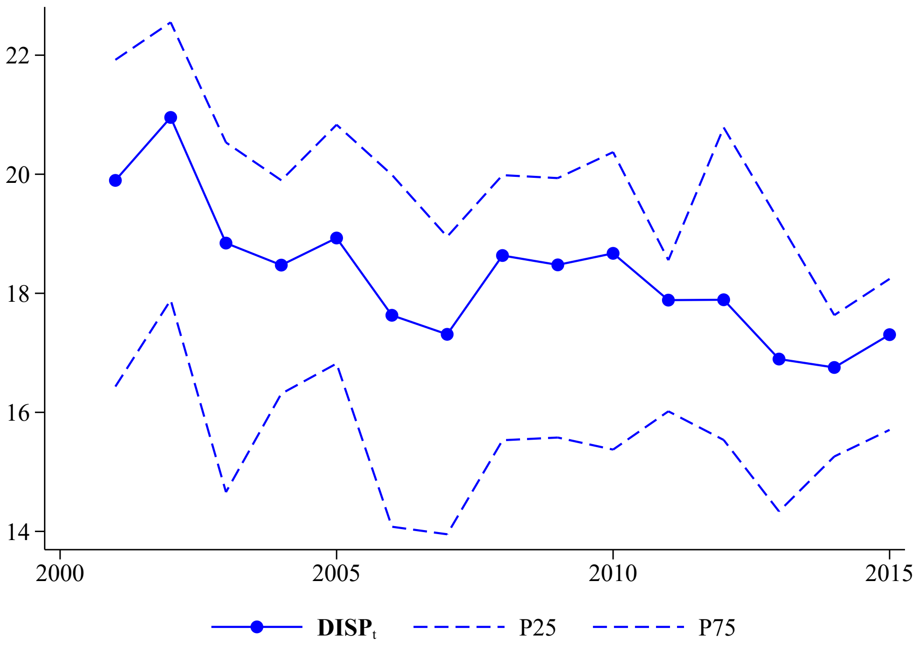
The interest of the skewness is to consider asymmetric changes in risk as suggested by Ordonez (2013), Orlik and Veldkamp (2014), Bloom et al. (2016), and Ruge-Murcia (2017) among others – see Section 5.1 for more information.

2.4 Stylized Facts

The mean value of the uncertainty is 18.04 for the panel of 570 year-country observations, but it varies substantially across time, countries, and sectors. Figure 1 shows the mean value of FDI uncertainty for each year between 2001 and 2015. Uncertainty has declined from 2002 to 2007, just before the financial crisis, and then increased between 2008 and 2009. Afterwards, it has decreased once again to recover the pre-crisis level. This pattern is close to that of the VIX[8], but with notable differences (Figure A.1 in the appendix compares the two measures). Besides, the interest of our measure of uncertainty is to vary across countries and sectors contrary to the

[8]The VIX is the implied volatility on the US stock market and is widely used as a worldwide measure of uncertainty.

Figure 1: FDI Return Uncertainty



NOTE: This figure presents the yearly average, P25 and P75 of our measure of uncertainty for all countries, where the dispersion by country $\mathtt{DISP}_{j,t}$ is defined by equation (7).

VIX index.

Dispersion across countries is quite large – the mean value of uncertainty by country is reported in Table 3. It varies from 12.79 in Tunisia to 22.21 in Russia. Interestingly, the dispersion does not seem related with the level of development. Uncertainty is high in some emerging economies as Russia (but also in Romania or India), as we should expect, but very low in Tunisia (but also in Thailand or South Korea). Actually, we do not find a significant correlation between uncertainty and the real GDP per capita in our data. It is worth mentioning, that we are not considering here the variance of realized returns but the variance of the idiosyncratic component of returns after we control for country average returns and country(-sector) fixed effects – see equation (3). Figure A.2 shows that the orthogonalization procedure was successful. The second moment of the idiosyncratic performance shocks is less correlated with country fundamental economic characteristics than the second moment of the raw returns. It validates the use of $\mathtt{DISP}_{j,t}$ as an exogenous source of uncertainty that we can causally identify.[9]

[9]Moreover, if we omit this procedure, the response function of FDI to the dispersion of the raw returns exhibits some evidence of pre-trend issue.

Table 3: FDI Return Uncertainty

	Affiliate-Year	Return Uncertainty	P25	P75
ARG	664	18.44	13.07	24.71
AUS	987	18.84	16.71	20.93
AUT	591	18.19	14.56	21.34
BEL	4050	16.15	13.92	18.04
BRA	1602	19.00	16.41	21.41
CAN	1450	16.34	14.23	17.91
CHE	2302	18.72	16.83	20.59
CHN	1573	19.18	17.45	20.27
CIV	405	15.91	13.15	17.09
CZE	959	19.17	15.53	24.67
DEU	4109	19.17	17.63	19.85
DNK	480	15.87	11.31	17.43
ESP	4702	18.19	17.41	18.95
FIN	303	17.07	13.08	21.67
GBR	4316	17.02	15.26	18.08
GRC	499	18.47	16.81	22.06
HKG	852	19.55	17.88	21.86
HUN	720	17.73	15.52	19.68
IND	746	20.15	18.24	21.10
IRL	699	18.37	16.03	20.47
ITA	3725	19.61	17.07	21.81
JPN	885	19.71	15.96	22.17
KOR	628	14.17	12.25	15.70
LUX	1404	15.08	13.65	16.05
MAR	844	17.54	15.49	18.62
MEX	780	17.41	13.93	20.51
NLD	2744	16.93	14.77	18.21
POL	1562	17.41	15.38	18.73
PRT	1374	20.68	19.68	21.48
ROU	555	21.11	18.08	22.62
RUS	669	22.21	17.74	25.63
SGP	918	19.88	17.34	22.96
SWE	781	19.10	15.48	20.27
THA	379	16.67	11.60	17.58
TUN	447	12.79	9.56	15.23
TUR	740	19.74	17.36	20.37
USA	4104	17.07	15.58	18.07
ZAF	473	17.91	13.68	20.19
Total	55021	18.03	15.71	20.09

NOTE: Countries with at least 15 affiliates per year. Idiosyncratic Returns are based on the residuals from estimating Equation 3.

3 Impact of FDI Return Uncertainty on FDI Flows

This section investigates the effect of uncertainty on the direct investment activity of French MNFs.

3.1 Baseline Regressions

Our baseline regression specification is as follows:

$$\Delta COF_{a,t} = \alpha_1 X_{j,t} + \alpha_2 X_{s,t-1} + \alpha_3 X_{a,t-1} + \beta_1 \mathtt{DISP}_{j,t} + \gamma_a + \gamma_t \times \gamma_k + \varepsilon_{a,t} \tag{9}$$

where $\Delta COF_{a,t}$ is the log difference of the cumulative stock of the affiliate $a = \{s, j, k\}$ – owned by the parent firm s in the sector k of the country j – as of time t.[10] As in Julio and Yook (2016) we use the log difference of the cumulative FDI position to avoid the issue of taking the logarithm of negative flows. All the regressions include country level controls $X_{j,t}$ for GDP growth, exchange rates changes, GDP per capita, trade openness and stock market return as in Julio and Yook (2016) – see the section A.1 for data construction. We also include a vector of lagged parent company controls $X_{s,t-1}$ to capture relevant firm characteristics for investment (e.g. Gilchrist and Himmelberg (1995) and Gala and Julio (2016)): the log of the total direct investment assets owned by the parent-firm to control for its size; the total number of foreign affiliates owned by the parent-firm to proxy alternative investment opportunities; and finally the parent-firm average return on investment to proxy the marginal return to capital. We add a vector of lagged affiliate characteristics $X_{a,t-1}$ to control for its financial constraint and investment opportunities: the size of the affiliate assets and its returns on investment. Finally, we follow Kovak et al. (2017) for the fixed effect structure: γ_a is an affiliate fixed effect that allows us to control for affiliates unobservable time-invariant characteristics, including its country and sector; $\gamma_t \times \gamma_k$ is a year by sector fixed effect that captures the business cycle of the sector.

The first column of Table 4 reports the estimation results of our baseline regression. The

[10] We cluster standard errors at the country level. Any other reasonable choice of clustering provides standard errors of similar size.

Table 4: Idiosyncratic Uncertainty and FDI. Direct Effect and Effect Conditional on Parent Company Past Performance

	Δ COF$_{a,t}$ × 100			
	(1)	(2)	(3)	(4)
		Performance		
	All Sample	Low	Medium	High
log GDP/cap.$_{j,t}$	8.884***	-9.197	27.485***	12.476***
	(2.837)	(7.825)	(5.623)	(2.425)
Δ GDP$_{j,t}$	22.899	50.352	-12.642	13.954
	(16.671)	(40.692)	(29.072)	(14.216)
Δ FX$_{j,t}$	-16.304***	-10.533	-14.914*	-24.066***
	(3.799)	(8.309)	(8.136)	(5.504)
Trade Openness$_{j,t}$$(\%GDP)$	-0.039	-0.107**	0.006	0.003
	(0.034)	(0.049)	(0.062)	(0.036)
Stock Market Return$_{j,t}$	-0.006	0.020	-0.042	0.007
	(0.014)	(0.031)	(0.047)	(0.030)
log Parent Assets$_{s,k,t-1}$	0.776	0.924	1.034	-0.630
	(0.639)	(1.290)	(1.290)	(1.026)
Parent Performance$_{s,k,t-1}$	0.117**	0.429*	0.822*	0.192**
	(0.052)	(0.239)	(0.442)	(0.079)
Nb. of Foreign Affiliates$_{s,k,t-1}$	-0.054	0.201	-0.029	-0.107
	(0.138)	(0.408)	(0.369)	(0.171)
log Affiliate Assets$_{a,t-1}$	-6.359***	-5.233***	-5.912***	-9.316***
	(0.651)	(1.727)	(1.143)	(1.043)
Affiliate Performance$_{a,t-1}$ (%)	0.080***	0.018	0.080**	0.082***
	(0.026)	(0.055)	(0.037)	(0.029)
DISP$_{j,t}$	-0.213***	-0.434**	-0.243	-0.128
	(0.073)	(0.182)	(0.154)	(0.099)
Affiliate FE	Yes	Yes	Yes	Yes
Sector × Year FE	Yes	Yes	Yes	Yes
Observations	39499	10820	9266	17812
R^2	0.302	0.388	0.355	0.324
Effect in pcp. of an IQR shift:				
- DISP$_{j,t}$	-0.904	-1.837	-1.026	-0.544
- Δ GDP$_{j,t}$	0.582	1.234	-0.336	0.364

NOTES: We report standard errors clustered at the country level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; a, s, k, j and t indexes affiliates, parent-firms, sectors, countries and years respectively.
We estimate the results above on a sample of 3056 French parent companies and their 10474 foreign affilates between 2001 and 2015 in 38 countries. See Section 3.3 for the construction of DISP$_{j,t}$. The last two lines present the contrasts of shifting from the 25th percentile of the distribution of the selected variable to the 75th while holding other variables constant at their mean value.

coefficient β_1 of our variable of interest $\texttt{DISP}_{j,t}$ is negative, equal to -0.002, and significant at the one percent level. The sign of the coefficient is consistent with the literature on the adverse effects of uncertainty on investment. The magnitude of this estimated effect is substantial. Indeed, shifting from the 25th percentile of the distribution of uncertainty to the 75th percentile results in a 0.904 (s.e.= 0.412) points of percentage reduction in FDI growth rate – that is approximately one quarter of the average growth rate of FDI in our data, namely 3.37%. As a comparison, a similar shift in the distribution of GDP growth rate implies a 0.582 points of percentage increase in FDI growth rate.[11]

When it comes to the control variables, as expected an increase in the GDP growth rate of the destination country is associated with a higher flow of FDI to this country. The coefficient for Trade Openness is negative but not significantly different from zero at the 10% level. Depreciation of the local currency (that is a positive variation of the real FX rate) is associated with lower FDI. The sign and significance of the coefficients for parent company and affiliate characteristics provides an interesting complement to the results from Gala and Julio (2016): the negative coefficient of the size of the affiliate reflects the diminishing returns of investment opportunities rather than financial constraints. The positive but non statistically significant coefficient of the size of the parent company (after controlling for lagged returns) would indicate that financial constraints do not play a major role in the FDI of multinational firms. The coefficients of other control variables for parent company (returns on investment and number of affiliates) are not significantly different from zero.

We supplement our results with the Local Projection method of Jordà (2005)[12] to assess the persistence of the adverse effect of uncertainty on FDI. This is important with regards to the rebound effect associated with the wait and see mechanism highlighted by Bernanke (1983) and Bloom (2009). The initial negative effect should not be persistent and then turn positive,

[11] We have also tested the effect of the lagged values of uncertainty, that is using $\texttt{DISP}_{j,t-1}$ instead of $\texttt{DISP}_{j,t}$ in our benchmark regressions. Lagged uncertainty shocks have no significant effects on cross-border investment. This is consistent with the fact that our measure of uncertainty exhibit a very low degree of persistence. It can also be related with Julio and Yook (2016) who show that the effect of uncertainty on FDI occurs mainly within the election years; years before elections are not associated with a fall in foreign investments.

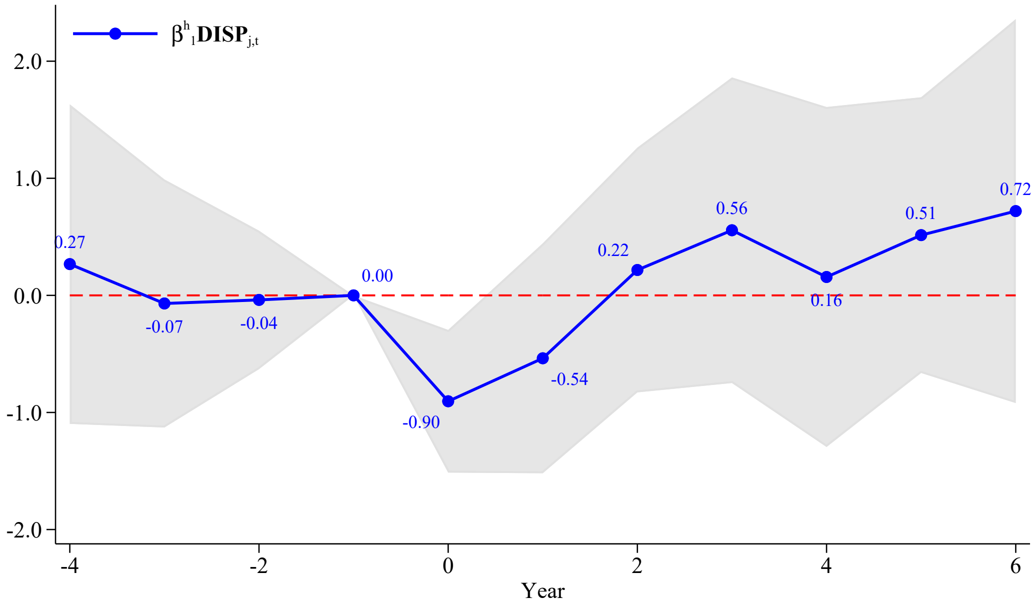
[12] See Crouzet et al. (2017) and Favara and Imbs (2015) for recent applications of Local Projection method to micro data.

reflecting the wait and see pattern documented by Julio and Yook (2016). We estimate the following equation:

$$\Delta COF_{a,t+h} = \alpha_1^h X_{j,t} + \alpha_2^h X_{s,t-1} + \alpha_3^h X_{a,t-1} + \beta_1^h \texttt{DISP}_{j,t} + \gamma_a^h + \gamma_t^h \times \gamma_k^h + \varepsilon_{a,t+h} \tag{10}$$

where h is the horizon of projection. Figure 2 shows the results. The sign of the coefficient remains negative for up to two years and turns positive until the end of the five year window, however it is not significantly different from zero at these horizons. Backward projections in Figure 2 show the absence of a pre-trend. There is no ex-ante effect depending on the intensity of the treatment.[13]

Figure 2: Affiliate Outcome Path Following an Interquartile Shift in the Distribution of Uncertainty



NOTE: This Figure presents estimates of β_1^h (scaled up by a 100 times an Interquartile Range shift of $\texttt{DISP}_{j,t}$) from estimating this equation for $h \in \{-4, 6\}$: $\Delta COF_{a,t+h} = \alpha_1^h X_{j,t} + \alpha_2^h X_{s,t-1} + \alpha_3^h X_{a,t-1} + \beta_1^h \texttt{DISP}_{j,t} + \gamma_a^h + \gamma_t^h \times \gamma_k^h + \varepsilon_{a,t}$. 95% error bands are displayed in gray with standard errors clustered at the country level.

[13]The pre-trends also appear to be parallel for the various groups of size and performance. It will also be the case in 3 and A.3, see below.

3.2 The role of firm ex-ante performances

Insights from the trade and uncertainty literature suggest that firms react heterogeneously to increased volatility. To test whether the effect of uncertainty may be caused by a heterogeneous reactions across firm characteristics, we replicate our baseline regressions (9) and (10) for split samples, i.e. the sub-samples of firms grouped according to their ex-ante characteristics. Barrero et al. (2017) and Patnaik (2016) also use split-sample analyses to assess the effect of uncertainty according to the level of firm leverage and to the degree of competition, respectively.[14] We focus here on the role of firm ex-ante performances and estimate the following equation:

$$\begin{aligned} \Delta COF_{a,t+h} = & \sum_{g \in \Gamma} \left(\alpha^h_{1,g} X_{j,t} + \alpha^h_{2,g} X_{s,t-1} + \alpha^h_{3,g} X_{a,t-1} + \beta^h_{1,g} \mathtt{DISP}_{j,t} \right) \mathbf{1}_{\{a \in \Gamma^g_t\}} \\ & + \gamma^h_a + \gamma^h_t \times \gamma^h_k + \varepsilon_{a,t+h} \end{aligned} \tag{11}$$

for $h \in \{-4, 6\}$ period ahead. Where Γ are firms groups based on their ex-ante performance:

$$\begin{cases} \Gamma^{(g=low)}_t & = \Gamma^{(P0,P40)}_t \\ \Gamma^{(g=medium)}_t & = \Gamma^{(P40,P60)}_t \\ \Gamma^{(g=high)}_t & = \Gamma^{(P60,P100)}_t \end{cases}$$

Columns (2)-(4) in Table 4 report the estimation results for $h = 0$ and Figure 3 presents the estimates of the coefficient β^h_1 of Equation (11) for various horizon h.

For most control variables, coefficients share the same sign and level of significance for the three groups of firms. When it comes to our main variable of interest, $\mathtt{DISP}_{j,t}$, the coefficient is significant only for firms with ex-ante low performances and substantially higher than estimated in average. Shifting from the 25th percentile of the distribution of uncertainty to the 75th percentile results in a reduction of FDI growth rate twice higher for these firms when compared

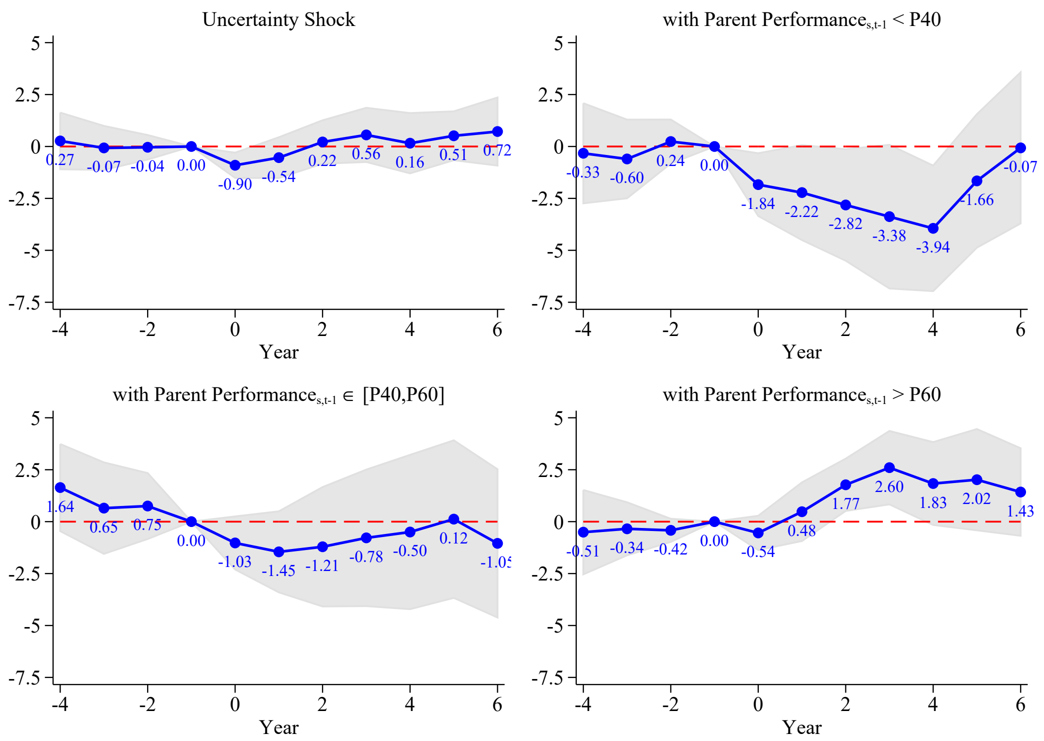
[14]See Zwick and Mahon (2017) for a split sample analysis of the effect of taxes on investment according to firm size.

with the full sample, e.g. a reduction of −3.38 of percentage points against −0.904.

Inspecting the dynamic responses in Figure 3 reveals a greater heterogeneity in the effects of uncertainty shocks on firms. The negative impact of return uncertainty for firms in the bottom 40% of the distribution becomes even more dramatic four years after the shock with a reduction of −3.94 percentage points in the FDI growth rate. Then, the impact becomes not significantly negative for higher horizons. The effect of uncertainty shocks turns out to be positive for the most performant firms (and significantly different from zero) two and three years after the shocks with a peak of 2.60 percentage points. These heterogeneous effects produce a huge gap of almost 6 points of percentage in FDI growth rate between most and less performing firms three years after the shocks.[15] Since we consider FDI growth rates, this transitory divergence between firms results in permanent divergence in the stock of assets held abroad. We find that most of the persistence is explained by the lack of recovery from the lower performing parent firms. Lastly, it is interesting to observe that the wait-and-see pattern observed for the entire sample of parent companies (e.g. the rebound effect) is actually driven by the heterogeneity of firm reactions to uncertainty.

[15] We also test the coefficient of the interaction of $\mathtt{DISP}_{j,t}$ and a dummy variable indicating that the firm belongs to the bottom 40 percent of past performance. We find that the slope of $\mathtt{DISP}_{j,t}$ for the low performance group is negative and statistically significant relative to the other group. The pattern of the response mostly matches that of our key result in Figure 3 (bottom and top right panel).

Figure 3: Affiliate Outcome Path Following an Interquartile Shift in the Distribution of Uncertainty Conditional on Parent Company Past Performance



NOTE: This Figure presents estimates of $\beta^h_{1,g}$ (scaled up by a 100 times an Interquartile Range shift of $\texttt{DISP}_{j,t}$) from estimating this equation for $h \in \{-4, 6\}$: $\Delta COF_{a,t+h} = \sum_{g\in\Gamma}(\alpha^h_{1,g}X_{j,t} + \alpha^h_{2,g}X_{s,t-1} + \alpha^h_{3,g}X_{a,t-1} + \beta^h_{1,g}\texttt{DISP}_{j,t})\mathbf{1}_{\{a\in\Gamma^g_i\}} + \gamma^h_a + \gamma^h_t \times \gamma^h_k + \varepsilon_{a,t}$. 95% error bands are displayed in gray with standard errors clustered at the country level. The left panel includes the entire sample, The top left panel includes the entire sample, the next three panels includes only the affiliates of parent companies which were, respectively, in the bottom 40%, middle 20% and top 40% of the performance distribution the year before.

4 Robustness

We attempt various comparison and validation exercises.

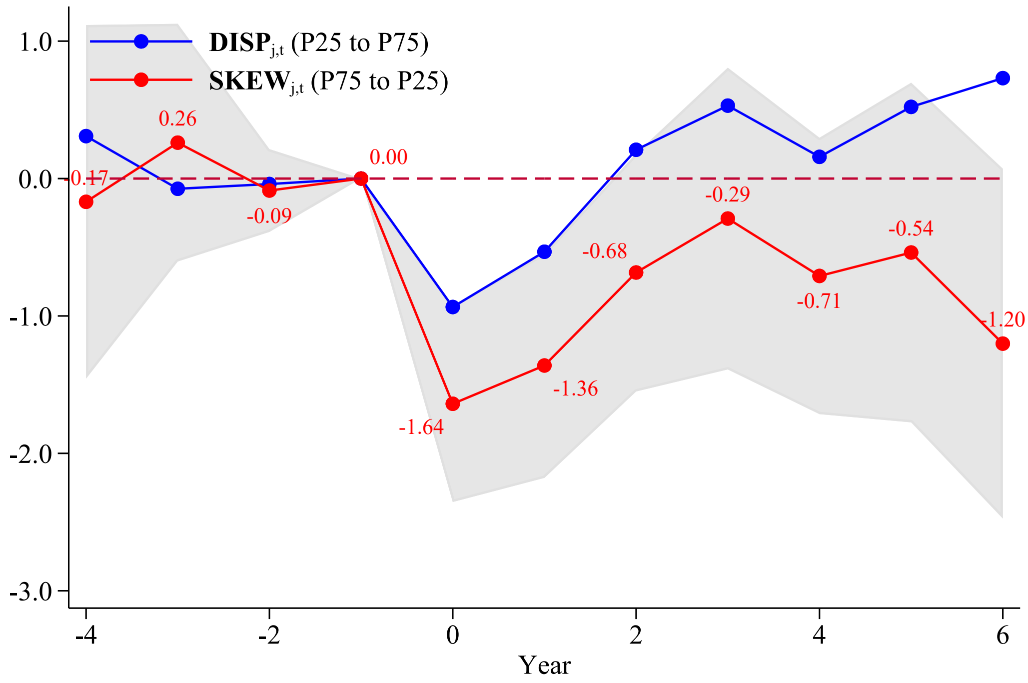
4.1 Asymmetric Uncertainty

This section investigates the effects of asymmetric uncertainty. Our benchmark measure of uncertainty is based on the second order moment of the distribution of shocks to FDI returns. An increase in uncertainty is symmetric shift of the two sides of the distribution. We can generalize our methodology to consider asymmetric shifts of the distribution in two different ways.

First, we can consider higher moments of the distribution such as the skewness (the third order moment). The interest of the skewness is to consider asymmetric changes in risk, while our measure $\texttt{DISP}_{i,j}$ consists in symmetric changes for the two sides of the distribution. Indeed, a fall in the skewness corresponds to a relative increase in the probability of extremely bad realizations of shocks. By investigating the effects of skewness shocks on FDI, we contribute to the growing literature on the skewness dynamics in business and financial cycles (e.g. Ordonez, 2013; Orlik and Veldkamp, 2014; Bloom et al., 2016; Ruge-Murcia, 2017). Table 5 extends our baseline regression by including the $\texttt{SKEW}_{j,t}$ of the distribution as an explanatory variable. In column (1), we introduce both $\texttt{DISP}_{j,t}$ and $\texttt{SKEW}_{j,t}$ as explanatory variables while in column (2) only $\texttt{SKEW}_{j,t}$ is introduced. Our estimates of β_1 is robust to the inclusion of $\texttt{SKEW}_{j,t}$ as an additional control variables: the coefficient of $\texttt{DISP}_{j,t}$ (column 1 in Table 5) is slightly lower when compared to that of reported in column (1) of Table 4, but still highly significantly different from zero. Column (1) suggests that the magnitude of the impact of $\texttt{SKEW}_{j,t}$ on FDI is stronger than that of $\texttt{DISP}_{j,t}$. An interquartile range shift of the skewness generates a variation of 1.645 points of percentage of the FDI growth rate. It is twice higher than the effect of a similar shift of the dispersion, namely 0.844. This estimate of the impact of skewness shocks is roughly unchanged when we drop $\texttt{DISP}_{j,t}$ from the regression – see column (2) in Table 5. Figure 4 compares the dynamic effects of an decrease in $\texttt{SKEW}_{j,t}$ with that of an increase in $\texttt{DISP}_{j,t}$ depicted in 3. An interquartile range shift of the skewness generates a stronger and more persistent response of cross-border investments than a similar shift of the dispersion of shocks.

The second way to consider asymmetric change in uncertainty is to split the sample of $\texttt{DISP}_{j,t}$ into good and bad uncertainty as suggested by Bollerslev et al. (2017). We use the country-year mean of the residuals $u_{a,t}$ to make the distinction between good and bad uncertainty. Country-year dyads where the mean of the performance shocks is positive are assigned to the first group and country-year dyads with negative performance shocks on average are assigned to the second one.

Figure 4: Affiliate Outcome Path Following an Interquartile Shift in the Distribution of Skewness



NOTE: This Figure presents estimates of β_1^h (scaled up by a 100 times an Interquartile Range shift of $\texttt{DISP}_{j,t}$) and β_2^h (scaled up by a 100 times an Interquartile Range shift of $\texttt{SKEW}_{j,t}$) from estimating those equations for $h \in \{-4, 6\}$: $\Delta COF_{a,t+h} = \alpha_1^h X_{j,t} + \alpha_2^h X_{s,t-1} + \alpha_3^h X_{a,t-1} + \beta_1^h \texttt{DISP}_{j,t} + \gamma_a^h + \gamma_t^h \times \gamma_k^h + \varepsilon_{a,t}$. and $\Delta COF_{a,t+h} = \alpha_1^h X_{j,t} + \alpha_2^h X_{s,t-1} + \alpha_3^h X_{a,t-1} + \beta_2^h \texttt{SKEW}_{j,t} + \gamma_a^h + \gamma_t^h \times \gamma_k^h + \varepsilon_{a,t}$. 95% error bands are displayed in gray with standard errors clustered at the country level.

Results are reported in columns (3)-(4) of the Table 5. The coefficient associated with $\texttt{DISP}_{j,t}$ (column 3) is negative. Its order of magnitude is less than half that of an increase in $\texttt{DISP}_{j,t}$ in the full sample and it is not significantly different from zero. Meanwhile in the sub-sample of countries with a positive mean, the effect is negative and much stronger. If we consider only bad uncertainty, the effect of an interquartile range shift (-1.436) is close to be twice higher than in our benchmark case (-0.904 in column 1 of Table 4).

Considering the skewness or the distinction between good and bad uncertainty highlights the asymmetric impact of uncertainty: rising dispersion on the left side of the distribution (low returns) is more painful than rising dispersion on the right side (high return). This conclusion is consistent with the model developed in Section B based on the role of financial frictions.

Lenders are exposed to default risk in the event of low FDI returns. In the event of high returns, this benefits the multinationals that receive the profits because the debt contract does not index the interest on the profits made. Lenders therefore react logically more strongly to an asymmetric increase in risk (biased towards low returns) than to a symmetric increase in risk, with a stronger increase in the risk premium at the origin of a fall in credit demand and cross-border investments by multinationals.

4.2 The role of firm size

This section investigates the role of firm size in shaping the effect of uncertainty on FDI. Size and performance are generally correlated (at least in theory, e.g. Melitz and Ottaviano (2008)) but that is not the case in our sample. Indeed, the coefficient of correlation between Parent Performance and Parent Size is around 0.06. Therefore, we investigate how firm size influences the effect of uncertainty shocks. Results are reported in Figure A.3 replicate the Figure 3 using regressions (11) for deciles of ex-ante size instead of ex-ante performances. Large firms are not impacted by uncertainty shocks, whatever the horizons, while small firms are strongly and lastingly affected.

4.3 Alternative uncertainty proxies

This section shows the effects of uncertainty shocks on FDI using alternative proxies for uncertainty. Columns (1)-(4) of Table A.2 considers alternatively four alternative measure of uncertainty: the volatility of the local stock market, the country measure of Economic Policy Uncertainty, the Foreign Exchange rate return Volatility, and finally the average one-year ahead forecast errors of the IMF.

The estimated coefficient is significantly different from zero only for foreign exchange rate volatility. As explained by Jeanneret (2016) the sign of the relation between FX volatility and FDI is actually both theoretically and empirically ambiguous. Interestingly, inspecting the dynamic effects of FX uncertainty confirms the importance of firm heterogeneity. Figure

Table 5: Asymmetric Uncertainty and FDI.

	Δ COF$_{a,t} \times 100$			
	(1)	(2)	(3)	(4)
	All Sample		MEAN$_{j,t}$	
			≥ 0	≤ 0
log GDP/cap.$_{j,t}$	8.849***	8.249***	2.186	11.178***
	(2.753)	(2.840)	(5.245)	(3.496)
Δ GDP$_{j,t}$	26.667	30.021*	53.348*	11.988
	(16.013)	(15.901)	(29.095)	(19.580)
Δ FX$_{j,t}$	-16.175***	-14.993***	-15.906*	-11.376**
	(4.070)	(4.035)	(8.084)	(4.476)
Trade Openness$_{j,t}$(%*GDP*)	-0.041	-0.039	-0.030	-0.042*
	(0.035)	(0.035)	(0.054)	(0.021)
Stock Market Return$_{j,t}$	-0.018	-0.012	0.003	-0.056**
	(0.016)	(0.016)	(0.020)	(0.021)
log Parent Assets$_{s,k,t-1}$	0.751	0.735	0.074	0.986
	(0.645)	(0.643)	(0.880)	(1.024)
Parent Performance$_{s,k,t-1}$	0.117**	0.117**	0.211**	-0.028
	(0.052)	(0.052)	(0.097)	(0.063)
Nb. of Foreign Affiliates$_{s,k,t-1}$	-0.056	-0.054	-0.127	-0.194
	(0.139)	(0.139)	(0.226)	(0.172)
log Affiliate Assets$_{a,t-1}$	-6.328***	-6.335***	-5.401***	-6.907***
	(0.656)	(0.655)	(0.711)	(1.124)
Affiliate Performance$_{a,t-1}$ (%)	0.082***	0.082***	0.125***	0.077***
	(0.026)	(0.026)	(0.039)	(0.022)
DISP$_{j,t}$	-0.199***		-0.109	-0.353***
	(0.071)		(0.125)	(0.088)
SKEW$_{j,t}$	1.395***	1.418***		
	(0.305)	(0.315)		
Constant	-29.624	-27.009	35.359	-44.608
	(27.084)	(27.678)	(56.284)	(32.568)
Affiliate FE	Yes	Yes	Yes	Yes
Sector × Year FE	Yes	Yes	Yes	Yes
Observations	39499	39499	17120	19055
R^2	0.303	0.303	0.391	0.391
Effect in pcp. of an IQR shift:				
- DISP$_{j,t}$	-0.844		-0.460	-1.436
- SKEW$_{j,t}$	1.645	1.672		

NOTES: We report standard errors clustered at the country level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; a, s, k, j and t indexes affiliates, parent-firms, sectors, countries and years respectively.
We estimate the results above on a sample of 3056 French parent companies and their 10474 foreign affiliates between 2001 and 2015 in 38 countries. See Section 3.3 for the construction of DISP$_{j,t}$. The last two lines present the contrasts of shifting from the 25^{th} percentile of the distribution of the selected variable to the 75^{th} while holding other variables constant at their mean value.

A.4 replicates the Figure 3 using regressions (11) with FX volatility instead of $\texttt{DISP}_{j,t}$. As in our benchmark, high performing firms react positively to an increase in uncertainty while low performing firms experience an important and lastingly reduction in FDI. It is worth mentioning that this effect of exchange rate volatility on FDI does not affect that of the uncertainty previously described. Indeed, the pattern depicted in Figure 2 is almost unchanged when the exchange rate volatility is included among the control variables of equation (9).

Our results for stock price volatility are consistent with Gourio et al. (2016) who report significant effects of uncertainty on total capital inflows who turn out to be non significant when they consider only FDI inflows.[16] We conclude that using micro-data allows us to build a firm-level based measure of uncertainty which may be more relevant than aggregate measures to capture its effects on firms decision.

4.4 Placebo Inference

In the baseline specification, we clustered standard errors at the country level. This provided us with standard errors that are asymptotically robust to serial auto-correlation in the error term. Here we implement Chetty et al. (2009)'s non-parametric permutation test[17] of $\beta_1^h = 0$.

To do so, we randomly reassign the uncertainty time serie across firms and then we re-estimate the baseline regression. We repeat this process 2000 times in order to obtain an empirical distribution of the placebo coefficients $\hat{\beta}_1^{h,p}$. If $\texttt{DISP}_{j,t}$ had no effect on FDI, we would expect our baseline estimate to fall somewhere in the middle of the distribution of the coefficients of the placebo coefficients $\hat{\beta}_1^{h,p}$. Since that test does not rely on any parametric assumption regarding the structure of the error term, it is immune to the over-rejection of the null hypothesis highlighted by Bertrand et al. (2004).

We plot the distribution of the placebo coefficients in Figure A.5. The figure confirms that our coefficients of interest $\beta_1^{h=0}$ (the blue connected markers) lie outside of the [p0.5,p99.5] interval (the light blue lines) of the distribution of placebo coefficients. Meanwhile, the estimates of $\beta_1^{h<0}$

[16] See the column 3 in Table 21 of Gourio et al. (2016)
[17] See Malgouyres et al. (2019) for a more recent application

fall within the bounds of the distribution of placebos. This exercise confirms that uncertainty has a negative effect on firm growth.

We repeat the same exercise for the other key finding of this paper. We randomly permute $\texttt{DISP}_{j,t}$ within the sub-samples of low and high parent company ex-ante performance. Figure A.6 confirms that each estimate of $\beta^{h>0}_{1,g=low}$ lies outside of its $[0.5, 99.5]$ interval of its placebos (the blue lines). Whereas the estimates of $\beta^{h>0}_{1,g=high}$ only fall outside of their intervals (in red) for $h = 3$. Although this estimates are fairly close to the outside of the distribution of the placebos for $h = \{1, 2, 4, 5\}$.

4.5 Specification Sensitivity

We show that the coefficient produced by our specification is not an outlier. We follow a procedure somewhat similar to that of Campbell et al. (2019). We omit 1-by-1 each control variable and plot the results in purple in Figure A.7. Then we test the following list of fixed effects: $s\times m\times jt$; $sm\times jt$; $sm\times t$; $s\times m\times j$; $m\times jt$; $sjm\times t$; $sm\times jm\times t$; t.. All specifications include the two following vectors of controls: $X_{j,t}$ = {GDP per capita, GDP growth, Exchange Rate growth, Trade Openness, Market Return}; $X_{s,t-1}$ = {Size, Performance, Number of Affiliates}. We plot the results in gold in Figure A.7. Our baseline specification falls in the middle of the distribution of the coefficients. There is one outlying result for the specification that does not include any time fixed-effect. Including the contemporaneous level of skewness and/or the lagged value of uncertainty does not change our estimates.

4.6 Sample Sensitivity

Since our sample includes events such as the Great Financial Crisis (2008 and 2009), we wish to check whether our results are robust to the omission of any particular year. We run the same baseline regressions while omitting turn by turn any year between 2001 and 2015. Results are quantitatively and qualitatively the same using these specifications as on the full sample; see the thin blue lines in Figure A.8. This conclusion remains valid when the two years of the

Great Recession 2008-2009 are simultaneously dropped from the regression. Interestingly, it turns out that the adverse effect of uncertainty on FDI is stronger when we consider only the after-crisis period (2010-2015) than if one consider the pre-crisis period (2000-2007). It may be interpreted as pervasive consequences of the Great Recession, even if we should remain cautious given the slight difference in the values of the estimated coefficients for the two sub-samples.

Finally, our estimate is also largely unchanged when taking out any sector (red lines) or country (green lines) including the USA.

5 Conclusion

The main motivation of this study was to extract the information regarding uncertainty that is embedded in FDI assets held abroad by french residents. We build a novel country and time-varying proxy for uncertainty based on the idiosyncratic volatility of the returns of French Foreign Direct Investment assets. Given this measure of uncertainty, we estimate how FDI react to uncertainty by regressing the individual FDI outflows by French MNF on our measure of uncertainty together with a set of relevant control variables and fixed effects.

An innovation in micro-uncertainty has a direct negative short-term impact on firm-level flows to the affected country whereas commonly used proxy for risk/uncertainty fail to explain most or any variation in flows. Following a one interquartile range increase in uncertainty in one country, French MNF decrease the rate of their direct investments to the affected country by as much as 0.904 (s.e.= 0.412) points of percentage. This effect decreases with the performance of the parent firm. Using Local Projections, we show that on average, it has little persistence beyond the initial shock. However, this effect hides strong parent-firm level heterogeneity. Indeed, parent companies with low ex-ante performance never recover while, higher performing parent companies over compensate in the following periods.

Our empirical results suggest a cleansing effect of uncertainty shocks. The literature on cleansing effect demonstrated that during recesssions less productive firms exit from the market while the most productive survive (Caballero and Hammour, 1994; Foster et al., 2016; Osotimehin and Pappadà, 2016; Aghion et al., 2019). We do not directly measure productivity of firms in our database, but if we proxy it by the return of FDI, our results suggest a cleansing effect too. Indeed, several years after an increase of uncertainty in a country, we should expect a higher level of assets held by ex-ante high performing firms and a lower level of assets held by ex-ante low performing firms. Interestingly, this reallocation process appears more important between low and high performing firms than between small and large firms. Further researches should be devoted to understand the mechanisms behind the heterogeneous behavior of firms and the potential role of irreversibilities and financial constraints.

References

Aghion, P., A. Bergeaud, G. Cette, R. Lecat, and H. Maghin (2019). Coase Lecture-the Inverted-U Relationship between Credit Access and Productivity Growth. Economica 86(341), 1–31.

Aizenman, J. and N. Marion (2004). The merits of horizontal versus vertical FDI in the presence of uncertainty. Journal of International economics 62(1), 125–148.

Anderson, E. W., E. Ghysels, and J. L. Juergens (2009). The impact of risk and uncertainty on expected returns. Journal of Financial Economics 94(2), 233–263.

Ang, A., R. J. Hodrick, Y. Xing, and X. Zhang (2006). The cross-section of volatility and expected returns. The Journal of Finance 61(1), 259–299.

Ang, A., R. J. Hodrick, Y. Xing, and X. Zhang (2009). High idiosyncratic volatility and low returns: International and further US evidence. Journal of Financial Economics 91(1), 1–23.

Atanassov, J., B. Julio, and T. Leng (2018). The bright side of political uncertainty: The case of R&D.

Baker, S. R., N. Bloom, and S. J. Davis (2016). Measuring economic policy uncertainty. The Quarterly Journal of Economics 131(4), 1593–1636.

Bar-Ilan, A. and W. C. Strange (1996). Investment lags. The American Economic Review 86(3), 610–622.

Barrero, J. M., N. Bloom, and I. Wright (2017). Short and long run uncertainty. Technical report, National Bureau of Economic Research.

Bernanke, B. S. (1983). Irreversibility, uncertainty, and cyclical investment. The Quarterly Journal of Economics 98(1), 85–106.

Bernanke, B. S., M. Gertler, and S. Gilchrist (1999). The financial accelerator in a quantitative business cycle framework. In J. B. Taylor and M. Woodford (Eds.), Handbook of Macroeconomics, Volume 1 of Handbook of Macroeconomics, Chapter 21, pp. 1341–1393. Elsevier.

Bertrand, M., E. Duflo, and S. Mullainathan (2004). How much should we trust differences-in-differences estimates? The Quarterly journal of economics 119(1), 249–275.

Blanchard, O. and J. Acalin (2016). PB 16-17 What Does Measured FDI Actually Measure?

Bloom, N. (2009). The impact of uncertainty shocks. econometrica 77(3), 623–685.

Bloom, N. (2014). Fluctuations in uncertainty. The Journal of Economic Perspectives 28(2), 153–175.

Bloom, N., M. Floetotto, N. Jaimovich, I. Saporta-Eksten, and S. J. Terry (2018). Really uncertain business cycles. Econometrica 86(3), 1031–1065.

Bloom, N., F. Guvenen, S. Salgado, et al. (2016). Skewed business cycles. In 2016 Meeting Papers, Number 1621. Society for Economic Dynamics.

Bollerslev, T., S. Z. Li, and B. Zhao (2017). Good volatility, bad volatility, and the cross section of stock returns. Journal of Financial and Quantitative Analysis, 1–57.

Boutchkova, M., H. Doshi, A. Durnev, and A. Molchanov (2012). Precarious politics and return volatility. Review of Financial Studies 25(4), 1111–1154.

Caballero, R. J. and M. L. Hammour (1994). The cleansing effect of recessions. The American Economic Review, 1350–1368.

Campbell, D., K. Mau, et al. (2019). Trade Induced Technological Change: Did Chinese Competition Increase Innovation in Europe? Technical report.

Chetty, R., A. Looney, and K. Kroft (2009). Salience and taxation: Theory and evidence. American economic review 99(4), 1145–77.

Christiano, L. J., R. Motto, and M. Rostagno (2014, January). Risk Shocks. American Economic Review 104(1), 27–65.

Crouzet, N., N. R. Mehrotra, et al. (2017). Small and Large Firms Over the Business Cycle. Technical report.

Cushman, D. (1985). Real Exchange Rate Risk, Expectations, and the Level of Direct Investment. The Review of Economics and Statistics 67(2), 297–308.

Dang, T. L., F. Moshirian, and B. Zhang (2015). Commonality in news around the world. Journal of Financial Economics 116(1), 82–110.

De Sousa, J., A.-C. Disdier, and C. Gaigné (2018). Export decision under risk.

Dixit, A. (1992). Investment and hysteresis. The Journal of Economic Perspectives 6(1), 107–132.

Favara, G. and J. Imbs (2015). Credit supply and the price of housing. American Economic Review 105(3), 958–92.

Fernández-Arias, E. and R. Hausmann (2001). Foreign direct investment: Good cholesterol? Inter-American Development Bank, Research Department Working Paper No 417.

Fillat, J. L. and S. Garetto (2015). Risk, returns, and multinational production. The Quarterly Journal of Economics 130(4), 2027–2073.

Foster, L., C. Grim, and J. Haltiwanger (2016). Reallocation in the Great Recession: cleansing or not? Journal of Labor Economics 34(S1), S293–S331.

Gala, V. and B. Julio (2016). Firm Size and Corporate Investment.

Ghosal, V. and P. Loungani (2000). The differential impact of uncertainty on investment in small and large businesses. Review of Economics and Statistics 82(2), 338–343.

Gilchrist, S. and C. P. Himmelberg (1995). Evidence on the role of cash flow for investment. Journal of Monetary Economics 36(3), 541–572.

Goldberg, L. and C. Kolstad (1995). Foreign Direct Investment, Exchange Rate Variability and Demand Uncertainty. International Economic Review 36(4), 855–73.

Gourio, F., M. Siemer, and A. Verdelhan (2016). Uncertainty and International Capital Flows.

Guiso, L. and G. Parigi (1999). Investment and demand uncertainty. The Quarterly Journal of Economics 114(1), 185–227.

Handley, K. and N. Limao (2015). Trade and investment under policy uncertainty: theory and firm evidence. American Economic Journal: Economic Policy 7(4), 189–222.

Handley, K. and N. Limão (2017). Policy uncertainty, trade, and welfare: Theory and evidence for china and the united states. American Economic Review 107(9), 2731–83.

Helpman, E., M. J. Melitz, and S. R. Yeaple (2004). Export versus fdi with heterogeneous firms. American economic review 94(1), 300–316.

Héricourt, J. and C. Nedoncelle (2018). Multi-destination firms and the impact of exchange-rate risk on trade. Journal of Comparative Economics.

Jeanneret, A. (2016, Aug). International Firm Investment under Exchange Rate Uncertainty. Rev. Financ. 20(5), 2015–2048.

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. American Economic Review 95(1), 161–182.

Julio, B. and Y. Yook (2016). Policy uncertainty, irreversibility, and cross-border flows of capital. Journal of International Economics 103, 13–26.

Jurado, K., S. C. Ludvigson, and S. Ng (2015). Measuring uncertainty. The American Economic Review 105(3), 1177–1216.

Kovak, B. K., L. Oldenski, and N. Sly (2017). The labor market effects of offshoring by us multinational firms: Evidence from changes in global tax policies. Technical report, National Bureau of Economic Research.

Lewis, L. T. (2014). Exports versus multinational production under nominal uncertainty. Journal of International Economics 94(2), 371–386.

Malgouyres, C., T. Mayer, and C. Mazet-Sonilhac (2019). Technology-induced Trade Shocks? Evidence from Broadband Expansion in France. CEPR Discussion Papers 13847, C.E.P.R. Discussion Papers.

Marmer, V. and M. E. Slade (2018). Investment and uncertainty with time to build: Evidence from entry into us copper mining. Journal of Economic Dynamics and Control 95, 233–254.

Melitz, M. J. and G. I. Ottaviano (2008). Market size, trade, and productivity. The review of economic studies 75(1), 295–316.

Mohn, K. and B. Misund (2009). Investment and uncertainty in the international oil and gas industry. Energy Economics 31(2), 240–248.

Morck, R., B. Yeung, and W. Yu (2000). The information content of stock markets: why do emerging markets have synchronous stock price movements? Journal of Financial Economics 58(1), 215 – 260. Special Issue on International Corporate Governance.

Ordonez, G. (2013). The asymmetric effects of financial frictions. Journal of Political Economy 121(5), 844–895.

Orlik, A. and L. Veldkamp (2014). Understanding uncertainty shocks and the role of black swans. Technical report, National Bureau of Economic Research.

Osotimehin, S. and F. Pappadà (2016). Credit frictions and the cleansing effect of recessions. The Economic Journal 127(602), 1153–1187.

Patnaik, R. (2016). Competition and the real effects of uncertainty.

Pindyck, R. S. (1991). Irreversibility, uncertainty, and investment. Journal of Economic Literature 29(3), 1110–1148.

Ramondo, N., V. Rappoport, and K. J. Ruhl (2013). The proximity-concentration tradeoff under uncertainty. Review of Economic Studies 80(4), 1582–1621.

Rodrik, D. (1991). Policy uncertainty and private investment in developing countries. Journal of Development Economics 36(2), 229–242.

Ruge-Murcia, F. (2017). Skewness risk and bond prices. Journal of Applied Econometrics 32(2), 379–400.

Russ, K. N. (2012). Exchange rate volatility and first-time entry by multinational firms. Review of World Economics 148(2), 269–295.

Stein, L. C. and E. Stone (2013). The effect of uncertainty on investment, hiring, and r&d: Causal evidence from equity options.

Townsend, R. M. (1979). Optimal contracts and competitive markets with costly state verification. Journal of Economic Theory 21(2), 265–293.

Vicard, V. (2018). The exorbitant privilege of high tax countries. Working paper.

Zwick, E. and J. Mahon (2017, January). Tax policy and heterogeneous investment behavior. American Economic Review 107(1), 217–48.

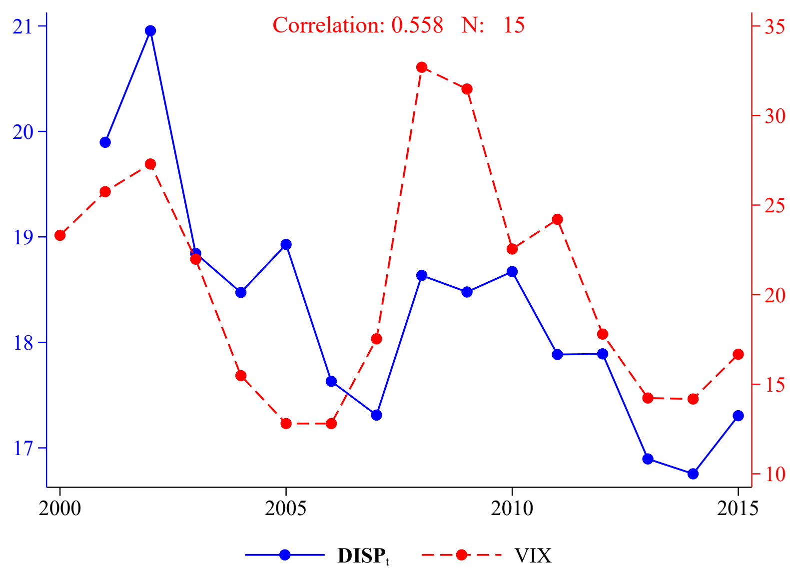
A Appendix

A.1 Data

Stock Price Volatility (SPV), GDP and GDP per capita are from the World Development Indicators (WDI) database from the World Bank. We obtain daily exchange rates against the Euro from World Market Reuters to calculate their growth rate by taking the log difference and then compute yearly average and volatility measures. The VIX is the implied volatility index computed by the CBOE and EPU is the Economic Policy Uncertainty Index from Baker et al. (2016). ΔGDP is computed by taking the log difference between year t and year $t-1$. Macro forecast errors are the dispersion of the IMF 1 year ahead forecast errors of GDP growth, inflation and current account balance.

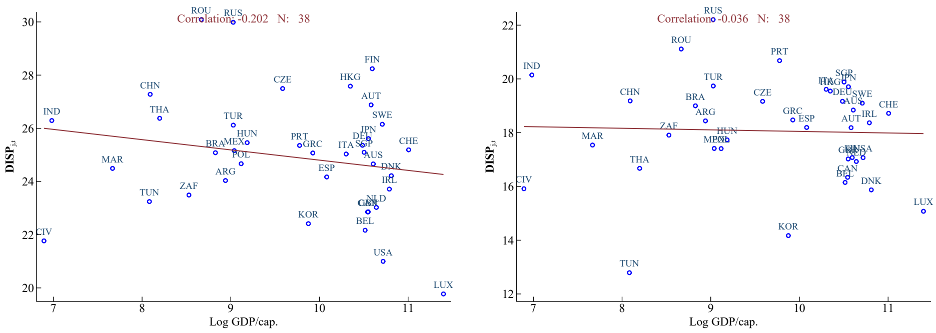
A.2 Additional Figures and Tables

Figure A.1: FDI Return Uncertainty and the VIX



NOTE: Banque de France data and authors' computations. The blue line presents the mean yearly value of FDI return uncertainty and the red dashed line the mean yearly value of the VIX.

Figure A.2: Uncertainty and GDP/cap.



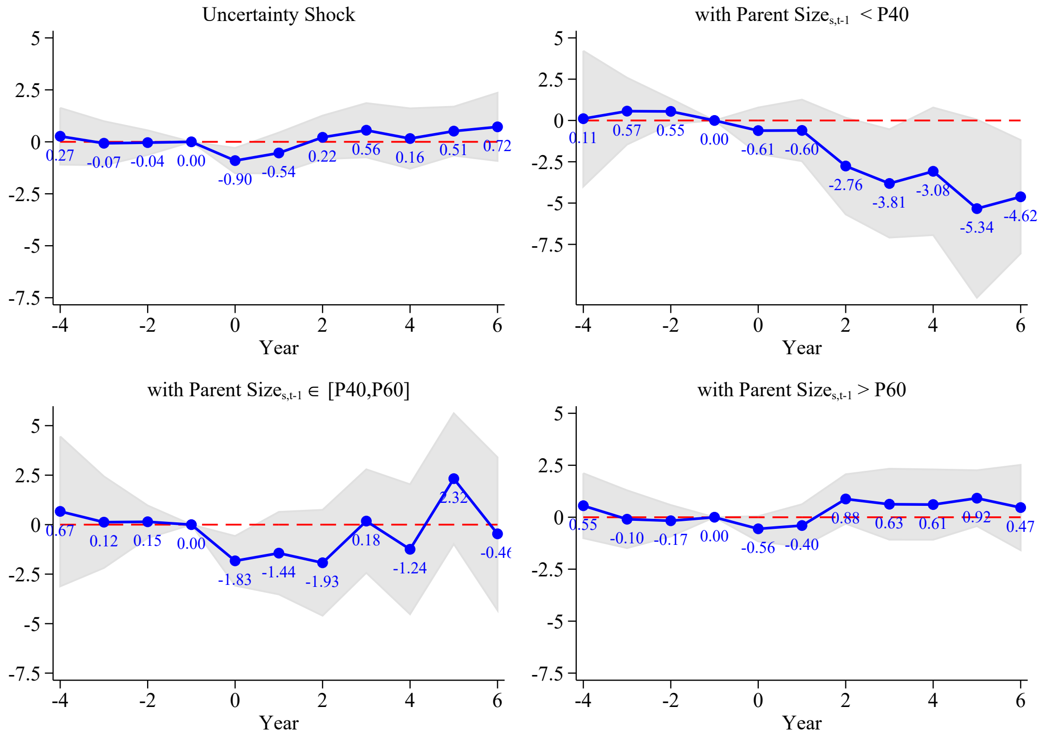
NOTE: Banque de France data and authors' computations. The figure shows the relationship between the period average value of log GDP per capita and the dispersion of the raw FDI returns (left panel) and the dispersion of the idiosyncratic returns (right panel).

Table A.1: Idiosyncratic Uncertainty and FDI. Baseline and Parent Company Characteristics

	Δ COF$_{a,t}$ × 100						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Performance			Size		
	All Sample	Low	Medium	High	Small	Medium	Big
log GDP/cap.$_{j,t}$	8.884***	-9.197	27.485***	12.476***	0.249	22.974***	13.245***
	(2.837)	(7.825)	(5.623)	(2.425)	(8.175)	(8.016)	(3.463)
Δ GDP$_{j,t}$	22.899	50.352	-12.642	13.954	37.143	-45.058	24.628
	(16.671)	(40.692)	(29.072)	(14.216)	(49.909)	(27.634)	(18.550)
Δ FX$_{j,t}$	-16.304***	-10.533	-14.914*	-24.066***	-0.627	-23.195**	-17.937***
	(3.799)	(8.309)	(8.136)	(5.504)	(9.771)	(8.860)	(5.780)
Trade Openness$_{j,t}$(*%GDP*)	-0.039	-0.107**	0.006	0.003	0.021	0.099*	-0.035
	(0.034)	(0.049)	(0.062)	(0.036)	(0.076)	(0.051)	(0.051)
Stock Market Return$_{j,t}$	-0.006	0.020	-0.042	0.007	-0.000	0.000	-0.009
	(0.014)	(0.031)	(0.047)	(0.030)	(0.074)	(0.052)	(0.016)
log Parent Assets$_{s,k,t-1}$	0.776	0.924	1.034	-0.630	2.154	-1.149	-0.802
	(0.639)	(1.290)	(1.290)	(1.026)	(1.429)	(2.975)	(0.797)
Parent Performance$_{s,k,t-1}$	0.117**	0.429*	0.822*	0.192**	0.114	0.093	0.045
	(0.052)	(0.239)	(0.442)	(0.079)	(0.143)	(0.163)	(0.079)
Nb. of Foreign Affiliates$_{s,k,t-1}$	-0.054	0.201	-0.029	-0.107	-0.553	0.223	0.156
	(0.138)	(0.408)	(0.369)	(0.171)	(0.899)	(0.326)	(0.143)
log Affiliate Assets$_{a,t-1}$	-6.359***	-5.233***	-5.912***	-9.316***	-4.753***	-3.567***	-7.470***
	(0.651)	(1.727)	(1.143)	(1.043)	(1.026)	(1.220)	(0.836)
Affiliate Performance$_{a,t-1}$ (%)	0.080***	0.018	0.080**	0.082***	-0.022	0.043	0.060**
	(0.026)	(0.055)	(0.037)	(0.029)	(0.061)	(0.056)	(0.024)
DISP$_{j,t}$	-0.213***	-0.434**	-0.243	-0.128	-0.146	-0.452***	-0.130*
	(0.073)	(0.182)	(0.154)	(0.099)	(0.170)	(0.158)	(0.072)
Affiliate FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	39499	10820	9266	17812	6300	5554	26115
R^2	0.302	0.388	0.355	0.324	0.457	0.470	0.303
Effect in pcp. of an IQR shift:							
- DISP$_{j,t}$	-0.904	-1.837	-1.026	-0.544	-0.615	-1.829	-0.557
- Δ GDP$_{j,t}$	0.582	1.234	-0.336	0.364	0.900	-1.097	0.645

NOTES: We report standard errors clustered at the country level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; a, s, k, j and t indexes affiliates, parent-firms, sectors, countries and years respectively.
We estimate the results above on a sample of 3056 French parent companies and their 10474 foreign affiliates between 2001 and 2015 in 38 countries. See Section 3.3 for the construction of DISP$_{j,t}$. The last two lines present the contrasts of shifting from the 25th percentile of the distribution of the selected variable to the 75th while holding other variables constant at their mean value.

Figure A.3: Affiliate Outcome Path Following an Interquartile Shift in the Distribution of Uncertainty Conditional on Parent Company Past Size



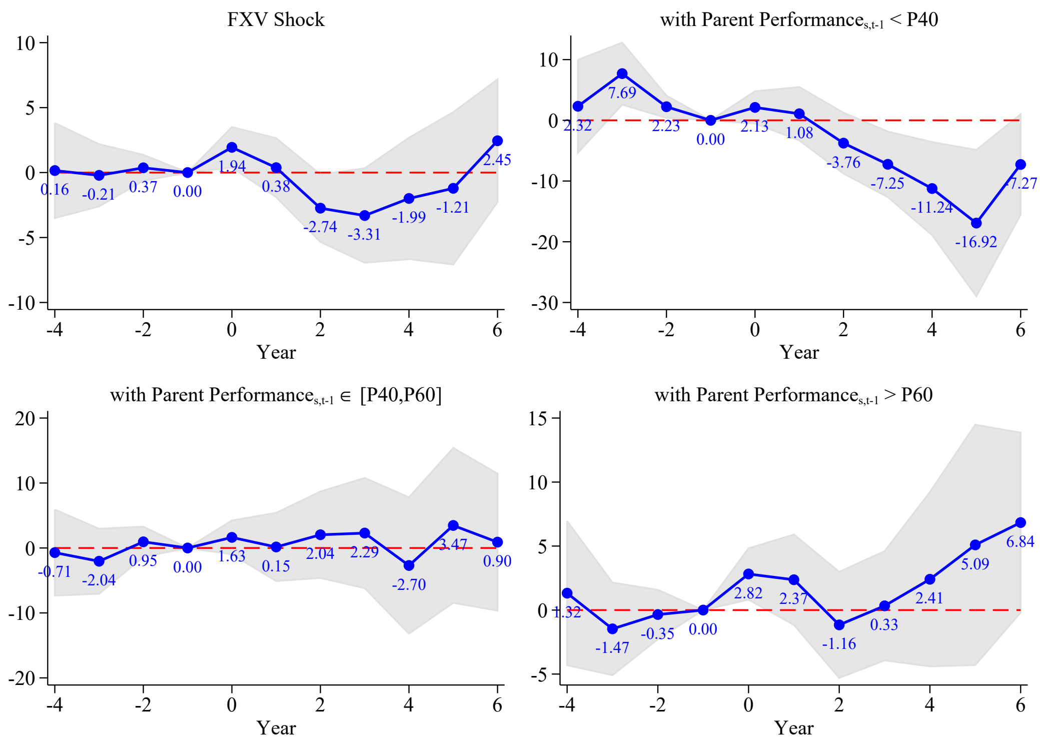
NOTE: This Figure presents estimates of $\beta^h_{1,g}$ (scaled up by a 100 times an Interquartile Range shift of $\texttt{DISP}_{j,t}$) from estimating this equation for $h \in \{-4, 6\}$: $\Delta COF_{a,t+h} = \sum_{g\in\Gamma}(\alpha^h_{1,g}X_{j,t} + \alpha^h_{2,g}X_{s,t-1} + \alpha^h_{3,g}X_{a,t-1} + \beta^h_{1,g}\texttt{DISP}_{j,t})\mathbf{1}_{\{a\in\Gamma^g_t\}} + \gamma^h_a + \gamma^h_t \times \gamma^h_k + \varepsilon_{a,t}$. 95% error bands are displayed in gray with standard errors clustered at the country level. The top left panel includes the entire sample, the next three panels includes only the affiliates of parent companies which were, respectively, in the bottom 40%, middle 20% and top 40% of the size distribution the year before.

Table A.2: Standard Risk Proxy and FDI

	Δ COF$_{a,t}$ × 100			
	(1)	(2)	(3)	(4)
log GDP/cap.$_{j,t}$	15.351***	6.410*	11.982***	14.725***
	(3.411)	(3.224)	(3.044)	(3.177)
Δ GDP$_{j,t}$	51.780**	59.689**	48.891**	47.178*
	(22.501)	(25.583)	(18.680)	(24.421)
Δ FX$_{j,t}$	-14.623***	-13.948**	-14.471***	-15.025***
	(5.070)	(5.554)	(4.393)	(4.904)
Trade Openness$_{j,t}$$(\%GDP)$	-0.021	-0.118	-0.048	-0.020
	(0.032)	(0.080)	(0.037)	(0.033)
Stock Market Return$_{j,t}$	0.008	-0.004	-0.008	0.007
	(0.024)	(0.024)	(0.017)	(0.024)
log Parent Assets$_{s,k,t-1}$	1.740**	2.750***	1.724**	1.750**
	(0.753)	(0.685)	(0.695)	(0.748)
Parent Performance$_{s,k,t-1}$	0.197***	0.132**	0.200***	0.199***
	(0.050)	(0.054)	(0.048)	(0.049)
Nb. of Foreign Affiliates$_{s,k,t-1}$	0.012	-0.115	-0.064	0.001
	(0.166)	(0.159)	(0.140)	(0.163)
log Affiliate Assets$_{a,t-1}$	-10.128***	-10.233***	-9.964***	-10.137***
	(0.989)	(1.385)	(0.942)	(0.991)
Affiliate Performance$_{a,t-1}$ (%)	-0.003	0.024	0.008	-0.005
	(0.031)	(0.040)	(0.027)	(0.031)
Stock Price Volatility$_{j,t}$	0.043			
	(0.076)			
Econ. Policy Unc.$_{j,t}$		0.010		
		(0.011)		
Foreign Exchange Volatility$_{j,t}$			68.785**	
			(32.235)	
Macro FC ERR$_{j,t}$				-0.045
				(0.209)
Affiliate FE	Yes	Yes	Yes	Yes
Sector × Year FE	Yes	Yes	Yes	Yes
Observations	36068	24121	39754	36085
R^2	0.298	0.304	0.290	0.298
Effect in pcp. of an IQR shift:				
- Variable of Interest	46.99	54.16	168.9	-5.950
- Δ GDP$_{j,t}$	138.9	145.3	126.8	126.7

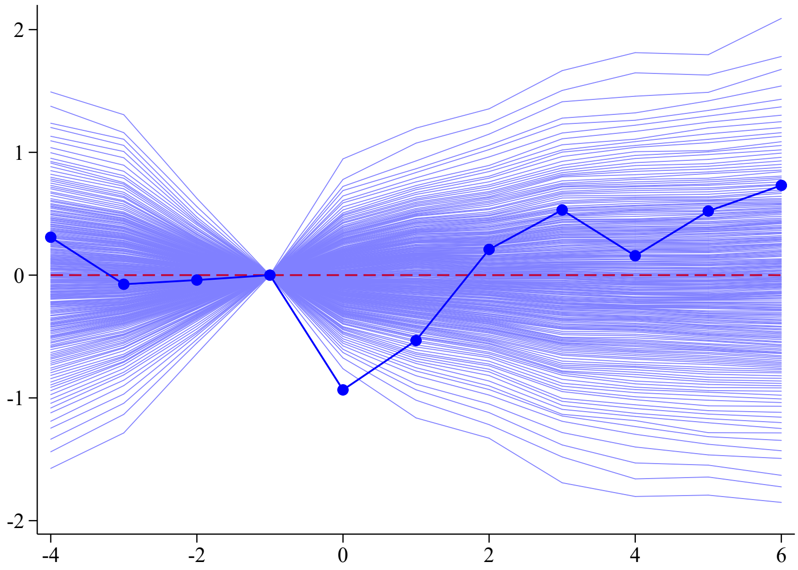
NOTES: We report standard errors clustered at the country level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; s, k, j and t indexes firms, sectors, countries and years respectively.
We estimate the results above on a sample of 3056 French parent companies and their 10474 foreign affilates between 2001 and 2015 in 38 countries. See Section 3.3 for the construction of $\texttt{DISP}_{j,t}$. The last two lines present the contrasts of shifting from the 25^{th} percentile of the distribution of the selected variable to the 75^{th} while holding other variables constant at their mean value.

Figure A.4: Affiliate Outcome Path Following an Interquartile Shift in the Distribution of Foreign Exchange Rate Volatility Conditional on Parent Company Past Performance



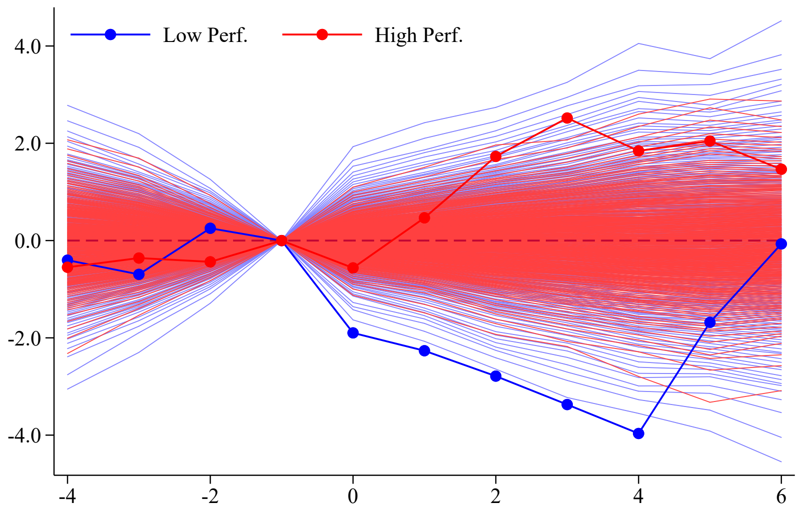
NOTE: This Figure presents estimates of $\beta^h_{1,g}$ (scaled up by a 100 times an Interquartile Range shift of $\texttt{FXV}_{j,t}$) from estimating this equation for $h \in \{-4, 6\}$: $\Delta COF_{a,t+h} = \sum_{g\in\Gamma}(\alpha^h_{1,g} X_{j,t} + \alpha^h_{2,g} X_{s,t-1} + \alpha^h_{3,g} X_{a,t-1} + \beta^h_{1,g}\texttt{FXV}_{j,t})\mathbf{1}_{\{a\in\Gamma^g_t\}} + \gamma^h_a + \gamma^h_t \times \gamma^h_k + \varepsilon_{a,t}$. 95% error bands are displayed in gray with standard errors clustered at the country level. The top left panel includes the entire sample, the next three panels includes only the affiliates of parent companies which were, respectively, in the bottom 40%, middle 20% and top 40% of the performance distribution the year before.

Figure A.5: Placebo Test: Whole Sample for all horizons



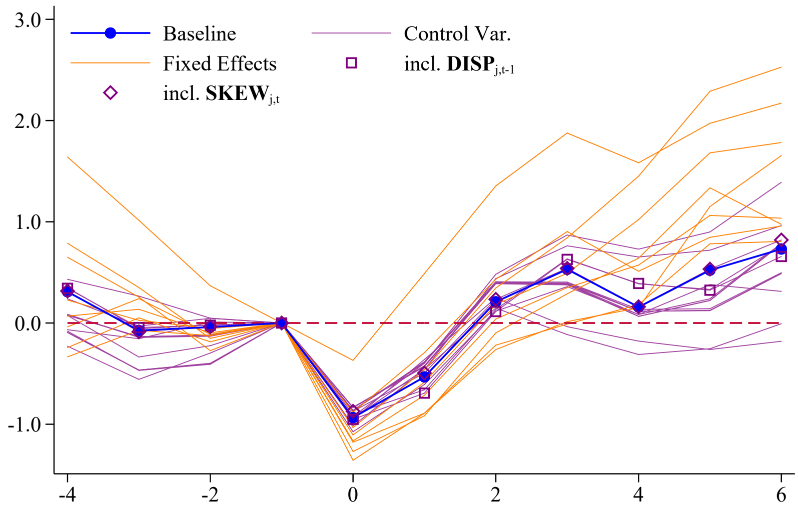
NOTE: This Figure presents each semi-percentile of the distribution of 2000 estimates of the coefficients β_1^h of our variable of interest $\texttt{DISP}_{j,t}$ (scaled up by a 100 times an Interquartile Range shift of $\texttt{DISP}_{j,t}$) after performing a random permutation. The sequence of coefficients of our main result is displayed in dark blue.

Figure A.6: Placebo Test: Low Perf. vs High Perf. for all horizons



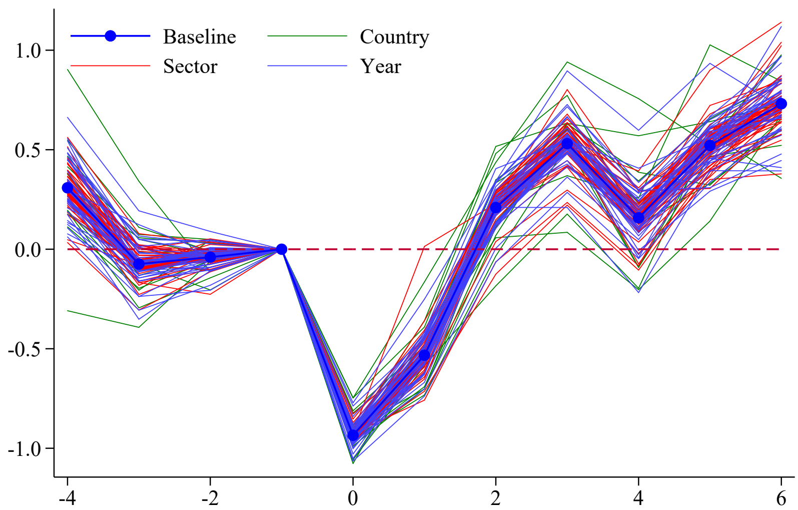
NOTE: This Figure presents each semi-percentile of the distribution of 2000 estimates of the coefficients $\beta_{1,g}^h$ of our variable of interest $\texttt{DISP}_{j,t}$ (scaled up by a 100 times an Interquartile Range shift of $\texttt{DISP}_{j,t}$) after performing a random permutation within each sub-sample. Results for low performing firms are displayed in blue and high performing firms in red.

Figure A.7: Specification Sensitivity



NOTE: The figure presents estimate of our coefficient of interest β_1 (scaled up by a 100 times an Interquartile Range shift of $\mathtt{DISP}_{j,t}$) for various combinations of controls.

Figure A.8: Sample Sensitivity



NOTE: This figure presents the distribution of the estimates of our coefficient of interest β_1 (scaled up by a 100 times an Interquartile Range shift of $\mathtt{DISP}_{j,t}$) while removing turn by turn any cluster of observations in our sample (2-digit sectors in red, countries in green, years in blue).

Table A.3: Other Summary Statistics

Panel A Country-level	N	Mean	Median	Std.Dev.
Stock Price Volatility $_{j,t}$	514	22.55	21.00	9.22
Econ. Policy Unc. $_{j,t}$	220	117.21	111.63	43.56
Foreign Exchange Volatility $_{j,t}$	570	0.02	0.02	0.02
Macro FC ERR $_{j,t}$	529	2.31	1.91	1.92
Δ GDP $_{j,t}$	570	0.03	0.03	0.03
Δ FX $_{j,t}$	570	0.02	0.00	0.09
Trade Openness $_{j,t}(\%GDP)$	570	99.48	73.52	84.31
GDP per capita $_{j,t}$	570	29658	27694	23122
Panel B Global				
Affilates per year	15	3894.27	3782.00	909.63
French Assets$_t$ (Bn.)	15	679.83	688.85	210.41
French Flows$_t$ (Bn.)	15	47.83	48.42	16.39

Stock Price Volatility (SPV), GDP and GDP per capita are from the World Development Indicators (WDI) database from the World Bank. We obtain daily exchange rates against the Euro from World Market Reuters and use it to compute yearly average and volatility measures. The VIX is the implied volatility index computed by the CBOE and EPU is the Economic Policy Uncertainty Index from Baker et al. (2016).

B Theoretical Explanation

This section provides an illustrative model to explain the effect of uncertainty shocks on foreign investments and accounting for heterogeneous responses of multinational firms. The model is based on the costly-state verification setup originally developed by Townsend (1979) and therefore incorporates in dynamic general equilibrium model by Bernanke et al. (1999). We follow the extension of this model by Christiano et al. (2014) who make uncertainty time-varying as the outcome of "Risk shocks". More precisely, we extend the partial and static equilibrium developed by Christiano et al. (2014) in their Appendix D to solve the market equilibrium for assets traded between domestic shareholders and multinational firms.

B.1 Assumptions

The model solves the partial market equilibrium for assets of domestic firms supplied by local shareholders to foreign investors. The supply of assets is decreasing with respect to the return yields, paid by local shareholders to foreign investors, according to

$$A^s = \overline{A} - \eta \times ROI \tag{1}$$

where $\overline{A} > 0$ is the inelastic supply of assets and $\eta > 0$ the elasticity of asset supply with respect to return yields, denoted ROI as in our empirical setup.

The demand for assets is the outcome of the maximization of expected returns by a continuum of multinational firms, which size is equal to one. To buy assets, they combine own capital, denoted N, and debt borrowed to financial intermediaries, denoted B. Then, the demand for assets A^d by the representative firm satisfies the financing constraint

$$A^d = N + B \tag{2}$$

In this static and partial equilibrium, capital N is treated as exogenous. The amount of debt B and the debt interest rate Z are however endogenous and determined by the optimal debt contract in the context of costly-state verification. Indeed, the multinational firm is exposed to an idiosyncratic shock on its return denoted ω. Idiosyncratic return shocks are distributed according to a lognormal distribution $F(\omega)$ which mean is equal to one, $E\omega = 1$, and the standard deviation of $\log(\omega)$ is σ. After realization of the shock, the return on assets is $\omega \times ROI$. There is a threshold $\overline{\omega}$ such that the multinational firm is unable to reimburse the debt if return shock ω is below this value: $\omega \leq \overline{\omega}$. The threshold value $\overline{\omega}$ satisfies

$$(1 + ROI)\,\overline{\omega}A^d = (1 + Z)\,B \tag{3}$$

and can be expressed as follows

$$\overline{\omega} = \frac{1 + Z}{1 + ROI}\frac{B}{A^d} = \frac{1 + Z}{1 + ROI}\frac{L - 1}{L} \tag{4}$$

where $L = A^d/N$ is the leverage ratio. The threshold $\overline{\omega}$ and the default rate $F(\overline{\omega})$ are both increasing with the leverage ratio L and the ratio of debt interest rate to asset returns $(1 + Z)/(1 + ROI)$. Taking into account the default risk, expected returns are

$$\frac{\int_{\overline{\omega}}^{\infty}\left[(1 + ROI)\,\omega A^d - (1 + Z)\,B\right]dF(\omega)}{N(1 + R)} \tag{5}$$

where R the risk-free interest rate accounts for the opportunity costs of investing capital N in assets instead of risk-free assets. Multinational firm earn profits only if they draw a return shock ω above the default threshold $\overline{\omega}$, otherwise the financial intermediary seize all assets and revenues.

The participation constraint of the financial intermediary to the contract writes as follows

$$[1 - F(\overline{\omega})]\,(1 + Z)\,B + (1 - \mu)\int_0^{\overline{\omega}} \omega\,(1 + ROI)\,A^d dF(\omega) = (1 + R)\,B \tag{6}$$

With a probability $[1 - F(\overline{\omega})]$, the borrower does not default and reimburses debt and interests $(1 + Z)\,B$. In the case of default, the financial intermediary seizes the revenues from assets, namely $\omega(1+ROI)A^d$, but incurs monitoring costs which represent a share μ of these revenues. Financial intermediaries borrow at the risk-free interest rate R.

It is useful hereafter to consider the notation introduced by Bernanke et al. (1999) for $\Gamma(\overline{\omega}) = \overline{\omega}[1-F(\overline{\omega})]+G(\overline{\omega};\sigma)$ which determines the sharing rule of revenues and $G(\overline{\omega}) = \int_0^{\overline{\omega}} \omega dF(\omega)$ which is the average return of defaulting entrepreneurs. The entrepreneurs receive the share $[1-\Gamma(\overline{\omega})]$ of revenues while the financial intermediary gets only $[\Gamma(\overline{\omega}) - \mu G(\overline{\omega})]$ since she supports the monitoring costs μ.

B.2 Equilibrium

The optimal debt contract is the set of variables $\{\overline{\omega}, Z, B\}$ that maximizes the entrepreneur expected returns (5) subject to the participation constraint of financial intermediary (6) and the definition of the idiosyncratic return threshold (3).The equilibrium value of the threshold value $\overline{\omega}$ solves

$$\frac{1-F(\overline{\omega})}{1-\Gamma(\overline{\omega})} = \frac{[1-F(\overline{\omega})-\mu\omega F'(\overline{\omega};\sigma)]\frac{1+ROI}{1+R}}{1-[\Gamma(\overline{\omega})-\mu G(\overline{\omega})]\frac{1+ROI}{1+R}} \quad (7)$$

Then, the amount of debt B is deduced from (6) and can be expressed as follows

$$L = \frac{1}{1-[\Gamma(\overline{\omega})-\mu G(\overline{\omega})]\frac{1+ROI}{1+R}} \quad (8)$$

Finally, (4) gives the loan interest rate Z

$$1+Z = \overline{\omega}(1+ROI)\frac{L}{L-1} \quad (9)$$

The definition of the equilibrium is as follows.

Definition 1. *The equilibrium is the set of variables $\left\{\overline{\omega}, Z, B, ROI, A^s, A^d\right\}$ which satisfies: the financial contract equilibrium equations: (7), (8), and (9); the supply of assets form the local shareholders (1) and the demand of assets by multinational firms (2); the market equilibrium for assets $A^s = A^d$; given the risk-free rate R, the capital of multinational firms N, the monitoring* *cost μ, the elasticity η and exogenous component $\overline{A}$ of the supply function of assets, the level of uncertainty σ, and the definition of the functions $F(\cdot)$, $\Gamma(\cdot)$, and $G(\cdot)$.*

B.3 Numerical simulations

We are interested in the impact of an increase in σ on the equilibrium. Unfortunately, it is not feasible to characterize analytically the effects on σ, then we use numerical simulations.

The monitoring costs and the level of uncertainty are taken from Christiano et al. (2014) (Appendix D): $\mu = 0.21$ and $\sigma = 0.26$. Then, the risk-free is set to 2%, $R = 0.02$, and we impose a return of 2% for assets taken from for our data, $ROI = 0.09$. Then, the following variables are deduced: the default risk is slightly above 10% ($F = 0.10$) and the leverage ratio more than three ($L = 3.59$). The supply elasticity of assets is set to one ($\eta = 1$), as the capital of multinational firms ($N = 1$), and we deduce $\overline{A} = 4.66$.

Figure B.9 shows the effect of increasing uncertainty σ in this model. Since multinational firm draw more extremely low values of idiosyncratic return shocks, there are more defaults in the economy as illustrated by the increase in F. Then, financial intermediaries ask for a higher interest rate Z to cover the higher monitoring costs and firms decrease their demand for debt and therefore their demand for domestic firm assets. As a results, the total investment in the domestic market for assets A decreases and the yield on these assets ROI increases as a compensation of the higher risk supported. Without considering fixed costs and extensive margin, but financial frictions, this model can therefore explain the negative average effect of uncertainty on FDI described in our empirical results. Can this model also explain the heterogeneity of the effects between multinational firms?

To investigate the effect of heterogeneity in this model, we assume that multinational firm differ with respect to the monitoring costs μ which takes now two values $\overline{\mu}$ and $\underline{\mu}$, with $\overline{\mu} > \underline{\mu}$. The population of firm, still normalized to the unity, is divided into two sub-populations of equal size. All firms have the same amount of wealth. Figure B.10 shows the effect of increasing uncertainty σ in this model. As in the case with homogeneous firms, there is an

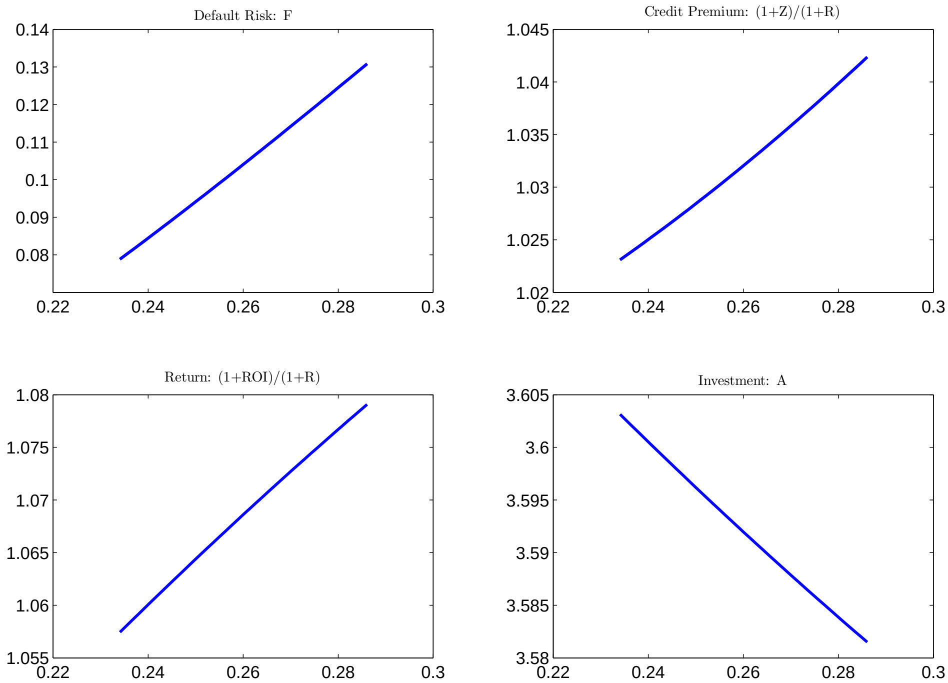


Figure B.9: Financial contract and market equilibrium for assets

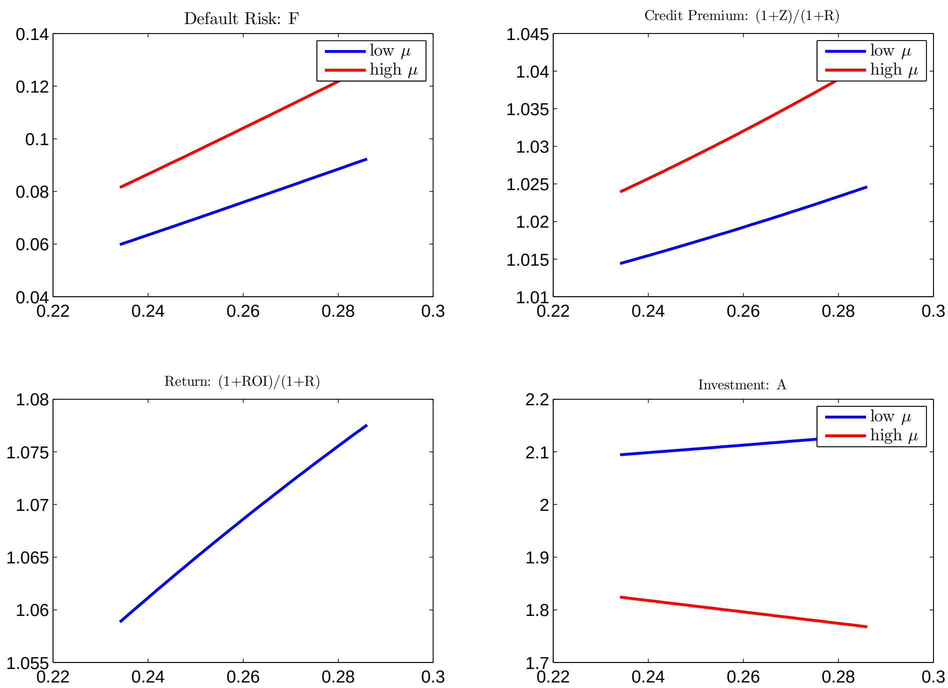


Figure B.10: Financial contract and market equilibrium for assets with heterogeneous multinational firms

increase in the default risk and in the risk premium for all firms and the fall in demand for domestic assets leads to an increase in the yields. The new fact is that we observe a divergence in investment. Firms with high monitoring costs decrease their investment while firms with low monitoring costs increase their investment. Firms with higher monitoring costs are more concern by the increase in uncertainty, since default is more costly for them, and therefore react more strongly than firms with low monitoring costs who get back market shares. Consistently with our empirical results the model describes a reallocation process of market shares between firms after an increase in uncertainty.