

Are central bank projections rational?

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Central bank projections have gained considerable attention for monetary policy modeling. However, less is known about the nature of central bank projections. This letter explores the unbiasedness and rationality of more than 2,000 growth and inflation projections published by 15 major central banks. The results indicate that central bank projections are in most cases rational and unbiased. Interestingly, inflation projections are more biased than growth projections.

JEL classification: E37, D84, E58

Keywords: Central Banks; Projections; Rationality; Unbiasedness

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Central bank projections have recently gained considerable attention for monetary policy modeling. However, less is known about the nature of central bank projections. This letter explores the unbiasedness and rationality of more than 2,000 growth and inflation projections published by 15 major central banks. The results indicate that central bank projections are in most cases rational and unbiased. Interestingly, inflation projections are more biased than growth projections.

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1 Introduction

The number of studies analyzing the rationality of professional forecasters (Elliott and Ito 1999, Frenkel et al. 2010) and the forecasting behavior of intergovernmental organizations, such as the IMF or OECD (Batchelor 2001, Elliott et al. 2008) is substantial. However, less empirical work exists concerning projections published by central banks. This is the first study investigating the properties of central bank projections such as unbiasedness and rationality. To this end, it employs a unique data set of more than 2,000 central bank projections from major central banks providing evidence that the majority of central banks publish unbiased and rational forecasts. We also document that inflation projections are more biased than growth projections while we find no systematic differences between projections published by inflation targeting central banks compared to other central banks. Interestingly, the length of the forecast horizon does not matter when evaluating central bank projections from the view of rationality.

2 The Data

This letter uses projections of the inflation rate and the growth rate of 15 central banks, namely the Bank of Argentina, Brazil, Canada, Chile, England, Japan, Mexico, Norway, South Africa, Sweden, European Central Bank (ECB), Federal Reserve Bank, Reserve Bank of Australia, and New Zealand and the Swiss National Bank. The sample consists of 2,340 projections for two forecast horizons, namely the current year and the next year. The characteristics of these projections are fairly different among the central banks (Hubert 2009). The ECB, for instance, declares that the forecasts have been produced by their staff members while the Bank of Japan and the Federal Reserve Bank state that the projections reflect the view of the board members. Important to note is that most central banks

produce conditional projections. For instance, the Bank of Norway and Sweden explicitly communicate their assumptions concerning the future economic development while the Bank of Argentina, Brazil and Chile do not publish the assumptions along their projections.

For each central bank Figure 1 plots the inflation projection for the current year (black squares) and the actual value (solid lines) taken from the IMF database. It also shows that some central banks, e.g. Bank of Norway and the Federal Reserve Bank, publish their forecasts quite frequently and have a considerable long track record while the Bank of Japan publishes its projections just since the recent time period. The sample period ends in December 2010. The vertical distance between the projections and the actual value can be interpreted as the forecast error which is relatively high in 2009 and 2010 mirroring the economic crisis. Figure 2 shows the distribution of these forecast errors for each central bank. The figure reports that the forecast errors have a considerable range for some central banks, such as Bank of Argentina, Brazil, and Chile while for the ECB the range of the forecast error is relatively small. This does not necessarily imply that the latter has a higher forecasting ability but could merely reflect that the economic development was more favorable or the forecast horizon was relatively short. Interestingly, the dispersion of forecast errors is larger for growth projections compared to inflation projections which might be related to the higher volatility in the actual time series.

Insert Figures 1 and 2 about here.

3 Rationality of Central Bank Projections

To analyze whether central bank projections are formed rationally, we follow Ito (1990), MacDonald and Marsh (1996), and Elliott and Ito (1999) in applying two criteria: unbiasedness and orthogonality. The unbiased-

ness condition investigates whether the projections represent an unbiased predictor of the future value. Hence, we estimate the following relationship

$$v_{t+k} = \alpha + \beta E_t[v_{t+k}] + \epsilon_{t+k}, \quad (1)$$

where v_{t+k} ($E_t[v_{t+k}]$)¹ is the (projected) value of the inflation rate and growth rate in period t for $t + k$ while ϵ_{t+k} reflects the error term. Unbiasedness prevails if $\alpha = 0$ and $\beta = 1$ and implies that the forecast errors do not show any systematic pattern. Table 1 reports the results based on the Newey-West (1987) estimator to account for serial correlation and heteroscedasticity. The results indicate that the unbiasedness condition ($\alpha = 0 \wedge \beta = 1$) can only be rejected on a ten (one) percent significance level in 16 (3) out of 58 cases. In most cases, the results indicate that the central bank projections are unbiased. Interestingly, this result does not depend on the forecast horizon since the unbiasedness condition can be rejected for current-year (next-year forecasts) in 9 (7) cases. Compared to this, for inflation projections the hypothesis can be rejected in 13 cases while for growth projections this applies to 3 cases. This reflects that inflation projections are more biased than growth projections.

The orthogonality criterion stipulates that rational forecasts should produce forecasts errors that are uncorrelated with information in central bank's information set at the time of the forecast. To approximate the information set, we use the forecast of the Consensus Economics Forecast poll which surveys financial market participants on a monthly basis concerning their inflation and growth expectations (Dovern and Weisser 2011). To ensure that the professional forecasts are available to the central banks we only use the professional forecast published about two weeks in advance to the central bank projection. One advantage of using professional forecasts is that we circumvent the real time data problem as the forecasts are not

¹The index k denotes the forecasting horizon expressed in months (with $k = 12, 11, \dots, 1$ for current-year forecasts, and $k = 24, 23, \dots, 13$ for next-year forecasts).

revised. Hence, the forecasts do actually fit into the information set of the central banks. Another advantage is that the professional forecasts refer to the same variable and to the same forecast horizon as the central bank projections. Therefore, the Consensus Economics Forecast poll should be of interest to the central bankers. In fact, most inflation reports compare the central bank projection to the professional forecasts of the Consensus Economics Forecast poll (Bank of Argentina 2010, p.16, Swiss National Bank 2010, p.17). Hence, we estimate

$$v_{t+k} - E_t[v_{t+k}] = \alpha + \beta E_{t-1}^{pro}[v_{t+k}] + \epsilon_{t+k} \quad (2)$$

Orthogonality implies that $\alpha = \beta = 0$ so that neither a constant nor the professional forecast of the previous period ($E_{t-1}^{pro}[v_{t+k}]$) can explain the forecast error. Table 2 reports the results and shows that the orthogonality condition can be rejected in 22 (11) out of 58 cases on a ten (one) percent level. Hence, the evidence of irrational central bank projections is relatively weak. This is surprising given that the rational expectations hypothesis concerning professional forecasts is soundly rejected in the literature (Ito 1990, Elliott and Ito 1999, Frenkel et al. 2010).

4 Conclusions

This letter examines whether central bank projections are unbiased and rational. To this end, we use more than 2,000 inflation and growth projections of 15 central banks. Compared to the literature on professional forecasters, we report that central bank projections tend to be rational and in most cases are unbiased. We also find interesting differences between inflation and growth projections. Inflation projections are more biased than growth projections while the results do not differ between current-year and next-year forecasts.

The results provide interesting policy implications. The evidence that central bank projections are rational gives confidence to studies using such

projections for monetary policy purposes (Gersbach and Hahn 2011). Since this is the first study which empirically analyzes the properties of central bank projection it also offers an avenue for future research. It might be interesting, for instance, to look whether and to what extent professional forecasters use the central bank projection as a yardstick for their own forecasting purposes.

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Table 1: Unbiasedness of Central Bank Projections

Variable Horizon	Argentina				Australia				Brazil				Canada				Chile			
	Growth		Inflation		Growth		Inflation		Growth		Inflation		Growth		Inflation		Growth		Inflation	
	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next
α	.07 (2.37)	7.18+ (3.37)	1.43* (.21)	1.77+ (.72)	3.46* (1.19)	1.33+ (.71)	-62 (.35)	-3.12 (3.19)	3.19 (1.19)	1.47 (2.97)	6.82+ (2.97)	-16 (.11)	-1.71 (2.02)	1.71 (.37)	7.9+ (.37)	1.05 (.73)	-39 (.36)	-3.25 (4.00)	1.18 (.49)	.91 (2.06)
β	.96* (.29)	.18 (.39)	.39* (.06)	.10 (.35)	.65* (.16)	.17 (.43)	1.17* (.08)	1.81* (.79)	1.00* (.29)	1.00* (.58)	1.00* (.58)	1.06* (.06)	1.35+ (.58)	.61* (.17)	.61* (.17)	.50 (.41)	.96* (.06)	1.30+ (.75)	.87* (.11)	.87* (.11)
$\alpha=0 \wedge \beta=1$	.91	.12	.00	.12	.08	.02	.10	.12	.12	.12	.04	.31	.21	.07	.50	.11	.94	.87	.51	
R^2	.46	.02	.70	.00	.25	.01	.71	.01	.51	.00	.00	.82	.21	.55	.07	.77	.01	.48	.05	
Obs.	29	29	12	8	44	40	46	11	47	43	52	48	52	48	52	48	35	17	35	31
Variable Horizon	Euro Area				Japan				Mexico				New Zealand				Norway			
	Growth		Inflation		Growth		Inflation		Growth		Inflation		Growth		Inflation		Growth		Inflation	
	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next
α	.07 (1.06)	-22 (.79)	.08 (.09)	1.74+ (.76)	-97 (.48)	-21 (1.21)	-05 (.05)	-29 (.26)	-58 (.36)	5.43 (3.02)	87* (.32)	3.34* (.38)	.88+ (.35)	2.12 (1.19)	.49 (.48)	.71+ (.35)	.38 (.43)	.11 (1.16)	.20+ (.09)	
β	1.06* (.03)	.79 (.59)	.98* (.04)	.13 (.49)	1.47* (.23)	.52 (.38)	.96* (.03)	.25 (.36)	1.09* (.09)	2.59* (.72)	.90* (.08)	.35* (.06)	.78* (.09)	.22 (.37)	.72* (.16)	.76* (.14)	.65+ (.13)	.64+ (.34)	.93* (.04)	.95* (.31)
$\alpha=0 \wedge \beta=1$	.27	.36	.30	.02	.14	.69	.40	.10	.25	.12	.00	.00	.04	.11	.02	.09	.01	.10	.41	
R^2	.92	.08	.96	.01	.77	.01	.88	.05	.83	.01	.80	.38	.53	.01	.44	.38	.66	.14	.93	
Obs.	30	26	30	26	27	17	27	17	44	13	44	39	57	53	57	53	41	38	41	38
Variable Horizon	South Africa				Sweden				Switzerland				United Kingdom				United States			
	Growth		Inflation		Growth		Inflation		Growth		Inflation		Growth		Inflation		Growth		Inflation	
	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next
α	-01 (.34)	-77 (1.3)	4.34 (.43)	4.34 (2.53)	-12 (.29)	-1.85 (1.61)	1.06* (.13)	.91+ (.34)	-12 (.11)	.19 (.22)	.10 (.08)	-34 (.22)	-01 (.24)	-1.05 (1.07)	.05 (1.33)	.01 (.88)	-42 (.36)	1.07 (1.12)	-1.15 (.32)	
β	1.14* (.09)	.96* (.34)	.41* (.08)	.41* (.42)	1.13* (.06)	1.63* (.53)	.47* (.06)	.42+ (.2)	1.01* (.05)	.83* (.12)	.94* (.07)	1.18* (.16)	1.10* (.06)	1.32* (.41)	1.17+ (.51)	1.51* (.44)	1.20* (.13)	.43 (.29)	1.11* (.11)	.79* (.12)
$\alpha=0 \wedge \beta=1$	.34	.12	.05	.07	.13	.50	.00	.02	.31	.12	.40	.11	.18	.47	.74	.25	.26	.05	.34	
R^2	.86	.01	.69	.01	.78	.21	.50	.16	.90	.83	.80	.55	.79	.27	.25	.28	.54	.08	.81	
Obs.	44	13	50	43	68	62	68	62	51	12	51	43	54	50	54	50	69	41	69	41

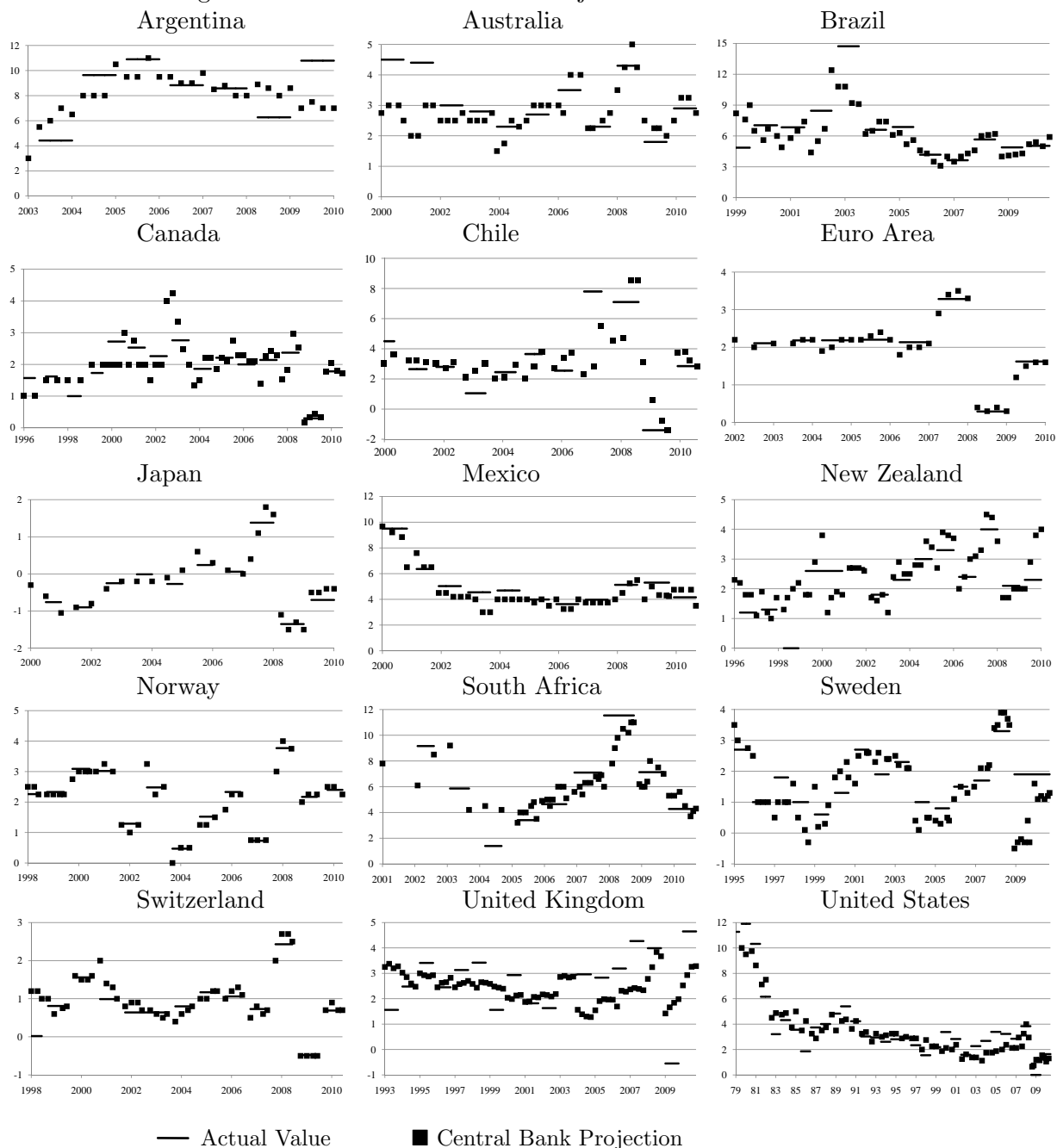
Note: Results of Equation 1 $v_{t+k} = \alpha + \beta E_t[v_{t+k}] + \varepsilon_{t+k}$ based on the Newey-West estimator; robust standard error in parentheses; * (+) indicates significance at the one (ten) percent significance level.

Table 2: Orthogonality of Central Bank Projections

Variable Horizon	Argentina		Australia		Brazil		Canada		Chile										
	Growth	Inflation	Growth	Inflation	Growth	Inflation	Growth	Inflation	Growth	Inflation									
	Current	Next	Current	Next	Current	Next	Current	Next	Current	Next									
α	1.35+	.43	-1.19+	-2.53*	1.33+	.84	.91+	3.33	.24	-1.22	.29	1.81	-1.10	-0.92	.55	2.37	-1.19	3.25	
	(.57)	(4.54)	(.43)	(.08)	(.56)	(1.45)	(.49)	(2.19)	(1.19)	(1.98)	(.21)	(2.58)	(.19)	(.83)	(.37)	(3.80)	(.71)	(3.23)	
β	-1.40*	-.11	.46*	1.25*	-.56+	-.40	.30+	-.97	-.12	-1.15	-.12	-.40	.04	.40	-.01	-1.14	.03	.24	
	(.06)	(.46)	(.15)	(.04)	(.24)	(.59)	(.09)	(.61)	(.23)	(.27)	(.11)	(.77)	(.12)	(.47)	(.06)	(.76)	(.19)	(.88)	
$\alpha=\beta=0$	.00	.20	.03	.00	.07	.11	.04	.32	.14	.22	.35	.11	.55	.13	.11	.44	.85	.54	
R^2	.34	.01	.52	.86	.33	.03	.23	.22	.02	.00	.05	.01	.00	.01	.00	.00	.00	.37	
Obs.	29	29	12	8	44	40	46	11	47	43	52	48	52	48	35	17	35	31	
Euro Area																			
Variable Horizon	Japan		Mexico		New Zealand		Norway												
	Growth	Inflation	Growth	Inflation	Growth	Inflation	Growth	Inflation											
	Current	Next	Current	Next	Current	Next	Current	Next											
α	-0.06	1.05	-0.09	-1.98*	.77+	.41	-0.05	.25	.64	.52	-0.44	-2.17*	-.84+	.58	.68	-0.06	-.49	-.83	-.45
	(.13)	(.79)	(.06)	(.62)	(.44)	(1.36)	(.04)	(.19)	(.37)	(6.68)	(.29)	(.56)	(.34)	(1.05)	(.48)	(.63)	(.36)	(.91)	(.09)
β	-0.07+	-.32	.02	1.02+	-.35*	.37	-0.00	.90+	-.11	.16	.01	.31+	.22+	-.28	-.21	-.06	.45*	.81+	.03
	(.04)	(.38)	(.03)	(.39)	(.11)	(.52)	(.04)	(.31)	(.09)	(2.12)	(.05)	(.14)	(.09)	(.36)	(.22)	(.27)	(.09)	(.34)	(.05)
$\alpha=\beta=0$	.18	.42	.14	.00	.01	.48	.95	.02	.22	.71	.91	.00	.05	.52	.15	.15	.00	.00	.56
R^2	.05	.01	.01	.13	.29	.01	.00	.32	.05	.01	.00	.38	.07	.01	.04	.00	.46	.17	.01
Obs.	30	26	30	26	27	17	27	17	44	13	44	39	57	53	57	53	41	38	41
South Africa																			
Variable Horizon	Switzerland		Sweden		United Kingdom		United States												
	Growth	Inflation	Growth	Inflation	Growth	Inflation	Growth	Inflation											
	Current	Next	Current	Next	Current	Next	Current	Next											
α	.15	-1.75	1.55+	-3.48	.24	-1.04	-1.03*	-1.06*	-.31	-1.83	.11	-1.84*	.06	1.32	2.00*	-4.88	.94*	2.05	54
	(.41)	(1.97)	(.56)	(3.11)	(.31)	(1.89)	(.16)	(.39)	(.21)	(1.28)	(.11)	(.31)	(.40)	(1.37)	(.79)	(3.59)	(.22)	(1.55)	(.32)
β	-1.17	.66	-.29*	.48	-2.20*	.50	.52*	.63*	-.10+	1.07	-0.02	1.84*	-.13+	-.46	-1.04*	1.85	-.37*	-.44	-.31*
	(.09)	(.51)	(.11)	(.53)	(.06)	(.69)	(.08)	(.18)	(.05)	(.69)	(.08)	(.29)	(.07)	(.39)	(.28)	(1.53)	(.11)	(.49)	(.09)
$\alpha=\beta=0$	.30	.17	.02	.37	.01	.45	.00	.00	.06	.34	.12	.00	.11	.29	.00	.11	.00	.14	.01
R^2	.11	.05	.16	.02	.09	.02	.46	.27	.03	.11	.00	.44	.05	.03	.25	.07	.25	.03	.22
Obs.	44	37	50	43	68	62	68	62	51	12	51	43	54	50	54	50	49	31	49

Note: Results of Equation 2 $v_{t+k} - E_t[v_{t+k}] = \alpha + \beta E_{t-1}^{proj}[v_{t+k}] + \epsilon_{t+k}$ based on the Newey-West estimator; robust standard error in parentheses; * (+) indicates significance at the one (ten) percent significance level.

Figure 1: Current-Year Inflation Projections



Note: This figure shows the inflation projections for the current year (black squares) as well as the actual values (solid line) taken from the IMF database.

Figure 2: Current-Year Forecast Errors

