BANK FOR INTERNATIONAL SETTLEMENTS

The evolution of inflation expectations in Japan

Masazumi Hattori and James Yetman

Hitotsubashi University Policy Forum on "Inflation: theory and reality", 17/2/2017

Inflation forecasts from Consensus….

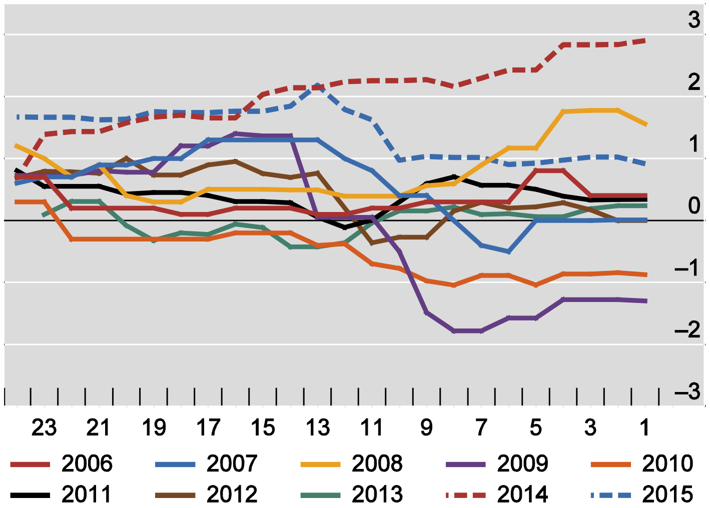
- Lots of horizons
  - Updated every month
  - Forecasts of current and following calendar years
- Lots of forecasters
  - 20-30 each month
- What's the best way to model / think about these?


Acting Like Animals.com

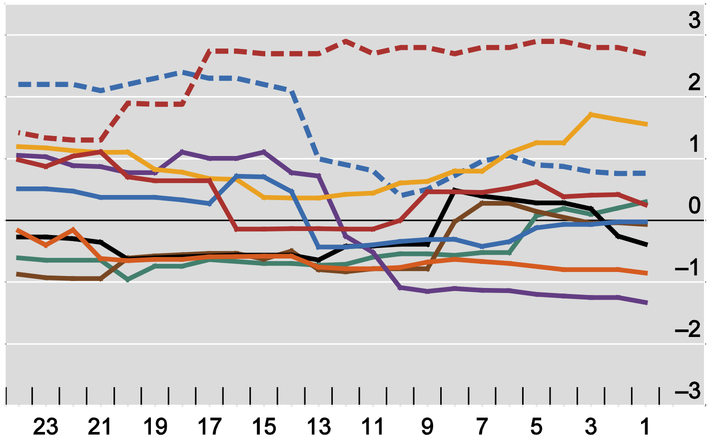
Forecasts of inflation across horizons

Graph 2a

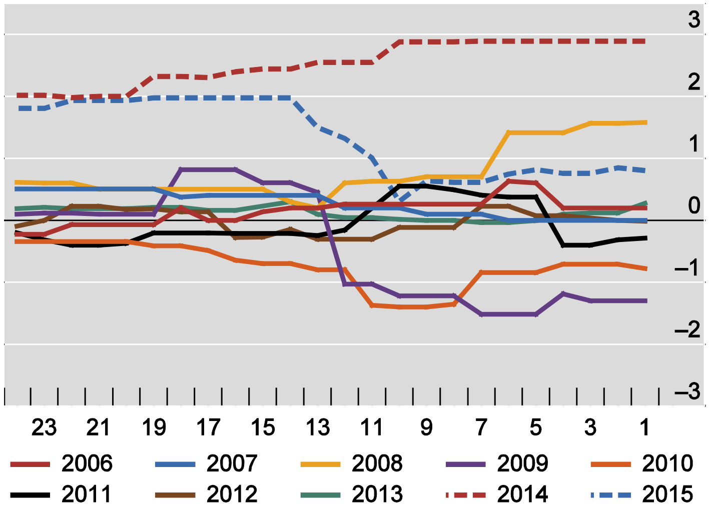
Forecaster 10



Forecaster 12



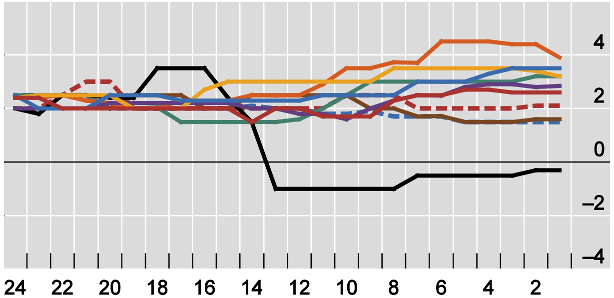
Forecaster 16



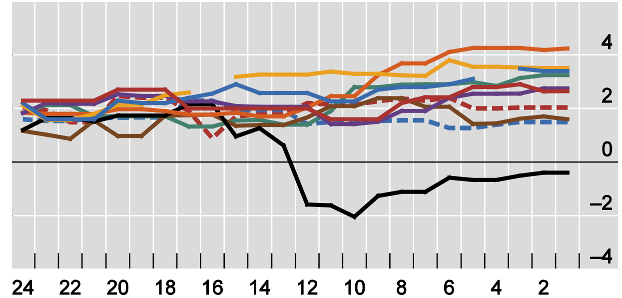
Each line shows forecasts of a given inflation outcome at different horizons. The horizontal axis shows the forecast horizon, eg "24" indicates forecasts made 24 months before the completion of the calendar year being forecast. The vertical axis is measured in percentage points.

Source: Authors' calculations.

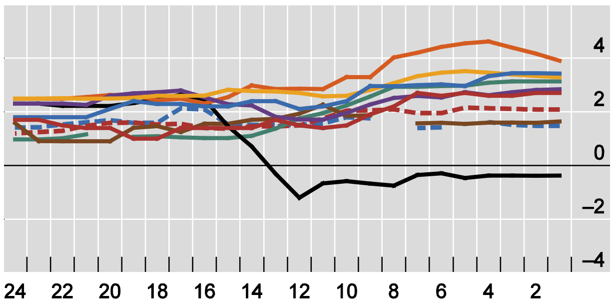
US forecaster 5



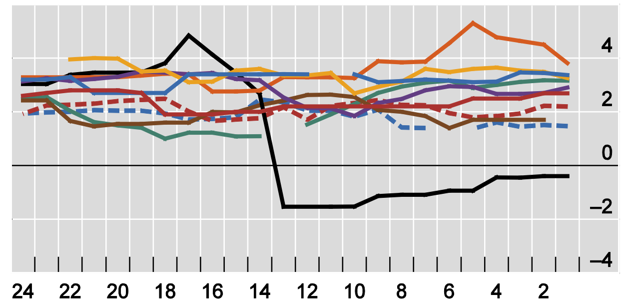
US forecaster 12



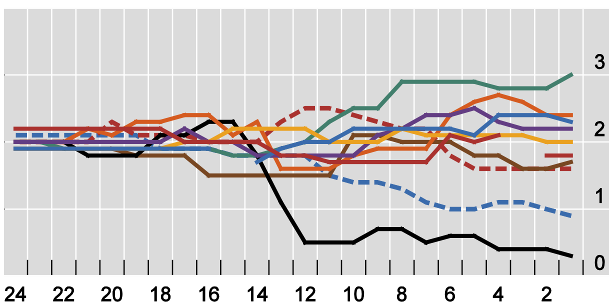
US forecaster 19



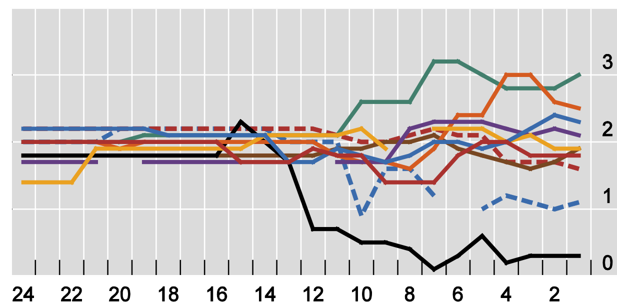
US forecast 29



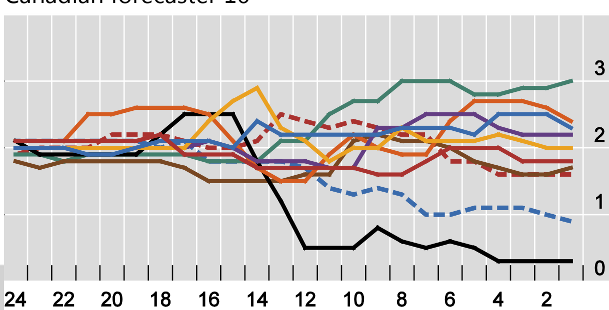
Canadian forecaster 7



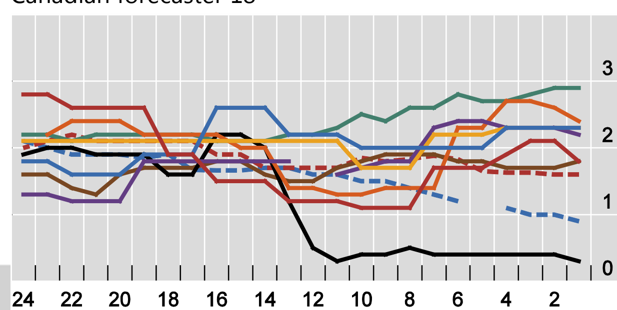
Canadian forecaster 10



Canadian forecaster 16



Canadian forecaster 18



2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

Modelling consensus inflation forecasts….

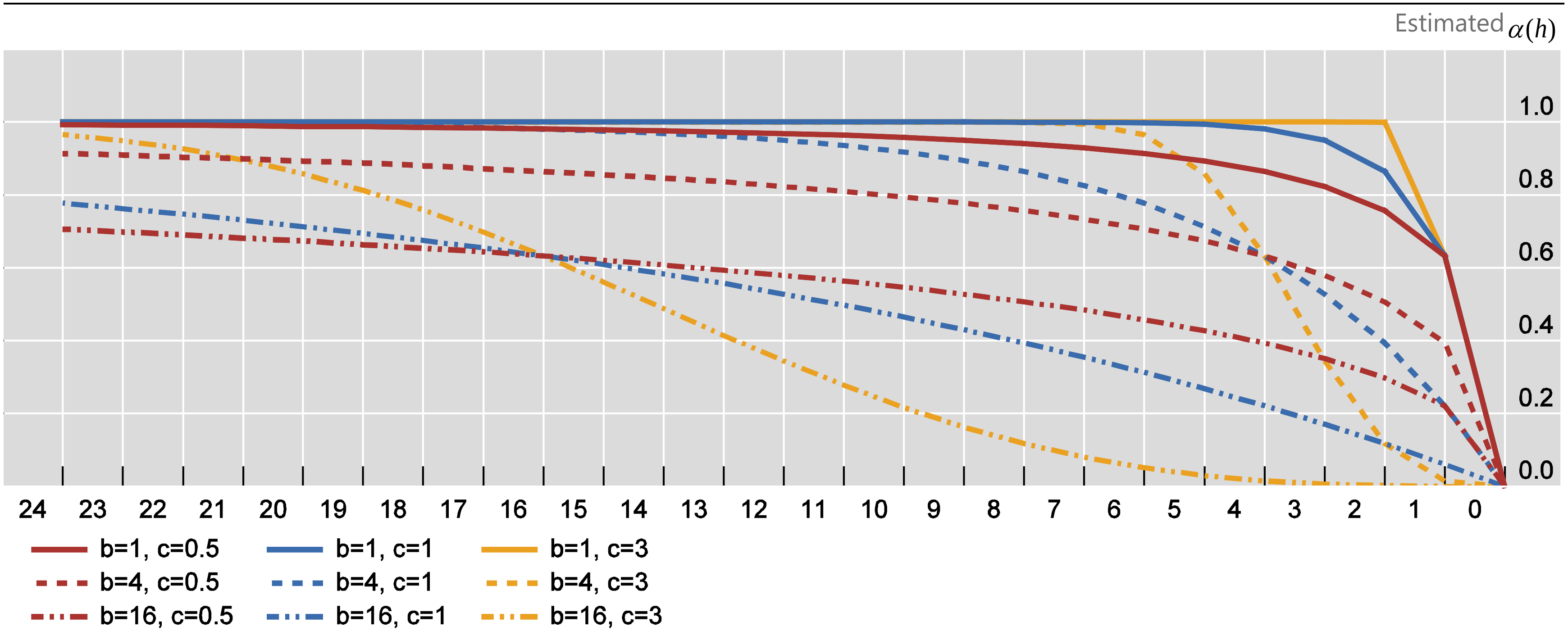
$$f(t, t-h) = \alpha(h)\pi^* + [1 - \alpha(h)]\pi(t-h) + \varepsilon(t, t-h)$$

$$\alpha(\infty) = 1 \text{ and } \alpha(0) = 0$$

$$\alpha(h) = 1 - \exp\left(-\left(\frac{h}{b}\right)^c\right)$$

Weibull decay functions

Graph 2



Note: Horizontal axis represents the forecast horizon *h*, which is the number of months before the end of the calendar year being forecast.

Modelling consensus infaltion forecasts…. (II)

$$\varepsilon(t, t-h)$$

$$V\big(\varepsilon(t, t-h)\big) = \exp(\delta_0 \ + \delta_1 \ h + \delta_2 \ h^2)$$

$$Corr\big(\varepsilon(t, t-h), \varepsilon(t, t-k)\big) = 1 - \phi_1 \ |h-k| - \phi_2 \ (h-k)^2$$

First step: constructing “forecasters”

Combine if:

- there is plausible evidence that the underlying entities are the same, via corporate websites, news stories or elsewhere; and
- the timing of the name change lines up with the departure and arrival of the associated names from the panel.

Split:

- considerable break with no forecasts

Drop if:

- panel is too short or incomplete

Forecasters

Table

1	Bank of Tokyo 10/1989-03/1996	Bank of Tokyo Mitsubishi 08/1996-06/2006	Bank of Tokyo-Mitsubishi UFJ 07/2006-12/2015
2	CS First Boston 10/1996-04/1998	Credit Suisse First Boston 08/1998-01/2006	Credit Suisse 02/2006-12/2015
3	Dai-Ichi Kangyo Bank 10/1989-07/1997	Dai-Ichi Kangyo Rsrch Institute 08/1997-03/2002	Mizuho Research Institute 04/2002-12/2015
4	Daiwa Securities Research 10/1989-11/1992	Daiwa Institute of Research 12/1992-12/2015	
5	Deutsche Securities 05/2000-12/2015		
6	Econ Intelligence Unit 11/2003-12/2015		
7	Global Insight 11/2003-10/2008	IHS Global Insight 11/2008-12/2013	IHS Economics 01/2014-12/2015
8	Goldman Sachs 05/2000-12/2015		
9	HSBC 06/2000-12/2015		
10	Industrial Bank of Japan 10/1989-07/2000		
11	ITOCHU Institute 01/2003-12/2015		
12	Japan Ctr for Econ Research 10/1989-12/2015		
13	JP Morgan - Japan 10/1992-11/2015		
14	Long Term Credit Bank 10/1989-06/1998	LTCB 08/1998-05/2000	Shinsei Bank 06/2000-12/2002
15	Merrill Lynch - Japan 10/1989-12/2015		

Source: Consensus Economics; Authors' calculations.

Forecasters

Table

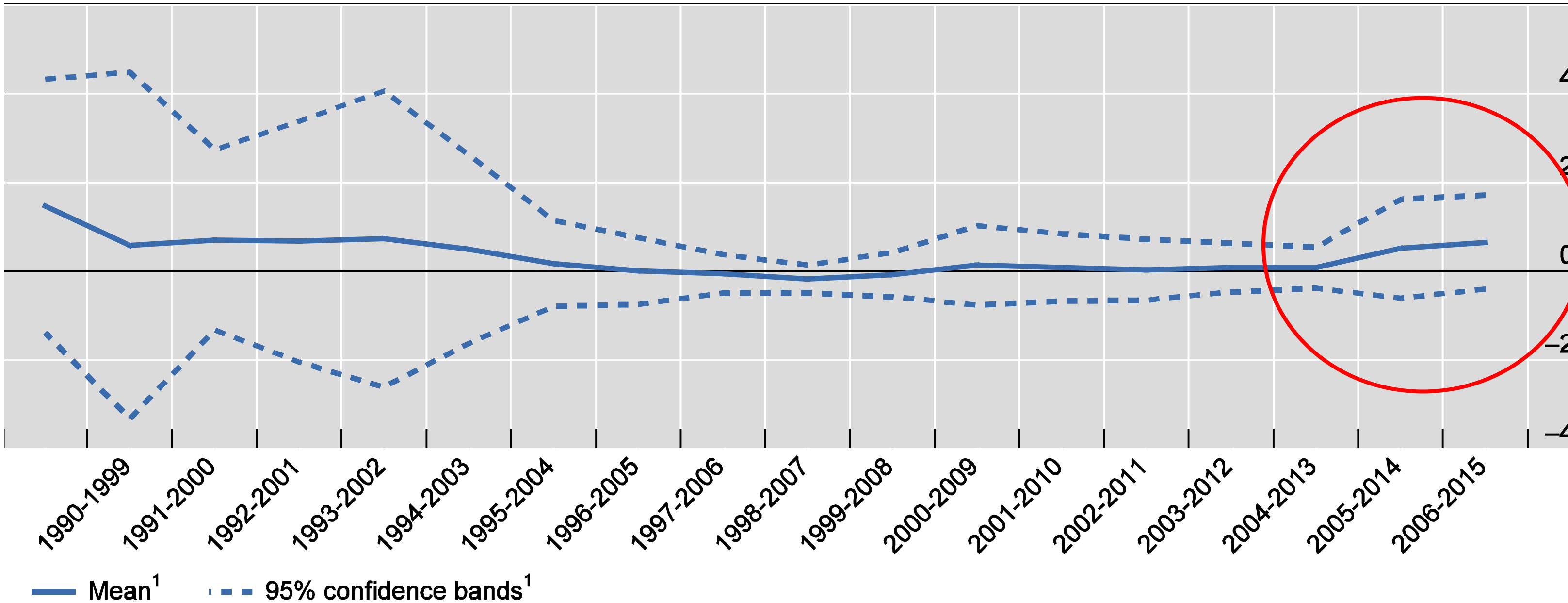
16	Mitsubishi Research 10/1989-02/1996	Mitsubishi Research Institute 01/1997-11/2015		
17	Nikko Research Center 10/1989-02/1999			
18	Nippon Credit Bank 10/1989-05/1997	NCB Research Institute 06/1997-04/2000		
19	NLI Research Institute 04/1996-12/2015			
20	Nomura Research Institute 10/1989-04/2005	Nomura Securities 05/2005-12/2015		
21	S G Warburg - Tokyo 10/1989	S G Warburg - Japan 11/1989-09/1995	SBC Warburg - Japan 11/1995-05/1998	LTCB Warburg - Japan 06/1998-07/1998
		Warburg Dillon Read - Japan 11/1998-10/1999	UBS Warburg 06/2000-05/2003	UBS 06/2003-12/2015
22	Salomon Brothers Asia 04/1996-12/1997	Salomon Smith Barney Asia 02/1998-03/1998	Salomon Smith Barney 04/1998-02/1999	Nikko Salomon Smith Barne 03/1999-03/2003
		Nikko Citigroup 04/2003-06/2010	Citigroup Global Mkts Japan 07/2010-04/2012	Citigroup Japan 05/2012-12/2015
23	Sanwa Research Institute 04/1996-03/2002	UFJ Institute 04/2002-12/2005	Mitsubishi UFJ Research 03/2006-12/2015	
24	Smith Barney - Tokyo 09/1994-11/1997	Smith Barney - Japan 10/1989-10/1993	Smith Barney Shearson - Tokyo 11/1993-08/1994	
25	Sumitomo Life Rsrch Institute 12/1990-03/2005			
26	Tokai Bank 10/1989-09/2001			
27	Toyota Motor Corporation 10/1989-12/2015			
28	Yamaichi Research Institute 10/1989-11/1997			

Source: Consensus Economics; Authors' calculations.

Japanese inflation anchors

In per cent

Graph 4

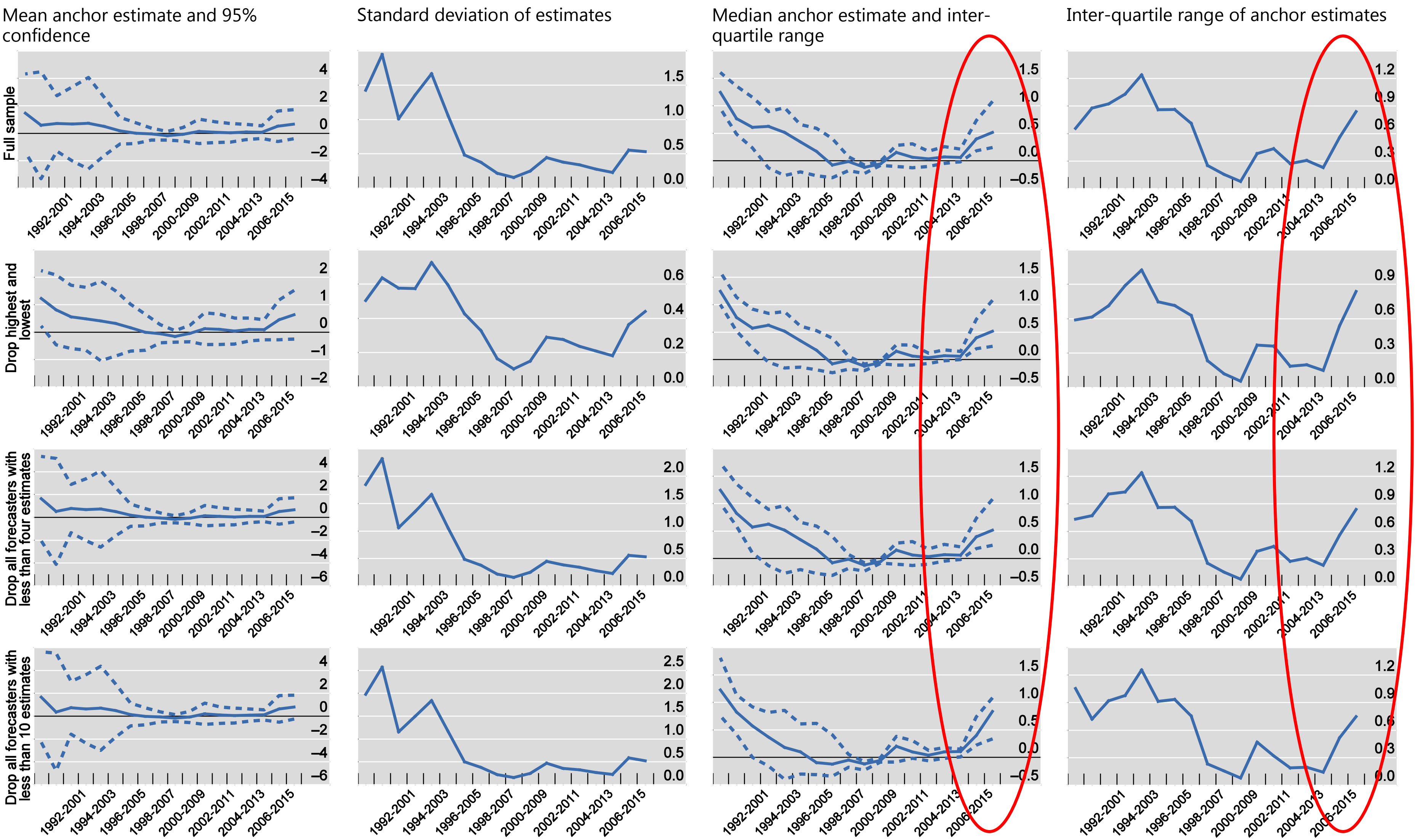


[1] Rolling sample.

Source: Authors' calculations

Japanese inflation anchors: robustness checks

Graph 5



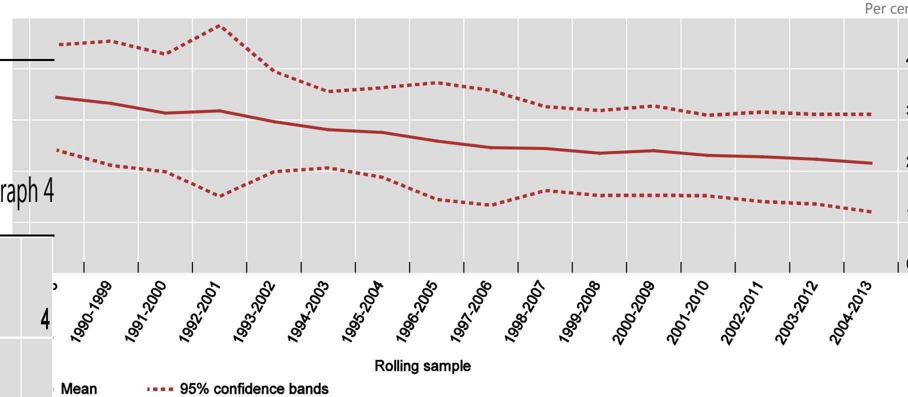
From the left: the first column contains the average estimated inflation anchor and 95% confidence band across all forecasters for each rolling sample. The second column contains the standard deviation of estimated inflation anchors. The third column contains median estimated inflation anchors and inter-quartile ranges. The final column contains inter-quartile ranges.

Source: Authors' calculations.

Estimated US inflation anchors

Mean and 95% confidence bands

Graph 3

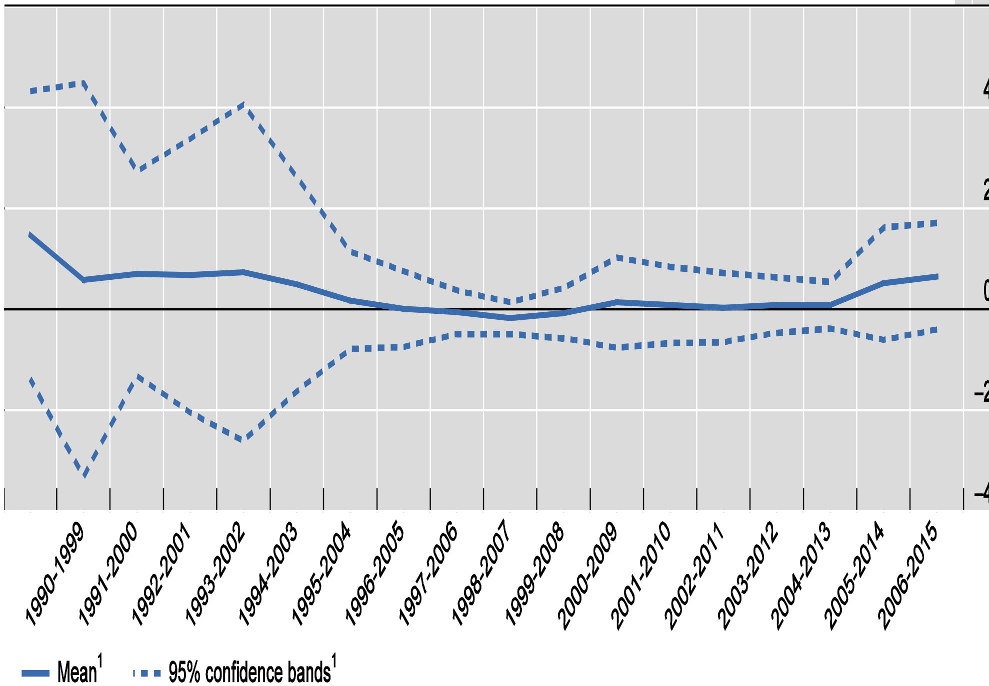


e: Author's calculations.

Japanese inflation anchors

In per cent

Graph 4



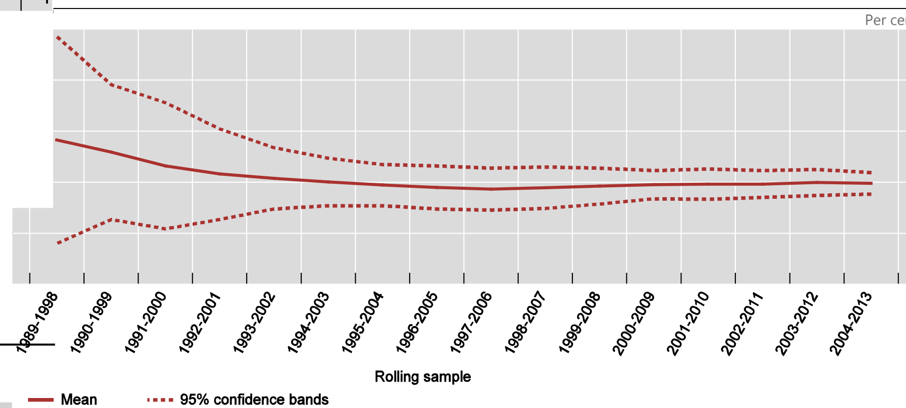
[1] Rolling sample.

Source: Authors' calculations

nated Canadian inflation anchors

n and 95% confidence bands

Graph 5



Source: Author's calculations.

What explains the cross-country difference?

Canada:

- Adopted inflation target in January 1988
- Target renewed repeatedly (’93,’98,’01,’06,’11) with minor changes

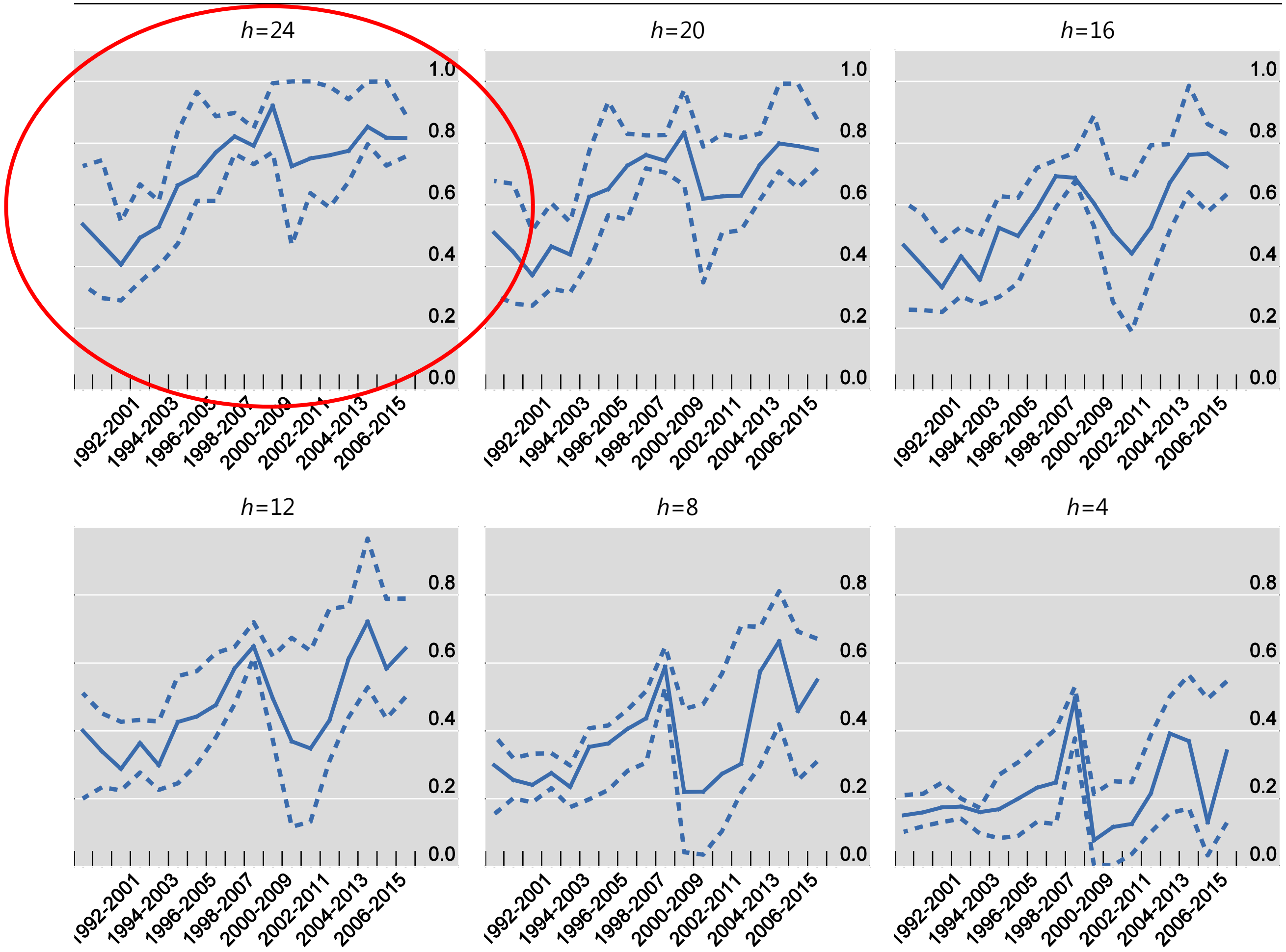
US:

- Multiple targets (“maximum employment, stable prices, and moderate long-term interest rates”) but increased clarity about importance of inflation over time
- Precise objective for long-run inflation first announced January 2012; updated annually since

Japan:

- Explicit target beginning January 2013

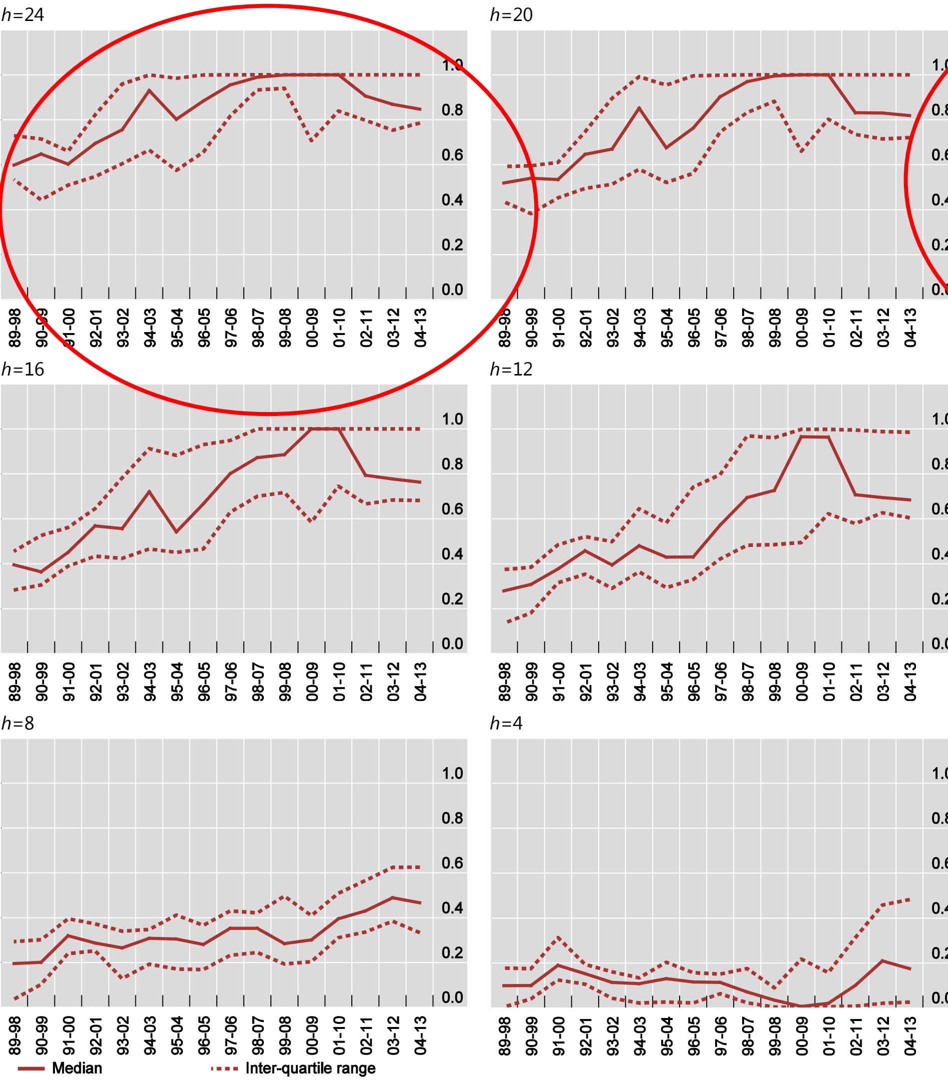
Japanese $\alpha(h)$: median and inter-quartile range for different values of h Graph 6



Source: Authors' calculations.

Estimated weight on inflation anchor for US forecasters, $\alpha(h)$

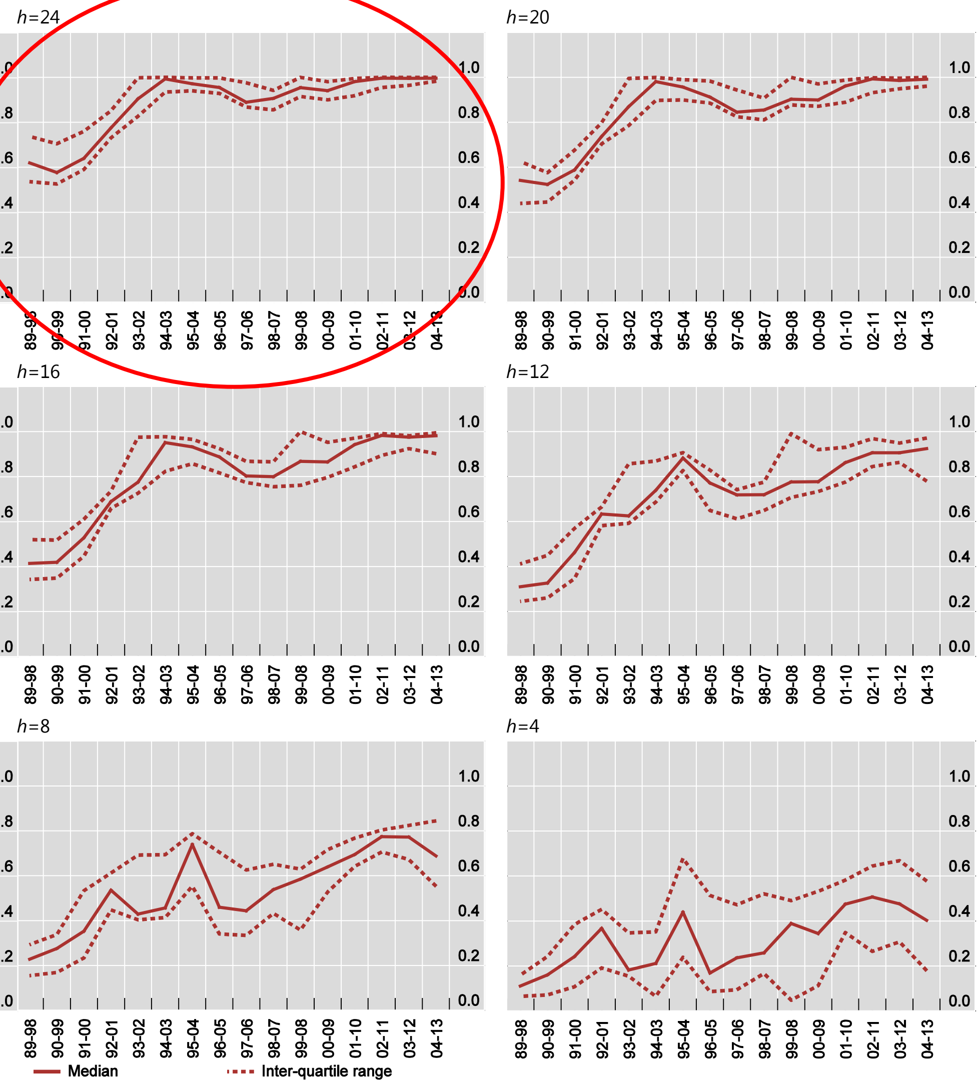
Graph 7



Source: Author's calculations.

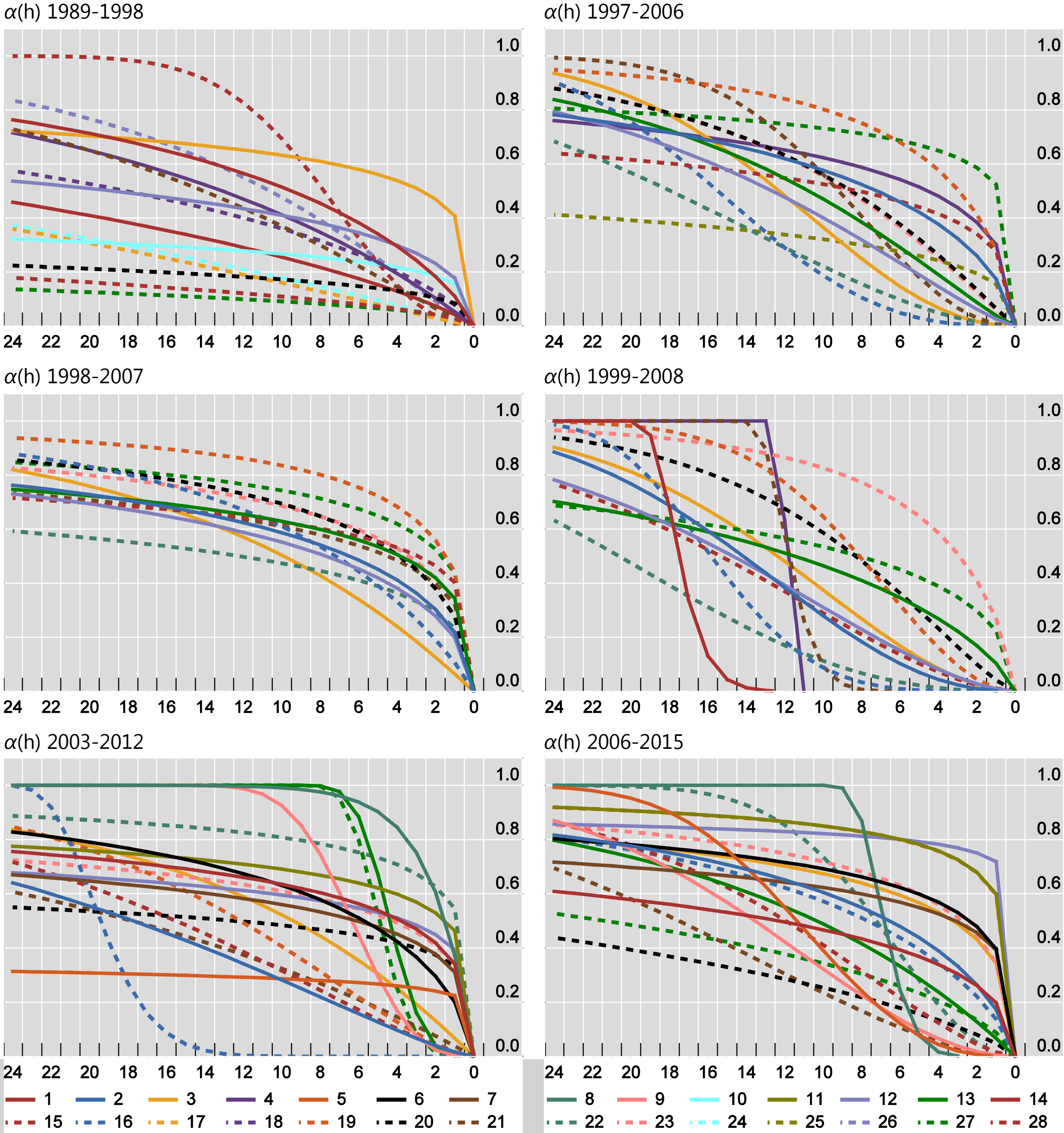
Estimated weight on inflation anchor for Canadian forecasters, $\alpha(h)$

Graph 8



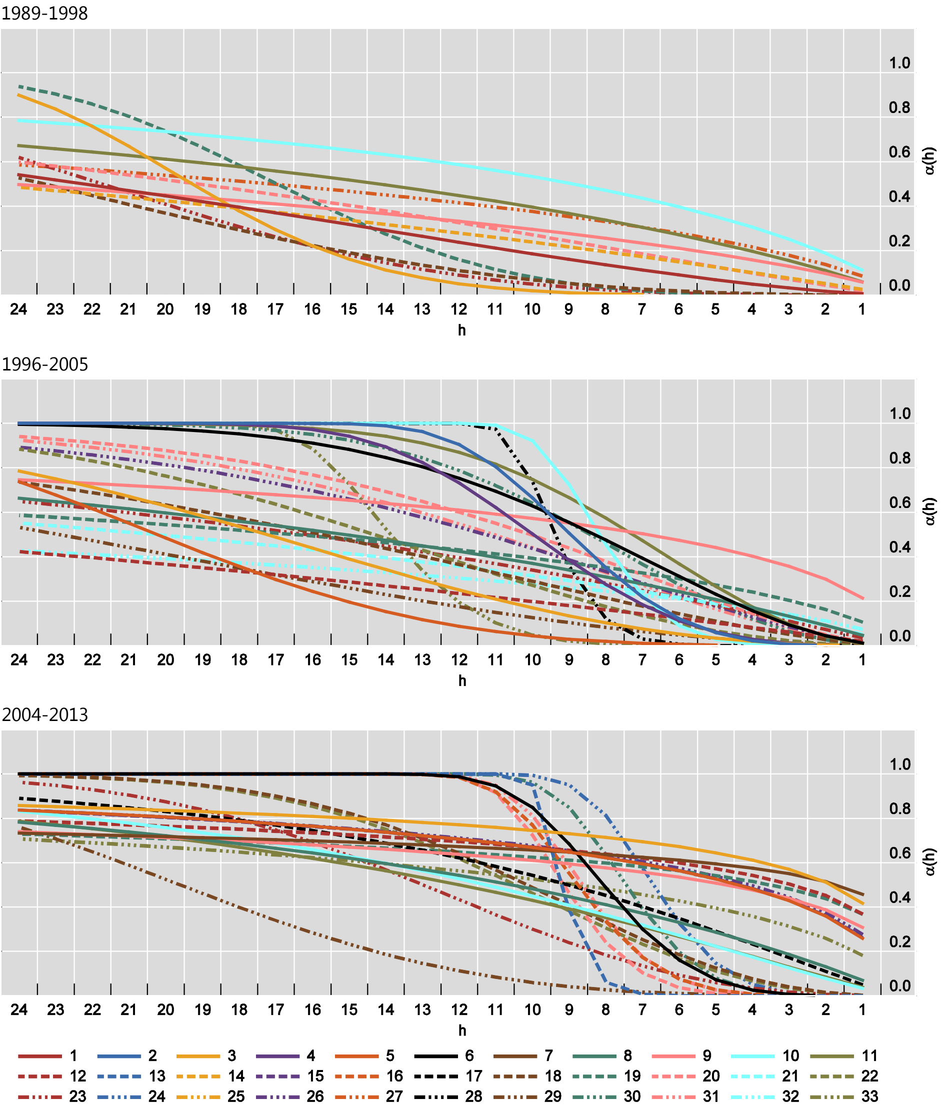
Source: Author's calculations.

Estimated decay paths by forecasters Graph 7



US estimated decay paths by forecaster

Graph 9

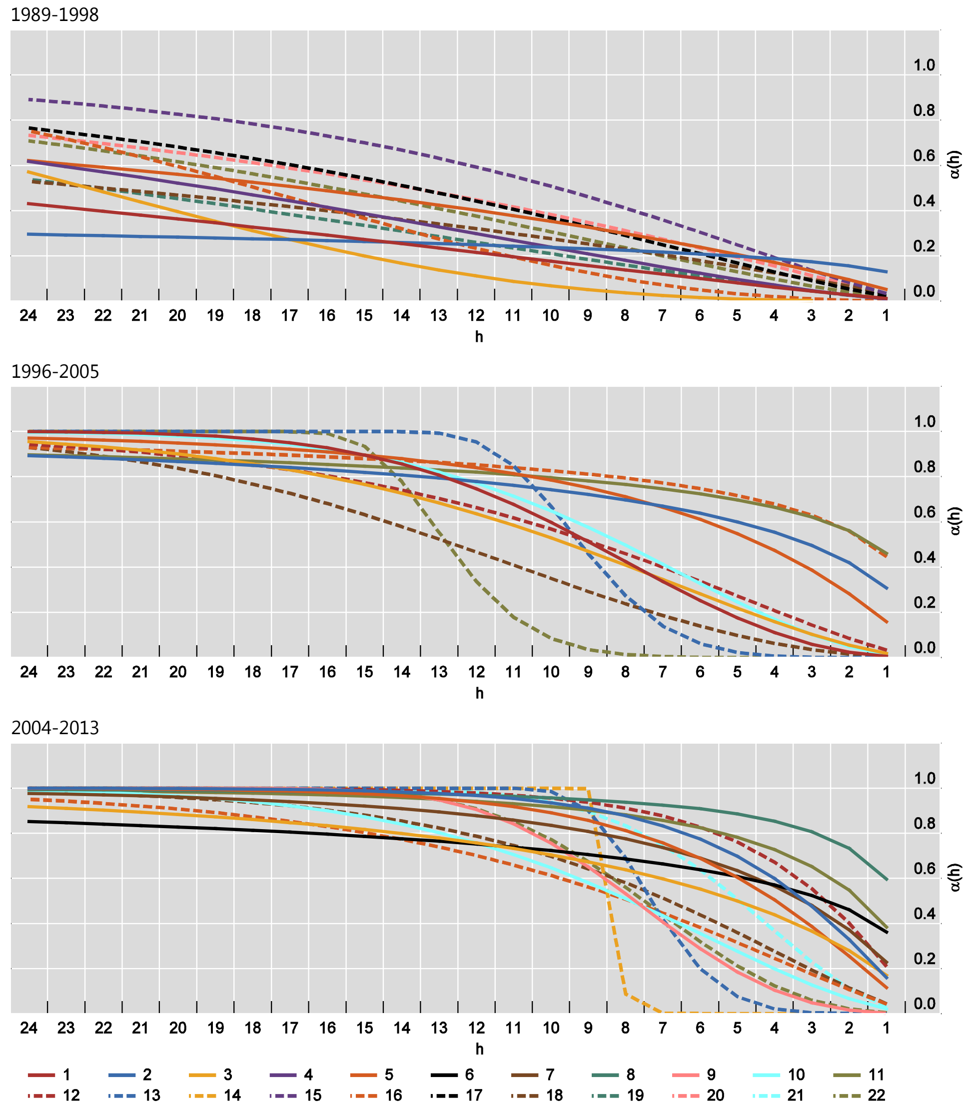


Forecaster numbers correspond to Table 1.

Source: Author's calculations.

Canadian estimated decay paths by forecaster

Graph 10

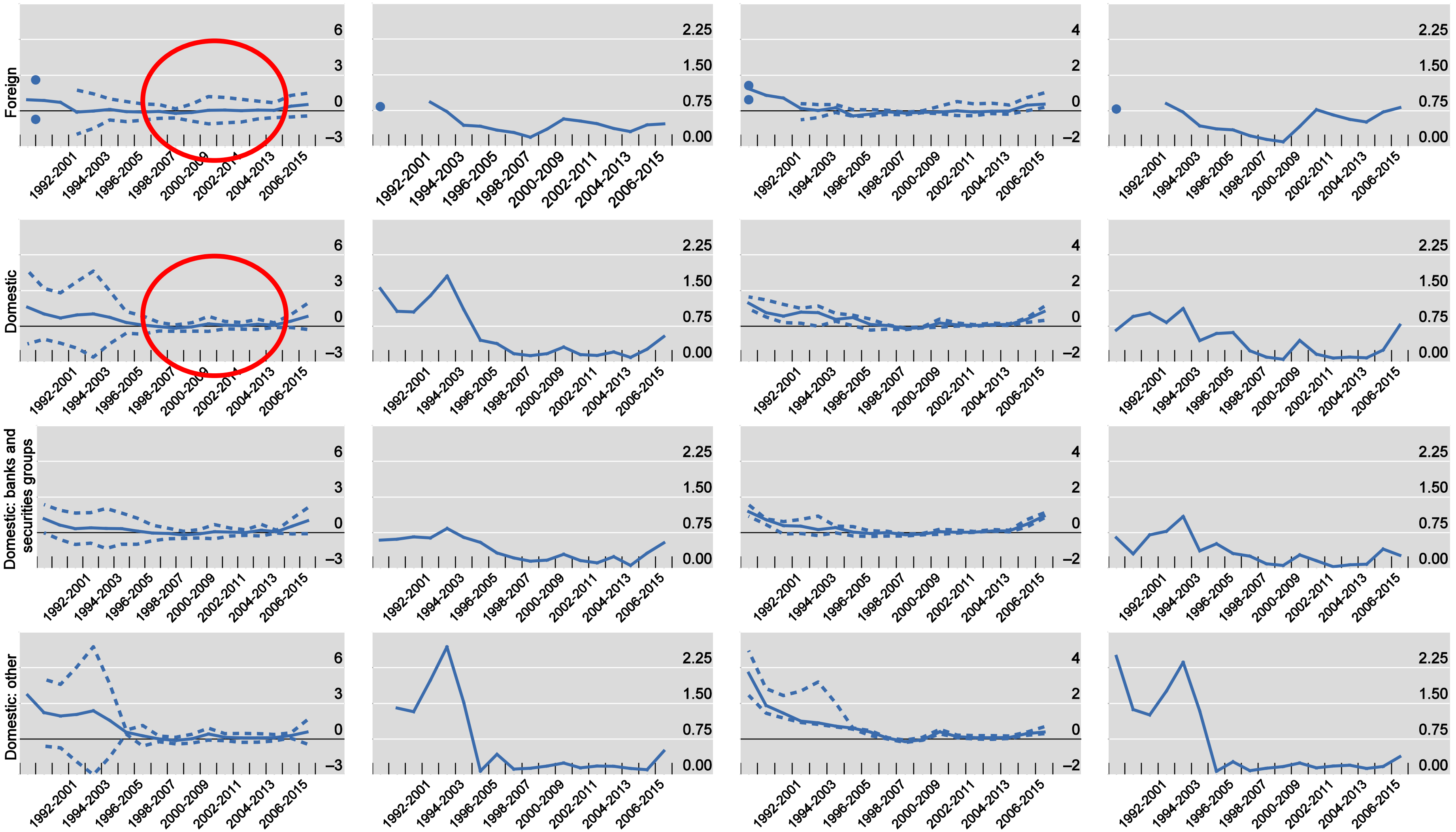


Forecaster numbers correspond to Table 2.

Source: Author's calculations.

Japanese inflation anchors: by type of forecaster

Graph 8



From the left: the first column contains the average estimated inflation anchor and 95% confidence band across all forecasters for each rolling sample. The second column contains the standard deviation of estimated inflation anchors. The third column contains median estimated inflation anchors and inter-quartile ranges. The final column contains inter-quartile ranges.

Source: Authors' calculations.

Adjusting for tax hikes:

- Use assumptions from BoJ (2012, 2013a, 2013b, 2014) on effect of tax hikes to adjust forecasts and actuals

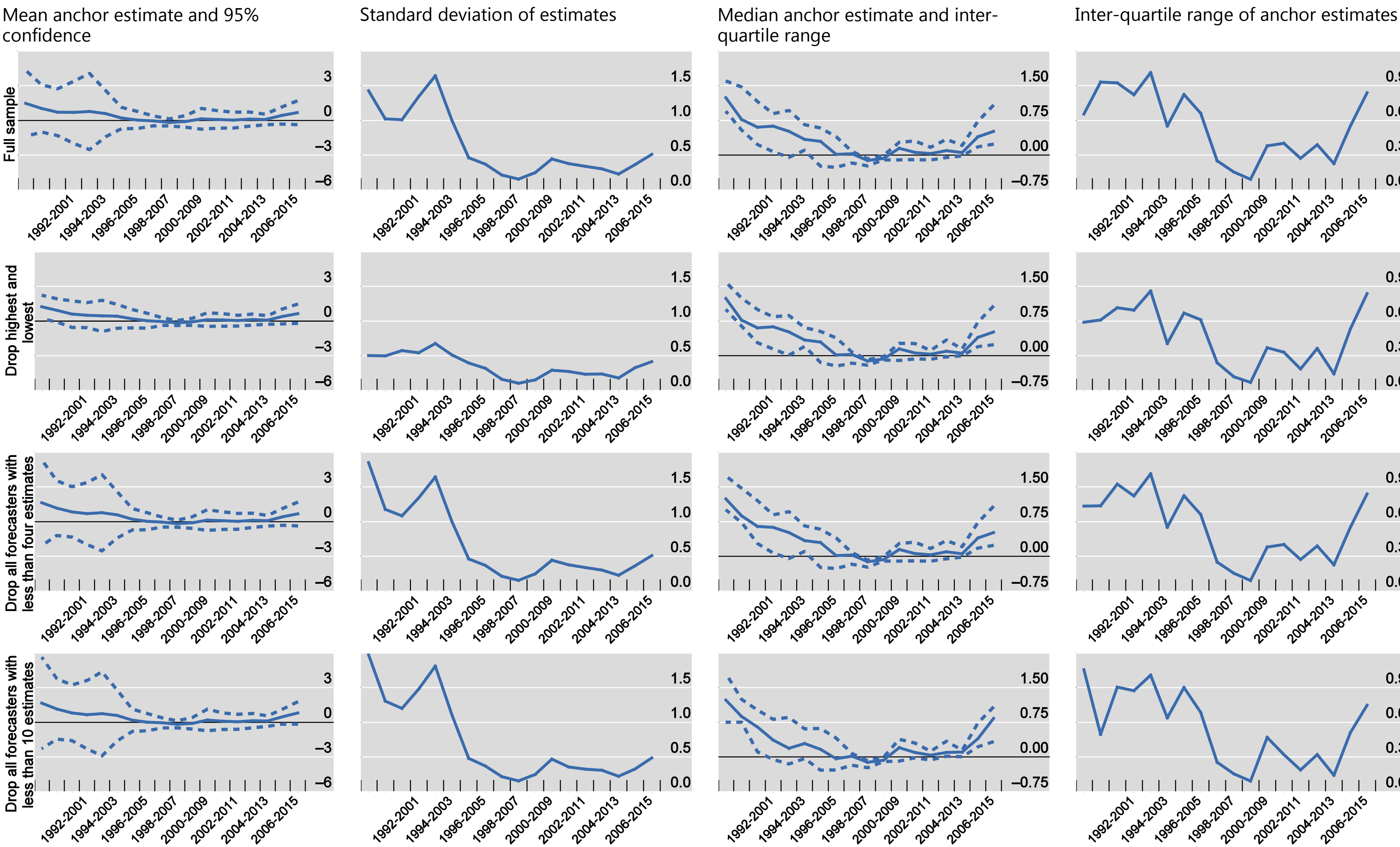
$$f(t,t-h) = \alpha(h)\pi^* + [1-\alpha(h)]\pi(t-h) + \varepsilon(t,t-h)$$

Subtract expected effect of taxes after Announcement from forecasts

Subtract estimated effect of taxes from actuals

Japanese inflation anchors: tax adjustment

Graph 9



From the left: the first column contains the average estimated inflation anchor and 95% confidence band across all forecasters for each rolling sample. The second column contains the standard deviation of estimated inflation anchors. The third column contains median estimated inflation anchors and inter-quartile ranges. The final column contains inter-quartile ranges.

Source: Authors' calculations.

Conclusions

- Many changes in the role of CPI inflation in BoJ policy over recent decades (documented in paper).
- What effect on inflation expectations anchoring?
  - Estimated anchors declined early in sample, remained close to zero 1996-2005 to 2004-2013, and then rose
  - Diversity of anchors across forecasters also rose in recent samples
- Interpretation:
  - Some success in unanchoring expectations from previous low levels and raising anchor point?
  - c.f. Canada (& US): expectations only weakly anchored