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THE EFFECTS OF ECONOMIC POLICY UNCERTAINTY AND LARGE INVESTMENT PROJECT ON LEVERAGE

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ABSTRACT

The dominant view on firms' financial leverage suggests a stable, long-term leverage ratio, while previous studies recognise that factors like macroeconomic fluctuations and unanticipated financing needs can cause deviations from this target leverage. This study seeks to explore the joint effect of economic policy uncertainty (EPU) and large long-term investments on firms' leverage decisions, specifically focusing on how these factors influence target leverage dynamics and financial flexibility. This study uses 2,865 listed firms in NYSE, NASDAQ, and AMEX from 1990 to 2019. The data is analysed through fixed effect panel regression model. The results show that EPU negatively affects firms' leverage, which are reduced through joint effects with large investment for five years. This study also demonstrates firms' financial flexibility motive to protect the debt capacity of large investments and enhance their capabilities.

Keywords: economic policy uncertainty, large investments projects, firm leverage ratio, target leverage, financial flexibility

INTRODUCTION

The presence of conflicting findings underscores the need to gain a deeper understanding of the intricate dynamics of firm leverage. The dominant view on firms' financial leverage is that they have a stationary long-term leverage ratio, with Graham and Leary (2011), Lemmon et al. (2008), and Rauh and Sufi

(2012) arguing that it is stable and persistent. However, some authors recognise the non-stationary long-term leverage ratio. Graham et al. (2015) argue that macroeconomics factors permanently change leverage levels. DeAngelo et al. (2011) state that unanticipated financing needs increase equity and debt, thereby deviating long-term target leverage. In addition, Denis and McKeon (2012) argue that firms prioritise operational sustenance than maintaining target leverage. They increase their target leverage to finance long-term investments and cover negative operating cash flow. He et al. (2021) prove the dynamic target leverage in an international scope. These authors believe that firms do not maintain their target leverage, but some factors can motivate them to adjust their leverage from the target.

Graham et al. (2015) show the importance of macroeconomics factors to firms' leverage decision, while some studies focus on economic uncertainty for the capital structure decision. Cao et al. (2013) argue that uncertainty increases external financing costs, while Çolak et al. (2018), Gungoraydinoglu et al. (2017), and Kaviani et al. (2020) explain that it increases asymmetric information and financial intermediaries' cost. Expensive financing cost discourages additional debt, deviating the target leverage. This reaction implies that firms are concerned about the macroeconomic and institutional changes. Therefore, economic uncertainty has substantial effects on the evolution of the capital structure. Gungoraydinoglu et al. (2017), Li and Qiu (2021), and Zhang et al. (2015) confirm that economic uncertainty affects firms' leverage.

Gulen and Ion (2016) claim that high irreversible investments raise firms' incentive to put them off until the uncertainty level dampens. When firms took irreversible large investment projects, even under high economic uncertainty, they sustain this investment projects by external financing. Consequently, large investments deviate leverage ratio further from the target leverage (Denis & McKeon, 2012) or make the firms have heterogenous speed of adjustments to the target leverage (Dang et al., 2012) under high uncertainty.

This study uses the EPU index to measure uncertainty. The EPU index was used because it has been adopted by corporations, policy makers, and practitioners in decision-making (Baker et al., 2016). It is a newspaper-based uncertainty measurement showing the concern of policy changes (Baker et al., 2016). Previous studies show that EPU affects firms' investment (Gulen & Ion, 2016; Kang et al., 2014; Liu et al., 2020; Vo et al., 2021), cost of debt (Bradley et al., 2016; Gungoraydinoglu et al., 2017), leverage (Li & Qiu, 2021; Zhang et al., 2015), and cash holdings (Demir & Ersan, 2017; Kim & Kung, 2017; Phan et al., 2019).

This study investigates the impact of uncertainty and large investments on firms' leverage. Several studies show that macroeconomic factors (Graham et al., 2015), unexpected funding (DeAngelo et al., 2011), and operational continuity (Denis & McKeon, 2012) changes target leverage. Additionally, some studies investigate the importance of uncertainty to large investments (Gulen & Ion, 2016) and leverage (Gungoraydinoglu et al., 2017; Li & Qiu, 2021; Liu et al., 2015). However, they do not discuss the joint impact of EPU and large investments on leverage. Denis and McKeon (2012), Dudley (2012), and Elsas et al. (2014) show that large investments significantly affect leverage in the long term. Furthermore, uncertainty increases target leverage deviation during large investment projects. Firms prioritise project continuity due to their irreversibility than maintaining target leverage. Therefore, this study examines the impact of EPU on target leverage during large long-term projects.

Economic uncertainty and large investments negatively affect leverage changes, specifically during the third year on the project. Therefore, firms prioritise the project's continuity during high uncertainty periods, deviating target leverage for some years. This is in line with DeAngelo et al. (2011), Denis and McKeon (2012), Graham et al. (2015), and He et al. (2021), which explain the substantial target leverage deviations and changes.

The results show that uncertainty and large investments affect leverage for higher financially constrained firms due to limited external financing access decreasing debt. This confirms the financial flexibility motives (Gamba & Triantis, 2008; Graham & Harvey, 2001; Rapp et al., 2014), which explains that firms decrease and reserve debt capacity for sustainability.

The primary objective of this research is to investigate the joint impact of economic policy uncertainty (EPU) and large long-term investments on firms' leverage decisions. Specifically, we seek to understand how the interaction between these factors influences target leverage dynamics and financial flexibility, particularly among financially constrained firms. By exploring this interaction, we aim to provide valuable insights into the complex and evolving nature of firms' leverage choices, shedding light on the factors that lead to deviations from target leverage and their implications for financial stability and sustainability.

LITERATURE REVIEW

Uncertainty and Capital Structure

Studies focusing on uncertainty and capital structure indicate two economic mechanisms. First, funds requirements decrease based on demand, where increased EPU affects the information asymmetries between borrowers and lenders. Uncertainty causes future cash flows volatility and higher default risk, hindering forecasts. Therefore, firms delay new externally financed investments under high uncertainty. Secondly, increased uncertainty reduces future capital for fund providers, specifically constrained financial firms, by increasing external financing costs (Çolak et al., 2018; Gungoraydinoglu et al., 2017; Kaviani et al., 2020; Matousek et al., 2020). Kaviani et al. (2020), using the US data, find that an increase of one standard deviation of the EPU increases the credit spread index[1] by 9.6 points. Therefore, firms reduce leverage to sustain their financial flexibility (Zhang et al., 2015) under high economic uncertainty.

Zhang et al. (2015) find that China's EPU decreases leverage ratios due to deteriorated external funding, but state-owned firms or prior bank relationships alleviate the negative effects. Gungoraydinoglu et al. (2017) use international data and find that leverage ratio decreases due to reduced long-term than short-term debts during high uncertainty. In addition, Li and Qiu (2021) find that economic uncertainty affects leverage ratios depending on the firms' characteristics. These characteristics determine the leverage's responsiveness to economic uncertainty innovations, including aggressively or conservatively.

H1: EPU negatively affects leverage.

Large Investment and Capital Structure

DeAngelo and Roll (2015) evaluate the substantial dynamics of individual and industry-median leverage ratios in US firms. Meanwhile Graham et al. (2015) and He et al. (2021) indicate their long-term non-stationary leverage evolution. Denis and McKeon (2012) and Elsas et al. (2014) also report that large investments is the one of the main factors that deviate the leverage from the target since firms mainly rely on external financing. DeAngelo et al. (2011) argue that funding large investments through transitory debt diverts the target leverage. Cook et al. (2016) state that downsizing and upsizing of the firm leads to changes in the target leverage.

Denis and McKeon (2012) find that most debt proceeds fund operating needs, specifically capital expenditures, and merger and acquisition (M&A). They find also that firms do not deliberately revert their target leverage. Additionally, after the original jump, the reduced leverage ratios are still significantly higher after seven years. Faulkender et al. (2012) find that leverage ratio deviates, specifically during negative operating cash flow or delayed growth. According to Dudley (2012), when firms take large investment projects, they tend to choose equity financing before realising tax shield from their investment and adjusting its target leverage. Dudley (2012) further state that target leverage of firms that undertake large investments evolve during growth options and are transformed into asset in place. Therefore, their leverage does not revert to the target after the large investments. Elsas et al. (2014) show that large investments alter a firm's unique characteristics comprehensively which brings its target leverage. Cook et al. (2016) report that significant upsizing firms decrease their target leverage ratio with increase in financing period. Bargeron et al. (2018) show that after investment spike around First World War leverage of firms subsequently decrease in the US. Frank and Shen (2019) also confirm that when a firm undertakes a large investment project like a major acquisition, its book leverage decreases for the next few years.

H2: Large investments negatively affect leverage.

Joint Effects of Uncertainty and Large Investments to Capital Structure

Uncertainty with investment irreversibility causes delaying options (Doshi et al., 2018; Gulen & Ion, 2016). High uncertainty increases delaying options and future cash flow volatility of new projects. The value of real option in investment for firms facing external financial costs is related with timing and financial flexibility (Bolton et al., 2019). Therefore, firms postpone investments until decrease of economic uncertainty copes with increased delaying costs.

The effects of uncertainty on investments depend on complex capital adjustment costs (Doshi et al., 2018). The impacts of increasing economic uncertainty on investment for firms that raise funds is largely dependent on external funding (Bolton et al., 2019). Therefore, firms decrease leverage to increase future financial flexibility and reserve their debt capacity (Gamba & Triantis, 2008; Graham & Harvey, 2001; Rapp et al., 2014). DeAngelo et al. (2018) report that firms that reach their historical high leverage choose deleveraging and hoard cash holdings to restore their financial flexibility.

Some firms stop funding large investment projects after facing high economic uncertainty due to irreversible large investment, despite having expensive external funding costs. When firms take large investment, their leverage increases (Bargeron et al., 2018) with decrease in financial flexibility. However, after taking large investments, firms rely on internal funding and external equity financing as the length of investment period becomes longer (Grundy & Verwijmeren, 2020) with increase in investment size (Dudley, 2012). Firms find it difficult reverting to target leverage due to economic uncertainty (Denis & McKeon, 2012). Therefore, after undertaking large investments, their leverage decrease in subsequent years.

H3: Irreversible large investments under high uncertainty negatively affect leverage.

DATA AND METHODOLOGY

Data and Sample Information

This study samples the US companies listed on the New York Stock Exchange (NYSE), National Association of Securities Dealers Automated Quotations (NASDAQ), and American Stock Exchange (AMEX). The financial report data is collected from the SandP Capital IQ platform from 1990 to 2019. The utilities (SIC 4900-4949) and financial industries (SIC 6000–6999) are excluded due to constrained leverage policy. Furthermore, it excludes observations with missing values for total assets, property plant and equipment, short- and long-term debts, sales, operating income, and capital expenditures. The final sample consists of 2,865 companies with 49,747 unbalanced annual observations. Following Gulen and Ion (2016), Kaviani et al. (2020), and Zhang et al. (2015), the EPU index by Baker et al. (2016) is applied as the proxy of economic uncertainty. It is a qualitative news-based measure of uncertainty that captures short- and long-term concerns on economic uncertainty policies, including what and when the actions will be undertaken and their effects. EPU is used by financial institutions, policymakers, and researchers for decision-making, showing its credibility to measure uncertainty. This study winsorizes all variables into the commonly applied extreme 1% to mitigate the effects of outliers (Frank & Goyal, 2009).

Target Leverage

The empirical model of Hovakimian and Hovakimian (2021) is applied to capture fixed effects of the panel models (Lemmon et al., 2008), the firm's characteristics,

investment policy, and the median industry leverage. The annual target leverage is defined as the fitted value from Equation (1):

$$Lev_{it} = \alpha_{it} + \alpha_1 Imed_{it\text{-}1} + \alpha_2 Size_{it\text{-}1} + \alpha_3 Tan_{it\text{-}1} + \alpha_4 \mathrm{Mtb}_{it\text{-}1} + \alpha_5 \mathrm{Pro}_{it\text{-}1} + \alpha_6 \mathrm{Cpx}_{it\text{-}1} + \alpha_7 \mathrm{RD}_{it\text{-}1} + \epsilon_{it} \ldots (1)$$

With industry median leverage ratio as *Imed*, the natural logarithm of sales as *Size*, net fixed assets as *Tan* growth opportunities as *Mtb*, earnings before interest and tax as Prof, capital expenditures as Capex, and R&D expenses as R&D. The variables of *Tan*, *Mtb*, *Pro*, *Cpx*, and *RD* are scaled by total assets, respectively.

Effects of Uncertainty on Leverage during the Large Projects

Equation (2) tests the hypothesis to find the effects of uncertainty on leverage during large investment projects. Coefficients of uncertainty and those with large investment-year dummy variables (D1–D3) are negative, indicating that uncertainty negatively impacts leverage during large investments.

$$Lev_{it} = \beta_{it} + \beta_1 EPU_{it-1} + \beta_2 EPU_{it-1} * D1_{it} + \beta_3 EPU_{it-1} * D2_{\mathrm{it}} + \beta_4 EPU_{it-1} * D3_{it} + X_{i,j,t-1} * \gamma_j + \varepsilon_{it} \ldots (2)$$

The dependant variable of this equation is leverage (Lev). With *EPU* as uncertainty index by Baker et al. (2016). Baker et al. (2016), D1 is the dummy variable that stands for 1 when a firm takes large investments in the first year, and others are zero. D2 shows the dummy variable that stands for 1 for the second year after the investment and others are zero, while D3 is the dummy variable standing for 1 for the third year and others are zero. X is the control variables, including industry median leverage ratio (Imed), the natural logarithm of sales (Size), net fixed assets (Tang), growth opportunities (MB), earnings before interest and tax (Prof), capital expenditures (Capex), and R&D expenses (R&D). The variables of Tang, MB, Prof, Capex, and R&D are scaled by total assets, respectively. Detailed variable definition are provided in Table 1. All the independent variables are lagged by one period to mitigate potential endogeneity issues (Lee & Wang, 2021).

Effects of Uncertainty and Target Leverage on the Leverage Changes during Large Investment Projects

Equation (3) investigates the impact of uncertainty to leverage changes during large investment projects. The coefficient of uncertainty, investment year, and interaction of uncertainty with investment year are negative. Therefore, during large investment projects, uncertainty decreases the change of leverage.

$$\Delta Lev_{it} = \delta_{it} + \delta_1 EPU_{it-1} + \delta_2 Dev_{it-1} + \delta_3 I_{it-1} + \delta_4 \Delta Tgt_{it-1} + \delta_5 EPU_{it-1} * Dev_{it-1} + \delta_6 EPU_{it-1} * I_{it-1} + \delta_7 EPU_{it-1} * \Delta Tgt_{it-1} + X_{i,j,t-1} * \gamma_j + u_{it} \ldots (3)$$

Where ΔLev is change in leverage and ΔTgt is change of target leverage.

With *EPU* as uncertainty index by Baker et al. (2016) and deviation (*Dev*) as the difference between actual and target leverage from equation (1). Investment year(s) (I) is the number of years after a firm's large investment projects. X shows the control variables, including industry median leverage ratio (Imed), the natural logarithm of sales (Size), net fixed assets (Tang), growth opportunities (MB), earnings before interest and tax (Prof), capital expenditures (Capex), and R&D expenses (R&D). The variables of Tang, MB, Prof, Capex, and R&D are scaled by total assets, respectively. Detailed variable definition are provided in Table 1.

Table 1
Definitions of variables

Variable	Formula/Operationalisation	Previous studies
Dependent variable		
Market leverage ($Lev_{i,t}$)	Total $debts_{i,t}$/[Total $debts_{i,t}$ + Market value of $equity_{i,t}$]	Denis and McKeon (2012); Dudley (2012); Graham et al. (2015); Lemmon et al. (2008)
Book leverage ($Lev_{i,t}$)	Total $debt_{i,t}$/Total $assets_{i,t}$	Dudley (2012); Lemmon et al., (2008)
Change in leverage ($\Delta Lev_{i,t}$)	$[Lev_{i,t} - Lev_{i,t-1}]/Lev_{i,t-1}$	Dudley (2012); Hovakimian and Hovakimian (2021)
Independent variables		
Industry median debts ($Imed_{i,t}$)	Industry median leverage ratio based on 3-digits SIC	Dudley (2012); He et al. (2021); Lemmon et al. (2008)
Firm size ($Size_{i,t}$)	Natural logarithm of total assets	Denis and McKeon (2012); Dudley (2012); He et al. (2021); Hovakimian and Hovakimian, (2021); Lemmon et al. (2008)
Tangibility ($Tan_{i,t}$)	Net fixed $assets_{i,t}$/Total $assets_{i,t}$	Denis and McKeon (2012); Dudley (2012); Hovakimian and Hovakimian (2021); Lemmon et al. (2008)
Growth opportunity ($MB_{i,t}$)	Market value of $equity_{i,t}$/Book $value_{i,t}$	Denis and McKeon (2012); Dudley (2012); Graham et al. (2015); He et al. (2021); Hovakimian and Hovakimian, (2021)

(*Continued on next page*)

Table 1 (*Continued*)

Variable	Formula/Operationalisation	Previous studies
Profitability ($Prof_{i,t}$)	EBIT $_{i,t}$/Total asset $_{i,t-1}$	Denis and McKeon (2012); Dudley (2012); Graham et al. (2015); He et al. (2021); Lemmon et al. (2008)
Investment ($I_{i,t}$)	[Capital expenditure $_{i,t}$ +R&D expenditure $_{i,t}$ –ΔNWCD $_{i,t}$]/ [Total asset $_{i,t-1}$ –Cash $_{i,t-1}$], where WCD = (Current assets – Cash and Cash equivalents) – (Current liabilities – Short term debts)	Dudley (2012)
Capital expenditure ($Capex_{i,t}$)	[Capital expenditure $_{i,t}$/Total Asset $_{i,t-1}$	Dudley (2012); Graham et al. (2015); He et al. (2021)
Research and development ($R\&D_{i,t}$)	R&D expenses $_{i,t}$/Sales $_{i,t,}$ if R&D data missing set as zero	Dudley (2012); He et al. (2021); Hovakimian and Hovakimian (2021)
Economic policy uncertainty ($EPU_{i,t}$)	Equal monthly average of the EPU index by Baker et al. (2016)	Baker et al. (2016); Gulen and Ion, (2016); He et al. (2021); Li and Qiu (2021)
Investment year (D_{it})	Firm years after large investments based on the variable Inv_{it}.	Dudley (2012)
Target leverage (Tgt_{it})	Fitted value from Equation (1)	Dudley (2012); Hovakimian and Hovakimian (2021); Lemmon et al. (2008)
Deviation from the target leverage ($Dev_{i,t}$)	$Lev_{i,t} – Tgt_{i,t}$	Dudley (2012); Hovakimian and Hovakimian (2021); Lemmon et al. (2008)
Change of target leverage ($\Delta Tgt_{i,t}$)	Tgt $_{i,t}$ – Tgt $_{i,t-1}$	Dudley (2012)

Large Investment

There is no theory defining a major or large investment,[2] hence, this study defines large investment projects following Dudley (2012) and Elsas et al. (2014) with a little modification. Large investments are defined as follows:

1. When a firm's annual investment rate is 1.5 times higher than the median industry rate, it is estimated from all firm-years based on 3-digits SIC (Dudley, 2012).

2. The annual investment rate surpasses 200% of the average 3 years' previous investments.

3. When the annual investment rate increased at least 30% of total assets (Elsas et al., 2014). This approach considers the firm's investment years when positive correlations among growth opportunities are found in a specific industry (Dudley, 2012), capturing its investment deviation.

EMPIRICAL RESULTS

Descriptive Statistics

Table 2 Panel A shows a lower mean of the market than book leverage, while the range and standard deviation in book leverage are higher than the market. This difference between book and market leverage is consistent with the mean of the market-to-book ratio of 2.031. The investment variable shows higher variability, showing heterogenous investment policies. Table 2 Panel B is based on the large investment criteria by Dudley (2012), showing 36,606 investment years. It represents 73.58% investment years of 49,747 total observations, with 75.15% of the firms having at least one investment year during the sample period.

Table 2
Descriptive statistics

Panel A. Descriptive Statistics for All Firms

	N	Mean	SD	p25	Median	p75	Min	Max
Size	49747	8.735	1.004	8.067	8.784	9.443	5.747	10.868
Investment	49747	0.162	0.559	0.021	0.073	0.156	–0.469	8.178
Market-to-book	49747	2.031	2.295	0.981	1.386	2.188	0.074	18.677
Profitability	49747	0.035	0.343	0.047	0.103	0.162	–2.72	0.429
Market Leverage	49747	0.383	0.312	0.145	0.302	0.534	0.006	1.631
Book Leverage	49747	0.463	0.349	0.263	0.421	0.571	0.026	3.071
Tangibility	49747	0.299	0.27	0.081	0.203	0.46	0	0.943
Income Tax	49747	0.018	0.033	0	0.011	0.033	–0.084	0.137
Depreciation	49747	0.016	0.027	0	0	0.027	0	0.126
Log Sales	49747	8.541	1.126	7.883	8.672	9.309	2.524	10.789
CAPEX	49747	0.049	0.058	0.01	0.03	0.06	0	0.34
R&D	49747	0.039	0.099	0	0	0.026	0	0.636
EPU	30	111.79	28.73	87.06	111.44	127.83	71.33	172.23

(*Continued to next page*)

Table 2 (*Continued*)

Panel B. Frequency Analysis of Large Investment

	N	%
Investment years	36,606	73.58
Firms with at least one investment year	2,153	75.15
Total number of observations	49,747	
Total number of firms	2,865	
The average number of observations per firm	16.801	

Table 3 shows the firm's characteristics based on different large investments criteria. The investment criteria based on Dudley (2012) in Panel A and Elsas et al. (2014) in Panel B and C shows that firms with high growth opportunities and market leverage take big investments. Large investments based on three criteria have consistent high capital expenditure, except for the firms with different characteristics.

Figure 1 shows the leverage level after the firms' large investment projects. The first five investment-year observations reaches 29,844 or 81.53% of total investment years. The observations are not enough beyond five investment years, with the book and market leverage showing a gradual downtrend until five years of a large investment project. However, the market decreases more than book leverage, showing that leverage decreases with investment year. This is in line with Elsas et al. (2014) and Graham et al. (2015), which show a long-term increases leverage deviation without reverting.

Baseline Results: Estimation Target Leverage

The effects of investment years on leverage ratio are estimated until five years because of limited observations of big investments, despite the longest investment period of 30 years. Column (3) in Table 4 shows that leverage decreases until the fifth year with an increase in investment year.[3] The growth opportunities to cash after the large investments reduce firms' leverage. This is partially consistent with Dudley (2012) that shows a leverage decrease until the second year and an increase from the third. This research is similar with the finding of Bargeron et al. (2018), which show that after the hike in investment by firms before the first world war, their leverage decreased for several years due to financial flexibility. Denis and McKeon (2012) state that firms deviate from target leverage to take large investments. The leverage decreases after the large investments because of growth opportunities or investments continuation using equity (Dudley, 2012).

Table 3
Descriptive statistics for big and small investment firms

Panel A. Big and small investment firms based on criteria 1

Small investment	Big investment				
	Mean	SD	Mean	SD	Mean diff.
Size	8.853	0.976	8.424	0.986	0.429***
Investment	0.048	0.105	0.419	0.950	–0.372***
Market to book	1.870	1.971	2.399	2.869	–0.529***
Profitability	0.071	0.260	–0.050	0.475	0.121***
Market leverage	0.384	0.296	0.377	0.344	0.006**
Book leverage	0.460	0.318	0.464	0.404	–0.005
Tangibility	0.296	0.266	0.296	0.277	0.000
CAPEX	0.041	0.043	0.066	0.080	–0.026***

Panel B. Big and small investment firm based on criteria 2

	Small investment		Big investment		Mean diff.
	Mean	SD	Mean	SD	Mean diff.
Size	8.633	1.015	8.854	0.958	–0.221***
Investment	0.141	0.569	0.201	0.559	–0.059***
Market to book	2.001	2.393	2.090	2.152	–0.089***
Profitability	0.010	0.382	0.069	0.278	–0.060***
Market leverage	0.414	0.338	0.331	0.258	0.082***
Book leverage	0.470	0.377	0.446	0.292	0.024***
Tangibility	0.294	0.272	0.300	0.266	–0.006**
CAPEX	0.046	0.056	0.053	0.062	–0.007***

Panel C. Big and small investment firm based on criteria 3

	Non-big investment		Big investment		Mean diff.
	Mean	SD	Mean	SD	Mean diff.
Size	8.761	1.006	8.502	0.934	0.258***
Investment	0.149	0.547	0.244	0.648	–0.095***
Market to book	1.913	2.132	2.664	2.955	–0.751***
Profitability	0.039	0.347	–0.002	0.340	0.041***
Market leverage	0.386	0.305	0.363	0.345	0.023***
Book leverage	0.465	0.352	0.440	0.320	0.026***
Tangibility	0.305	0.268	0.251	0.273	0.054***
CAPEX	0.047	0.054	0.055	0.078	–0.008***

Notes: Standard errors are in parentheses;: *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$

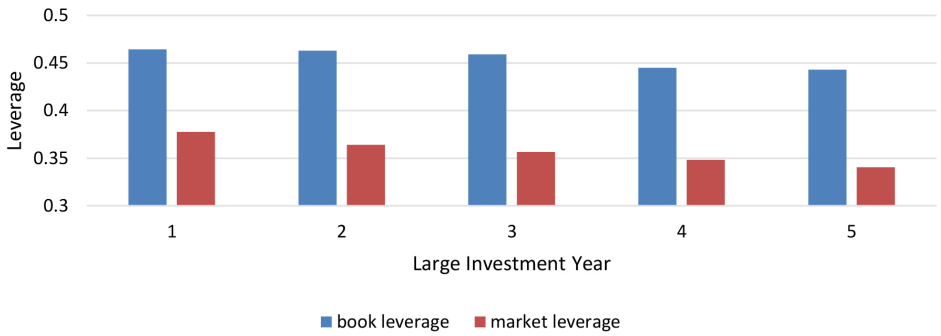

Figure 1. Leverage and large investment year

Table 4
Estimation of target leverage

	Predicted sign	(1)	(2)	(3)
		Market leverage	Book leverage	Market leverage
$Imed_{jt-1}$	+	0.046***	0.542***	0.046***
		(0.006)	(0.017)	(0.018)
$Size_{it-1}$	–	–0.075***	–0.018***	–0.075***
		(0.003)	(0.003)	(0.009)
$Tang_{it-1}$	+	0.14***	0.174***	0.14***
		(0.011)	(0.013)	(0.022)
MB_{it-1}	–	–0.033***	0.006***	–0.033***
		(0.001)	(0.001)	(0.001)
$Prof_{it-1}$	–	–0.101***	–0.222***	–0.098***
		(0.005)	(0.006)	(0.01)
$R\&D_{it-1}$	+	0.038*	0.115***	0.055
		(0.02)	(0.023)	(0.038)
$CAPEX_{it-1}$	+	0.055**	–0.168***	0.081**
		(0.025)	(0.029)	(0.037)
Dummy: year=1	–			–0.026***
				(0.003)
Dummy: year=2	–			–0.022***
				(0.004)
Dummy: year=3	–			–0.021***
				(0.002)
Dummy: year=4	–			–0.024***
				(0.004)

(*Continued on next page*)

Table 4 (*Continued*)

	Predicted sign	(1)	(2)	(3)
		Market leverage	Book leverage	Market leverage
Dummy: year=5	–			–0.021***
				(0.004)
_cons		1.036***	0.34***	1.049***
		(0.023)	(0.027)	(0.079)
Firm Fixed Effect		Yes	Yes	Yes
Observations		44,903	44,903	44,903
R^2		0.0773	0.0954	0.1062

Notes: Standard errors are in parentheses; *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$
Fixed effects panel regression is performed using 1990–2019. The book and market leverages are calculated by total debts over assets ratios and the ratio of total debts over market and book equity value of debts, respectively. Industry median leverage (Imed) is calculated as the median of the same industry for book and market leverage, respectively. The firm's size (Size) and tangibility (Tang) are calculated by the natural logarithm of sales and the ratio of net fixed assets over total assets, respectively. Growth opportunities (MB) are calculated by the ratio of the equity market over book value, while the earnings before interest and tax (Prof) are calculated by the ratio of EBIT over total assets. Capital expenditures (CAPEX) are calculated by the capital expenditure ratio over total assets, while R&D expenses (R&D) are calculated by R&D expenses over total assets, with the missing value as zero. The dummy years are defined as 1 from the first to the fifth year of large investment, and the others are zero.

Effects of Uncertainty on Leverage

Table 5 shows that EPU negatively affects leverage in columns (1) and (3) at 10% and 1% significance levels, respectively. This result confirms that the hypothesis (HI) EPU has negative effects on the leverage ratio. It is consistent with the findings of Bargeron et al. (2018), Gungoraydinoglu et al. (2017), Li and Qiu (2021), and Zhang et al. (2015). When economic uncertainty increases, hike in financial frictions leads to rise in external funding costs (Çolak et al., 2018; Kaviani et al., 2020). Hence, firms decrease their leverage when EPU increases.

Table 5 also shows that interaction variables between EPU and length of period after firms undertook large investments ($D_1 \times EPU$, $D_2 \times EPU$, and $D_3 \times EPU$) negatively affect leverage in columns (1) and (3) at 10% and 1% significance levels, respectively. Firms that undertook large investment tends to issue equity (Dudley, 2012) and reduce usage of debt (Bargeron et al., 2018). Decrease of leverage is intensified with increase the economic policy uncertainty. This finding confirms that large investment projects strengthen the negative effect of EPU on leverage, thereby rejecting hypothesis (H3). Increased economic uncertainty decreases leverage due to rise in external funding costs (Cao et al., 2013; Çolak et al., 2018; Gungoraydinoglu et al., 2017). Firms decrease leverage with increase in uncertainty for maintaining financial flexibility for continuous operation of large investments.

Interaction between EPU and length of period after firms undertook large investment has negative effects on leverage ratio under economic uncertainty until the third year. This implies that leverage of the firms do not reverse back to its original target until the third year. This joint effect of EPU and large investment projects shows the long-term leverage deviation phenomena by Denis and McKeon (2012), Graham et al. (2015), and He et al. (2021).

Effects of Economic Uncertainty and Large Investment on Leverage Change

Table 6 reinforces the negative impact of EPU and large investment projects on leverage. Consistent effects are not shown on the leverage changes of big investment dummy variable, which indicates H2 is not supported. This results is not consistent with the findings of Dudley (2012), where firms use equity to fund large investment projects. Furthermore, it also found that big investment dummy and economic uncertainty interaction (EPU*BigInv) negatively affect leverage change, hence H3 is not supported. This is in addition to the joint effects of EPU (EPU*Dev) with leverage deviation and change of target leverage (EPU*ΔTgt). Since uncertainty increases financing costs, firms decrease their leverage level to reduce potential financial distress. In addition, they decrease debt to increase financial flexibility and sustain large investment projects (Gamba & Triantis, 2008; Rapp et al., 2014). Firms prioritise project continuity over maintaining their target leverage due to irreversible costs of large investments, deviating the leverage longer than expected (Deangelo & Roll, 2015; Denis & McKeon, 2012). Firms decrease debts usage in decreasing the impact of the expensive external funding costs (Bolton et al., 2019), which increases the economic policy uncertainty.

Table 6 shows that deviation (Dev) negatively affects the leverage change, moving the target leverage ratio. This movement is weaker during high economic uncertainty, specifically in the book leverage ratio. High uncertainty increases external financing cost (Çolak et al., 2018; Gungoraydinoglu et al., 2017; Kaviani et al., 2020), delaying the reversion to target leverage.

The variable change of target leverage (ΔTgt) negatively affects the leverage change at 5% and 10% significance levels, specifically the book leverage. Similar to leverage deviation (Dev), the change of target leverage limits the leverage changes. Firms adjust their preferences on target leverage to the current, reducing changes. However, EPU and change of target leverage (EPU*ΔTgt) do not affect leverage change.

Table 5
The effect of uncertainty and big investments on leverage

	Predicted sign	(1)	(2)	(3)	(4)	(5)	(6)
			Market leverage			Book leverage	
EPU_{t-1}	–	–0.0003*	–0.000003	–0.0004*	–0.00003	0.00001	–0.00003
		(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0001)	(0.0001)
$D1 \times EPU_{t-1}$	–	–0.0001***	–0.0005***	–0.0002***	–0.0001***	–0.0001*	–0.0006***
		(0.00003)	(0.00005)	(0.00004)	(0.00003)	(0.00005)	(0.0001)
$D2 \times EPU_{t-1}$	–	–0.0001***	–0.0004***	–0.00002	0.000007	–0.0001	–0.0001***
		(0.00002)	(0.00004)	(0.0001)	(0.00002)	(0.00005)	(0.00002)
$D3 \times EPU_{t-1}$	–	–0.0001***	–0.0004***	–0.00002	0.000006	–0.0001***	–0.0001**
		(0.00002)	(0.0001)	(0.0001)	(0.00002)	(0.00004)	(0.00002)
$Imed_{jt-1}$	+	0.0465***	0.0456***	0.0447***	0.5446***	0.543***	0.5405***
		(0.0157)	(0.0168)	(0.0159)	(0.0159)	(0.0158)	(0.0161)
$Size_{it-1}$	–	–0.0666***	–0.0508***	–0.0704***	–0.0177	–0.0138	–0.0312**
		(0.0104)	(0.0106)	(0.011)	(0.0124)	(0.012)	(0.0138)
$Tang_{it-1}$	+	0.1404***	0.1267***	0.1374***	0.1725***	0.1717***	0.1611***
		(0.0194)	(0.0194)	(0.0187)	(0.0226)	(0.022)	(0.022)
MB_{it-1}	–	–0.0331***	–0.0318***	–0.0327***	0.0056***	0.0057***	0.0073***
		(0.0014)	(0.0014)	(0.0014)	(0.0021)	(0.0021)	(0.0021)
$Prof_{it-1}$	–	–0.102***	–.1024***	–0.1028***	–0.2214***	–0.2228***	–0.2192***
		(0.0109)	(0.011)	(0.011)	(0.0171)	(0.0173)	(0.0165)
$R\&D_{it-1}$	+	0.0585	0.073*	0.0486	0.1291	0.1207	0.1241
		(0.0382)	(0.0415)	(0.0372)	(0.0816)	(0.0831)	(0.0805)

(*Continued on next page*)

Table 5 (*Continued*)

	Predicted sign	(1)	(2)	(3)	(4)	(5)	(6)
			Market leverage			Book leverage	
$CAPEX_{it-1}$	+	0.0522	0.0551	0.0452	–0.1589***	–0.1701***	–0.1197***
		(0.0375)	(0.0359)	(0.0365)	(0.0334)	(0.0311)	(0.0311)
_cons		1.0096***	0.8653***	1.0454***	0.3408***	0.3079***	0.4612***
		(0.0795)	(0.0801)	(0.0842)	(0.1105)	(0.1079)	(0.1211)
Observations		44,903	44,903	44,903	44,903	44,903	44,903
Pseudo R^2		0.108	0.1188	0.1085	0.0784	0.0782	0.0878

Note: Standard errors are in parentheses; *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$

Fixed effects panel regression is performed using 1990–2019. The book and market leverage are calculated by total debts over total assets ratio and total debts over market and book equity value of debts, respectively. EPU is calculated by the annual average using the quarterly economic policy of uncertainty index from Baker et al. (2016). A large investment in columns (1) and (4) shows a higher annual investment rate by 1.5 times than the industry's median rate (Dudley, 2012). In columns (2) and (5), it is defined when the investment surpasses 200% of the 3 years average previous investments (Elsas et al., 2014). In columns (3) and (6), it is defined when total assets increased more than 30% (Elsas et al., 2014). Industry median leverage (Imed) is calculated as the median of the same industry for book and market leverage, respectively. The firm's size (Size) and tangibility (Tang) is calculated by the natural logarithm of sales and the ratio of net fixed assets over total assets, respectively. Growth opportunities (MB) are calculated by market equity over book value ratio, while earnings before interest and taxes (Prof) are calculated by the ratio of EBIT over total assets, and capital expenditures (CAPEX) are calculated by the ratio of capital expenditure over total assets. R&D expenses (R&D) are calculated by R&D expenses over total assets, with the missing value as zero. The dummy years for the first to third years are defined as 1 after taking a large investment, and others are zero.

Table 6
Effects of EPU and investment on leverage change

	Predicted Sign	(1)	(2)	(3)	(4)	(5)	(6)
		Δ Market Leverage			Δ Book Leverage		
EPU_{t-1}	–	–0.0019**	–0.0022***	–0.0019**	–0.0009***	–0.001***	–0.0009***
		(0.0008)	(0.0009)	(0.0009)	(0.0003)	(0.0004)	(0.0003)
Dev_{it-1}	–	–1.2706***	–1.2797***	–1.2625***	–0.7569***	–0.7588***	–0.7566***
		(0.2693)	(0.2693)	(0.2713)	(0.0747)	(0.0741)	(0.075)
$EPU_{t-1} \times Dev_{it-1}$	+	0.0039	0.004	0.0038	0.0012*	0.0012*	0.0012*
		(0.0025)	(0.0025)	(0.0025)	(0.0006)	(0.0006)	(0.0006)
ΔTgt_{it-1}	–	–0.5246	–0.5321	–0.4258	–0.2113*	–0.2141**	–0.2091*
		(0.7914)	(0.7863)	(0.7958)	(0.1086)	(0.1079)	(0.1085)
$EPU_{t-1} \times \Delta Tgt_{it-1}$	–	0.0005	0.0005	–0.0003	–0.0011	–0.0011	–0.0012
		(0.0076)	(0.0075)	(0.0076)	(0.0009)	(0.0009)	(0.0009)
$BigInv_{it-1}$	–	0.0795	–0.0386*	0.1389**	0.0386	–0.0089	0.0328
		(0.049)	(0.0231)	(0.0555)	(0.0238)	(0.0135)	(0.0276)
$EPU_{t-1} \times BigInv_{it-1}$	–	–0.0007*	0.0003	–0.0012***	–0.0003*	0.0001	–0.0004*
		(0.0004)	(0.0002)	(0.0004)	(0.0002)	(0.0001)	(0.0002)
$Imed_{jt-1}$	–	–0.1336*	–0.1329*	–0.1329*	–0.0861*	–0.085*	–0.0849*
		(0.0684)	(0.0687)	(0.0683)	(0.0486)	(0.0488)	(0.0478)
$Size_{it-1}$	+	0.1355***	0.1372***	0.1374***	–0.0199	–0.0195	–0.0196
		(0.0453)	(0.0449)	(0.0449)	(0.0136)	(0.0132)	(0.0133)
$Tang_{it-1}$	–	–0.278***	–0.286***	–0.2736***	0.0019	–0.0004	–0.0042

(*Continued on next page*)

Table 6 (*Continued*)

	Predicted Sign	(1)	(2)	(3)	(4)	(5)	(6)
		Δ Market Leverage			Δ Book Leverage		
		(0.065)	(0.065)	(0.0676)	(0.0438)	(0.0431)	(0.0446)
MB_{it-1}	+	0.0854***	0.0857***	0.0852***	0.0013	0.0014	0.0015
		(0.0071)	(0.0072)	(0.0071)	(0.0039)	(0.0039)	(0.0039)
$Prof_{it-1}$	–	0.0343	0.0352	0.0335	–0.1964***	–0.1962***	–0.1939***
		(0.0354)	(0.0351)	(0.0347)	(0.0267)	(0.0271)	(0.0274)
$R\&D_{it-1}$	–	–0.417***	–0.4011***	–0.4032***	–0.0755	–0.0706	–0.0801
		(0.0857)	(0.0805)	(0.0744)	(0.0671)	(0.0702)	(0.0695)
$CAPEX_{it-1}$	+	0.7773***	0.8405***	0.7913***	–0.0944	–0.0725	–0.0693
		(0.1801)	(0.192)	(0.1796)	(0.1164)	(0.111)	(0.1061)
_cons		–1.0031***	–0.9801***	–1.0211***	0.6218***	0.6326***	0.626***
		(0.3777)	(0.3754)	(0.364)	(0.1322)	(0.1333)	(0.1302)
Observations		38,944	38,944	38,944	38,944	38,944	38,944
Pseudo R^2		0.1458	0.1457	0.1461	0.0968	0.0968	0.0969

Note: Standard errors are in parentheses; *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$

Fixed effects panel regression is performed using 1990–2019. The book and market leverage are calculated by total debts over total assets ratio and total debts over market and book equity value of debts, respectively. EPU is calculated by the annual average using the quarterly economic policy of uncertainty index from Baker et al. (2016). A large investment in columns (1) and (4) shows a higher annual investment rate by 1.5 times than the industry's median rate (Dudley, 2012). In columns (2) and (5), it is defined when the investment surpasses 200% of the 3 years average previous investments (Elsas et al., 2014). In columns (3) and (6), it is defined when total assets increased more than 30% (Elsas et al., 2014). Industry median leverage (Imed) is calculated as the median of the same industry for book and market leverage, respectively. The firm's size (Size) and tangibility (Tang) is calculated by the natural logarithm of sales and the ratio of net fixed assets over total assets, respectively. Growth opportunities (MB) are calculated by market equity over book value ratio, while earnings before interest and taxes (Prof) are calculated by the ratio of EBIT over total assets, and capital expenditures (CAPEX) are calculated by the ratio of capital expenditure over total assets. R&D expenses (R&D) are calculated by R&D expenses over total assets, with the missing value as zero. The dummy years for the first to 3 years are defined as 1 after taking a large investment, and others are zero.

Robustness Tests

Propensity score matching of large investments

The main model has potential endogeneity problems due to the simultaneous relationship between leverage ratio and investment policy (Aivazian et al., 2005; Sundaresan et al., 2015) and omits variables such as governance characteristics potentially correlating with other independent variables. These problems can be alleviated by a propensity score matching approach (Rosenbaum & Rubin, 1983), utilising the conditional probability of large investments with observable firm characteristics. This study assumes that firms take large investment projects based on their characteristics as shown in equation (1) baseline model. The logistic model is used to calculate propensity score of each firm by using a value of 1 if a firm takes large investments until a certain period, otherwise zero. Since we define the length of investment period up to 5 years, we run logistic regression for each investment period to get propensity score. After estimating the propensity score of each firm taking large investment projects, those without investments are matched based on the results. A greedy matching algorithm (Rosenbaum, 1989) is applied to match each treated observation to untreated ones and determine the closest matching firm.

Propensity score matching models of large investments

T-test and Wilcoxon signed-rank for the mean and median difference are applied to evaluate the balance of firm characteristics between the treatment and control groups. Table 7 shows that most firms' characteristics have a similar mean except growth opportunities as indicate in Panels A to E. Panel A shows that growth opportunities (MB), profitability (Prof), and R&D expenses (R&D) have a significant difference of median for both groups. However, one firm's characteristics median is similar in both groups. This shows that the algorithm effectively finds the matching firms based on their respective characteristics.

Table 7
Analysis of matched pair based on propensity score

	Mean treatment	Mean control	Median treatment	Median control	*p*-value of *t*-stat	*p*-value of Pearson
Panel A: Large investment in 1st year (Each group 6242 Obs.)						
Imed	0.0054	0.0054	0.0045	0.0045	0.0000	0.0000
Size	8.7247	8.7071	8.7657	8.7480	0.0176	0.0178
Tang	0.3411	0.3389	0.2276	0.2228	0.0022	0.0048
MB	1.8140	1.9015	1.2602	1.3677	–0.0874	–0.1075
Prof	0.0733	0.0746	0.0939	0.1023	–0.0014	–0.0084
R&D	0.0242	0.0246	0.0000	0.0000	–0.0004	0.0000
CAPEX	0.0398	0.0411	0.0200	0.0300	–0.0012	–0.0100
Panel B: Large investment until 2nd year (Each group 3116 Obs.)						
Imed	0.0025	0.0025	0.0056	0.0056	0.0000	0.0000
Size	8.5115	8.4889	8.5206	8.5339	0.0226	–0.0133
Tang	0.3418	0.3423	0.2303	0.2299	–0.0004	0.0004
MB	2.1656	2.2340	1.3928	1.3477	–0.0684	0.0451
Prof	0.0342	0.0266	0.0912	0.0900	0.0076	0.0013
R&D	0.0539	0.0505	0.0000	0.0000	0.0033	0.0000
CAPEX	0.0532	0.0575	0.0300	0.0300	–0.0043	0.0000
Panel C: Large investment until 3rd year (Each group 1565 Obs.)						
Imed	0.0022	0.0022	0.0057	0.0057	0.0000	0.0000
Size	8.5733	8.5640	8.6156	8.6101	0.0092	0.0054
Tang	0.3378	0.3488	0.2273	0.2379	–0.0110	–0.0105
MB	1.9888	2.0357	1.3537	1.3249	–0.0469	0.0288
Prof	0.0677	0.0583	0.0975	0.0903	0.0094	0.0072
R&D	0.0247	0.0254	0.0000	0.0000	–0.0006	0.0000
CAPEX	0.0411	0.0388	0.0300	0.0200	0.0023	0.0100
Panel D: Large investment until 4th year (Each group 924 Obs.)						
Imed	0.0184	0.0184	0.0181	0.0181	0.0000	0.0000
Size	8.6276	8.6121	8.6807	8.6633	0.0155	0.0174
Tang	0.3324	0.3472	0.2138	0.2326	–0.0148	–0.0189
MB	2.0995	2.1212	1.3812	1.3265	–0.0217	0.0546
Prof	0.0790	0.0507	0.0993	0.0907	0.0282	0.0087
R&D	0.0239	0.0245	0.0000	0.0000	–0.0006	0.0000
CAPEX	0.0380	0.0348	0.0200	0.0200	0.0032	0.0000

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Table 7 (*Continued*)

	Mean treatment	Mean control	Median treatment	Median control	*p*-value of *t*-stat	*p*-value of Pearson
Panel E: Large investment until 5th year (Each group 626 Obs.)						
Imed	0.0141	0.0141	0.0036	0.0036	0.0000	0.0000
Size	8.6375	8.6361	8.7359	8.6828	0.0015	0.0532
Tang	0.2883	0.3265	0.1812	0.2084	–0.0381	–0.0272
MB	2.0248	2.0585	1.4321	1.3758	–0.0337	0.0563
Prof	0.0870	0.0758	0.1034	0.0905	0.0112	0.0129
R&D	0.0219	0.0210	0.0000	0.0000	0.0010	0.0000
CAPEX	0.0368	0.0328	0.0200	0.0200	0.0040	0.0000

Note: Industry median leverage (Imed) is calculated as the median of the same industry for book and market leverage, respectively. The firm's size (Size) and tangibility (Tang) are calculated by the natural logarithm of sales and the ratio of net fixed assets over total assets, while growth opportunities (MB) are calculated by the ratio of market equity over the book value. Earnings before interest and tax (Prof) are calculated by the ratio of EBIT over total assets, while capital expenditures (CAPEX) are calculated by the ratio of capital expenditure over total assets. R&D expenses (R&D) are calculated by R&D expenses over total assets, with the missing value as zero. Dummy years are defined as 1 during large investments for the first to the fifth year, and others have zero. The firms are matched through a greedy matching algorithm (Rosenbaum 1989).

Effects of Large Investment to Leverage based on Matched PSM

Table 8 shows Equation 1 regression results with the propensity score-matched observations through the greedy algorithm (Rosenbaum, 1989). Columns 1 and 2 of Table 8 show that an increase in investment year decreases leverage until the 5th year. After treating endogeneity-related problems using propensity score matching, the result confirms that taking large investment projects decreases the leverage of the firm, as shown in Table 4. However, the propensity score-matched observations in columns 3 to 5 have a negative and insignificant coefficient on investment year dummy variables.

Table 8
Effects of large investment to market leverage with the matching firms

	1	2	3	4	5
$Imed_{jt-1}$	0.0608***	0.0167	0.037**	0.0895***	0.0557
	(0.0199)	(0.0146)	(0.0184)	(0.0339)	(0.0478)
$Size_{it-1}$	–0.0604***	–0.0457***	–0.0374**	–0.0171	–0.0593**
	(0.0123)	(0.0092)	(0.0187)	(0.0208)	(0.0289)
$Tang_{it-1}$	0.1344***	0.0882**	0.1053***	0.1016	0.3644***
	(0.0278)	(0.0383)	(0.0368)	(0.078)	(0.0788)

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Table 8 (*Continued*)

	1	2	3	4	5
MB_{it-1}	–0.032***	–0.0278***	–0.046***	–0.0252***	–0.0197***
	(0.0023)	(0.002)	(0.0043)	(0.0043)	(0.0053)
$Prof_{it-1}$	–0.1561***	–0.1197***	–0.0039	–0.1988**	–0.219*
	(0.0245)	(0.0164)	(0.0258)	(0.0875)	(0.1228)
$R\&D_{it-1}$	0.0833	0.1261*	0.4208*	0.2063	0.3934
	(0.0736)	(0.0702)	(0.2208)	(0.3938)	(0.4464)
$CAPEX_{it-1}$	0.0993	0.1192***	0.2076	0.2785	–0.0507
	(0.0741)	(0.0436)	(0.1603)	(0.2732)	(0.3644)
Dummy: year=1	–0.0302***	–0.0612***	–0.0211	–0.0143	0.0131
	(0.0051)	(0.0119)	(0.0145)	(0.0231)	(0.0235)
Dummy: year=2	–0.029***	–0.0498***	0.0112	–0.0135	0.0286
	(0.0056)	(0.0104)	(0.0154)	(0.025)	(0.0199)
Dummy: year=3	–0.0241***	–0.0467***	–0.0158*	–0.0216	0.0464**
	(0.006)	(0.0122)	(0.0095)	(0.0298)	(0.0214)
Dummy: year=4	–0.0368***	–0.0685***	–0.0268	–0.0077	0.0311
	(0.0075)	(0.017)	(0.0272)	(0.0186)	(0.0472)
Dummy: year=5	–0.0299***	–0.0296	–0.0473*	–0.0367	0.0254
	(0.0069)	(0.0235)	(0.027)	(0.0234)	(0.0198)
_cons	0.9453***	0.8202***	0.7441***	0.5212***	0.7718***
	(0.105)	(0.0737)	(0.1542)	(0.201)	(0.2394)
Firm fixed effect	YES	YES	YES	YES	YES
Observations	12,484	6,232	3,130	1,848	1,252
R^2	0.0843	0.0904	0.0962	0.0816	0.1118

Note: Standard errors are in parentheses; *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$

Fixed effects panel regression is performed using 1990–2019. The dependent variable (market leverage) is calculated by the ratio of total debts over the market and the book equity value of debts. Industry median leverage (Imed) is calculated as the median of the same industry for book and market leverage, respectively. The firm's size (Size) and tangibility (Tang) are calculated by the natural logarithm of sales and the ratio of net fixed assets over total assets, respectively. Growth opportunities (MB) are calculated by the ratio of the market over book equity value, earnings before interest and tax (Prof) are calculated by the ratio of EBIT over total assets, and capital expenditures (CAPEX) are calculated by the ratio of capital expenditure over total assets. R&D expenses (R&D) are calculated by R&D expenses over total assets, with the missing value as zero. For the first to fifth year, dummy years are defined as 1 when a firm take large investment and others are zero. The firms are matched through a greedy matching algorithm (Rosenbaum, 1989).

Constrained and Unconstrained Firm Based on Size

Robustness tests are conducted by grouping the sample into two based on financial constraints, following size, and whether it pays dividends. Financially constrained firms are small or non-dividend payers, while unconstrained firms include big or dividend-payers.

Table 9 shows that the leverage ratio of financially constrained firms (small firms) is more sensitive to EPU and large investment variables ($D_1 \times EPU$, $D_2 \times EPU$, and $D_3 \times EPU$). The small firms' interaction variables ($D_1 \times EPU$, $D_2 \times EPU$, and $D_3 \times EPU$) have a higher coefficient than the big ones. It reveals that despite EPU increases, financially unconstrained firms can take more expensive external financing than constrained firms. This result shows that small firms aggressively adjust their leverage to enhance financial flexibility (Gamba & Triantis, 2008; Graham & Harvey, 2001; Rapp et al., 2014) and maintain large investment projects.

The interaction variable between EPU and small firms' deviation in Panel A Tables 8 and 6 positively affects the leverage change. However, the same variable in Panel B from Table 10 does not influence the leverage changes, showing that the deviation effects are the same for the large firms despite high economic uncertainty. Small firms have limited external financing access, increasing the level of uncertainty and limiting the convergence of leverage changes.

The variable of interaction between economic uncertainty and large investments consistently negatively affects leverage change, as shown in Table 6. There is no difference between financially constrained and unconstrained firms categorised by size.

Table 9
EPU and large investment effects on financial constrained and unconstrained firms

Panel A. Financially constrained firms (small firms)

	1	2	3	4	5	6
	Market leverage			Book leverage		
EPU_{t-1}	–0.0003	0.00004	–0.0003	0.00001	0.0001	0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0001)
$D1 \times EPU_{t-1}$	–0.0002***	–0.0006***	–0.0006***	–0.0002**	–0.0002**	–0.0013***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)
$D2 \times EPU_{t-1}$	–0.0002***	–0.0005***	–0.0002**	0.0001	–0.0002	–0.0002**
	(0.00005)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$D3 \times EPU_{t-1}$	–0.0001**	–0.0004***	–0.0001	0.0001	–0.0002**	–0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.00004)	(0.0001)	(0.0001)
_cons	1.2716***	1.075***	1.388***	0.8624***	0.7913***	1.1708***
	(0.1116)	(0.0969)	(0.1216)	(0.1975)	(0.1853)	(0.2309)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21,633	21,633	21,633	21,633	21,633	21,633
Pseudo R^2	0.1047	0.1161	0.1117	0.0933	0.0931	0.1228

(*Continued on next page*)

Table 9 (*Continued*)

Panel B. Financially unconstrained firms (big firms)

	1	2	3	4	5	6
		Market leverage			Book leverage	
EPU_{t-1}	–0.0004**	–0.0002	–0.0004***	–0.0001	–0.0002*	–0.0001
	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)
$D1 \times EPU_{t-1}$	–0.00003	–0.0003***	0.0002***	–0.000001	0.0001**	0.00004
	(0.00002)	(0.00002)	(0.00003)	(0.00002)	(0.00002)	(0.00002)
$D2 \times EPU_{t-1}$	–0.00002	–0.0002***	0.0001***	–0.00004	0.0001**	–0.00004
	(0.00003)	(0.00002)	(0.00004)	(0.00003)	(0.00002)	(0.00002)
$D3 \times EPU_{t-1}$	–0.00002	–0.0002***	0.0001***	0.00002	0.000005	–0.00005**
	(0.00003)	(0.00002)	(0.00004)	(0.00002)	(0.00003)	(0.00002)
_cons	1.0211***	0.9406***	0.9775***	0.1526**	0.1674**	0.1308*
	(0.1336)	(0.138)	(0.1355)	(0.0637)	(0.0659)	(0.0694)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23,270	23,270	23,270	23,270	23,270	23,270
Pseudo R^2	0.1227	0.129	0.1247	0.0712	0.0717	0.0716

Note: Standard errors are in parentheses; *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$

Table 10
Effects of EPU and investment on leverage change in constrained and unconstrained firms

Panel A. Constrained firms (small firms)

	1	2	3	4	5	6
	ΔMarket leverage			ΔBook leverage		
EPU_{t-1}	–0.0026***	–0.003***	–0.0027**	–0.0011**	–0.0013***	–0.0012***
	(0.001)	(0.0011)	(0.0011)	(0.0004)	(0.0005)	(0.0004)
Dev_{it-1}	–1.4722***	–1.4819***	–1.4532***	–0.802***	–0.8031***	–0.8004***
	(0.3045)	(0.3039)	(0.3075)	(0.1038)	(0.1032)	(0.1042)
$EPU_{t-1} \times Dev_{it-1}$	0.0048*	0.0048*	0.0046*	0.0017**	0.0017**	0.0017*
	(0.0028)	(0.0028)	(0.0028)	(0.0008)	(0.0008)	(0.0009)
ΔTgt_{it-1}	–0.2872	–0.2933	–0.2078	–0.2069	–0.2105	–0.2028
	(0.752)	(0.7458)	(0.7729)	(0.1622)	(0.1624)	(0.1631)
$EPU_{t-1} \times \Delta Tgt_{it-1}$	–0.0019	–0.0018	–0.0025	–0.0014	–0.0013	–0.0014
	(0.0068)	(0.0067)	(0.0069)	(0.0013)	(0.0013)	(0.0013)
$BigInv_{it-1}$	0.0917	–0.0548	0.1567*	0.0516	–0.0292	0.0604*
	(0.0865)	(0.0458)	(0.0831)	(0.0499)	(0.0273)	(0.0347)
$EPU_{t-1} \times BigInv_{it-1}$	–0.0008	0.0003	–0.0013**	–0.0005	0.0002	–0.0005
	(0.0007)	(0.0004)	(0.0006)	(0.0004)	(0.0002)	(0.0003)
_cons	–2.2373***	–2.2125***	–2.2365***	0.2296	0.2449	0.2319
	(0.4957)	(0.4827)	(0.4794)	(0.257)	(0.2517)	(0.253)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,457	17,457	17,457	17,457	17,457	17,457
Pseudo R^2	0.1596	0.1596	0.1597	0.097	0.0969	0.0969

(*Continued on next page*)

Table 10 (*Continued*)

Panel B. Unconstrained firms (large firms)

	1	2	3	4	5	6
	Δ Market leverage			Δ Book leverage		
EPU_{t-1}	–0.0013*	–0.0013*	–0.0012*	–0.0004	–0.0004	–0.0004
	(0.0007)	(0.0007)	(0.0007)	(0.0003)	(0.0003)	(0.0003)
Dev_{it-1}	–1.0464***	–1.0479***	–1.048***	–0.7495***	–0.7497***	–0.7456***
	(0.2819)	(0.2823)	(0.2805)	(0.0861)	(0.0861)	(0.0864)
$EPU_{t-1} \times Dev_{it-1}$	0.0027	0.0028	0.0028	0.0003	0.0003	0.0003
	(0.0024)	(0.0024)	(0.0024)	(0.0006)	(0.0006)	(0.0006)
ΔTgt_{it-1}	–1.3134	–1.3152	–1.2349	–0.2505	–0.252	–0.2491
	(1.1392)	(1.1429)	(1.1533)	(0.2256)	(0.2261)	(0.2272)
$EPU_{t-1} \times \Delta Tgt_{it-1}$	0.0072	0.0072	0.0064	–0.0005	–0.0005	–0.0005
	(0.0108)	(0.0108)	(0.0109)	(0.0021)	(0.0021)	(0.0021)
$BigInv_{it-1}$	0.0198	–0.0049	0.0569	0.0055	0.0084	–0.009
	(0.0302)	(0.0154)	(0.0349)	(0.0107)	(0.0108)	(0.028)
$EPU_{t-1} \times BigInv_{it-1}$	–0.0002	0.00003	–0.0006**	–0.00003	–0.0001	–0.0002
	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0002)
_cons	–0.0252	–0.0217	–0.0264	0.9793***	0.9782***	1.0156***
	(0.3203)	(0.3226)	(0.3225)	(0.1231)	(0.1234)	(0.1224)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21,487	21,487	21,487	21,487	21,487	21,487
Pseudo R^2	0.1469	0.1468	0.1471	0.1188	0.1188	0.1199

Note: Standard errors are in parentheses; *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$

Table 11
EPU and big investment effects on financial constrained and unconstrained firms based on dividend payment

Panel A. Financially constrained firms (non-dividend payer)

	1	2	3	4	5	6
	Market leverage			Book leverage		
EPU_{t-1}	–0.0002	0.0001	–0.0003	0.00005	0.0001	0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0001)
$D1 \times EPU_{t-1}$	–0.0003***	–0.0006***	–0.0005***	–0.0002***	–0.0002**	–0.001***
	(0.00005)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$D2 \times EPU_{t-1}$	–0.0002***	–0.0005***	–0.0001***	–0.00001	–0.0001	–0.0003***
	(0.00003)	(0.0001)	(0.0001)	(0.00004)	(0.0001)	(0.0001)
$D3 \times EPU_{t-1}$	–0.0002***	–0.0004***	–0.0001**	–0.000008	–0.0002***	–0.0002***
	(0.00004)	(0.0001)	(0.0001)	(0.00003)	(0.0001)	(0.00005)
_cons	1.0301***	0.8602***	1.1021***	0.4808***	0.4226***	0.679***
	(0.0814)	(0.0753)	(0.0851)	(0.1579)	(0.1522)	(0.1683)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	26,146	26,146	26,146	26,146	26,146	26,146
Pseudo R^2	0.0999	0.1119	0.1043	0.0836	0.0833	0.1043

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Table 11 (*Continued*)

Panel B. Financially unconstrained firms (dividend payer)

	1	2	3	4	5	6
	Market leverage			Book leverage		
EPU_{t-1}	–0.0004***	–0.0003*	–0.0004***	–0.0002***	–0.0002**	–0.0002***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$D1 \times EPU_{t-1}$	0.00003	–0.0002***	0.0003***	0.00003	0.00002	0.0002***
	(0.00002)	(0.00002)	(0.00004)	(0.00002)	(0.00002)	(0.0001)
$D2 \times EPU_{t-1}$	0.00002	–0.0001***	0.0002***	0.00003	0.00002	0.0002***
	(0.00002)	(0.00002)	(0.00004)	(0.00002)	(0.00002)	(0.00003)
$D3 \times EPU_{t-1}$	0.00001	–0.0001***	0.0001***	0.00003***	–0.000001	0.0001***
	(0.00002)	(0.00004)	(0.0001)	(0.00001)	(0.00002)	(0.00003)
_cons	0.7167***	0.6609***	0.6836***	0.0154	0.0216	–0.0095
	(0.092)	(0.1015)	(0.0921)	(0.0621)	(0.0612)	(0.0639)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,757	18,757	18,757	18,757	18,757	18,757
Pseudo R^2	0.1123	0.1149	0.1183	0.0789	0.0788	0.0837

Note: Standard errors are in parentheses; *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$

Constrained and Unconstrained Firms Based on Dividend Payment

Table 11 Panel A shows that the interaction between EPU and large investment year variables ($D_1 \times EPU$, $D_2 \times EPU$, and $D_3 \times EPU$) negatively affects leverage change in financially constrained firms. However, these negative effects are not consistent in Panel B, similar to Table 9 using different financial constraint proxies. This indicates that financially constrained firms are more sensitive to uncertainty. Those with large investment projects decrease their leverage to maintain financial flexibility. Furthermore, it confirms the main findings that the leverage deviation of financially constrained firms is bigger than unconstrained ones.

Table 12 shows that the leverage deviation negatively affects the leverage change in financially constrained and unconstrained firms, similar to Table 6. EPU and leverage deviation variables positively affect leverage change in financially constrained, not in unconstrained firms. This result reconfirms that leverage changes in financially constrained firms are influenced by uncertainty, which is not the case for unconstrained firms, as shown in Table 10. The EPU and large investment project variables negatively affect leverage changes. Therefore, large investment decreases leverage changes in small firms during high economic uncertainties, as shown in Table 6. Financially unconstrained firms are dependent on the applied large investment definition and rarely affected by economic uncertainty.

Table 12
Effects of EPU and investment on leverage change in constrained and unconstrained firms

Panel A. Financially constrained firm (non-dividend payer)

	1	2	3	4	5	6
	Market leverage			Book leverage		
EPU_{t-1}	–0.0022**	–0.0025**	–0.0023**	–0.0011***	–0.0014***	–0.0013***
	(0.001)	(0.0011)	(0.0011)	(0.0004)	(0.0004)	(0.0004)
Dev_{it-1}	–1.4315***	–1.4418***	–1.4215***	–0.7996***	–0.8053***	–0.8028***
	(0.2914)	(0.2909)	(0.2952)	(0.0928)	(0.0918)	(0.0931)
$EPU_{t-1} \times Dev_{it-1}$	0.0049*	0.0049*	0.0048*	0.0017**	0.0017**	0.0017**
	(0.0027)	(0.0027)	(0.0027)	(0.0008)	(0.0008)	(0.0008)
ΔTgt_{it-1}	–0.6913	–0.7008	–0.6195	–0.2591**	–0.2649**	–0.2606**
	(0.8231)	(0.8158)	(0.8306)	(0.1145)	(0.1132)	(0.1137)
$EPU_{t-1} \times \Delta Tgt_{it-1}$	0.0017	0.0018	0.0011	–0.0009	–0.0008	–0.0009
	(0.0077)	(0.0077)	(0.0078)	(0.001)	(0.001)	(0.001)
$BigInv_{it-1}$	0.109**	–0.0216	0.113*	0.0859***	–0.0018	0.0309
	(0.0526)	(0.0347)	(0.0619)	(0.0296)	(0.0225)	(0.0343)
$EPU_{t-1} \times BigInv_{it-1}$	–0.0008**	0.0001	–0.0009*	–0.0007***	–0.00002	–0.0003
	(0.0004)	(0.0003)	(0.0005)	(0.0002)	(0.0002)	(0.0003)
_cons	–1.5005***	–1.4706***	–1.5006***	0.5204***	0.5459***	0.5399***
	(0.3604)	(0.36)	(0.351)	(0.1738)	(0.175)	(0.1683)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21,802	21,802	21,802	21,802	21,802	21,802
Pseudo R^2	0.1603	0.1605	0.1605	0.1003	0.10	0.10

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Table 12 (*Continued*)

Panel B. Financially unconstrained firm (dividend payer)

	1	2	3	4	5	6
	Market Leverage			Book Leverage		
EPU_{t-1}	–0.0014**	–0.0016**	–0.0013**	–0.0002	–0.0001	–0.0001
	(0.0006)	(0.0006)	(0.0006)	(0.0003)	(0.0003)	(0.0003)
Dev_{it-1}	–1.0374***	–1.0415***	–1.0481***	–0.7936***	–0.7946***	–0.7939***
	(0.2471)	(0.2468)	(0.2449)	(0.1156)	(0.1155)	(0.1149)
$EPU_{t-1} \times Dev_{it-1}$	0.0017	0.0017	0.0018	–0.0004	–0.0003	–0.0003
	(0.0022)	(0.0022)	(0.0022)	(0.0007)	(0.0007)	(0.0007)
ΔTgt_{it-1}	0.8032	0.783	0.8713	–0.1888	–0.1856	–0.183
	(0.6585)	(0.6525)	(0.6615)	(0.2242)	(0.2237)	(0.2254)
$EPU_{t-1} \times \Delta Tgt_{it-1}$	–0.0111	–0.0109	–0.0118*	–0.0014	–0.0014	–0.0015
	(0.0068)	(0.0067)	(0.0068)	(0.002)	(0.002)	(0.0021)
$BigInv_{it-1}$	–0.0024	–0.039***	0.1137**	–0.0377**	–0.0043	0.0339
	(0.0434)	(0.0136)	(0.0502)	(0.0148)	(0.016)	(0.0243)
$EPU_{t-1} \times BigInv_{it-1}$	0.0001	0.0003***	–0.0012***	0.0003**	0.0001	–0.0004*
	(0.0003)	(0.0001)	(0.0004)	(0.0001)	(0.0001)	(0.0002)
_cons	–0.2508	–0.2409	–0.2712	0.8989***	0.8937***	0.8884***
	(0.3425)	(0.3428)	(0.3347)	(0.1189)	(0.1199)	(0.1209)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,142	17,142	17,142	17,142	17,142	17,142
Pseudo R^2	0.1239	0.124	0.1245	0.1107	0.1106	0.1108

Note: Standard errors are in parentheses; *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.1$

CONCLUSION

This study investigates the effects of EPU and large investment projects on leverage. It shows that EPU negatively impacts a firm's leverage after firm undertook large projects up to the first three years. The irreversibility of these projects causes firms to prioritise their continuity rather than maintain target leverage. Furthermore, EPU and large investment projects' effects on leverage are higher in constrained than unconstrained firms. This study supports the financial flexibility motives, maintaining firms' debt capacity to sustain the project.

The economic agents, specifically firms that undertake large long-term investment projects, shall anticipate and absorb the effect of economic policy changes as sources of economic uncertainty. Thus, the government can mitigate the uncertainty impact on the economy by promptly releasing information related economic policy changes capable of escalating economic policy and the overall economic uncertainty. This study's limitation can be improved by future study by including corporate governance since it influences financing decisions.

NOTES

1. The EPU index is taken from www.policyuncertainty.com.
2. Dudley (2012), Denis and McKeon (2012), and Elsas et al. (2014) define large or major investments of the individual firms differently. Dudley (2012) defines major investments related to the same industry and excludes M&A. Denis and McKeon (2012), and Elsas et al. (2014) define it only based on the magnitude of investment of the individual firms, including M&A.
3. Fixed panel model is applied in all regressions with Driscroll-Kraay standard error to reduce the effects of heteroskedasticity, autocorrelation, and cross dependency of the data.

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