The Impact of Central Bank Transparency on Inflation Expectations*

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Abstract

In contrast to previous empirical attempts to examine the effect of increasing central bank transparency on macroeconomic magnitudes, we investigate how the link between inflation and inflation expectations alters with increasing transparency. Our motivation stems from the belief that changes in the institutional features or operations of the Central Bank affect, first and foremost, the way that private agents form their expectations about the future behaviour of the Central Bank, and only through them, inflation. We apply the framework used by Levin et al (2004) who differentiate between inflation targeters and countries that do not have explicit quantitative objectives. They discover that inflation targeters benefit from a weaker link between inflation and expectations, and the more so for longer horizons. We, in turn, examine whether this observation still holds as central banks become more transparent. Our attempt is facilitated by the recent development of quantitative measures for transparency, used in the main text. We find that our results provide some evidence to substantiate the beneficial impact of transparency, on helping fix private sector expectations.

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1 Introduction

In a study undertaken by Blinder (2000) in which a group of Central Banks and academic economists were asked to rank those features that help, in their view, build credibility in monetary policy, transparency ranked fourth. Although admittedly not very different in terms of scores, Central Bank transparency was preceded by, "history of honesty", "Central Bank Independence" and "history of fighting inflation", which ranked first, second and third, respectively. Despite that, however, transparency has attracted a significant amount of attention in the past two decades, in our view for the following reasons. First, the literature over the same period has been very concrete about the benefits of making Central Banks independent from government. But as theoretical recommendations on this issue were put into practice and Central Banks began to acquire greater autonomy in setting and pursuing their objectives, there was automatically a greater need for direct accountability. Reasons of democratic legitimacy thus provided a political economy justification for greater transparency. Second, and this time from the point of view of the Central Bank, the three features deemed more important than transparency in Blinder's survey do not constitute choice variables for the Central Bank to act upon; they are either the result of its actions (one and three) or in the case of independence, it is imposed on its structure. In that respect, therefore, to the extent that the Central Bank wishes to help improve its credibility, the level of transparency is the first of these features it can act upon directly. Last, the establishment of the European System of Central Banks and the creation of the European Central Bank itself at the end of the 90s, involved having to consider anew the architecture that would help establish credibility for the monetary policy authority.

Despite extensive discussions on the desirability of Central Bank transparency[1], economic literature on this issue does not always arrive at a unique conclusion. By means of an example, regarding the publication of forecasts produced by Central Banks, Buiter (1999) and Issing (1999) argue at opposite ends of the spectrum. The former thus argues in favour of their publication, on grounds of accountability, such that the public can evaluate the quality of monetary policy. Issing on the other hand, argues against it, by saying that to the extent that actual policy decisions are not entirely based on these predictions, their publication may be misleading. Similar 'disputes' arise with reference to the publication of the minutes of meetings (and indeed their timing), or on whether decisions should be accompanied by press conferences.

Inevitably however, the merits of transparency can only ultimately be justified through empirical validation, enabled by the recent development of explicit indices for Central Bank transparency. Eijffinger and Geraats (2002) (EG) construct an index for nine major Central Banks based on the five aspects of Central Bank transparency identified by Geraats (2000) and allow for changes in the index for the period 1998-2002. Other attempts to capture various aspects

[1] Inter alia Jensen, (2002), Faust and Svensson (2002), Geraats,(2002), Demertzis and Hughes Hallett, (2002). See also van der Cruijsen (2004) for a comprehensive survey.

of Central Bank transparency include those by Bini-Smaghi and Gros (2001), Siklos (2002), Chortareas et al (2002) and De Haan et al (2004). The limited availability of data however, makes the empirical investigation still problematic. Demertzis and Hughes Hallett (2002) calculate correlations between the EG index and the mean and standard deviation of inflation and the output gap and discover that while greater transparency does not affect the averages, it does affect the variability of these magnitudes. While greater transparency is beneficial to inflation, it appears to be detrimental to the output gap (although weak). Using the same index, EG (2004b) use a Taylor rule type of set-up and show that greater transparency reduces both the use of the short term interest rate (thus increasing flexibility in monetary policy), as well as the long term interest rate levels, thus enhancing authorities' reputation[2].

We will argue in this paper that previous empirical attempts remain indirect in their efforts to identify the impact of Central Bank transparency. We believe that any change in the institutional features or operations of the Central Bank affects, first and foremost, the way that private agents form their expectations about the future behaviour of the Central Bank, and only through them, inflation. We thus attempt to check the effect of greater transparency on the way that expectations are formed, directly. We base our analysis on the work by Levin et al (2004) who examine the impact of inflation targeting on the way that expectations are formed. They argue that if expectations are better pinned down in an inflation targeting regime, then the relation between expectations (for difference horizons) and current inflation is weaker. While Levin et al classify countries in inflation targeters and non-inflation targeters, we use the aforementioned indices to classify countries according to their degree of transparency. The measure for expectations we use (in line with Levin et al) is that from Consensus Forecasts.

The paper is organised as follows. Section 2 describes how inflation, inflation expectations and central bank transparency have evolved since 1989. Section 3 then examines whether the level of transparency has an impact on the degree of anchoring of inflation expectations to the current level of inflation. Section 4 examines the stability of β with the aid of the Kalman filter. Section 5 summarises our main findings and concludes.

2 Inflation, Expectations and Transparency

As mentioned above, our analysis is based on the methodology by Levin et al (2004) in which inflation and inflation expectations are related as follows:

$$\Delta\hat{\pi}_t^q = \alpha + \beta\Delta\bar{\pi}_t + \varepsilon_t \tag{1}$$

The regressand $\Delta\hat{\pi}_t^q$ represents the first difference of inflation expectations q years ahead, formed at period t. The regressor, $\Delta\bar{\pi}_t$ is the first difference of the three-year moving average of realized CPI inflation, ending at, and including,

[2] See also earlier attempts by Chortareas et al (2003).

time t. The argument, the authors put forward is that as monetary regime changes help agents form their expectations, the link between inflation and expectations is weakened and the value of β tends to zero, and the more so for longer horizons. This is tested for countries that adopt inflation targeting regimes, while we will examine whether this is true for countries with more transparent central banks.
We provide first an overview of the way inflation and inflation expectations have changed from 1989 till 2004. To describe the evolution of inflation and inflation expectations we look at both the average, as well as the variability of these variables. In addition, we look at how the degree of transparency of Central Banks increased since 1998. We plot the way the EG index has changed from 1998 to 2002 for the nine (groups of) countries it concerns.

2.1 The data

We present data for inflation and its expectations for eight industrialized countries and the Euro-area. The countries in question (and their respective Central Banks) are Australia (RBA), Canada (BoC), the Euro area (ECB), Japan (BoJ), New Zealand (RBNZ), Switzerland (SNB), Sweden (SRB), UK (BoE) and the US (US Fed). Realised Inflation is based on consumer price indices taken from the International Financial Statistics of the International Monetary Fund, (except for the ECB which is taken from the OECD), presented in the form of a three-year moving average. Inflation expectations are taken from the Consensus Economic Forecasts for one, three, five and six-to-ten years ahead, with the exception of the Euro area where the longer horizons (two and five years ahead) are the data provided by the ECB itself. Consensus inflation expectations are measured twice a year, in April and October. We assume that the April measures represent inflation expectations in the first half of the year while the October measures are representative for inflation expectations during the second part of the year. The data period ranges from the second half of 1989 till the first half of 2004[3].
Table 1 summarises the evolution of the data, in terms of the mean (μ) and standard deviation (σ) of the aforementioned variables for three distinct periods. We have split the data in three periods of equal length to help summarise them: period I ranges from the second half of 1989 till the first half of 1994, period II then runs till the first half of 1999, and period III ends at the first half of 2004. Inflation expectations data for the ECB refers to a shorter period and is split in two parts: period I:1999S1-2001S2 and period II:2002S1-20041S1.

[3] See Appendix A for a detailed description of the inflation and the inflation expectations data and a comment on the bias that survey data may possibly contain.

Table 1. The development of inflation and inflation expectations

	AU		CAN		EURO		JPN		NZ		CH		SWE		UK		US	
	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ	μ	σ
$\pi(3-yearMA)$																		
I	5	2.8	4.1	1.5	4.9	0.7	2.2	1.0	4.1	2.3	4.2	1.5	6.9	2.8	6.3	2.4	4.3	0.9
II	2.2	1.4	1.4	0.6	2.8	0.6	0.8	0.8	2.3	0.9	1.3	1.0	1.9	1.4	2.7	0.6	2.6	0.4
III	3	1.4	2.2	0.9	2.0	0.5	0.5	0.5	1.8	1.0	0.8	0.5	1.2	1.1	2.2	0.7	2.4	0.7
$\pi^e(1)$																		
I	3.9	0.8	3.5	1.6	1.7	0.2	1.9	0.8	na	na	3.2	0.5	4.6	2.1	4.5	1.1	3.8	0.6
II	2.9	0.8	1.9	0.3	1.7	0.2	0.5	0.6	1.4	0.4	1.8	0.6	2.3	1.0	3.0	0.4	2.9	0.4
III	2.8	0.7	2.0	0.3	-	-	0.3	0.3	2.1	0.2	1.2	0.3	1.9	0.3	2.3	0.1	2.3	0.3
$\pi^e(3)$																		
I	4.3	0.8	3.2	0.8	1.7*	0.1*	2.2	0.4	na	na	na	na	na	na	4.4	0.5	4.0	0.3
II	3.2	0.5	2.0	0.2	1.8*	0.1*	1.2	0.6	1.7	0.1	1.9	0.1	2.4	0.5	3.1	0.5	3.1	0.4
III	2.6	0.1	1.9	0.1	-	-	0.4	0.5	1.9	0.3	1.6	0.1	2.0	0.1	2.4	0.2	2.5	0.2
$\pi^e(5)$																		
I	4.0	0.7	3.2	0.7	1.8	0.1	2.2	0.4	na	na	na	na	na	na	4.1	0.4	3.9	0.3
II	2.8	0.6	1.9	0.2	1.9	0.0	1.5	0.4	1.7	0.1	2.0	0.2	2.3	0.5	2.9	0.3	3.0	0.4
III	2.5	0.1	1.9	0.1	-	-	0.8	0.3	2.0	0.2	1.5	0.1	1.9	0.1	2.4	0.1	2.4	0.2
$\pi^e(6-10)$																		
I	4.1	0.7	3.0	0.6	-	-	2.2	0.4	na	na	na	na	na	na	3.9	0.3	3.9	0.2
II	2.9	0.4	2.0	0.3	1.9	0.1	1.4	0.5	1.8	0.1	1.9	0.2	2.4	0.5	3.0	0.4	3.0	0.3
III	2.5	0.1	2.0	0.1	-	-	0.9	0.4	2.0	0.2	1.6	0.1	2.0	0.0	2.4	0.1	2.5	0.1

Source: IMF, OECD, Consensus Economics and ECB. *two-years ahead.

Table 1 shows that, as a general trend, both the mean as well as the standard deviation of realised inflation have decreased during the period in question and for all countries. This change in inflation is the largest when comparing the first half of the nineties to the second. This is not the case for Canada and Australia which experienced a reversal in this trend for their mean after the second period.

The general trend in inflation expectations is in line with that for realized inflation. Both the mean and the variability of inflation expectations decrease throughout the whole period. Canada's experience constitutes again an exception which followed approximately the same pattern as its actual inflation. Interestingly, New Zealand was also faced with slightly increasing expectations across the sample for all horizons, despite it being an inflation targeter, which, generally thought, manages to produce lower expectations. The level and variability of inflation expectations in the Euro area have not changed much in the five-year period examined.

2.2 Central Bank Transparency

As mentioned earlier, there have been a number of attempts to measure how transparent Central Banks are. Using the index constructed by Eijffinger and Geraats (2002 and 2004a), we show changes in the degree of transparency in

the period from 1998 to 2003. Appendix B1 summarises the way the index was constructed for the nine Central Banks mentioned above, and Appendix B2 describes in detail the number of distinct changes observed[4]. Figure 1 provides an overview of the development of the scores for total Central Bank transparency for the nine banks.

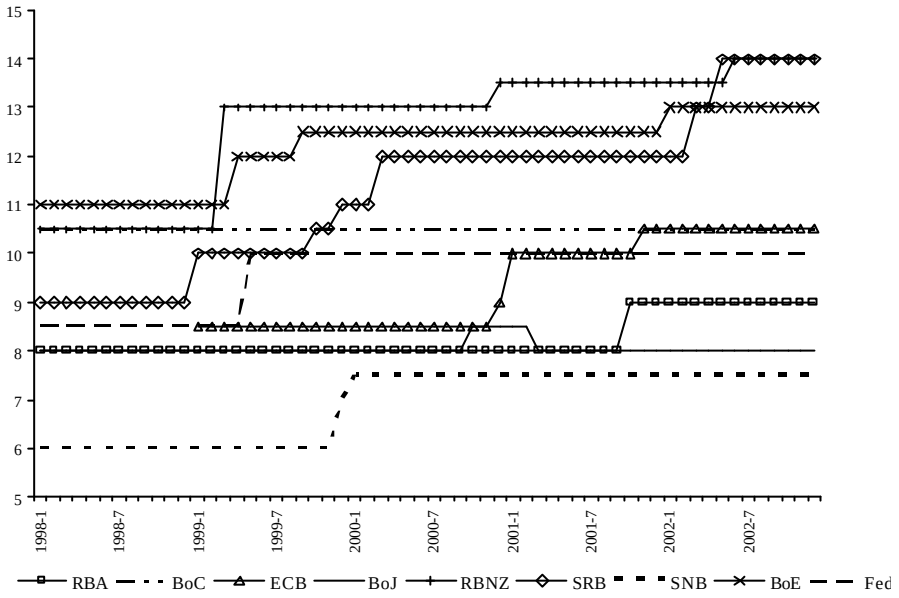

Figure 1: Eijffinger and Geraats Index of Transparency (1998-2002)

Most banks have experienced increases in transparency, but they differ both in terms of the specific aspects that they had changed, as well as the timing of these changes. The average score of the nine banks examined increased from 8.9 at the start of the period to 10.7 at the end. Starting in 1998, the BoE was the most transparent Central Bank with a score of 11 out of 15, closely followed by the BoC and the SRB. The SNB had the lowest level of transparency and remained at this position at the end of the sample period, although at a higher absolute level of transparency. The BoC and the BoJ ended at the same level of transparency as they started with whereas all other Central Banks saw their total level of transparency increase, with the RBNZ and SRB having the higher score of 14 out 15 in 2002. We attempt next to link the level of transparency to the way inflation expectations are linked to realised inflation.

[4] We compile this based on both EG (2004b) as well as Tomljanovich (2004).

3 Transparency and Expectations

We are going to apply Levin et al's (2004) methodology in three ways. First we apply a panel regression in which we group countries according to their degree of transparency. Second we carry out a country-specific analysis in which we test whether particular instances of changes in transparency have had a significant impact on the relationship between the two variables. Last, we re-group the results by Levin et al on inflation persistence, according to the level of transparency indicated by the EG index.

3.1 A panel analysis

We use panel data to compare how expectations anchoring to actual inflation varies with central bank transparency. Levin et al (2004) distinguish between countries based on whether they follow an inflation targeting regime. We argue that the concept of Central Bank transparency is broader than inflation targeting alone, as the existence of a quantitative target is just one component of the measure. We expect therefore, that more transparent central banks will have a better ability to anchor inflation expectations, thus weakening their relationship with inflation. We investigate whether this is true by separating countries into two groups of 'low' and 'high' transparency, based on countries' score in various indices. A country that scores higher than two thirds of the maximum score is classified as one of 'high' transparency, and 'low' otherwise. We thus estimate the following panel data equation:

$$\Delta\hat{\pi}^{q}_{j,t} = \alpha + \beta\Delta\bar{\pi}_{j,t} + \varepsilon_{i,t} \tag{2}$$

where now j = ('high', 'low'). Equation (2) implies that the relationship is for two groups of countries, representing 'high' and 'low' levels of transparency. We expect that the high transparency group will have a lower value for β, and that the relationship weakens for longer horizons. We apply the EG index as it constitutes a very comprehensive examination of all Central Bank characteristics. Table 2 gives an overview of the results for the slope parameter and its significance.

Table 2. Estimates of β in equation (2) based on the EG index

EG Index	Low		High	
	SNB (6.9), BoJ (8), RBA (8.2), ECB (9.4), US Fed (9.7)		BoC (10.5), SRB (11.4), BoE (12.2,)RBNZ (12.8)	
	β		β	
$q = 1$	0.06	[0.44]	-0.09	[0.15]
$q = 3^*$	0.05	[0.32]	-0.03	[0.38]
$q = 5$	0.09	[0.06]	-0.03	[0.33]
$q = 6 - 10$	0.10	[0.03]	-0.01	[0.73]

Note: p-values in square brackets[5]. *two-year ahead inflation for the ECB.

[5] Maximum score for the EG index is 15. Countries classified according to their

The results show that the value of β is positive and significant for the longest horizon (6-10 years) for the low transparency groups. This is not the case for the high transparency group where the value is insignificant, and anyway closer to zero for the long horizons. This is an indication, that comparatively speaking, countries that invest in transparent monetary policy institutions benefit from having better anchored expectations of inflation. We repeat the same exercise for three other indices by Bini-Smaghi and Gros (2001), Siklos (2002) and De Haan et al (2004) as well as experiment with different cut-off values for the splitting of the countries into high and low transparency groups. The results are presented in Appendix C and show no significant deviation from the analysis presented so far. We perform next the same analysis for each country individually, examining how (and whether) institutional changes that enhanced transparency during the 90s, have also affected the relationship between inflation and inflation expectations.

3.2 Country-specific analysis

We carry out next a country-specific analysis to check whether distinct institutional changes that have contributed to an increase in transparency, had a significant impact on the way inflation expectations follow actual inflation. Based especially on EG (2004b) and Tomljanovich (2004) we take into account all changes that have occurred since 1989, described in detail for the nine Central Banks in Appendix B2. Similarly to above, we now perform the following regression:

$$\Delta\hat{\pi}_t^q = \alpha + \beta\Delta\bar{\pi}_t + \sum_{i=1}^{n} \gamma_{i,t} \left(D_{i,t} * \Delta\bar{\pi}_t\right) + \varepsilon_t \tag{3}$$

where n represents the number of institutional changes, the dummy D_i takes the following values:

$$D_i = \begin{cases} 0 \text{ for } t = 1...k_i - 1 \\ 1 \text{ for } t = k_i...T \end{cases}$$

and k_i is the timing of institutional change i. We drop subscript j for convenience, but the regressions are now performed for the nine central banks individually. For changes that have taken place consecutively in one year, we have timed the dummy to coincide with the first, but the term may very well capture a combined effect. We expect γ_i to be negative, so that increases in the level of transparency weakens the link between inflation and expectations (i.e. $\beta > \beta + \gamma_i$) and thus decrease the degree to which inflation expectations

average value for the period 1998-2002. Note that although the absolute level of transparency has increased for most countries in the sample, their relative position has remained stable. We apply least squares estimation with GLS cross-section weights, and assume cross sectional heteroskedasticity.

are fixed[6]. We have adopted a general-to-specific approach in the sense that we introduce a dummy for all institutional changes listed in Appendix B2 to start with, dropping every time the ones that do not have a significant impact at any horizon. The Wald-test checks for the joint significance of the dummy parameters. Table 3 gives an overview of the results, reporting the significant institutional changes only and showing the dummies with the largest impact on anchoring inflation expectations first.

Table 3. Transparency and anchoring inflation expectations

	Score		$\hat{\pi}^{(1)}$		$\hat{\pi}^{(3)}$		$\hat{\pi}^{(5)}$		$\hat{\pi}^{(6-10)}$	
RBNZ	(14)	β	0.27	[0.55]	-0.09	[0.22]	0.13*	[0.06]	0.12*	[0.00]
		γ_{2002}	-0.40	[0.21]	-0.05	[0.89]	-0.32*	[0.02]	-0.16	[0.14]
		γ_{1999}	-0.39	[0.44]	0.07	[0.70]	-0.13*	[0.08]	-0.11*	[0.01]
		Wald-test		[0.23]		[0.92]		[0.03]*		[0.03]*
SRB	(14)	β	-0.25*	[0.06]	0.46*	[0.01]	0.27*	[0.06]	0.63*	[0.00]
		γ_{1997}	-0.01	[0.94]	-0.66*	[0.00]	-0.25*	[0.06]	-0.59*	[0.00]
		γ_{2002}	0.63*	[0.07]	0.31*	[0.00]	0.07	[0.53]	0.04	[0.72]
		Wald-test		[0.16]		[0.00]*		[0.08]*		[0.01]*
BoE	(13)	β	-0.06	[0.27]	-0.11	[0.40]	-0.09	[0.34]	-0.05	[0.23]
		γ_{1998}	-0.22	[0.62]	-0.56*	[0.06]	-0.35	[0.15]	-0.39*	[0.02]
		γ_{1997}	-0.14	[0.57]	0.53*	[0.01]	0.14	[0.43]	0.25*	[0.01]
		γ_{1999}	0.40	[0.12]	0.27	[0.14]	0.29*	[0.09]	0.13	[0.22]
		Wald-test		[0.14]		[0.05]*		[0.38]		[0.01]*
BoC	(10.5)	β	1.08*	[0.01]	-0.29*	[0.05]	0.01	[0.93]	-0.03	[0.61]
		γ_{1991}	-1.16*	[0.00]	0.31*	[0.05]	-0.01	[0.90]	0.04	[0.67]
		Wald-test		[0.00]*		[0.05]*		[0.90]		[0.67]
ECB	(10.5)	β	0.35	[0.62]	0.02[1]	[0.80]	0.02	[0.43]	na	-
US Fed	(10)	β	0.02	[0.82]	0.06	[0.31]	0.10*	[0.01]	0.04	[0.25]
RBA	(9)	β	0.53*	[0.03]	0.49*	[0.07]	0.62*	[0.00]	0.48*	[0.01]
		γ_{1996}	-0.79*	[0.03]	-0.41	[0.19]	-0.58*	[0.00]	-0.47*	[0.02]
		Wald-test		[0.03]*		[0.19]		[0.00]*		[0.02]*
BoJ	(8)	β	0.41*	[0.02]	0.16	[0.47]	0.23	[0.38]	0.48*	[0.01]
		γ_{1998}	-0.75*	[0.00]	-0.45*	[0.08]	-0.25	[0.43]	-0.21	[0.53]
		γ_{2000}	0.67*	[0.00]	1.77*	[0.02]	-0.52	[0.28]	-0.01	[0.99]
		Wald-test		[0.00]*		[0.11]		[0.31]		[0.64]
SNB	(7.5)	β	0.04	[0.71]	-0.35*	[0.10]	-1.22*	[0.03]	-1.07*	[0.01]
		γ_{1999}	0.10	[0.78]	0.44*	[0.03]	1.61*	[0.06]	1.24*	[0.03]
		Wald-test		[0.78]		[0.03]*		[0.06]*		[0.03]*

Source: see Appendix A[7]. Scores based on the EG 2002 index; p-values in square brackets. Results are based on Newey-West standard errors. [1]Two year ahead inflation. *Significant at 10 percent confidence level.

[6] We test for autocorrelation with the Langrange-Multiplier F-test. Those regressions that reject the hypothesis of no autocorrelation are re-estimated with extra lags of the dependent variable, $\Delta\hat{\pi}_t^q$.

[7] We have added the first lag of $\Delta\hat{\pi}_t^q$ to solve for autocorrelation in: all RBA regressions, BoJ $\Delta\hat{\pi}^{(6-10)}$, US $\Delta\hat{\pi}^{(3)}$. Two lags were needed for BoJ $\Delta\hat{\pi}^{(5)}$.

We present first a number of general comments and then discuss each country in greater detail. We observe that a number of countries has a positive and significant value for β, and therefore a strong link between inflation and inflation expectations. This is more so for the two countries that are classified as having the highest transparency score in the EG 2002 index, although Australia is also similar to that, despite a lower transparency score. By contrast, the UK which has achieved a relative high level of transparency during the course of the 90s, produces slightly counter intuitive results. However, high transparency countries seem to have benefited from actions to increase their degree of transparency in the sense that this relationship is reversed by negative and significant γ(s). In that respect those countries that stand the most to benefit from further institutional changes are the ones to make the effort required. Canada and Australia have very clearly benefited from introducing a regime of inflation targeting. We cannot test this for New Zealand and Sweden but they both appear to be at the top of the transparency index, and clearly benefit from other institutional changes. The introduction of inflation targeting in the UK at the end of 1992, did not appear to have a significant impact in our data-set.

New Zealand

New Zealand is the country with the highest score in the transparency index, and the first country to adopt an explicit inflation target, at the start of 1989. The whole period therefore, investigated is one during which there was an explicit quantitative target. Our results show that perhaps for the whole period there was a small but significant link between inflation and inflation expectations for the longer horizons (namely q : 5, $\beta = 0.13$ and q : 6-10, $\beta = 0.12$). This relationship however appears to weaken as we allow for the introduction of the provision of explanations for policy changes, the unconditional projections of the 90-day bank bill rate in the quarterly *Monetary Policy Statement* and increased operational transparency (1999) and extra data on the web site to accompany the Monetary Policy Statement (2002).

Sweden

Here the relationship between inflation and inflation expectations is strongly positive, (with the exception of the one year horizon), but the value for the coefficient tends to zero when we allow for two institutional changes. These are, the publication of the inflation report in 1997 and the announcement of a policy inclination as a likely adjustment of the policy rate in the future and the effective provision of attributed voting records by clarifying the dissents in 2002. Note that Sweden adopted inflation targeting in 1993, but as we do not have data for inflation expectations prior to 1995 we cannot test for its impact explicitly. Bryan and Palmqvist (2005) find evidence that inflation targeting has been very effective in influencing inflation expectations in Sweden.

UK

The regressions performed do not appear to capture a significant relationship between expectations and inflation throughout the period examined. The UK has seen a number of substantial changes in its institutional set-up of its monetary

policy, including an introduction of inflation targeting in 1992, the granting of independence to the Bank of England in 1997, the introduction of timely publication of the policy meetings minutes in 1998 and transparency about the models used and the discussion of the inflation and output forecasting record in 1999. However, it is not clear how these changes have affected the disassociation of expectations from the underlying inflation process. We see that the granting of independence contributes positively (and significantly) to the slope parameter for the 3 and 6-10 years horizons, and the publication of minutes contributes negatively (and again significantly) at the same horizons. Thus it is only the latter that appears to have affected the relationship in the expected manner. The 1999 changes did not seem to have any desired effect.

Canada
Inflation and inflation expectations appear to be very strongly linked at the one-year horizon, but this relationship completely disappears when we allow for the shift to an inflation targeting regime in 1991. Similarly, the coefficient collapses to zero for the longer horizons when including the dummy, but is only significant at the three-year span. Note that as our data starts in the middle of 1989, we only have two years of non-inflation targeting data, and therefore, not necessarily enough information to capture the institutional shift.

Euro area
The data for the Euro area shows that there is no strong relation between the two variables for the horizons that data is available for, as the coefficients are insignificant and mostly very small. No other institutional changes appeared to have affected that since its inception.

US
Just as for the Euro area, there is no apparent relationship between inflation and expectations. We have experimented with a number of institutional changes across the period but they appear to have made no significant difference.

Australia
Australia appears to have strongly benefited from switching to an inflation targeting regime. Thus, inflation expectations for all horizons were very closely linked to current inflation prior to 1996. However, the introduction of a quantitative target has eliminated this relationship and has brought the value of the coefficient close to zero.

Japan
It is very difficult to draw any conclusions about Japan given its history in the period in question. The granting of operational independence, the submission of a semi-annual report on monetary policy, and the publication of minutes and transcripts of the monetary policy meetings however, appear to have some effect especially for the very short run. The 2000 change in transparency seems to be undesirable.

Switzerland

Finally, Switzerland, the country with the lowest transparency score according to the EG 2002 index does not exhibit a relationship that is easy to interpret. Thus when the coefficients appear significant, they are wrongly signed (i.e. negative). The clarification of the definition of price stability in 1999 appears to have had a significant impact, bringing the coefficient close to zero but again these results are not readily intuitive.

3.3 Inflation Persistence

In their paper, Levin et al (2004) also examine whether inflation targeting countries have experienced less persistent inflation. The objective behind this exercise is to examine whether inflation has a unit root. They show that those countries that follow a regime of inflation targeting exhibit lower inflation persistence than the rest of the countries. Similar to that we search whether this pattern is also applicable to countries that have higher degrees of transparency. As they do this for countries individually, it is immediately possible to use their results and rank them according to the degree of transparency. Levin et al (2004) make a distinction between core CPI, (without food and energy prices), and total CPI and estimate a univariate autoregressive process for inflation in the form of equation (4)[8].

$$\pi_t = \mu + \sum_{j=1}^{k} \alpha_j \pi_{t-j} + \varepsilon_t \tag{4}$$

The authors then present two ways of testing for the existence of a unit root[9]. First, they derive a scalar measure of persistence in the form of the largest autoregressive root, ρ, defined as the largest root of the following characteristic equation.

$$\lambda^k - \sum_{j=1}^{k} \alpha_j \lambda^{k-j} = 0 \tag{5}$$

The rational behind this choice is that this captures the size of the impulse response $\frac{\partial \pi_{t+j}}{\partial \varepsilon_t}$, as j increases. Applying Stock's (1991) method, the authors get an estimate for the unbiased median and an upper 95^{th} percentile (the upper

[8] The error term ε_t is uncorrelated, homoskedastic and random. The amount of autoregressive lags, k, is determinded with the Akaike information criterion with a maximum lag order of 4.

[9] It is worth noting that for $k = 1$ we can re-write equation (4) as follows:

$$\begin{aligned} \pi_t &= \mu + \alpha \pi_{t-1} + \varepsilon_t \\ \Delta \pi_t &= \alpha \Delta \pi_{t-1} + \eta_t \end{aligned}$$

Parameter α will not be significant unless inflation is highly persistent. This is not dissimilar to equation (1), if one assumes that the consensus forecast applied is a good proxy for the unbiased forecast of π_t for the given horizon, and the moving average of inflation captures the same information as the first inflation difference. Both specifications therefore, are designed to test for inflation persistence, albeit the first in an indirect way.

bound of a two-sided 90% confidence interval) for the largest autoregressive root, estimated over 1994:Q1-2003:Q2. However, since the largest autoregressive root may be unrepresentative of the dynamics in the series, they consider as an alternative measure, the sum of the autoregressive coefficients,

$$\alpha = \sum_{j=1}^{k} \alpha_j \tag{6}$$

and by using the "grid bootstrap" technique by Hansen (1999), construct the confidence intervals of the t-statistic

$$t = \frac{\hat{\alpha} - \alpha}{SE\left(\hat{\alpha}\right)} \tag{7}$$

Again they report the unbiased median and the value for the upper 95^{th} percentile estimate. A value less than unity for the latter implies that a unit root can be rejected and therefore, the inflation series is white noise (at the 5 percent significance level for a one-tailed test). Our expectation is that more transparent central banks will fail to reject white noise processes, whereas lower transparency banks will fail to reject a unit root more often. Table 4 gives an overview of the persistence estimates (for both tests). Note that this table is taken directly from Levin et at (2004)[10], but countries are rearranged according to the EG 2002 index scores for their central banks, in a descending order of transparency.

Table 4a. Persistence of inflation (based on ρ)

		Core CPI		Total CPI	
	Score	Median	Upper 95^{th} perc.	Median	Upper 95^{th} perc.
RBNZ	(14)	0.24*	0.60	0.25*	0.61
SRB	(14)	0.16*	0.54	0.04*	0.44
BoE	(13)	0.33*	0.68	0.06*	0.45
BoC	(10.5)	0.27*	0.63	-0.22*	0.21
ECB	(10.5)	0.84	1.06	0.87	1.06
US Fed	(10)	1.04	1.10	0.54*	0.86
RBA	(9)	0.70	1.02	0.47*	0.80
BoJ	(8)	0.82	1.05	0.72	1.03

Source: Levin et al (2004), part of table 3 p.59, based on OECD data.[11] No information on Switzerland available. *indicates failure to accept a unit root.

[10] Inflation is the quarterly percentage change in the price index. There was no information on Switzerland available.

[11] Note that the Euro area is represented as an average of France, Germany, Italy and the Netherlands, using GDP shares as averages.

Table 4b. Persistence of inflation (based on $\Sigma\alpha_j$)

		Core CPI		Total CPI	
	Score	Median	Upper 95^{th} perc.	Median	Upper 95^{th} perc.
RBNZ	(14)	0.43*	0.72	0.44*	0.73
SRB	(14)	0.44*	0.70	0.28*	0.58
BoE	(13)	0.50*	0.77	0.34*	0.64
BoC	(10.5)	0.45*	0.73	0.12*	0.46
ECB	(10.5)	0.88	1.08	0.76	1.24
US Fed	(10)	1.03	1.16	0.36*	0.87
RBA	(9)	0.77	1.05	0.59*	0.85
BoJ	(8)	0.81	1.10	0.5	1.14

Source: Levin et al (2004), part of table A2 p.79, based on OECD data. No information on Switzerland available. *indicates failure to accept a unit root.

The two persistence tests, reported in tables 4a and 4b produce identical results. We see that countries that score high in the transparency index reject the unit root and therefore exhibit lower persistence for both measures of inflation. The US Fed and Reserve Bank of Australia appear also to reject the unit root for total CPI. Also it is worth mentioning that although Canada and the Euro area have identical transparency scores, the latter fails to reject the hypothesis posed.

4 Kalman filter

The analysis so far has assumed that the value of β was stable over the period examined, and only differed between high and low transparency countries. In this section we relax this assumption and examine whether the coefficient β has varied over the period in question. In other words, following the decreasing trends in inflation and expectations, we investigate whether the relationship between these two variables has weakened during our measurement period. Our attempt aims to bring the Levin et al argument a step further, by saying that increases in transparency have a similar effect on this relationship. Thus, we expect inflation expectations in countries where Central Banks experienced increases in transparency to be better anchored after those increases. We first look at how the relationship between inflation and inflation expectations has changed, by estimating the following state space for each country in our sample.

$$\text{Measurement equation}: \Delta\hat{\pi}^{q}_{j,t} = \alpha_{j,t} + \beta_{j,t}\Delta\bar{\pi}_{j,t} + \varepsilon_{j,t} \tag{8}$$

$$\text{Transition equation}: \beta_{j,t} = \beta_{j,t-1} + \eta_{j,t} \tag{9}$$

where $j = 1...9$, for the nine central banks in the sample. Our aim is to see whether the value of β has fallen during the sample examined, thus reducing the link between the two variables. The Kalman filter technique, allows to see how agents use new information when it becomes available to them, to update their estimate of the slope parameter, β_t. Given an initial estimate for β_t, the Kalman filter then provides the optimal forecast of the unobserved β_{t+1}, for

$t = 0, .., T$, based on the Minimum Mean Square Error criterion[12]. Assuming normally distributed errors, the Kalman filter produces the maximum likelihood estimators for α and β_t. We examine how the one-step ahead predicted states of β_t evolve for all forecast horizons. We assume that the initial estimate of β_t equals zero.
In general terms, graphs (2)-(5) at the end, show that the value of β_t has tended towards zero towards the end of the sample. While for most countries, the value started positive, there are instances where the value is negative to start with (Canada, $q = 3$) or even throughout the whole sample, the UK being the prime example.

5 Summary and Conclusions

We have seen that inflation and inflation expectations have followed a declining trend over the past 15 years. At the same time, a number of central banks have made considerable efforts to improve the way they communicate to the public and more general their degree of transparency. The rational behind such attempts is to allow for expectations to be driven by the monetary authorities commitment to alleviate the effects of shocks, rather than the affected level of inflation itself. In achieving that, the monetary policy authorities task of cushioning shocks is thus much facilitated. The question that we then ask in this paper is whether these observations were a coincidence or whether these apparent efforts to increase transparency are, at least in part, responsible for the downward trend in inflation, the expectation of inflation but also the weakening of the relation between the two variables.
Following then the approach by Levin et al (2004) we link the relation between inflation and expectations to the changes at the level of transparency, measured by four alternative indices. We find that those countries that are associated with higher levels of transparency experience a weaker link between the two variables. In addition, those countries are the ones to benefit the most when they undertake further institutional changes. Further, we have seen that adopting a regime of inflation targeting has proved very beneficial to a number of countries, and in any case inflation targeting countries, which according to Levin et al have better anchored expectations, tend to score higher in the transparency index in general. Our third section, showed in a very consistent manner that higher transparency reduces the level of inflation persistence in the respective countries. In section four we applied a Kalman filter technique which shows us that the link between inflation and inflation expectations has become weaker and tended to zero towards the end of the sample period.
Our results indicate that transparency matters. For policy makers it is important to know that some aspects of transparency are more important than others. For example transparency about inflation targets, which belongs to political transparency as defined by Geraats(2000), seems to matter a lot.

[12] See Boone (1997) for a summary of the technique.

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APPENDICES

A DATA

A.1 Inflation Expectations

RBA
$\hat{\pi}$(1, 3, 5 and 6-10): 1991s1-2004s1
Source: Consensus Economics

BoC, BoE, US Fed
$\hat{\pi}$(1, 3 and 5): 1989s2-2004s1, except 2003s1
$\hat{\pi}$(6-10): 1990s1-2004s1, except 2003s1
Source: Consensus Economics

ECB
$\hat{\pi}$(1): 1999s1-2004s1, except 2003s1
$\hat{\pi}$(6-10): 2003s2-2004s1
Source: Consensus Economics
$\hat{\pi}$(2): 1999s1-2004s1, except 2003s1
$\hat{\pi}$(5): 1999s1-2004s1, except 2003s1, except 1999s1 and 2000s1
Source: www.ecb.int/stats/prices/indic/forecast/html/table_hist_hicp.en.html

BoJ
$\hat{\pi}$(1, 3): 1989s2-2004s1, except 2003s1
$\hat{\pi}$(5): 1989s2-2004s1, except 2001s1 and 2003s1
$\hat{\pi}$(6-10): 1990s1-2004s1, except 2001s1 and 2003s1
Source: Consensus Economics

RBNZ
$\hat{\pi}$(1, 3, 5 and 6-10): 1995s2-2004s1
Source: Consensus Economics

SNB
$\hat{\pi}$(1): 1989s2-2004s1, except 2003s1
$\hat{\pi}$(3, 5 and 6-10): 1998s2-2004s1, except 2003s1
Source: Consensus Economics

SRB
$\hat{\pi}$(1): 1990s1-2004s1, except 2003s1
$\hat{\pi}$(3, 5 and 6-10): 1995s1-2004s1, except 2003s1
Source: Consensus Economics

Consensus Economics forecast data is the average of the expectations of a group of experts. These forecasts are likely to perform better than the individual forecasts that make the consensus. Although there will be some individuals

that perform better, they are difficult to identify a priori and their performance is not the same in each period. Pooling the forecasts deletes various behaviour biases.
Batchelor (2001) compares, among other variables, inflation forecasts produced by the IMF and Consensus Economics, during the 90s. He finds that average forecasts were too high in both cases and the longer the forecast horizon the higher this bias. Although the mean absolute forecast error is higher in the Consensus Economics inflation forecasts, the root mean squared error is in all cases lower, which indicates that Consensus Economics forecasts were better suited to avoid large forecast errors. Nevertheless testing for differences in mean square errors, indicates that IMF inflation forecasts are significantly less biased. On the other hand, the Consensus Economics forecasts have a higher information content.

A.2 Inflation

RBA, RBNZ
Source: IMF, International Financial Statistics inflation data
Quarterly data
Period: 1989s2-2004s1

BoC, BoJ, SNB, SRB, BoE and US Fed
Source: IMF, International Financial Statistics inflation data
Monthly data
Period: 1989s2-2004s1

ECB
Source: OECD, Main Economic Indicators
Period: 1989s2-2004s1

B An Index of Transparency

B.1 The Eijffinger Geraats, 2002 Index

The methodology that EG (2002) applied to construct their index is summarized in table B1.

Table B1. Methodology used by Eijffinger and Geraats

1^{st}	Sifting through published information by central banks and other relevant government sources (freely available in English as of June 2001).
2^{nd}	Sending the scores for each central bank with a detailed description to a senior official of the central bank with the request to review the scores.
3^{rd}	Making a few modifications as a result of the reactions received.
4^{th}	Updating the index for 2002 and determining the indexes back to 1998.

Source: EG (2002) text on p.9 and 10.

The index is compiled for nine major central banks and is based on information disclosed by the banks themselves. Furthermore, it distinguishes between various aspects of transparency, based on the ways in which they affect monetary policy. The E&G index is defined by the following components of transparency:

Table B2. Transparency Components, E&G Index

1.	Political	2.	Economic
(a)	Formal Objectives	(a)	Economic Data
(b)	Quantitative Targets	(b)	Policy Models
(c)	Institutional Arrangements	(c)	Central Bank Forecasts
3.	Procedural	4.	Policy
(a)	Explicit Strategy	(a)	Prompt announcement
(b)	Minutes	(b)	Policy Explanation
(c)	Voting Records	(c)	Policy Inclination
5.	Operational		
(a)	Control Errors		
(b)	Transmission Disturbances		
(c)	Evaluation Policy Outcomes		

Table B3 below presents the scores obtained for the individual banks, in decreasing order of total 2002 transparency:

Table B3. The E&G Index of Central Bank Transparency (and its components)

	Political		Economic		Procedural		Policy		Operational		Total	
	'98	'02	'98	'02	'98	'02	'98	'02	'98	'02	'98	'02
NZ	3	3	2.5	3	3	3	1	3	1	2	10.5	14
SWE	2	3	1.5	2	2	3	1.5	3	2	3	9	14
UK	3	3	1.5	3	3	3	1.5	1.5	2	2.5	11	13
CAN	3	3	2.5	2.5	1	1	2	2	2	2	10.5	10.5
ECB	n.a.	3	n.a.	2.5	n.a.	1	n.a.	2	n.a.	2	n.a.	10.5
US	1	1	2.5	2.5	2	2	1.5	3	1.5	1.5	8.5	10
AU	3	3	1	2	1	1	1.5	1.5	1.5	1.5	8	9
JPN	1.5	1.5	1	1.5	2	2	1.5	1.5	2	1.5	8	8
CH	1	2.5	1	1.5	1	1	2	2	1	0.5	6	7.5

The "Total" column is the arithmetic sum of the individual columns (for 1998 and 2002 respectively) and reflects a measure of total transparency.

B.2 Transparency Changes (since 1989)

Table B4: Institutional Changes

CB		Source	Transparency change
RBA	01/1990	CC (2003)	Introduction of announcements for changes to the target cash rate. (not applied here because it occurred before the inflation expectations data period.)
	08/1996	T (2004)	Formalization of inflation-targeting framework.
	10/2001	EG (2004b)	The model is clarified.
BoC	02/1991	T (2004)	Inflation Targets first announced.
	07/1994	T (2004)	50 basis point operating band for overnight rate announced.
	02/1996	T (2004)	Announcement of Official Overnight Rate target. Press release whenever change in band occurs, including explanation for change.
ECB	12/2000	EG (2004b)	The June and December Monthly Bulletin contain conditional inflation and output projections for the medium term.
	01/2001	EG (2004b)	Publication of a structural macroeconomic model used for policy analysis.
	11/2001	EG (2004b)	All monetary policy meetings of the Governing Council (once a month) are followed by a press conference with an explanation of the policy decision. Previous to that there were two meetings each month of which only half were follwed by a press conference.
	05/2003		Change in the inflation target from positive below 2% to an inflation rate of below, but close to, 2% over the medium term.
BoJ	04/1998	EG (2004b), T (2004)	Central Bank granted operational independence through Bank of Japan Act. Publication of minutes and transcripts of monetary policy meetings and submission of a semi-annual report on monetary policy to the Diet.
	10/2000	EG (2004b)	Short-term conditional forecasts for inflation and output by the Policy Board are part of the semiannual Outlook and Risk Assessment of the Economy and Prices.
	03/2001	EG (2004b)	The main operating target was changed from the average uncollateralized overnight call rate (which has been effectively zero since February 12, 1999) to the outstanding balance of the current accounts at the Bank. The latter is a very rough range and the targeted variable shows significant fluctuations within it, but there are no explanations for these control errors.

RBNZ	01/1989	T (2004)	Adoption of Inflation Targeting, via Reserve Act of 1989. Operational independence also granted through Act. (This change is not used in the regressions because it occured prior to the inflation expectations data period we have.)
	03/1999	EG (2004b)	Explanations of policy changes are provided. In addition, unconditional projections of the 90-day bank bill rate (closely related to the Official Cash Rate) in the quarterly Monetary Policy Statement (policy inclination). Initially, there was opacity about control errors because there was no evaluation of the achievement of the daily settlement cash target. The main operating target changed to the Official Cash Rate, which is almost perfectly controlled.
	12/2000	EG (2004b)	Explanations were provided for non-adjustement of the Official Cash Rate
	06/2002	EG (2004b)	The quarterly Monetary Policy Statement is accompanied by data on capacity utilization in Excel spreadsheets on the website. (precise timing is not known)
SNB	12/1999	EG (2004b)	Price stability defined as an inflation rate of less than 2% per annum. The June and December Quarterly Bulletin and the half-yearly media news conference present an inflation forecast for the next three years. The policy target changes and explanations for control errors are not given anymore in the Annual Report.
	01/2000	EG (2004b)	The Bank's independence is preserved with a constitutional amendment.
SRB	03/1997	EG (2004b) and HV (2002)	Inflation report published at quarterly frequency.
	01/1999	EG (2004b)	Amendments to the Constitution Act and the Sveriges Riksbank Act clarify the Riksbank's institutional independence and main objective.
	10/1999	EG (2004b)	The announcement of every policy decision, not only adjustments, is explained.
	12/1999	EG (2004b)	Data on many economic variables, including capacity utilization, can be downloaded from the Riksbank Website.
	03/2000	EG (2004b)	Discussion of past inflation forecast errors, macroeconomic transmission disturbances, evaluation of inflation in the last three years (including an account of the contribution of monetary policy) are in the March Inflation Report.
	03/2002	EG (2004b)	First time that there was a policy inclination that indicated likely adjustment of interest rates in the near future.
	05/2002	EG (2004b)	Clarified who are the dissents, so that the minutes effectively provide attributed voting records.

BoE	10/1992	T (2004)	Announcement of an explicit Inflation Target. Minutes of policy meetings released within six weeks instead of 30 years.
	05/1997	EG (2004b), T (2004)	Bank of England Act led to operational independence and the immediate disclosure of policy decisions.
	06/1998	T (2004)	The minutes of Policy Meetings are made public within 15 days.
	04/1999	EG (2004b)	Extensive documentation of the policy models and the computer code of the macro econometric model are made available.
	08/1999	EG (2004b)	The August inflation report contains a discussion of inflation and output forecasting record of the Monetary Policy Committee.
	?/2002	EG (2004b)	Bank of England web site contains time series of important macroeconomic variables (including output gap). (uncertainty about the precise timing, therefore we did not use this change)
Fed	02/1994	EG (2004b), T (2004)	The FOMC started announcing changes in its policy stance. Announcements about the target are made on the day of FOMC meeting, release of minutes with 6 weeks delay and transcripts with 5 years delay.
	05/1999	EG (2004b)	Provision of policy decisions even in the case of non-adjustment. The statement that is released after each policy meeting includes an explicit phrase that describes the policy tilt.
	01/2000	T (2004)	Public statements after FOMC meetings have revised language (f.e. without ´neutral bias´).

Source: EG= Eijffinger and Geraats, CC= Coppel and Connolly, T=Tomljanovich (2004), HV=Heikensten and Vredin (2003). The last one gives an overview of transparency changes indicated by Coppel and Connolly (2003), Muller and Zellmer (1999), King (1997) and Central Bank Webpages.

C Panel data regressions

We repeat the same exercise for three other indices by Bini-Smaghi and Gros (2001), Siklos (2002) and De Haan et al (2004). Maximum score for the three indices are BSG:(25), Siklos:(1), and de Haan et al:(19). These indices do not always cover the same group of countries and are not as comprehensive as that by EG. Nevertheless, we examine how well they confirm our observations in the main text.

Table C1. Estimates of β in equation (2) based on alternative indices

	Low		High	
BSG	BoJ (14), BoC (15), US Fed (16), ECB (19)		BoE (24)	
	β		β	
$q = 1$	0.03	[0.75]	-0.06	[0.58]
$q = 3^*$	0.03	[0.53]	-0.06	[0.35]
$q = 5$	0.05	[0.20]	-0.07	[0.08]
$q = 6 - 10$	0.06	[0.10]	-0.05	[0.18]
Siklos	ECB (0.52), RBA (0.56), SNB (0.65), BoJ (0.74)		BoC (0.83), RBNZ (0.83) SRB (0.87) US Fed (0.87), BoE (0.91)	
$q = 1$	0.06	[0.61]	-0.05	[0.33]
$q = 3^*$	0.04	[0.55]	-0.02	[0.62]
$q = 5$	0.04	[0.61]	-0.00	[0.90]
$q = 6 - 10$	0.05	[0.69]	0.01	[0.74]
De Haan	US Fed (11)		ECB (15), BoC (16), BoE (17), RBNZ (16-18)	
$q = 1$	0.02	[0.90]	-0.05	[0.50]
$q = 3^*$	0.04	[0.59]	-0.02	[0.65]
$q = 5$	0.10	[0.18]	-0.03	[0.24]
$q = 6 - 10$	0.04	[0.45]	-0.02	[0.56]

Note: p-values in square brackets[13]. *two-year ahead inflation for the ECB.

Comparing the composition of the groups for the four indices, the ECB, BoC and the US Fed are the only Central Banks that are not always associated with the same transparency group. The remaining Central Banks belong consistently to the same group. Results are broadly similar with those attained by the EG index, albeit not significant. Nevertheless, the size of the slope parameter β is always found to be larger in size for countries with lower levels of transparency. Furthermore, we experiment with different cut-off values for the distinction between the high and low transparency groups of countries. Table C2 considers as a cut-off value 50% of the maximum index value and table C3, 75% of the maximum index value.

[13] Least squares estimation with GLS cross-section weights, with cross sectional heteroskedasticity assumed.

Table C2. Equation 2: cut-off value 50% max

	Low		High	
EG Index			BoJ (8), RBA (8.2), ECB (9.4), US Fed (9.7),	
	SNB (6.9)		BoC (10.5), SRB (11.4), BoE (12.2), RBNZ (12.8)	
$q = 1$	0.05	[0.68]	-0.05	[0.39]
$q = 3^*$	0.03	[0.87]	-0.01	[0.83]
$q = 5$	0.16	[0.68]	0.00	[0.88]
$q = 6 - 10$	-0.01	[0.97]	0.02	[0.49]
BSG	BoJ (14), BoC (15)		US Fed (16), ECB (19), BoE (24)	
$q = 1$	0.02	[0.82]	-0.03	[0.75]
$q = 3^*$	0.01	[0.84]	-0.01	[0.84]
$q = 5$	0.02	[0.76]	-0.03	[0.45]
$q = 6 - 10$	0.03	[0.61]	-0.02	[0.55]
Siklos			ECB (0.52), RBA (0.56), SNB (0.65), BoJ (0.74),	
			BoC (0.83), RBNZ (0.83) SRB (0.87), US Fed (0.87), BoE (0.91)	
$q = 1$			-0.03	[0.54]
$q = 3^*$			-0.00	[0.89]
$q = 5$			0.00	[0.84]
$q = 6 - 10$			0.02	[0.46]
De Haan			US Fed (11), ECB (15), BoC (16),	
			BoE (17), RBNZ (16-18)	
$q = 1$			-0.04	[0.59]
$q = 3^*$			-0.00	[0.87]
$q = 5$			-0.01	[0.57]
$q = 6 - 10$			-0.00	[0.87]

Note: p-values in square brackets. Least squares estimation with GLS cross-section weights, with cross sectional heteroskedasticity assumed.*two-year ahead inflation for the ECB. Note that this cut-off value implies that there are no "low" transparency countries according to the Siklos and De Haan et al index.

Table C3. Equation 2: cut-off value 75% max

	Low		High	
EG Index	SNB (6.9), BoJ (8), RBA (8.2), ECB (9.4), US Fed (9.7), BoC (10.5)		SRB (11.4), BoE (12.2), RBNZ (12.8)	
$q = 1$	0.03	[0.60]	-0.11	[0.14]
$q = 3^*$	0.03	[0.40]	-0.05	[0.26]
$q = 5$	0.05	[0.17]	-0.03	[0.29]
$q = 6 - 10$	0.06	[0.09]	-0.01	[0.67]
BSG	BoJ (14), BoC (15), US Fed (16), ECB (19)		BoE (24)	
$q = 1$	0.03	[0.75]	-0.06	[0.58]
$q = 3^*$	0.03	[0.53]	-0.06	[0.35]
$q = 5$	0.05	[0.20]	-0.07	[0.08]
$q = 6 - 10$	0.06	[0.10]	-0.05	[0.18]
Siklos	ECB (0.52), RBA (0.56), SNB (0.65), BoJ (0.74)		BoC (0.83), RBNZ (0.83), SRB (0.87), US Fed (0.87), BoE (0.91)	
$q = 1$	0.07	[0.41]	-0.08	[0.20]
$q = 3^*$	0.04	[0.50]	-0.02	[0.57]
$q = 5$	0.07	[0.30]	-0.01	[0.69]
$q = 6 - 10$	0.11	[0.29]	0.00	[0.96]
De Haan	US Fed (11)		ECB (15), BoC (16), BoE (17), RBNZ (16-18)	
$q = 1$	0.02	[0.90]	-0.05	[0.50]
$q = 3^*$	0.04	[0.59]	-0.02	[0.65]
$q = 5$	0.10	[0.18]	-0.03	[0.24]
$q = 6 - 10$	0.04	[0.45]	-0.02	[0.56]

Note: p-values in square brackets. Least squares estimation with GLS cross-section weights, with cross sectional heteroskedasticity assumed.*two-year ahead inflation for the ECB.

D Kalman filter

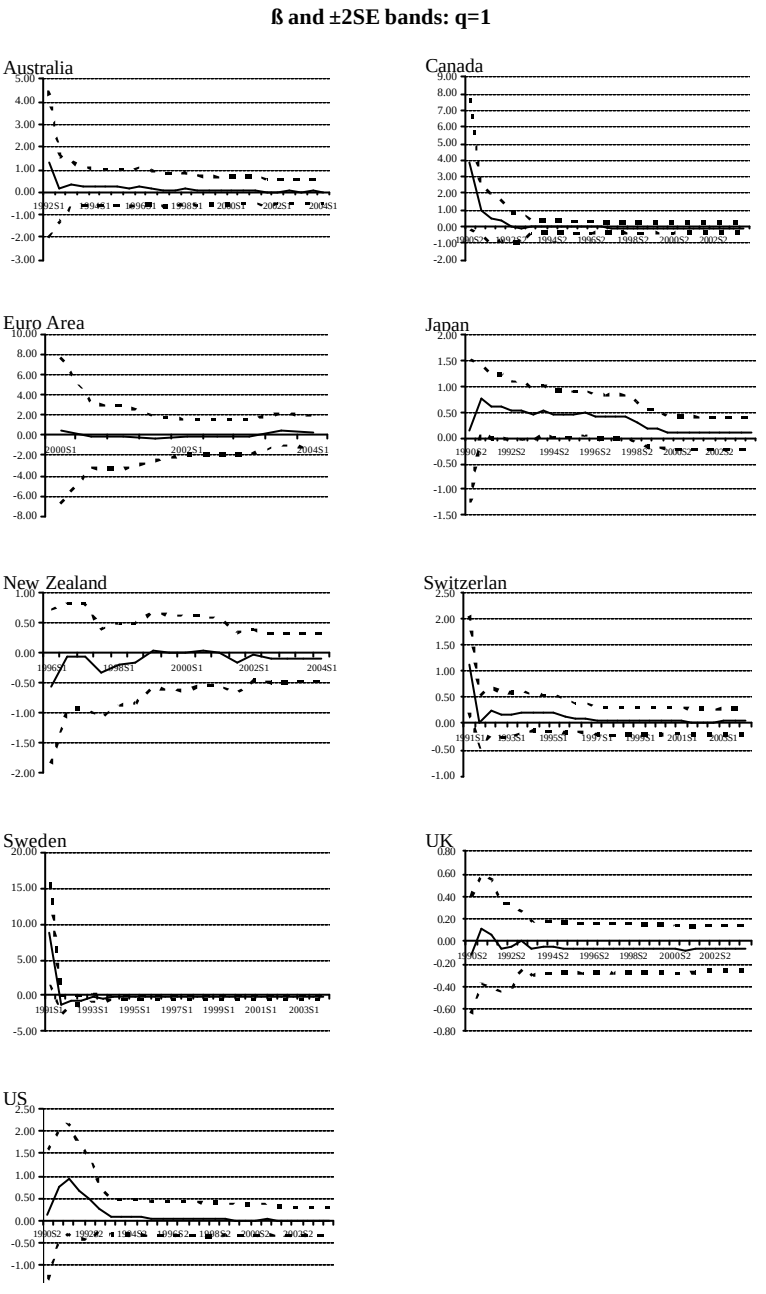
ß and ±2SE bands: q=1
Australia
Canada
Euro Area
Japan
New Zealand
Switzerlan
Sweden
UK
US

Figure 2:

ß and ±2SE bands: q=3

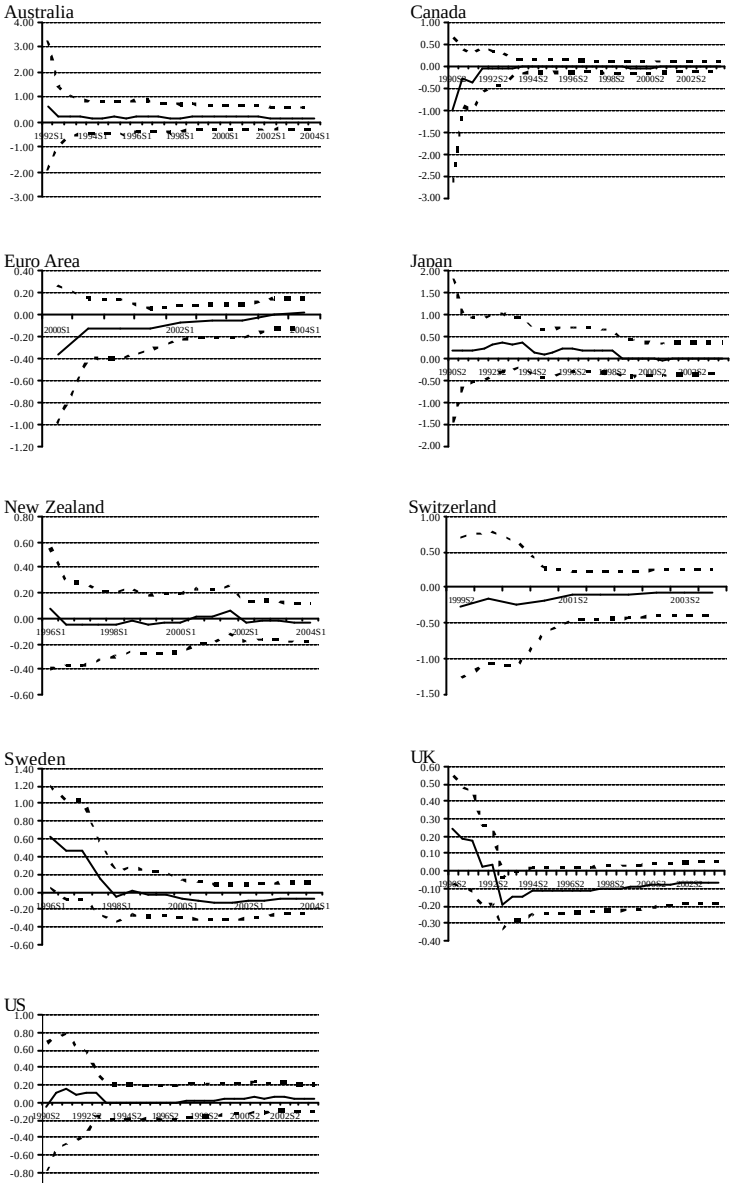

Figure 3:

ß and ±2SE bands: q=5

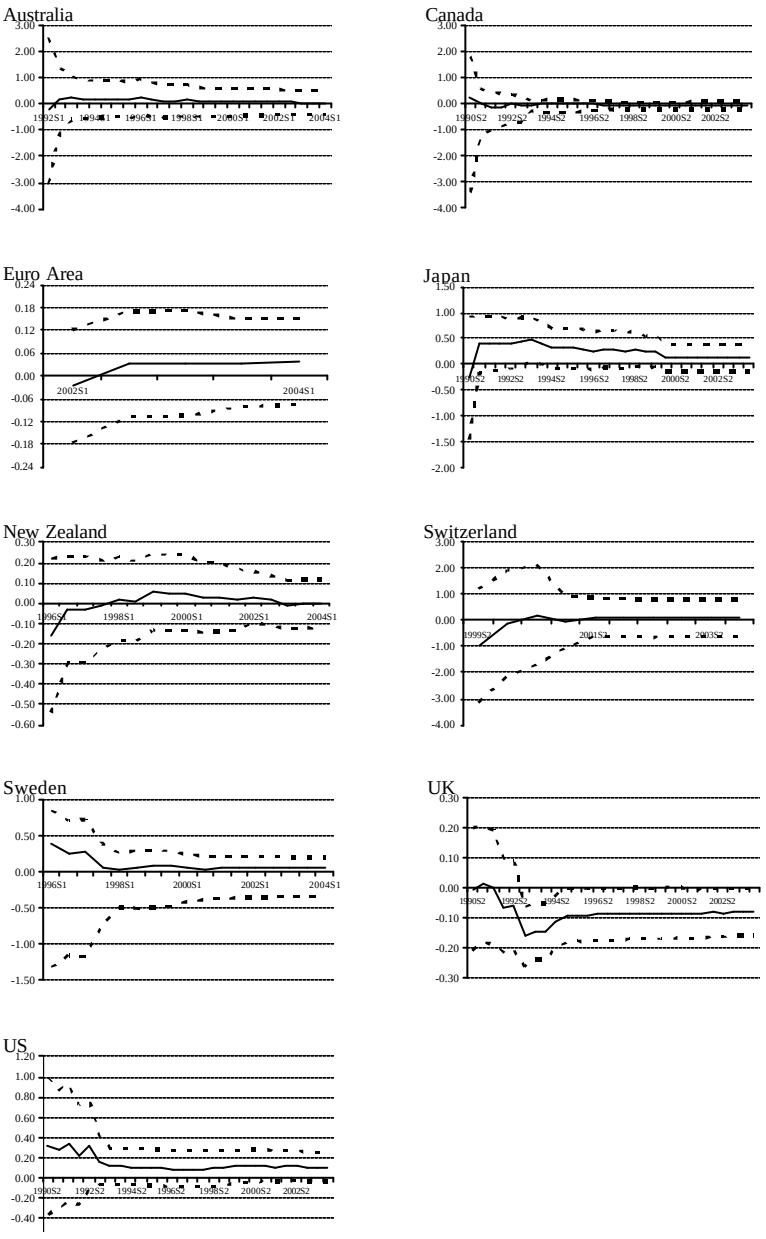

Figure 4:

ß and ±2SE bands: q=(6-10)

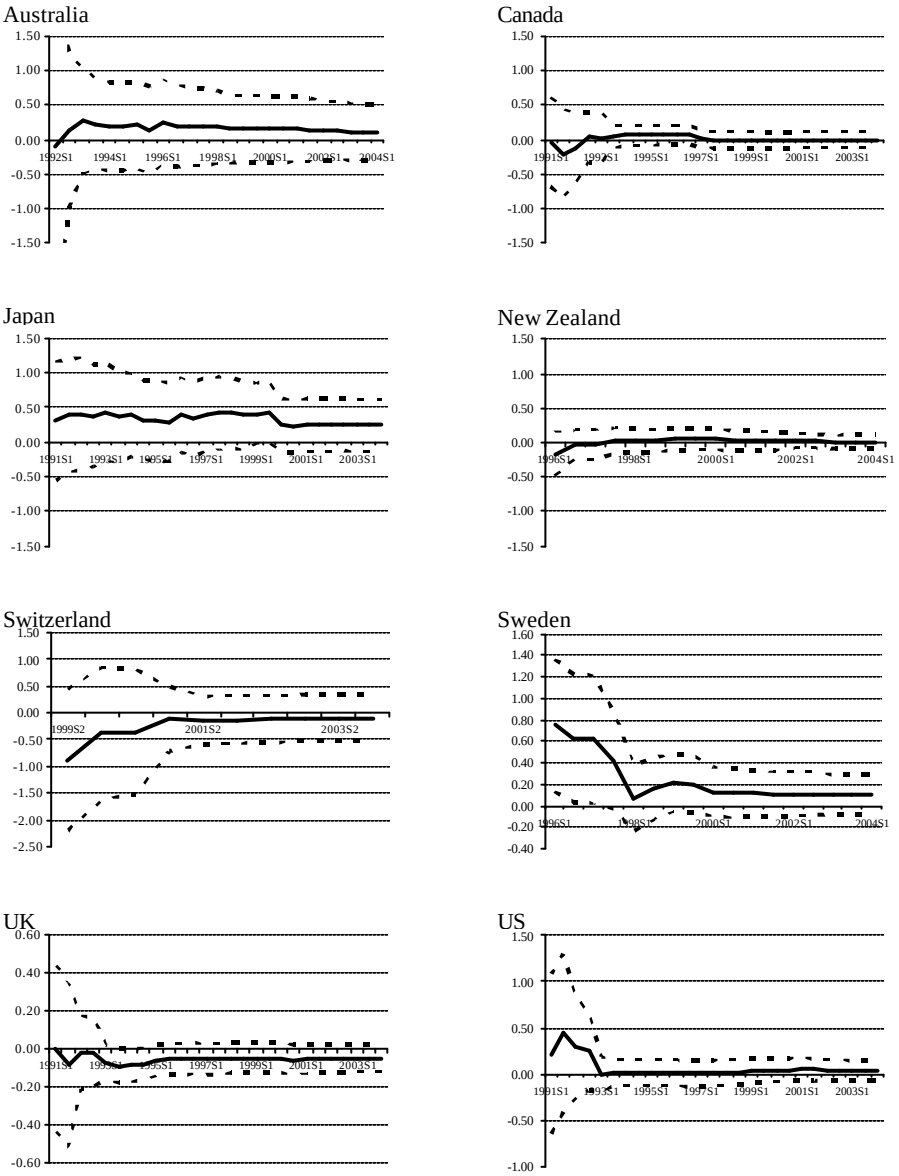

Figure 5: