Cross-border investments and uncertainty: Firm-level evidence

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Preliminary

Abstract

This paper studies the impact of uncertainty on cross-border investments. We build a dataset 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 lower their foreign investments. Meanwhile high-performing firms overcompensate 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.

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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 strongly 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

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

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 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

corporate tax avoidance.

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

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). 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. 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 contemporaneous 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). Thus, 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

[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.

[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).

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 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 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) negative for low uncertainty levels, then positive.[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

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

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.

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 industry-specific 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 2 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 3 provides our empirical results concerning the effects of uncertainty on FDI and Section 4 a set of robustness tests. The model is presented and simulated in the Section B of the Appendix. Section 5 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 French Direct Investments abroad come from highly dis-aggregated data available at the Banque de France. Those databases are produced by the Direct Investment Unit of the Statistical General Directorate with the primary goal of calculating 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 notional 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 measures 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. 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 that weights around €184 Mn in equity assets.

2.2 Direct Investment Returns

Thereafter, the letter corresponds $t = \{1, ..., T\}$ 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 intersection of those last three groups is the affiliate indexed with the letter

[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.

$a = \{s, j, k\}$ – 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 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, the *Financial Assets*, and $NOF_{a,\tau}$ to the Net Out-Flows as of time τ. 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 or currency changes. 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	Median	Std.Dev.
Panel A Affiliate-level				
Affiliate Assets$_{a,t}$ (Mn.)	55021	180.47	15.65	1009.58
Affiliate Flows$_{a,t}$ (Mn.)	55021	8.30	0.17	229.08
$ROI_{a,t}$ (%)	55021	9.90	5.23	24.66
Δ COF$_{a,t}$ $\times$ 100	49869	3.37	2.15	45.40
Panel B Firm-level				
Affiliates per firm	19387	2.97	2.00	3.43
Parent Firm Assets$_{s,k,t}$ (Mn.)	19387	521.94	37.31	2567.50
Parent Firm Flows$_{s,k,t}$ (Mn.)	19387	33.00	0.66	426.55
Panel C Country-level				
Affilates per country	570	102.48	62.00	95.57
French Assets$_{j,t}$ (Bn.)	570	17.89	3.92	33.19
French Flows$_{j,t}$ (Bn.)	570	1.26	0.29	3.54
Panel D Year-level				
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

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,

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

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:

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

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 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. Finally, 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)
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:

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

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

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

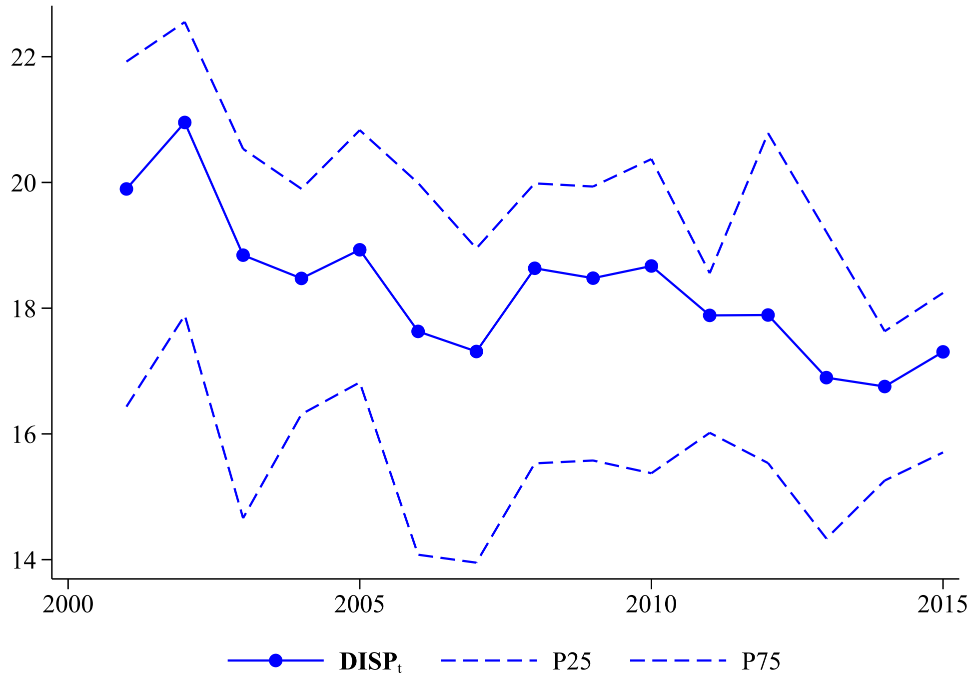
where $\mathtt{DISP}_{j,t}$, by measuring the dispersion of the residuals, tells us how widely uninformative fundamentals are to predict firm specific returns. Throughout this paper, we will use $\mathtt{DISP}_{j,t}$ as our proxy for time varying uncertainty over the idiosyncratic returns of French MNF in country j.

2.4 Stylized Facts

This section presents some stylized facts on our measure of FDI Return uncertainty. 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 between 2001 and 2015. Uncertainty has declined form 2002 to 2007, before the financial crisis, then sharply increased during the years of the crisis, namely 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 substantial 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 VIX index.

[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 dispersion of idiosyncratic FDI returns for all countries $\texttt{DISP}_t$, where the dispersion by country $\texttt{DISP}_{j,t}$ is defined by equation (7).

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 $\texttt{DISP}_{j,t}$ as an exogenous source of uncertainty that we can causally identify.

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:

$$\Delta COF_{a,t} = \alpha_1 X_{j,t} + \alpha_2 X_{s,t-1} + \alpha_3 X_{a,t-1} + \beta_1 \texttt{DISP}_{j,t} + \gamma_a + \gamma_t \times \gamma_k + \varepsilon_{a,t} \tag{8}$$

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. 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. 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 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.

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 to the destination country. 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)[9] to assess

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

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

	Δ COF$_{a,t}$			
	(1)	(2)	(3)	(4)
			Performance	
	All Sample	Low	Medium	High
log GDP/cap.$_{j,t}$	0.089***	-0.092	0.275***	0.125***
	(0.028)	(0.078)	(0.056)	(0.024)
Δ GDP$_{j,t}$	0.229	0.504	-0.126	0.140
	(0.167)	(0.407)	(0.291)	(0.142)
Δ FX$_{j,t}$	-0.163***	-0.105	-0.149*	-0.241***
	(0.038)	(0.083)	(0.081)	(0.055)
Trade Openness$_{j,t}(\%GDP)$	-0.000	-0.001**	0.000	0.000
	(0.000)	(0.000)	(0.001)	(0.000)
Stock Market Return$_{j,t}$	-0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
log Parent Assets$_{s,k,t-1}$	0.008	0.009	0.010	-0.006
	(0.006)	(0.013)	(0.013)	(0.010)
Parent Performance$_{s,k,t-1}$	0.001**	0.004*	0.008*	0.002**
	(0.001)	(0.002)	(0.004)	(0.001)
Nb. of Foreign Affiliates$_{s,k,t-1}$	-0.001	0.002	-0.000	-0.001
	(0.001)	(0.004)	(0.004)	(0.002)
log Affiliate Assets$_{a,t-1}$	-0.064***	-0.052***	-0.059***	-0.093***
	(0.007)	(0.017)	(0.011)	(0.010)
Affiliate Performance$_{a,t-1}$ (%)	0.001***	0.000	0.001**	0.001***
	(0.000)	(0.001)	(0.000)	(0.000)
DISP$_{j,t}$	-0.002***	-0.004**	-0.002	-0.001
	(0.001)	(0.002)	(0.002)	(0.001)
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 2.3 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.

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 should then temporaly turn positive, reflecting the wait and see pattern documented by Julio and Yook (2016). We estimate the following equation:

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

where h is the horizon of project. 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.[10]

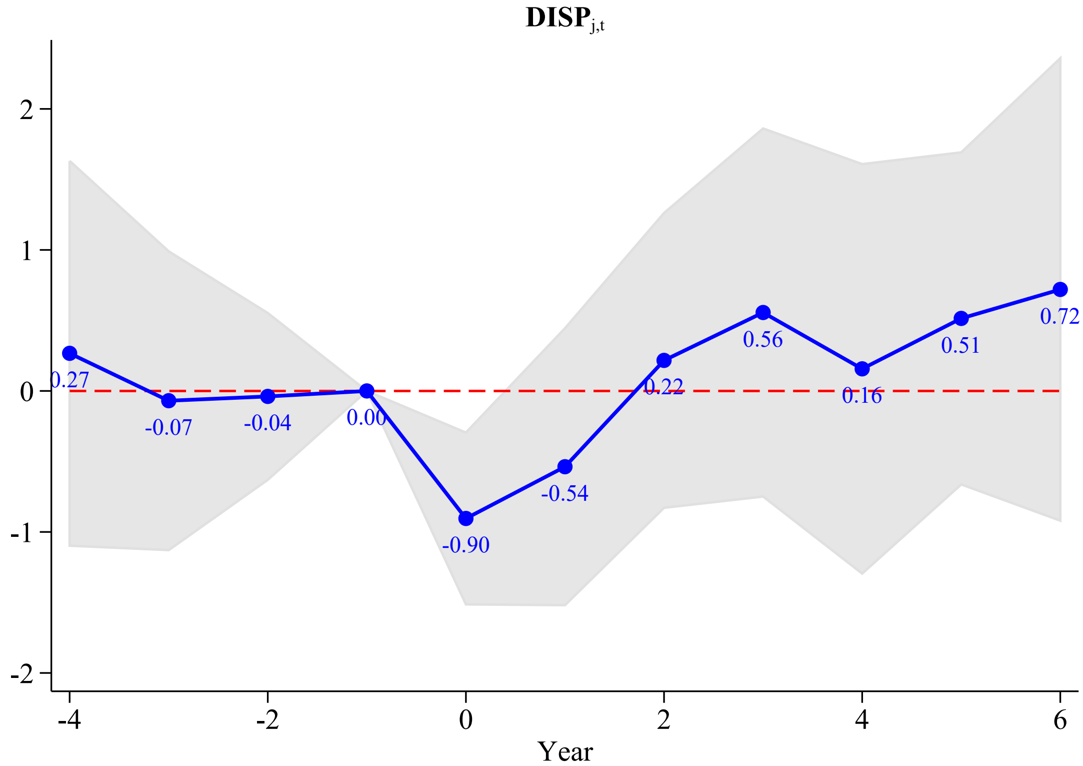
3.2 The role of firm ex-ante performances

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 reaction across firm characteristics, we replicate our baseline regressions (8) and (9) 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.[11] We focus here on the role of firm ex-ante performances and estimate the following

[10] 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". 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.

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

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



NOTE: This Figure presents estimates of β_1^h from estimating this equation for $h \in \{0, 4\}$: $\Delta COF_{a,t+h} = \alpha_1^h X_{j,t} + \alpha_2^h X_{s,t-1} + \alpha_3^h X_{a,t-1} + \beta_1^h \texttt{DISP}_{j,t} + \gamma_a^h + \gamma_t^h \times \gamma_k^h + \varepsilon_{a,t}$. 95% error bands are displayed in gray with standard errors clustered at the country level.

equation:

$$\Delta COF_{a,t+h} = \sum_{g \in \Gamma} \left(\alpha_{1,g}^h X_{j,t} + \alpha_{2,g}^h X_{s,t-1} + \alpha_{3,g}^h X_{a,t-1} + \beta_{1,g}^h \texttt{DISP}_{j,t} \right) \mathbf{1}_{\{a \in \Gamma_t^g\}} + \gamma_a^h + \gamma_t^h \times \gamma_k^h + \varepsilon_{a,t+h} \tag{10}$$

for $h \in \{0, 4\}$ period ahead. Where Γ are firms groups based on their ex-ante performance:

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

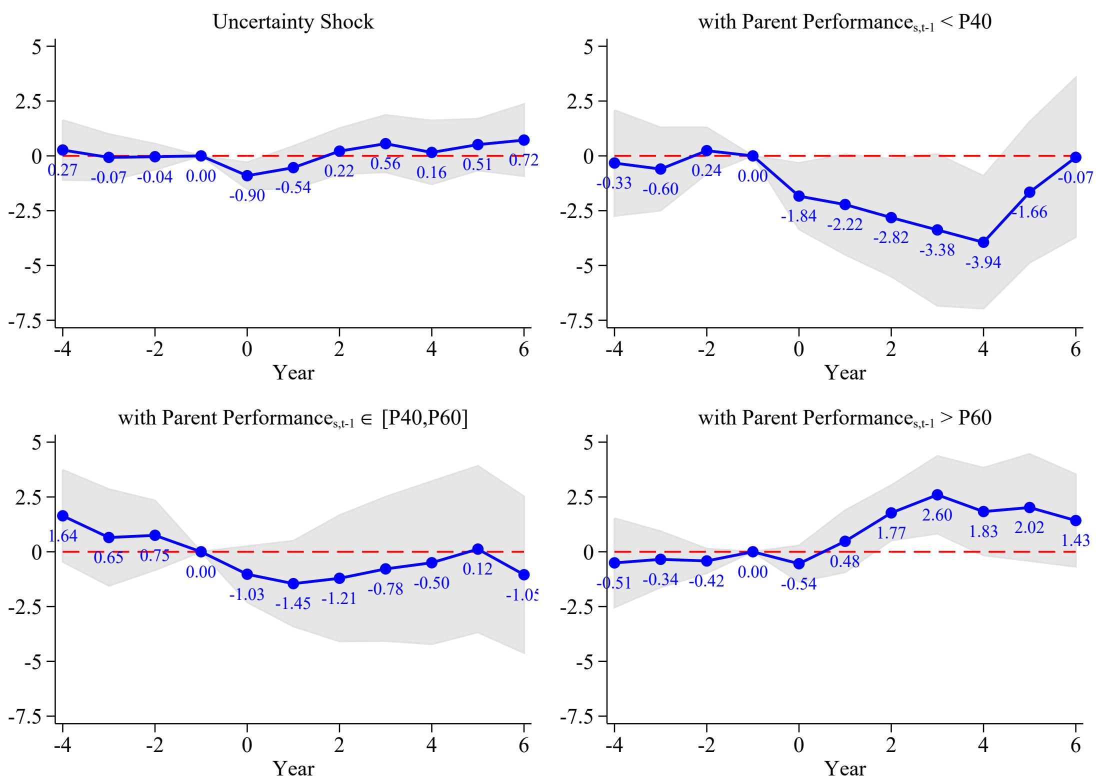
Columns (2)-(4) in Table 8 report the estimation results for $h = 0$ and Figure 3 presents the estimates of the coefficient β_1^h of Equation (10) for various horizon h.

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, $\texttt{DISP}_{j,t}$, 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 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 (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. 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.

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 β_1^h from estimating this equation for $h \in \{0, 4\}$: $\Delta COF_{a,t+h} = \sum_{x\in\iota}(\alpha^h_{1,x}X_{j,t} + \alpha^h_{2,x}X_{s,t-1} + \alpha^h_{3,x}X_{a,t-1} + \beta^h_{1,x}\texttt{DISP}_{j,t})\mathbf{1}_{a\in\iota} + \gamma^h_a + \gamma^h_t \times \gamma^h_k + \varepsilon_{a,t}$. 95% error bands are displayed in gray with standard errors clustered at the country level. The left panel includes the entire sample, the center and right panel includes, respectively, only the affiliates of parent companies which were in the bottom 40% (respectively top 40%) of the performance distribution the year before.

4 Robustness

We attempt various comparison and validation exercise.

4.1 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$_{s,t}$ and Parent Size$_{s,t}$ 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 (10) 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.

4.2 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 A.4 replicates the Figure 3 using regressions (10) 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.

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.[12]. 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.

4.3 Placebo Inference

Bias could be caused by serial correlation at the country level. To validate our choice of clustering standard errors at the country level, we implement Chetty et al. (2009)'s non parametric permutation test of $\beta_1 = 0$.

Figure A.5 shows the result of one thousand random permutations of the serie of uncertainty. We take the values of $\texttt{DISP}_{j,t}$ from each country and assign it randomly to another one. We then run our baseline regression using this permuted variable and collect its coefficient and standard errors. We repeat the process 1000 times in total. We inspect the distribution of the coefficients. We confirm that it is normally distributed around 0. This distribution supports our choice of clustering the standard errors at the country level. We then draw in red the 0.5, 2.5, 97.5 and 99.5 percentile of the distribution of the placebos. We confirm that the coefficient of our main result lies outside the $[0.5, 99.5]$ interval of the distribution of the placebos.

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 estimate our baseline equation for $h = 3$. Figure A.6 confirms that each estimate of $\beta_{1,g}^{h=3}$ lies outside of their respective confidence intervals $[0.5, 99.5]$.

[12] See the column 3 in Table 21 of Gourio et al. (2016)

4.4 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. We find results that are quantitatively and qualitatively the same A.7c) as on the full sample. It shows that our specification satisfyingly accounts for the complex dynamics of our sample period. This estimate is also statistically highly significant and robust to taking out any of our clusters at the sector and country level – see Figure A.7a for sectors (NAF 2 digit) and Figure A.7b for countries. Finally, we also demonstrate that this estimate is robust to the inclusion of various combinations of fixed effects in Figure A.8 and of observable characteristics in Figure A.9.

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). 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.

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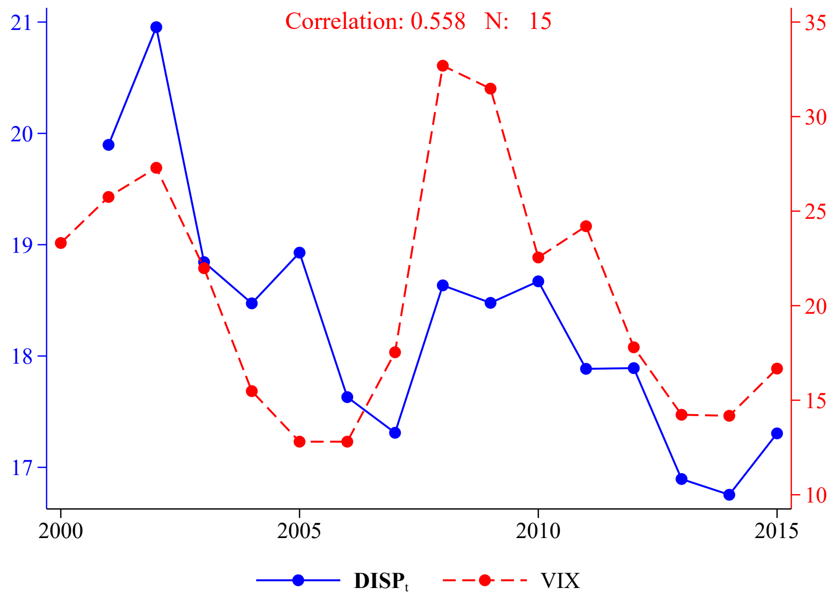
A Appendix

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.

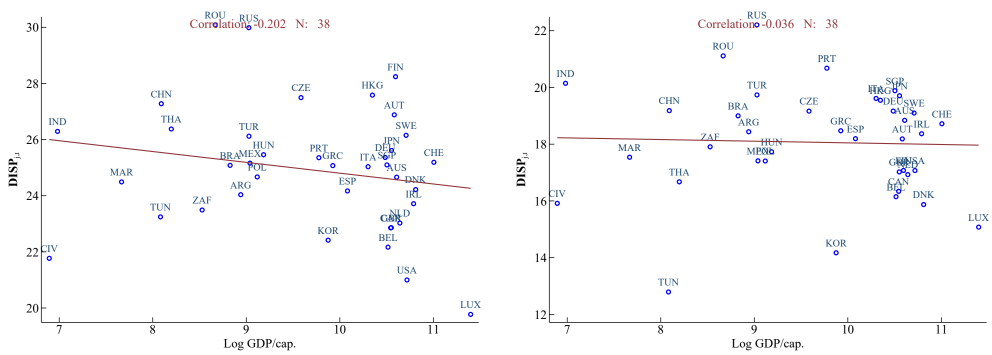
A.2 Additional Figures and Tables

Figure A.1: FDI Return Uncertainty and the VIX



NOTE: Banque de France data and authors' computations.

Figure A.2: Uncertainty and GDP/cap.



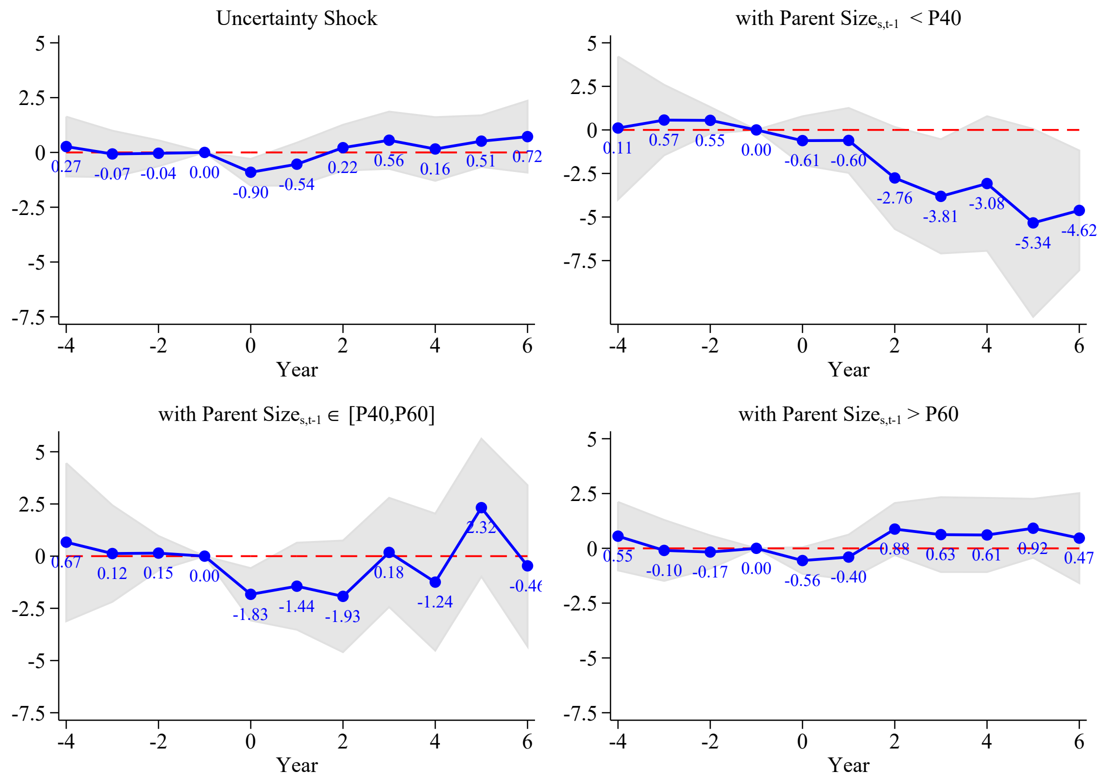
NOTE: Banque de France data and authors' computations.

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

	Δ COF$_{a,t}$						
	(1)	(2)	(3) Performance	(4)	(5)	(6) Size	(7)
	All Sample	Low	Medium	High	Small	Medium	Big
log GDP/cap.$_{j,t}$	0.089***	-0.092	0.275***	0.125***	0.002	0.230***	0.132***
	(0.028)	(0.078)	(0.056)	(0.024)	(0.082)	(0.080)	(0.035)
Δ GDP$_{j,t}$	0.229	0.504	-0.126	0.140	0.371	-0.451	0.246
	(0.167)	(0.407)	(0.291)	(0.142)	(0.499)	(0.276)	(0.185)
Δ FX$_{j,t}$	-0.163***	-0.105	-0.149*	-0.241***	-0.006	-0.232**	-0.179***
	(0.038)	(0.083)	(0.081)	(0.055)	(0.098)	(0.089)	(0.058)
Trade Openness$_{j,t}$($\%GDP$)	-0.000	-0.001**	0.000	0.000	0.000	0.001*	-0.000
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Stock Market Return$_{j,t}$	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
log Parent Assets$_{s,k,t-1}$	0.008	0.009	0.010	-0.006	0.022	-0.011	-0.008
	(0.006)	(0.013)	(0.013)	(0.010)	(0.014)	(0.030)	(0.008)
Parent Performance$_{s,k,t-1}$	0.001**	0.004*	0.008*	0.002**	0.001	0.001	0.000
	(0.001)	(0.002)	(0.004)	(0.001)	(0.001)	(0.002)	(0.001)
Nb. of Foreign Affiliates$_{s,k,t-1}$	-0.001	0.002	-0.000	-0.001	-0.006	0.002	0.002
	(0.001)	(0.004)	(0.004)	(0.002)	(0.009)	(0.003)	(0.001)
log Affiliate Assets$_{a,t-1}$	-0.064***	-0.052***	-0.059***	-0.093***	-0.048***	-0.036***	-0.075***
	(0.007)	(0.017)	(0.011)	(0.010)	(0.010)	(0.012)	(0.008)
Affiliate Performance$_{a,t-1}$ (%)	0.001***	0.000	0.001**	0.001***	-0.000	0.000	0.001**
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
DISP$_{j,t}$	-0.002***	-0.004**	-0.002	-0.001	-0.001	-0.005***	-0.001*
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
Affiliate FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector $\times$ 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 affilates between 2001 and 2015 in 38 countries. See Section 2.3 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.

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



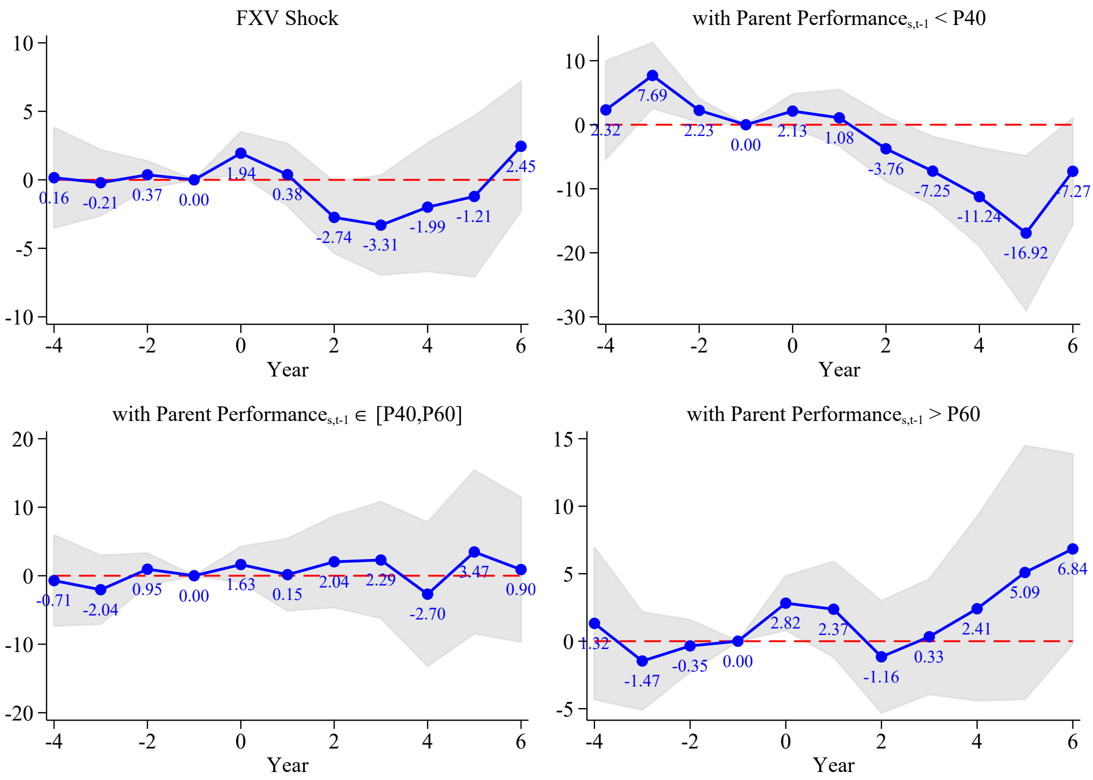
NOTE: This Figure presents estimates of β_1^h from estimating this equation for $h \in \{0,4\}$: $\Delta COF_{a,t+h} = \sum_{x\in\iota}(\alpha^h_{1,x}X_{j,t} + \alpha^h_{2,x}X_{s,t-1} + \alpha^h_{3,x}X_{a,t-1} + \beta^h_{1,x}\texttt{DISP}_{j,t})\mathbf{1}_{a\in\iota} + \gamma^h_a + \gamma^h_t \times \gamma^h_k + \varepsilon_{a,t}$. 95% error bands are displayed in gray with standard errors clustered at the country level. The left panel includes the entire sample, the center and right panel includes, respectively, only the affiliates of parent companies which were in the bottom 40% (respectively top 40%) of the performance distribution the year before.

Table A.2: Standard Risk Proxy and FDI

	Δ COF$_{a,t}$			
	(1)	(2)	(3)	(4)
log GDP/cap.$_{j,t}$	0.158***	0.060*	0.124***	0.151***
	(0.037)	(0.033)	(0.033)	(0.034)
Δ GDP$_{j,t}$	0.518**	0.595**	0.480**	0.470*
	(0.233)	(0.263)	(0.191)	(0.253)
Δ FX$_{j,t}$	-0.151***	-0.136**	-0.150***	-0.157***
	(0.050)	(0.056)	(0.043)	(0.048)
Trade Openness$_{j,t}(\%GDP)$	-0.000	-0.001	-0.000	-0.000
	(0.000)	(0.001)	(0.000)	(0.000)
Stock Market Return$_{j,t}$	0.000	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
log Parent Assets$_{s,k,t-1}$	0.016**	0.026***	0.016**	0.016**
	(0.008)	(0.006)	(0.007)	(0.008)
Parent Performance$_{s,k,t-1}$	0.002***	0.001**	0.002***	0.002***
	(0.001)	(0.001)	(0.000)	(0.001)
Nb. of Foreign Affiliates$_{s,k,t-1}$	0.000	-0.001	-0.000	0.000
	(0.002)	(0.002)	(0.001)	(0.002)
log Affiliate Assets$_{a,t-1}$	-0.102***	-0.101***	-0.100***	-0.102***
	(0.010)	(0.013)	(0.009)	(0.010)
Affiliate Performance$_{a,t-1}$ (%)	-0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Stock Price Volatility$_{j,t}$	0.001			
	(0.001)			
Econ. Policy Unc.$_{j,t}$		0.000		
		(0.000)		
Foreign Exchange Volatility$_{j,t}$			0.790**	
			(0.324)	
Macro FC ERR$_{j,t}$				0.000
				(0.002)
Affiliate FE	Yes	Yes	Yes	Yes
Sector × Year FE	Yes	Yes	Yes	Yes
Observations	36787	24618	40537	36804
R^2	0.299	0.304	0.290	0.299
Effect in pcp. of an IQR shift:				
- Variable of Interest	0.619	0.560	1.941	0.000789
- Δ GDP$_{j,t}$	1.389	1.449	1.244	1.264

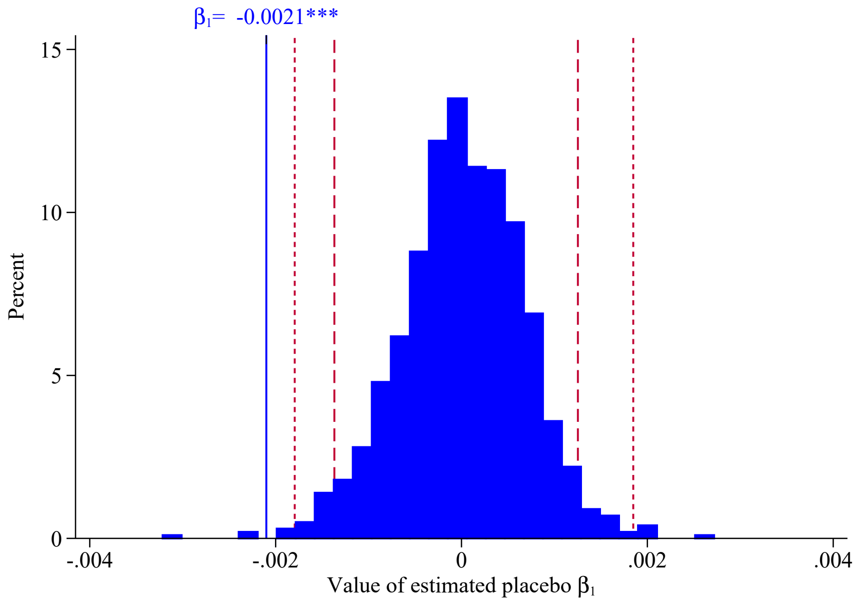
NOTES: We report standard errors clustered at the country level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; a, s, k, j and t indexes affiliates, parent-firms, sectors, countries and years respectively. We estimate the results above on a sample of 3056 French parent companies and their 10474 foreign affilates between 2001 and 2015 in 38 countries. See Section 2.3 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.

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



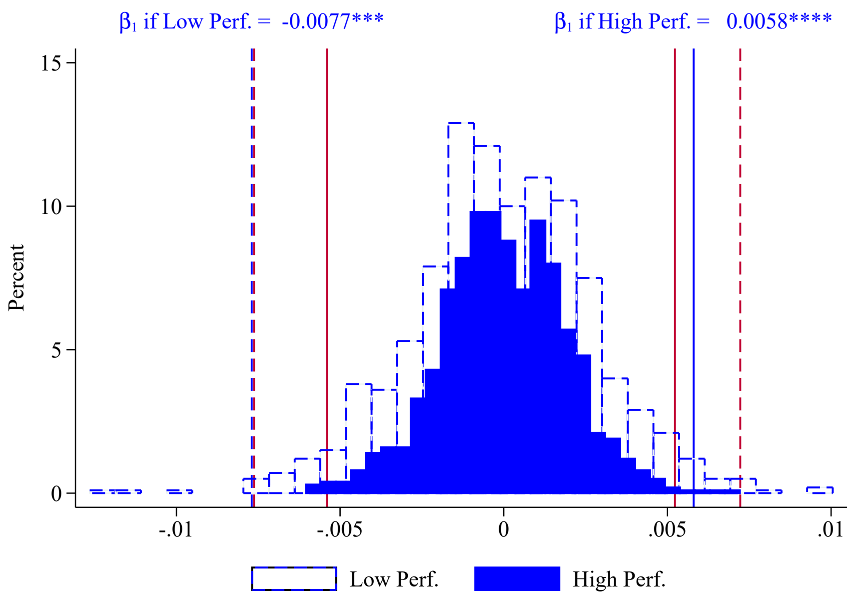
NOTE: This Figure presents estimates of β_1^h from estimating this equation for $h \in \{0, 4\}$: $\Delta COF_{a,t+h} = \sum_{x \in \iota}(\alpha_{1,x}^h X_{j,t} + \alpha_{2,x}^h X_{s,t-1} + \alpha_{3,x}^h X_{a,t-1} + \beta_{1,x}^h \texttt{DISP}_{j,t})\mathbf{1}_{a \in \iota} + \gamma_a^h + \gamma_t^h \times \gamma_k^h + \varepsilon_{a,t}$. 95% error bands are displayed in gray with standard errors clustered at the country level. The left panel includes the entire sample, the center and right panel includes, respectively, only the affiliates of parent companies which were in the bottom 40% (respectively top 40%) of the performance distribution the year before.

Figure A.5: Placebo Test: Whole Sample for $h = 0$



NOTE: This Figure presents 1000 estimates of the coefficient β_1 of our variable of interest $\texttt{DISP}_{j,t}$ after performing a random permutation.

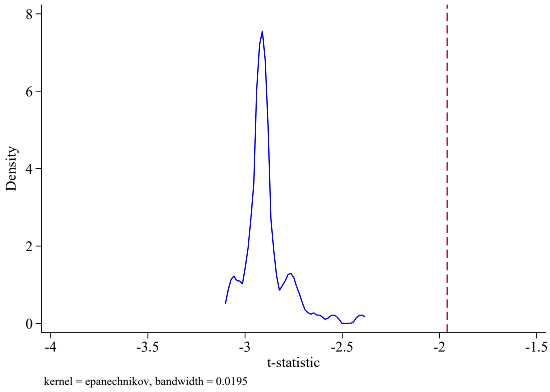
Figure A.6: Placebo Test: Low Perf. vs High Perf. for $h = 3$



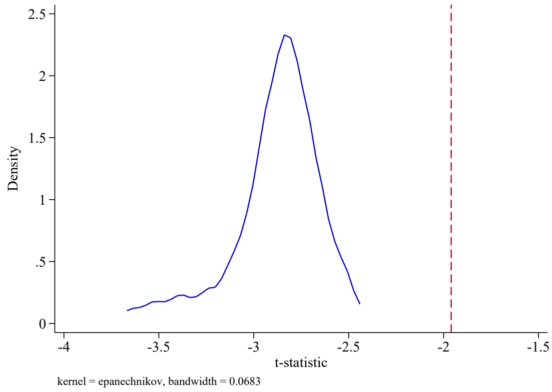
NOTE: This Figure presents 1000 estimates of the coefficient β_1 of our variable of interest $\texttt{DISP}_{j,t}$ after performing a random permutation within each sub-sample.

Figure A.7: Cluster Sensitivity

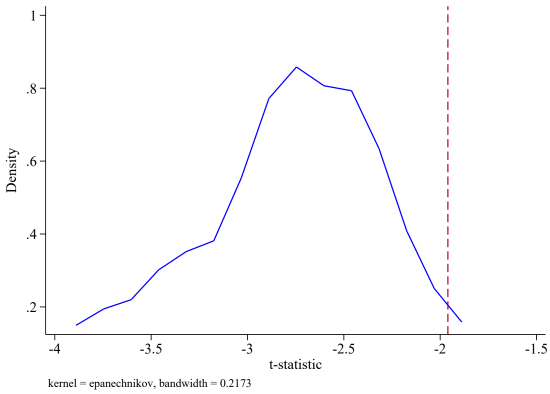
(a) Sector



(b) Country

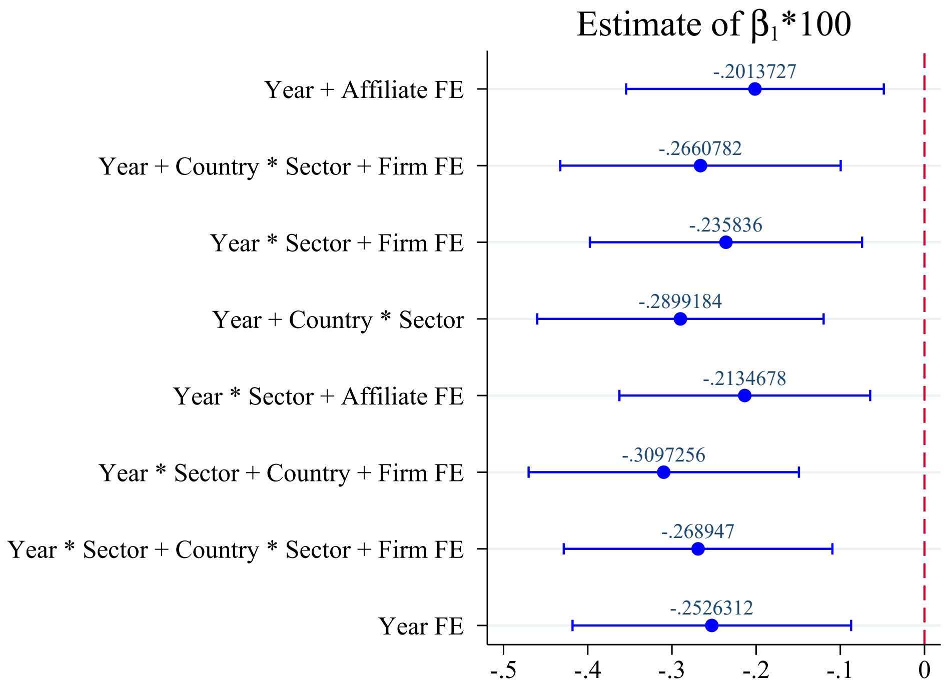


(c) Year



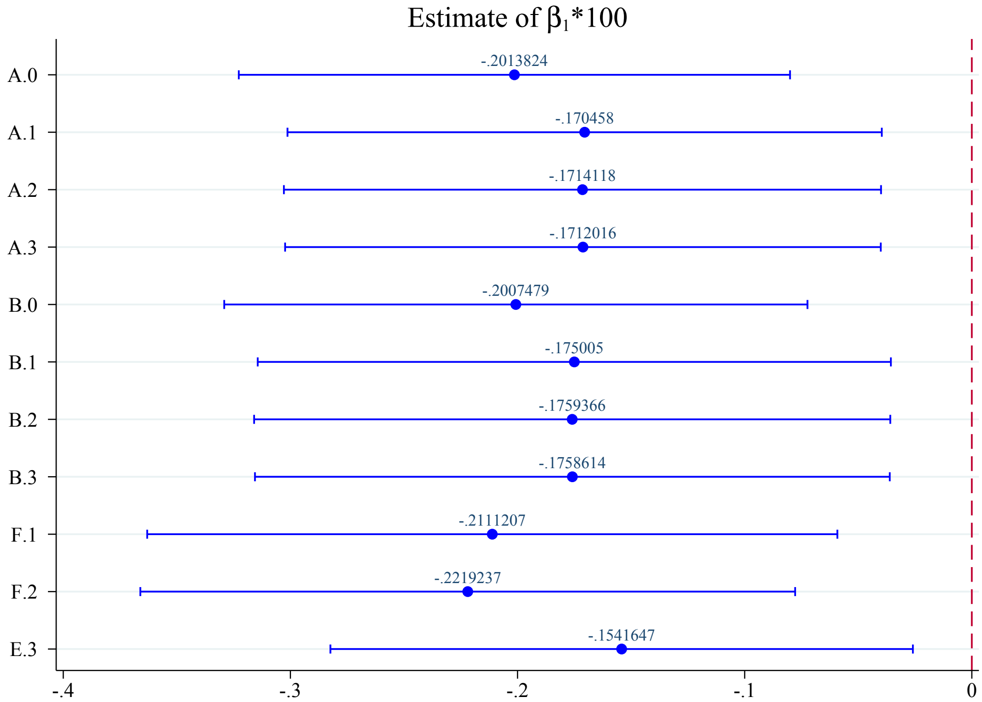
NOTE: This figure presents the distribution of the estimates of the t-stats of our coefficient of interest β_1 while removing any cluster of the main level of clusters in our sample (2-digit sectors in panel A.7a, countries in panel A.7b, years in panel A.7c).

Figure A.8: Controlling for various combinations of un-observable characteristics



NOTE: The figure presents estimate of our coefficient of interest $\beta_1 \times 100$ for various combinations of fixed effects. 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$\}$. Standard errors are clustered at the country level.

Figure A.9: Controlling for additional country, parent company and affiliate characteristics



NOTE: The figure presents estimate of our coefficient of interest $\beta_1 \times 100$ for various combinations of control variables. All combinations include at least the same controls as in Julio and Yook (2016), which corresponds to our specification A.0 as well as an affiliate fixed effect (γ_a) and a sector by year fixed effect ($\gamma_{k,t}$). Standard errors are clustered at the country level.

A.0: $X_{j,t}$ = {GDP per capita, GDP growth, Exchange Rate growth, Trade Openness, Market Return}; $X_{s,t-1}$ = {.}

A.1: $X_{j,t}$ = {A.0}; $X_{s,t-1}$ = {Lagged Parent Size}

A.2: $X_{j,t}$ = {A.0}; $X_{s,t-1}$ = {Size, Performance}

A.3: $X_{j,t}$ = {A.0}; $X_{s,t-1}$ = {Size, Performance, Number of Affiliates}

B.0: $X_{j,t}$ = {A.0, Chinn-Ito Index}; $X_{s,t-1}$ = {.}

B.1: $X_{j,t}$ = {A.0, Chinn-Ito Index}; $X_{s,t-1}$ = {Lagged Parent Size}

B.2: $X_{j,t}$ = {A.0, Chinn-Ito Index}; $X_{s,t-1}$ = {Size, Performance}

B.3: $X_{j,t}$ = {A.0, Chinn-Ito Index}; $X_{s,t-1}$ = {Size, Performance, Number of Affiliates}

F.1: $X_{j,t}$ = {A.0}; $X_{s,t-1}$ = {Size, Performance, Number of Affiliates}; $X_{a,t-1}$ = {Size}

F.2: $X_{j,t}$ = {A.0}; $X_{s,t-1}$ = {Size, Performance, Number of Affiliates}; $X_{a,t-1}$ = {Size, Performance}

E.3: $X_{j,t}$ = {A.0, $\texttt{SKEW}_{j,t}$}; $X_{s,t-1}$ = {Size, Performance, Number of Affiliates}

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

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

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

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

Finally, (4) gives the loan interest rate Z

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

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 $\overline{A} = 4.66$.

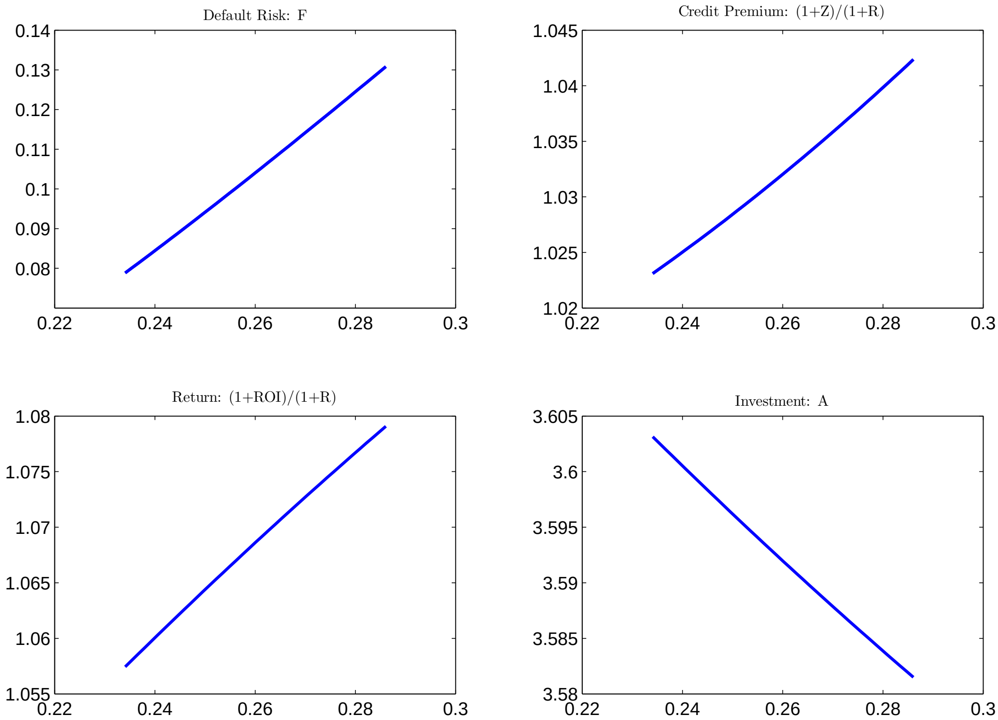


Figure B.10: Financial contract and market equilibrium for assets

Figure B.10 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.11 shows the effect of increasing uncertainty σ in this model. As in the case with homogeneous firms, there is an 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.

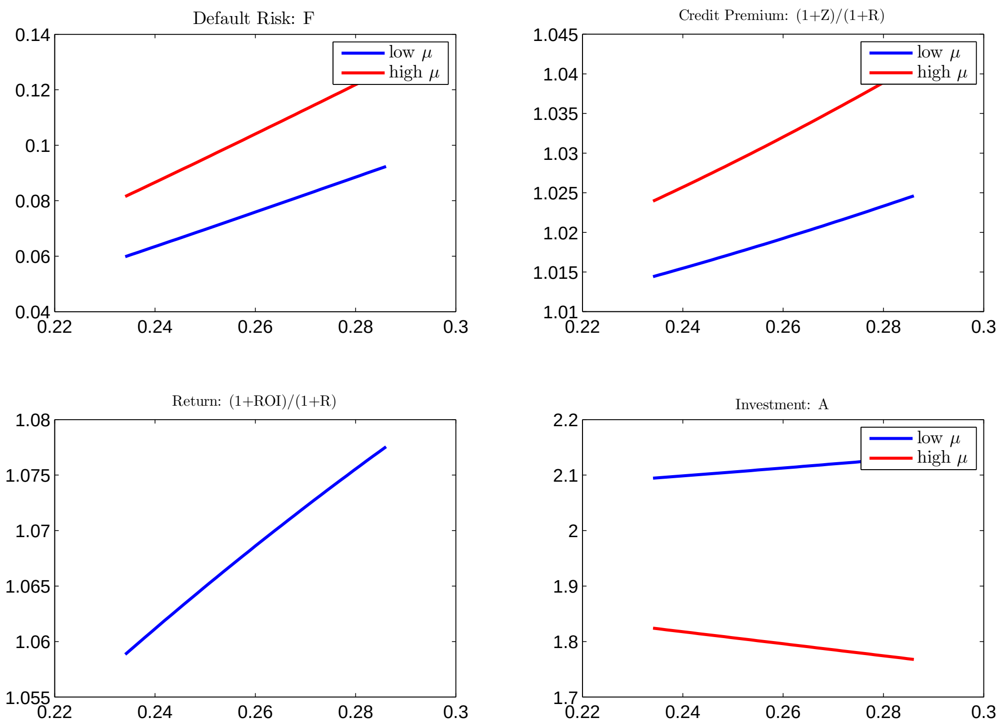


Figure B.11: Financial contract and market equilibrium for assets with heterogeneous multinational firms