The industrial impact of commodity price uncertainty in a small open economy

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What we do

- Construct a measure of commodity price uncertainty using forecast data from Consensus Economics
- Estimate VAR models for Australia focusing on different industries
- Evaluate an effect of commodity price uncertainty on Australian industries

Motivation

- Australia depends heavily on exports of a range of commodities.
- Iron ores accounted for 19% of total exports in 2024.
- Coal – for 13%.
- Natural gas, gold, aluminium ores, crude petroleum and copper ores – for 21%.
- The resource sector accounted for 15% of Australian GDP in 2024.

Motivation

- Commodities and their prices are important in Australia
- Firms across industries must consider future commodity prices when making plans about production and investment.
- Firms' perceptions of future commodity price uncertainty can play a potentially important role in their decision-making.
- Very few studies that focus on commodity price uncertainty.
- Also a limited number of studies exploring the effects of any type of uncertainty on different industries.
- We contribute to this scarce literature.

Related literature: 1 – Commodity prices and Australia

- Chen and Rogoff (2003) explore the effects of commodity prices on the real exchange rate in Australia, Canada and New Zealand.
- Bloch et al. (2006) study the link between commodity prices and inflation in Australia and Canada.
- Gaston and Rajaguru (2013) demonstrates theoretically and empirically for Australia that a sustained improvement in the terms of trade leads to lower unemployment.

Related literature: 2 – The effects of commodity prices on different Australian industries

- Effects of commodity prices on different industries received attention in Australia, especially during the commodity price boom of the late 2000s-early 2010s.
- A problem of a two-speed economy
- Garton (2008) argued that income gains from the commodity-price boom of the late 2000s were widely distributed and non-mining states didn't miss out.
- Knop and Vespignani (2014) found that commodity price shocks have an asymmetric effect in Australia: increase output in mining, construction and manufacturing and have no effect on financial and insurance sectors.
- Bjørnland and Thorsrud (2016) found positive productivity spillovers from the resource sector to other industries in Australia and Norway.

Related literature: 3 – The effects of uncertainty on different industries

- Broad consensus in the literature: higher uncertainty has a negative effect on economic activity, amplified during recessions.
- Choi et al. (2018): higher stock market volatility leads to a larger decrease in productivity growth in industries dependant on external finance.
- Yoon and Ratti (2011): higher energy price uncertainty reduces the responsiveness of investment to sales growth for the US firms.
- Maghyereh and Abdoh (2020): The higher volatility of positive oil price returns has a more negative effect on US firms' investment compared to volatility of negative returns, and this effect differs across industries and firm sizes.

Our aggregated measures of commodity price uncertainty with survey data

- We use Consensus Economics *individual* forecast data for 20 metal and energy commodities from August 1995.
- Metal commodities include *iron ore*, 9 non-precious metals (*aluminium, cobalt, copper, lead, molybdenum, nickel, tin, uranium and zinc*), and 4 precious metals (*gold, silver, palladium and platinum).*
- Energy commodities include *crude oil, RBOB gas, gas oil, natural gas, coking coal and steaming coal.*
- Interpolation challenges with data: fixed-event price forecasts, irregular frequency in dataset for different commodities.
- We construct 12-month ahead forecast dispersions for each commodity using the interquartile range (IQR).

Construction of aggregate measures of commodity price uncertainty

State-space approach

- We construct commodity price uncertainty indices using the following state-space model:

$$u_t = \rho u_{t-1} + \epsilon_t \qquad \epsilon_t \sim N(0, P) \tag{1}$$

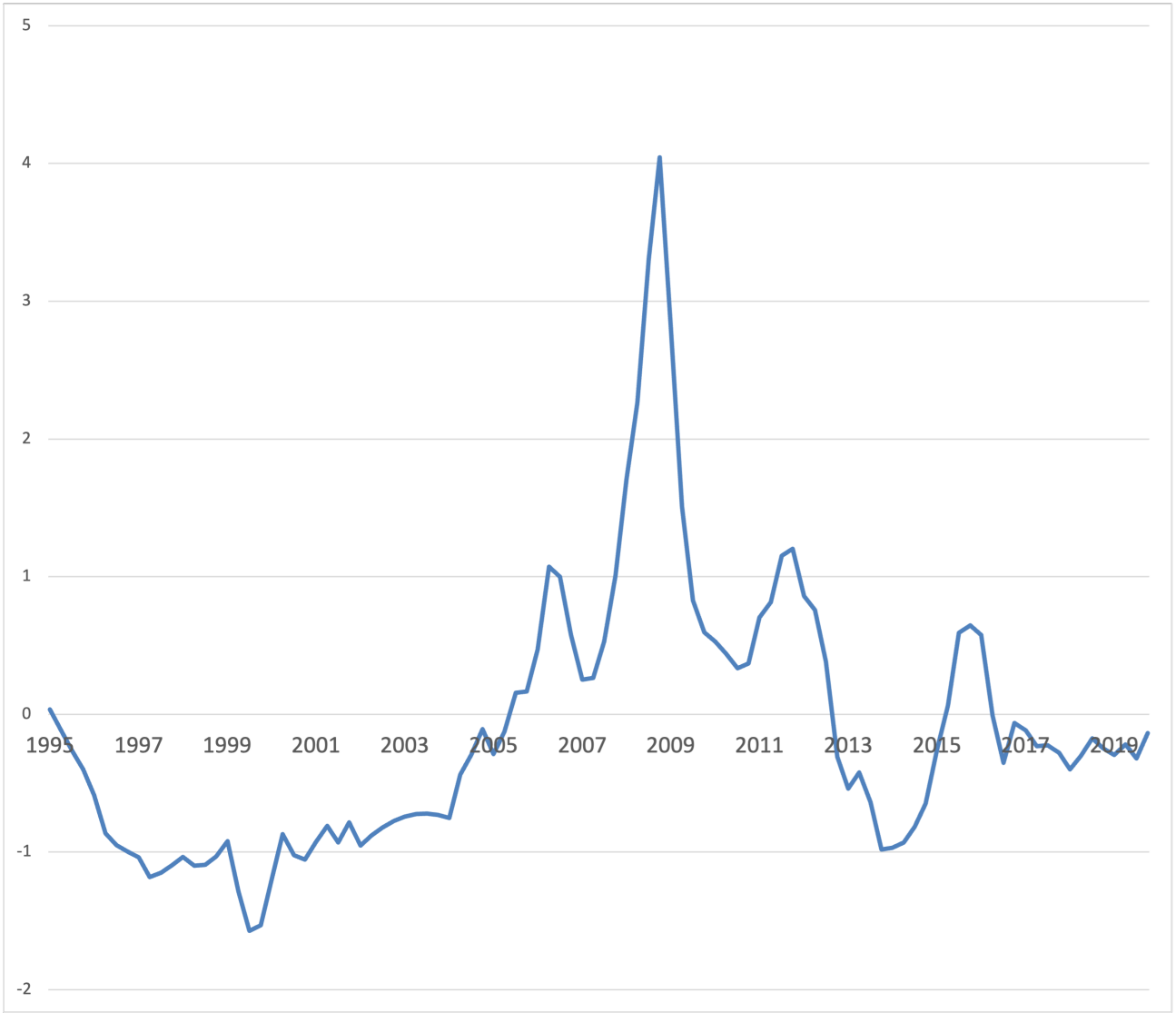
$$Y_t = \gamma Y_{t-1} + \beta u_t + \eta_t \qquad \eta_t \sim N(0, Q) \tag{2}$$

- where u_t as the unobserved (general) commodity price uncertainty measure, and Y_t is the vector of observed forecast dispersion variables.
- Given data irregularity, we replace equation (2) with:

$$Y_t^* = \gamma^* Y_{t-1}^* + \beta^* u_t + \eta_t^* \qquad \eta_t^* \sim N(0, Q^*) \tag{3}$$

where $Y_t^* = S \times Y_t$ and S is a selection matrix with the value 1 for valid data for Y_t and 0 for missing data.

Our commodity price uncertainty index



Contributions of industries to GDP

Industry Category	Industry Share
Agriculture, forestry and fishing	2.5%
Mining	14.3%
Manufacturing	5.7%
Electricity, gas, water and waste services	2.0%
Construction	7.1%
Financial and insurance services	7.4%
Combined non-financial services	63.5%

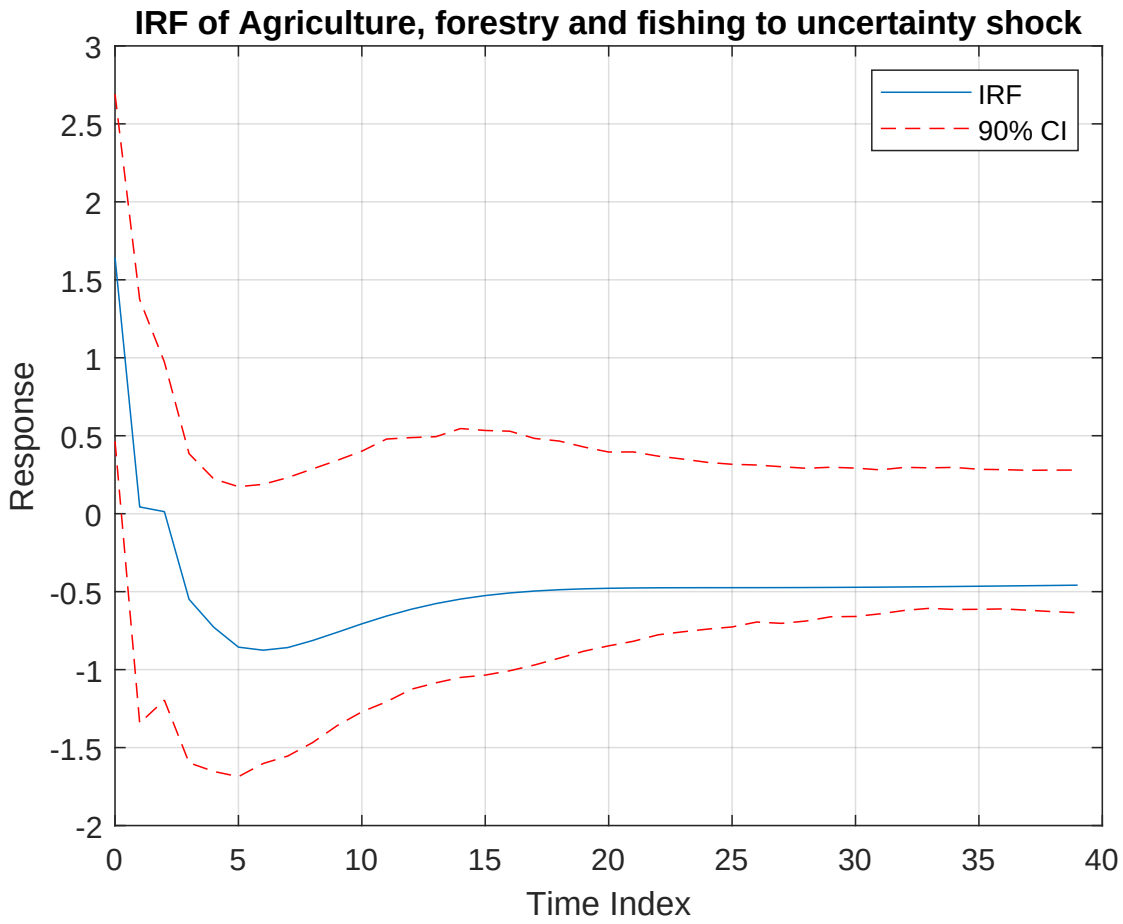
Combined non-financial services

- Wholesale trade
- Retail trade
- Accommodation and food services
- Transport, postal and warehousing
- Information media and telecommunications
- Rental, hiring and real estate services
- Professional, scientific and technical services
- Administrative and support services
- Public administration and safety
- Education and training
- Health care and social assistance
- Arts and recreation services
- Other services

VAR model(s)

- Small number of essential foreign and domestic variables
- Foreign block:
  - an index of global economic activity
  - a non-rural commodity price index
  - commodity price uncertainty measure
- Domestic block:
  - GDP (excluding the industry considered)
  - industry's real value-added
  - CPI inflation
  - cash rate
  - real trade-weighted exchange rate
- Two dummies: one for the period 2008Q4-2009Q3 and the other for the 2008Q4

Impulse Responses to a one standard deviation commodity price uncertainty shock



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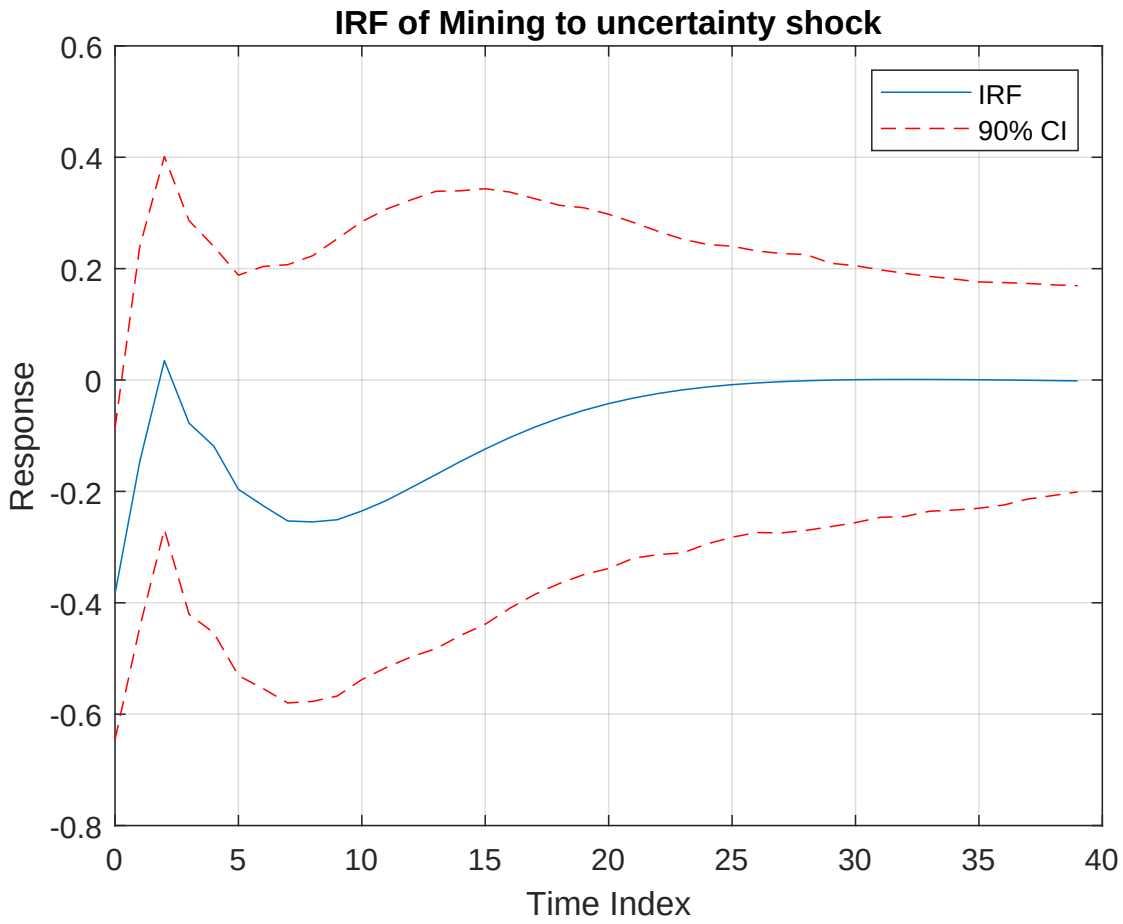

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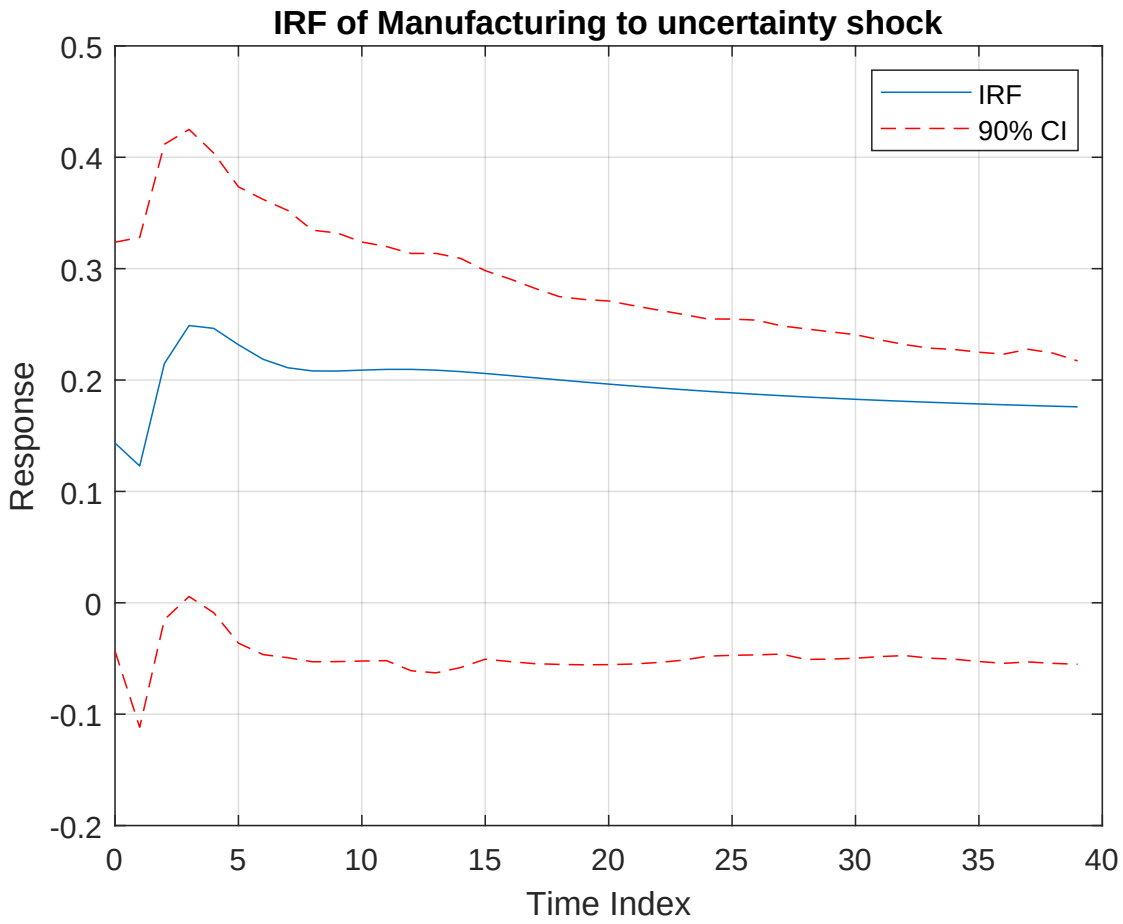

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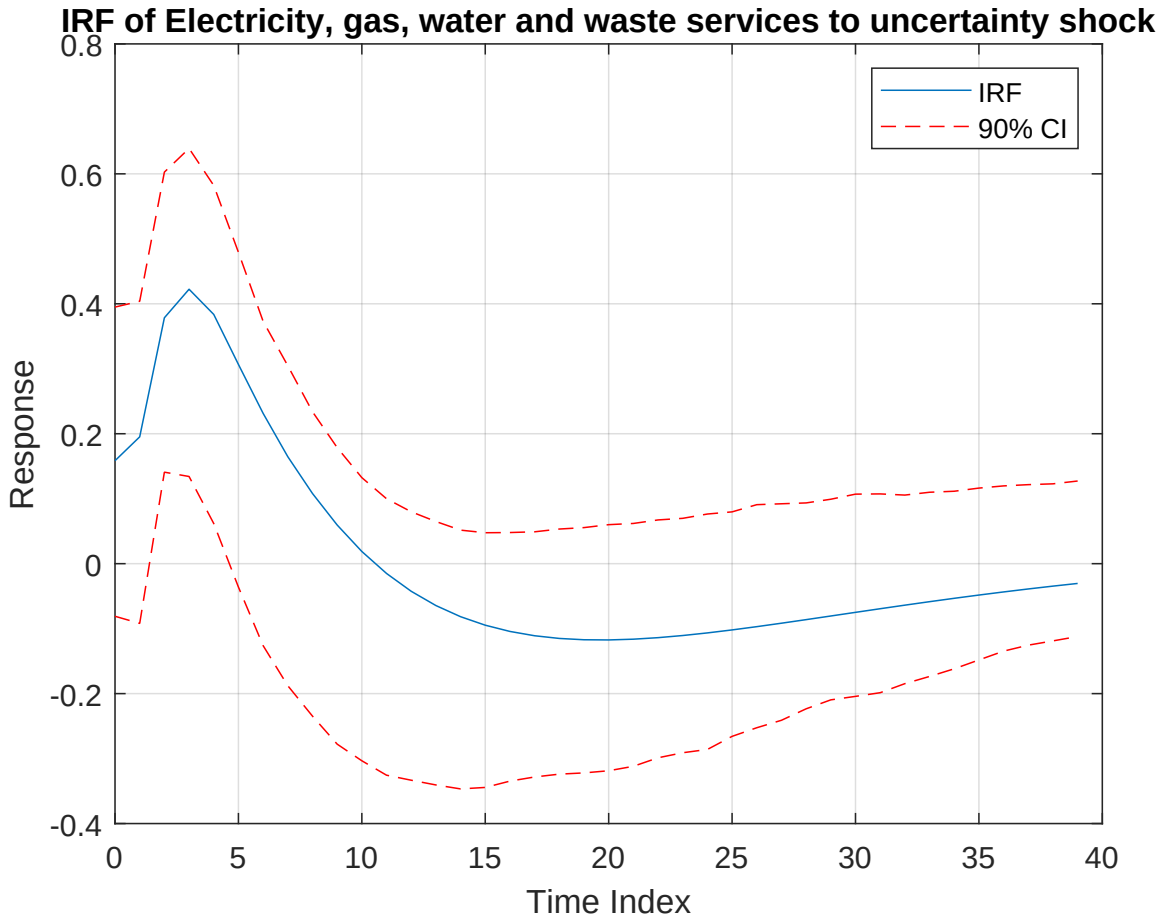

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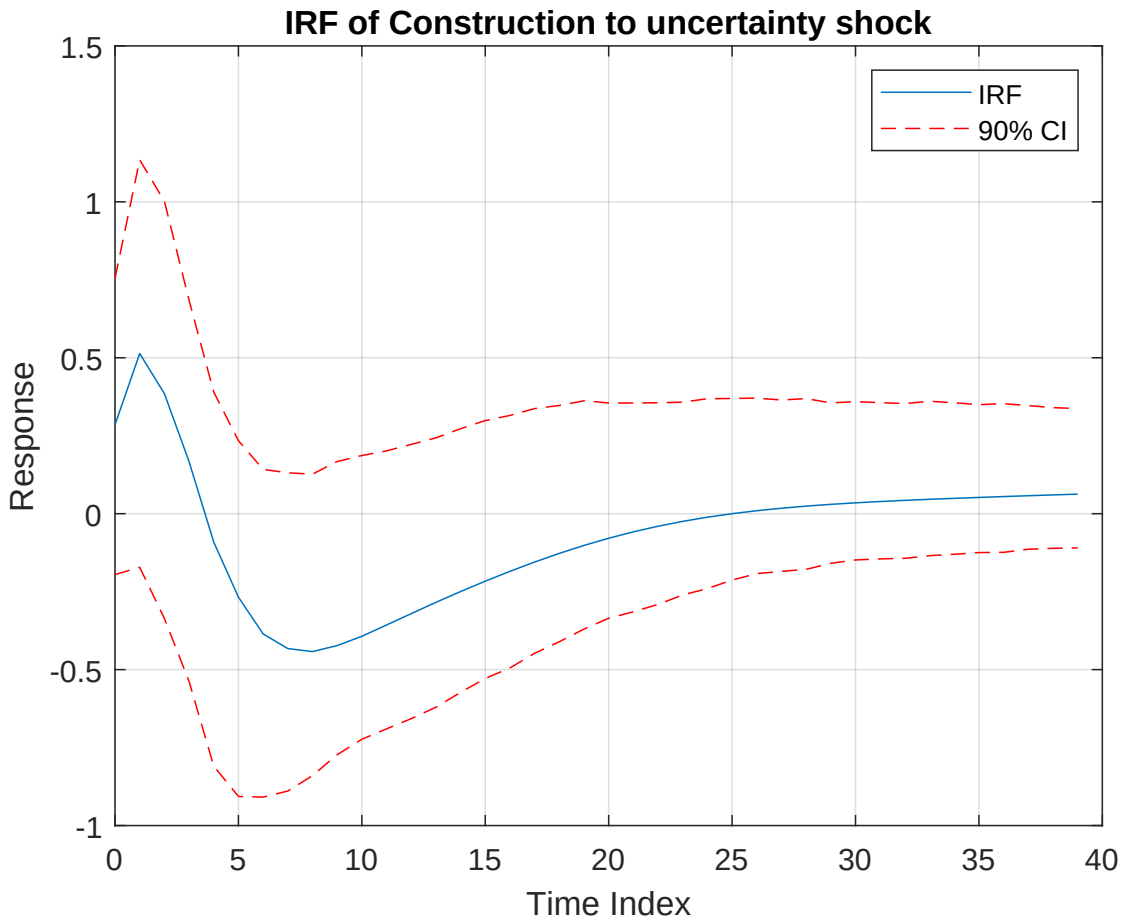

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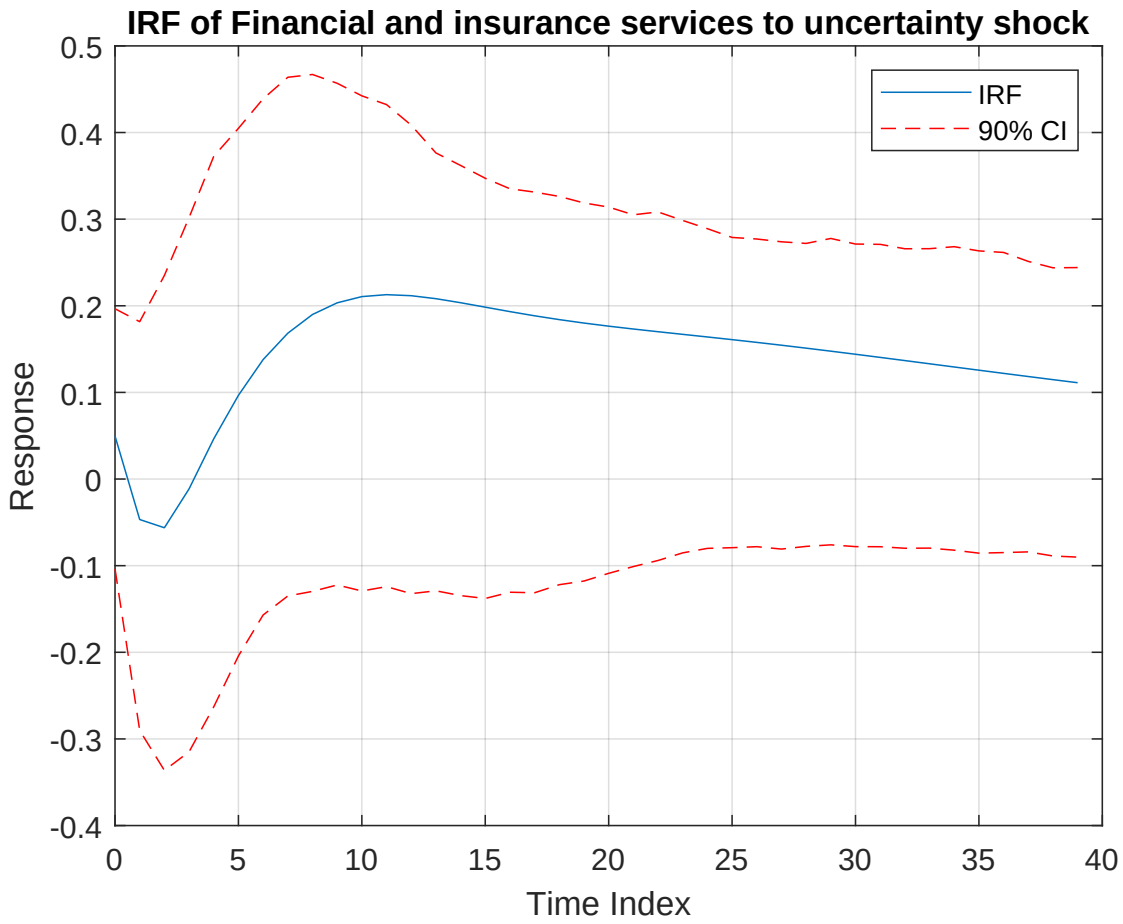

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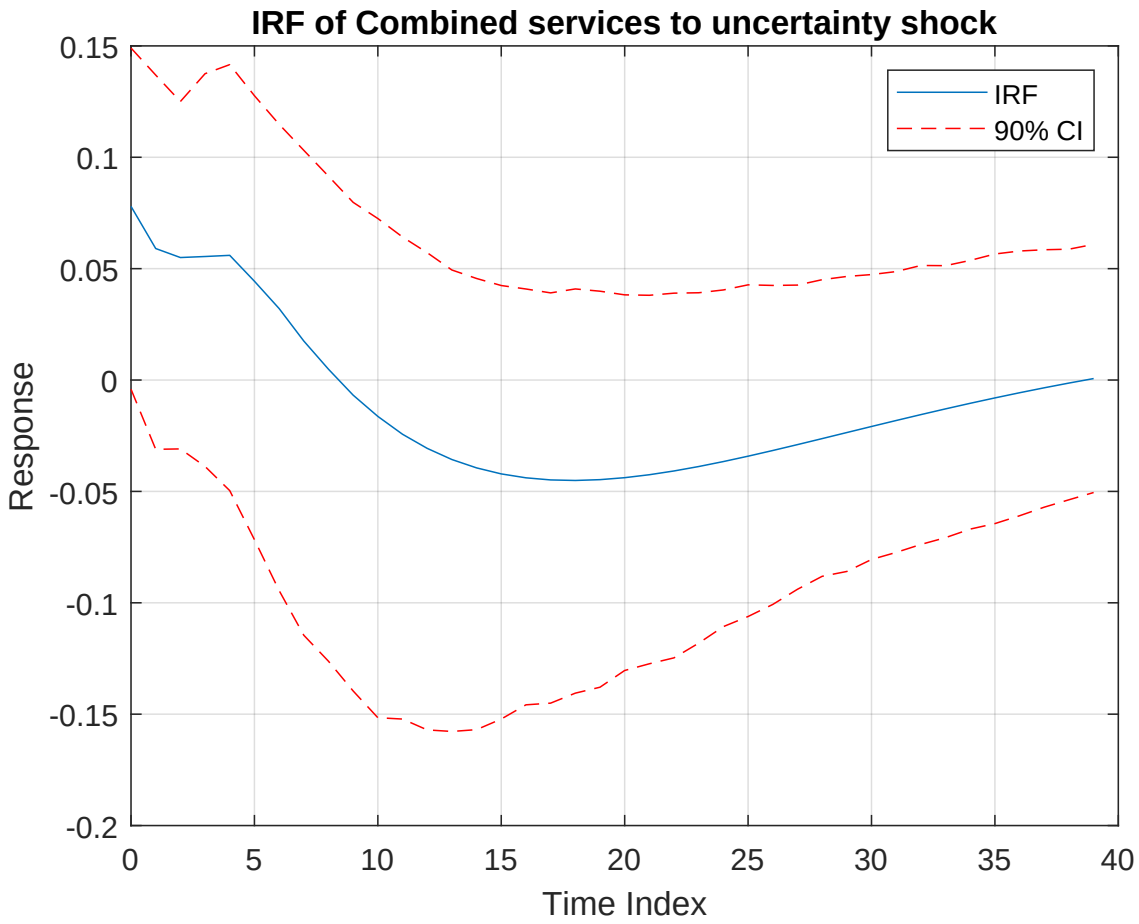
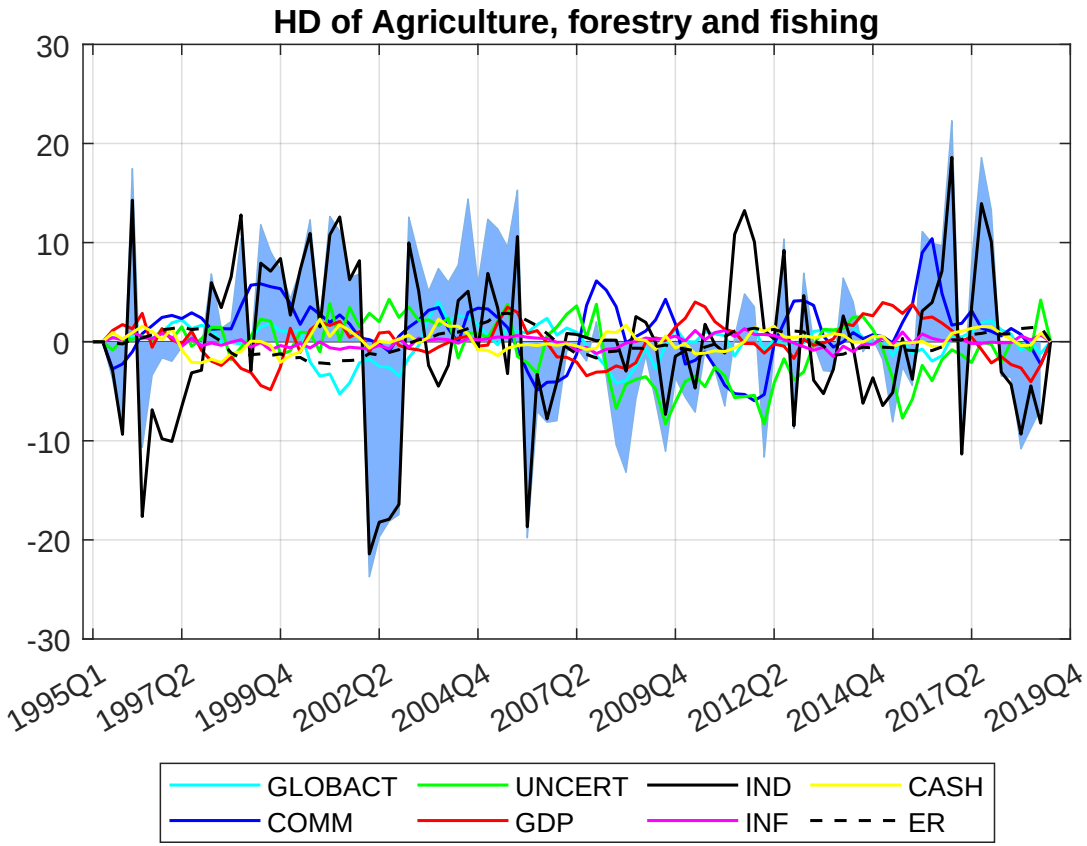


Historical Decomposition



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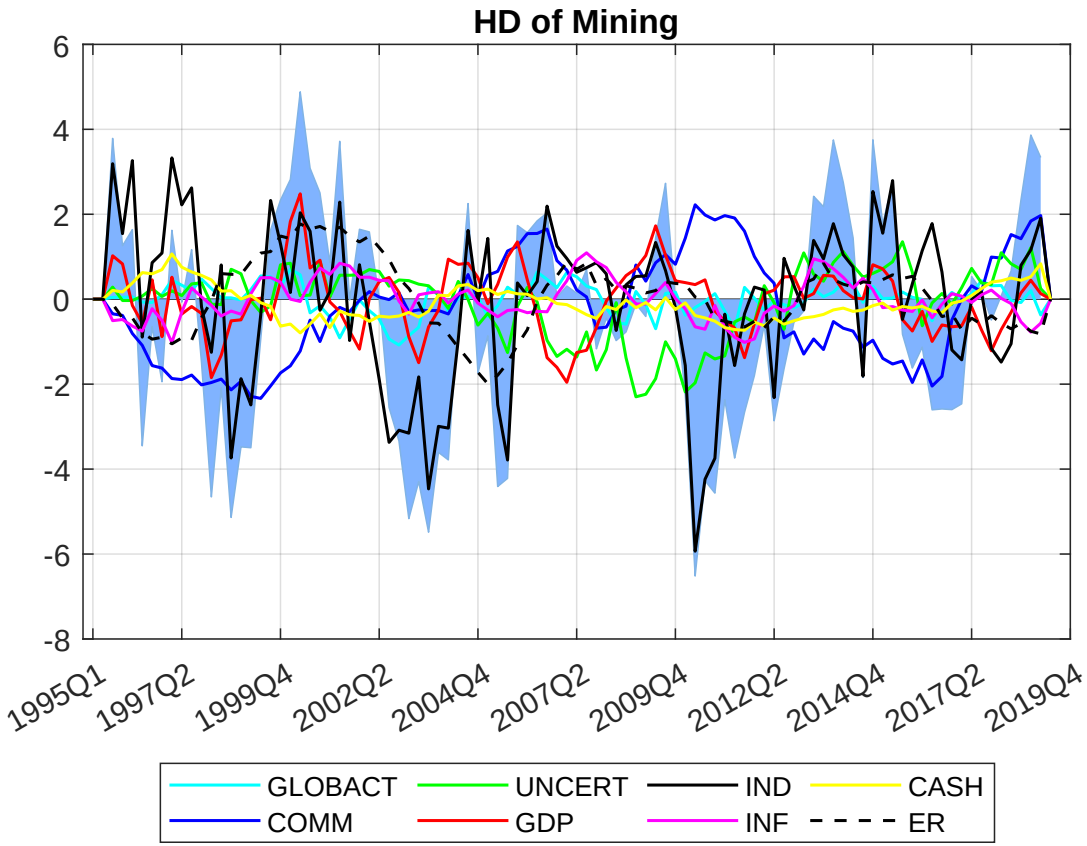

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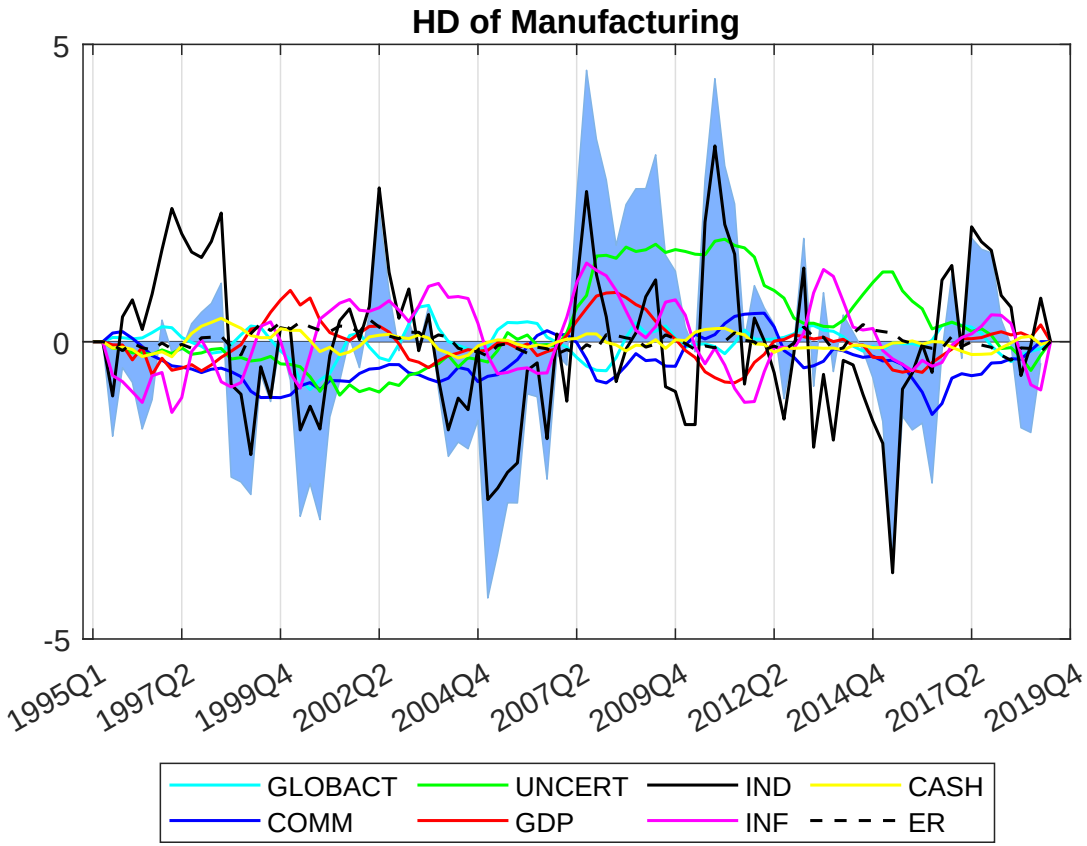

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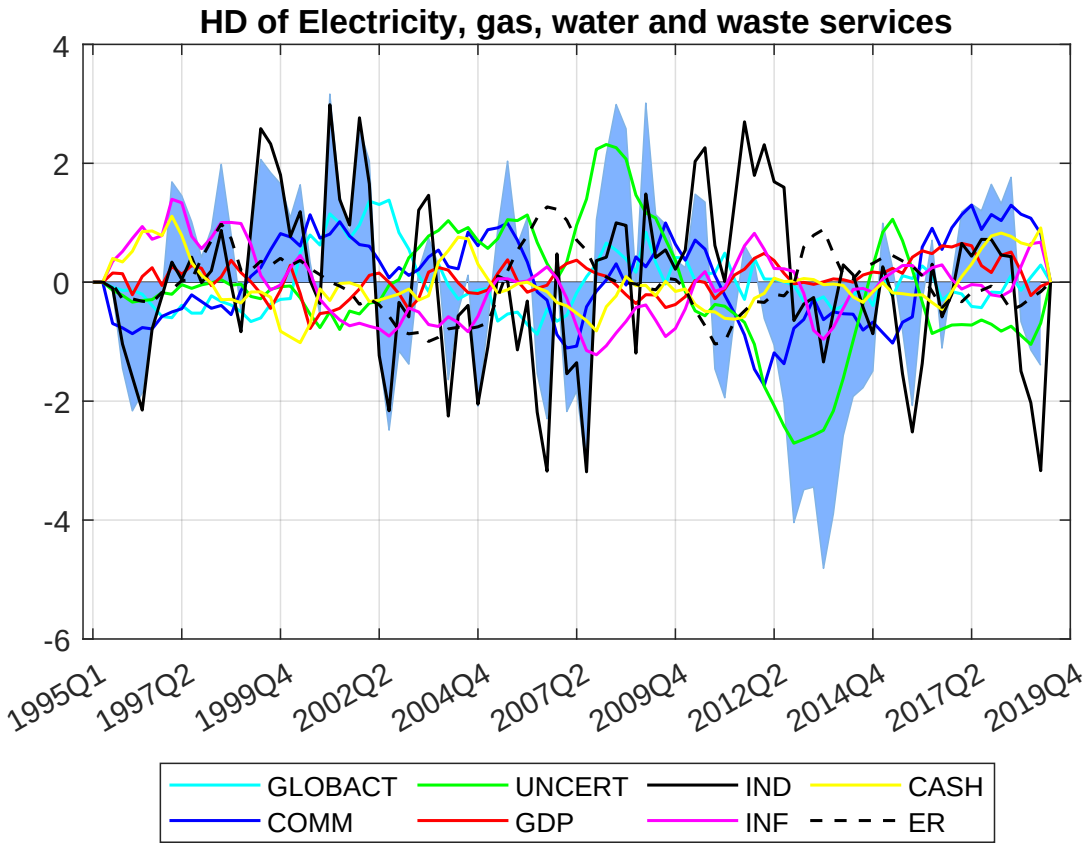

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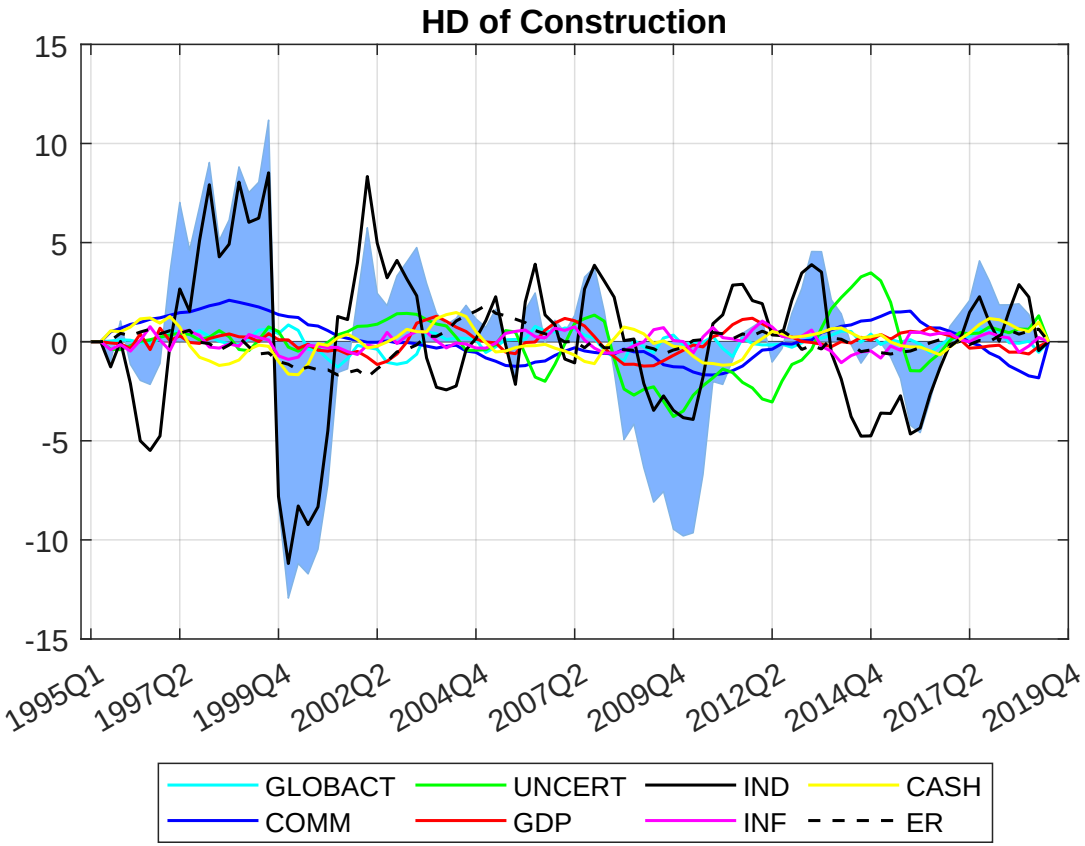

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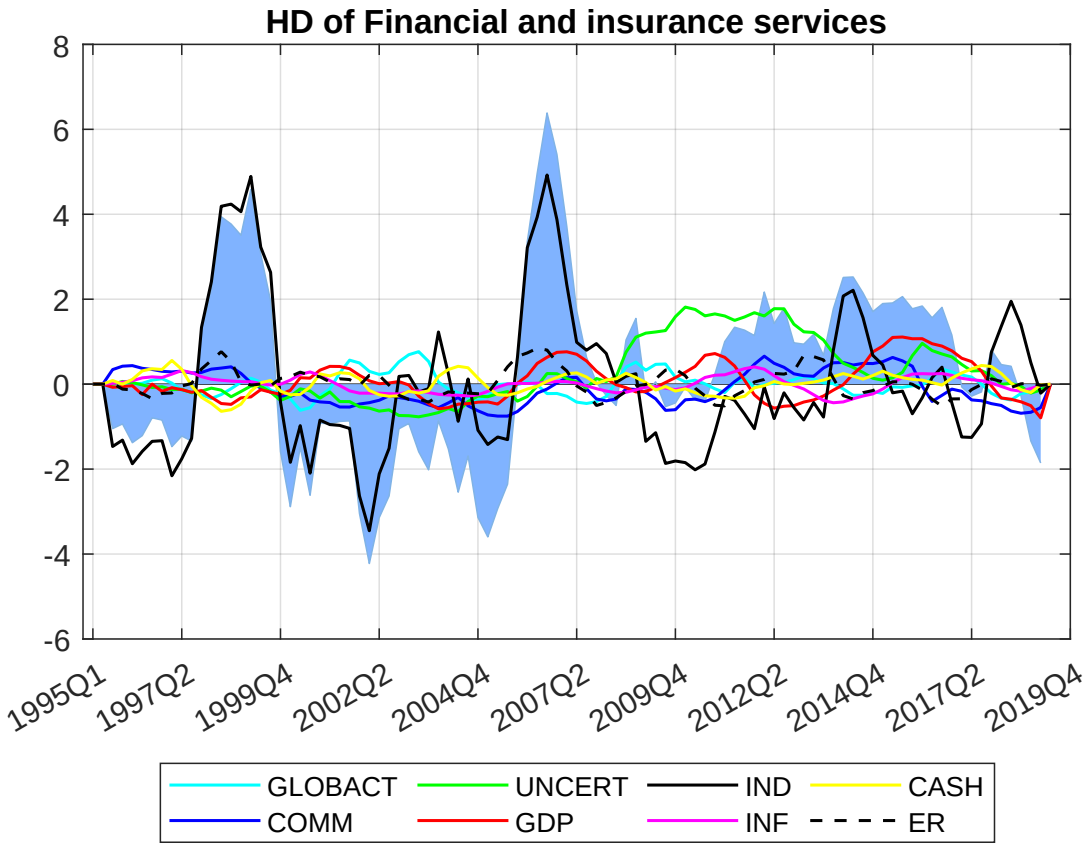

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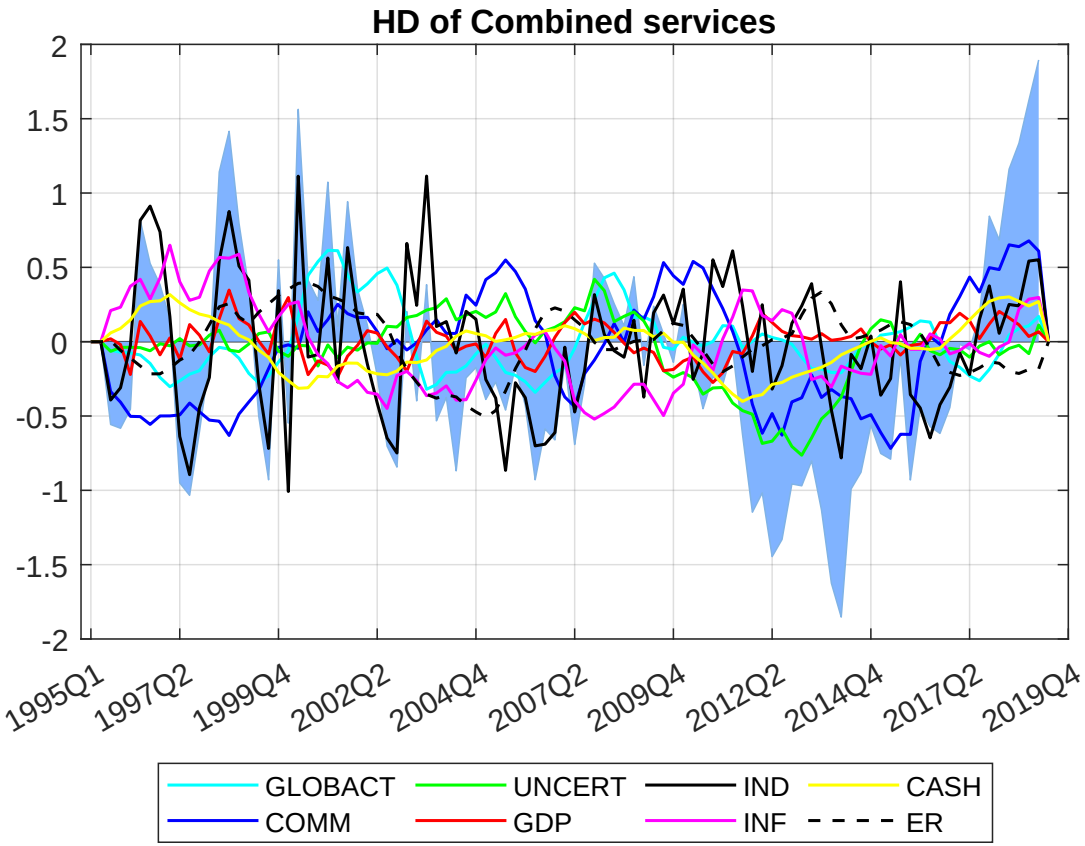

VD Agriculture, forestry and fishing

Horizon	GEA	CP	CPU	GDP	IND	INF	CASH	RER
1	0.00	0.03	0.04	0.02	0.91	0.00	0.00	0.00
2	0.00	0.05	0.04	0.03	0.87	0.00	0.01	0.00
3	0.01	0.05	0.04	0.04	0.85	0.00	0.01	0.00
4	0.02	0.05	0.04	0.05	0.83	0.00	0.01	0.00
8	0.04	0.08	0.07	0.07	0.73	0.00	0.01	0.01
20	0.03	0.14	0.11	0.06	0.63	0.00	0.01	0.02
40	0.03	0.14	0.14	0.06	0.59	0.00	0.01	0.02

VD Mining

Horizon	GEA	CP	CPU	GDP	IND	INF	CASH	RER
1	0.01	0.01	0.05	0.03	0.89	0.00	0.00	0.00
2	0.01	0.01	0.04	0.10	0.81	0.01	0.01	0.01
3	0.01	0.01	0.04	0.09	0.79	0.03	0.01	0.02
4	0.02	0.03	0.03	0.08	0.76	0.03	0.01	0.04
8	0.02	0.16	0.04	0.06	0.57	0.03	0.02	0.10
20	0.02	0.26	0.07	0.05	0.44	0.02	0.02	0.12
40	0.02	0.26	0.07	0.05	0.43	0.02	0.02	0.12

VD Manufacturing

Horizon	GEA	CP	CPU	GDP	IND	INF	CASH	RER
1	0.00	0.00	0.02	0.00	0.98	0.00	0.00	0.00
2	0.01	0.01	0.02	0.00	0.92	0.03	0.00	0.01
3	0.02	0.01	0.04	0.01	0.81	0.10	0.00	0.01
4	0.02	0.01	0.07	0.01	0.73	0.15	0.01	0.01
8	0.02	0.03	0.13	0.06	0.59	0.16	0.01	0.01
20	0.02	0.10	0.24	0.06	0.44	0.12	0.01	0.01
40	0.02	0.13	0.35	0.05	0.35	0.09	0.00	0.01

VD Electricity, gas, water and waste

Horizon	GEA	CP	CPU	GDP	IND	INF	CASH	RER
1	0.00	0.06	0.02	0.01	0.92	0.00	0.00	0.00
2	0.04	0.07	0.03	0.01	0.80	0.01	0.02	0.01
3	0.05	0.08	0.09	0.01	0.65	0.05	0.04	0.03
4	0.05	0.10	0.13	0.01	0.55	0.08	0.05	0.04
8	0.07	0.11	0.19	0.02	0.42	0.10	0.06	0.04
20	0.09	0.12	0.18	0.06	0.35	0.10	0.05	0.05
40	0.09	0.14	0.19	0.06	0.33	0.09	0.05	0.05

VD Construction

Horizon	GEA	CP	CPU	GDP	IND	INF	CASH	RER
1	0.01	0.00	0.01	0.00	0.97	0.00	0.00	0.00
2	0.00	0.01	0.03	0.00	0.94	0.01	0.01	0.01
3	0.01	0.01	0.04	0.00	0.92	0.01	0.02	0.01
4	0.01	0.01	0.03	0.00	0.90	0.01	0.02	0.01
8	0.01	0.04	0.06	0.01	0.81	0.01	0.03	0.02
20	0.01	0.10	0.10	0.02	0.69	0.01	0.03	0.04
40	0.01	0.10	0.10	0.02	0.69	0.01	0.03	0.04

VD Financial and insurance services

Horizon	GEA	CP	CPU	GDP	IND	INF	CASH	RER
1	0.00	0.01	0.00	0.00	0.98	0.00	0.00	0.00
2	0.01	0.02	0.00	0.01	0.94	0.00	0.01	0.01
3	0.01	0.02	0.00	0.02	0.92	0.00	0.01	0.02
4	0.01	0.02	0.00	0.03	0.90	0.00	0.01	0.02
8	0.01	0.03	0.02	0.06	0.84	0.01	0.01	0.02
20	0.01	0.03	0.12	0.07	0.73	0.01	0.02	0.02
40	0.01	0.05	0.18	0.06	0.65	0.01	0.01	0.02

VD Combined non-financial services

Horizon	GEA	CP	CPU	GDP	IND	INF	CASH	RER
1	0.00	0.06	0.03	0.02	0.89	0.00	0.00	0.00
2	0.02	0.10	0.03	0.01	0.78	0.04	0.00	0.00
3	0.06	0.14	0.03	0.02	0.65	0.08	0.01	0.02
4	0.08	0.17	0.03	0.02	0.54	0.10	0.01	0.04
8	0.09	0.25	0.03	0.01	0.39	0.13	0.03	0.06
20	0.09	0.26	0.05	0.03	0.35	0.13	0.03	0.06
40	0.09	0.25	0.07	0.03	0.34	0.13	0.03	0.06

Results

1. Higher commodity price uncertainty has a short-term positive effect on
   - Agriculture, forestry and fishing
   - Manufacturing
   - Electricity, gas, water and waste
2. Higher commodity price uncertainty has a short-term negative effect on mining.
3. Commodity price shocks seem to play an important role for many industries during and after the GFC.
4. Commodity price uncertainty shocks play an important role in driving unexpected variation in industry value added at longer horizons.

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