Explaining Weak Investment Growth After the Great Recession: A Macro-Panel Analysis

Ines Buono and Sara Formai

Abstract Business investment could be dampened by weak aggregate demand, the high cost of capital and macroeconomic uncertainty. The importance of each factor may vary both over time and across countries. In this chapter we use a panel of advanced economies to estimate a model of business investment based on the above mentioned factors. The main objective is to understand, through time-varying parameters estimations, how their relative importance has changed over time, in particular after the global financial crisis. The analysis reveals that all three factors matter for investment, and suggests a key role for countercyclical policies aiming at lowering interest rates, supporting aggregate demand, and restoring confidence on financial markets against unfavorable macroeconomic and financial developments, such as those that followed the global financial crisis and the debt crisis.

Keywords Investment · Uncertainty · Time-varying parameters

JEL classification E22 · C23

1 Introduction

Business fixed investment has been persistently weak in advanced economies since the global financial crisis: nine years after its outburst, the investment-to-GDP ratio was still almost 3% points lower, on average, than its pre-crisis level of 24 per cent.

The views expressed are those of the authors and do not necessarily reflect those of the Bank of Italy.

I. Buono
Bank of Italy, Directorate General for Economics, Statistics and Research,
International Relations and Economics Directorate, Rome, Italy
e-mail: ines.buono@bancaditalia.it

S. Formai (✉)
Bank of Italy, Directorate General for Economics, Statistics and Research,
Structural Economic Analysis, Rome, Italy
e-mail: sara.formai@bancaditalia.it

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Although the downturn was comparable with past experiences of financial crisis, the recovery was highly heterogeneous across countries, and especially slow for those hit by the European sovereign debt crisis in 2011. For some countries investment is therefore still stuck at pre-crisis levels.

Different explanations have been invoked for the puzzling sluggishness of the recovery, and several recent empirical works have tried to identify the relative roles played by different factors in holding back aggregate investment. According to a conventional model combining an accelerator and a neoclassical approach, investment is a function of aggregate output and the user cost of capital, while recent contributions have successfully explored the importance of uncertainty (for instance, Meinin and Roehe (2017)).

In this chapter, we take stock of previous results and study whether the response of investment to expected demand, user cost of capital and uncertainty has changed over time, especially after the outbreak of the 2008–2009 crisis. We consider a panel of 19 countries and take semi-annual data from 1990 to 2016. After testing how the benchmark model performs, we go on to study how its main parameters have changed over time. We first test the hypothesis of a structural break, generally during the 1990–2016 period, and specifically in 2008. We then exploit the time dimension of the data and perform a series of analyses in which the parameter of each determinant of investment is allowed to be time-varying. Finally, we check whether our findings are common to all the cross-sectional units, or whether the countries more severely hit by the crisis (peripheral European countries) were characterized by specific dynamics.

We find that the role played by investment determinants has changed over time: while expected demand was the main driver of investment in the first part of the sample, economic uncertainty became the most significant variable during the crisis. Interestingly, even after the crisis uncertainty has continued to play an important role. The elasticity of investment to the user cost of capital has, instead, been remarkably constant across time: however, its magnitude is higher on average for peripheral European countries, especially after the crisis.

As already mentioned, our work relies on a vast empirical literature on the determinants of investment. Recently this literature has focused on identifying which of the main drivers can be held responsible for the weak performance of the last few years, since this would have important implications for the optimal policy responses. Busetti et al. (2016) analyse the severe decline in investment in Italy between 2007 and 2014, finding that, although demand conditions were the most important driver of capital accumulation, uncertainty was an impediment both during the global crisis and in 2013–2014, appearing as one of the main factors behind the delayed recovery of the Italian economy. Meinin and Roehe (2017) first conduct an extensive comparison of various widely-used uncertainty proxies and then analyse the role of macroeconomic uncertainty for gross fixed capital formation in machinery and equipment for the four largest euro-area economies, finding that it accounts for a considerable share of the decline in investment during the Great Recession.

Several other studies, covering broader samples of countries over different time periods, find a predominant role of output decline in explaining the fall in investment: Lewis et al. (2014) who studied 13 OECD countries between 1993q1 and 2013q3; Chap. 4 of the IMF's April 2015 WEO, which uses data for 27 countries during and after the crisis; and Barkbu et al. (2015) who perform country-specific estimations for seven euro-area countries in the period 1990–2013.

Finally, Bussiere et al. (2015), who perform a panel estimation for 22 countries with annual data from 1996 to 2014, find that the main cause of the fall in investment was weak demand, but they show that this is best accounted for when expectations for future demand (measured, in their main specification, as the current-year IMF-WEO GDP nowcast) as opposed to past GDP, are used in the investment model. We will use a similar approach.

Against this background, our work explores whether the relative importance of the determinants of investment has changed over time, an issue that is not addressed in any of the studies referred to above. Our results suggest the existence of a structural break in the aggregate business investment model, induced by the recent crisis.

The remainder of the chapter is organized as follows. Section 2 describes the data set. Section 3 explains the empirical strategy and presents the main results. Section 4 deals with robustness checks. Section 5 concludes.

2 The Model for Investment and the Data

The models most commonly used in the literature to explain the dynamics of private non-residential investment at the aggregate level are: (i) the accelerator model; (ii) the neoclassical model; and (iii) Tobin's q model. The first two are based on the idea that investment I_t is a distributed lag function of changes in the desired capital stock.

The accelerator approach assumes that the level of desired capital stock is proportional to the level of output.[1] In the neoclassical model, instead, investment is determined by the expected return on new capital and the real user cost of obtaining and using this capital.

The main idea in Tobin's q model is that the marginal product of capital is not directly observable, and its best measure comes from the stock-market value of a firm. A firm's investment decision is given by the comparison of this value with the current cost of replacing the capital stock in place. Tobin's q is thus defined as $q = \frac{market\ value\ of\ installed\ capital}{replacement\ cost\ of\ installed\ capital}$.

The empirical literature has often enriched the models mentioned above with additional variables that are thought to affect the dynamics of investment, such as credit risk, liquidity, leverage and, more recently, uncertainty (see for instance Barkbu et al. (2015), Lewis et al. (2014), and Bussiere et al. (2015)). When investment projects are irreversible, uncertainty may restrain the propensity to invest, since waiting for more information can be a valuable option (see Bernanke (1983) and Dixit and Pindyck (1994)). The role of uncertainty in shaping investment decisions has also been analyzed at the micro level: Guiso and Parigi (1999) find that firm-specific uncertainty weakens investment, the more so when capital expenses are less

[1] See Jorgenson and Siebert (1968) for a more detailed description of the accelerator model.

reversible and the greater the firm's market power. Gilchrist et al. (2014) show that, conditional on investment fundamentals, i.e. proxies for the marginal product of capital, increases in idiosyncratic volatility are associated with a substantial decline in the rate of capital formation. The Chap. 4 of the IMF's April 2015 WEO, besides estimating an accelerator model based on aggregate data, employs firm-level data and finds that both credit constraints and uncertainty cause investment to be put off.[2]

We follow the recent empirical literature on the determinants of aggregate investment, in particular Bussiere et al. (2015), and estimate a model that takes into account demand, as measured by output, a proxy for economic uncertainty and the user cost of capital.

We use an unbalanced panel of more than 900 observations with semi-annual data from 1990h1 to 2016h2 for 19 countries.[3] Data on real private non-residential investment and realized GDP come from the OECD Economic Outlook 100 and the OECD QNA dataset.[4] Data on expected GDP comes from IMF-WEO vintages collected in April and October. While other data are available on a quarterly basis, data on expected GDP are only available on a semi-annual basis. We thus transform quarterly into semi-annual data and use half-years as our time-series unit.

Uncertainty is, by nature, not observable and can relate to various dimensions that are relevant for economic agents' decisions. The literature has thus proposed different measures of uncertainty.[5] Measures of uncertainty in financial markets are usually based on the observed or implied volatility of asset prices. The underlying idea is that a greater expected volatility of asset prices presumably reflects greater uncertainty about their determinants. These financial market based measures are commonly used as they are easy to compute from financial market data and are available for most countries, on long time series and with varying frequencies. These measures can be computed either as implied volatility of forward looking financial instruments (the VIX, for instance, is a 30-day option-implied volatility in the S&P500) or as the realized stock market volatility. Although the latter measure is backward looking, it has two important advantages: first, its computation does not require any specific assumption, and second it is free of any risk premium component.[6] In this work we thus use realized financial market volatility, given by the variance over the semester

[2]See Bussiere et al. (2015) and Busetti et al. (2016) for a more extensive review of the literature on both theoretical and empirical investment models.

[3]The countries are Australia, Austria, Belgium, Canada, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, New Zealand, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States.

[4]For Austria, Belgium, Greece, Ireland, Italy, Portugal, Spain and Switzerland data on non-residential investment are obtained by the QNA dataset by subtracting residential capital expenditure from total (private plus public) gross fixed capital formation. This means that for these countries the dependent variable is total (instead of private) non-residential investment. Notice, however that all results hold when we consider this measure for all the available countries (that is all the countries in the dataset, with the exception of Japan). Moreover the correlation between the two variables is 0.83.

[5]See Ferrara et al. (2018) for a comprehensive review.

[6]See Bekaert et al. (2013) for a decomposition of the VIX into two components, an uncertainty measure and a proxy for risk aversion.

(130 working days) of daily stock returns Δx_{it}. Formally, for each country in our sample, we compute:

$$UNC_{it} = \sqrt{\frac{1}{130}\sum_{i=1}^{130}(\Delta x_{it})^2}$$

Although this measure directly refers to financial markets, it can be interpreted as a broader proxy of macroeconomic uncertainty to the extent that the determinants of stock market prices are closely related to macroeconomic variables. Other measures, instead, are more directly related to non-financial outcomes. A growing literature, for instance, measures uncertainty as reflected in forecasting errors of macroeconomic variables or in the disagreement among professional forecasters. Uncertainty can also be measured using firm-level data. Bloom (2009), for instance, uses US data to compute uncertainty as the cross-sectional standard deviation of firms' profit and TFP growth. In his seminal contribution, the author also shows that stock market volatility is strongly correlated both with these micro-founded measures of uncertainty and with those based on forecasters disagreement. This finding further supports our choice of UNC_{it} as a proxy for economic uncertainty.[7] More recently, Baker et al. (2016) focusing on the uncertainty around the realization of economic programs and reforms, have constructed a narrative measure of Economic Policy Uncertainty (henceforth, EPU) based on the number of times specific words or sequences of words related to economic policy appear in newspapers. Differently from other measures of uncertainty, EPU is less correlated with stock market volatility, thus capturing a different dimension of uncertainty.[8] As a further analysis we thus show results using the EPU index.[9]

Finally, the user cost of capital is measured by using a standard definition which multiplies the cost of capital (given by the real interest rate, $i_{it} - \pi_{it}$, adjusted by capital depreciation δ_{it}) by the relative price of capital (given by the ratio between investment and the GDP deflator), namely:

$$UCC_{it} = (i_{it} - \pi_{it} + \delta_{it}) * \frac{INVdef_{it}}{GDPdef_{it}}$$

From the OECD Economic Outlook 100 we obtain data for the interest rate on the 10-year government bond i_{it} and for the realized annual growth rate of the GDP

[7]On the other hand, the correlation between UNC_{it} and expected demand in our sample is negative and quite low (-0.2), confirming that expected demand does not capture uncertainty.

[8]For instance the correlation between the EPU index and our main proxy for economic uncertainty in our dataset is indeed very low (0.15).

[9]This is however only available for a limited number of countries, so when we include this measure in our analysis, we restrict the sample to G7 countries.

deflator π_{it}.[10] The depreciation rate comes from the European Commission AMECO database, computed from the consumption of fixed capital and the stock of capital.[11]

Table 1 reports summary statistics for the main variables used in the analysis, showing how they differ between the pre-crisis and the post-crisis periods. While uncertainty is higher after 2008, the growth rate of investment and that of both realized and forecasted GDP are on average higher in the pre-crisis period. In the full sample (panel a), investment growth varies from −30 per cent (in Ireland during the second semester of 2012) to +42 per cent (in Greece during the second semester of 1995), with an average of 16 per cent throughout the sample. In order to obtain results which are robust to these extreme values, from the main analysis we exclude six outliers, identified as those observations with the three highest and the three lowest private investment growth rates.[12] Finally, the user cost of capital is characterized by a negative growth in both subsamples, slightly lower after the crisis. Nevertheless, as we discuss shortly, this variable is characterized by a high degree of heterogeneity across countries.

Figure 1 shows the average growth rate of fixed private investment for the countries in our dataset both before and after the crisis, as well as the latest data available for 2016. Notwithstanding a marked heterogeneity in investment growth within our panel of countries, the figure highlights some common interesting patterns. First, after 2008 average investment growth was very low in almost all countries (with the notable exception of Ireland and Switzerland); second, there seems to be no correlation between the growth rates of investment and their fall during the crisis; finally in 2016 there were widespread signs of an upturn.

Figure 2 shows our uncertainty proxy for several countries: not surprisingly, the index displays a strong co-movement, especially during the crisis. Among advanced economies outside the euro area, the pattern for Japan moved away from that of other countries in the period 2013–2014 (as Abenomics set in), while within the euro area, the index for Spain was considerably higher in 2010, as well as between 2012 and 2014.

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[10] Although firms' borrowing cost may be more accurately reflected by yields on corporate bond, this measure is not available for all the countries in our sample, thus, following previous studies we use 10-year government bond and abstract from the differences between business and government borrowing rates.

[11] Analysis on the determinants of investment at the micro-level have shown the relevance of firm-specific credit constraints (see, for instance, Cingano et al. (2016) and Buono and Formai (2018)). It is unlikely that our aggregate measure of user cost of capital can fully capture the extents of credit constraints restraining firms' investment decisions. Unfortunately it is extremely hard to obtain a micro-funded measure which is comparable across all the countries in our sample. Barkbu et al. (2015) proxy credit rationing for euro-area countries by using results from the European Commission's consumer and business survey. Since, from the supply side, credit constraints may also arise in response to economic uncertainty, it is plausible that their effect is partially captured by our proxy for uncertainty.

[12] These are Greece in 1995h2 (42 per cent), and 2012h1 (−23 per cent); Ireland in 2003h2 (38 per cent), 2012h1 (39 per cent) and in 2012h2 (−30 per cent) and New Zealand in 1991h1 (−21 per cent). We add back these observations in a robustness check.

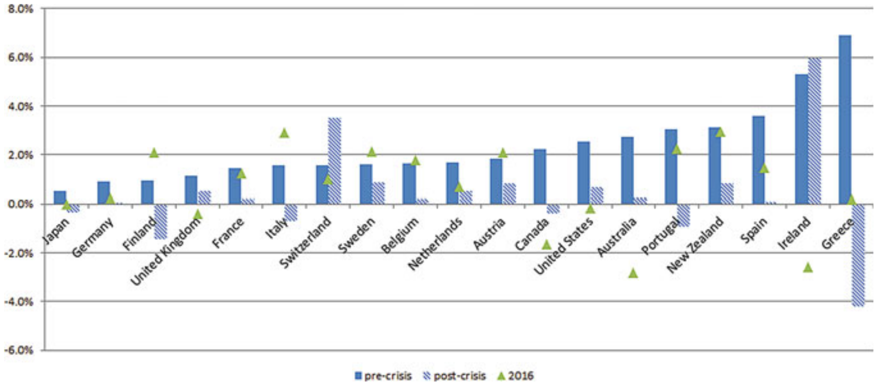

Fig. 1 Fixed private investment growth rates. *Note* Pre-Crisis refers to the average growth in the period 1990h1–2008h1, Post-Crisis to the average growth in 2008h2–2016h2. *Source* authors' calculations based on OECD Economic Outlook 100 and QNA dataset

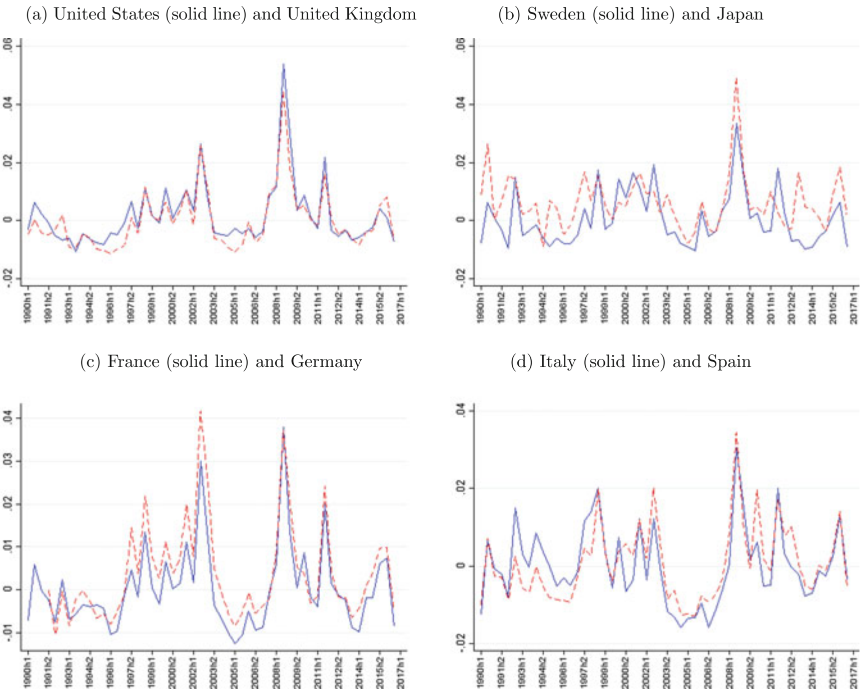

Fig. 2 Realized stock market volatility in some economies of the sample. *Note* Realized financial volatility is computed as the variance over the semester (130 working days) of daily stock returns. *Source* authors' calculations on Datastream data

Table 1 Descriptive statistics

	Obs	Mean	Std. dev.	Min	Max
(a) Full sample					
Investment	921	0.016	0.060	−0.30	0.42
GDP realized	921	0.020	0.033	−0.14	0.46
GDP nowcast	921	0.017	0.020	−0.08	0.09
GDP forecast	921	0.023	0.012	−0.04	0.07
Uncertainty	921	0.012	0.006	0	0.04
User cost of capital	921	−0.001	0.021	−0.10	0.10
(b) Pre-Crisis sample					
Investment	599	0.023	0.054	−0.21	0.42
GDP realized	599	0.026	0.025	−0.10	0.18
GDP nowcast	599	0.023	0.015	−0.03	0.09
GDP forecast	599	0.027	0.010	−0.01	0.07
Uncertainty	599	0.011	0.005	0	0.04
User cost of capital	599	−0.002	0.018	−0.10	0.07
(c) *Post-crisis sample*					
Investment	322	0.003	0.067	−0.30	0.38
GDP realized	322	0.007	0.041	−0.14	0.46
GDP nowcast	322	0.006	0.023	−0.08	0.05
GDP forecast	322	0.014	0.012	−0.04	0.04
Uncertainty	322	0.013	0.006	0.005	0.04
User Cost of Capital	322	−0.001	0.025	−0.10	0.10

Note All variables, except for uncertainty, are expressed in growth rates. The statistics are based on all observations, including outliers. Pre-Crisis refers to the period 1990h1–2008h1, Post-Crisis to 2008h2–2016h2

Figure 3 reports analogous information for the user cost of capital measure. This variable shows a clear downward trend for the UK, the US, Sweden, France, Germany and, to a lesser extent, for Japan. In Italy and Spain the decreasing trend started to reverse in 2003 and 2005, respectively: the user cost of capital reached its highest value during the sovereign debt crisis and then decreased again as the ECB's QE was implemented.

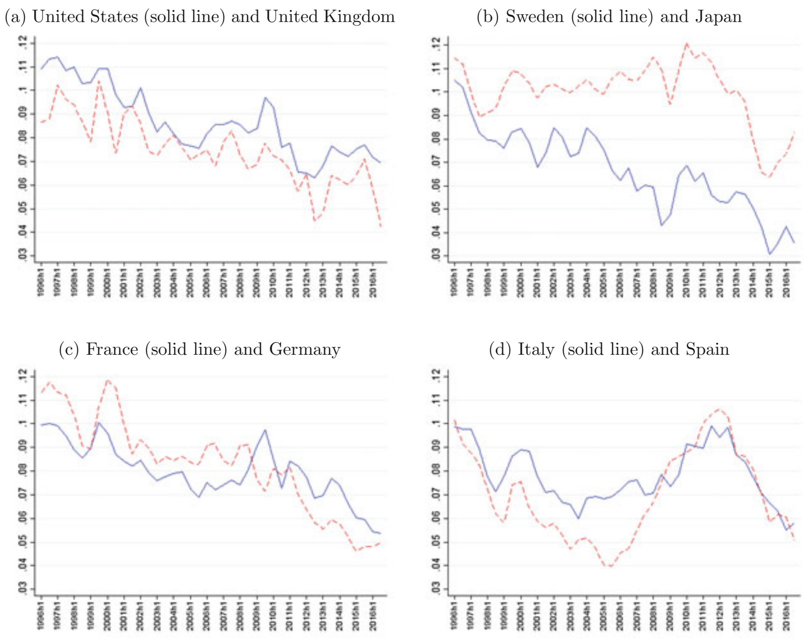

Fig. 3 User cost of capital in some economies of the sample. *Note* The user cost of capital is computed as the real cost of capital $i_{it} - \pi_{it} - \delta_{it}$ multiplied by the ratio between the investment and the GDP deflator. *Source* authors' calculations on OECD Economic Outlook 100 and European Commission AMECO data

3 Results

3.1 Time-Invariant Coefficients: Model Selection

We consider the following model for investment I_{it}:

$$\Delta lnI_{it} = \alpha_i + \beta_1 \Delta lnY_{it} + \beta_2 UNC_{it} + \beta_3 \Delta lnUCC_{it} + u_{it} \tag{1}$$

where Y_{it} is a measure of demand, UNC_{it} is uncertainty and UCC_{it} is the user cost of capital as defined above. The dependent variable is the semiannual growth rate of investment, while the growth rate of demand is yearly, although the data release frequency is semiannual (see below, for further discussion). All our specifications include year fixed effects that account for international macro shocks that affect investment simultaneously across countries (for instance, oil prices), and country fixed effects that account for country-specific determinants of investment.[13] In what

[13]Results are robust when country fixed effects are omitted from the model.

follows we compare some alternatives of Eq. 1, in order to select the main model we will use throughout the rest of the chapter.

While we have already described our measures of uncertainty and the user cost of capital in Section 2, the choice of a suitable measure of demand requires a more thoughtful discussion, being it widely debated in the literature, for both econometric and economic issues. According to an accelerator model, investment depends on the desired amount of capital, which is proportional to the level of output/demand. Many previous works thus make investment depend on realized output, and to avoid the endogeneity stemming from investment being a component of output, this usually enters the model with a time lag. If capital adjusts to meet future demand, however it is reasonable that entrepreneurs choose investments based on their envisaged capacity needs and expectations of future demand, as the micro empirical literature suggests. For instance, Gennaioli et al. (2016) provide empirical evidence about the extent to which a CEO's expectations for earnings growth help explain firms' choices, including investment and production. Their result shows that expectations contain information on investment plans that is not captured by Tobin's q. Bussiere et al. (2015) are the first to apply this idea to a macro panel analysis, and prove it to be correct.

In Table 2 we compare estimates of Eq. 1 using different measures of the demand determinant of investment decisions. We start with the standard lagged realized growth rate of GDP (column 1). This variable is computed as the annualized growth rate from semiannual data, in order to harmonize it with the other measures we use for demand. The estimated coefficient is 0.52, meaning that if (lagged) GDP growth increases by 1 p.p., then the semiannual investment growth increases by 0.5 p.ps. The effect on the annualized growth rate of investment is roughly twice as much.[14]

Following Bussiere et al. (2015), we then replace the realized GDP growth with forecasts taken from the IMF WEO, i.e. the nowcast $GDPnow_{it}$ and the 1-year ahead forecast $GDP1yf_{it}$. As shown in Table 1, both these variables have been on average higher in the pre-crisis than in the post-crisis period. More interestingly, while in the pre-crisis period both forecasts are quite similar to the realized growth rate, in the post-crisis period the 1-year ahead forecast tends to be significantly higher than the other two growth rates. Both forecasts are only available for annual growth rates and are released and updated every six months, in April and October. As for column 2 of Table 2, the semiannual investment growth of the first semester of a given year is regressed on the April WEO's nowcast of GDP growth for that year, while for the investment growth of the second semester the expected GDP growth refers to the same year, but comes from the WEO October vintage. Analogously, in column 3, $GDP1yf_{it}$ refers, for both semiannual observations within a year, to the annual growth rate of the same following year, but it comes from two different WEO vintages. This implies that the explanatory variable in each observation incorporates new information on future demand that is relevant to the current investment decision. On the other hand, the forecast horizons change between observations, and this could

[14]Given g_s a semi-annual growth rate and g_y the corresponding annualized rate, $\Delta g_s = x$ implies $\Delta g_y \approx 2x$, if g_s is small. In our data, the semi-annual investment growth rate is on average 0.02.

Table 2 Main specification: searching for a proxy for aggregate demand

	(1)	(2)	(3)	(4)	(5)
GDP_{it-1}	0.520*** (0.141)				
$GDPnow_{it}$		0.958*** (0.210)			
$GDP1yf_{it}$			1.183*** (0.398)	1.183** (0.533)	
$GDPyf2_{it}$					1.336** (0.521)
UNC_{it}	−0.730** (0.271)	−0.690** (0.270)	−0.656** (0.296)	−0.212 (0.630)	−0.715** (0.292)
UCC_{it}	−0.555*** (0.116)	−0.501*** (0.129)	−0.501*** (0.134)	−0.358** (0.153)	−0.498*** (0.133)
Observations	906	915	915	453	915
R^2	0.316	0.300	0.284	0.371	0.283

Note Robust standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

cast doubts on the interpretation of the coefficients. We tackle this concern in columns 4 and 5.

The nowcast used in column 2 is probably the most endogenous among the different measures, since investment at time t is an important component of contemporaneous GDP. The coefficient for the 1-year ahead forecast for GDP growth in column 3 is 1.2, suggesting that investment reacts significantly to expected demand. If expected GDP growth increases by 1 p.p., then the semi-annual investment growth increases by 1.2 p.ps. The results do not change when we align the forecast horizon across observations: in column 4 we halve the sample and estimate the model by only using observations for the first semester. This requires only using the April WEO forecast for $GDP1yf_{it}$ and all observations have the same forecast horizon. The coefficient for expected demand is unchanged, although the estimation is less precise due to the smaller sample size. As a further check, in column 5 the independent variable $GDP1yf_{it}2$ is given, in the first semester, by the 1-year ahead April forecast and, in the second semester, by the average between the 1-year ahead and the 2-year ahead forecasts for GDP growth rates, both taken from the October WEO. Again the results are basically unchanged.

All the other determinants of investment have the expected signs, as we will discuss later in more detail: increases in the uncertainty proxy and in the user cost of capital both drive investment down. Moreover, with the exception of uncertainty in column 4, the coefficients are always significantly different from zero and similar across specifications. Our preferred measure of demand is thus going to be GDP $GDP1yf_{it}$, as used in column 3.

In Table 3 we show results considering different lag structure of the investment model, using our preferred measure for the expected demand (the 1-year ahead GDP forecast). In the first column we augment the specification with the lagged depen-

Table 3 Main specification: searching for the lag structure of the variables

	OLS	AB	OLS	OLS
Inv_{t-1}	0.025 (0.082)	−0.051 (0.113)		
$GDP1yf_{it}$	1.135** (0.398)	1.133*** (0.348)	1.113*** (0.383)	1.183*** (0.398)
UCC_{it}	−0.506*** (0.136)	−0.508*** (0.153)	−0.486*** (0.133)	−0.501*** (0.134)
UCC_{it-1}			−0.104 (0.100)	
UNC_{it}	−0.661** (0.268)	−0.827*** (0.271)	−0.526 (0.315)	−0.656** (0.296)
UNC_{it-1}			−0.298 (0.265)	
Observations	900	886	902	915
R^2	0.284		0.285	0.284

Note Robust standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Coefficients for $GDP1yf_{it}$ and UCC_{it} should be interpreted as elasticities

dent variable which is not significant. To overcome standard endogeneity problems with the lagged dependent variable we show the estimates using the Arellano-Bond estimator in the second column, which confirms that the investment growth at time t is uncorrelated with past growth rates. In the third column, we insert a lag for the user cost of capital and the proxy for uncertainty.[15] Only contemporaneous variables are significant in explaining investment. In particular, even if the joint effect of contemporaneous and lagged uncertainty is significantly different from zero, the effect of the former is estimated with more precision, and thus in subsequent regressions we only keep UNC_{it}.

In order to choose the appropriate estimation technique, we test for the presence of cross sectional correlation and non-stationarity. Macroeconomic variables are notoriously affected by these issues, which can seriously undermine consistency and efficiency. Cross sectional dependence may arise because of common shocks to the cross sectional units, which ultimately become part of the error term. Increasing economic and financial integration makes this issue particularly relevant. To check for cross-sectional dependency, we compute a set of Pesaran (2004) cross-sectional dependence test statistics (CD_P), which are N(0, 1) distributed under the null hypothesis of cross-sectional independence. The CD_P statistic obtained after performing our main regression is 5.8, meaning that cross-sectional independence for all variables is rejected at the 1 per cent significance level. Thus, cross-sectional dependence should be accounted for when performing regressions.

[15]In unreported regressions we also insert the past value of one-year-ahead GDP, which is not significant. We also try a specification with both the GDP nowcast and the 1-year-ahead GDP forecast. In this case we find that only the first is significant. However, we think this variable is seriously flawed by endogeneity: thus in our main analysis we use the one-year-ahead GDP forecast.

Table 4 Test for stationarity

	IPS	Fisher-type
	$Z_{\tilde{t}-bar}$	Inverse $\tilde{\chi}^2$
Investment	-15.70^{***}	273.07^{***}
GDP forecast	-8.16^{***}	136.89^{***}
Uncertainty	-10.51^{***}	168.42^{***}
UCC	-17.97^{***}	847.86^{***}

Note IPS and Fisher-type panel unit root test statistics. Asterisks indicate rejection of the null hypothesis of a unit root at 1 per cent (***)

Table 5 Main specification: solving the cross-sectional dependence

	OLS	PCSE	Driscoll-Kraay
$GDP1yf_{it}$	1.183^{***} (0.398)	1.183^{***} (0.299)	1.183^{***} (0.368)
UNC_{it}	-0.656^{**} (0.296)	-0.656^{***} (0.226)	-0.656^{**} (0.304)
UCC_{it}	-0.501^{***} (0.134)	-0.501^{***} (0.117)	-0.501^{***} (0.112)
Observations	915	915	915
R^2	0.284	0.308	
Country FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes

Note Robust standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Coefficients for $GDP1yf_{it}$ and UCC_{it} should be interpreted as elasticities

In order to test for stationarity, we perform both an Im-Pesaran-Shin (IPS) and a Fisher-type test. Both are panel unit root tests that can account for cross-sectional correlations and preserve the desired properties when performed on an unbalanced panel like ours. The null hypothesis is that all panels contain a unit root. As shown in Table 4, the null is strongly rejected for each variable, suggesting that our series are all stationary.

Table 5 reports the results of our preferred specification when we deal with the presence of cross-sectional dependence. In column 2 we report panel-corrected standard errors (PCSEs) and in column 3 Driscoll-Kraay standard errors, which remain valid also when the cross-sectional dimension grows large compared with the time dimension. The estimates are unbiased and the covariance matrix estimator is consistent under the hypothesis that the cross sectional dependence is caused by common factors which are unobserved but uncorrelated with the included regressors. Overall, this table shows that estimates and significance levels are quite stable across the different methodologies.

To summarize, our preferred model is one where the growth rate of investment is explained by the 1-year-ahead forecast of GDP growth, a proxy of contemporaneous uncertainty, and the contemporaneous user cost of capital. We estimate this model by using OLS with PCSEs, and the result is that aggregate investment increases when expected demand increases, when uncertainty decreases and when the user cost of capital declines. In particular, when the 1-year-ahead forecast of GDP growth increases by 1 p.p., the semi-annual growth rate of business investment increases by 1.2 p.ps. This corresponds to an increase of roughly 2.4 p.ps of the annualized growth rate, a result equivalent to that found by Bussiere et al. (2015), although they use the GDP nowcast as a proxy for future demand. As for the user cost of capital, an increase of 1 per cent implies a decrease in investment equal to 0.5 per cent (compared with 0.7 per cent in Bussiere et al. (2015)). The coefficient for (the standardized) UNC_{it}[16] suggests that a one standard deviation increase in uncertainty implies a reduction of 0.7 p.ps in the semi-annual investment growth rate, which is around half the overall mean growth rate (see Table 1). This estimate is again close to that obtained by Bussiere et al. (2015), although uncertainty enters their preferred specification with a lag. In what follows we investigate whether these average coefficients hide relevant variations in the determinants of aggregate investment over time.

3.2 The Determinants of Investment Over Time: Sample Split

We split our sample into two sub-periods: before and after the Great Recession. The first and third columns of Table 6 report results for the main specification: while the coefficient of the user cost of capital is unchanged between the two sub-samples and with respect to the one obtained for the entire period, the coefficients for the expected demand and uncertainty coefficients show interesting patterns. The first decreases after the Great Recession, the latter becomes economically and statistically significant only afterwards (in the last column it is almost significant at 10 per cent). In particular, after 2008h2, a one standard deviation increase in uncertainty implies a decrease in the semi-annual investment growth rate of around 1.5 p.ps.

The picture that emerges reveals that expected demand is an important determinant of investment over the full sample, even if with a magnitude that changes over time, while uncertainty only became a key determinant of aggregate investment after the Great Recession.[17] It follows that, in the aftermath of the financial crisis, sluggish expected demand, increased uncertainty and, in some countries, a sharp increase in the cost of capital, negatively contributed to investment growth. In the following semesters, expectations on GDP growth, usually above realized values (see Table 1),

[16] In the regressions uncertainty is normalized by subtracting the country-specific mean and dividing by country-specific standard deviation.

[17] An alternative interpretation of our results could be a non-linear, but constant, relationship between uncertainty and investment growth. If uncertainty was increasingly detrimental on investment when getting larger, the higher uncertainty in the second part of the sample would result in a higher coefficient if the non-linearity was not taken into account. To exclude this interpretation, we run the main specification by adding a quadratic term for uncertainty: this is never significant, while the linear term is basically unchanged in magnitude, being higher after 2008h1, and almost significant at conventional levels.

Table 6 Sample split

	1990h1–2008h1	1990h1–2008h1	2008h2–2016h2	2008h2–2016h2
$GDP1yf_{it}$	1.715*** (0.278)	1.848*** (0.267)	1.329** (0.670)	1.400** (0.672)
UNC_{it}	−0.216 (0.218)	−0.181 (0.220)	−1.018* (0.592)	−0.857 (0.599)
UCC_{it}	−0.524*** (0.150)		−0.453*** (0.167)	
$BorrCost_{it}$		−0.611** (0.244)		−0.427 (0.283)
$RelPInv_{it}$		−0.598*** (0.174)		−0.718** (0.281)
Observations	596	596	319	319
R^2	0.325	0.343	0.359	0.377

Note Robust standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Coefficients for $GDP1yf_{it}$ and UCC_{it} should be interpreted as elasticities. BorrCost is the borrowing cost as defined in the text; RelPInv is the relative price of investment as defined in the text. Estimates are obtained using OLS and standard errors are corrected for cross-sectional dependence.

positively contributed to investment growth, although with a lower impact compared to the pre-crisis period. On the contrary, high uncertainty had an increasing negative contribution, that in many countries lasted till the most recent period.[18] The user cost of capital, whose effect has been quite constant over time, contributed differently across countries depending, for instance, on the timing of the introduction of non conventional monetary policies.

In columns 2 and 4 of Table 6 we replace the user cost of capital by its two components: the borrowing cost $i_{it} - \pi_{it} + \delta_{it}$ and the relative price $\frac{INVdef_{it}}{GDPdef_{it}}$ (see Sect. 2). Our results show that both components have an important effect on aggregate investment: the relative price coefficient is more stable throughout the sample, while borrowing costs are slightly more relevant in the first part of the sample.[19]

The results in Table 6 point to the presence of a structural break in the relationship under analysis. Now we formally test the hypothesis that the change in the aggregate investment model took place following the global crisis of 2008–2009. For this purpose we first construct a dummy that takes the value 1 starting from 2008h2 (Post-crisis dummy), and we run the main regression on the three dependent variables as well as on their interactions with the crisis dummy. As usual, we insert country and time dummies (which also incorporate the Post-crisis dummy). The results in Table 7 confirm that the determinants of investment have changed since the crisis. In particular, while expected demand and the user cost of capital have a significant

[18]Only for the last observation, 2016h2, uncertainty contributed positively to the investment growth rate of most countries.

[19]There is a lively academic and policy debate on how the decrease in the price of investment goods—due to rapid advances in technology—is shaping labour and the capital share of firms' production function.

Table 7 Post-crisis dummy

	1990–2016
$GDP1yf_{it}$	1.247*** (0.339)
*Post-crisis dummy	−0.281 (0.503)
UNC_{it}	−0.200 (0.281)
*Post-crisis dummy	−0.901** (0.389)
UCC_{it}	−0.552*** (0.167)
*Post-crisis dummy	0.098 (0.236)
Observations	915
R^2	0.314

Note Robust standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Coefficients for $GDP1yf_{it}$ and UCC_{it} should be interpreted as elasticities. Estimates are obtained using OLS and standard errors are corrected for cross-sectional dependence

effect throughout the sample (as obtained by testing for the significance of the sum of the coefficients before and after the crisis), our proxy for economic uncertainty enters the model significantly only after the global crisis.

Finally, we test whether the existence of a structural break is common to all countries in the dataset. To do this, for each country we perform a standard structural break test (Chow test) under the null hypothesis that the coefficients do not vary after 2008h2. The null hypothesis of no structural break is tested using a Wald test which is distributed as a Chi-square. In Fig. 4 we report the Chi-square statistic ranked from the lowest (Japan) to the highest value (New Zealand). The horizontal line indicates the threshold above which we reject the null hypothesis: thus the Chow test detects the presence of a break in 2008h2 for nine countries in our dataset.[20]

The evidence collected so far suggests that the aggregate investment model has changed over time and that important transformations may have happened after the burst of the 2008–2009 crisis. In the next section we go a step further and analyse a time-varying coefficient model to back up these findings and obtain precise estimates for each point in time.

[20]In an unreported analysis we find that in each country in the dataset there is at least one structural break (however not necessarily in 2008h2). This result is obtained by performing a series of Wald test over a range of possible break dates in the sample.

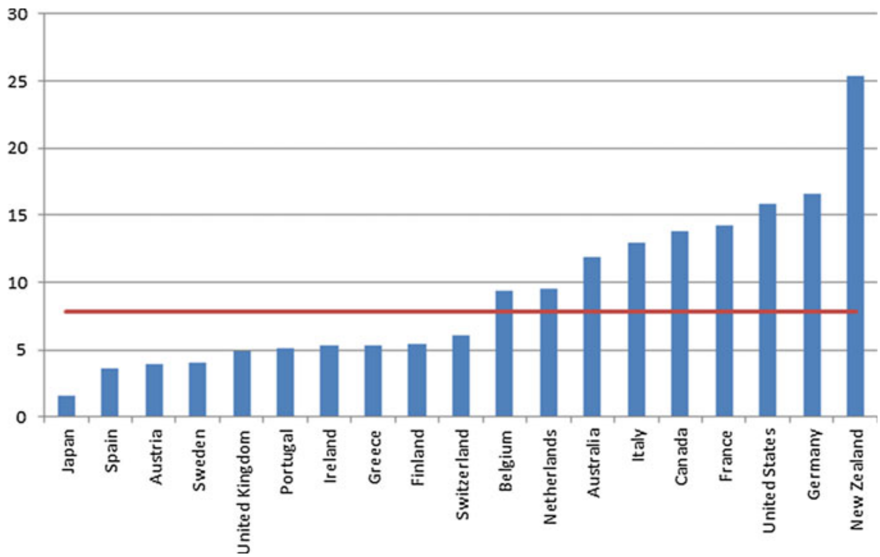

Fig. 4 Structural break test (2008h2). *Note* Chi-square statistic for Chow's structural break test. Bars above the horizontal line indicate the rejection of the null hypothesis of no structural break. *Source* Authors' calculations

3.3 The Determinants of Investment over Time: Time-Varying Coefficients

The aim of this section is to estimate the following regression:

$$\Delta lnI_{it} = \alpha_i + \beta_{1,t}\Delta lnY_{it} + \beta_{2,t}UNC_{it} + \beta_{3,t}\Delta UCC_{it} + u_{it} \tag{2}$$

where all the coefficients are indexed by t. We first employ a rolling window methodology in which, given our sample of semiannual observations from 1990h1 to 2016h2, Eq. 2 is estimated with OLS for all the overlapping backward-looking windows of n observations $[t - n + 1, t]$, with $t =$ 1990h1 + n − 1, ..., 2016h2. This provides a sequence of estimated parameters $\{\beta_{1999\text{h2}}, ..., \beta_{2016h2}\}$. Figures 5, 6 and 7 show, for each explanatory variable, the estimated parameters and the 90 per cent confidence intervals when $n = 20$ as well as the time-invariant coefficient (dotted horizontal lines) from the regression in Table 5, column 1.

The results confirm and qualify the findings from the previous analysis. In particular, Fig. 5 shows that the role of expected demand, with an estimation of around 1.6 before the crisis, became less important after 2009, losing some significance in the following five years. According to Fig. 6, the coefficient of economic uncertainty is zero at the beginning of the sample, decreases as the world slips into global crisis, and remains significantly negative thereafter. Since the crisis, global investment has become significantly reactive to financial uncertainty, which has thus contributed to

Fig. 5 Expected demand on investment; rolling windows with n = 20. *Source* Authors' calculations

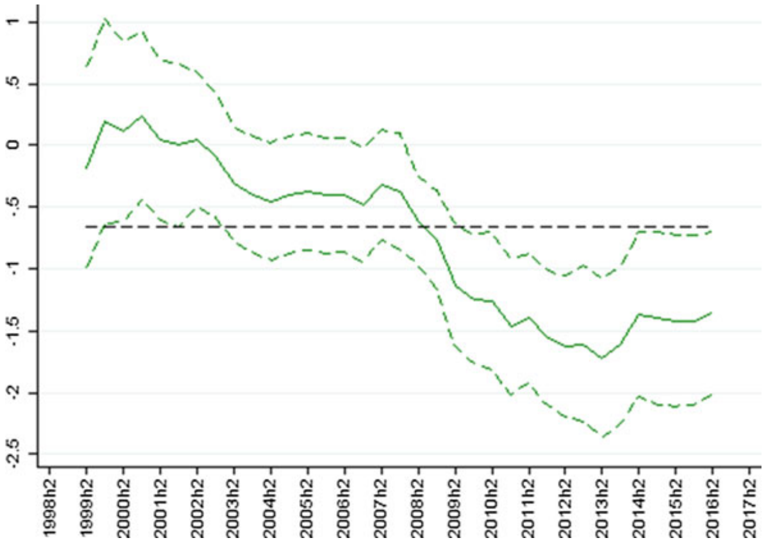

Fig. 6 Uncertainty on investment; rolling windows with n = 20. *Source* Authors' calculations

keeping it al lower levels. The decreasing trend in the uncertainty coefficient seems to have ended by 2014. However, the latest point estimate is still negative and large, which does not suggest a reversal of the trend. Finally, Fig. 7 shows a remarkably stable estimated coefficient for the user cost of capital throughout the entire period.

Fig. 7 User cost of capital on investment; rolling windows with n = 20. *Source* Authors' calculations

Of course, rolling window results may be sensitive to the choice of the window length n. In particular, as n increases the graph levels out.[21] Moreover, this methodology applies equal weights to all the past observations n in $[t-n+1; t]$, and a weight equal to zero to all the remaining ones. Alternatively, one could apply a different weighting scheme: for instance, discounting the more distant past observations would produce a path for β_t that could better capture gradual structural changes in the underlying relationship. To this end, we estimate Eq. 2 by implementing a non-parametric technique whose properties have been discussed by Giraitis et al. (2014). This implies estimated coefficients given by:

$$\hat{\beta}_t = \left[\sum_{j=t-n}^{t} \omega_{j,t} x_j x_j'\right]^{-1} \left[\sum_{j=t-n}^{t} \omega_{j,t} x_j y_j\right], \tag{3}$$

where $\omega_{j,t}$ is the weight and x_j and y_j stand for generic observations of the dependent and the independent variable. This is a weighted-OLS estimate whose weight may be chosen from different classes of distributions. In particular, given the generic weight function

$$\omega_{j,t} = cK\left(\frac{t-j}{H}\right), \tag{4}$$

[21] As a robustness check we estimate the model by imposing $n = 15$ and the results are confirmed.

we will consider both the Exponential Kernel function $K(z) = e^{(-z)}$ and the Gaussian Kernel function $K = (1/\sqrt{2\pi})e^{\frac{-z^2}{2}}$. Both are normalized by the bandwidth H and c is an integration constant such that the weights within each window sum up to 1. While using the exponential weighting scheme implies backward looking weights, increasing up to t, the Gaussian Kernel function implies a scheme that is forward-looking at the beginning of the sample, backward-looking at the end and centred in t for the other observations. In both cases, any variation of H changes the weighting scheme and the estimated parameters: the higher H is, the more uniform the weights (when $H \to \infty$ the estimation becomes an unweighted OLS and corresponds to the rolling windows specification described above).[22,23] Following Giraitis et al. (2014), we set $H = \sqrt{T}$.[24]

Estimates are shown in Figs. 8, 9 and 10, where in panel (a) there are those using the Gaussian Kernel, while those obtained with the Exponential Kernel are in panel (b).[25] The effect of expected demand on investment decreases starting from a coefficient greater than 1.5 to values lower than 1 during the global recession and then remaining at values around the unity thereafter (see Fig. 8). The coefficient of uncertainty is instead insignificant at the beginning of the sample and decreases, reaching a minimum value during the crisis of around −1.5 using the Gaussian Kernel (Fig. 8, panel a) and around −2 using the Exponential (panel b). Interestingly the graphs show that after the crisis the coefficient remains permanently low, even if it shows an upward trend. The effect of the user cost of capital does not reveal any surprises: the time-varying coefficient is quite stable and fluctuates around its mean value (Fig. 10).[26]

Given that the intensity of the crisis and the length of time until the first signs of recovery have been quite heterogeneous across countries, we estimate Eq. 2 using the Gaussian Kernel separately for peripheral European countries as opposed to other countries.[27] The results are reported in Fig. 11 where the solid lines are time-varying coefficients for the peripheral countries. The analysis shows that the effect of expected demand is stable and of a higher magnitude for non-peripheral countries throughout the time sample, while after the crisis it became nil for peripheral European countries. Economic uncertainty instead drags investment down in non-peripheral countries only after the crisis, while for peripheral European countries it has always played a role, with the negative effects only being mitigated around the early 2000s. The most interesting result comes from the borrowing cost of capital ($i_{it} - \pi_{it} - \delta_{it}$) whose

[22] See Buono and Formai (2016) for further discussion on these two weighting schemes.

[23] The Gaussian Kernel estimator has recently been used by Riggi and Venditti (2015), to estimate the time-varying parameters of a (backward-looking) Phillips curve and by Buono and Formai (2016) to estimate the de-anchoring of inflation expectations.

[24] Results are robust to different choices of H.

[25] As the Exponential Kernel is backward-looking, the estimates β_t start at $t = 1999$. On the other hand, for the Gaussain Kernel in the first part of the dataset, estimations are obtained by using only future information, and we chose only to show results from 1995 onwards.

[26] When we perform regressions separating the effect of the borrowing cost of capital from that of the relative price of investment, we find quite stable results, without any clear trend.

[27] The peripheral European countries include: Italy, Spain, Portugal, Ireland and Greece.

(a) Gaussian Kernel; H=8. (b) Exponential Kernel; H=6.

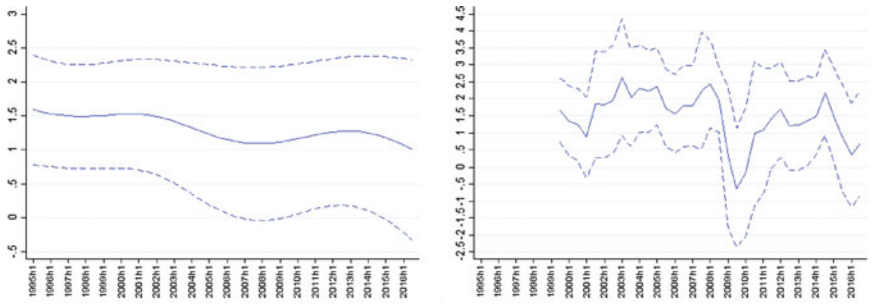

Fig. 8 Expected demand on Investment—time-varying specification. *Source* Authors' calculations

(a) Gaussian Kernel; H=8. (b) Exponential Kernel; H=6.

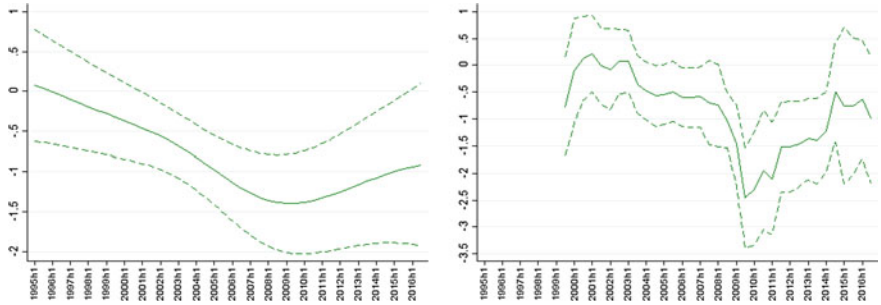

Fig. 9 Uncertainty on Investment—time-varying specification. *Source* Authors' calculations

(a) Gaussian Kernel; H=8. (b) Exponential Kernel; H=6.

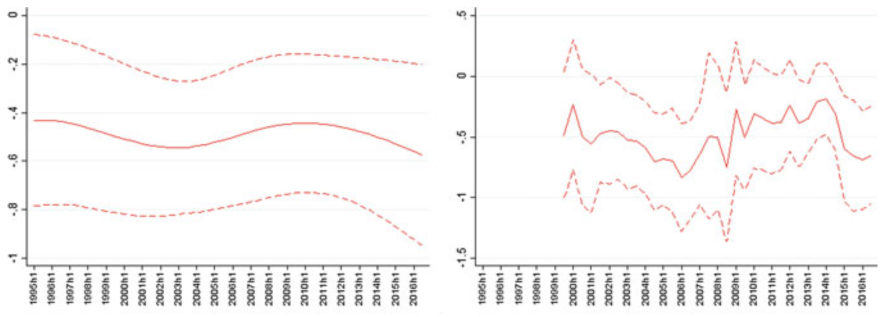

Fig. 10 User cost of capital on Investment—time-varying specification. *Source* Authors' calculations

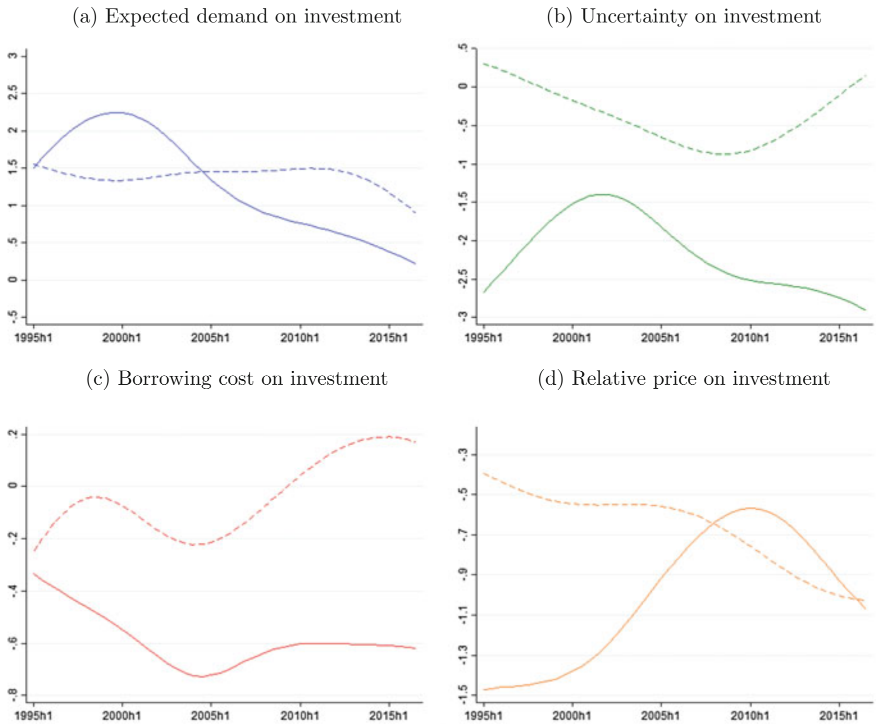

Fig. 11 Periphery European Countries (solid lines), comparison with the rest of the sample (dotted lines)—Gaussian weights; H = 8. *Source* Authors' calculations

effect appears to be larger in peripheral European countries, especially around and after the great recession. This might suggest that the stimulus of European monetary policy may be acting precisely for the countries that need it most, i.e. those where the consequences of the financial and debt crisis have been more severe. Finally, the response of investment to its relative price shows a clear downward trend for non-peripheral countries, where, in absolute value, it has doubled in the last twenty years.

4 Robustness and Further Analysis

The analysis has been so far performed excluding extreme observations, defined as the observations with the three highest and the three lowest growth rates of private investment. Table 8 reports results when these outliers are included too. We find that main findings hold, except for the coefficient of uncertainty losing some significance, although its magnitude is stable.

Table 8 Robustness 1: including outliers

	(1)	(2)	(3)
$GDP1yf_{it}$	1.198*** (0.325)	1.344*** (0.316)	1.204***
*Post crisis dummy			−0.136 (0.610)
UNC_{it}	−0.797*** (0.241)	−0.686*** (0.240)	−0.426 (0.301)
*Post crisis dummy			−0.732* (0.450)
UCC_{it}	−0.494*** (0.136)		−0.468** (0.199)
*Post crisis dummy			−0.042 (0.274)
$BorrCost_{it}$		−0.510** (0.225)	
$RelPInv_{it}$		−0.752*** (0.199)	
Observations	921	921	921
R^2	0.283	0.307	0.286

Note Robust standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Coefficients for $GDP1yf_{it}$ and UCC_{it} should be interpreted as elasticities. Column 1 reports results for the benchmark regression; column 2 reports results for regression in which the user cost of capital is replaced by its two components (borrowing cost and investment relative price); column 3 reports results for regression which includes Post-crisis dummy interactions with the main variables. Estimates are obtained using OLS and standard errors are corrected for cross-sectional dependence

The results presented so far are obtained from specifications that include year- and country-fixed effects. It follows that identification relies on the variability of the regressors over time within each country. This greatly reduces the chance that our estimates are biased due to omitted variables. On the other hand, any global trend in both uncertainty and in the relative cost of capital does not contribute to the estimation of the parameters of interests. The same is true for systematic differences across countries in any of the explanatory variables. To check whether this significantly alters the results, in Table 9 we compare the main time-invariant estimations (column 1) with those obtained by omitting year-fixed effects (column 2) and country-fixed effects (column 3). While in the latter case results are basically unchanged, removing year-fixed effect reduces the R^2 and increases the effect of expected demand. On the other hand, the parameters for uncertainty and the user cost of capital are not affected.[28]

[28]We also check whether the estimated year-fixed effects exhibit any time trend, and this in not the case. We also could not find evidence in favor of a liner trend in any of our main variables. This is not that surprising, at least for investment, expected demand and user cost of capital, as they are taken as first differences.

Table 9 Robustness 2: omitting fixed effects

	(1)	(2)	(3)
$GDP1yf_{it}$	1.183^{***} (0.299)	1.492^{***} (0.267)	1.225^{***} (0.249)
UNC_{it}	-0.656*** (0.226)	-0.673^{***} (0.248)	-0.682^{***} (0.216)
UCC_{it}	-0.501^{***} (0.117)	-0.495^{***} (0.113)	-0.495^{***} (0.118)
Observations	915	915	915
Country F.E.	Yes	Yes	No
Year F.E.	Yes	No	Yes
R^2	0.308	0.205	0.293

Note Robust standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Coefficients for $GDP1yf_{it}$ and UCC_{it} should be interpreted as elasticities. Estimates are obtained using OLS and standard errors are corrected for cross-sectional dependence

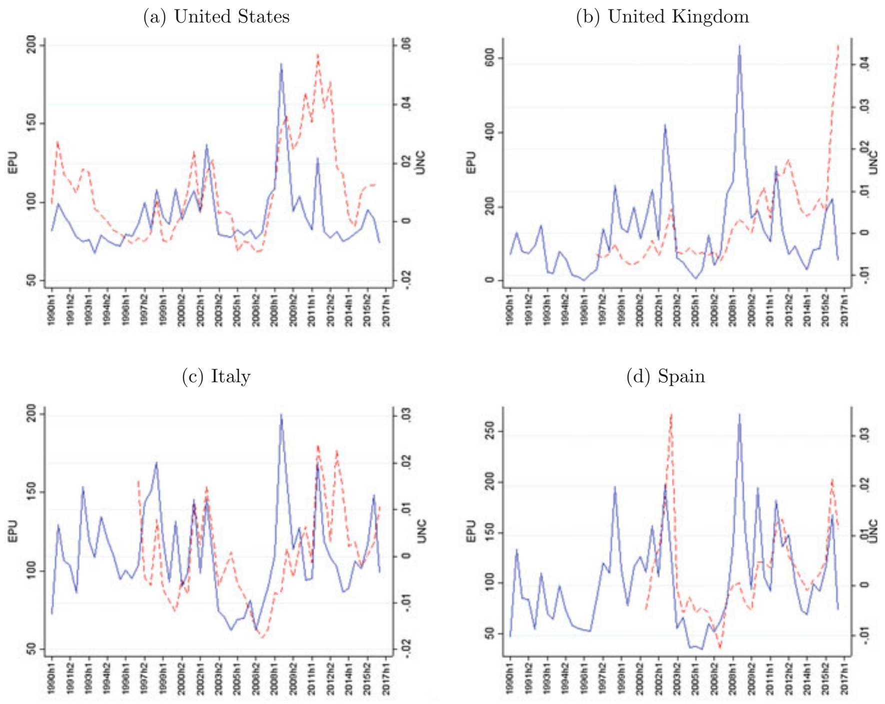

Fig. 12 Economic policy uncertainty Index (EPU, dashed line, left-hand axis) and realized financial volatility (UNC, solid line, right-hand axis.) *Source* EPU Index is from Baker et al. (2016), realized financial volatility is authors' calculation on Datastream data

Table 10 Robustness 3: Political versus economic uncertainty

	(1)	(2)	(3)	(4)	(5)
$GDP1yf_{it}$	1.241*** (0.236)	1.362*** (0.246)	1.228*** (0.237)	1.190*** (0.286)	0.985*** (0.278)
*Post crisis dummy				0.500 (0.478)	0.368 (0.465)
UNC_{it}	−0.655*** (0.222)		−0.641*** (0.224)		0.020 (0.288)
*Post crisis dummy					−1.184*** (0.389)
UCC_{it}	−0.405*** (0.118)	−0.406*** (0.119)	−0.409*** (0.118)	−0.271 (0.173)	−0.268 (0.169)
*Post crisis dummy				−0.265 (0.236)	−0.219 (0.236)
EPU_{it}		−0.003 (0.003)	−0.002 (0.003)	0.003 (0.007)	−0.009 (0.007)
*Post crisis dummy				−0.008 (0.008)	0.008 (0.008)
Observations	343	343	343	343	343
R^2	0.518	0.503	0.518	0.508	0.536

Note Robust standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Coefficients for $GDP1yf_{it}$ and UCC_{it} should be interpreted as elasticities. Estimates are obtained using OLS and standard errors are corrected for cross-sectional dependence

As mentioned in Sect. 2, several alternative measures of uncertainty have been proposed by the literature. Here, we consider the EPU index of Baker et al. (2016) as opposed to our proxy based on financial market data, UNC. This measure has become increasing central in the debate as its evolution has started to diverge from that of other more traditional measures of uncertainty. Figure 12 shows that, although in some periods the two measures were capturing uncertainty in a similar way, more recently they have largely diverged in some countries, most notably in the United Kingdom (after the Brexit), but also in Italy both in 2014 and in 2016. More generally, the correlation between EPU and UNC in the sample was 0.26 before the global crisis, −0.009 after it. This may cast doubt on the ability of financial markets to properly account for political and economic policy uncertainty. In Table 10 we thus replicate the analysis for the subset of countries for which the EPU measure is available.[29] First of all, according to column 1 the results for this restricted sample are very close to those obtained for the full set of countries (Table 5, column 1). When we replace the measure of financial uncertainty with EPU_{it} (see column 2), the coefficient for this new variable is zero, while the coefficients for other variables are essentially unchanged. When we have both measures of uncertainty (column 3), only UNC_{it} has a negative and significant coefficient. The picture does not change when we allow

[29] Australia, Canada, France, Germany, Ireland, Italy, Japan, Netherlands, Spain, Sweden, the United Kingdom and the United States.

the effects to be different before and after the crisis. This result is similar to that of Bussiere et al. (2015), who also find that the EPU index does not seem to play a role in explaining investment.

5 Concluding Remarks

This chapter studies how the determinants of business investment have changed over time, using a panel of 19 advanced economies over the period 1990–2016. Taking stock of existing contributions, we consider an empirical model where investment depends on expected demand (1-year ahead), economic uncertainty (as proxied using financial data) and the user cost of capital.

We find that the role played by the various determinants of investment has changed over time: while expected demand, its main driver, has decreased in importance since the onset of the financial crisis, uncertainty has become a much more important variable. These results, which are stronger for peripheral European countries, qualify previous findings in the literature that, based on time-invariant models, stressed the major role played by aggregate demand and missed out the increasing importance of uncertainty. We also find that the elasticity of investment to the user cost of capital has been remarkably constant across the years. Moreover, peripheral European countries appear to have become more sensitive to the borrowing cost component, especially in the last part of the sample.

Our results suggest the following policy implications. First, monetary policy, by curbing interest rates and thus the user cost of capital, retains a key role as a way to stimulate aggregate investment, and this role has probably been crucial in preventing the recent crisis from having even more serious consequences for investment, especially in the hardest hit countries. Second, policies that stimulate aggregate demand (including, of course, monetary and fiscal policies) have an indirect positive effect on capital accumulation. Third, reducing uncertainty on financial markets also helps to create an environment that supports investment. In this respect, the central banks' efforts to re-build confidence after the outbreak of the global financial crisis and the debt crisis may have been key in preventing a much deeper and more persistent collapse on business confidence and productive investment.

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