Infrastructure Investment News and Business Cycles: Evidence from the VAR with External Instruments

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Acknowledgement

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Objective

Propose a new approach to tackle the

"Fiscal Foresight" Problem

Structure of presentation

1. Introduction
2. VAR with External Instruments (VAR-IV)
3. News Indicator: details
4. Results from VAR-IV with news indicator
5. Conclusions

1. Introduction

Why Public Investment?

- Always a subject of heated debate in Japan.

- And… suddenly, also in the US! (since late 2016…)

Difficulty in estimating the impact
="Fiscal Foresight" Problem

Most fiscal policy measures are pre-announced.

Main idea

Estimate the effects of a
"**News Shock**"
to public investment

= Changes in the public's perception about the
future course of the policy.

Step 1: Construction of a news indicator

- Shioji and Morita (2017) constructed a **daily** indicator which captures changes in people's perceptions about future policy. This combines

  - **News approach** (Ramey)
  - **Stock market approach** (Fisher and Peters)

= Look at responses of stock prices of construction companies when major news about policy arrived.

Step 2: Incorporate the news indicator into a time series analysis

--- How??

- Previous paper: Put it into a regular VAR as another endogenous variable.

- This paper: Use this as the instrument in the **VAR with External Instruments (VAR-IV)**.

2. On VAR-IV

VAR-IV

- Stock and Watson (2012), Mertens and Ravn (2013), Gertler and Karadi (2015)

- Survey paper by <u>Stock and Watson</u> (NBER-WP24216, January 2018)

- Identification without exclusion restrictions.

Identifying assumptions

- IV is correlated with the true shock contemporaneously.

- IV is orthogonal to the other types of shocks

VAR-IV: **2** variables, **1** lag example

Reduced form VAR

$$Y_t = AY_{t-1} + \nu_t$$

Structural relationship

$$\nu_t = B\varepsilon_t$$

$$Y_t \equiv \begin{bmatrix} y_{1,t} \\ y_{2,t} \end{bmatrix} \qquad B \equiv \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \qquad \varepsilon_t \equiv \begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \end{bmatrix}$$

Endogenous variables

Structural shocks (mutually orthogonal)

VAR-IV, continued

Assuming invertibility,

$$Y_t = C(L) B \varepsilon_t$$

where $C(L) = (I - AL)^{-1}$

$$\begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \end{bmatrix}$$

...then we just need to know the first column of B!

Suppose we are just interested in the first shock...

VAR-IV, continued

Suppose we have an instrument Z_t which satisfies

| Assumption 1: "relevance" | $E\varepsilon_{1,t}Z_t = \alpha \neq 0$ |

| Assumption 2: "exogeneity" (wrt the other shocks) | $E\varepsilon_{2,t}Z_t = 0$ |

then, $Ev_tZ_t = \begin{bmatrix} b_{11}\alpha \\ b_{21}\alpha \end{bmatrix}$
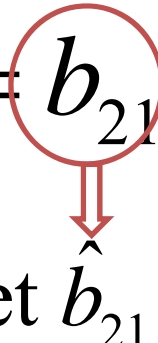
Normalize to equal 1. We can focus on b_{21}.

16

VAR-IV, estimation

Step 1: IV stage Using Z_t as the instrument, estimate:

$$y_{2,t} = b_{21} y_{1,t} + d_1 y_{1,t-1} + d_2 y_{2,t-1} + b_{22} \varepsilon_{2,t}$$

get $\hat{b}_{21}$

Step 2: VAR stage Estimate the reduced form VAR:

$$Y_t = A Y_{t-1} + \nu_t$$

get $\hat{C}(L) = (I - \hat{A}L)^{-1}$

17

VAR-IV, Impulse responses

Compute the h period ahead
Impulse Response Function as:

$$IRF_h = \hat{C}_h \begin{bmatrix} 1 \\ \hat{b}_{21} \end{bmatrix}$$

Our case: Use the news indicator as an IV

- Our news indicator = **Captures only a part of shocks** to expectations about future policies.

  - But it is **correlated with true shocks to expectations**.

  - And it is **uncorrelated with the other types of shocks**.

3. News Indicators

Its construction: a rough sketch

Identify the dates on which important news arrived.

↓

Examine the reaction of construction companies' stock prices.

continued

Companies that are more dependent on public procurements

Companies that are less dependent.

Study the difference in their responses.

22
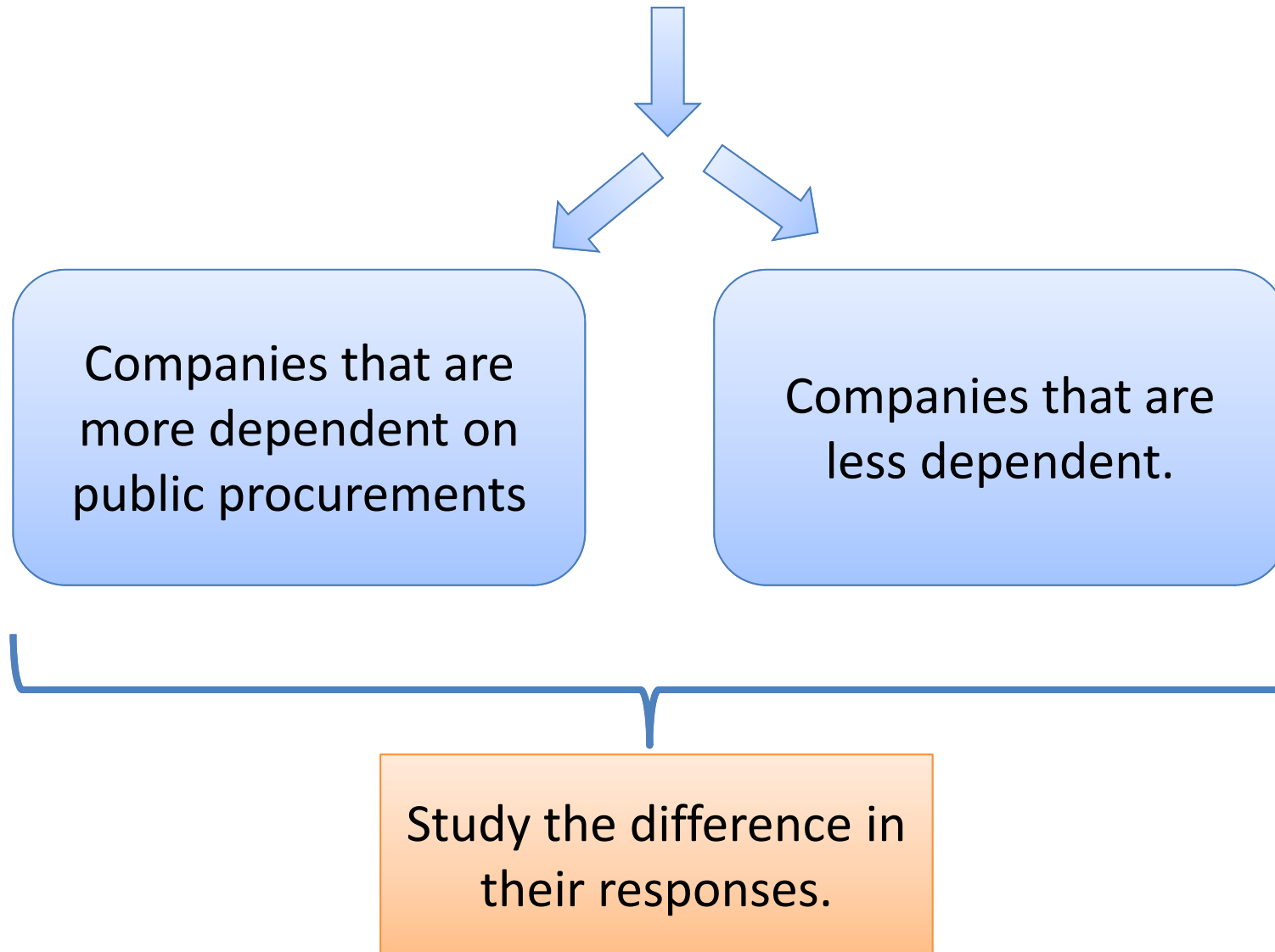
Dependence on Public Investment
= Share of Public work in Total (as of 2000)
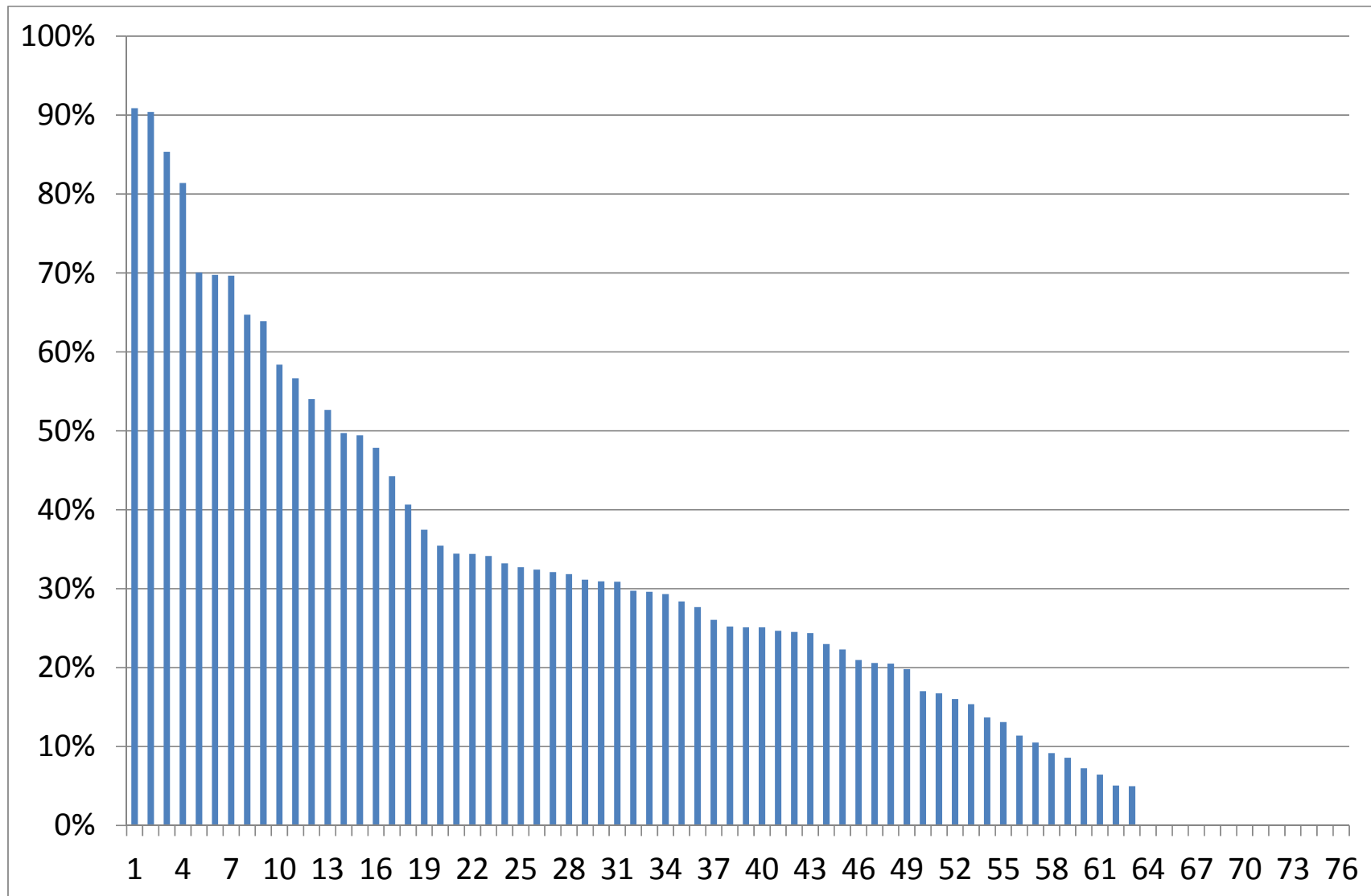
Cross-group heterogeneity?
Example from a big "news" event…

Great East Japan Earthquake (March 11, 2011)
sum of excess returns, March 14-15
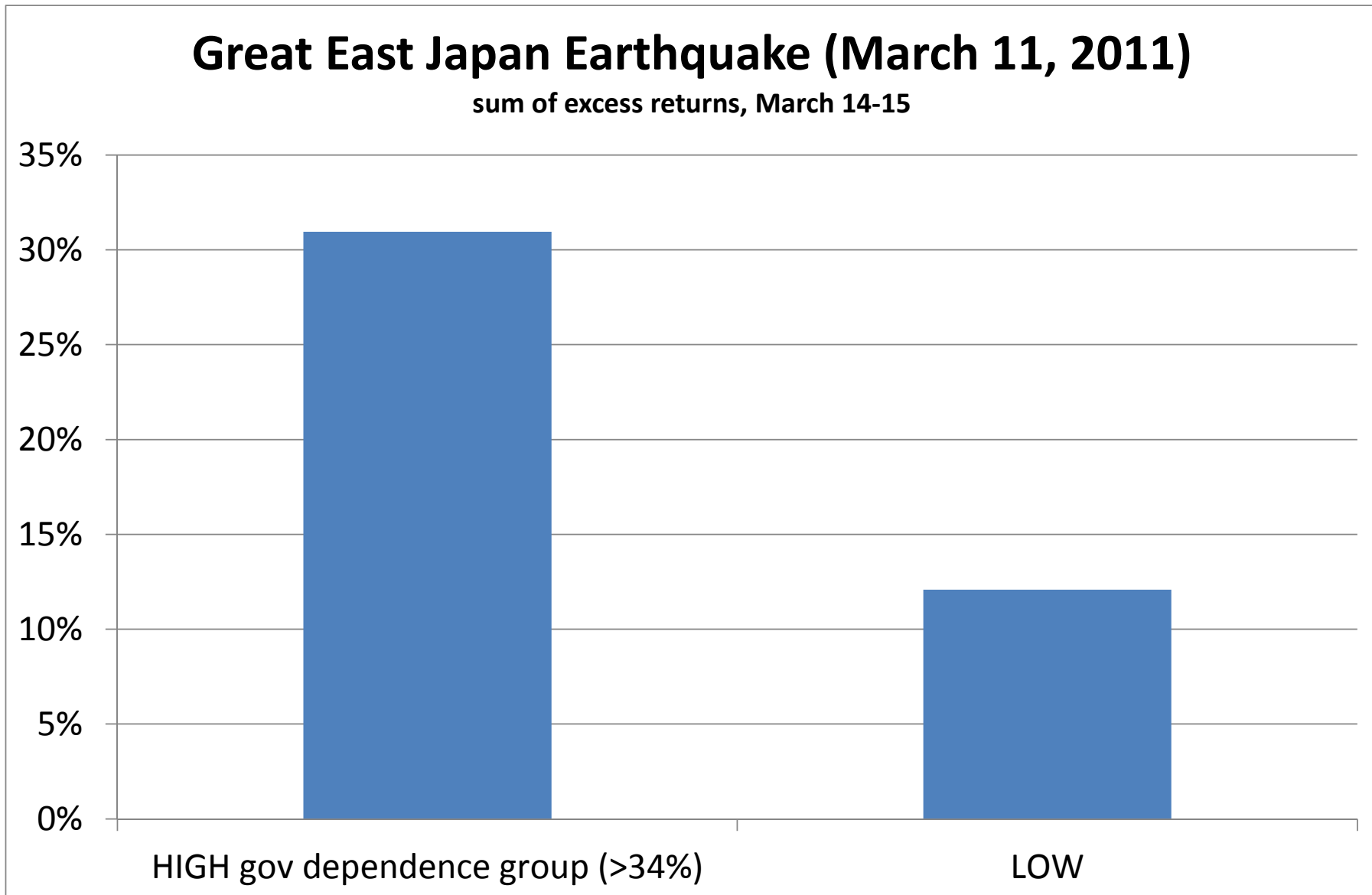
Two stock market indices

- **Stock Mkt Index 1** = "High – Low"

  = (Avg of Upper Half) – (Avg of Bottom Half)

- **Stock Mkt Index 2** = "G-factor"

  – Extract 5 common factors -> **Rotate** them!

  – **Target rotation**: Select a rotation which gives the closest factor loadings to… (see next page)

Target for rotation

	(1) Industry-wide Factor	(2) Home Builders Factor	(3) G-Factor (Gov. Dependence)	(4) Electric Facilities Builders Factor	(5) Plant Builders Factor
Mid-sized Contractors	1	0	0/1	0	0
Big Four Contractors	1	1	0	0	0
Home Builders (all big)	1	1	0	0	0
Electric Facilities Builders	1	0	0/1	1	0
Plant Builders	1	0	0/1	0	1

Stock Mkt Index 1 & 2 (and 0), Cumulative
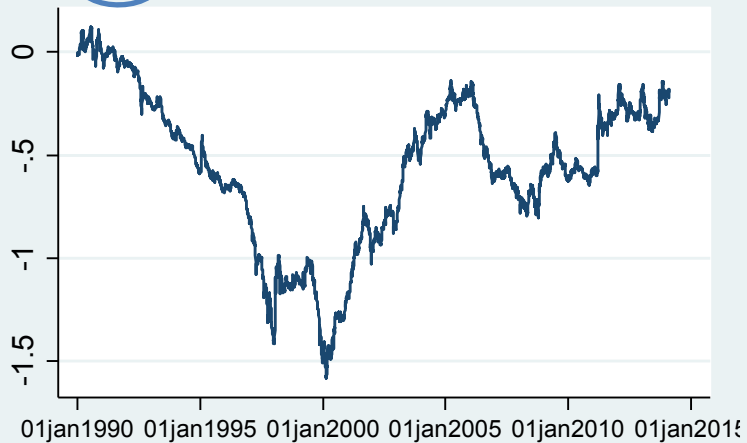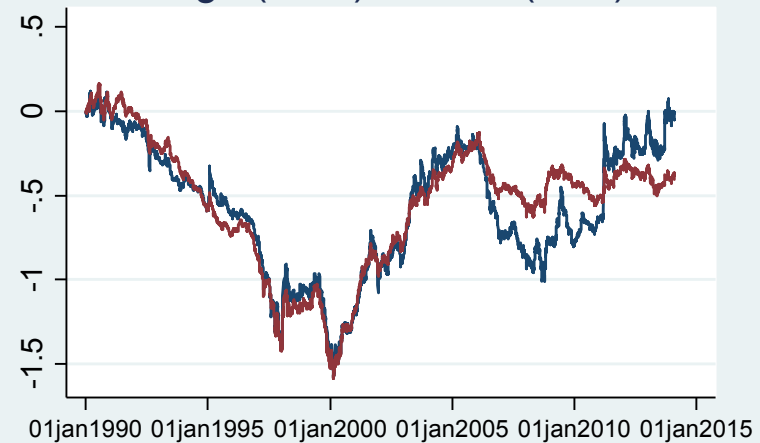
News indicator (1 & 2 and 0)

Defined as

(News dates)*(Stock mkt index 1 or 2 or 0)

News indicators (daily)
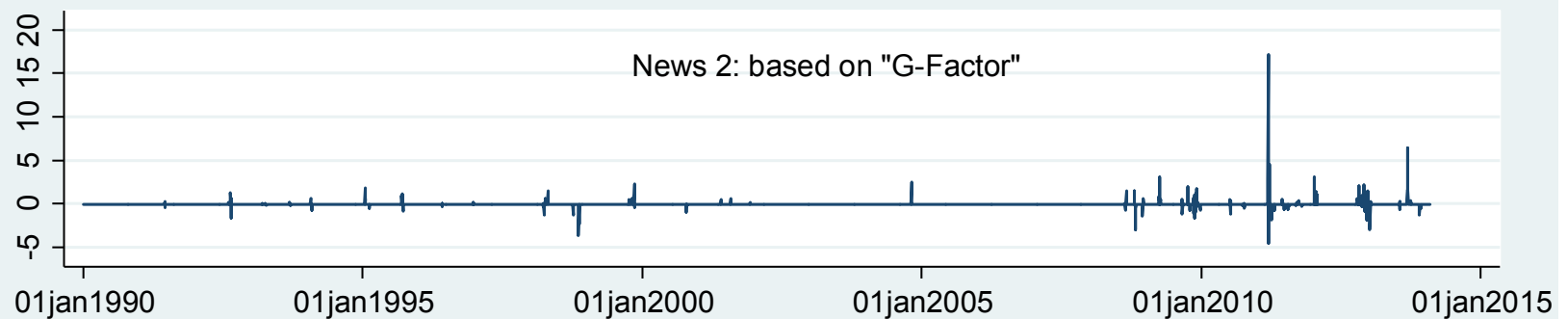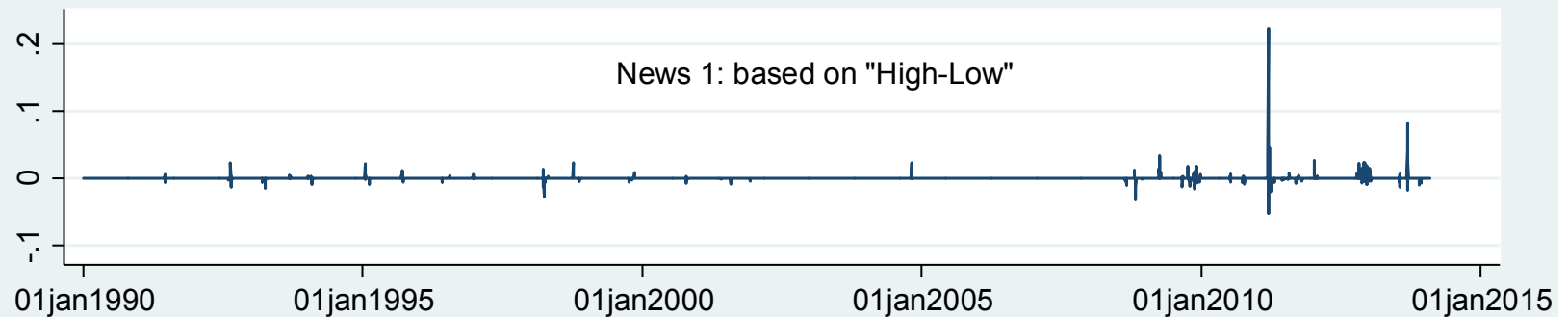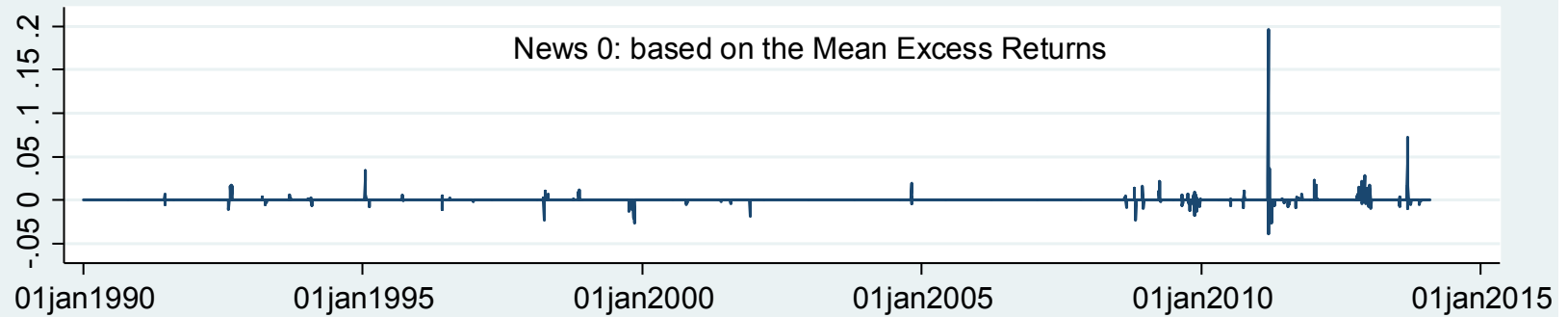
News indicators (quarterly aggregates)
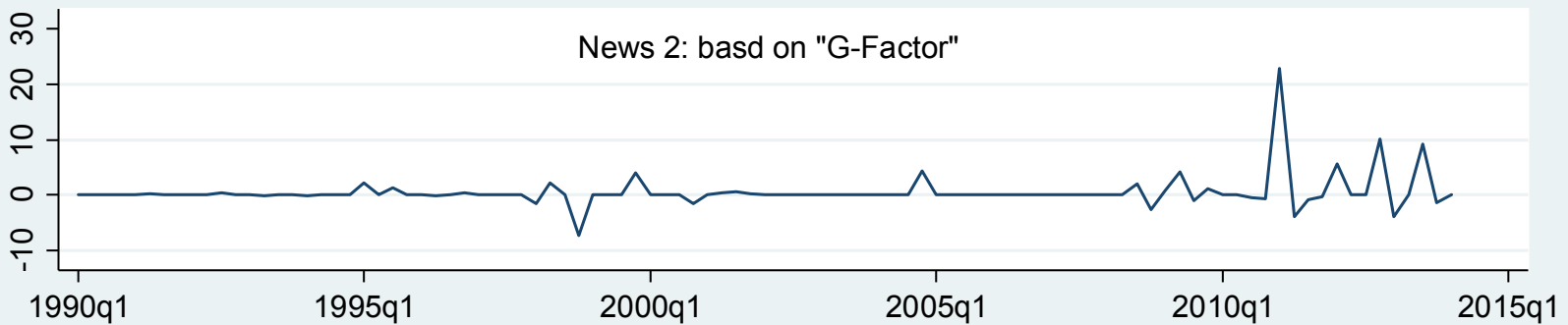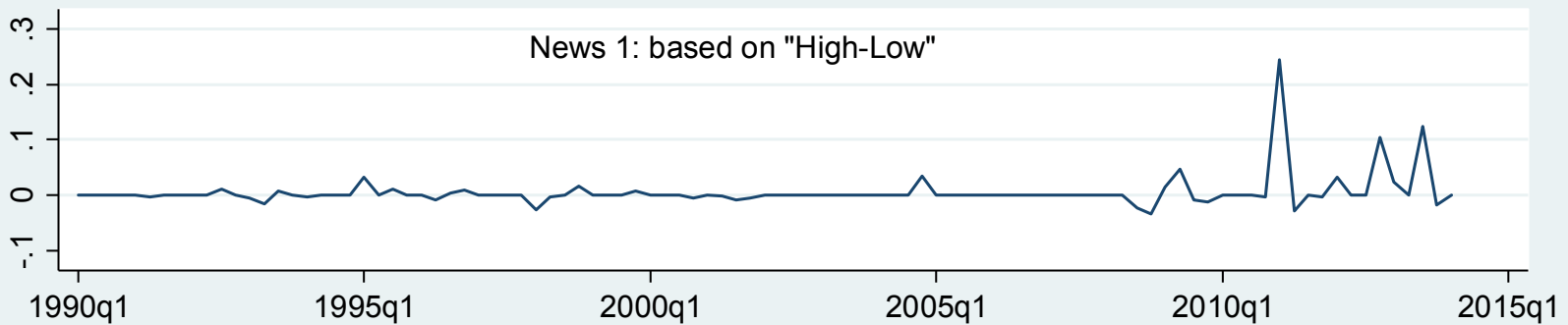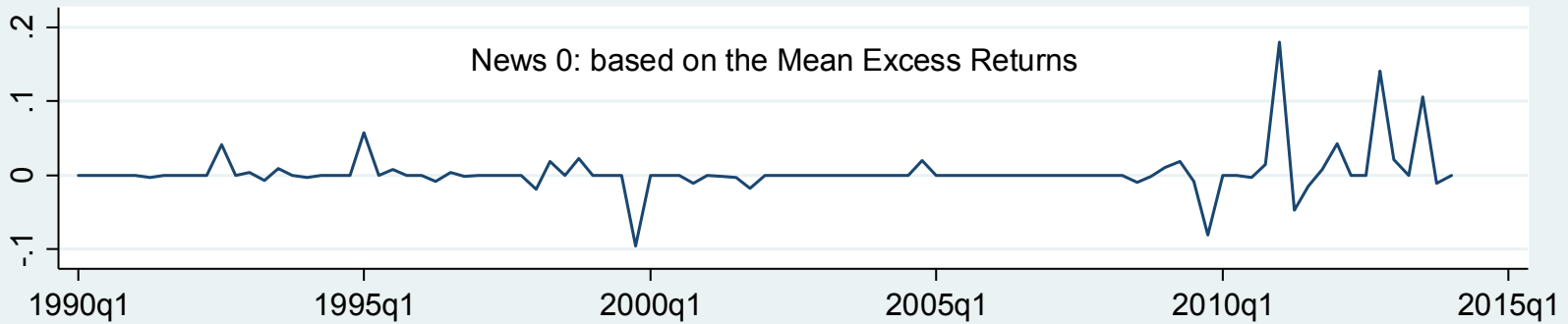
4. VAR-IV analysis: specification and results

VAR-IV

IV = the news indicator

Endogenous variables
= See the list on the next page

List of endogenous variables

- **X1 =Stock Mkt Index 1 or 2 (or 0)**

- Construction orders from the public sector (top 50 companies)

- Nominal Public Investment (SNA)

- Public Investment Deflator (SNA)

- **X5 = One of the macro variables (GDP etc.)**

Specifications

- All in log differences except for the news variables.

- # of lags = 4

- Dummies for the 3 major earthquakes & Consumption tax hike.

X1 = "Stock Mkt Index **1**", X5 = Real GDP, IV =News **1**
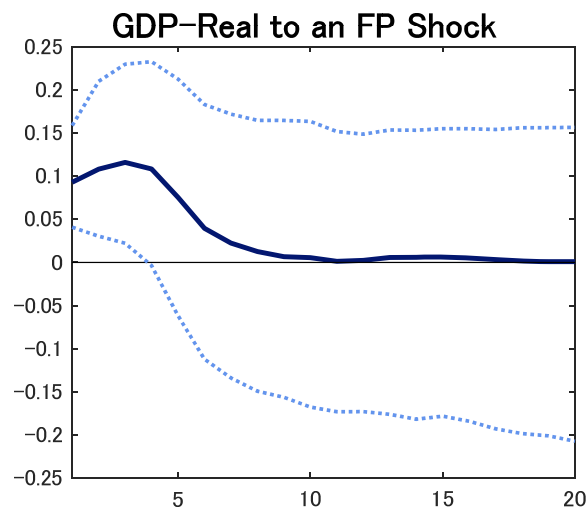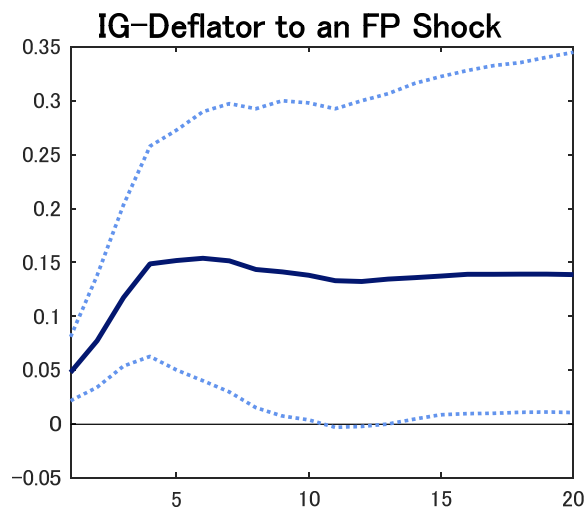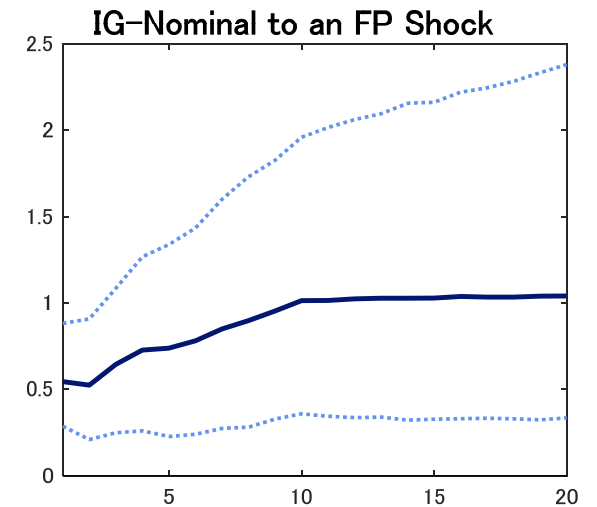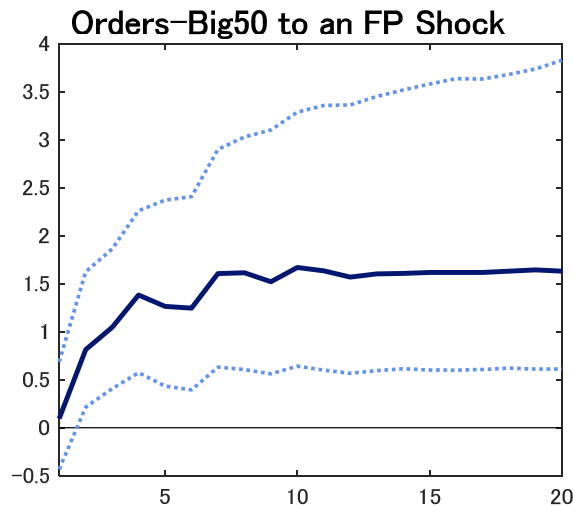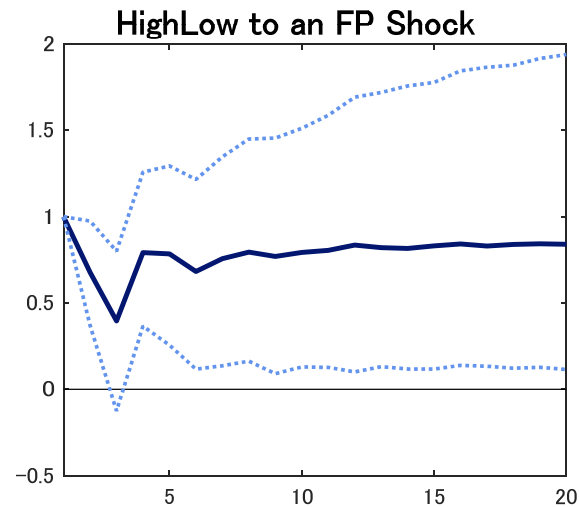
# X1 = Stock Mkt Index **2**, X5 = Real GDP, IV =News **2**
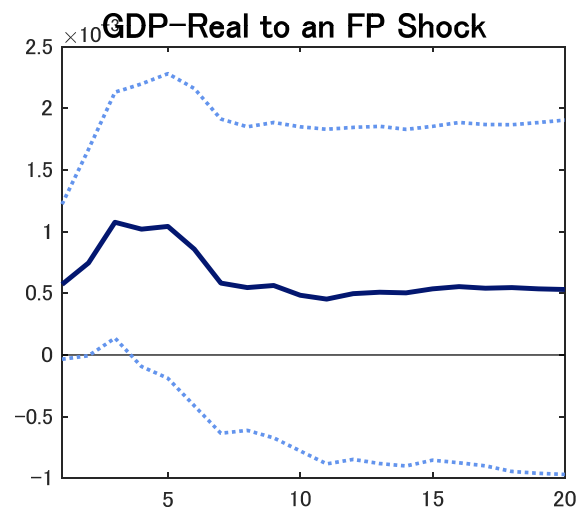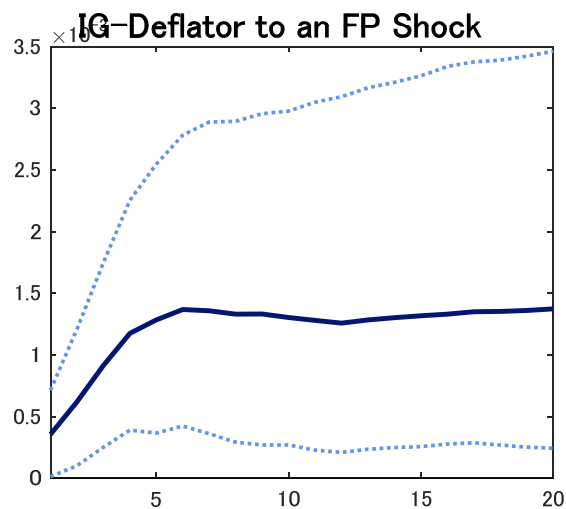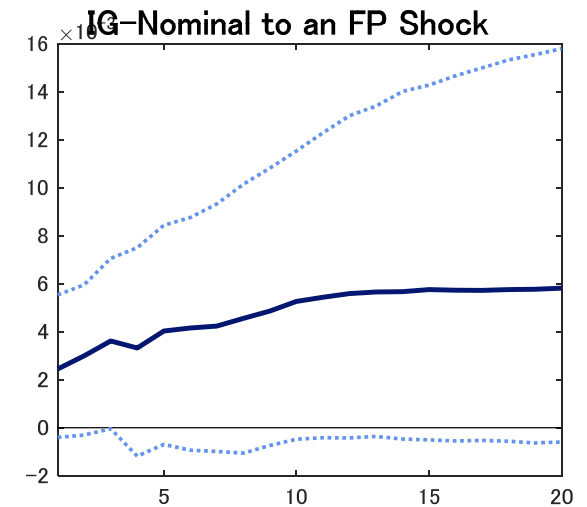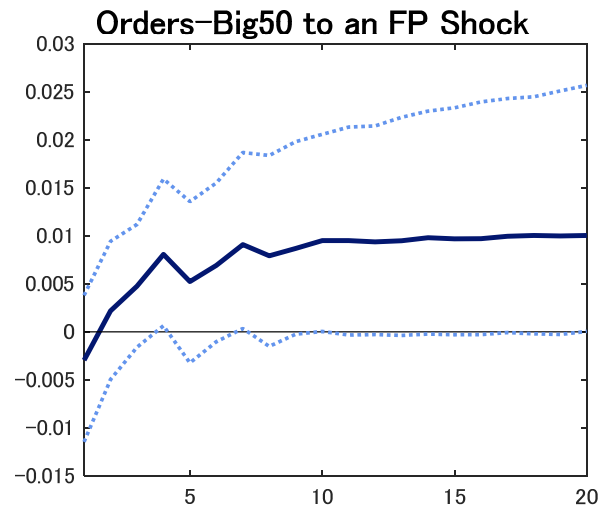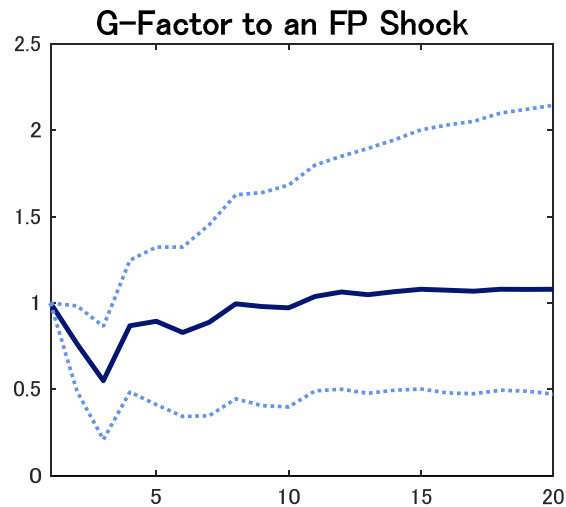
For comparison:

X1 = Stock Mkt Index **0**, X5 = Real GDP, IV =News **0**
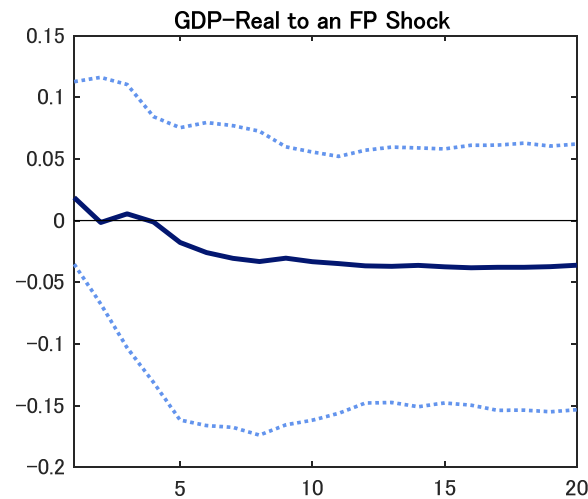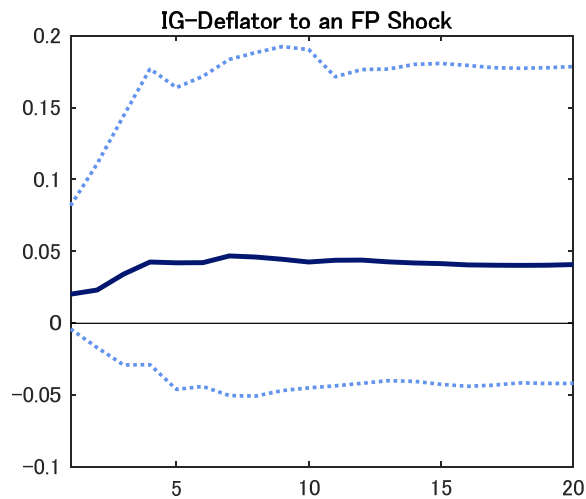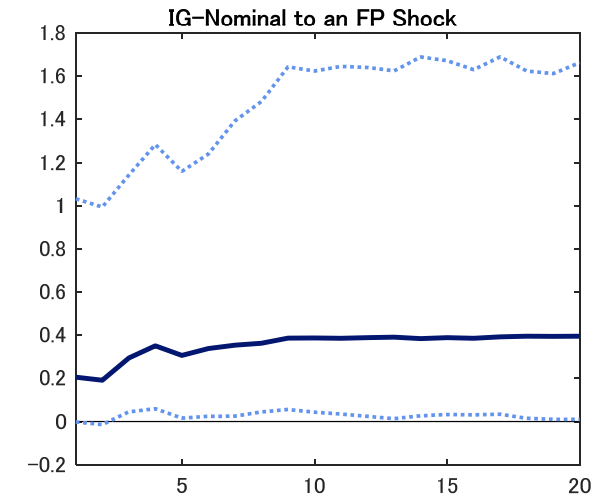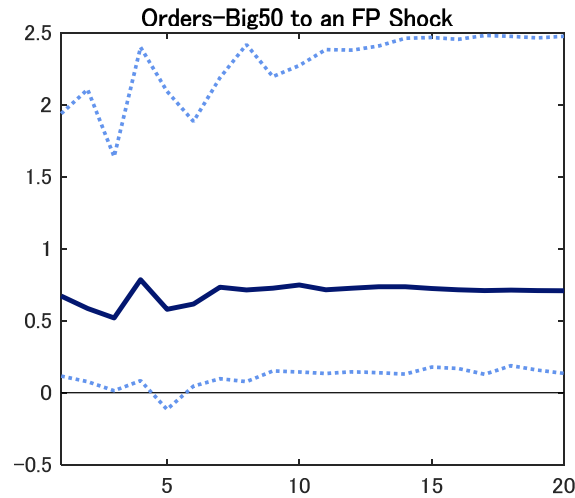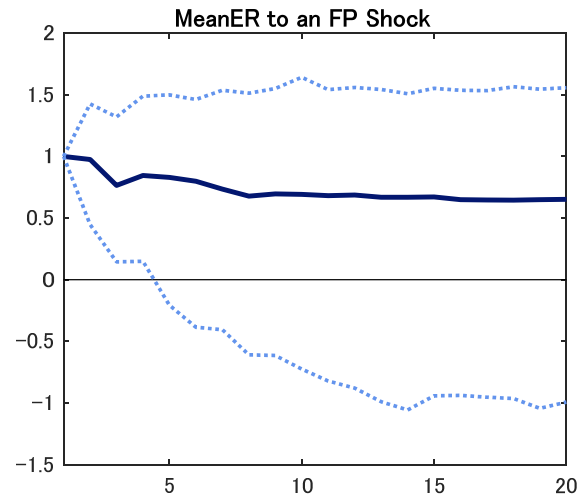
5. Summary

- What we have done:
  - Proposed a new way to estimate effects of an anticipated shock to public investment.
    - Combine stock market info and news.
    - Use VAR-IV

- The identified shock has a positive and significant impact on GDP.

  Impact elasticity = 0.2-0.3

  → Impact multiplier =2-6! (too large?)

Thank you!
Your comments welcome!
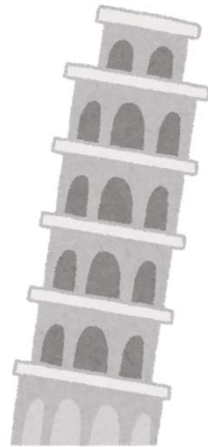
Appendix 1
Details about the news indicator

Literature (1) News-based approach

- **Ramey & Shapiro (Carnegie 1997)**, **Ramey (QJE 2011)**: news about future US military spending.

- For Japan: **Fukuda & Yamada (JJIE 2011)**: News on **Emergency Fiscal Stimulus Packages**.

- Drawback = No sense of **magnitude** or **surprise**

Literature (2) Stock based approach

- **Fisher & Peters (EJ 2010)**
  - Excess return on four large military contractors in the US.

- Drawbacks = They are **Contaminated** signals.

- **Morita (Ph.D. thesis, 2014)**
  - Excess returns of the **Construction Industry** for Japan.
  - **"Purified"** measure based on SVAR.

[1] News Analysis side: List of FP events

1. Extension of the Fukuda-Yamada list of Emergency Stimulus Measures beyond 2010.

2. Reconstruction Budget after the Great East Japan Earthquake.

3. Important National Elections.

4. Natural Disasters (three earthquakes and a tunnel collapse).

5. Future Sports Events (Nagano, World-cup, Tokyo)

6. "Negative" Fiscal Events (Hashimoto reform, Koizumi reform, "Shiwake").

Identified **38 FP events**; **159 dates**.

[2] Stock market side

- Original data: Construction industry's 177 firms, listed on Tokyo Stock Exchange (1st or 2nd), <u>at some point between 1974 and 2014</u>.

- Returns = log difference of the close price.

- We regress them on the Market (TOPIX) return to obtain excess returns.

- **Are they really informative?** Let's see…

Excess returns by firm

(a) Great East Japan Earthquake (March 14-15, 2011)
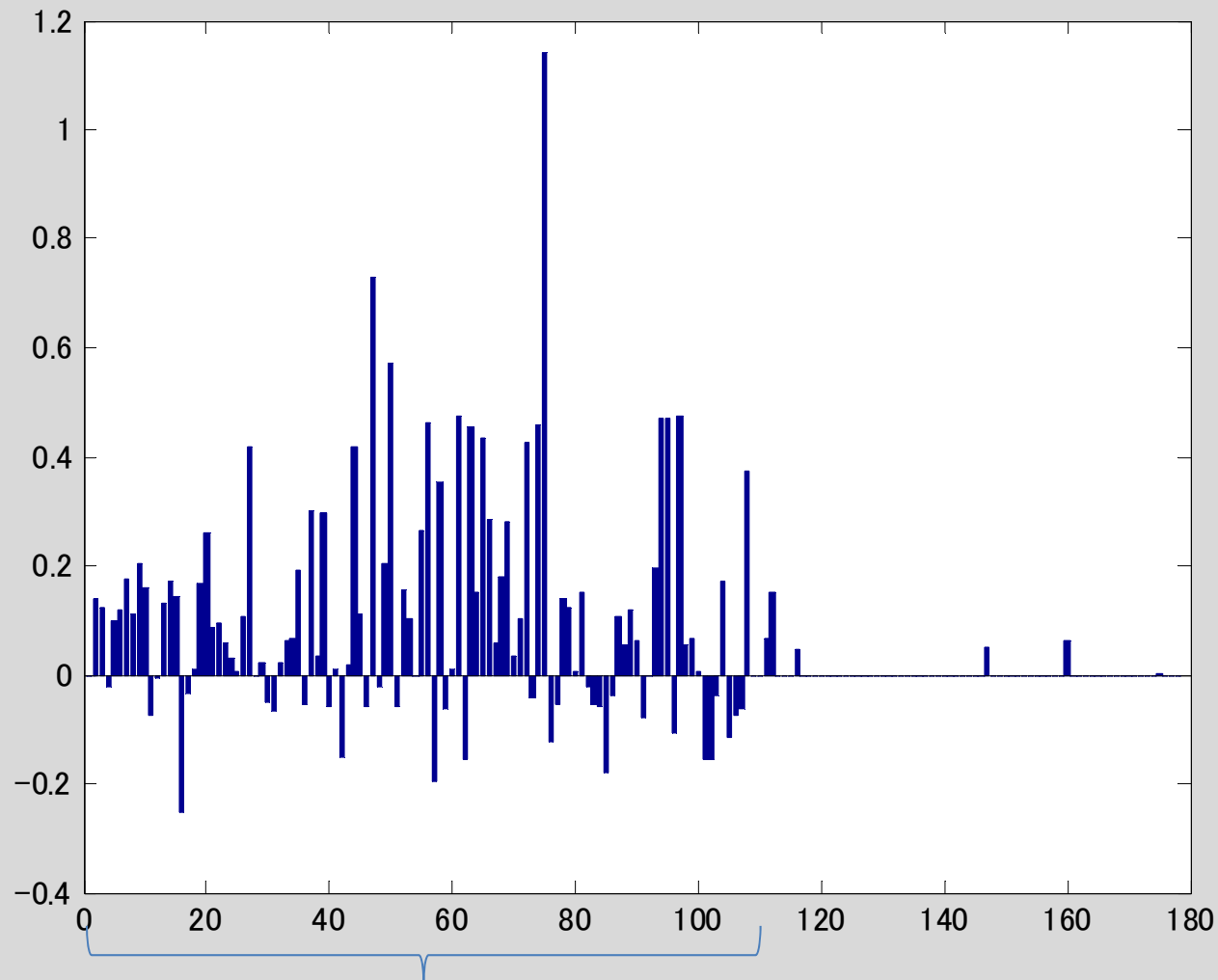
Ranking based on the total market value as of 2012 (if present).

46

(b) Sasako Tunnel Failure (December 3-5, 2012)
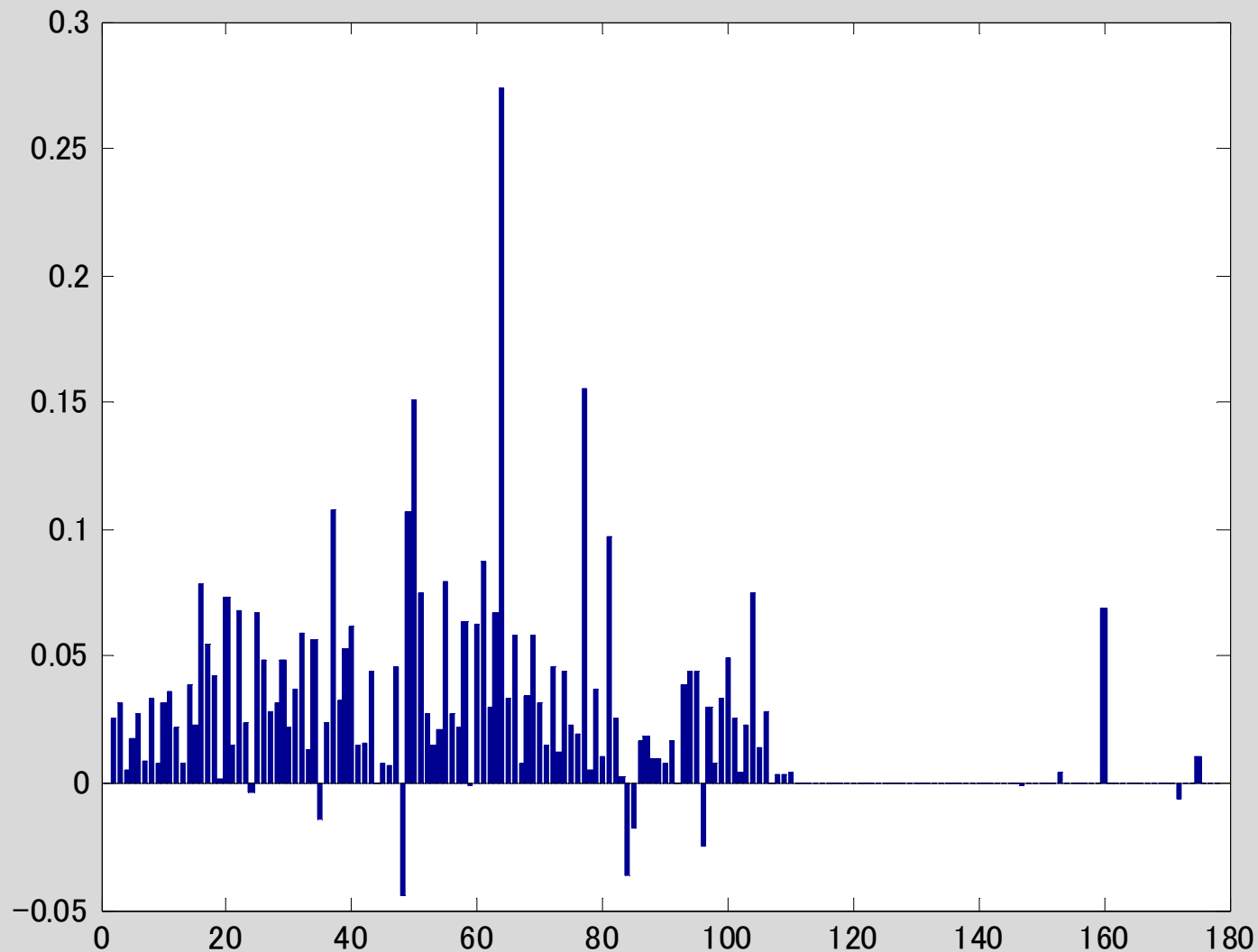
(c) IOC gives the Olympics 2020 to Tokyo (Sept 9-11, 2013)
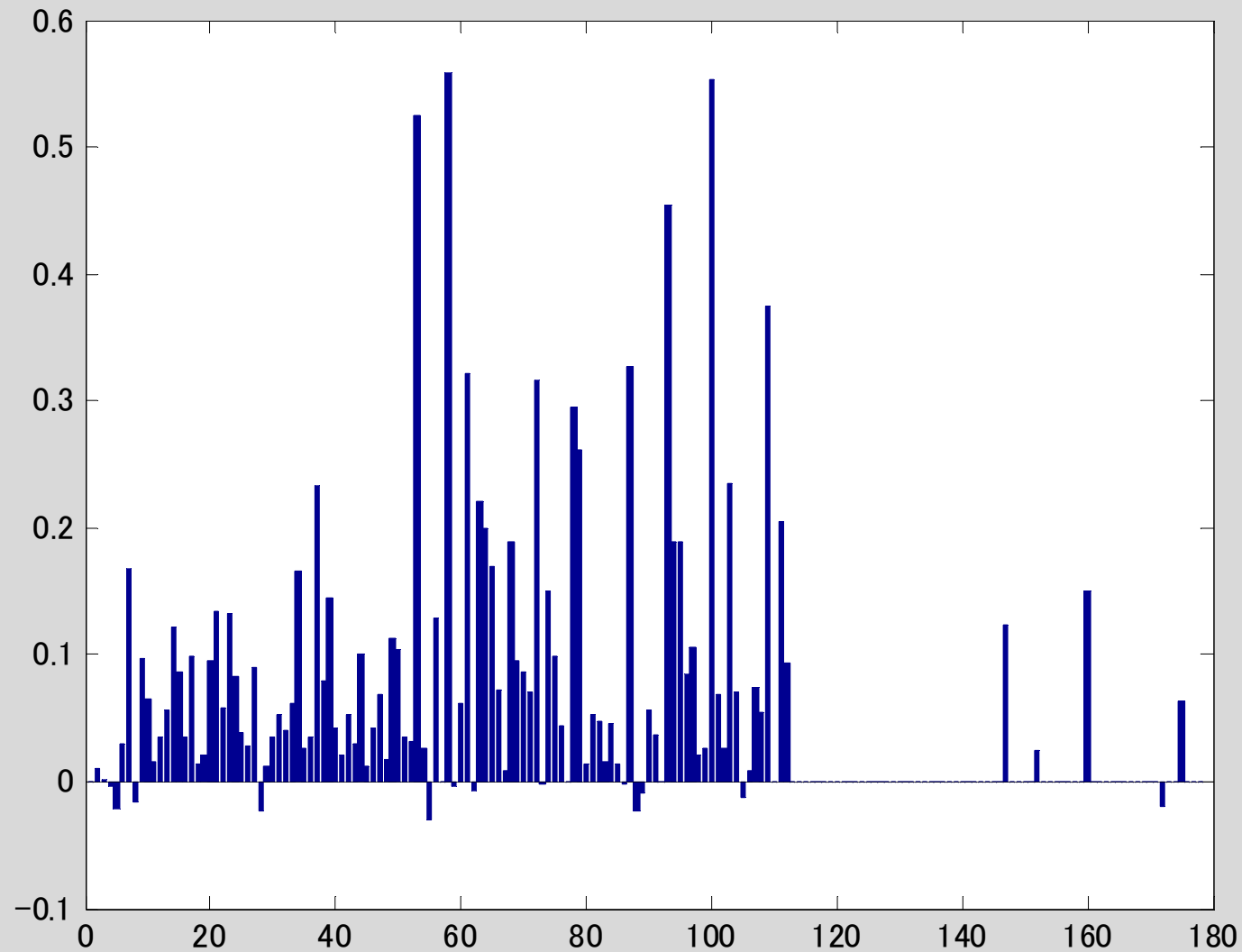
(d) FIFA gives World Cup 2002 to Korea/Japan (June 3, 1996)
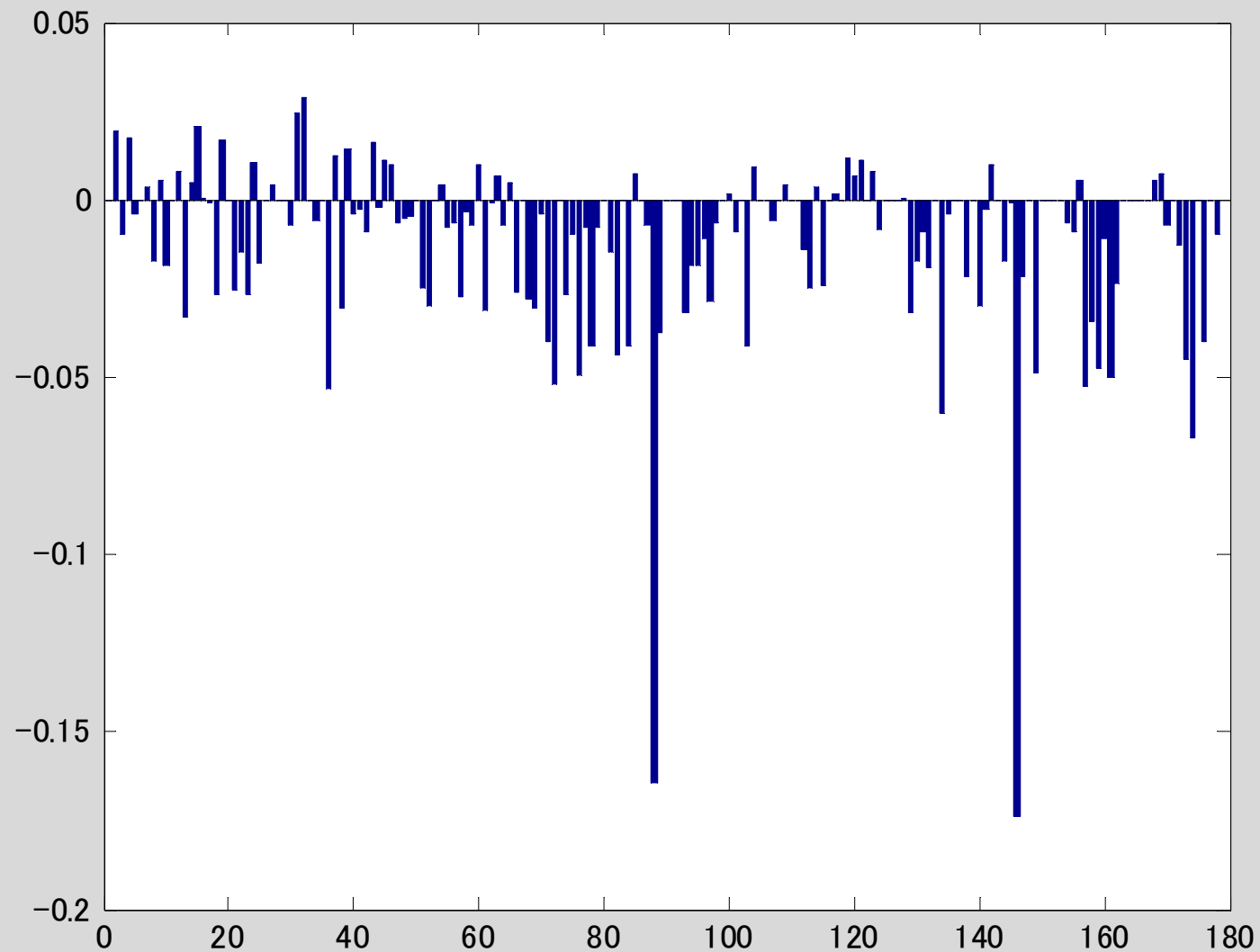
(e) "Shiwake" (Nov 10-27, 2009)
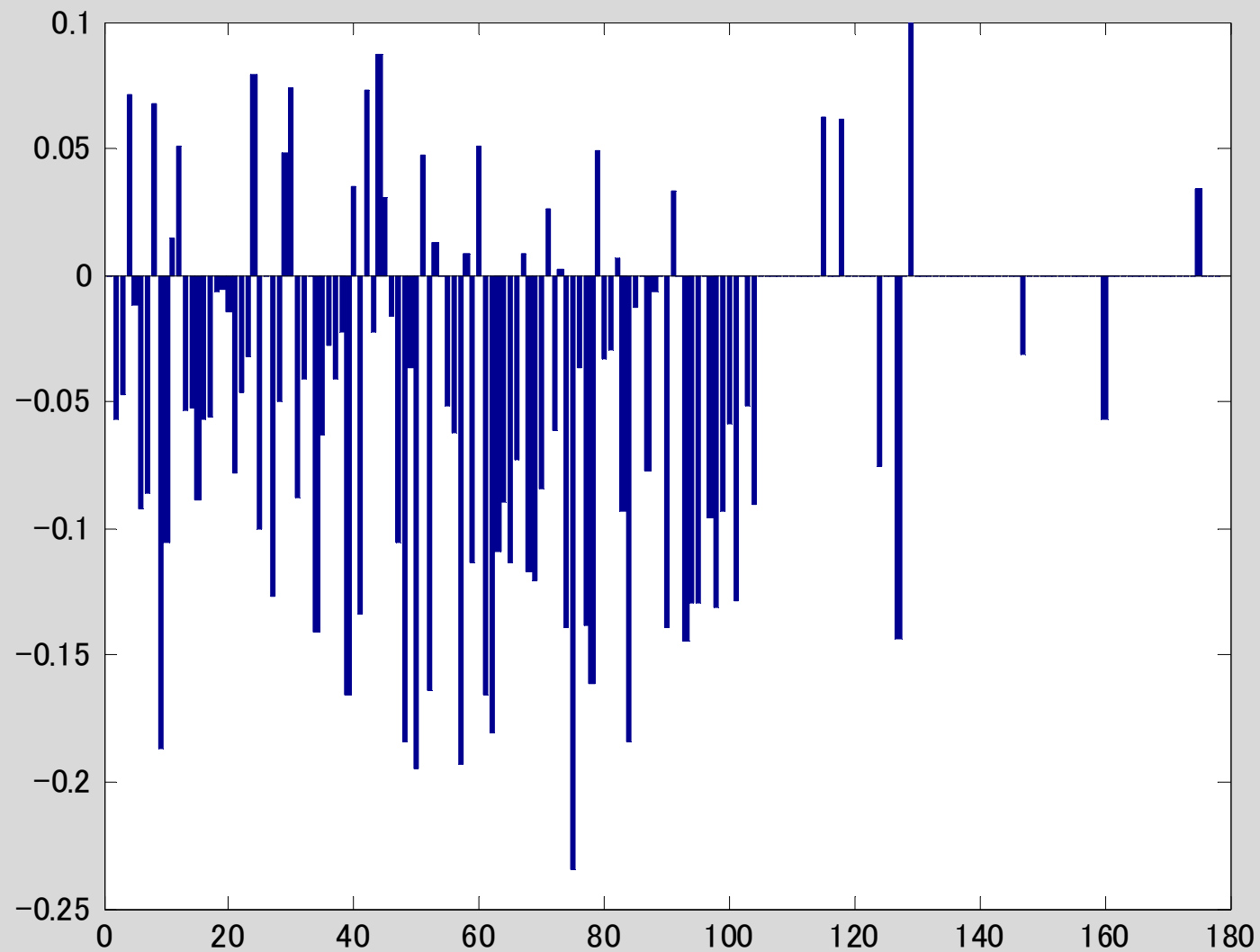
How do we combine the two sides?

- Take a simple average?
- But it may reflect all sorts of things.

- Instead, we take advantage of **within-industry heterogeneity.**

- From here, data is limited to 76 firms that existed throughout the period 1990-2014.

IOC announces Tokyo to hold the Olympics Games
sum of excess returns, Sept. 8-10, 2013
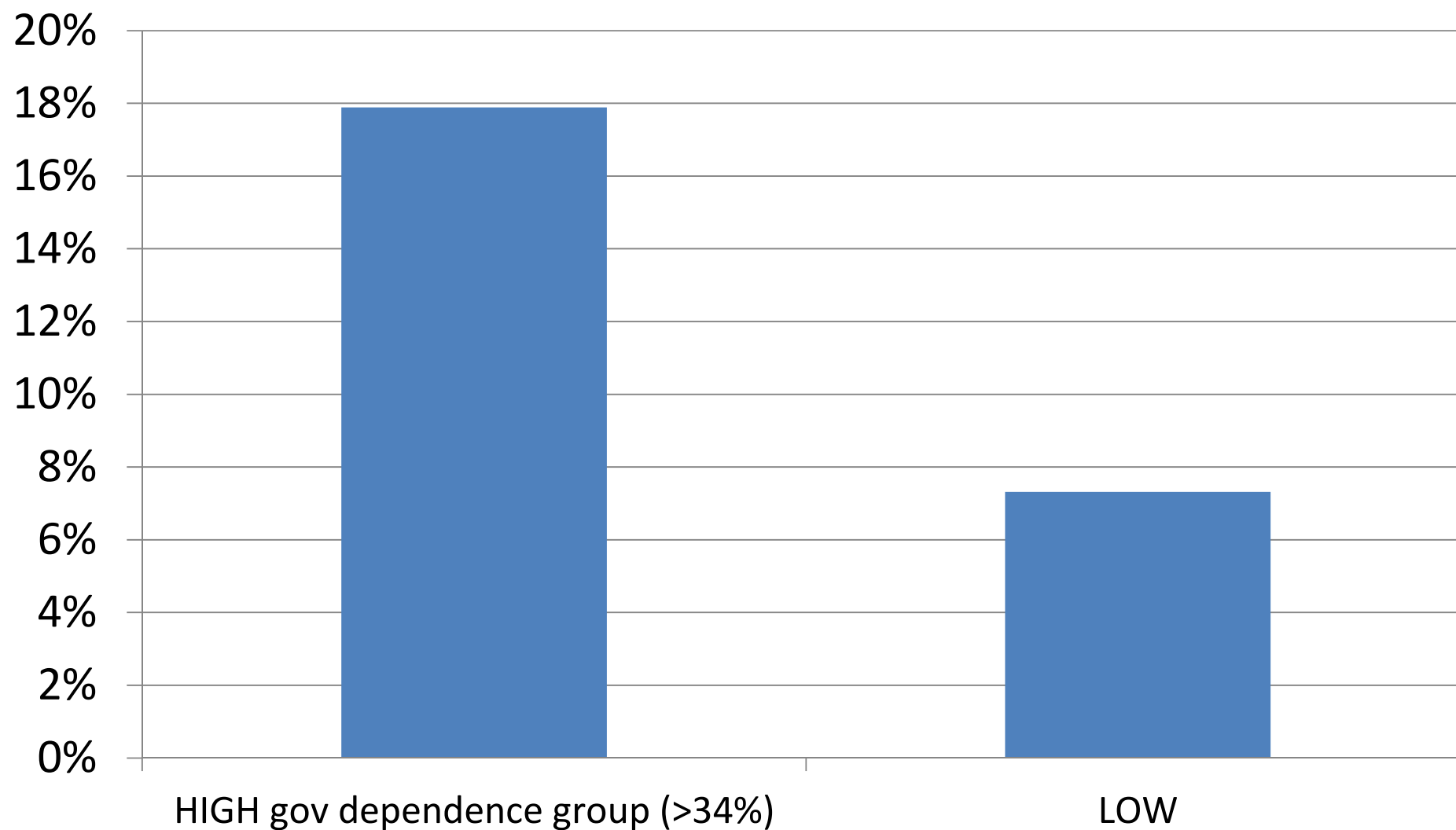
Appendix 2
Factor loadings

Factor loadings
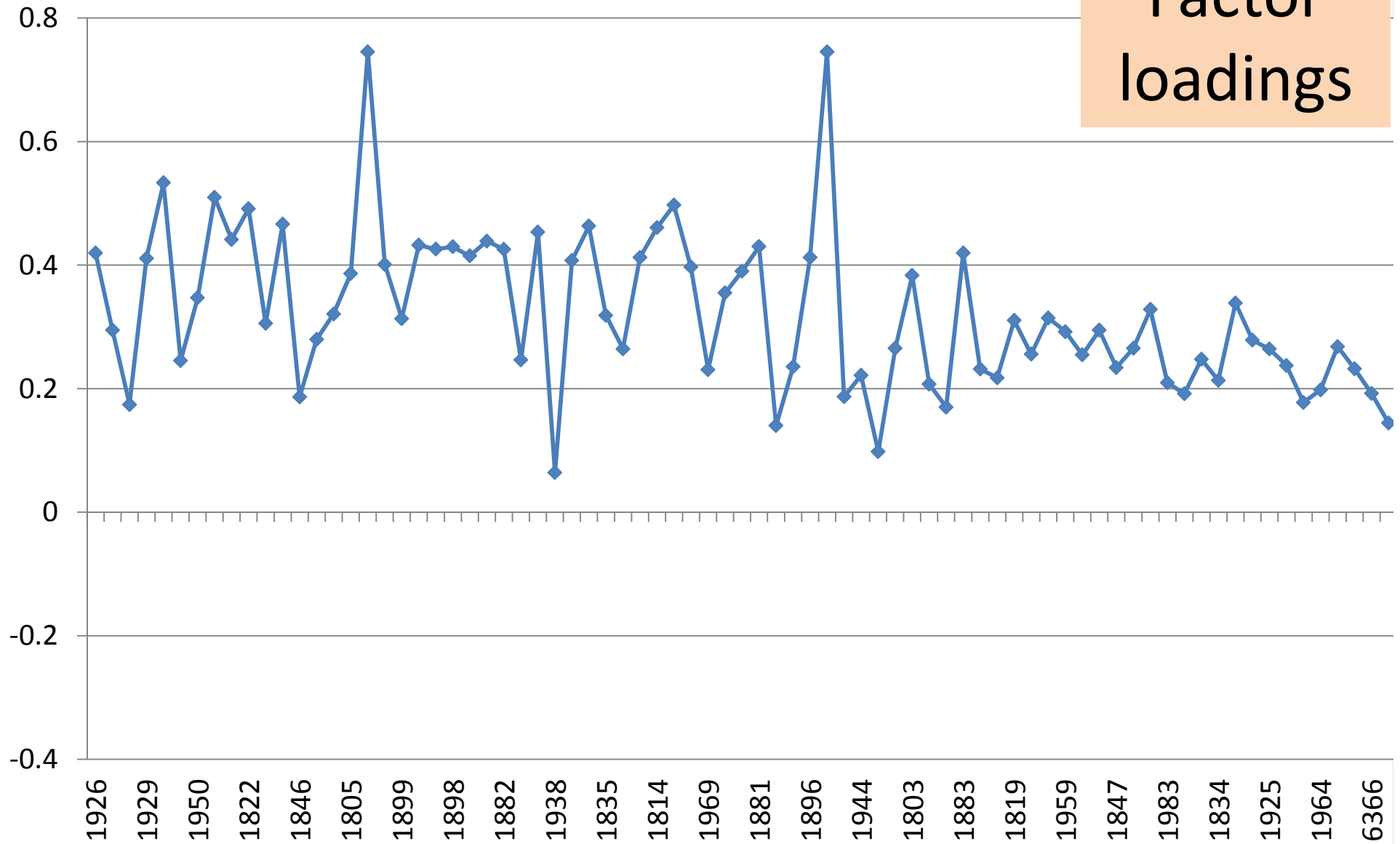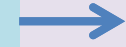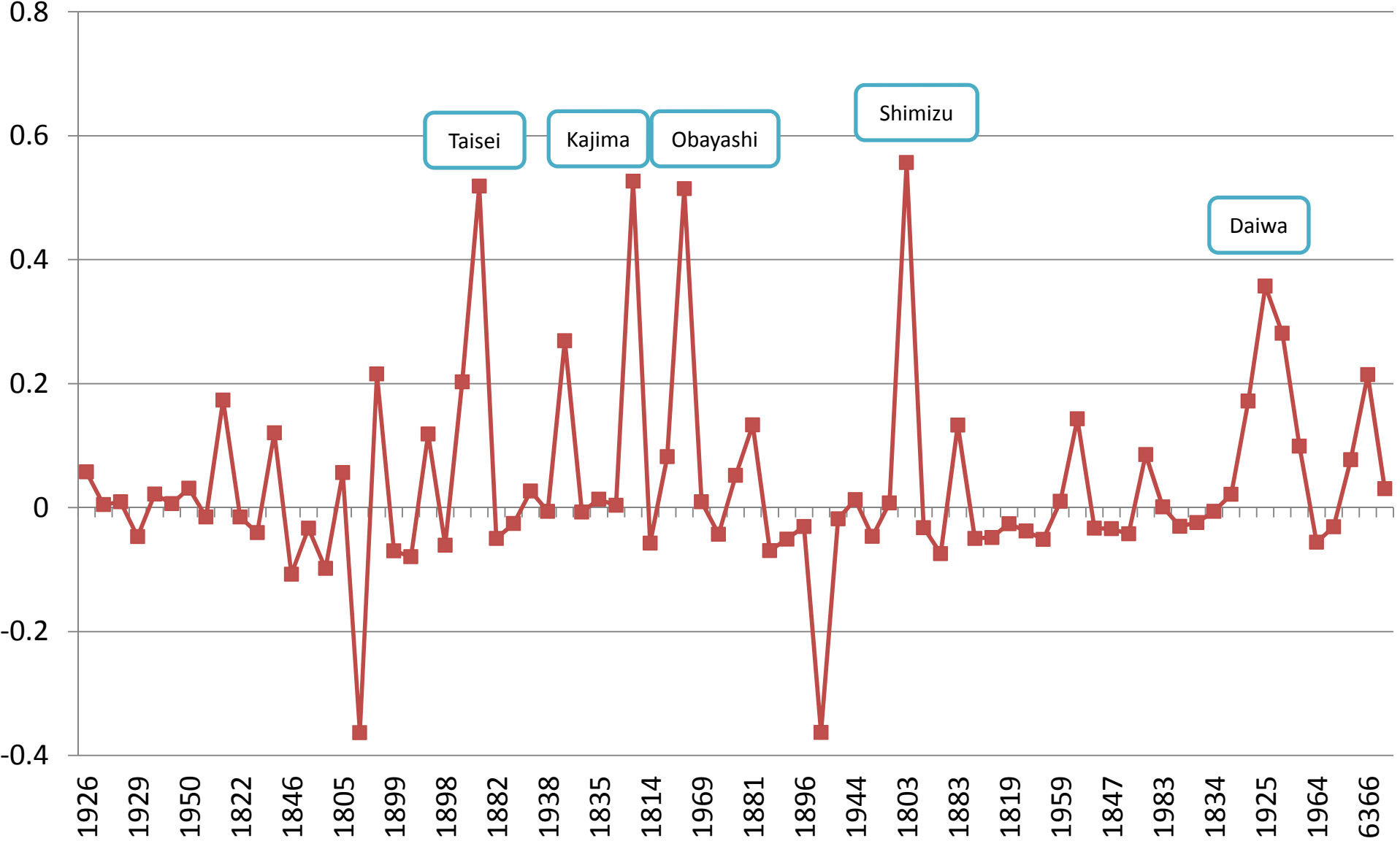
Factor2

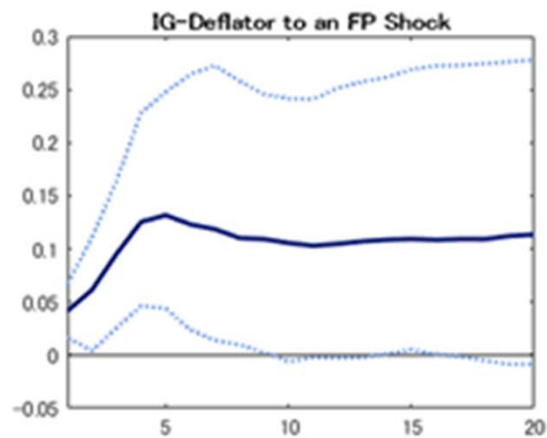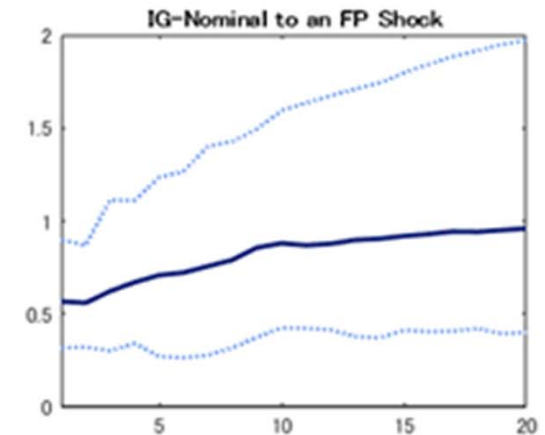Factor3
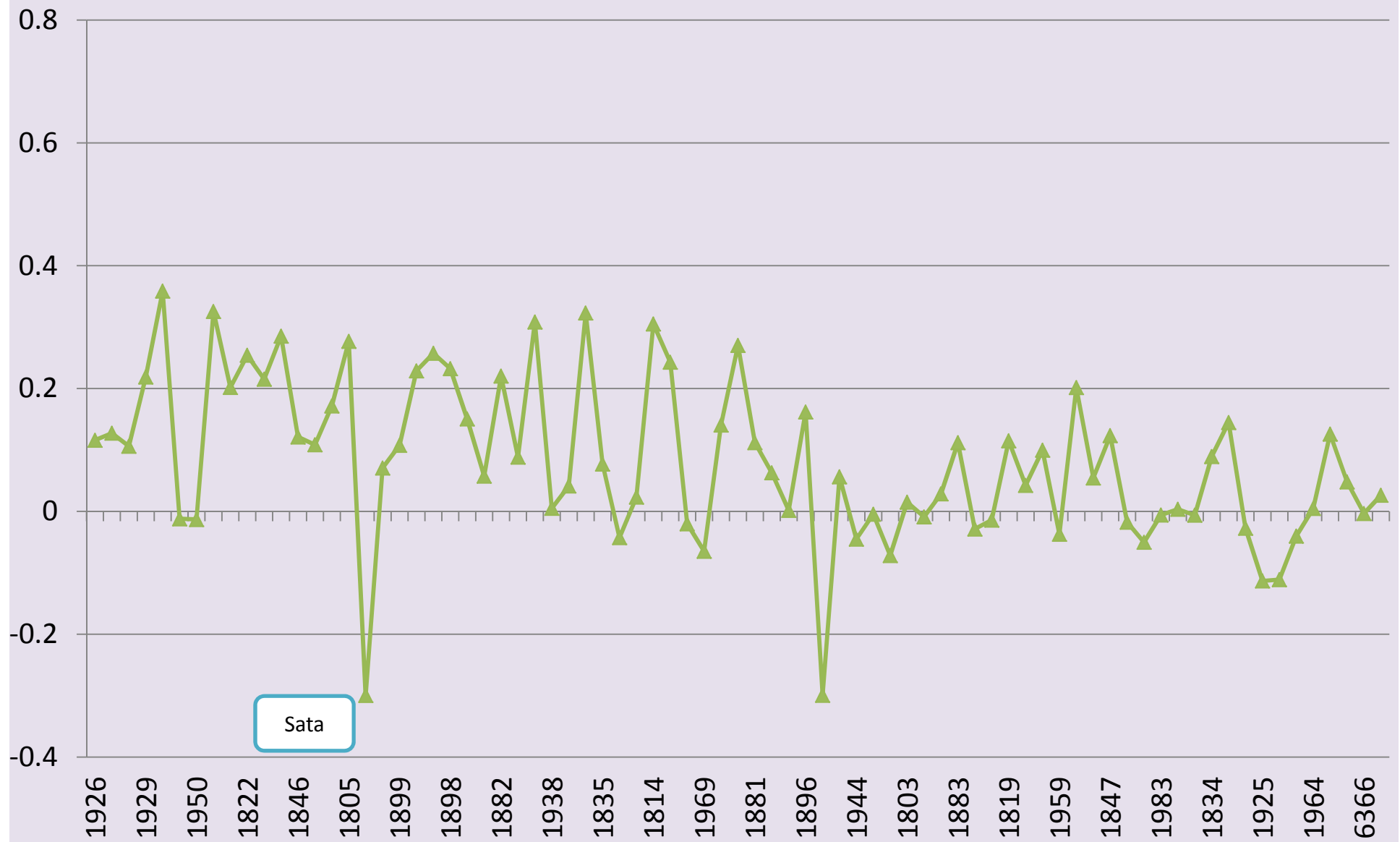
Appendix 3
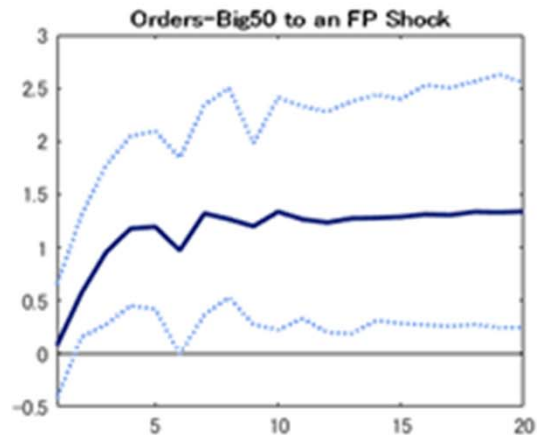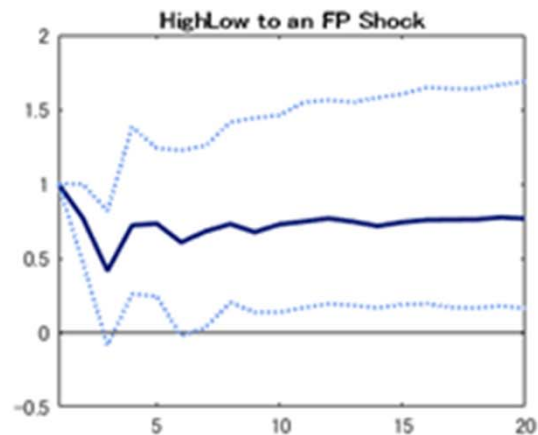## More IRFs
(X1= High-Low)

X5 = Real consumption
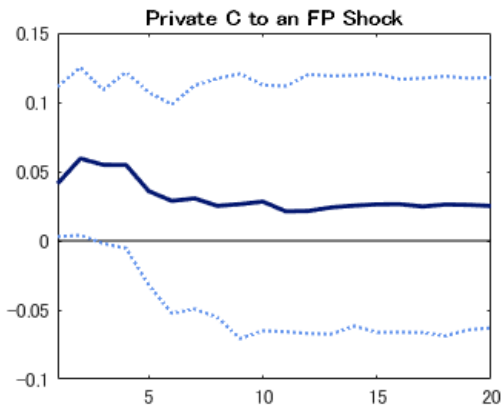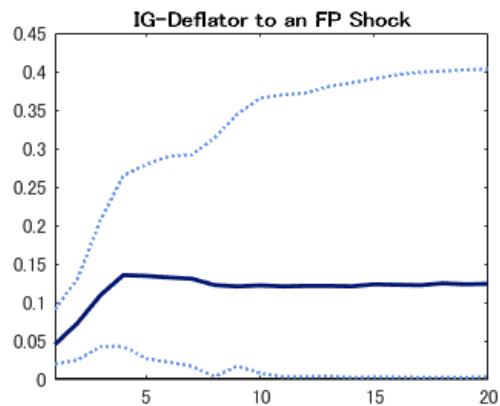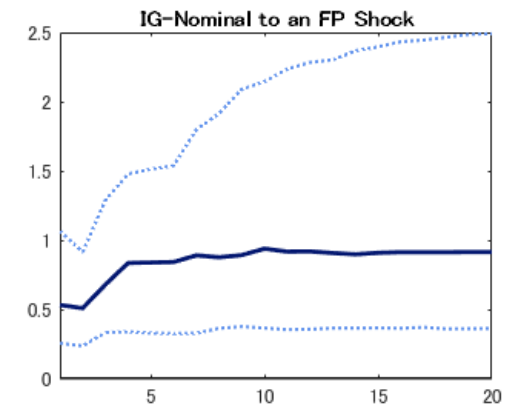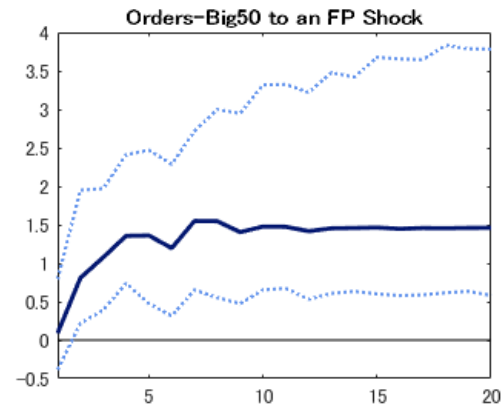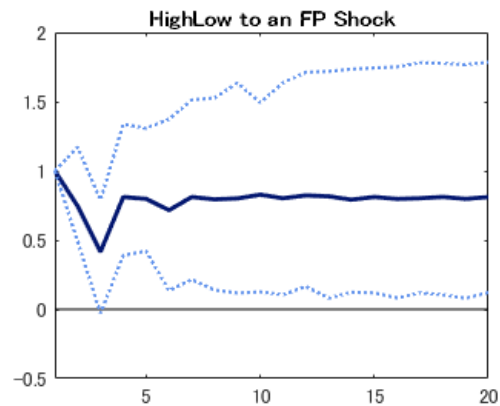
X5 = Real Business Investment
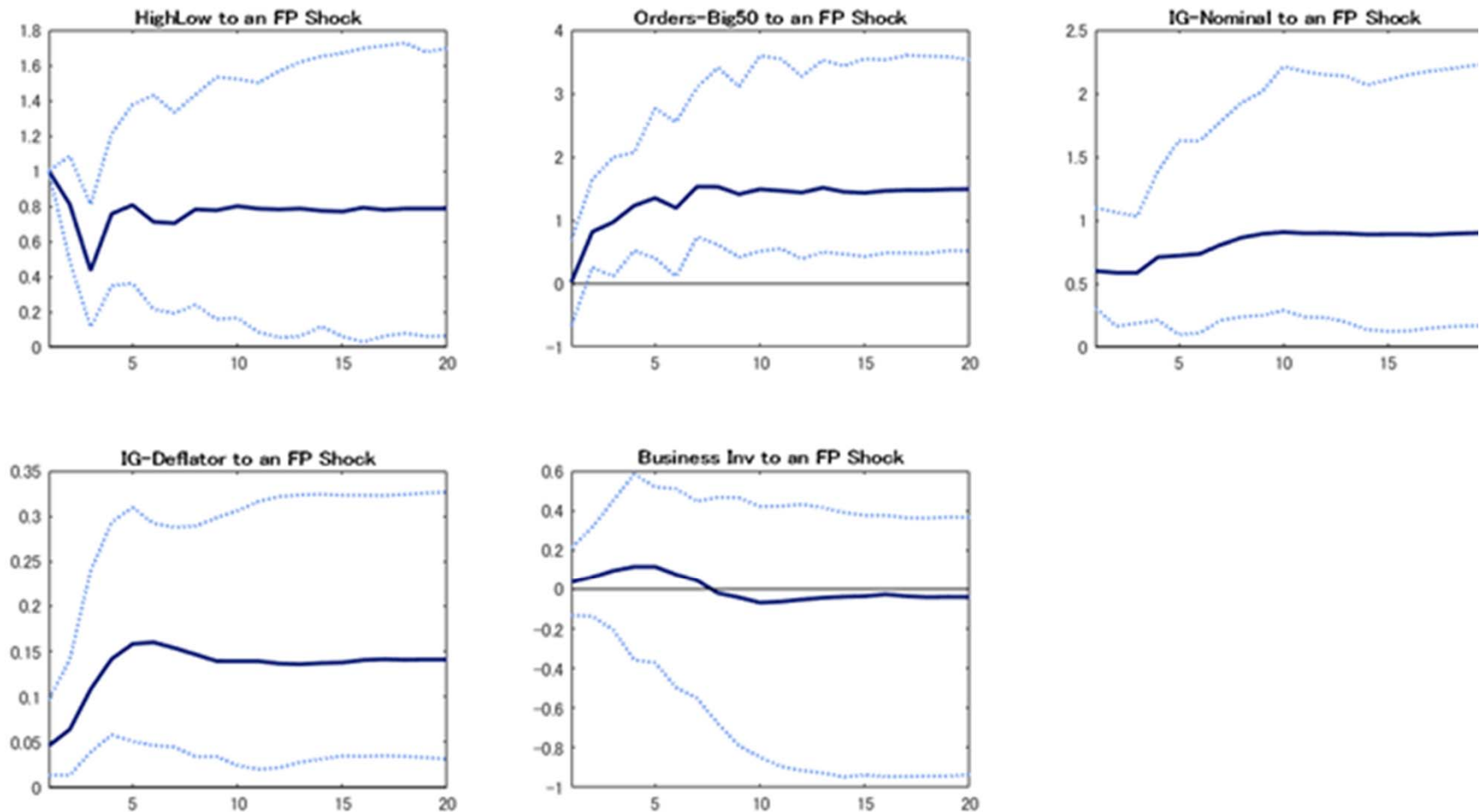
X5 = GDP Deflator

X5 = Nominal GDP