What is the Investment Loss due to Uncertainty?

Theodore Panagiotidis* and **Panagiotis Printzis****

Abstract

We investigate the effect of uncertainty on investment. We employ a unique dataset of 25000 Greek firms' balance sheets for 14 years covering the period before and after the eurozone crisis. A dynamic factor model is employed to proxy uncertainty. The investment performance of 14 sectors is examined within a dynamic investment model. Robust GMM estimates of the investment rate model reveal a high degree of heterogeneity among these sectors. Overall uncertainty affects negatively investment performance and this effect substantially increased in the years of crisis. Agriculture and Mining are the least affected and the most affected ones include Manufacturing, Real Estate and Hotels. Focusing on the response of investment to uncertainty, it emerges that (relative) smaller firms are affected more compared to larger ones.

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"Although our intellect always longs for clarity and certainty,
our nature often finds uncertainty fascinating"

Carl von Clausewitz

1 Introduction

Uncertainty is hard to measure and more than one ways of defining it exists. It is an abstract notion that affects both macroeconomic and microeconomic phenomena. The global financial crisis and the subsequent effects on economic activity have amplified the role of uncertainty in the economy overall (firms, households, sectors and policy makers). Most studies would capture uncertainty by a measure of volatility or with an index similar to the one proposed by Baker et al. (2016). Blanchard (2009) emphasizes the importance of uncertainty: *"Crises feed uncertainty. And uncertainty affects behavior, which feeds the crisis. Were a magic wand to remove uncertainty, the next few quarters would still be tough (some of the damage cannot be undone), but the crisis would largely go away"*.

There are alternative theoretical channels through which uncertainty affects economic activity and business decisions. Few imply a positive effect; an increase in uncertainty stimulates investment. Most of them would argue that uncertainty reduces investment and productive capacity and increases the cost of borrowing. This effect is larger for more irreversible investments and on investment in housing and the export sector. The theoretical literature is rich and will be presented in the next section. The empirical one is still growing. Overall, there is a broad consensus among empirical researchers that the relationship between investment and uncertainty is negative and only in a few cases, this nexus is weak or not significant.

Of particular importance is the case of Greece. The Greek economy has been through a period of high growth and low uncertainty from the introduction of the single currency (2001) till 2008-9. After this, it has been through a steep recession. The intensity of the recession (Greek GDP fell from €242 billion in 2008 to €179 billion in 2014) makes it a natural choice for further examination of the effect of uncertainty on investment. This time window (before and after the crisis) offers a distinctive paradigm for assessing the effect of uncertainty on investment. A Google news search on the terms "Greece and uncertainty" returns a quite impressive result: from 2003 to the end of 2008 there were 836 newspaper articles containing both words ("Greece" and "Uncertainty"). Over the 2009-2015 period, this number rose to 55.000 articles (see Figure 1). This turbulent economic environment offers an opportunity to revisit the causal nexus between uncertainty and investment. We employ a unique dataset of 25000 firms for 14 years (including the period before and after the crisis). This would allow us to quantify the cost of uncertainty with regard to investment.

[Figure 1 here)

The purpose of this paper is to empirically investigate the effect of uncertainty on investment decisions. A dynamic factor model is employed to estimate a proxy for volatility. We construct a large panel dataset of Greek firms and examine investment performance by employing a dynamic investment model. We corroborate the existence of a negative effect of uncertainty on investment. Furthermore, we provide evidence of a within-sector heterogeneity based on firm sizes which appear to be crucial for the response of investment to uncertainty changes. Some sectors (and smaller firms) are more sensitive to uncertainty than others (bigger ones).

This work contributes to the empirical literature in four ways. To the best of our knowledge, this is (i) the first attempt to construct an extensive panel of annual data on 25000 Greek firms' balance sheets (overall more than 422000 obs). (ii) It covers the period before and after the global financial crisis (2000 to 2014). (iii) It is the first to analyze the effects of uncertainty on each of the sectors of the Greek economy which has experienced a significant shift in volatility within the sample we cover. (iv) Last we reveal the within-sector heterogeneity in firm sizes and in particular the different responses of investment to uncertainty based on the size of the firm.

The paper is organized as follows: Section 2 reviews the theoretical and empirical literature on uncertainty and investment. Section 3 outlines the econometric specification of the study and Section 4 discusses the data and the measures of uncertainty. Results are presented in Section 5. The last one concludes and provides policy implications.

2 Literature review

2.1 Theoretical literature

The classical approaches discuss choice under uncertainty looking at two different aspects of uncertainty; the objective and the subjective[1]. Keynes (1936) was one of the first to acknowledge a positive link between uncertainty and growth through the precautionary motive. For Keynes, the precautionary motive together with the transaction and the speculative motives constitute the three mechanisms that drive liquidity preferences. Sandmo (1970) provided additional support on the positive effects of uncertainty on

[1] In the former, probability distributions (objectives) are used to give a quantitative expression to the possible outcome. In the latter, no objective measure exists and uncertainty is treated in a subjective manner. The N-M model (Von Neumann and Morgenstern, 1953) belongs to the first case. The Savage Style model (Savage, 1954) of endogenous probabilities belongs to the second. The origin of the subjective probability theory, belongs to Ramsey (1926) and it was further developed by de Finetti (1937) and Savage (1954). A third approach combines the two previous ones using objective lotteries and subjective probabilities (Anscombe and Aumann, 1963).

saving decisions[2]. Another stimulating mechanism of the uncertainty influence is known as the Oi-Hartman-Abel effects and it is based on the models of Oi (1961), Hartman (1972) and Abel (1983). The underlying notion of this is that prices with greater variability get more probability weight, thus if the profits are convex more uncertainty will lead to increased expected profits. A third positive channel of uncertainty influence is the growth options mechanism based on the view that an increase in uncertainty raises the expected future profit stimulating investment decisions. It finds evidence especially in the cases of petroleum leases, R&D investments and construction lag phenomena[3].

The literature highlights two negative channels of the uncertainty effect. The first examines the effects of uncertainty from a financial perspective and links the increasing uncertainty with an increased risk premium. In other words, the investor interprets the uncertain macroeconomic or firm-specific environment as an increased cost of finance or as an increased probability of bankruptcy which makes her postpone or even cancel investment[4]. Risk aversion and the ambiguity aversion function is a related issue[5]. The second negative channel stems from the real options theory (also known as the theory of irreversible investment or the theory of the option value of waiting). The real options framework traces its roots back to Black and Scholes (1973), Merton (1973) and Cox and Ross (1976). Bernanke (1983) was one of the pioneers of the irreversible investment models and based his analysis on two main assumptions. The first is that an investment

[2]This positive link between uncertainty and growth has been also advanced by Mirman (1971), Drèze and Modigliani (1972), Skinner (1987), Blanchard and Mankiw (1988) , Kimball (1990), Caballero (1991), Skinner (1987), Deaton (1991), Carroll (1992), (1996), (1997), (2008); Carroll et al. (2003); Carroll and Samwick (1997), (1998)

[3] See Paddock et al, (1988), Bar-Ilan and Strange (1996), Kulatilaka and Perotti (1998), Minton and Schrand (1999), Folta and O' Brien (2004), Stein and Stone (2012), Segal et al. (2015), Kraft et al. (2013), Vo (2017), Czarnitzki and Toole (2006), (2008), (2013)

[4] See Pástor and Veronesi (2013), Arellano et al. (2011), (2018), Christiano et al. (2014), Gilchrist et al. (2014), Chen (2015).

[5] Earlier works on the mechanism of ambiguity and uncertainty aversion include Epstein and Wang (1994); Epstein and Zin (1991); Gilboa and Schmeidler (1989); Hansen et al. (1999). Recent works include Al-Najjar and Weinstein (2009), Miao et al. (2012), Ilut and Schneider (2012)

project takes place in conditions of irreversibility; this means that any alterations are highly costly. The second is that the arrival of new information over time provides the agent the opportunity, (i.e. the *option*) to postpone the project, to assess the business environment under the new conditions and to choose the right timing to maximize his returns. Dixit and Pindyck (1994) presented a thorough survey of the proposed theoretical approach and review the basic real options models of investment under uncertainty. Schwartz and Trigeorgis (2001) summarize the literature on the theoretical real options models[6].

2.2 Empirical literature

A vast empirical literature on the uncertainty-investment relationship grew out of the work of Jorgenson (1971) and that of Dixit and Pindyck (1994). The prior empirical literature, until the early 2000s, is reviewed in Carruth et al. (2000), Lensink et al. (2001) and Butzen and Fuss (2003) (for a more recent see Forbes (2016)). There is a broad consensus among empirical researchers that the relationship between investment and uncertainty is negative and there are only a few examples where this relationship is weak or insignificant. For example, from the twenty empirical papers presented in the literature table in Lensink et al. (2001), the seventeen indicate a negative sign of the investment-uncertainty relationship while only two indicate mixed evidence. Carruth et al. (2000) set two levels for the empirical analysis of the uncertainty – investment relationship: an aggregate that omits the idiosyncratic effects of the individual firm and a disaggregate that takes into account the idiosyncratic factors by using firm-level data. Our analysis belongs to the second group.

[6] See also Baldwin and Clark (1993); Baldwin and Trigeorgis (1993); Dixit (1992); Kulatilaka and Trigeorgis (1994); Pindyck (1991); Trigeorgis (1995).

According to Bernanke (1983) an empirical analysis at the aggregate level (all industries) may have to address the following problems:

i. the incongruity of firms' uncertainty levels will have counteracting effects at the aggregate level (fluctuations may wash out)
ii. the economic uncertainty and the several macroeconomic factors are affecting the micro-level decisions
iii. the rate of diversification of an economy doesn't ensure immunity from shocks or decisions of *big players* (large firms, decision makers etc.).

Huizinga (1993) sheds more light to the problems mentioned above. When the US manufacturing sector is examined as a whole, an increase in uncertainty about real wages and real output prices leads to lower investment. When a cross-sectional analysis of manufacturing industries is performed, the response of the output prices is in the opposite direction. Carruth et al. (2000) argue that a firm-level approach offers the following advantages over an aggregate-level one:

i. it captures the idiosyncratic uncertainty of the individual firm
ii. it allows the use of panel data to examine the simultaneous effects between uncertainty and investment
iii. the panel data, when used, give the option to control for heterogeneity at the firm level

Econometric developments boosted further the interest on the effects of uncertainty on investment. One of the challenges that many studies face is the proxy measure of uncertainty. Two dimensions need to be discussed further here: the econometric and the economic one. The first is related to the econometric methods employed to measure uncertainty (e.g. stochastic volatility, moving standard deviation, GARCH models etc.) while the second concerns choosing the source of uncertainty (e.g. inflation, stock market, etc.). The vast majority of the empirical studies indicate that uncertainty, regardless of the proxy measure used, is negatively associated with the rate of investment and to the business cycle. However, in the case of R&D investments, some studies provide mixed results. Table 17 in the online Appendix reviews 50 studies. Two of them find positive effects of uncertainty on liquidity, one finds positive effects of market uncertainty on investment and four provide mixed results. The rest of the studies indicate a negative relationship.

[Table 17 here]

2.3 Uncertainty in Greece

The empirical literature on the relationship between uncertainty and business decisions in Greece is limited. Since joining the single currency in 2001 Greece has experienced positive growth rates that lasted till 2009. The average growth this period was 3.51%. Since 2009, Greece has entered a period of prolonged recession with severe macroeconomic implications (unemployment rate rose from around 10% to more than 25%). This environment provides a unique opportunity for the investigation of the uncertainty - investment nexus. Table 18 in the online Appendix summarizes the existing studies that focus on Greece.

[Table 18 here]

3 Empirical Specification

3.1 *q*-model of investment

The adopted framework is based on Tobin's q theory of investment (Tobin, 1969). The latter introduced the ratio q of the market value of assets (or investment) to its replacement cost (or book value). The firm will decide to invest depending on future profitability. Values of q above 1 encourage investment while values below 1 have a deterrent effect. In this context, the q-ratio relates investment to the firm's market valuation and can be considered as an index of the firm's investment behavior. The basic relationship can be written as:

$$\left(\frac{I}{K}\right)_{it} = \alpha + \frac{1}{b}(q_{it} - 1) + \varepsilon_{it} = \alpha + \frac{1}{b}Q_{it} + \varepsilon_{it} \qquad (1)$$

where I_{it} is the gross investment, K_{it} the fixed capital stock, q_{it} the marginal q defined as the ratio of the shadow value of an additional unit of capital to its replacement cost, $Q_{it} = (q_{it} - 1)$ and ε_{it} is the error term[7]. The error term includes fixed (c_i) and time period effects (ζ_t):

$$\varepsilon_{it} = c_i + \zeta_t + e_{it} \qquad (2)$$

The investment equation stems from a firm's profit maximization problem in a state of perfect competition and convex adjustment costs and represents one of the most popular empirical models of investment[8]. Frequently this model produces insignificant coefficients and low explanatory power. Lensink et al. (2001) argue that this can be attributed to the use of average q as a proxy for marginal q. This suffers from the strict assumptions of perfect competition and homogeneous production function. Furthermore, since market value data are needed to estimate the average q ratio[9], small and private firms are excluded from the sample. Bond et al. (2004) provide more explanations for this failure:

[7] Derivation of the q-model of investment with standard neoclassical assumptions is given in Blundell et al. (1992), Bond et al. (2004) and Bond and Van Reenen (2007).

[8] See: Summers (1981), Hayashi (1982), Fazzari et al. (1988), Blundell et al. (1992), Ferderer (1993), Bond et al. (2004), Bond et al. (2005), Bo and Lensink (2005), Mohn and Misund (2009), Henriques and Sadorsky (2011).

[9] Hayashi (1982) proved that if the firms are price takers with constant returns to scale the unobserved marginal q is equal to average q.

the financing constraints of the firm, the fixed costs, imperfect competition, non-rational managerial behavior or decreasing returns to scale. To overcome these shortcomings the empirical *q*-models of investment are usually augmented by the presence of additional explanatory variables including cash flow variables, leverage, firm size or volatility indices. These variables are used in order to fill the missing information gap and to take into account the information asymmetries due to financing constraints (Fazzari et al., 1988) or to macroeconomic environment conditions. Tobin's q measures based on stock market did not prove helpful. They were replaced by alternative measures of the firm's growth opportunities e.g. the growth of sales, profitability or earnings forecasts. This is usually the case when privately held companies data are available and q_t is not directly observable or computable. Furthermore, many argue that such measures are more appropriate since stock market based q indices may suffer from measurement errors or low informative power.[10]

Despite the drawbacks, the q models of investment have become increasingly popular in the literature. When the focus is on the uncertainty effects, the q models are the benchmark approach. Augmented *q*-models have been applied to different sectors including manufacturing, construction, commerce, housing etc. and have been also adapted to aggregate, cross-sectoral or within sector analyses [11] .

3.2 Empirical model

We will start with a framework similar to Baum et al. (2008). We examine the investment behavior of a panel of Greek firms by employing the following investment model:

$$\left(\frac{I}{K}\right)_{it} = \alpha_0 + \alpha_1 \left(\frac{I}{K}\right)_{it-1} + \alpha_2 \left(\frac{CF}{K}\right)_{it-1} + \alpha_3 \left(\frac{GS}{K}\right)_{it-1} + \alpha_4 id_{i,t-1} + \beta h_{t-1} + c_i + u_{it} \quad (3)$$

[10] See Bond and Van Reenen (2007), Bond et al. (2005) and Erickson and Whited (2000) for related literature.

[11] See for example: Bellgardt and Behr (2002); Bond and Cummins (2001); Kalyvitis (2006); Kubota et al. (2013); Lerbs (2014); Tori and Onaran (2016)

where I is the investment, K the capital stock, CF the cash flow, GS the growth of sales, $id_{i,t}$ the idiosyncratic uncertainty, h_t the economic uncertainty, c_i the firm fixed effects and u_{it} the error term. To be consistent with the literature the lagged investment and the control variables of cash flow and growth of sales are expressed in rates deflated by the capital stock K. The investment dynamics and the *lagged investment effect* are taken into account by introducing lagged investment rate $\left(\frac{I}{K}\right)_{it-1}$ as a regressor. In this way the past investment behavior is taken into account in accordance with the proposition that there is an association between current and one-period lagged investment spending. This variable expresses the temporal persistence in investment and according to Eberly et al. (2012) it is the best predictor of investment at the firm level (much better than q_t or CF in terms of statistical significance).

To control for the firms' investment opportunities and to consider the growth potential of a company *CF* and *GS* variables also enter the model. Following a large strand of the literature[12], the growth of sales ratio is used instead of Tobin's *q*. The cash flow ratio and uncertainty augment the standard investment model. We choose to use this less restrictive approach of the *q*-model of investment for three reasons. The first is that we prefer a full-range sample in terms of firm size to a sample that consists only of large stock-market firms. For the latter q measures are computable but for the former, this is not applicable since the availability of market value data is limited. A wider coverage of the Greek firms' investment behavior is possible in this case. We choose to include in our sample small, midsized and large companies. The second reason is that the empirical performance of the traditional *q*-models of investment is not encouraging. That could lead us to departures from the original approach that only q matters for the firm's decision to invest and to augment the model with alternative measures. Third, the cash

[12] See among others: Asker et al. (2011); Badertscher et al. (2013); Bo (1999); Bond et al. (2005); Ghosal and Loungani (2000); Rashid (2011); Rashid and Saeed (2017); Whited and Wu (2006).

flow and growth of sales variables can adequately summarize the expected future profitability of the Greek firms and they can satisfactorily substitute q providing more informational power to the specification.

With regard to uncertainty, it enters the model in lagged values to reflect the manager's response to the information acquired from the previous period. Furthermore time fixed effects were not included in the model because the economic uncertainty index doesn't vary cross-sectionally. By doing so we focus on the explanatory power of the uncertainty measure which would be otherwise absorbed by the year dummies because of collinearity issues.

3.3 Estimation technique

The empirical model is a dynamic investment model and follows the general form:

$$y_{it} = \alpha w_{it} + \beta x_{it} + c_i + u_{it} \tag{4}$$

where x_{it} is a vector of strictly exogenous variables, w_{it} the vector of endogenous or predetermined variables, c_i the unobserved group level effects, u_{it} the observation error term and α, β the parameters to be estimated. The w_{it} vector contains the autoregressive terms (lags of y_{it}). The conditions are:

$$E(c_i) = E(u_{it}) = E(c_i u_{it}) = E(u_{it} u_{is}) = 0$$

$$E(x_{it} u_{is}) = 0 \; for \; all \; s, t \text{ (For strictly exogenous variables)}$$

$$E(x_{it} u_{is}) = 0 \; for \; all \; s \geq t \text{ (For predetermined variables)}$$

The model is estimated using the first-difference Arellano-Bond estimator developed by Arellano and Bond (1991)[13]. This approach behaves well for *"small T, large N"* panels and has been a standard approach for solving the inconsistency problem of the dynamic linear models.[14] In our specification, the rates of lagged investment, cash flow and growth of sales and the intrinsic uncertainty are treated as endogenous variables. The economic uncertainty is treated as strictly exogenous. To avoid instrument proliferation, we invoke the "collapse" option in order to restrict the lag ranges in the generation of the instruments sets. This method is suggested by Roodman (2007), (2009) to deal with the problem of endogenous variables overfitting.

We estimate our model by applying the Windmeijer (2005) WC-robust two-step estimator. This estimator overcomes the issue of downward biased standard errors and takes into account the finite sample bias by proposing a finite sample correction mechanism[15].

4 Data and Uncertainty proxy

4.1 Measuring Uncertainty

We need a proxy measure of uncertainty that would capture the economic and political events in Greece. We employ a dynamic factor model for two reasons. First, to take into account the time series dimension of our data and combine it with the traditional principal components and factor analysis methods. Second, using a dynamic factor model will reveal the common unobserved factor which will be used as the measure of economic

[13] Implemented in STATA 14 using Roodman (2007), (2009).

[14] In an autoregressive panel data model the lagged dependent variable is correlated with the individual effects c_i. By first-differencing the equations the method eliminates the unobserved group level effects and potential sources of endogeneity. For the first differences of predetermined and endogenous regressors the lags of their own levels are used as instruments. The strictly exogenous variables are used in the instrument matrix also in first differences.

[15] Windmeijer (2005) estimator provides Windmeijer-corrected cluster–robust standard errors. Thus, standard errors are robust to heteroscedasticity and serial correlation and adjusted for clustering at the firm level.

volatility. The dynamic factor model represents the vector y_t of k dependent variables as a linear function of n_f unobserved factors and x_t exogenous variables. The unobserved factors f_t follow an autoregressive process:

$$y_t = Af_t + Bx_t + u_t \tag{5}$$

$$f_t = Cw_t + D_1 f_{t-1} + D_2 f_{t-2} + \cdots + D_{t-p} f_{t-p} + \varepsilon_t \tag{6}$$

$$u_t = E_1 u_{t-1} + E_2 u_{t-2} + \cdots + E_{t-q} u_{t-q} + \nu_t \tag{7}$$

We simplify the model by omitting the exogenous parts x_t and w_t:

$$y_t = Af_t + u_t \tag{8}$$

$$f_t = D(L) f_{t-1} + \varepsilon_t \tag{9}$$

The parameters of the model are estimated by maximum likelihood (ML) in a state-space form and using the Kalman filter.[16] An important step is the selection of the number of factors. Several information criteria have been proposed in the literature. They extend the standard AIC and BIC criteria to take into account the unobserved common components and the cross-section dimension of the dataset. Bai and Ng (2002) examine the static case of approximate factor models and provide an upper bound of the true number of factors. Bai and Ng (2007), Hallin and Liska (2007), Onatski (2009), Barigozzi et al. (2016) suggest alternative criteria to determine the number of dynamic factors in large factor models. The finite sample properties of most of the information criteria and their performance are compared in Guo-Fitoussi (2013). The results show that in the case of small samples the Hallin and Liska (2007) and Onatski (2009) criteria can more accurately estimate the correct number of factors. We compute all of them.

[16] For more about dynamic factor and state space models see: Geweke (1977); Jong (1988), (1991); Lütkepohl (2005); Stock and Watson (1989), (1991).

We incorporate more than one macroeconomic variables and financial indicators. The uncertainty that the Greek economy is facing can be decomposed at three groups: domestic, EU and international. Our set includes 9 indices covering the period 1994M01 to 2015M08. The Greek specific ones are: Athens Stock Exchange closing prices (ASE), Long-term Government Bond Yields (BONDS), Bank interest rates (INTR), Industry Production Index (IP), Loans to domestic private sector (LOANS), Unemployment rate (UNEMPL), Economic Sentiment Indicator (ESI) and the European specific ones are Euro Area Business Climate Indicator (BCI) and Economic Policy Uncertainty (EPU). BCI and ESI indicators are survey-based measures for the Euro area and for Greece respectively. EPU is a policy uncertainty index based on the frequency of newspaper articles and references on the uncertainty created by Baker et al. (2016). Descriptions, transformations and sources of data are presented in Table 1.

[Table 1 here]

We start our analysis by testing each of the variables for unit roots. The Phillips and Perron (1988) test is applied to the levels and first differences of the series. The results presented in Table 2 provide evidence against the null hypothesis. As a result, we can treat the first differences as stationary processes.

[Table 2 here]

The next step would be to estimate the dynamic factor model. To construct the vector y_t of the dynamic factor model, we derive the individual measures of uncertainty from each of the transformed variables. The rolling standard deviation method is used to proxy volatility. We compute the individual volatility measures in a rolling window of 2 years with the exception of the EPU index (no transformation in this case as this is an uncertainty measure). The ASE volatility index is the conditional variance from a GARCH (1,1) model that accounts for the *volatility clustering* of the stock exchange market. All the series are demeaned and standardized by their standard deviation to have mean zero and variance one. We apply alternative information criteria for the selection of the number of dynamic factors. The results are presented in Table 3 and suggest the use of one dynamic factor.[17] Both the Akaike's and Schwarz's Bayesian information criteria suggest an optimal lag length of 1 for the unobserved factor autoregressive equation. The dynamic factor model estimates appear in Table 4. The unobserved factor will serve as a proxy for the uncertainty and is illustrated in Figure 2 annotated with the key events of recent years.

[Table 3, 4, Figure 2 here]

The derived uncertainty index can capture the most important macroeconomic events of the last decade and seems to follow closely the main political and economic episodes of the Greek financial crisis. Focusing on the coefficients of the unobservable factor one can argue that the strongest contribution to the construction of the factor stems from the EPU and the ASE indices. The correlation matrix between the uncertainty proxy and the individual uncertainty measures demonstrates a high correlation with EPU, ASE, LOANS, IP and BONDS volatilities (see Table 5). These variables are highly correlated with the computed uncertainty proxy. The patterns of EPU, ASE and the constructed index are compared in Figure 3. In the robustness section, we will also confirm our results with alternative measures of uncertainty.

[Table 5, Figure 3 here]

[17] Tests are based on a maximum number of factors *r=3*. All estimation were performed using Matlab (R2016a). The codes are publicly accessible at the author's webpage.

4.2 Firm-level Panel Data

Our sample consists of an unbalanced panel of 25000 Greek firms with sales turnover in excess of 100000€. We exclude smaller firms due to limited data availability and the degree of unbalanceness. The annual balance sheets span from 2000 to 2014 and were obtained from the Infobank Hellastat database (IBHS)[18]. The sample follows the national statistical classification of economic activities, called STAKOD–03 which is derived from the corresponding classifications of European Union (NACE Rev. 1.1) and United Nations (ISIC 3.1). Hence, we focus on the following sectors: 1) Agriculture, 2) Fishing, 3) Mining and Quarrying, 4) Manufacturing, 5) Electricity, Gas and Water supply, 6) Construction, 7) Wholesale and Retail Trade, 8) Hotels and Restaurants, 9) Transport, Storage and Communication, 10) Financial Intermediation, 11) Real Estate, 12) Education, 13) Health and Social Work, 14) Other Community, Social and Personal Service Activities.

[Table 6 here]

To quantify the standard investment model of equation (3), we construct the following variables:

- Investment (I): Capital Expenditures in material fixed assets, equal to the change of the net value of fixed assets plus the year depreciation
- Capital Stock (K): The book value of total fixed assets
- Cash Flow (CF): Net profits plus depreciation
- Growth of Sales (GS): Change is sales S (annual turnover), $\Delta S_{it} = S_{it} - S_{it-1}$
- Idiosyncratic Uncertainty (id_{it}): Standard deviation of scaled sales estimated in a 5-year rolling window

[18] See http://www.cbfa.gr/

- Uncertainty (h_t): The common unobserved factor as estimated by the dynamic factor model.

The descriptive statistics for these variables are presented in Table 7 covering three time periods: 2000-2008, 2009-2014 and 2000-2014. The investment rate shows that on average a Greek firm invests 16.8% of its total fixed assets in capital expenditures. This rate is different for the periods before (21.2%) and after (11.3%) the global financial crisis. The sizeable cash flow rate of 0.55 provides an indication of strong financial constraints (Fazzari et al., 1988). It is worth noting that the variables are skewed. As noted by Bo and Lensink (2005) this is a common feature of investment empirical models suggesting to keep the original data without transformation. The constructed variables are trimmed at the 5th and 95th percentile to reduce the potential effect of outliers. The economic uncertainty (h_t) observations are converted from monthly to annual frequency to match the panel data time unit reducing the informational content of the uncertainty factor.

[Table 7 here]

As a first step in the analysis of the sectors of the Greek economy, we provide their descriptive statistics in Table 19 in the online Appendix. Electricity, Transport, Trade, Health, Education are among the sectors with the strongest investment (higher average $I/_K$). Hotels & Restaurants, Agriculture and Fishing appear to invest less (lower $I/_K$). The growth of sales ratio takes negative values for the Hotels & Restaurant, Manufacturing, Real Estate, Construction Trade and Education sectors. We investigate this further by examining the samples for the two sub periods (before and after the crisis). There is a deterioration in the sales of the last years (2009-2014) which drives the total performance. Regarding the cash flow and idiosyncratic uncertainty indices the results are mixed.

[Table 19 here]

5 Results

Regression analysis is carried out at 4 different levels: Aggregate level, firm level, sector level and within sector level. At the first level, we examine the effect of uncertainty using the entire dataset (where the sectoral heterogeneity is not taken into account). Next, we focus on the firm size by classifying our sample into three categories. At the sector level, we investigate the investment performance under uncertainty for each of the sectors of the economy. Finally, we consider a within sector analysis to assess the behavior of each sector depending on the size of the firm (analysis carried out on sector-specific samples). All these four levels of analysis would enable us to answer the question: what is the investment loss that can be attributed to uncertainty?

5.1 Aggregate level

We start with the results for the aggregate level that are reported in Table 8. In the first model, we omit the volatility indices and estimate a standard investment model. The deflated cash flow and growth of sales regressors reveal a statistically significant and positive impact on the investment ratio. This first restricted version of the model statistically confirms the persistence characteristic of investment known as lagged investment effect. The same applies to the second model which includes the lagged value of idiosyncratic uncertainty. The contribution of the idiosyncratic ($id_{i,t-1}$) term to the investment performance is lower than other coefficients, however it is statistically significant at the 5% level. These restricted versions of the model (Model 1 & 2) pass the tests of second-order autocorrelation and the Sargan–Hansen J-test of overidentifying restrictions suggesting the suitability of the instrument sets. The third version is the more complete one and it is augmented with the presence of the economic uncertainty measure. The control variables of lagged cash flow to total assets and lagged growth of sales to total assets carry the expected positive sign and are consistent with the theory and the empirical literature in terms of magnitude and sign. The lagged value of investment to capital stock takes a positive sign and confirms the lagged investment effect. However its, economic importance is doubtful, an indication that investments in Greece may focus on short-term horizons. All the coefficients of the third model are found to be statistically significant at the 1% level. The diagnostics indicate that there is no auto-correlation in residuals and that the instruments used are exogenous and valid. Both the economic uncertainty and the firm specific uncertainty factors carry the expected negative sign. If compared, we note that the effect of economic uncertainty appear to be greater than the effect of the firm specific uncertainty. At the aggregate level, this provides an indication that the investment performance of the Greek firms is affected in a non-homogenous manner by the alternative uncertainties. Economy-wide volatility impairs more the investment decisions compared to fluctuations in the micro environment of the firm.

Next, we investigate at the aggregate level the firms' investment behavior before and after the financial crisis. Table 9 presents the results for the periods 2000-2008 and 2009-2014. As expected, the negative impact of uncertainty on investment is substantially increased in the years of crisis from -0.006 to -0.033. In the same period, the investment lag effect is cut in half while the cash flows exhibit an unusual performance. In the period 2009-2014, the lagged cash flow coefficient takes a negative sign. This implies that when cash flows decrease (increase) the firms invest more (less). The investment – cash flow sensitivity has received much attention in the literature as an indication and measure of financial constraints. Fazzari et al. (1988), among others, support the view that higher cash flow sensitivities characterize financial constrained firms that find it hard to access external capital. Hovakimian (2009) argues that a negative sign reflects relative low internal liquidity and relatively high financial constraints. Bhagat et al. (2005) reveal that financially distressed firms with operating losses exhibit negative cash flow sensitivities but they continue to invest. In stressful operating conditions, the investments are funded by equity holders. In the period 2000-2008, the cash flow sensitivity is positive and strong. One apparently puzzling finding of the pre-crisis estimation results is the negative sign of the growth of sales coefficient. A deeper inspection of the descriptive statistics of the sample in the 2000-2008 period reveals that 36% of the growth of sales observations are negative. However, 49.5% of these firms present a positive change in investment rates. These results indicate that in the pre-crisis period the strong financial constraints and the decrease in the growth of sales were not important hindrances to investment. The same applies to uncertainty measures. To sum up, at (i) the aggregate level we demonstrate the negative effect of uncertainty on investment decisions. The next step would be to examine the effect of uncertainty on investment based on the (ii) the size of the firm, (iii) the sector and (iv) the size within the sector.

[Tables 8, 9 here]

5.2 Firm size classification

The second level of analysis classifies firms based on their size (as determined by the firms' annual turnover). The first category includes firms below the 25th percentile (p25), the second between the 25th and the 75th and the third above the 75th percentile (p75). The GMM estimates are reported in Table 10. Both the economic and idiosyncratic uncertainty have a negative impact on investment rate. However, firms behave differently in an uncertainty environment depending on their size. The effect of economic uncertainty on investment is stronger in the case of small-sized firms. Firms above p75 are affected less and seem more secure. The intrinsic volatility affects adversely the investment decisions but its role is more vital for the smaller firms. These results suggest that the investment of larger firms in Greece is more protected from uncertainty fluctuations compared to smaller firms while the smaller firms appear to be more vulnerable in volatility shocks compared to larger firms. The medium-sized firms are less affected by idiosyncratic shocks while their response to uncertainty is the same (-0.028) as in the aggregate level. Qualitatively similar are the results for the rest of the coefficients of the model. The lagged investment rate is approximately 4 times higher for the firms above p75 (0.028 to 0.122) showing that investment persistence is more profound for these firms. The lagged growth of sales is also differentiated across the sample and in terms of firm size. Thus, our results show that larger firms weigh more the expected future profitability when they decide to invest compared to small firms. The cash flow effect on investment is greater for the smaller firms and even stronger for the medium-sized ones. We interpret this result as an indication of the different degree of financial constraints and internal liquidity among the three categories of firms[19]. The large firms in Greece are positive - cash flow insensitive (compared to smaller firms), and seem to be less financially constrained. Small firms in Greece are the most influenced ones by economic and intrinsic uncertainty and are more responsive to cash flow and less to the growth of sales (when they decide to invest). The Wald test, the Arellano and Bond (1991) test for second-order serial correlation and the Sargan/Hansen test of overidentifying restrictions provide satisfactory results for all the models of our analysis.

[Table 10 here]

5.3 Sector level

We apply the empirical model of equation 3 on each of the sectors of economic activity in Greece. The results of the GMM regressions are presented in Summary Table 11 and in Table 20 in the online Appendix. The degree of statistical significance varies across

[19] See Allayannis and Mozumdar (2004); Bhagat et al. (2005); Drakos and Regent (2005); Fazzari et al. (1988); Gilchrist and Himmelberg (1995); Hassan et al. (2011); Hovakimian (2009); Marhfor et al. (2012); Schiantarelli (1996);

the model specifications. The coefficients of the uncertainty terms are the more stable in terms of statistical significance, however, their magnitude varies widely across sectors. The economic uncertainty affects negatively investment performance. The negative impact is found to be stronger on the Real estate sector, the Manufacturing sector and the Hotels & Restaurants sector (the latter is an indirect evidence of the sensitivity of the tourism sector to uncertainty). The effect is much smaller for the Agriculture, Mining and Electricity sectors. The impact of the lagged investment rate is small compared to the results reported in the literature (usually 0.3 to 0.5 for US or UK firms) and rather mixed, from 0.069 for the Health sector to 0.243 for the Mining sector. This indicates that the presence of the lagged investment effect is significant but not of the same magnitude for all the sectors. The same applies to the other coefficients of the model. What is worth mentioning: The relatively high coefficient values of the lagged cash flow rate for the Fishing (0.402) and the Real Estate (0.563) sectors and the strong effects of the growth of sales and idiosyncratic uncertainty for the Hotels sector (1.733 and -2.409 respectively). All in all, our analysis of the effects of uncertainty on investment show that there is a high degree of heterogeneity among Greek sectors.

We perform a disaggregated examination of the manufacturing sectors given the more detailed classification that is available (more than twenty two-digit SIC subsectors). Equation 3 is estimated for each of the manufacturing subsectors (Manufacturing of Tobacco products and Office machinery are excluded due to the lack of data). Table 23 presents the results of the GMM regressions. Coke & petroleum products and Motor Vehicles manufacturing are affected more, followed closely by Textiles industry and Pulp & Papers manufacturing. The Food & Beverages industry appears to be less sensitive to uncertainty effects. For the rest of the subsectors, the results of the disaggregated analysis are mixed.

[Table 11, 23 here]

We attempt to quantitatively assess the impact of uncertainty by calculating the investment loss for each of the economic sectors. The investment loss is the marginal effect of uncertainty on investment rate, ceteris paribus, multiplied by the median value of the capital stock. We excluded the electricity sector because of its extreme capital stock values. The results are presented in Figure 5. Hotels, Manufacturing and Real Estate sectors suffer the greatest investment losses as the level of uncertainty rises. At the aggregate level, the median Greek firm suffers an investment loss of 12227€ when uncertainty is incremented by one unit. For hotels, this number is above 40000€ per firm per year and slightly less than that in the Real Estate sector.

[Figure 5 here]

5.4 Within sector classification

To investigate the within-sector investment performance in conditions of uncertainty we conduct GMM regressions for the firms below the 25th percentile and the firms above the 75th percentile. The results are reported in Summary Table 11 and Tables 21 & 22 in the Appendix. For illustrative purposes, Figure 4 summarizes in a bar chart the effect of uncertainty at the sector and within sector level. The investment decisions of the small firms are more severely influenced by macroeconomic volatility for most sectors of the analysis (Hotels, Fishing and Real Estate are the three exceptions). This effect is especially profound for the other Community, Social and Personal Service Activities sector (other services), the Agriculture sector, the Education sector and the Health sector. In other words, small firms in these sectors are influenced much more by uncertainty compared to the large firms. For the rest of the sectors, the effect is the same but of a smaller magnitude. The same degree of heterogeneity is observed in the intrinsic component of the uncertainty effect. For several sectors, its contribution to investment performance is substantial and large. Particularly for the Hotels, the Agriculture and the Fishing sector, this effect is several times higher compared to the macroeconomic effect. For some sectors the id_{it} term takes positive values, something that is not in line with the previous results. We employed the rolling standard deviation of sales as a measure of the firm-specific uncertainty. Our findings reveal that for small firms of certain sectors the managerial response to volatility of sales is expansionary in terms of investment spending. A possible explanation could be that for these sectors (Mining, Real Estate, Education and Health) the increased variability in sales activates a growth option mechanism in order to gain a strategic advantage or to raise the expected future profits. Of course, further close investigation of the micro-environment of these sectors or a sectoral study which lies beyond the scope of this paper could help to realize the nature of this positive effect.

[Table 21, 22, Figure 4 here]

6 Robustness Analysis

6.1 The role of Debt

The role of debt ratio and its effect on the firm's investment policy has been studied extensively in the literature[20]. Results depend on the firm's growth opportunities, however, in many cases the link is negative. Baum et al. (2010) examined this link in an uncertain environment. They revealed a stimulating or mitigating effect of leverage depending on the uncertainty regime. We perform additional analysis to check the robustness of the empirical model and the stability of the results under different specifications. The alternative empirical model includes a lagged leverage effect $\left(\frac{D}{K}\right)_{i,t-1}$ as a regressor, where D is the total bank liabilities. The augmented model is presented in Table 12 and in Figure 6. The results are similar to the previous ones. The negative

[20] See Ahn et al. (2006) for a brief literature review on leverage and investment.

effect of uncertainty is confirmed again and the estimated coefficients take almost identical values. At aggregate level, the, impact of leverage on investment is found to be negative, thus the investment decisions of the Greek firms appear to be constrained by increased debt. To further evaluate the robustness of our findings, we conducted regressions at the sector level. The results are reported in Table 13 and a comparison graph of the uncertainty effect is presented in Figure 7. For most sectors there is no qualitatively difference between uncertainty estimates. The models are not sensitive to the inclusion of the leverage effect and the significance of the coefficients is maintained in the alternative specification. The Agriculture, Financial, Real Estate and Community Sectors are the exceptions of the robustness analysis. For these sectors, the stability of the uncertainty effect is reduced by the introduction of the debt rate.

[Table 12, 13, Figure 6, 7 here]

Another deviation from the model one would consider is a model with time dummies. Figure 8 presents the basic coefficients of the model together with their confidence intervals for (i) the model with time dummies, (ii) the model with time demeaned variables and (iii) the aggregate model we did consider in section 5.1. As one can observe the results with regard to the sign of uncertainty remain the same although in the case (i) the coefficient is closer to 0. Qualitatively deviations are not revealed in other cases. Table 16 also provides the starting fixed effects estimates of the aggregate model of section 5.1 which is in line with our previous results.

[Table 16, Figure 8 here]

6.2 Interaction terms

To further investigate the robustness of the results, we include an interaction term between uncertainty and growth of sales and another between uncertainty and cash flow ratio. The incorporation of these terms extends the basic model allowing to examine to what extent uncertainty affects investment through alternative channels. The results are presented in Table 14. Model 1 represents the basic model and models 2 and 3 are augmented with the interaction effects. The transmission mechanism of the volatility effect through the growth of the sales channel is negative and statistically significant. This shows that the impact of the growth of sales ratio on investment is weakening in case of higher uncertainty level. In other words, the investment response on the growth of sales is significantly lower when uncertainty increases. This finding indicates the existence of a "wait and see" effect in periods of high volatility. In these periods, Greek firms develop a precautionary behavior that leads to postponing or to canceling investments (they prefer the "option to wait"). This is in line with the theoretical literature of investment under uncertainty in a partial irreversibility framework and with the empirical findings of Bloom et al. (2007) and Bond and Cummins (2004). The alternative channel of cash flow interaction doesn't yield statistically significant results showing that in periods of high uncertainty the investment responsiveness is reduced through a demand shock channel rather than a profitability channel. However, the introduction of both interaction terms provide quite similar coefficient values and more support to the robustness of our model.

[Table 14 here]

6.3 Alternative uncertainty measures

The use of alternative measures of uncertainty is a third of the battery of robustness checks we performed. The macroeconomic variables and financial indicators of the dynamic factor model in Section 4.1 (with the exception of the unemployment index) are selected as individual proxies of volatility. We also introduce a new Greek specific measure of uncertainty $\boldsymbol{hgrexit_{t-1}}$, an index based on the web search queries as provided by the Google Trends online tool[21]. The regression estimates are reported in Table 15. The results for the alternative specifications are very similar, in terms of magnitude and sign (the exception here is *ESI* and *IP*). Each alternative uncertainty index doesn't have the same impact on investment, a quite expected result. The $\boldsymbol{hgrexit_{t-1}}$ index seems to underestimate the importance of the uncertainty effect compared to the initial model estimations. However, this is not necessary casting doubt on the selection of the common unobserved factor as an economic uncertainty index. Because of its simplicity the $\boldsymbol{hgrexit_{t-1}}$ index may overlook certain aspects of the Greek case.

[Table 15 here]

7 Conclusions

This paper examines the link between uncertainty and investment decisions. Greece offers a useful paradigm as the country has experienced low and high levels of uncertainty within the time window that we employ. A unique dataset of 25000 firms for 14 years is constructed. We employed a dynamic investment model using GMM on aggregate, firm size classified, sector, within sector data. Our results reveal that uncertainty has a negative impact on economic activity and on the firm investment. This negative impact of uncertainty on investment is substantially increased in the years of crisis. However, its magnitude varies widely across sector samples indicating a high degree of heterogeneity among sectors. This negative impact is found to be stronger on the Manufacturing, Real Estate and Hotels sectors. Small firms behave differently compared

[21] The key phrases are: *Greek-Greece crisis, Greek debt crisis, Greece bailout, Greek debt, Grexit, Greece uncertainty.*

to the large firms providing evidence of a within-sector heterogeneity in firm sizes. Large firms appear to have stronger protective mechanisms against uncertainty effects. The results are robust to the inclusion of the lagged leverage effect and to alternative interaction terms or uncertainty indices. The "wait and see" effect is present in periods of higher volatility which reduces the responsiveness of investment through a demand shock channel. Alternative approaches with regard to the model (debt), the variable that uncertainty affects more (interaction terms) or different definitions of uncertainty do not alter the results.

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Table 1: Macroeconomic Variables and Indices

	Variable	Abbreviation	Source	Transformation
Greek specific variables	Athens Stock Exchange closing prices	ASE	Athens Stock Exchange	(1− L)ln(Xt)
	Long-term Government Bond Yields	BONDS	Bank of Greece	(1− L)ln(Xt)
	Economic Sentiment Indicator	ESI	European Commission	(1− L)ln(Xt)
	Unemployment Rate	UNEMPL	Eurostat	(1− L)Xt
	Bank Interest Rate (Bank interest rates on new euro-denominated deposits and loans)	INTR	Bank of Greece	(1− L)ln(Xt)
	Industry Production Index (Total industry excluding construction)	IP	OECD	(1− L)ln(Xt)
	Loans to domestic private sector (Growth rate same period previous year)	LOANS	Bank of Greece	(1− L)Xt
Europe specific variables	Euro Area Business Climate Indicator	BCI	European Commission	Xt
	Economic Policy Uncertainty	EPU	Baker et al. (2016)*	Xt

Notes: *Xt* is the transformed variable and *L* is the lag-operator
*Data available on http://www.policyuncertainty.com/
The Economic Sentiment Indicator (ESI) and the Business Climate Indicator (BCI) are survey-based indices conducted by the Directorate General for Economic and Financial Affairs (DG ECFIN). In Greece, the surveys are conducted by the Foundation of Economic & Industrial Research (FEIR/IOBE).

Table 2: Unit Root Tests

Series	Phillips–Perron Unit Root Test	
	Level	First Difference
ASE	-1.073	-14.500***
BCI	-3.785***	-12.344***
BONDS	-1.975	-13.399***
ESI	-1.373	-13.792***
EPU	-4.766***	-29.634***
INTR	-3.408**	-14.176***
IP	-1.149	-29.027***
LOANS	-0.857	-17.877***
UNEMPL	0.203	-12.735***

Notes: Phillips-Perron test (Ho: unit root), *** (**, *) rejects the null hypothesis at the 1% (5% and 10%) level, Phillips-Perron test includes an intercept term.

Table 3: Determining the Number of Factors

Tests	Number of factors							
Bai and Ng (2002)	IC1	IC2	IC3	PC1	PC2	PC3	BIC3	AIC3
	0	0	0	1	1	1	2	0
Bai and Ng (2007)					1			
Hallin and Liska (2007)	Penaltv		a		b		c	d
	Large Window		1		1		1	1
	Small Window		1		1		1	1
Onatski (2009)					1			
Alessi et al. (2010)					1			
Barigozzi et al. (2016)	Penalty		a		b		c	d
	Large Window		1		1		1	1
	Small Window		1		1		1	1

Notes: Sample size N=9, T=258. Tests are based on a maximum number of factors *r=3*. All estimation were performed using Matlab (R2016a). The codes are available at the author's web pages.

Table 4: Dynamic Factor Model Estimates

Variable	Coefficient	Std. Error	P>|z|
f t-1	0.922***	0.031	0.000***
ASE_{VI}	0.187***	0.037	0.000***
BCI	0.059**	0.028	0.033**
$BONDS_{VI}$	0.122***	0.041	0.003***
ESI_{VI}	0.076**	0.030	0.012**
EPU	0.354***	0.062	0.000***
$INTR_{VI}$	-0.058***	0.020	0.004***
IP_{VI}	0.114***	0.044	0.010***
$LOANS_{VI}$	-0.072***	0.019	0.000***
$UNEMPL_{VI}$	0.045	0.027	0.105
Wald *p*-value	0.000		

Notes: Subscript VI refers to volatility index; Robust std errors; * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Table 5: Uncertainty Indices Correlation Matrix

Volatility	f	ASE_{VI}	BCI	$BONDS_{VI}$	ESI_{VI}	EPU	$INTR_{VI}$	IP_{VI}	$LOANS_{VI}$	$UNEMPL_{VI}$
f	1.0000									
ASE_{VI}	0.4571	1.0000								
BCI	0.1337	0.2794	1.0000							
$BONDS_{VI}$	0.3038	0.1361	-0.0200	1.0000						
ESI_{VI}	0.1686	0.1575	-0.0087	0.0060	1.0000					
EPU	0.8208	0.4258	0.1365	0.2621	0.2035	1.0000				
$INTR_{VI}$	-0.1302	0.0006	-0.0341	0.0127	-0.0688	-0.1358	1.0000			
IP_{VI}	0.2387	0.0847	-0.0118	0.0891	0.0080	0.2565	-0.0846	1.0000		
$LOANS_{VI}$	-0.1811	-0.0383	-0.0759	-0.0801	-0.0872	-0.1651	0.0257	-0.0838	1.0000	
$UNEMPL_{VI}$	0.0913	0.0990	0.0146	-0.0038	0.0669	0.0803	-0.0733	0.0598	-0.0394	1.0000

Note: Subscript VI refers to volatility index; f is the common unobserved factor estimated by the Factor Model

Table 6: Sectors of Economic Activity in Greece

Sector	Section	Abbreviation
Agriculture, Animal Husbandry, Hunting and Forestry	A	Agriculture
Fishing	B	Fishing
Mining and Quarying	C	Mining
Manufacturing	D	Manufacturing
Electricity, Gas and Water supply	E	Electricity
Construction	F	Construction
Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal and Household Goods	G	Trade
Hotels and Restaurants	H	Hotels
Transport, Storage and Communication	I	Transport
Financial Intermediation	J	Financial
Real Estate*	K*	Real Estate
Education	M	Education
Health and Social Work	N	Health
Other Community, Social and Personal Service Activities	O	Community

Notes: *The Real Estate sector of section K refers to division 70 without renting and business activities. The sectors of Public administration and defense; compulsory social security, Activities of households, and Extra-territorial organizations and bodies (Sections L, P, Q respectively) are not included due to limited availability of data. For more details on this see http://www.cbfa.gr/

Table 7: Descriptive Statistics

Time	Variable	mean	sd	p5	p25	p50	p75	p95
2000-2008	I/K	0.21239	0.25556	-0.06253	0.02539	0.13507	0.34576	0.75556
	CF/K	0.62032	1.08133	-0.09613	0.08379	0.23089	0.64103	3.03846
	GS/K	0.32903	2.56233	-3.14973	-0.11492	0.07663	0.69185	4.87830
	id_{it}	7.18990	14.81538	0.06100	0.31085	1.27772	6.12851	38.25301
	h_t	-1.04366	1.11913	-2.37267	-2.28133	-1.13620	0.02072	0.70187
2009-2014	I/K	0.11343	0.22211	-0.12434	0.00008	0.03422	0.16622	0.61721
	CF/K	0.45328	1.03013	-0.34396	0.01606	0.12635	0.43058	2.64983
	GS/K	-0.60644	2.70327	-6.01434	-0.79787	-0.08962	0.07901	2.60434
	id_{it}	6.91673	14.82692	0.05817	0.28747	1.11801	5.32149	37.88941
	h_t	2.42260	1.49445	0.25912	1.04542	2.58973	3.39777	4.65384
Total Sample	I/K	0.16772	0.24602	-0.09333	0.00669	0.08052	0.27394	0.70908
	CF/K	0.54804	1.06270	-0.21371	0.05094	0.18407	0.55359	2.88735
	GS/K	-0.10782	2.67019	-4.68852	-0.39371	0.00196	0.37024	3.96232
	id_{it}	7.02104	14.82456	0.05912	0.29597	1.17431	5.62592	38.05542
	h_t	0.34285	2.12800	-2.37267	-1.67847	0.19047	1.94258	4.65384

Notes: Investment (I): Capital Expenditures in material fixed assets
Capital Stock (K): The lagged book value of total assets
Cash Flow (CF): Net profits plus depreciation
Growth of Sales (GS): Change in annual turnover
Idiosyncratic Uncertainty (id_{it}): Standard deviation of scaled sales estimated in a 5-year rolling window
Economic Uncertainty (h_t): The common unobserved factor
sd is the standard deviation and p5-p95 are the percentiles of the variables. The variables are trimmed at the 5th and 95th percentile to reduce the effect of outliers

Table 8: GMM Estimates of Investment rate – Entire Sample

Variable	Model1		Model2		Model3	
$(I/K)_{i.t-1}$	0.214**	(0.107)	0.082***	(0.014)	0.070***	(0.014)
$(CF/K)_{i.t-1}$	0.161***	(0.033)	0.297***	(0.058)	0.112***	(0.018)
$(GS/K)_{i.t-1}$	0.047***	(0.012)	0.038***	(0.014)	0.042***	(0.015)
h_{t-1}	-	-	-	-	-0.028***	(0.001)
$id_{i.t-1}$	-	-	-0.005**	(0.002)	-0.012***	(0.002)
Wald test (p-value)	0.000		0.000		0.000	
AR(2) test	1.93		0.79		0.087	
AR(2). p-value	0.053		0.428		0.931	
J (Sargan/Hansen) test	4.45		1.22		1.763	
J. p-value	0.616		0.747		0.623	
Number of Instruments	10		8		9	
Observations	422025		422025		422025	

Notes: The models are estimated using the first-difference Arellano-Bond estimator developed by Arellano and Bond (1991) and implemented in STATA 14 by Roodman (2009). Robust standard errors are reported in braces. Sargan–Hansen J-test is a test of overidentifying restrictions. AR (2) is the Arellano and Bond (1991) test for second order serial correlation. Robust standard errors are computed using the Windmeijer (2005) WC-robust two-step estimator. Instrument sets of the second through sixth lags of the right hand variables are used for the differenced equations. To avoid instrument proliferation we invoke the "collapse" option in order to restrict the lag ranges in the generation of the instruments sets. The *h* term is the measure of economic uncertainty. while the *id* term refers to the idiosyncratic uncertainty of each firm. To eliminate the effect of outliers the data are screened by trimming observations at the 5th and 95th percentile. The following tests are applied: 1. Sargan-Hansen J-test as a test of overidentifying restrictions. 2. The difference-in-Hansen tests of exogeneity and validity of instrument subsets (not reported but available on request). 3. The Arellano and Bond (1991) test for second order serial correlation and 4. The Wald chi-squared statistic of the null hypothesis that all the coefficients except the constant are zero.
* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Table 9: GMM Estimates of Investment Rate – Before and After the Crisis

Variable	2000-2008		2009-2014		Total Sample	
$(I/K)_{i.t-1}$	0.069***	(0.011)	0.031***	(0.017)	0.070***	(0.014)
$(CF/K)_{i.t-1}$	0.191***	(0.047)	-0.113**	(0.045)	0.112***	(0.018)
$(GS/K)_{i.t-1}$	-0.022**	(0.009)	0.065***	(0.015)	0.042***	(0.015)
h_{t-1}	-0.006**	(0.003)	-0.033***	(0.001)	-0.028***	(0.001)
$id_{i.t-1}$	-0.0001	(0.002)	-0.005***	(0.002)	-0.012***	(0.002)
Wald test (p-value)	0.000		0.000		0.000	
AR(2) test	-0.33		-1.59		0.087	
AR(2). p-value	0.741		0.113		0.931	
J (Sargan/Hansen) test	8.97		3.24		1.763	
J. p-value	0.440		0.355		0.623	
Number of Instruments	15		9		9	
Observations	253215		168810		422025	

Notes: The models are estimated using the first-difference Arellano-Bond estimator developed by Arellano and Bond (1991) and implemented in STATA 14 by Roodman (2009). Robust standard errors are reported in braces. Sargan–Hansen J-test is a test of overidentifying restrictions. AR (2) is the Arellano and Bond (1991) test for second order serial correlation. Robust standard errors are computed using the Windmeijer (2005) WC-robust two-step estimator. Instrument sets of the second through sixth lags of the right hand variables are used for the differenced equations. To avoid instrument proliferation we invoke the “collapse” option in order to restrict the lag ranges in the generation of the instruments sets. The h term is the measure of economic uncertainty while the id term refers to the idiosyncratic uncertainty of each firm. To eliminate the effect of outliers the data are screened by trimming observations at the 5^{th} and 95^{th} percentile. The following tests are applied: 1. Sargan-Hansen J-test as a test of overidentifying restrictions. 2. The difference-in-Hansen tests of exogeneity and validity of instrument subsets (not reported but available on request). 3. The Arellano and Bond (1991) test for second order serial correlation and 4. The Wald chi-squared statistic of the null hypothesis that all the coefficients except the constant are zero.

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Table 10: GMM Estimates of Investment Rate – Classified by Firm Size

Variable	Small firms ≤ p25		p25 < Medium firms < p75		Large Firms ≥ p75	
$(I/K)_{i.t-1}$	0.028	(0.024)	0.045***	(0.017)	0.122***	(0.030)
$(CF/K)_{i.t-1}$	0.064	(0.080)	0.099***	(0.032)	0.019	(0.077)
$(GS/K)_{i.t-1}$	0.007	(0.036)	0.048**	(0.024)	0.056*	(0.032)
h_{t-1}	-0.049***	(0.003)	-0.028***	(0.002)	-0.025***	(0.002)
$id_{i.t-1}$	-0.051**	(0.025)	-0.006**	(0.003)	-0.021***	(0.008)
Wald test (*p*-value)	0.000		0.000		0.000	
AR(2) test	-2.03		-1.45		1.59	
AR(2). *p*-value	0.042		0.146		0.111	
J (Sargan/Hansen) test	2.90		4.64		0.33	
J. *p*-value	0.716		0.914		0.848	
Number of Instruments	11		16		8	
Observations	63793		130137		66344	

Notes: The models are estimated using the first-difference Arellano-Bond estimator developed by Arellano and Bond (1991) and implemented in STATA 14 by Roodman (2009). Robust standard errors are reported in braces. Sargan–Hansen J-test is a test of overidentifying restrictions. AR (2) is the Arellano and Bond (1991) test for second order serial correlation. Robust standard errors are computed using the Windmeijer (2005) WC-robust two-step estimator. Instrument sets of the second through sixth lags of the right hand variables are used for the differenced equations. To avoid instrument proliferation we invoke the "collapse" option in order to restrict the lag ranges in the generation of the instruments sets. The *h* term is the measure of economic uncertainty while the *id* term refers to the idiosyncratic uncertainty of each firm. To eliminate the effect of outliers the data are screened by trimming observations at the 5^{th} and 95^{th} percentile The following tests are applied: 1. Sargan-Hansen J-test as a test of overidentifying restrictions. 2. The difference-in-Hansen tests of exogeneity and validity of instrument subsets (not reported but available on request). 3. The Arellano and Bond (1991) test for second order serial correlation and 4. The Wald chi-squared statistic of the null hypothesis that all the coefficients except the constant are zero.

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Table 11: GMM Estimates of Investment Rate – Sector Level – Summary Table

Time	Variable	Agriculture	Fishing	Mining	Manufacturing	Electricity	Trade	Construction
Sector level	I/K	0.146*	0.168**	0.243**	0.151***	0.135**	0.075***	0.133***
	CF/K	-0.030	0.402***	0.293*	0.184***	-0.263	0.067***	0.207**
	GS/K	0.137**	-0.047**	-0.100**	-0.028	-0.096	0.029***	-0.030**
	h_t	-0.018**	-0.025***	-0.018**	-0.032***	-0.018***	-0.025***	-0.019***
	id_{it}	-0.066**	0.095*	0.050	-0.063***	-0.009***	-0.005***	-0.002
Small Firms ≤ p25	I/K	0.149**	-0.062	0.384**	0.100**	-0.586**	-0.019	-0.285***
	CF/K	0.409	0.262	0.906***	-0.368**	-0.100	0.282*	-0.014
	GS/K	0.094	0.465***	0.201***	0.028	-0.090	-0.056**	0.005
	h_t	-0.040**	-0.011**	0.134***	-0.041***	-0.008**	-0.031***	-0.032**
	id_{it}	-0.475***	-0.426**	0.033***	-0.023**	-0.385	0.001	-0.002***
Large Firms ≥ p75	I/K	0.059	0.232	-0.253	0.125***	0.481***	0.132***	0.152***
	CF/K	-0.196**	-0.169	0.270**	-0.212	-0.007***	-0.015	0.029
	GS/K	0.031***	0.038	-0.013	0.214***	0.000	0.008**	0.009
	h_t	-0.016*	-0.059***	-0.031***	-0.028***	0.003***	-0.030***	-0.018***
	id_{it}	-0.010	0.385***	-0.017	-0.085***	0.006***	-0.003***	-0.016**
Time	**Variable**	**Hotels**	**Transport**	**Financial**	**Real Estate**	**Education**	**Health**	**Community**
Sector level	I/K	0.073**	0.107***	-0.067	0.077	0.086	0.069*	0.119***
	CF/K	-0.379	0.250***	0.016	0.563*	0.134***	0.113***	0.263**
	GS/K	1.733**	-0.013	0.007	0.088*	-0.046**	-0.014	-0.061**
	h_t	-0.048***	-0.019***	-0.024*	-0.046***	-0.022**	-0.022***	-0.021***
	id_{it}	1.733**	-0.013	0.007	0.088*	-0.046**	-0.014	-0.061**
Small Firms ≤ p25	I/K	-0.151	-0.078***	-0.307***	-0.144*	-0.307**	-0.213**	-0.137
	CF/K	-3.587	0.008	-0.002	0.761**	0.049***	0.053***	0.056**
	GS/K	6.748**	-0.004	0.000	-0.383**	0.046	0.018	-0.063*
	h_t	-0.060***	-0.020**	-0.038**	-0.017***	-0.039***	-0.072***	-0.046**
	id_{it}	-9.459***	-0.021***	-0.022***	0.117***	0.060**	0.012***	-0.076*
Large Firms ≥ p75	I/K	0.254***	0.137**	-0.094	0.267**	-0.263**	-0.058	0.142
	CF/K	0.400	0.059***	0.014	-0.170***	-0.298**	0.258***	0.180**
	GS/K	-2.262**	0.003	-0.016	-0.045***	0.046	-0.000	0.030
	h_t	-0.064***	-0.019***	-0.003	-0.089***	-0.019**	-0.030**	-0.041**
	id_{it}	-0.345	-0.001	0.005	-0.034	0.010	-0.025***	-0.087**

Notes: The table summarizes Tables 14, 15, 16 of online appendix. The models are estimated using the first-difference Arellano-Bond estimator developed by Arellano and Bond (1991) and implemented in STATA 14 by Roodman (2009). Robust standard errors are computed using the Windmeijer (2005) WC-robust two-step estimator. The h term is the measure of economic uncertainty while the *id* term refers to the idiosyncratic uncertainty of each firm. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Table 12: Robustness Analysis -The Role of Debt

Variable	Model1		Model2		Model3	
$(I/K)_{i.t-1}$	0.019	(0.028)	0.070***	(0.019)	0.076***	(0.012)
$(CF/K)_{i.t-1}$	0.186***	(0.046)	0.157****	(0.035)	0.093***	(0.027)
$(GS/K)_{i.t-1}$	0.127***	(0.023)	0.072***	(0.015)	0.035***	(0.012)
$(D/K)_{i,t-1}$	-0.116***	(0.038)	-0.094***	(0.030)	-0.055***	(0.019)
h_{t-1}	-	-	-	-	-0.029***	(0.002)
$id_{i.t-1}$	-	-	-0.003**	(0.001)	-0.005***	(0.002)
Wald test (p-value)	0.000		0.000		0.000	
AR(2) test	-1.05		0.32		-0.63	
AR(2). p-value	0.291		0.752		0.527	
J (Sargan/Hansen) test	1.38		7.20		2.60	
J. p-value	0.847		0.302		0.627	
Number of Instruments	9		12		11	
Observations	422025		422025		422025	

Notes: The models are estimated using the first-difference Arellano-Bond estimator developed by Arellano and Bond (1991) and implemented in STATA 14 by Roodman (2009). Robust standard errors are reported in braces. Sargan–Hansen J-test is a test of overidentifying restrictions. AR (2) is the Arellano and Bond (1991) test for second order serial correlation. Robust standard errors are computed using the Windmeijer (2005) WC-robust two-step estimator. Instrument sets of the second through sixth lags of the right hand variables are used for the differenced equations. To avoid instrument proliferation we invoke the "collapse" option in order to restrict the lag ranges in the generation of the instruments sets. The h term is the measure of economic uncertainty while the id term refers to the idiosyncratic uncertainty of each firm. To eliminate the effect of outliers the data are screened by trimming observations at the 5th and 95th percentile. The following tests are applied: 1. Sargan-Hansen J-test as a test of overidentifying restrictions. 2. The difference-in-Hansen tests of exogeneity and validity of instrument subsets (not reported but available on request). 3. The Arellano and Bond (1991) test for second order serial correlation and 4. The Wald chi-squared statistic of the null hypothesis that all the coefficients except the constant are zero.
* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Table 13: Robustness Analysis - The Role of Debt – Sector Level

Variable	Agriculture	Fishing	Mining	Manufacturing	Electricity	Trade	Construction	Hotels	Transport	Financial	Real Estate	Education	Health	Community
$(I/K)_{i.t-1}$	0.243**	0.141**	0.238**	0.095***	0.056	0.088***	0.172***	0.303***	0.074**	-0.267**	0.104**	0.117*	0.105**	-0.039
	(0.121)	(0.065)	(0.094)	(0.019)	(0.095)	(0.020)	(0.044)	(0.068)	(0.036)	(0.117)	(0.048)	(0.067)	(0.051)	(0.050)
$(CF/K)_{i.t-1}$	0.490	0.146	-0.060	-0.099	-0.208**	0.075**	0.122**	0.652	0.137***	0.019	-0.131***	0.169***	0.155***	-0.192**
	(0.322)	(0.143)	(0.236)	(0.105)	(0.104)	(0.029)	(0.052)	(0.980)	(0.053)	(0.035)	(0.046)	(0.034)	(0.057)	(0.082)
$(GS/K)_{i.t-1}$	0.121*	-0.008	-0.042	0.044**	-0.052***	0.025**	-0.019*	-2.080*	0.005	-0.010	-0.027**	-0.017***	-0.019	0.042**
	(0.063)	(0.019)	(0.041)	(0.022)	(0.020)	(0.011)	(0.011)	(1.207)	(0.006)	(0.015)	(0.012)	(0.007)	(0.036)	(0.016)
h_{t-1}	-0.034***	-0.027***	-0.025**	-0.032***	-0.017**	-0.028***	-0.021***	-0.045***	-0.017***	-0.060**	-0.027***	-0.013	-0.026***	-0.046***
	(0.012)	(0.009)	(0.011)	(0.002)	(0.008)	(0.003)	(0.005)	(0.011)	(0.005)	(0.028)	(0.004)	(0.011)	(0.009)	(0.009)
$id_{i.t-1}$	-0.107**	0.074**	0.002	-0.020***	-0.003*	-0.004***	-0.002	-1.197*	0.001	0.047**	0.004	-0.001	-0.005*	-0.004
	(0.053)	(0.033)	(0.038)	(0.007)	(0.001)	(0.002)	(0.002)	(0.616)	(0.001)	(0.019)	(0.005)	(0.002)	(0.003)	(0.003)
$(D/K)_{it-1}$	0.272**	0.085***	0.143***	-0.105**	-0.562**	-0.033**	0.094***	2.595***	0.039**	0.064**	0.096***	-0.003	0.017	0.090***
	(0.130)	(0.020)	(0.039)	(0.043)	(0.224)	(0.015)	(0.033)	(0.878)	(0.019)	(0.026)	(0.032)	(0.045)	(0.047)	(0.033)
Wald test (p-value)	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.001	0.000
AR(2) test	-0.427	0.695	-1.211	-0.287	0.726	-0.847	0.977	-0.953	-1.418	0.264	0.118	-1.584	0.197	-0.271
AR(2) p-value	0.670	0.487	0.226	0.774	0.468	0.397	0.328	0.340	0.156	0.792	0.906	0.113	0.844	0.786
J (Sargan/Hansen) test	10.775	37.210	31.866	2.475	4.333	2.181	2.712	3.342	57.318	32.970	7.631	59.353	43.596	70.046
J. p-value	0.768	1.000	0.708	0.929	0.632	0.949	0.910	0.502	0.710	0.810	0.813	0.390	0.362	0.376
Number of Instruments	22	78	44	14	13	14	14	11	71	48	19	64	48	74
Observations	3105	1605	1965	86220	3375	144180	29505	46830	21855	6705	16425	4050	9075	9240

Notes: The models are estimated using the first-difference Arellano-Bond estimator developed by Arellano and Bond (1991) and implemented in STATA 14 by Roodman (2009). Robust standard errors are reported in braces. Sargan–Hansen J-test is a test of overidentifying restrictions. AR (2) is the Arellano and Bond (1991) test for second order serial correlation. Robust standard errors are computed using the Windmeijer (2005) WC-robust two-step estimator. Instrument sets of the second through sixth lags of the right hand variables are used for the differenced equations. To avoid instrument proliferation we invoke the "collapse" option in order to restrict the lag ranges in the generation of the instruments sets. The h term is the measure of economic uncertainty while the id term refers to the idiosyncratic uncertainty of each firm. To eliminate the effect of outliers the data are screened by trimming observations at the 1st and 99th percentile. The following tests are applied: 1. Sargan-Hansen J-test as a test of overidentifying restrictions. 2. The difference-in-Hansen tests of exogeneity and validity of instrument subsets (not reported but available on request). 3. The Arellano and Bond (1991) test for second order serial correlation and 4. The Wald chi-squared statistic of the null hypothesis that all the coefficients except the constant are zero. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Table 14: Robustness Analysis –Interaction Terms

Variable	Model 1		Model 2		Model 3	
$(I/K)_{i.t-1}$	0.070***	(0.014)	0.071***	(0.009)	0.054***	(0.014)
$(CF/K)_{i.t-1}$	0.112***	(0.018)	0.168***	(0.023)	0.206***	(0.079)
$(GS/K)_{i.t-1}$	0.042***	(0.015)	0.029***	(0.009)	0.045***	(0.013)
h_{t-1}	-0.028***	(0.001)	-0.025***	(0.001)	-0.025***	(0.003)
$id_{i.t-1}$	-0.012***	(0.002)	-0.002**	(0.001)	-0.004***	(0.001)
$h_{t-1}\ x\ (GS/K)_{i.t-1}$	-	-	-0.018***	(0.003)	-0.018***	(0.005)
$id_{i.t-1}\ x\ (CF/K)_{i.t-1}$	-	-	-	-	0.006	(0.012)
Wald test (*p*-value)	0.000		0.000		0.000	
AR(2) test	0.087		-0.525		-0.977	
AR(2). *p*-value	0.931		0.600		0.329	
J (Sargan/Hansen) test	1.763		6.795		1.612	
J. *p*-value	0.623		0.658		0.807	
Number of Instruments	9		16		12	
Observations	422025		422025		422025	

Notes: The models are estimated using the first-difference Arellano-Bond estimator developed by Arellano and Bond (1991) and implemented in STATA 14 by Roodman (2009). Robust standard errors are reported in braces. Sargan–Hansen J-test is a test of overidentifying restrictions. AR (2) is the Arellano and Bond (1991) test for second order serial correlation. Robust standard errors are computed using the Windmeijer (2005) WC-robust two-step estimator. Instrument sets of the second through sixth lags of the right hand variables are used for the differenced equations. To avoid instrument proliferation we invoke the "collapse" option in order to restrict the lag ranges in the generation of the instruments sets. The *h* term is the measure of economic uncertainty while the *id* term refers to the idiosyncratic uncertainty of each firm. To eliminate the effect of outliers the data are screened by trimming observations at the 5st and 95th percentile. The following tests are applied: 1. Sargan-Hansen J-test as a test of overidentifying restrictions. 2. The difference-in-Hansen tests of exogeneity and validity of instrument subsets (not reported but available on request). 3. The Arellano and Bond (1991) test for second order serial correlation and 4. The Wald chi-squared statistic of the null hypothesis that all the coefficients except the constant are zero.
* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Table 15: Robustness Analysis –Alternative Uncertainty Measures

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$(I/K)_{i.t-1}$	0.070***	0.073***	0.049**	0.075***	0.082***	0.061***	0.047**	-0.024	0.077***	0.019
	(0.014)	(0.014)	(0.021)	(0.015)	(0.011)	(0.014)	(0.023)	(0.040)	(0.014)	(0.027)
$(CF/K)_{i.t-1}$	0.112***	0.147***	0.148***	0.128***	0.130***	0.138***	0.179***	0.155***	0.226***	0.156***
	(0.018)	(0.020)	(0.025)	(0.020)	(0.018)	(0.022)	(0.027)	(0.046)	(0.081)	(0.032)
$(GS/K)_{i.t-1}$	0.042***	0.059***	0.096***	0.051***	0.028***	0.069***	0.094***	0.183***	0.066***	0.127***
	(0.015)	(0.014)	(0.021)	(0.014)	(0.010)	(0.015)	(0.024)	(0.040)	(0.025)	(0.028)
$id_{i.t-1}$	-0.012***	-0.008***	-0.003*	-0.010***	-0.005**	-0.005***	-0.006*	-0.010**	-0.006**	-0.006**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)	(0.002)	(0.003)
h_{t-1}	-0.028***									
	(0.001)									
$hgrexit_{t-1}$		-0.010***								
		(0.001)								
$hbci_{t-1}$			-0.012***							
			(0.000)							
$hepu_{t-1}$				-0.021***						
				(0.001)						
$hase_{t-1}$					-0.020***					
					(0.001)					
$hbonds_{t-1}$						-0.008***				
						(0.001)				
$hintr_{t-1}$							-0.023***			
							(0.001)			
$hloans_{t-1}$								-0.051***		
								(0.011)		
$hesi_{t-1}$									0.005***	
									(0.002)	
hip_{t-1}										-0.001
										(0.001)
Wald test (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2) test	0.087	0.824	-0.190	-0.195	-1.051	1.035	-0.159	-0.005	0.653	0.601
AR(2) *p*-value	0.931	0.410	0.850	0.845	0.293	0.301	0.873	0.996	0.514	0.548
J (Sargan/Hansen) test	1.763	4.561	7.820	1.783	0.492	3.698	2.596	0.361	0.306	0.376
J. *p*-value	0.623	0.335	0.098	0.619	0.921	0.448	0.273	0.548	0.858	0.540
Number of Instruments	9	10	10	9	9	10	8	7	8	7
Observations	422025	422025	422025	422025	422025	422025	422025	422025	422025	422025

Notes: The models are estimated using the first-difference Arellano-Bond estimator developed by Arellano and Bond (1991) and implemented in STATA 14 by Roodman (2009). Robust standard errors are reported in braces. Sargan–Hansen J-test is a test of overidentifying restrictions. AR (2) is the Arellano and Bond (1991) test for second order serial correlation. Robust standard errors are computed using the Windmeijer (2005) WC-robust two-step estimator. Instrument sets of the second through sixth lags of the right hand variables are used for the differenced equations. To avoid instrument proliferation we invoke the "collapse" option in order to restrict the lag ranges in the generation of the instruments sets. The *h* term is the measure of economic uncertainty while the *id* term refers to the idiosyncratic uncertainty of each firm. To eliminate the effect of outliers the data are screened by trimming observations at the 5th and 95th percentile. The following tests are applied: 1. Sargan-Hansen J-test as a test of overidentifying restrictions. 2. The difference-in-Hansen tests of exogeneity and validity of instrument subsets (not reported but available on request). 3. The Arellano and Bond (1991) test for second order serial correlation and 4. The Wald chi-squared statistic of the null hypothesis that all the coefficients except the constant are zero.
* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level

Table 16: Fixed Effects Coefficients of the Aggregate Model discussed in Section 5.1

VARIABLES	(1) Total Sample	(2) se	(3) Total Sample with Debt	(4) se
$(CF/K)_{i,\ t-1}$	0.062***	(0.002)	0.064***	(0.003)
$(GS/K)_{i,\ t-1}$	0.001*	(0.000)	0.001**	(0.001)
h_{t-1}	-0.019***	(0.000)	-0.022***	(0.000)
id_{t-1}	0.001***	(0.000)	0.001***	(0.000)
$(D/K)_{i,t-1}$			0.018***	(0.001)
Constant	0.115***	(0.001)	0.083***	(0.002)
R-squared	0.082		0.119	
R-square	0.082		0.119	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figures

Figure 1: Google News Results on “Uncertainty” & “Greece”

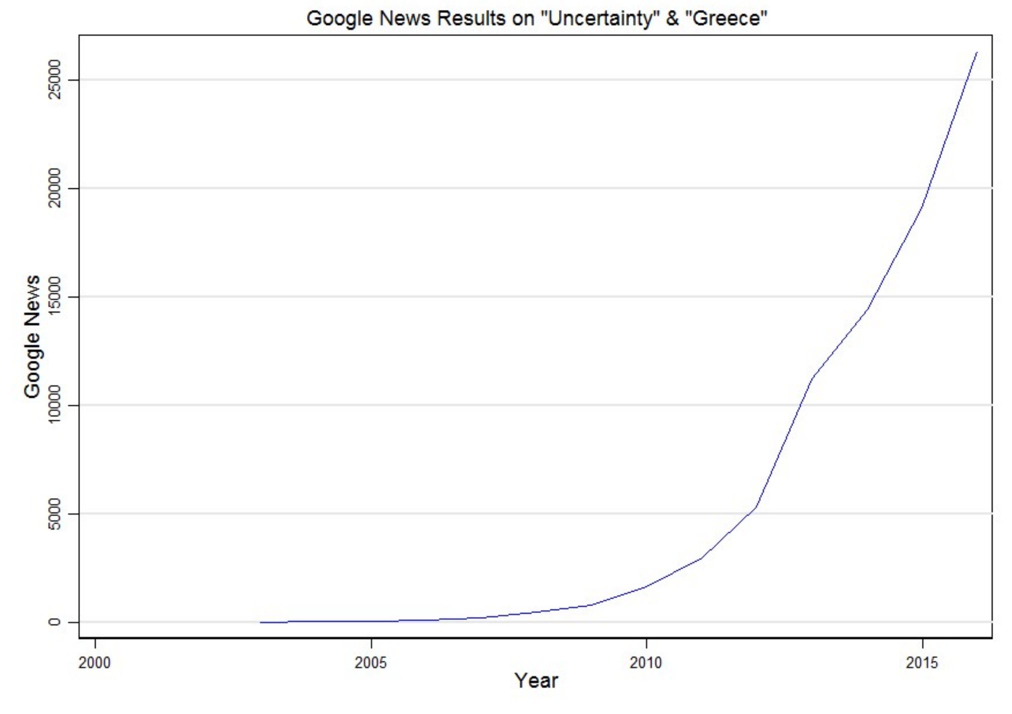

Figure 2: Uncertainty Proxy

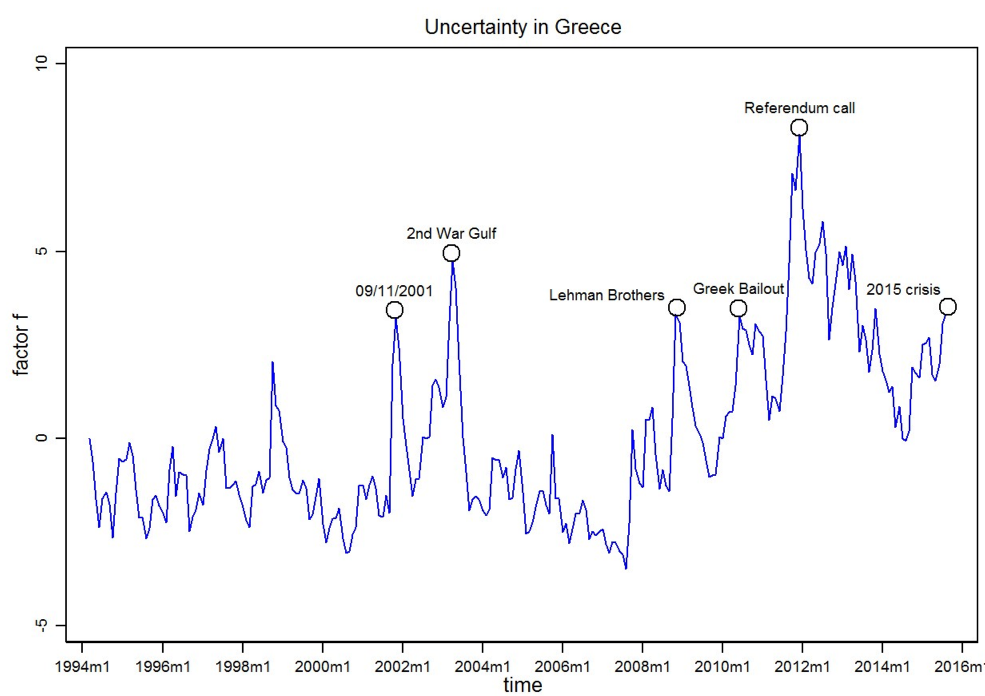

Figure 3: Economic Uncertainty-EPU-ASE

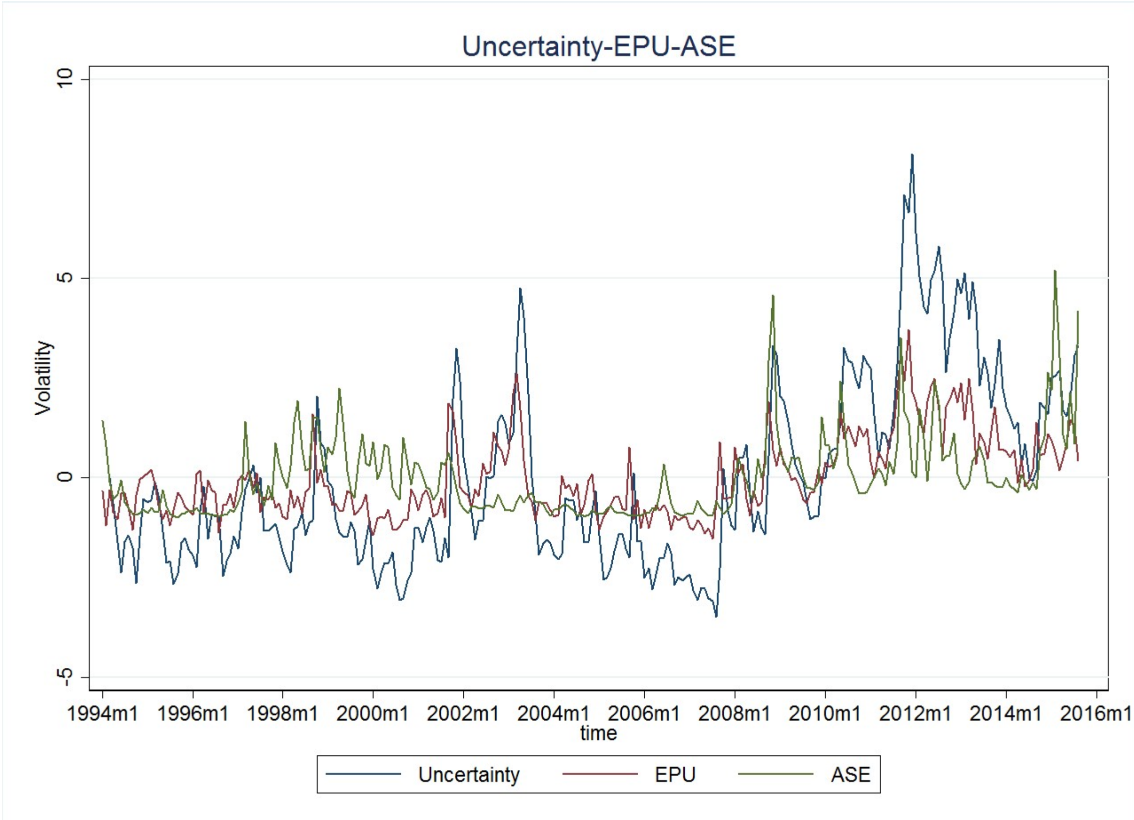

Figure 4: Uncertainty Effect on Investment – Sector level

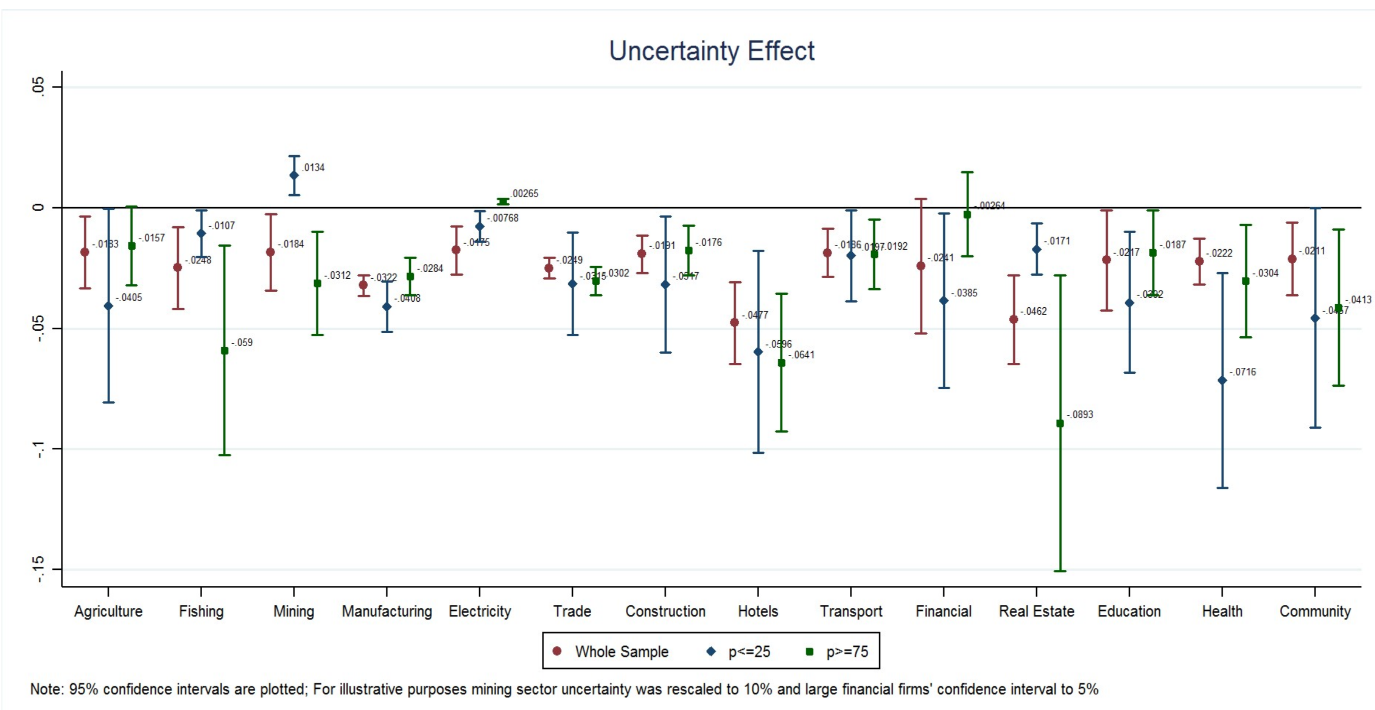

Figure 5: Investment Loss

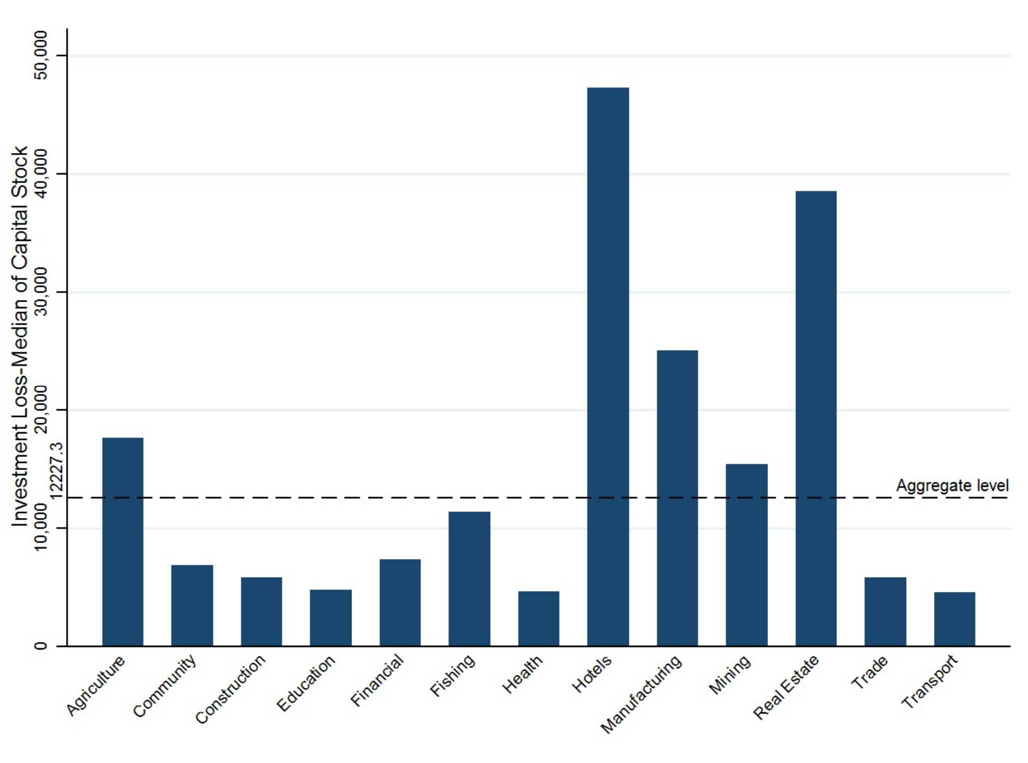

Figure 6: Robustness Analysis – The Role of Debt

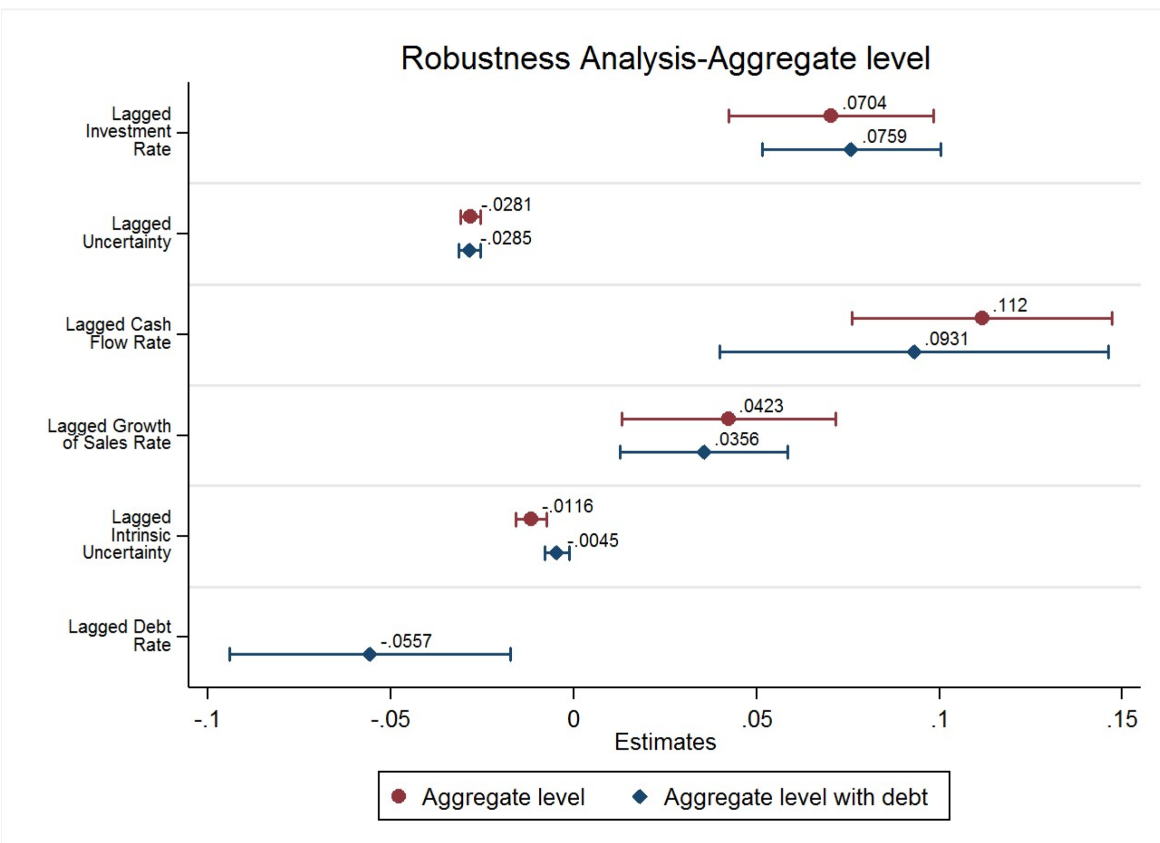

Figure 7: Robustness Analysis – Sector level

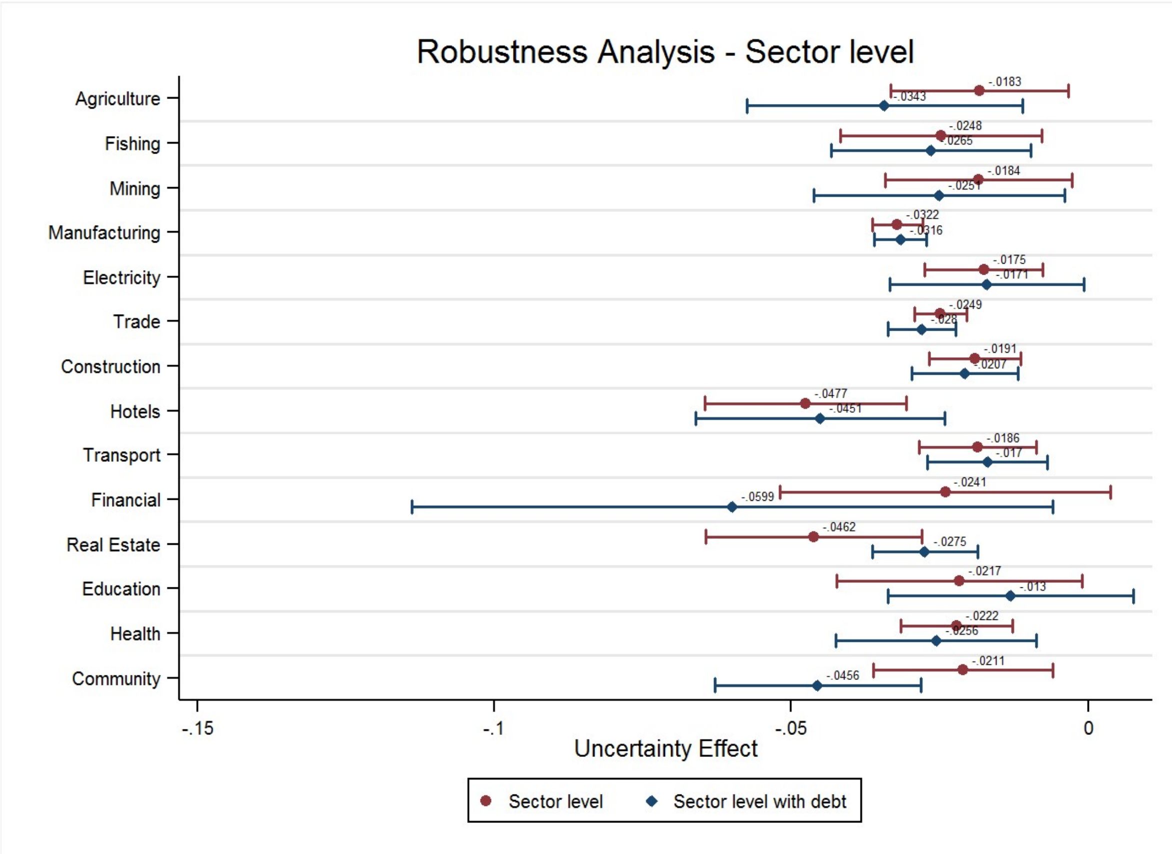

Figure 8: Robustness Analysis – The Role of Time Dummies