ΙΔΡΥΜΑ ΟΙΚΟΝΟΜΙΚΩΝ &
ΒΙΟΜΗΧΑΝΙΚΩΝ ΕΡΕΥΝΩΝ

The impact of business uncertainty on economic activity during the Greek Crisis

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Rationale - scope of the study

Higher frequency of incidents causing uncertainty

- **At global / regional level**
  - Banking and broader financial turmoils (e.g. 2008 Lehman – Brothers crisis)
  - Sovereign debt crises (e.g. Eurozone 2010-2011)
  - Geopolitical tensions - military conflicts (e.g. 2003 Iraq invasion)
  - Terrorist attacks (e.g. US 2001)
  - Decisions of central banks, country federations, transnational organisations (e.g. OPEC's decisions)
- **At country level**
  - Sovereign debt crisis (e.g. 2010 Greece)
  - Multiple policy measures in the context of the successive economic adjustment programs
  - Banks' recapitalization episodes (e.g. 2011 Ireland, 2013 Cyprus)

Scope of the study

- Case of frequent disruptions to expectations, which heighten uncertainty, during the Greek debt crisis and the economic adjustment period 2010-2018
- Examine their impact on economic activity
- Presentation contents
  - Survey of the literature on uncertainty metrics
  - Visual inspection of uncertainty and business activity trend at Greek sectors level (Manufacturing, Services, Retail Trade)
  - Empirical estimation

Survey of literature

Types of uncertainty metrics

ECB (2013)

Main categories of measures of uncertainty:

1) Measures of **economic agents' perceived uncertainty** about the future economic situation based on surveys

   e.g. measures based on the EC BCS, on ECB's Survey of Professional Forecasters

2) Measures of uncertainty or of risk aversion **based on financial market indicators** (e.g. Popescu, A. and Smets, F. 2010)

3) Measures of economic policy uncertainty **based on media coverage** (e.g. Baker et al. 2013, Hardouvelis et al. 2018)

Each of these measures has pros and cons, as they concern specific types of economic agents, specific aspects of the economy or specific sources of uncertainty

Metrics based on economic agents' expectations - assessments

Backmann et. al (2013)

- 1st Uncertainty metric: **dispersion** ($FDISP_t$) of positive (increase; $Frac(+)_t$) and negative(decrease; $Frac(-)_t$) responses:

$$FDISP_t = \sqrt{(Frac(+)_t + Frac(-)_t - (Frac(+)_t - Frac(-)_t)^2)}$$

- 2nd Uncertainty metric: **forecast error** ($FEDISP_t$): subtraction of responses about change expectations in period *t* from responses concerning change realisations in period *t+3*

$$FEDISP_t = stdw(error_{t,t+3})$$

- Application to questions of IFO – BCS survey about expected / actual production and of US – BOS, about business activity / shipments 6 months ahead
- **VAR models results: A shock to uncertainty, results to significant reduction in production and employment** in both Germany and the US. In Germany, production declines and rebounds fairly quickly. The response of output in the US is slowly-building, persistent and prolonged.

Studies based on economic agents' expectations - assessments

Friz (2013)

- Uncertainty measure based on **dispersion of economic agents' responses**
- **Application to BCS questions**: 1) expected economic activity (different measures) in Manufacturing, Services, Retail Trade 2) expected financial position / expected economic situation of households
- Examination of uncertainty trends, along with actual trends in economic activity and household demand: **strong negative relation among uncertainty proxy and economic variables.**
- However, via this uncertainty measure one **cannot distinguish among the main forces** causing its change: 1) rising or falling dominance of 'increase' over 'decrease' replies (or vice versa) and 2) increasing or decreasing share of 'unchanged' replies

Studies based on economic agents' expectations - assessments

Reuter (2015)

- **Various metrics of uncertainty:**
  1. **dispersion of responses**
  2. **indirect forecast error dispersion:** log-difference of dispersions among backward-looking (change in the past) and forward-looking (change in the future) versions of a question
  3. **inter-question dispersion:** calculation of dispersion across all the BCS questions

- Uncertainty impact on GDP via VAR models:
  1. **negative and significant impact** of all indicators on GDP
  2. impact fades over time
  3. magnitude of maximum impact differs
  4. **timing and persistence** differ

Studies based on media coverage

Hardouvelis et al. (2018) for Greece

- Estimation of the role of uncertainty in the Greek crisis
- Uncertainty metrics based on **Greek newspapers' article coverage frequency** of topics of interest, from 1998 to 2017
- **Various sub-indices**: economic uncertainty (EU), fiscal policy (EPUF), monetary policy (EPUM), currency fluctuations (EPUC), banking (EPUB), pension system (EPUP). Also, an index of political uncertainty (POLU) was constructed.
- VAR models results: **POLU, EPU, EU have a negative impact** on the Greek 10-year GGB spread during 8/2007-12/2017. A 3-year effect of a 22% shock in EPU – as much it changed across two halves of the sample - explains 2/3 of the drop in industrial production and 1/4 in GDP.
- **Economic Policy Uncertainty index included in our VECM estimations**, in order to benchmark results with and check robustness of our uncertainty metrics

Uncertainty measures & correlation with economic activity during the Greek crisis

Uncertainty measures applied

- **1st Uncertainty metric:** Dispersion (**Uncd_t**) of economic agents' expectations, as in Friz (2013), Blackmann (2013)
- **2nd Uncertainty metric:** Forecast Error (**Uncf_t**), based on the absolute value of the difference of responses' dispersions in backward-looking and forward-looking versions of a question (drawing from Reuter (2015)):

$$\text{Uncf}_t = abs[(\text{Pos}_t - \text{Neg}_t) - (\text{EvalPos}_{t+3} - \text{EvalNeg}_{t+3})]$$

- where:

Pos_t: fraction of "increase" responses and Neg_t: fraction of "decrease" responses, at time t, to a forward looking question

EvalPos_{t+3}: fraction of "increase" responses and EvalPos_{t-3}: fraction of "decrease" responses, at time t+3, to a backward looking question

Use of absolute instead of simple difference of dispersions, so as to focus on changes to the magnitude of uncertainty, rather than its intertemporal sources (e.g. optimism, pessimism)

Uncertainty measures applied

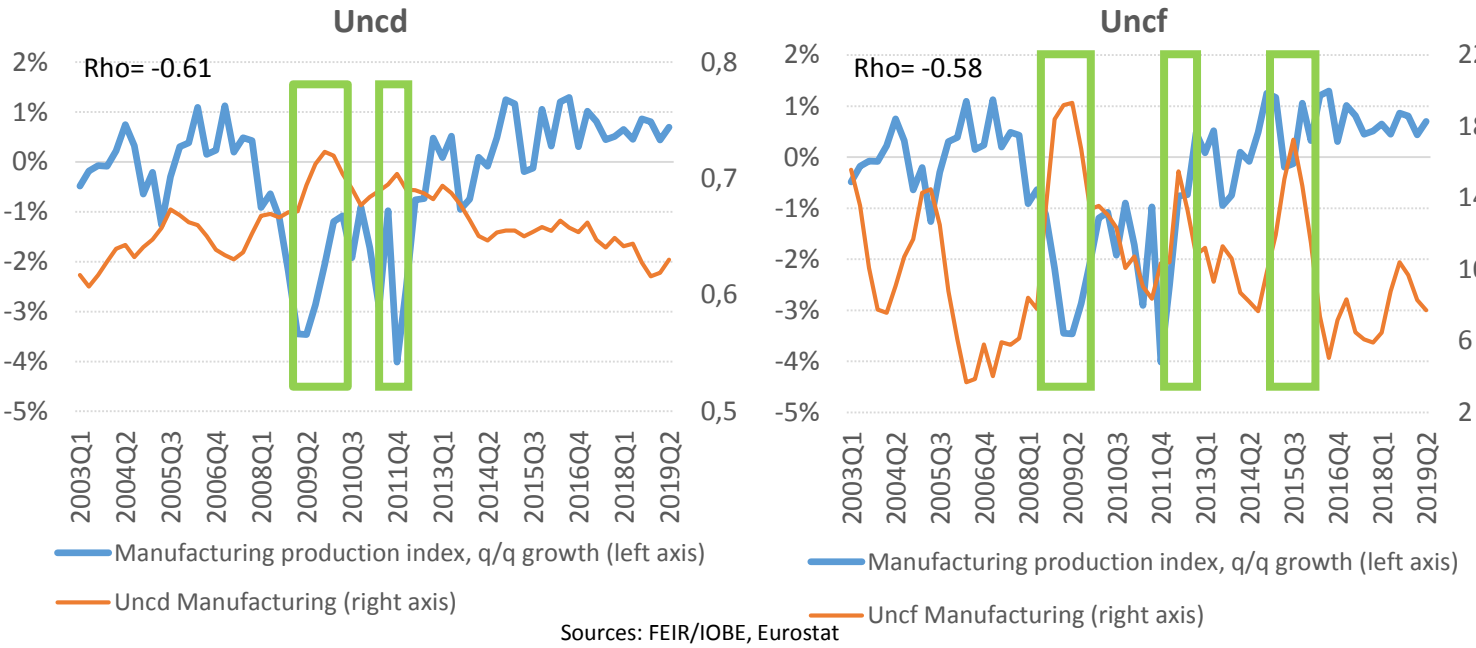
Uncertainty metrics calculation details:

- For correspondence with the frequency of short-term economic activity indicators, **indicators averaged on a quarterly basis**
- Smoothing of fluctuations due to seasonality: **use of rolling 4-quarter averages**

Metrics applied to responses about:

- **Manufacturing sector:** (Q1) How did your turnover evolve compared to the last three months? (Q2) How do you expect your turnover to evolve over the next three months?
- **Services sector:** (Q1) How did demand evolve compared to the last three months? (Q2) How do you expect demand to evolve over the next three months?
- **Retail trade sector:** (Q1) How did your turnover evolve compared to the last three months? (Q2) How do you expect your turnover to evolve over the next three months?

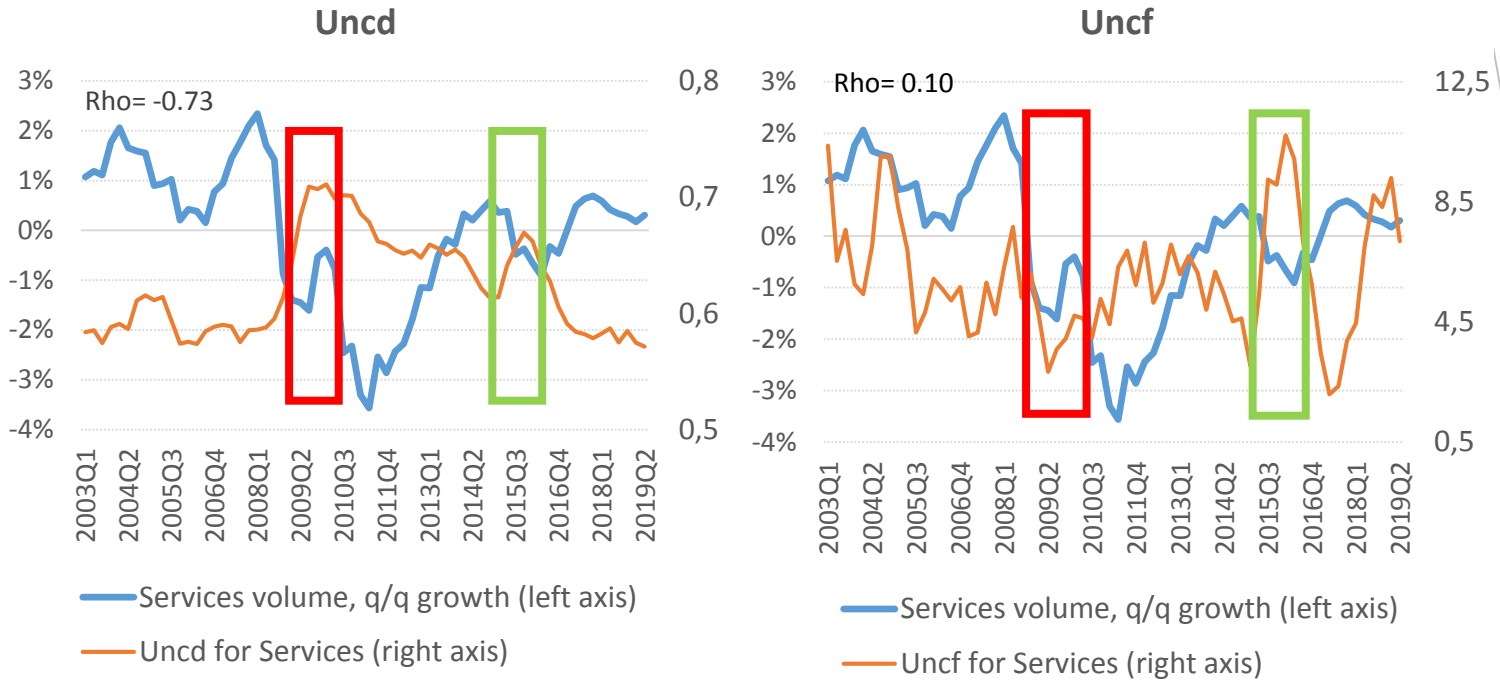
Uncertainty trends in Manufacturing



Sources: FEIR/IOBE, Eurostat

- **Strong negative relationship** between uncertainty & production, with both indices (correl. coef. <-0.50). **Average uncertainty during crisis - economic adjustment higher** than average uncertainty earlier.
- **More intense** uncertainty fluctuations when adjusting for forecasting errors
- **Highest average level of dispersion** in 2009 Q1 – 2010 Q3 (2008 global financial crisis – emergence of Greek crisis)
- Uncertainty fluctuations closely **linked to important economic and political events**: 2011 government resignation, PSI, 2012 & 2015 elections, 2015 referendum, but also exit from last Adjustment Program in 2018 Q3)

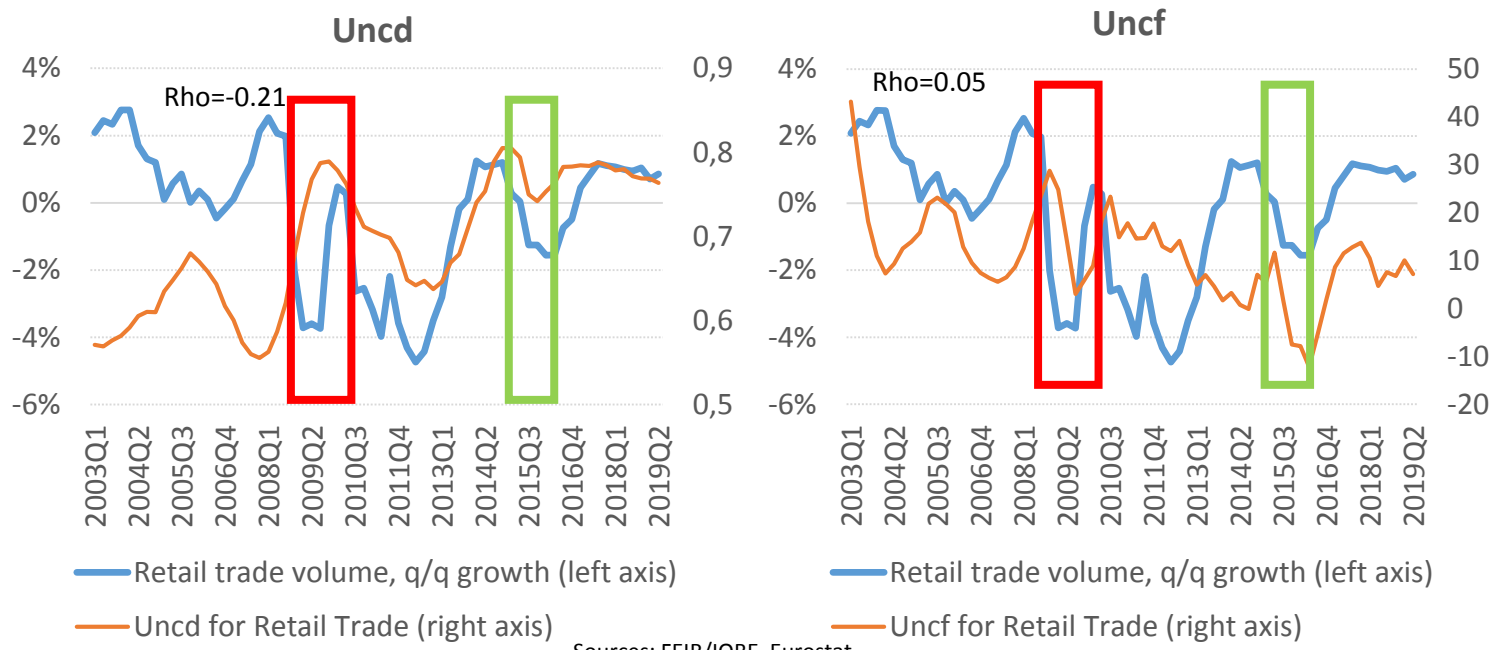
Uncertainty trends in Services



Sources: FEIR/IOBE, Eurostat

- **Negative relationship** between uncertainty & production volume, throughout the examined period with dispersion of responses (Uncd). After adjusting for forecasting errors, correlation is marginally negative **only during Greek crisis - economic adjustment** (-0.05).
- **No clear linkage** between uncertainty and major important economic - political events: Increase in 2015 for both indices, different trends in 2009 – mid 2010, relative stability in 2012.

Uncertainty trends in Retail Trade



Sources: FEIR/IOBE, Eurostat

- **Moderate negative relationship** between uncertainty & production volume with **Uncd**. After adjusting for forecasting errors, relationship is **negative only during Greek crisis - economic adjustment** (-0.24).
- **Almost identical trend** of dispersion of responses and volume of production **after mid-2009** ➔ indication of **low uncertainty** & dispersion due to difference in turnover expectations
- Interpretation in line with **falling Uncf during 2009 - 2016**, **significantly lower** than before the crisis

Empirical estimation

Empirical estimation objective

- **Calibrate the trend of sectors' economic activity**
  - Test whether model fit improves when accounting for uncertainty
- **Evaluate the forecasting power across models**
  - Test whether forecasting accuracy improves when accounting for uncertainty

Data

Sector economic activity

- Manufacturing volume of production (s.a. real)
- Services excl. public sector GVA (s.a. real)
- Retail Trade volume index (s.a. real)

Macroeconomic determinants

- Price deflator (per sector)
- Employment (per sector), unemployment (national)
- Labour productivity

Uncertainty metrics

- Survey based: Uncf, Uncd
- Media based: Uncm

VEC-Model

- Sector's activity trend is endogenously determined by the set of macro variables and business uncertainty

$$\Delta y_t = c + \mathrm{A} y_{t-1} + B \sum_{i=1}^{p} \Delta y_{t-i} + e_t$$

- Dynamic long run relationships between all endogenous variables $\mathrm{A} y_{t-1}$
- Short run adjustment coefficients $B \sum_{i=1}^{p} \Delta y_{t-i}$
- 4 model specifications

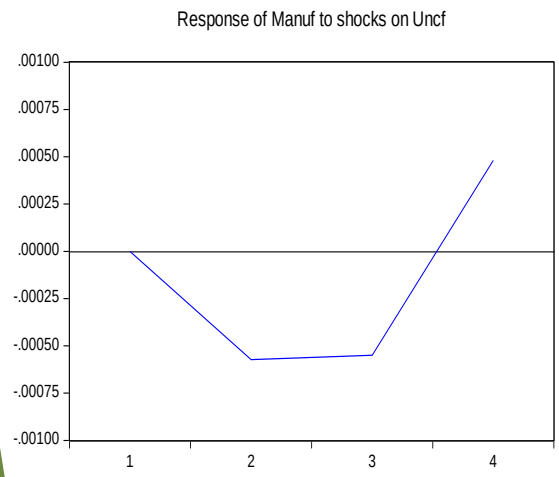
	Set of endogenous variables	Endogenous uncertainty proxy
Model 1	Sector activity proxy, Deflation, Unemployment, labor productivity	None
Model 2	Sector activity proxy, Deflation, Employment, labor productivity	Uncf
Model 3	Sector activity proxy, Deflation, Employment, labor productivity	Uncd
Model 4	Sector activity proxy, Deflation, Employment, labor productivity	Uncm

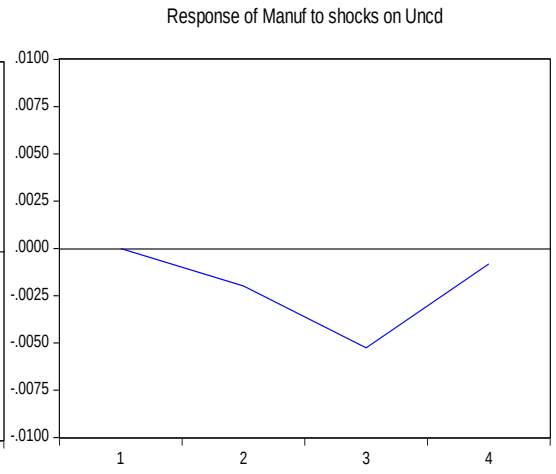
Results in a snapshot

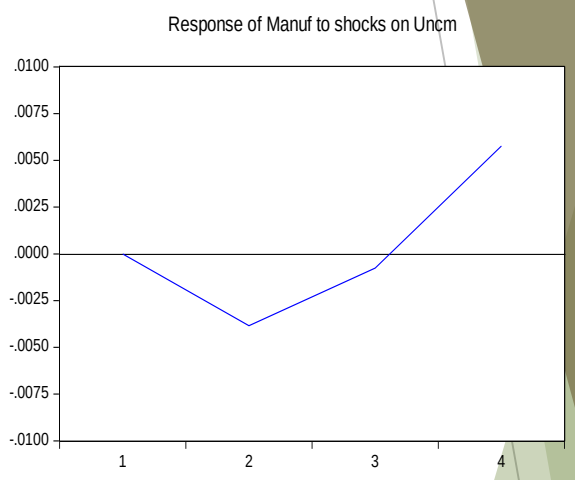
- **Long run co-integration relationships**
  - Manufacturing production activity relates…
    - positively with employment, labor productivity
    - negatively with uncertainty
  - Services GVA relates, albeit w/o statistical significance…
    - Positively with labor productivity
    - Negatively with unemployment and uncertainty
  - Retail Trade relates…
    - Positively with labor productivity
    - Negatively with unemployment and uncertainty
- Shocks in uncertainty have low persistence on economic activity, albeit explain a non-negligible share of its variance (between 7% and 28%)
- **Accounting for uncertainty improves the accuracy of forecasting sectors' economic activity**
- Robustness with respect to distinct Unc proxies

Uncertainty effects on Manufacturing

- Impulse response over 4 quarters



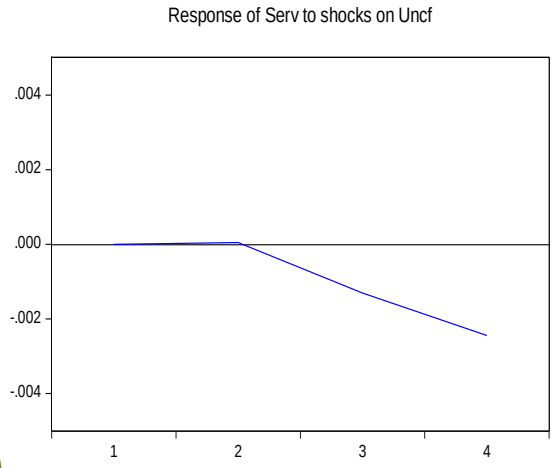


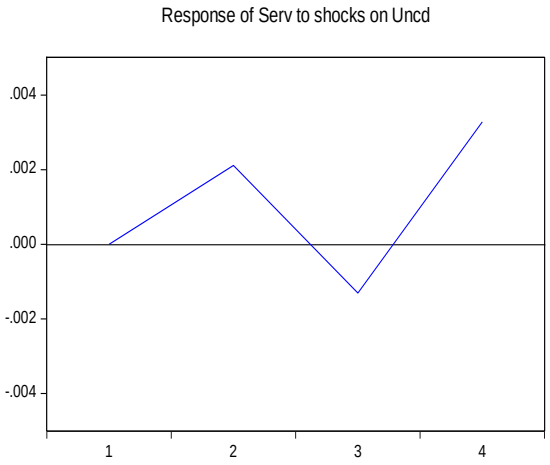


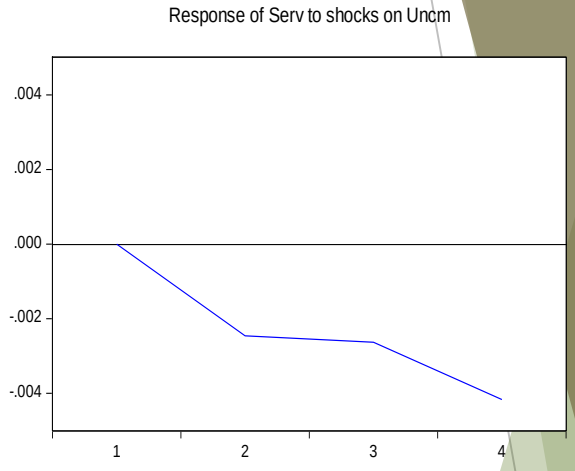
- Adverse impact on activity (low persistence)
- Explains up to 28 pct of activity's volatility
- Inflationary impact on Manuf prices
- VECM's fit improves when accounting for Unc
  - Best fit: Uncd (LogL), Uncf (AIC), Uncf (SIC), Uncm (R^2)

Uncertainty effects on Services

- Impulse response over 4 quarters



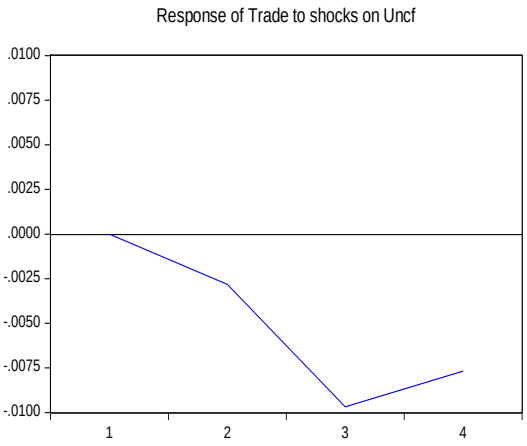


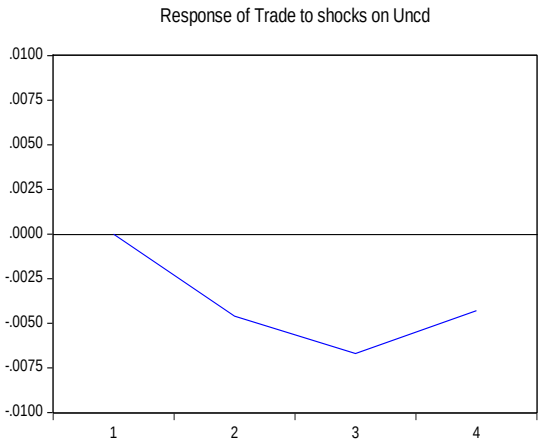


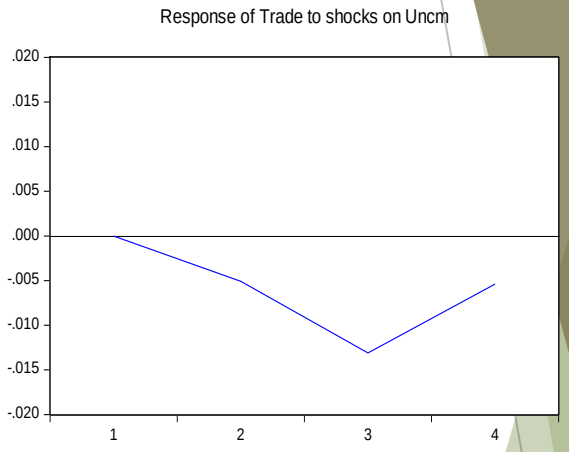
- Not statistically significant adverse impact on activity
- Explains only up to 7 pct of activity's volatility
- VECM's fit improves marginally when accounting for Unc
  - Best fit: Uncd (LogL), Uncf (AIC), Uncf (SIC), Uncm (R)

Uncertainty effects on Retail Trade

- Impulse response over 4 quarters







- Adverse impact on activity (medium persistence)
- Explains up to 18 pct of activity's volatility
- VECM's fit improves when accounting for Unc
  - Best fit: Uncd (LogL), Uncf (AIC), Uncf (SIC), Uncm (R^2)

Comparing the models' performance on forecasting sectors' activity

- Accounting for uncertainty improves out-of-sample forecasting accuracy
- 5-year rolling window, 36 1-year ahead forecasts over 2010-2018

Manufacturing	RMSE 1 quarter ahead	RMSE 2 quarters ahead	RMSE 3 quarters ahead	RMSE 4 quarters ahead
Model 1 (No Unc)	2.57	3.33	3.83	**4.87**
Model 2 (Uncf)	2.59	3.37	4.01	5.23
Model 3 (Uncd)	2.38	3.03	3.96	5.17
Model 4 (Uncm)	**2.36**	**3.03**	**3.65**	5.05
Services				
Model 1 (No Unc)	401	648	905	1245
Model 2 (Uncf)	386	602	845	1174
Model 3 (Uncd)	393	650	912	1245
Model 4 (Uncm)	**327**	**536**	**761**	**1104**
Retail trade				
Model 1 (No Unc)	4.01	6.86	8.83	10.33
Model 2 (Uncf)	**3.35**	**4.71**	**5.68**	**6.76**
Model 3 (Uncd)	3.74	6.53	8.59	10.41
Model 4 (Uncm)	3.47	5.58	7.37	8.74

- Robustness with MAE, MAPE

Conclusions

- BCS based uncertainty metrics explain non-negligible part of Greek main sectors' economic activity trends during the Greek crisis - economic adjustment period
- Increases in sectoral uncertainty metrics are linked to important economic and political events, mainly in the Manufacturing sector
- Negative correlation between all metrics and production during the domestic crisis – economic adjustment period, albeit with differences in magnitude
- Negative long run relationship between uncertainty and sectors' economic activity, significant in Manufacturing and Retail Trade
- Shocks in uncertainty have low persistence on economic activity, albeit explain a non-negligible share of its variance
- Accounting for uncertainty improves the accuracy of forecasting sectors' economic activity
- Results are robust with respect to various measures of uncertainty

Thank you for your attention!