FOUNDATION FOR ECONOMIC & INDUSTRIAL RESEARCH

The role of economic uncertainty in the investment and employment gap in the Greek economy*

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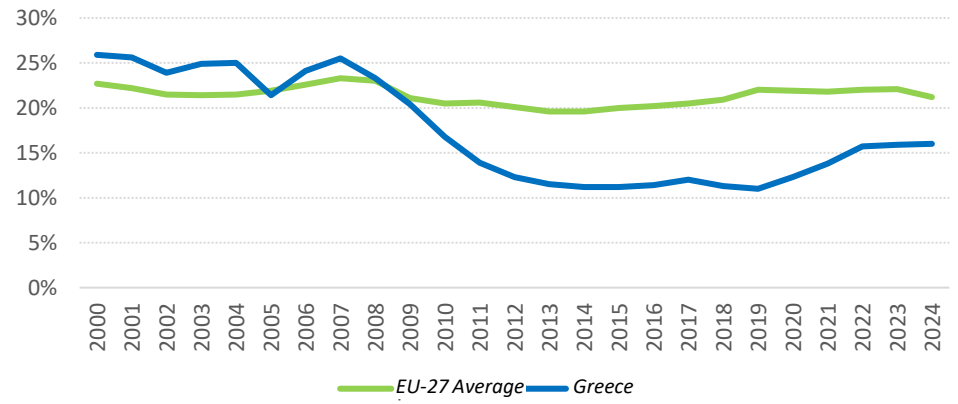
1 Introduction

Greece’s Investment Gap

-63%

Decline in investment 2008–2016

Gross fixed capital formation in the total economy, % of GDP (2000–2024)



Source: Eurostat, IOBE analysis

16.9%

Investment-to-GDP ratio 2025

-4.4 percentage points

Investment Gap Greece vs EU27 2025

Study objective:

To identify the relationship and the extent to which economic uncertainty acts as a deterrent to business decisions regarding investment and employment

Since 2008, the Greek economy has experienced a succession of crises (fiscal, Covid-19 pandemic, energy) which have heightened uncertainty for prolonged periods.

Research Questions & Study Contribution

1. How do we measure uncertainty?

Development of new, complementary indicators based on microdata from Business and Consumer Surveys.

2. What is the macroeconomic impact of uncertainty?

Estimation of the impact of uncertainty on investment and employment for the economy as a whole and across four key sectors of economic activity: Manufacturing, Construction, Retail Trade and Services.

3. Is there heterogeneity at the firm level?

Microeconometric analysis by sector, size and business expectations.

4. What proportion of the “gap” can be explained?

Quantification of the contribution of uncertainty to the decline in investment and employment.

2

Literature Review

Definition & Methods of Measuring Uncertainty

Definition

A situation in which future economic outcomes cannot be predicted with certainty — specifically, the component of volatility that remains unpredictable even after accounting for available information (Bloom, 2014; Jurado et al., 2015).

Text Analysis

Frequency of "key" words in news articles

(Baker et al., 2016; Fountas et al., 2018; Ahir et al., 2018; Hardouvelis et al., 2024)

Financial & Macroeconomic Variables

Volatility in macroeconomic and financial variables

(Jurado et al., 2015; Carriero et al., 2018)

Business and Consumer Surveys

Dispersion & forecasting errors in firms' expectations

(Bachmann et al., 2013)

- *A specific survey question was introduced in 2021*

Transmission Channels & Effects

Key findings from the international literature

- **Countercyclical behaviour:** Uncertainty rises in the presence of major economic, political and geopolitical events (Bloom, 2009; Bachmann et al., 2013; Jurado et al., 2015; Baker et al., 2016; Ludvigson et al., 2021).
- **Macroeconomic effects:** Higher uncertainty leads to lower economic activity and employment (Bachmann et al., 2013; Jurado et al., 2015; Baker et al., 2016; Leduc & Liu, 2016; Scotti, 2016; Basu & Bundick, 2017).
- **Microeconomic effects:** Uncertainty systematically affects firm behaviour, leading to reduced investment, lower employment and a weaker response to demand (Guiso and Parigi, 1999; Bontempi et al., 2010; Bianco et al., 2013; Kolev and Randall, 2024). It also adversely affects consumer expectations and decisions, resulting in lower spending and fewer major purchases (Sabourin P., Bank of Canada, 2024).
- **Transmission mechanisms:** The international literature identifies two channels through which the negative relationship between uncertainty and economic activity can be explained:

    1) Wait-and-see effect: When firms face an uncertain environment, they tend to temporarily postpone investment decisions and hiring, awaiting future developments (Bernanke, 1983; Dixit & Pindyck, 1994; Bloom, 2009; Bloom et al., 2018).

    2) Financial frictions: Higher uncertainty increases both the cost of capital and investment risk, which in turn constrains investment activity (Gilchrist et al., 2014; Christiano et al., 2014; Arellano et al., 2019).

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New Uncertainty Indices

Existing Uncertainty Indices

For the Greek economy, four main indices have been developed to capture uncertainty:

- Three are based on the frequency of "key" words and phrases in news articles (FKT, HKKS, WUI)
- A fourth indicator is based on data from the *Business and Consumer Surveys*

Index	**Construction Method**
Fountas-Karatasi-Tzika Index of Economic Policy Uncertainty for Greece (FKT)	Text analysis of news articles: *Kathimerini*
Hardouvelis-Karalas-Karanastasis-Samartzis Uncertainty Indices for Greece (HKKS)	Text analysis of news articles: *To Vima*, *Ta Nea*, *Naftemporiki* and *Kathimerini*
World Uncertainty Index (WUI)	Text analysis of *Economist Intelligence Unit (EIU)* country reports
European Commission Uncertainty Index (EC UNC)	Specific question included in the *Business and Consumer Surveys* questionnaire

Three New Indicators

EXAFD

Ex-Ante Forecast Disagreement

Methodological framework:
Bachmann et al., 2013

Dispersion in firms' expectations (greater heterogeneity = higher uncertainty)

$$EXAFD_{i,t} = \sqrt{(POS_{i,t}+NEG_{i,t}) - (POS_{i,t} - NEG_{i,t})^2}$$

$POS_{i,t}$, $NEG_{i,t}$:the percentage of firms expecting an increase and a decrease in their business activity, respectively

EXPFE

Ex-Post Forecast Errors

Methodological framework:
Bachmann et al., 2013

Ex-post forecast errors of firms regarding business activity (greater heterogeneity = higher uncertainty)

$$EXPFE_{i,t} = std(FE_{j,t})$$

$$FE_{j,t} = Real_{j,t+3} - Forecast_{j,t}$$

$$MEXPFE_{i,t} = mean(|FE_{j,t}|)$$

BS UNC (Micro)

Business Uncertainty (Micro-level)

Based on a question in the Business and Consumer Surveys:

The future development of your business situation is currently:
a) easy to predict, b) moderately easy to predict, c) moderately difficult to predict and d) difficult to predict

Annual average calculated for each firm based on its monthly responses.

Primary data from the Business and Consumer Surveys are used to construct all three new, complementary uncertainty indices

Data Source: Business and Consumer Surveys

Manufacturing

1. Over the past three months, how has your production changed?:

a) Increased, b) Remained unchanged, c) Decreased

2. Over the next three months, do you expect your production to:

a) Increase, b) Remain unchanged, c) Decrease

Construction

1. Over the past three months, your firm's activity has:

a) Increased, b) Remained unchanged, c) Decreased

2. Over the next three months, do you expect the number of persons employed in your firm (permanent staff and contractors) to:

a) Increase, b) Remain unchanged, c) Decrease

Retail Trade

1. How have your sales changed over the past three months?:

a) Increased, b) Remained unchanged, c) Decreased

2. Over the next three months, do you expect your sales to:

a) Increase, b) Remain unchanged, c) Decrease

Services

1. How do you assess the evolution of demand for your firm's services over the past three months?:

a) Increased, b) Remained unchanged, c) Decreased

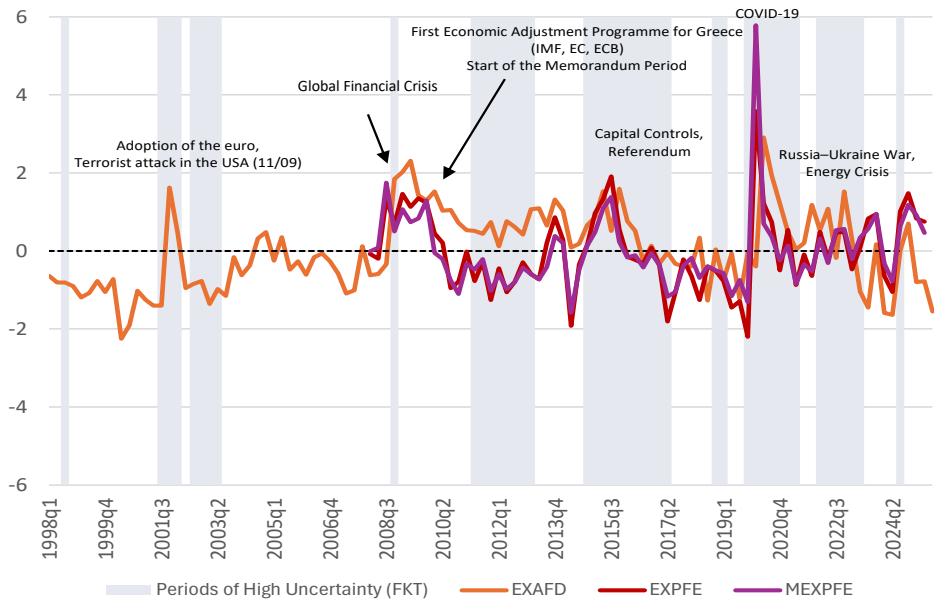
2. How do you expect demand for your firm's services to develop over the next three months?:

a) Increase, b) Remain unchanged, c) Decrease

All questions used in the study are part of the harmonised DG ECFIN Business and Consumer Surveys, conducted on a monthly basis across 33 countries.

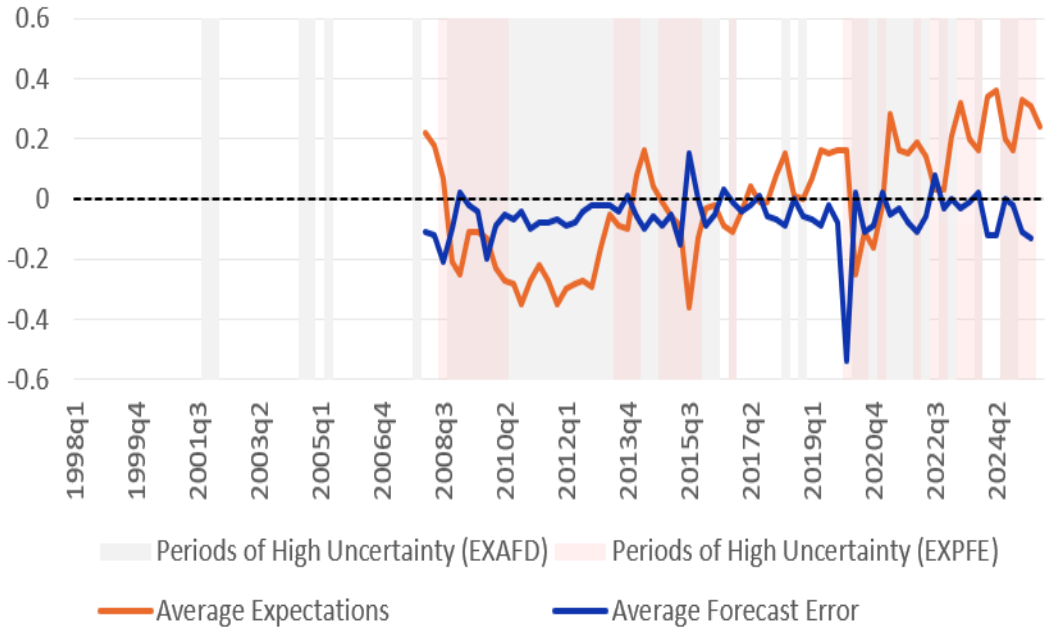
The New Indices Capture Similar Periods of Uncertainty

New Uncertainty Indices



Source: IOBE analysis. Note: All indices are normalized.

Periods of High Uncertainty



Source: IOBE analysis. Note: Average expectations range between [-1, +1] and average forecast error ranges between [-2, +2]

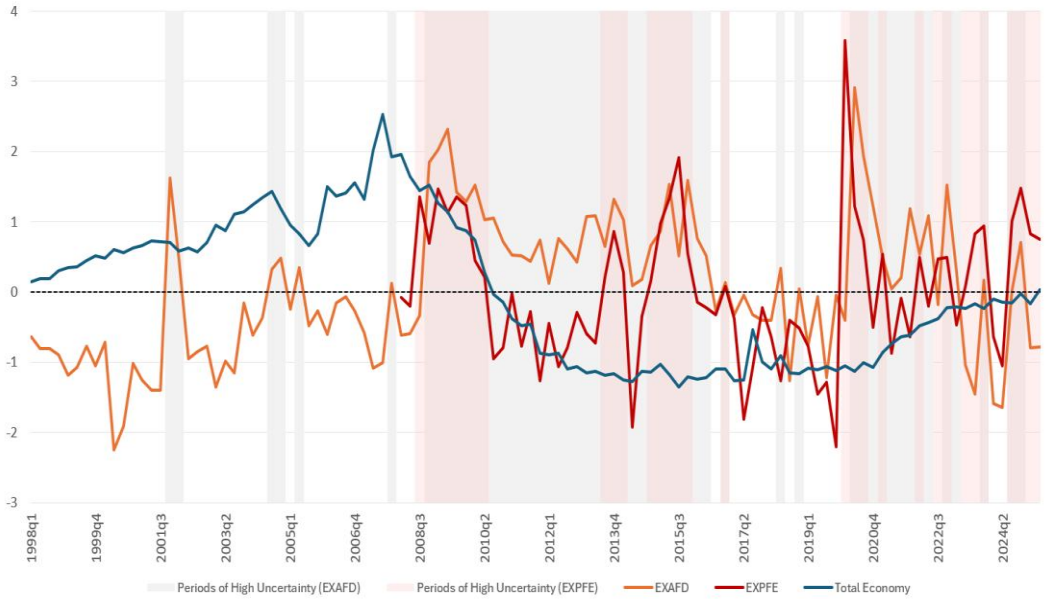
- The **peaks** of **both** new **indices coincide with periods** in which the **Greek economy faced major crises and external shocks**, such as the Global Financial Crisis, the domestic sovereign debt crisis, the pandemic and the energy crisis.
- A different pattern emerges during 2010 Q3–2013 Q2: Although firms reported divergent expectations regarding the future course of their activity—resulting in relatively high values of the EXAFD indicator—most formed negative expectations. These expectations were ultimately confirmed, as reflected in small forecast errors and limited dispersion.

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Macroeconometric Analysis

Negative Correlation between Uncertainty and Investment

Uncertainty and Investment



Source: IOBE analysis. Note: Uncertainty and investment timeseries are normalised

Correlation between Uncertainty and Investment

Uncertainty	Full Period	Periods of Prolonged Uncertainty*
GFCF	-0.322***	-0.439***

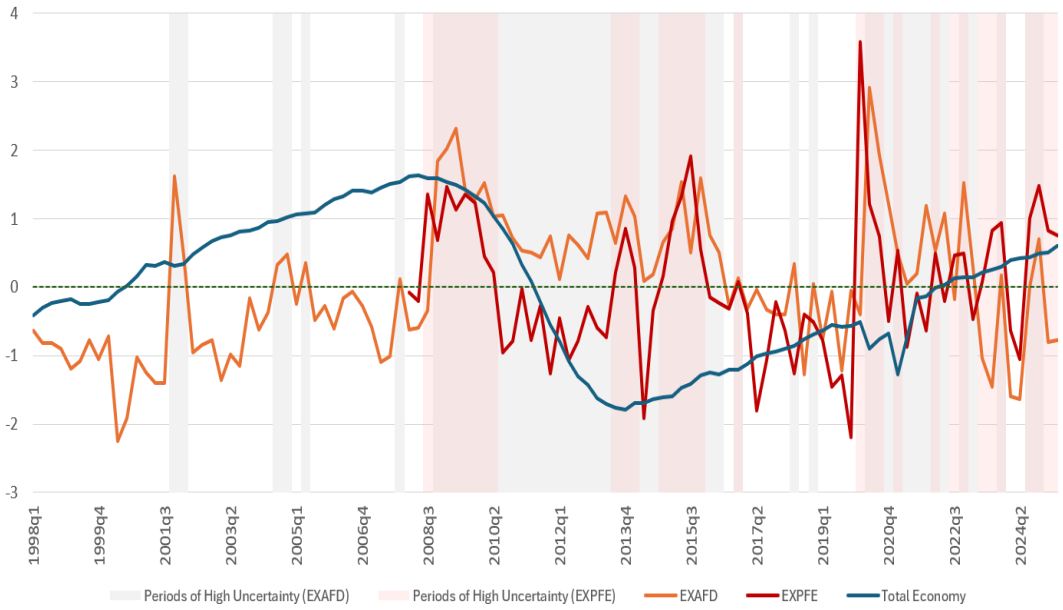
*Periods in which high uncertainty persists for more than three consecutive quarters.

Key Findings

- Higher levels of uncertainty act as a constraint on investment activity.
- Beyond its intensity, the duration of uncertainty also plays a decisive role in shaping investment decisions.

Negative Correlation between Uncertainty and Employment

Uncertainty and Employment



Source: IOBE analysis. Note: Uncertainty and employment timeseries are normalised

Correlation between Uncertainty and Employment

Uncertainty	Full Period	Periods of Prolonged Uncertainty*
Employment	-0.208**	-0.373***

*Periods in which high uncertainty persists for more than three consecutive quarters.

Key Findings

- Higher levels of uncertainty adversely affect firms' decisions, both with respect to creating new jobs and retaining existing ones.
- The relationship is stronger during periods of prolonged uncertainty.

Model & Variables

To investigate the dynamic effects of uncertainty on investment and employment, a **Vector Error Correction Model (VECM)** is utilised, in which the EXAFD uncertainty index is introduced as the main source of shocks in the system, whilst investment and employment are the response variables.

$$\Delta \boldsymbol{Y}_t = \boldsymbol{a} + \boldsymbol{\Pi} \boldsymbol{Y}_{t-1} + \sum_{i=1}^{p-1} \boldsymbol{\Gamma}_i \Delta \boldsymbol{Y}_{t-i} + \boldsymbol{\varepsilon}_t$$

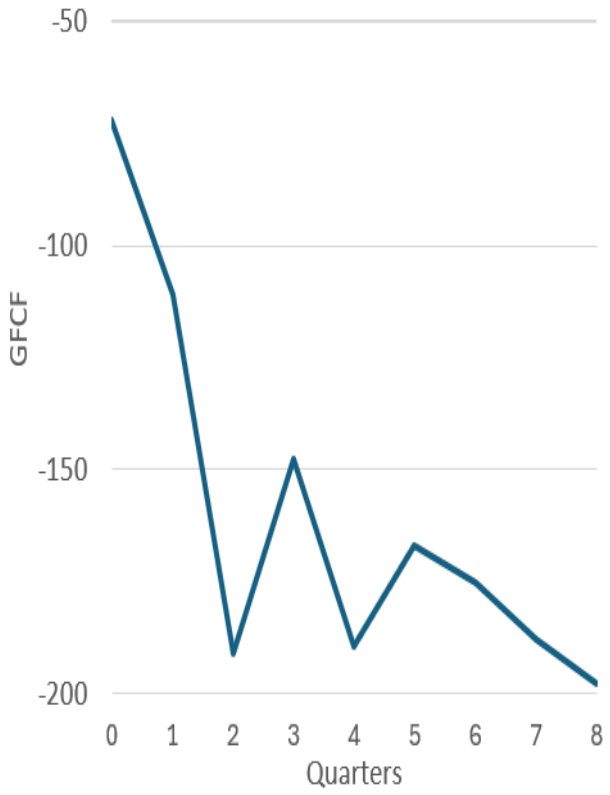
where $\boldsymbol{\Pi} = \sum_{i=1}^{p} \boldsymbol{A}_i - \boldsymbol{I}_k$ και $\boldsymbol{\Gamma}_i = -\sum_{j=i+1}^{p} \boldsymbol{A}_j$

Model Variables

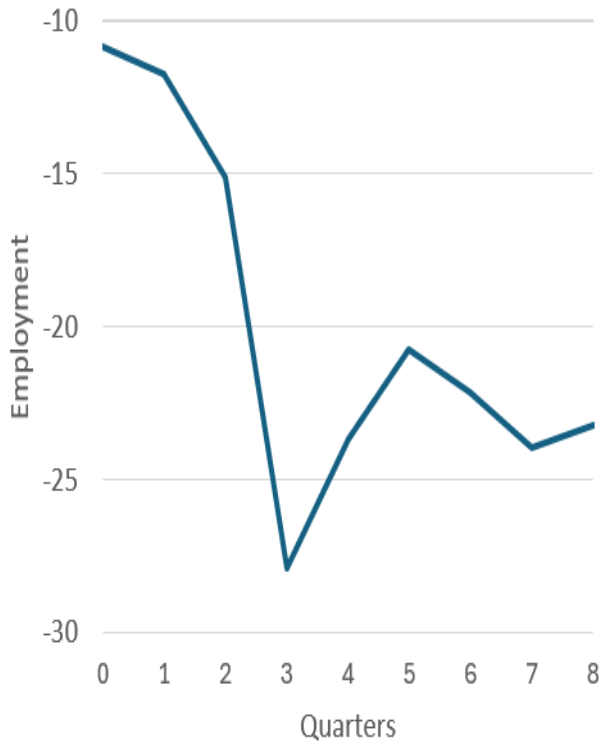
Variable	Description	Source
EXAFD	Uncertainty index based on ex ante disagreement in expectations	Business and Consumer Surveys (IOBE)
GFCF	Gross fixed capital formation	Eurostat (namq_10_an6)
GVA	Gross value added	Eurostat (namq_10_a10)
EMP	Employment	Eurostat (lfsq_egan2)
Spread	Interest rate spread on new business loans relative to the euro area average (20 members)	European Central Bank (MIR.M.GR.B.A2I.AM.R.A.2240.EUR.N)

Impact of Uncertainty on Investment and Employment – IRFs

Uncertainty → Investment



Uncertainty → Employment



Note: Orthogonalised impulse response functions (Cholesky ordering) of investment and employment to a one-standard-deviation increase in uncertainty. GFCF in EUR millions, constant prices 2020; employment in thousand persons

Key Findings

Total Economy

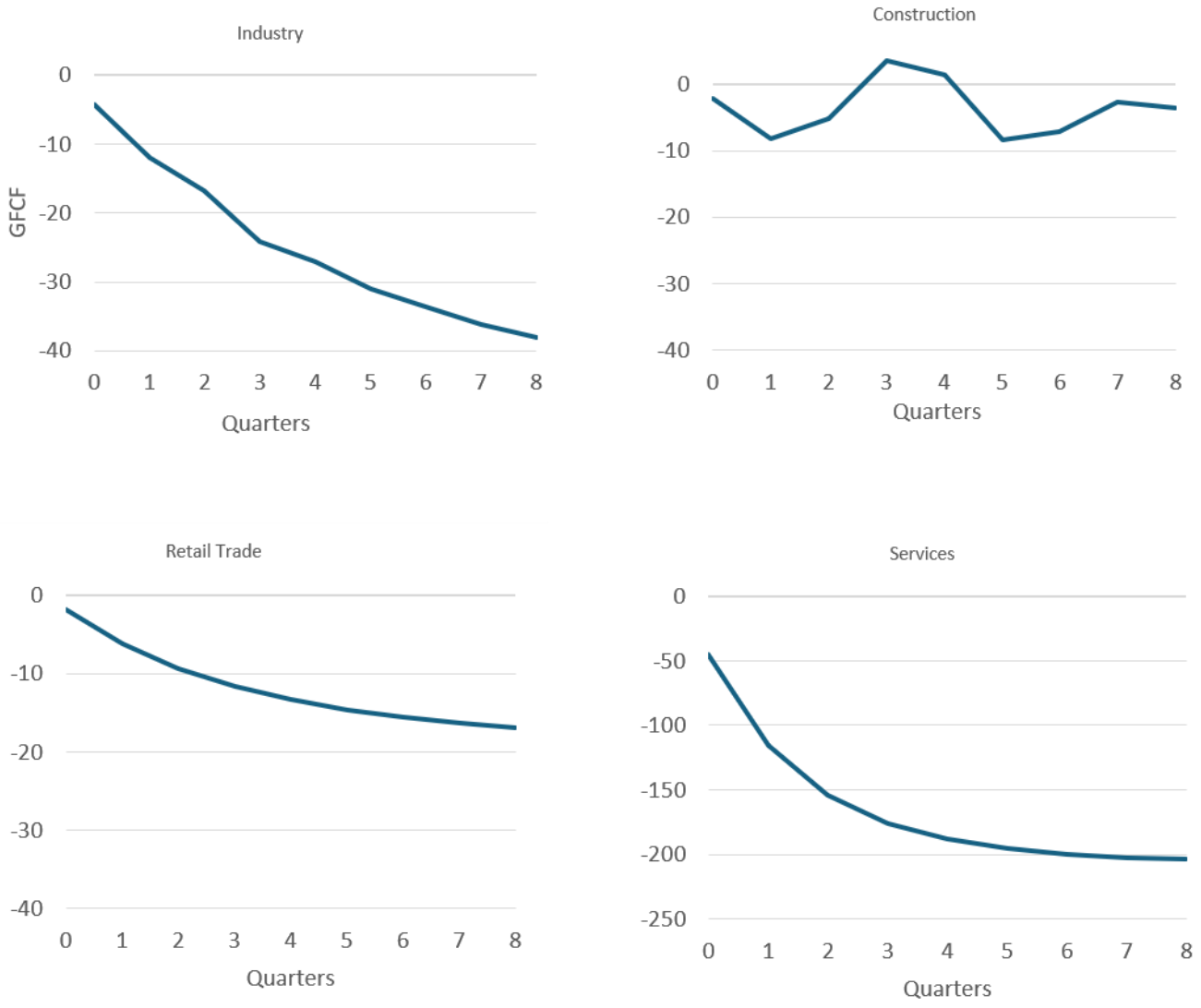
Investment

- An estimated **decline** of approximately **€200 million**, emerging within the first few quarters.
- Uncertainty is estimated to have contributed, over **2009–2011**, to a cumulative investment loss of approximately **€3.3 billion (1.7% of GDP in 2011**), explaining around **one-quarter of the investment gap in 2011**.

Employment

- A loss of **20,000 – 25,000 jobs**, peaking three quarters after the initial shock.
- Uncertainty is estimated to have contributed, over **2009–2011**, to the loss of approximately **58,000 jobs (1.5% of employment in 2011),** explaining **20% of the overall decline in employment in 2011.**

Impact of Uncertainty on Investment by Sector – IRFs



Note: Orthogonalised impulse response functions (Cholesky ordering) of investment to a one-standard-deviation increase in uncertainty. GFCF in EUR millions, constant prices 2020

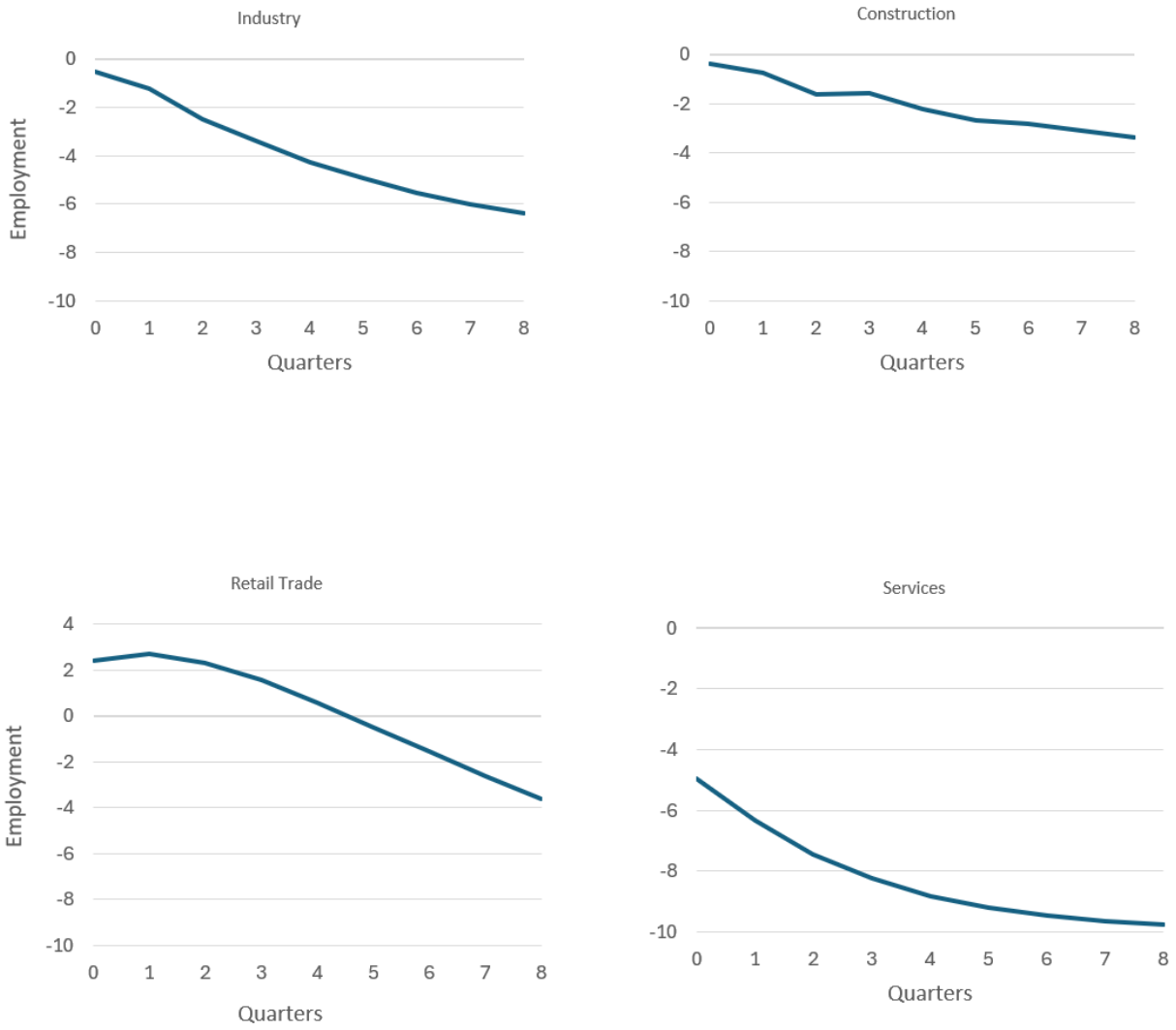
Key Findings

by Sector

- Investment declines by approximately **€40 million** in **Manufacturing**.
- Investment in **Services** falls sharply from the first quarters following the initial shock, reaching approximately **€200 million** over a one-year horizon.
- The effect is milder in **Retail Trade**, where investment declines by approximately **€20 million**.
- In **Construction**, investment does not display a systematic or persistent response.

Heterogeneity across sectors in the investment response to a one-standard-deviation increase in uncertainty

Impact of Uncertainty on Employment by Sector – IRFs



Note: Orthogonalised impulse response functions (Cholesky ordering) of employment to a one-standard-deviation increase in uncertainty. Employment in thousand persons

Key Findings
by Sector

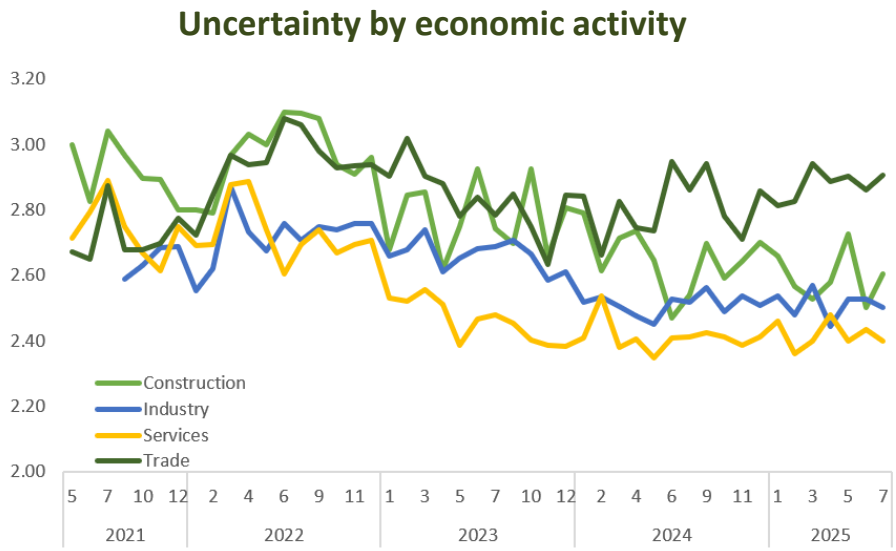
- Employment declines by approximately **6,000 jobs in Manufacturing** and **10,000 jobs in Services**.
- Job losses are more limited in **Retail Trade** and **Construction**, not exceeding **4,000 jobs**.

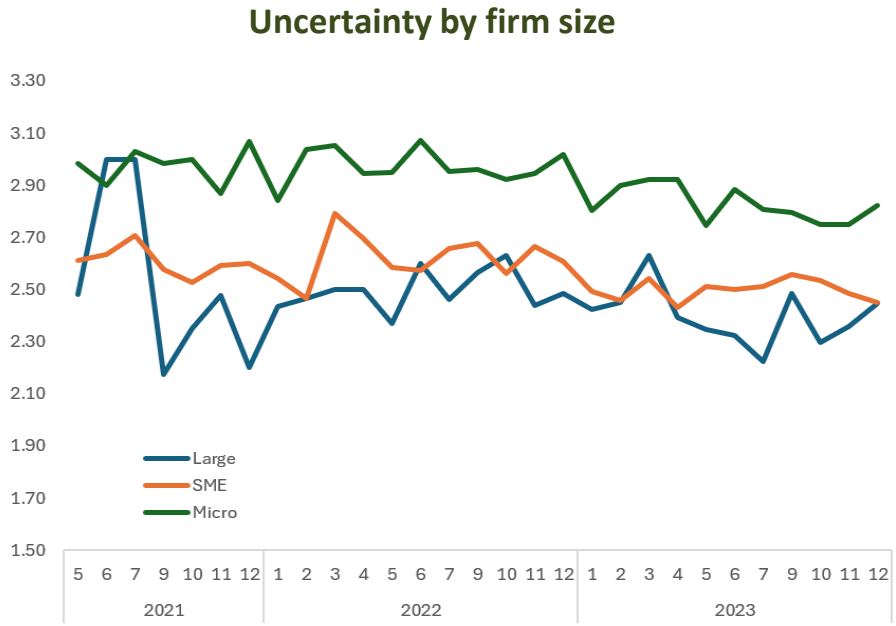
Heterogeneous sectoral responses to a one-standard-deviation uncertainty shock.

5

Microeconometric Analysis

Descriptive Analysis of the Uncertainty Index





- Higher uncertainty in the **Retail Trade** sector, particularly from 2024 onwards.
- **Construction** follows, with 2021 marked by a significant increase, possibly related to the Covid-19 pandemic.
- **Manufacturing** and **Services** follow.
- Uncertainty increased across all sectors in 2022, likely reflecting Russia's invasion of Ukraine and the subsequent energy crisis.

- Firm size appears to be negatively associated with the level of uncertainty.
- **Very small** firms exhibit higher uncertainty than small and medium-sized and large firms over most of the period.

Analysis of the Effects on Investment and Employment

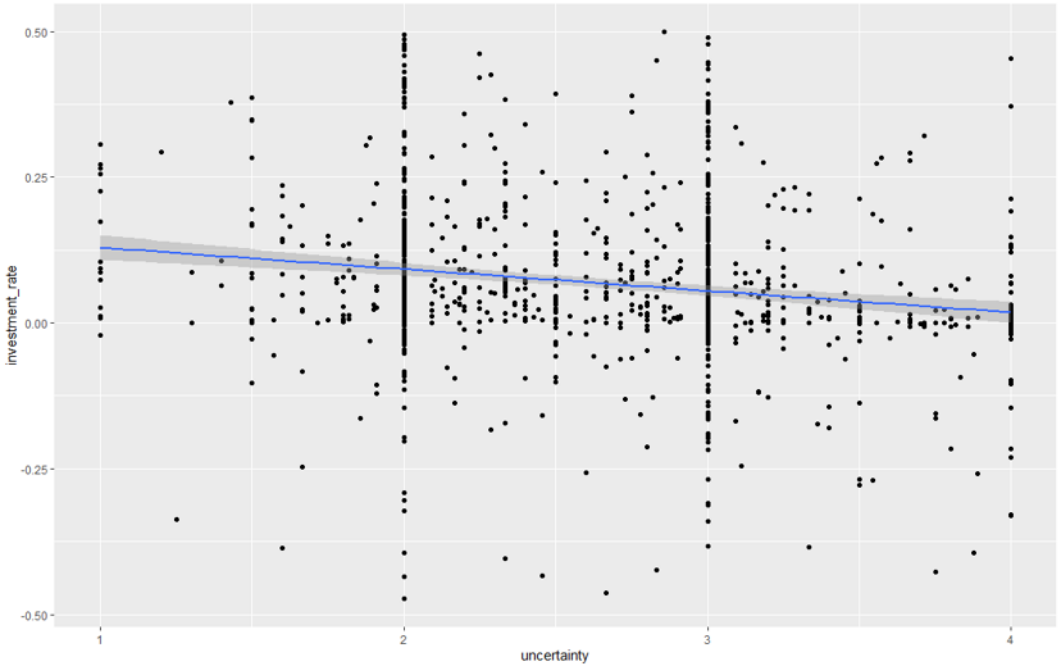
- **Objective:** To assess how economic uncertainty affects investment and employment at the firm level.
- **Data**
  - Microdata from the Business and Consumer Surveys (IOBE), combined with firms' financial-statement data (ICAP).
  - ~700 firms per month.
  - Period: 2021–2024.
- **Measuring Uncertainty:**
  - Direct self-assessment: "The future development of your business situation is currently:
    a) easy to predict, b) moderately easy to predict, c) moderately difficult to predict and d) difficult to predict"
  - Scale 1–4 (1 = easy, 4 = difficult).
- **Model**:

$$Y_{ist} = \beta_1 Uncertainty_{ist} + \beta_2 firm\ controls_{ist} + \delta_{st} + \varepsilon_{ist}$$

  - Y_{ist} is defined in two alternative ways: (i) the firm's gross investment as a percentage of net tangible fixed assets from the previous period and (ii) the annual percentage change in employment.
  - i: firm, s: sector of activity, t: year
  - $Uncertainty_{ist}$: the micro-level uncertainty index, BS UNC
  - $firm\ controls_{ist}$: firm size
  - δ_{st}: sector and year fixed effects

Impact on Investment

Investment Rate vs. BS UNC Uncertainty Index (Micro-level)



Key findings

Main result:
Uncertainty significantly reduces the investment rate.

- Coefficient: **-0.012** (*p < 0.05*)
- A one-unit increase in uncertainty is associated with a **1.2 percentage-point decline in investment**.

Asymmetry across expectations:

- The effect is negative when expectations are pessimistic or neutral.
- No statistically significant effect when expectations are optimistic.

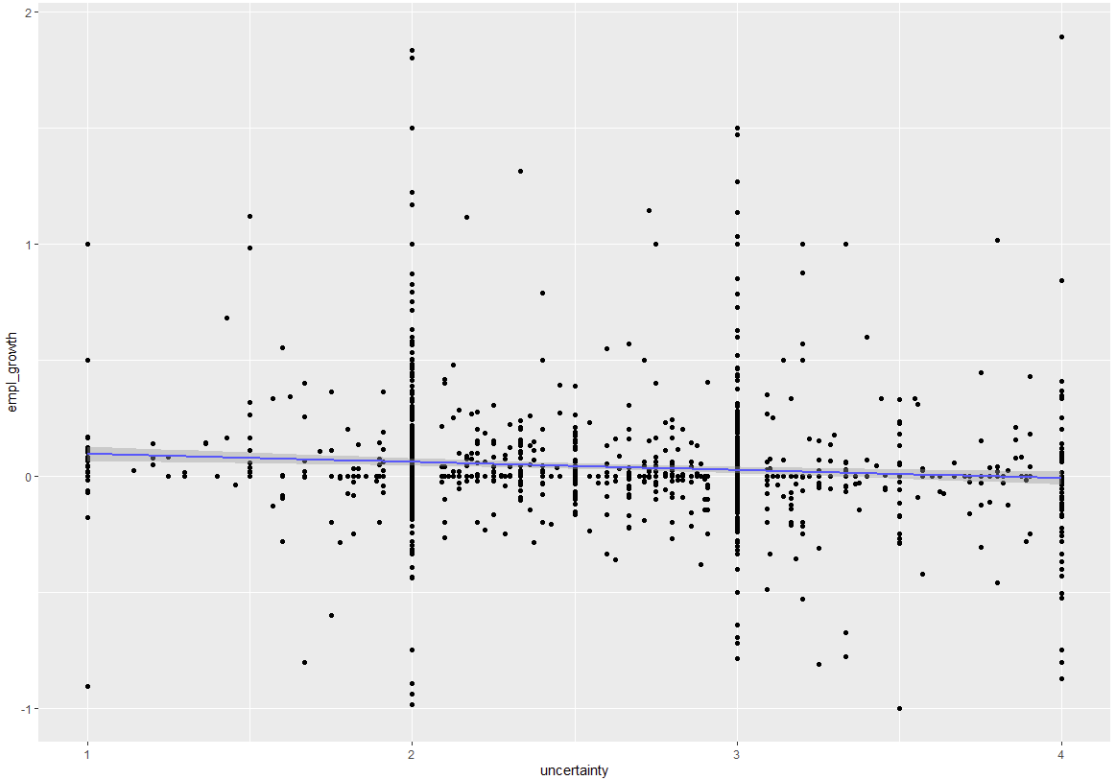
By sector:

- Manufacturing displays the largest negative effect (coefficient: -0.0204, *p<0.01*).
- No statistically significant effects in the other sectors

- During 2009–2015, uncertainty was 0.9 standard deviations above its average level, implying a 1.6 percentage-point reduction in the annual rate of firm investment.
- Given that the Greece–EU investment gap averaged 5.2 percentage points annually, up to one-third of this gap is estimated to be attributable to elevated uncertainty.

Impact on Employment

Employment Growth Rate vs. BS UNC Uncertainty Index (Micro-level)



Key findings

Main result:
Uncertainty significantly reduces employment.

- Coefficient: **-0.0187** (*p<0.01*)
- A one-unit increase in uncertainty is associated with a 1.8% decline in employment.

Asymmetry across expectations:

- The effect is stronger when expectations are pessimistic.

By sector:

- Manufacturing and Retail Trade show the largest declines in employment.

- During 2009–2013, uncertainty was 1.0 standard deviation above its average level, reducing the annual employment growth rate by 2.5%.
- Given an average annual employment decline of 6.2%, around 40% of the fall in employment can be attributed to uncertainty.

Firm-Size Differences

Which firms are most affected?

Small and Medium-sized Enterprises (SMEs):

- Investment: Particularly sensitive to uncertainty (decline of ~0.03 points, *p<0.01*).
- Employment: strong negative effect.

Large Enterprises:

- Lower impact (protection through economies of scale, easier access to finance).
- In some cases, they retain staff (labour hoarding).

Microeconometric Analysis Results

Regression results with investment growth rate as the dependent variable

Variables	(1)	(2)	(3)	(4)
Uncertainty	-0.0120**			
	(0.0054)			
Future Expectations × Uncertainty				
Negative × Uncertainty		-0.0120**		
		(0.0058)		
Neutral × Uncertainty		-0.0104*		
		(0.0058)		
Positive × Uncertainty		-0.0030		
		(0.0066)		
Size × Uncertainty				
Large × Uncertainty			0.0099	
			(0.0068)	
Medium × Uncertainty			-0.0102*	
			(0.0057)	
Small × Uncertainty			-0.0304***	
			(0.0056)	
Sector × Uncertainty				
Construction × Uncertainty				0.0077
				(0.0161)
Industry × Uncertainty				-0.0204**
				(0.0062)
Services × Uncertainty				-0.0049
				(0.0084)
Retail Trade × Uncertainty				-0.0036
				(0.0079)
Size Controls				
Medium	-0.0516***	-0.0514***		-0.0519**
	(0.0111)	(0.0111)		(0.0111)
Small	-0.1143***	-0.1121***		-0.1139**
	(0.0134)	(0.0134)		(0.0134)
Constant	0.1638***	0.1533***	0.1068***	0.1634***
	(0.0164)	(0.0171)	(0.0146)	(0.0164)
Observations	1,231	1,231	1,231	1,231
Adjusted R^2	0.0961	0.0991	0.0918	0.1009

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All models include fixed sector-year effects.

Regression results with the growth rate in employment as the dependent variable

Variables	(1)	(2)	(3)	(4)
Uncertainty	-0.0187***			
	(0.0064)			
Future Expectations × Uncertainty				
Negative × Uncertainty		-0.0187***		
		(0.0069)		
Neutral × Uncertainty		-0.0182***		
		(0.0067)		
Positive × Uncertainty		-0.0139*		
		(0.0076)		
Size × Uncertainty				
Large × Uncertainty			-0.0128*	
			(0.0077)	
Medium × Uncertainty			-0.0211***	
			(0.0065)	
Small × Uncertainty			-0.0197***	
			(0.0068)	
Sector × Uncertainty				
Construction × Uncertainty				-0.0238
				(0.0186)
Industry × Uncertainty				-0.0240**
				(0.0072)
Services × Uncertainty				-0.0034
				(0.0112)
Retail Trade × Uncertainty				-0.0178*
				(0.0089)
Size Controls				
Medium	-0.0212*	-0.0213*		-0.0202*
	(0.0121)	(0.0122)		(0.0122)
Small	-0.0232	-0.0212		-0.0213
	(0.0166)	(0.0167)		(0.0166)
Constant	0.0865***	0.0814***	0.0708***	0.0821***
	(0.0187)	(0.0194)	(0.0167)	(0.0189)
Observations	921	921	921	921
Adjusted R^2	0.0408	0.0400	0.0406	0.0410

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All models include fixed sector-year effects.

6

Conclusions

Key findings

- **A one-standard-deviation increase in uncertainty** leads to an immediate **decline in investment of around 0.5 percentage points of GDP**, with effects persisting for at least two years.

- During the early phase of the Greek crisis, when the investment-to-GDP ratio diverged substantially between Greece and the EU-27, elevated uncertainty is estimated to have contributed:
  - between **one-quarter and one-third of the annual investment gap** recorded over 2009–2015
  - up to approximately **40% of the decline in employment** over 2010–2013.

- The **impact** of **uncertainty** on **investment decisions differs** markedly according to **firms' expectations**:
  - it is **negative** when firms hold **pessimistic** or **neutral** expectations
  - it is **not statistically significant** when expectations are **optimistic**.

- The **impact** of **uncertainty** on business decisions also **differs by firm size**:
  - regarding **investment**, only **small and medium-sized enterprises** (SMEs) appear to be **significantly affected by heightened uncertainty**
  - regarding **employment**, **medium-sized and small firms** are **more strongly affected than large firms**, which may retain workers through labour hoarding because of their greater resilience to successive business-cycle shocks.

- At the **sectoral level**, **investment** in **Manufacturing** appears to be most **adversely affected** by heightened uncertainty, while **employment** declines significantly among firms operating in **Manufacturing** and **Retail Trade**.

Conclusions

Summary

- *Uncertainty shocks have a significant adverse impact on both investment and employment, with effects of considerable magnitude and a duration exceeding one year.*
- *There is significant heterogeneity and asymmetry in the effects of uncertainty depending on firms' expectations, sector of activity and firm size.*

Directions for Further Research

- Further investigation of sectoral heterogeneity.
- Incorporating expectations as a control variable in the microeconometric analysis.

Lessons for the Future

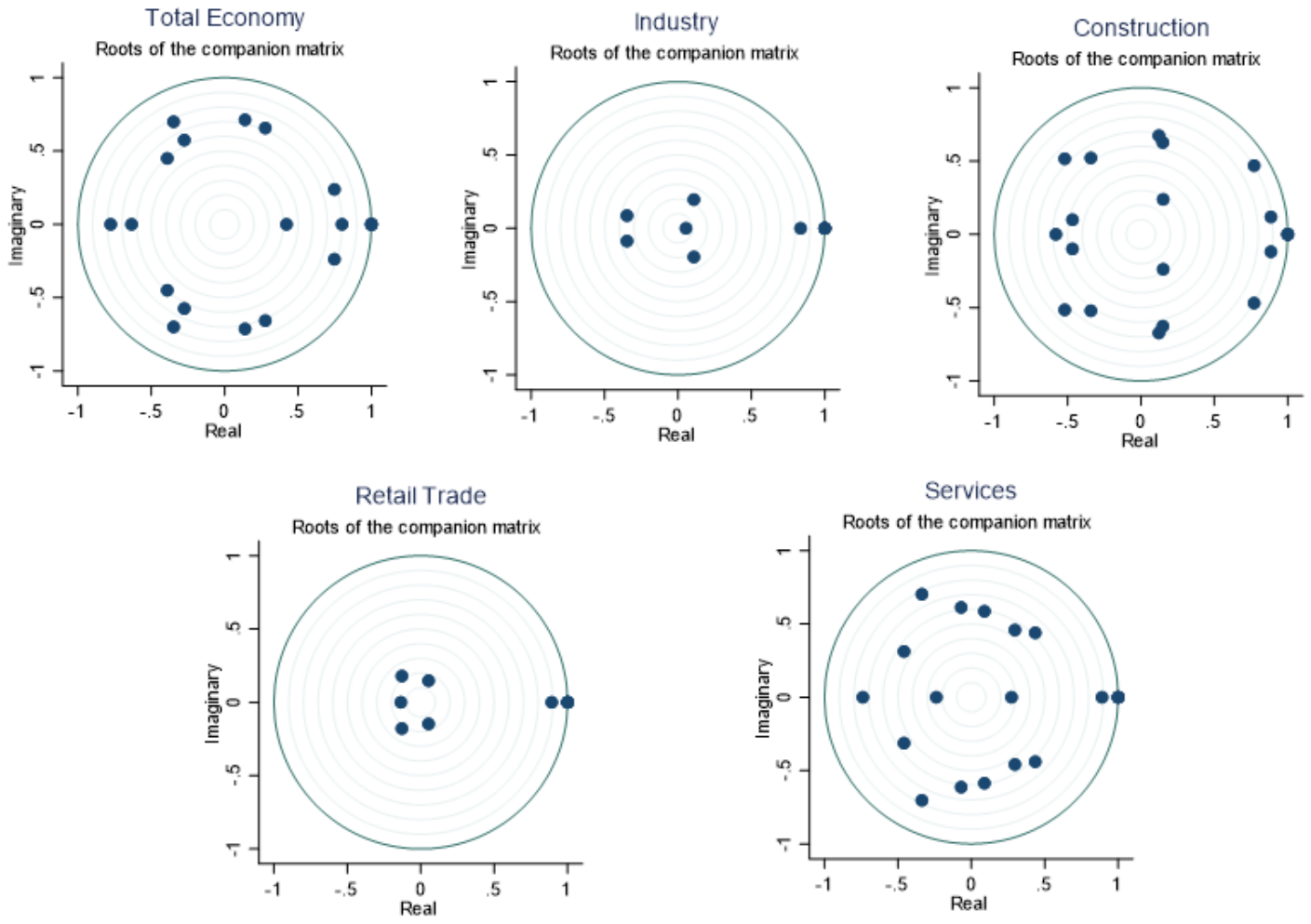
- *Measuring and systematically monitoring uncertainty can:*
  - *enable the timely identification of challenges facing firms in relation to their investment and employment plans*
  - *provide valuable evidence for the design and implementation of policy measures aimed at mitigating the adverse effects of uncertainty shocks and strengthening the economy's resilience.*
- *Complementary uncertainty indicators are useful, as they capture different dimensions of uncertainty.*
- *Significant role for the insurance market and hedging instruments*

References

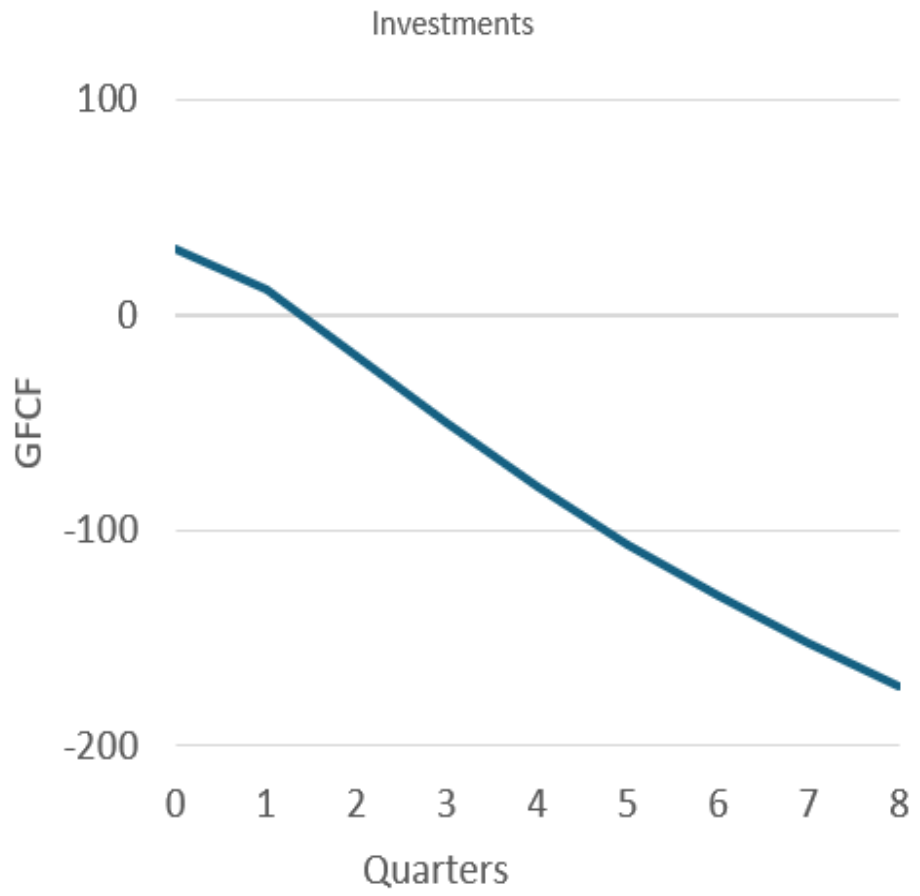
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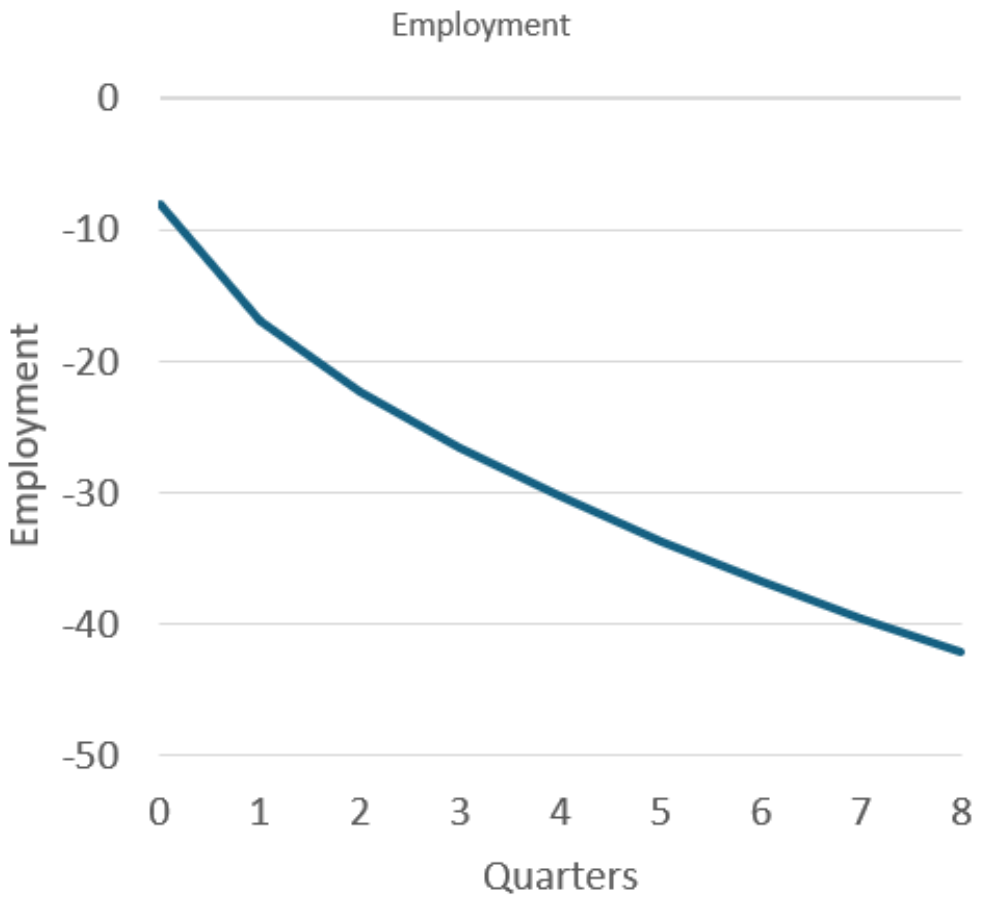
Appendix

VECM Stability Conditions



Impact of Uncertainty (EXPFE) on Investment and Employment





Note: Orthogonalised impulse response functions (Cholesky ordering) of investment and employment to a one-standard-deviation increase in uncertainty. GFCF in EUR millions, constant prices 2020; employment in thousand persons