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## MONETARY POLICY TRANSPARENCY, INFLATION AND THE SACRIFICE RATIO

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### ABSTRACT

We examine how inflation and the costs associated with disinflation episodes are related to monetary policy transparency. We develop a simple model that demonstrates how transparency may result in lower inflation. Our empirical results show that in general, transparency may be associated with lower inflation across a broad range of countries and frameworks. In addition, the output costs of disinflation, as measured by the sacrifice ratio, are negatively related to the degree of monetary policy transparency. The capacity of the central bank to limit the monetary financing of government deficits also has an inflation-reducing effect. Considering transparency as a possible determinant of cross-country differences in the costs of disinflation represents a new contribution to the literature, especially given the failure of previous empirical research to find a robust negative relationship between other aspects of the central bank's institutional design and the sacrifice ratio. Copyright © 2002 John Wiley & Sons, Ltd.

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### 1. INTRODUCTION

Maxwell Fry applied the highest standards to the research and practice of conducting monetary policy in a very wide range of countries, and his relentless enthusiasm meant that those who worked with Max invariably found that much more was achievable than they anticipated. This paper, and the research project on which it was based, would not have been possible without his input.

In the years leading up to Maxwell's appointment as Director of the Bank of England's Centre for Central Banking studies (CCBS) in September 1997, he had become very interested in the design of monetary policy in developing economies. At a meeting of central bank governors at the Bank of England in 1995, he presented the results of his survey of monetary frameworks in 44 developing countries (Fry *et al.*, 1996). Maxwell held strong views regarding the particular problems of fiscal dominance over monetary policy; he argued that the more a government used the country's financial system to finance its deficit, the less independent a central bank would be. In Fry (1998), he measured central bank independence according to the central bank's reaction to increased credit demands by the central government. In Fry *et al.* (2000) he argued that by being transparent, a central bank could help to build a constituency for low inflation that might prompt government to curtail fiscal activities that limit the effectiveness of central bank independence: 'A central bank that turns to the government and says "While we can't resist your financing demands, we will neutralize them by squeezing the private sector and

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we will tell the private sector exactly why we have to squeeze credit” is surely acting more independently than one that simply lets domestic credit rise by the full extent of any extra government borrowing from the banking system. If the central bank behaves consistently in this way by punishing the government through the lobby for private-sector credit, it may exert indirect pressure on the government to reduce its deficit or to finance it in less inflationary ways’ Fry *et al.* (2000, p. 118). Fry’s argument highlights the importance of transparency in making the reputations of policy makers more sensitive to their actions, a key theoretical channel identified in subsequent literature. The proposition that lower inflation will be secured both by legal limits on the amount of government borrowing from the central bank, and in terms of greater transparency of policy, is one we test below.

Many policy makers considering monetary framework reform have sought to identify the circumstances in which adopting transparency can be effective. In particular, we seek to answer such questions as: Is this effectiveness inextricably linked to inflation targeting? Is this effectiveness more pronounced in industrialized economies? Does transparency has a greater impact on this effectiveness when other certain framework characteristics are in place, such as independence?

Some authors have asserted that there exist important prerequisites before effective inflation-targeting could be implemented (see Masson *et al.*, 1997). Sterne (2001) disputes this assertion arguing that inflation targets and transparency could be regarded as being distinct pieces in the jigsaw that comprises monetary policy frameworks, along with many other framework characteristics. There is no compelling reason why in general the *marginal* contribution to monetary stability from introducing an inflation target or transparency should depend upon them being sequenced after or before other framework characteristics such as use of a money target, central bank independence, lack of fiscal dominance, or a capacity to forecast using advanced econometric techniques.

Max Fry directed a team of researchers at the CCBS to collect the necessary survey data on monetary frameworks. He and his co-authors recognized that such data might offer researchers the opportunity to empirically examine which of the framework’s jigsaw pieces were important factors affecting macro-performance, and whether or not there were circumstances in which other elements of monetary framework were complements or substitutes. The CCBS team set about conducting the broadest ever survey of monetary policy frameworks (see Fry *et al.*, 2000) The survey measured the extent to which policy focused on particular objectives, such as inflation and money targets. It also measured various other aspects of monetary frameworks, including accountability, independence, transparency and the nature of analysis conducted in central banks. The survey’s extremely broad country-coverage and high response rate reflected in large part the enormous respect many governors held for Max Fry following successive annual presentations to them at Governors’ Symposia at the Bank of England between 1995 and 1998. The response rate of 90% was extraordinary by any standards (see, for example, Blinder, 2000). The survey included 94 countries that represent 97% of the global GDP.

In this paper we focus on the implications of this data set for analysing the effects of monetary policy transparency. Fry *et al.* reported that in 1998/9, 74% of central banks regarded transparency as either a vital or very important part of their monetary framework, third in importance of the twenty-one categories they were asked to rank, behind only independence, and maintenance of low inflation expectations.

In Section 2 we discuss recent theoretical developments regarding the macroeconomic implications of transparency and develop a simple model showing how greater transparency may reduce inflation. In Section 3 we obtain empirical evidence indicating that greater transparency in monetary policy leads to lower inflation, and investigate further the circumstances under which the type of transparency, the country characteristics, and the institutional framework affect those relationships and the strength of the transmission channel. For a smaller sample of mainly industrialized economies, in Section 4 we present empirical evidence confirming that transparency reduces the sacrifice ratio. To our knowledge, this represents the first empirical evidence that links the choice of institutional framework to costs of disinflation with a sign that is consistent with theoretical literature. Section 5 draws some policy implications and concludes.

## 2. TRANSPARENCY IN THEORY: THE EFFECT OF ON INFLATION AND THE SACRIFICE RATIO

The theoretical literature on the macroeconomic effects of transparency has been rapidly expanding in the last few years. Geraats (2001b) provides a review of the literature noting that the arguments for institutional reform originated from central banks as opposed to academic research is stronger for transparency than it was in the earlier debates about increasing central bank independence. At the 1999 central bank governors' symposium at the Bank of England, Mervyn King spoke of the task of rebuilding credibility in UK monetary policy following the exit from Exchange Rate Mechanism: 'We wanted to acquire credibility and you cannot do that easily without a track record. But you can do something on the way to developing a track record. We felt that by being transparent—by explaining not only what the target was but also how we thought about the economy—we could actually acquire some credibility. So if we were doing things privately, we should say what we were doing. Our motto became "do as you say and say as you do", and that guided the construction of our framework with an inflation target and a high degree of transparency' (M. King, in Mahadeva and Sterne, 2001, p. 184).

In most of the recent theoretical literature the effect of increased transparency on inflation is negative. Faust and Svensson (2001), Geraats (2001a) and Jensen (2000), each develop multi-period models in which transparency reduces inflation by increasing the sensitivity of the central bank's reputation to its actions. Of course exceptions exist. For example, a result portrayed in Geraats (2001a) is that in the absence of central bank independence, the government may be more inclined to intervene when more information and in this context central bank secrecy can deter expansionary government policies.<sup>1</sup> Cukierman (2000b) offers an additional insight by developing a model where there is a possibility of a policy maker being dependable or weak, yet inflation control errors are sufficiently large to offer weak policy makers a possible cloak of disguise. Dependable policy makers like to raise the probability of being revealed as such, whereas opportunistic policy makers like to reduce the probability of being revealed as weak. An interpretation of his results is that a decision to become transparent and that of becoming dependable may be observationally inseparable.

Certain aspects of the existing literature on transparency (or secrecy) also imply that in countries where monetary policy is more transparent the costs of disinflation may be lower. For example, Cukierman and Meltzer (1986) establish that the costs of disinflation are lower when central banks have more precise control of monetary aggregates. One can easily reinterpret their discussion of control as referring to transparency. Faust and Svensson (2001) build on the Cukierman and Meltzer model and also establish that costs of disinflation will be lower when central banks are transparent. The intuition is that the costs of disinflation in terms of lost output and employment are lower when inflation expectations shift quickly in response to any policy change by a central bank. This is more likely to happen when central banks publish their inflation forecasts, and as a result the public can observe central bank intentions directly.

### 2.1. A stylized model

This section provides a simple model showing how transparency in the form of forecast publication may be desirable. Our objective is not to provide an exhaustive and inclusive description of the role of monetary policy transparency, but rather to show that our results are consistent with the implications of a highly stylized workhorse model in monetary policy. Besides simplicity, we want our model to be general enough so that it matches the scope of our cross-country empirical analysis. Developing a full-fledged model of monetary policy that includes variations of the underlying assumptions is beyond the scope of this paper.

Consider a simple version of a Barro–Gordon (1983) model of monetary policy as in Canzoneri (1985) and Walsh (1998). The economy is characterized by nominal wage rigidities due to contracts giving rise to a Phillips curve. Thus, inflation surprises may reduce unemployment below the natural rate in the shortrun. This is,

$$u_t = u^n - \lambda(\pi_t - \pi_t^e) + \varepsilon_t \quad (1)$$

where  $u_t$  is the actual rate of unemployment,  $u^n$  is the natural rate of unemployment,  $\pi_t$  is the inflation rate,  $\pi^e = E(\pi_t|\Omega_{t-1})$  is the expected inflation conditional on the information set available at time  $t$ , and  $\varepsilon_t$  is a supply-side shock with Gaussian properties. In the context of the one-period model,  $t$  is the beginning of the period and  $t + 1$  is the end.

We assume that the loss function shared by society and the central bank is

$$L^S = L^{CB} = (u_t - u^*)^2 + \beta(\pi_t - \pi^*)^2 \quad (2)$$

where  $u^*$  denotes targeted rate of unemployment. Both the central bank and society *ex-ante* desire an unemployment rate lower than the socially optimal one because of market imperfections, so that  $u^* = u^n - k$ , ( $k > 0$ ), where  $k$  reflects the central banker's inflationary bias. The term  $\beta$  ( $\beta > 0$ ) reflects the central bank's relative concern for inflation versus output. We assume that the inflation target is set to zero ( $\pi^* = 0$ ) for simplicity.

The central bank sets the money growth rate ( $g$ ) to achieve the preferred inflation outcomes subject to the structure of the economy and the reaction function of the private sector. We assume that besides the supply side shock a velocity error ( $\psi$ ) exists as well. Thus inflation is given by

$$\pi_t = g_t - \gamma\varepsilon_t + \psi_t \quad (3)$$

Workers lock themselves into contracts incorporating the private sector's rational expectations about the rates of money growth and inflation. The central bank observes its forecasts about both the demand- and supply-side shocks. The central bank chooses whether to announce its forecasts about the velocity error and/or the supply side shock before the private sector contracts are written. If it does so we will say that the central bank is transparent and if not we will say that the central bank is not transparent. The central bank sets the policy instrument according its reaction function taking the private sector's expectations as given. Then the shocks are realized and the equilibrium policy outcomes emerge. Whether the central bank observes the velocity shock before or after setting monetary policy does not significantly affect the results in this setting. In the rest of this section we drop the time subscripts for simplicity.

The first-order conditions from solving the central bank's optimization problem subject to the constraint of the economic structure suggest that the optimal central bank policy setting of the rate of money growth is:

$$g = \left(\frac{\lambda}{\lambda^2 + \beta}\right)k + \left(\frac{\lambda^2}{\lambda^2 + \beta}\right)g^e - \psi^{f,cb} + \left(\gamma - \frac{\lambda}{\beta + \lambda^2}\right)\varepsilon^{f,cb} \quad (4)$$

The superscripts  $f,cb$  indicate the central bank's forecast and that public forms expectations rationally according to  $E_{t-1}[\varepsilon_t|\Omega_{t-1}] = \varepsilon^{f,p}$ , and  $E_{t-1}[\psi_t|\Omega_{t-1}] = \psi^{f,p}$ . We assume that both shocks are non-zero mean and normally distributed.

Now the private sector's expectations about the rate of money growth and inflation are respectively given by

$$g^e = \left(\frac{\lambda}{\beta}\right)k - \psi^{f,p} - \left(\frac{\lambda}{\beta} - \gamma\right)\varepsilon^{f,p} \quad (5)$$

and

$$\pi^e = \left(\frac{\lambda}{\beta}\right)k - \left(\frac{\lambda}{\beta}\right)\varepsilon^{f,p} \quad (6)$$

Solving for the rate of money growth and inflation in equilibrium we obtain:

$$g = \left(\frac{\lambda}{\beta}\right)k + \left(\frac{\lambda^2}{\lambda^2 + \beta}\right)\left(\frac{\lambda}{\beta}\right)\varepsilon^{f,p} - \psi^{f,cb} + \left(\gamma - \frac{\lambda}{\beta + \lambda^2}\right)\varepsilon^{f,cb} \quad (7)$$

and

$$\pi = \left(\frac{\lambda}{\beta}\right)k + \left(\frac{\lambda^2}{\lambda^2 + \beta}\right)\left(\frac{\lambda}{\beta}\right)\varepsilon^{f,p} + (\psi - \psi^{f,cb}) + \left(\gamma - \frac{\lambda}{\beta + \lambda^2}\right)\varepsilon^{f,cb} - \gamma\varepsilon \quad (8)$$

Thus the inflation outcome depends not only on the realized stochastic shocks but also on the expectations that the reaction functions of the central bank and the private sector incorporate.

Now suppose that the private sector's forecasts consist of two components: one component corresponds to the central bank's forecasts and the other is an idiosyncratic component ( $\delta$ ) as follows:

$$e^{f,p} = \tau e^{f,cb} + (1 - \tau)\delta \tag{9}$$

Furthermore, we assume that the central bank forecasts are superior to those of the private sector. This assumption is consistent with recent work showing that the central bank may have an information advantage (e.g. Romer and Romer, 2000; Peek *et al.*, 1999). Thus, the equilibrium inflation rate can be written as:

$$\begin{aligned} \pi = & \left(\frac{\lambda}{\beta}\right)k + (\psi - \psi^{f,cb}) - \gamma\varepsilon + \left[\gamma - \left(\frac{\lambda}{\beta + \lambda^2}\right)\left(1 + \frac{\lambda^2}{\beta}\tau\right)\right]e^{f,cb} \\ & - \left[\left(\frac{\lambda^2}{\beta + \lambda^2}\right)\left(\frac{\lambda}{\beta}\right)(1 - \tau)\delta\right] \end{aligned} \tag{10}$$

and the potential for an inflation surprise can be written as:

$$\pi - \pi^e = (\psi - \psi^{f,cb}) - \gamma(\varepsilon - e^{f,cb}) + \left(\frac{\lambda}{\beta + \lambda^2}\right)(1 - \tau)(\delta - e^{f,cb}) \tag{11}$$

In other words inflation surprises may result from imperfect central bank forecasts for the demand-side shock, the supply-side shock and discrepancies between the central bank's forecasts and the idiosyncratic component of the private sector's forward-looking projections. The first two terms reflect the competency of the central bank's forward-looking analysis and if we assume perfect central bank forecasts the first two terms collapse to zero. The last term reflects the informational asymmetries between the private sector and the central bank. Note that at the limit, full transparency of central bank forecasts ( $\tau = 1$ ) eliminates the potential for inflation surprises.

Thus the Philips curve in equilibrium is

$$u = u^e - \lambda \left\{ (\psi - \psi^{f,cb}) - \gamma(\varepsilon - e^{f,cb}) + \left(\frac{\lambda}{\beta + \lambda^2}\right)(1 - \tau)(\delta - e^{f,cb}) \right\} + \varepsilon \tag{12}$$

Consider the expected value of the inflation deviations from the target that is the variability of inflation ( $E(\pi - \pi^*)^2$ ) when the inflation target is set to zero for simplicity. Taking the first derivative of this expression with respect to the central bank's degree of transparency ( $\tau$ ) we obtain:

$$\frac{\partial E(\pi)^2}{\partial \tau} = \left(\frac{\lambda}{\beta + \lambda^2}\right)\left(\frac{\lambda}{\beta}\right)\left[\left(\frac{\lambda}{\beta + \lambda^2}\right)\left(1 + \frac{\lambda^2}{\beta}\tau\right)\sigma_{e^{f,cb}}^2 - \left(\frac{\lambda}{\beta}\right)(1 - k - \tau)\delta\right] \tag{13}$$

Using equation (9) it is straightforward to see that this expression is negative provided that the condition  $2\tau\sigma_{e^{f,cb}}^2 < k + \sigma_{e^{f,p}}^2$  holds. In other words a higher degree of transparency about the central bank's forecasts for the supply-side shocks reduces the expected inflation variability provided that the variance of the central bank forecasts multiplied by twice the transparency factor is lower than the sum of the inflation bias and the variance of the private sectors forecasts. More intuitively, the lower the variance of the central bank's forecasts about the supply-side shock as compared to that of the private sector, the more desirable the publication of those forecasts is. In addition, the higher the inflation bias, the more easily the condition ensuring the forecast publication desirability is met. To put it in another way, even when the variance of the central bank forecasts is not much lower than that of the private sector, the publication of forecasts is important when the inflation bias is sufficiently large. This aspect of our result is consistent with other literature (e.g. Faust and Svensson, 2001; Jensen, 2000). We do not provide an explicit channel for this effect, however, since our focus is on the direct role of information contained in forecasts rather than on this information as a means for making inferences about policy makers' preferences.



### 3. TRANSPARENCY AND INFLATION: EMPIRICAL EVIDENCE

#### 3.1. *What kind of transparency?*

A monetary policy becomes increasingly transparent when those outside the central bank are provided with greater access to the information necessary to understand the goals of policy and the means by which policy makers react to economic conditions. The debate about transparency has covered numerous aspects. We use data from (Fry *et al.*, 2000: henceforth FJMRS) who provide measures of three separate forms of policy explanations. These include explanations of policy decisions,<sup>2</sup> forecasts, and current analysis by the central bank. In exchange-rate targeting frameworks, where short- and long-term objectives may be inherently transparent, explanations of policy may not be as important since transparency comes primarily from the ability of market participants and the public to continuously observe and test the credibility of the regime. Geraats (2001) distinguishes five separate aspects of transparency: (a) political, (b) economic, (c) procedural, (d) policy and (e) operational.

Chortareas *et al.* (2002) focus on the effects of publishing forecasts on inflation, since the theoretical literature generally conceptualizes transparency as the publication of central bank forecasts.<sup>3</sup> In this paper we extend the results by seeking to establish the effect not just of publishing forecasts but also of the discussion of policy decisions. We also consider a number of further extensions. We seek to determine different effects of transparency according to country type. We identify the role of rules governing central bank finance of government borrowing. We also investigate the impact of transparency on the sacrifice ratio.

#### 3.2. *Data on central bank forecasts*

The great majority of central banks in our sample publish some form of forward-looking analysis—79% of the 94 covered in the FJMRS survey.<sup>4</sup> Forward-looking analysis may, of course, take many forms, some of which may help to guide expectations by more than others. Short-term targets, for example, could be interpreted as yielding information about objectives, forecasts, or both. During disinflation there is also a tricky issue that targets for inflation and money are revised annually in accordance with out-comes for the previous year. Mahadeva and Sterne (2002) argue that as a result, such targets are more akin to conditional forecasts than policy rules. And some central banks in the survey, regarded the publication of a money target as a form of forward-looking analysis, since such targets are often more benchmarks rather than rules and must be underpinned by forecasts for other variables such as nominal GDP.

The questions in the survey not only ask whether the central bank provides forward-looking analysis. They also consider the quality, scope and frequency of forecasts, and the extent to which forecast errors are monitored and publicly discussed. The exact wording of the questions and the distribution of the results to each question are shown in Table 1. The questions are:

- (a) *What is the form of publication of forecasts? Is it in words only, or is it also presented formally in terms of numbers?*<sup>5</sup> The 'bottom line' of a forecast is usually presented in a numerical or graphical format. The analysis underpinning the forecast may, however, be more important than the precise number, since the accuracy of numerical forecasts may sometimes be attributable to luck as well as judgement.
- (b) *With what frequency does the central bank publish forward-looking analyses in standard bulletins and reports?* Forecasts published more frequently will guide/anchor expectations and may discipline policy over different forecast horizons.
- (c) *Are risks to the forecast published, and if so in what form?* An assessment of risks can convey a more accurate representation of the forecasters' subjective assessment of monetary conditions, thus avoiding any impression of spurious accuracy in the forecast.
- (d) *Is there a discussion of past forecast errors, and if so is this a standard feature of discussion?* An open assessment of forecast errors may reinforce the quality of future forecasts.

Table 1. Measure of explanations of forecasts and forward-looking analysis: questions and distributions of responses

Questions	Categories of answers, distribution of results	All	Industrialized	Transitional	Developing
1 Form of publication of forecasts	Words and numbers	<b>35</b>	16	5	14
	One of words or numbers	<b>25</b>	8	6	11
	Unspecified	<b>13</b>	0	4	9
	None	<b>21</b>	4	7	10
2 Forward-looking analysis in standard bulletins and reports	More than annually	<b>39</b>	18	7	14
	At least annually	<b>24</b>	4	4	16
	Unspecified	<b>10</b>	2	4	4
	Otherwise	<b>21</b>	4	7	10
3 Discussion of past forecast errors	Yes	<b>21</b>	8	3	10
	Sometimes	<b>9</b>	7	2	0
	No	<b>64</b>	13	17	34
4 Risks to forecast published	Words and numbers	<b>9</b>	7	2	0
	One of words and numbers	<b>23</b>	9	4	10
	None	<b>62</b>	12	16	34

Table 2. Measures of the explanation of policy decisions

Questions	Categories of answers, distribution of results	All	Industrialized	Transitional	Developing
1 Central bank provides explanations on day policy changed?	Yes	76	25	21	30
	No	18	3	1	14
2 Policy decisions Discussed in standard bulletins and reports	At least twice a year	61	21	15	25
	At least annually	12	2	2	8
	No	21	5	5	11
3 Minutes of policy Meetings published	Within 1 month of meeting	12	7	2	3
	More than a month after	5	2	2	1
	No	77	19	18	40
4 Voting patterns published	Yes	6	5	1	0
	No	88	23	21	44

### 3.3. Data on central bank explanation of policy decisions

We also utilize data from FJMRS (2000) regarding the detail with which central banks explain policy decisions. Most central banks publish information when a policy change is made (Table 2) and slightly fewer discuss these decisions in standard bulletins and reports. The number of central banks publishing minutes and voting patterns is much smaller, particularly for developing and transitional economies. Only one developing and transitional economy in the sample published details of voting patterns.

### 3.4. Constructing an index for transparency of (i) forecasts and (ii) decisions

For both our summary measures of transparency the FJMRS data set provides four separate indicators. Rather than creating an aggregate measure by simply taking the average of the different transparency

measures in the FJMRS data set, we considered the extent to which the FJMRS indicators can be arranged to form a Guttman scale. Its major advantage is that unlike an average of several variables, a Guttman scale constructed from several indicators does not result in a loss of information through aggregation. A Guttman scale is constructed by arranging binary variables in a sequence such that a positive value for one indicator implies a positive value for all previous variables in the sequence. To construct a Guttman scale for each of our measures of transparency, we ordered our variables according to the decision tree in Figure 1. Although a few of the central banks in our sample do not fit this pattern (for example they discuss risks to their forecast but not past forecast errors), the vast majority did. A common criterion for judging whether data can be ordered in a Guttman scale is if the ‘coefficient of reproducibility’, defined as number of errors/total responses, is less than 0.10 (‘errors’ are cases where ordering according to a Guttman scale results in a false prediction for a response). Our transparency data set easily satisfies this criterion, with a ratio of errors to total responses of 0.08 for transparency in forecasting and 0.04 for transparency in explaining policy decisions.<sup>6</sup>

The advantage of Guttman scaling is that based on the aggregate index, one can determine exactly how a central bank scores on each of the four separate sub-indicators. So, for example, a score of 2 on our transparency index implies that a central bank publishes forecasts and that it does so at least on an annual basis, but it does not discuss either past forecast errors or risks to the current forecast.<sup>7</sup> In contrast, if we took the simple average of the four indicators, then a score of 2 could imply a positive response on any two of the four sub-indicators. Furthermore, we later show that our results are robust to the use of either a Guttman scale or the simple average of our four sub-indicators of transparency in forecasting.

### 3.5. Transparency and inflation

In the regressions that follow we use a number of control variables, whose effect on inflation we find to be broadly consistent with earlier studies. First, we include the log of real GDP per capita, based, among other factors, on the possibility that lower-income countries may rely more heavily on the inflation tax to finance government expenditures. In regressions (1) and (4) below it was negatively associated with inflation while political instability tends to be associated with higher inflation. Second, we included a measure of openness,<sup>8</sup> following Romer (1993) and Lane (1997) who argue that incentives for policy makers to generate ‘surprise’ inflation are weaker in more open economies. Third, we included a measure of political instability as a control variable, based on the prediction from a number of different political economy models that a high frequency of government turnover may shorten the time horizons of politicians,

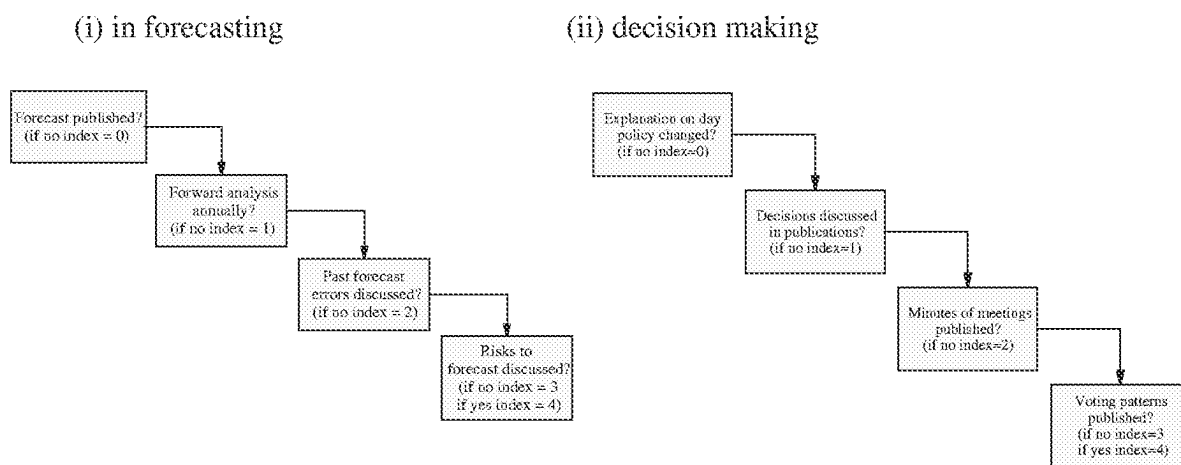


Figure 1. A Guttman scale of transparency.





prompting them to adopt more inflationary macroeconomic policies.<sup>9</sup> Finally, we added a dummy variable to control for a country's exchange rate regime (Fixed = 1).<sup>10</sup> Pegging can serve as a commitment device, and, with the exception of higher-income economies, our results reaffirm those of Ghosh *et al.* (1995), Bleaney (1999), and others who show that there is a clear negative correlation between exchange rate pegs and average inflation.

The results shown in Table 3 extend the empirical work of Chortareas *et al.* (2002) who found that greater transparency in publishing forecasts is associated with lower inflation and that the impact is not significantly different for those countries whose frameworks are based more upon a money or inflation target. In countries that target the exchange rate the publication of forecasts did not appear to have a significant impact on inflation. Chortareas *et al.* (2002) conduct a comprehensive range of robustness tests and find their result stands even after allowing for the possibility of endogeneity, reverse causality, a plethora of institutional controls and alternative specifications of average inflation and transparency.

In this paper we extend their work in a number of ways. First, we seek to establish if the nature of transparency makes a difference. In addition to considering the implications of being transparent about forecasts, we consider whether the efforts made to explain different policy decisions make a detectable difference to inflation outcomes. Table 3 provides empirical tests of the effect of transparency on inflation using a cross-section of 87 countries over the period 1995–9. Regression (1) indicates that the type of transparency matters: transparency in forecasting reduces inflation and is highly significant, while transparency in explaining decisions is wrongly signed and insignificant. We find this result a little surprising, since the different forms of transparency are often inextricably linked in the policy process and therefore one can suspect the existence of multicollinearity between the two measures. Figure 2 shows the partial correlation of inflation with forecast transparency, calculated by correlating forecast transparency with the residual from a regression of inflation on all explanatory variables in the regression other than transparency. It illustrates the result does not appear to be driven by particular outlying residuals.

Table 3. Transparency in forecasting and average inflation

Dependent variable: Log inflation	(1) Main result	(2) Fiscal dominance	(3) Low per capita GDP	(4) High per capita GDP
Log GDP per capita	-0.492*** (0.073)		0.032 (0.214)	-0.933*** (0.116)
CB finance of deficit		-1.38*** (0.50)		
Openness	0.0001 (0.0020)	-0.000 (0.003)	0.002 (0.004)	-0.003* (0.0016)
Political instability	1.10 (0.0623)	0.687 (0.687)	0.484 (1.11)	0.821 (0.564)
Exchange rate peg (peg = 1)	-0.411 (0.257)	-0.911*** (0.272)	-0.952* (0.480)	-0.248 (0.234)
<b>Transparency in forecasting</b>	<b>-0.187**</b> <b>(0.072)</b>	<b>-0.255**</b> <b>(0.098)</b>	<b>-0.245**</b> <b>(0.121)</b>	<b>0.0292</b> <b>(0.076)</b>
<b>Transparency in decisions</b>	<b>0.103</b> <b>(0.114)</b>	<b>0.002</b> <b>(0.120)</b>	<b>0.175</b> <b>(0.178)</b>	<b>-0.193*</b> <b>(0.112)</b>
Constant	6.00 (0.529)	3.63 (0.41)	2.79* (1.12)	10.43 (1.25)
R <sup>2</sup>	0.53	0.33	0.24	0.66
N	82	82	41	41

Notes: Heteroscedastic consistent standard errors in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1%, 5% and 10% levels respectively.

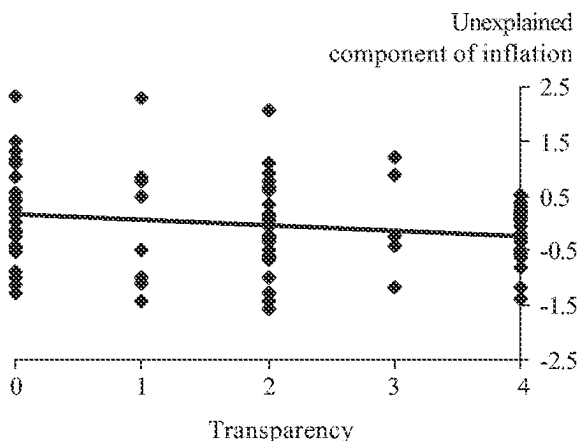


Figure 2. Unexplained component of inflation and transparency in forecasts.

Table 4. Independence in terms of absence of government borrowing from a central bank

To what extent are there limits on central bank financing of the fiscal deficit?	Value of variable	Nature of government borrowing from a central bank	All	Industrial	Transitional	Developing
	1.00	Prohibited, or so small independence not affected	<b>46</b>	26	11	9
	0.75	Narrow, well enforced limits exist	<b>15</b>	1	5	9
	0.50	Limits exists that are usually enforced	<b>25</b>	1	4	20
	0.25	Wide limits and some procedures when limits missed	<b>7</b>	0	2	5
	0.00	No limits or little enforcement	<b>1</b>	0	0	1

Fry’s suppositions that absence of fiscal dominance and transparency could be important weapons against inflation are supported by the results in column 2 of Table 3. In regression (2) in Table 3 we replace the per capita GDP control variable with a measure of the degree to which the law prohibits government borrowing from the central bank. The variable is measured by FJ RMS and includes both legal and traditional protection from government borrowing from the central bank. Governments in industrialized economies virtually never borrow from central banks, whereas the practice is present in transitional economies and common in developing ones (Table 4). The results are strongly supportive of the view that absence of fiscal dominance over monetary policy (see Sargent and Wallace, 1981) leads to lower inflation outcomes.<sup>11</sup>

Finally we search for discernible differences between low- and high-income economies. Columns 3 and 4 perform a regression that is identical to regression (1), but split the sample into two according to per capita income. The results are broadly similar, though there are particular differences between the two groups. First, the exchange rate peg dummy ceases to become significant in high-income economies, a result that is in line with Chapter 2 of FJMRS where the authors show that whereas various industrialized economies



have, since the 1970s, achieved periods of low and stable inflation by basing policy on a variety of nominal anchors, developing economies have only ever achieved prolonged periods of low and stable inflation using exchange rate targets.

According to these results, differing forms of transparency are important in high- and low-income economies. In low-income economies, transparency in forecasting better explains inflation performance whereas in high-income economies it is transparency in explaining policy decisions. There may be a number of explanations for this result. Few low-income economies have established credibility using a domestic nominal anchor, so the provision of forecasts may be relatively powerful in these countries. As regards transparency in explaining policy decisions, the results shown in Table 2 above indicated that very few low-income economies publish these with a high degree of detail so we are not surprised to find the impact insignificant in these countries. In the case of high-income economies where inflation tends to be lower, many of these countries already have a high degree of anti-inflationary credibility so, in accordance with the models of Faust and Svensson (2001) and Jensen (2000) the effect of transparency on inflation will be weaker. In high-income economies there is, however, a high correlation between transparency in forecasts and in decisions so we do not attach great importance to the significance of one rather than the other measure of transparency. We consider more important the overall result that transparency leads to lower inflation in these economies and in general.

#### 4. TRANSPARENCY AND THE SACRIFICE RATIO

##### 4.1. *Measuring the sacrifice ratio*

The most commonly used measure of the costs of disinflation is the 'sacrifice ratio' which may be defined as the number of percentage points of lost output associated with a policy-induced 1% reduction in inflation. There are two common methods for calculating this measure. The first method is due to Ball (1994) and involves the identification of actual periods of disinflation for individual countries and then the calculation of changes in the output gap relative to changes in inflation over those periods. The second method, suggested by Hutchinson and Walsh (1998), consists of calculating sacrifice ratios for individual countries based on time-series estimates of short-run Phillips curves. We use the first method because of its simplicity, which allows us to calculate sacrifice ratios for quite short time periods for a relatively large number of countries.<sup>12</sup>

We follow a slight variation on Ball's (1994) method, suggested by Andersen and Wascher (1999). For each country we identify the beginning of a disinflation period as one in which the change in the CPI was greater than the change in either the previous or the following year. The end of the disinflation period is identified in a similar manner. The sacrifice ratio is then calculated as the cumulative change in the output gap over the period, divided by the change in inflation.<sup>13</sup> We also use the cumulative change in the unemployment rate as a substitute for the change in the output gap. An additional advantage of this method, besides simplicity, is that it makes it feasible the calculation of sacrifice ratios for each given country over a brief time period. We recognize, however, that our approach relies on several strong assumptions. In particular, because this method does not control for changes in the natural rate of unemployment, it is possible for the calculated sacrifice ratio to be negative if the natural rate of unemployment declines during the course of the disinflation episode. In cases where there were several disinflation periods for a country during the 1990s we chose the latest possible period in order to maximize the likelihood that disinflation occurred subsequent to the establishment of transparency. The sacrifice ratios tend to be higher in OECD countries, possibly reflecting greater nominal wage rigidity or other structural differences. There is also very substantial variation in the sacrifice ratio within each group of countries, which may reflect variation in monetary institutions.

#### 4.2. Empirical estimates

Using our estimates of the sacrifice ratio based upon (a) unemployment rates and (b) output, we investigated the extent to which the costs of disinflation are associated with transparency. Table 5 shows regressions both for a sample exclusively of OECD countries and for a broader sample including both OECD and non-OECD countries for which data were available. In the regression for the entire sample, we also added an OECD dummy to control for unobserved factors that may explain the difference in sacrifice ratios between the two groups of countries. Other potential control variables turned out not to be significant.<sup>14</sup>

The first three regressions in Table 5 show results where the dependent variable is the sacrifice ratio based upon the unemployment rate. The regressions differ in terms of sample size. Regression (1) is for the whole sample, (2) for OECD members and (3) for non-OECD members. In each case we include our measure of transparency in both forecasts and decisions, calculated by the methods described in Section 2 of the paper.

The estimates provide a strong indication that countries whose central banks are more transparent with their forecasts tend to find disinflation less costly. For the whole sample of 44 countries, regression (1) illustrates that transparency in forecasting is significant at the 1% level and transparency in decision-making is significant at the 10% level. Figure 3 shows the partial correlation of transparency in forecasting and the component of the sacrifice ratio not explained by other variable in the regression. It illustrates the relatively high degree of uncertainty about our estimates, but suggests that the residuals are well behaved.<sup>15</sup> For the sub-sample of OECD countries, a similar result holds. Transparency in forecasting remains highly significant, but the coefficient on transparent decision-making is less negative and no longer significant. For the sub-sample of non-OECD economies, the evidence for transparency affecting the sacrifice ratio is weaker. Transparency in forecasting remains significant, but only at the 10% level.

Our measures of transparency do less well at explaining output-based measures of the sacrifice ratio. The coefficient on forecast-based transparency is negative but is estimated imprecisely and is not quite significant at the 10% level. In part, the inferior performance may be attributable to having fewer country-observations of the sacrifice ratio available using this method.

Table 5. Transparency, accountability, and the costs of disinflation

(sacrifice ratios calculated from actual disinflation episodes)				
Dependent variable is sacrifice ratio	Based on unemployment rate			(4) Whole sample: output based
	(1) Whole sample	(2) OECD	(3) Non-OECD	
<b>Transparency in forecasts</b>	<b>-0.46***</b>	<b>-0.71***</b>	<b>-0.17*</b>	<b>-0.40</b>
	<b>0.13</b>	<b>(0.24)</b>	<b>(0.095)</b>	<b>(0.24)</b>
<b>Transparency in policy decisions</b>	<b>-0.20*</b>	<b>-0.088</b>	<b>-0.09</b>	<b>0.16</b>
	<b>(0.11)</b>	<b>(0.26)</b>	<b>(0.091)</b>	<b>(0.42)</b>
OECD dummy	1.78***			1.53
	(0.49)			(0.78)
Constant	1.54***	3.80**	0.73**	0.77
	(0.38)	(1.09)	(0.34)	(1.08)
N=	44	22	22	33
R <sup>2</sup>	0.37	0.30	0.23	0.16

Notes: Heteroscedastic consistent standard errors in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels respectively.

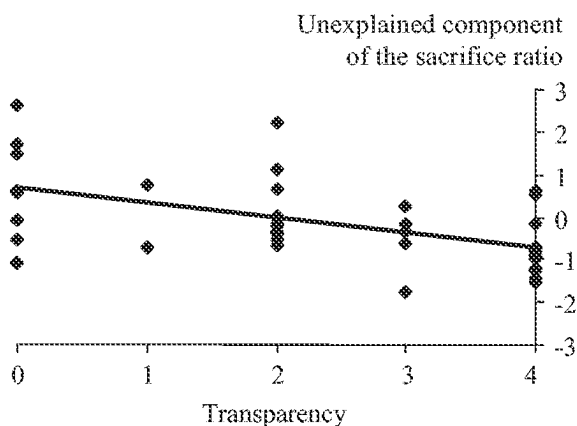


Figure 3. Unexplained component of the sacrifice ratio and transparency in forecasts.

## 5. CONCLUDING THOUGHTS

Our analysis suggests that central bank transparency results in lower inflation and lower costs of disinflation. Moreover, it indicates that greater transparency may give rise to lower inflation outcomes across a range of country and monetary policy framework types. Chortareas *et al.* (2002) show that the effect of transparency on inflation is unaffected by whether policy was based more upon a money or inflation target. Here, we also show that transparency reduces inflation for both low- and high-income economies, and that for our sample as a whole the effect works in tandem with rules and operations that limit governing borrowing from the central bank.

Our attempts to explain cross-country differences in the sacrifice ratio represent an advance on previous empirical research, which has so far failed to find unequivocal evidence on the relationship between central bank institutional characteristics and the sacrifice ratio. For example, a typical corollary of theoretical work is that, in general, central bank independence should be negatively related to the sacrifice ratio. Earlier empirical research, however, failed to establish an unambiguous negative relationship between central bank independence and the sacrifice ratio. For example, Debelle and Fischer (1994) and Walsh (1995) find that greater central bank independence is either associated with *higher* costs of disinflation in OECD countries while Posen (1998) finds that no significant relationship exists between the two. Our results provide encouraging indications that institutional reform may lower the costs of disinflation. They suggest that transparency is clearly associated with smaller costs of disinflation, and this effect is relatively stronger for estimates of the sacrifice ratio based on unemployment.

Of course we do not claim that the results prove that the adoption of greater transparency will inevitably lead to lower inflation and lower costs of disinflation. Circumstances will always be important. Knowledge of policy-maker preferences and shocks will be stronger in some countries than in others and this will affect the strength of the results in a particular country.<sup>16</sup> We also acknowledge the possibility that the adoption of transparency may be associated with a decision to move towards more dependability of policy in general, along the lines suggested by Cukierman (2000b). Some inflation-targeting countries may, for example, have adopted transparency and switched inflation preferences at the same time, in which case the task of precise empirical distinction of the role of increased dependability and greater transparency could be beyond the capacity of any empirical data we and others possess. We are not aware, however, of any evidence to show that countries adopting transparency have ever experienced a sustained increase in inflation. Whether it is transparency that causes the improvements in macroeconomic performance we have measured, or whether it is some deeper change in policy preferences, transparency may be beneficial to the extent that it helps to

lock in such improvements. Increases in transparency have continued to spread rapidly across monetary practice globally, even after the FJMRS (2000) survey was conducted, and Maxwell Fry would surely have approved of such developments.

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#### NOTES

1. Geraat's channel is complementary to the one mentioned in the introduction by Fry *et al.* (2000). Fry alluded to circumstances in which central banking transparency about government policy might serve to make government reputation more sensitive to its fiscal actions. Geraats points to central bank transparency making government more certain about the economy and therefore more willing to exercise control over monetary policy actions.
2. Buiter (1999) and Issing (1999) debate the benefits of publishing detailed minutes, for example.
3. Publication of forecasts allows the public to observe the control error. An exception in the recent theoretical literature is Cukierman (2000a), who focuses on the economic model and the operational objectives of the central bank rather than central bank forecasts and votes.
4. Eighty-two of these observations are included in our estimates. The other 12 are excluded because other data do not match up with them.
5. Graphs are treated as identical to numbers in this analysis.
6. Alternative orderings, such as scaling in the following order: (1) forecasting, (2) forward analysis, (3) risks to forecast, (4) past forecast errors, generate virtually identical results for the 82-observation sample that we use in our regression.
7. This highlights the importance of having the overall data set closely approximate a perfect Guttman scale, in order to be able to make this inference.
8. We define openness as  $(x+m)/GDP$ , where  $x$  and  $m$  stand for exports and imports respectively.
9. Drawn from a database created by Beck *et al.* (1999) this variable measures the percentage of key decision makers (executive, legislative majority(ies), coalition members) which change in a given year.
10. Based on the classifications in the IMF's *Annual Report on exchange arrangements and exchange restrictions*.
11. And would be even stronger were some high inflation episodes in our sample not caused by the laws and traditions preventing such borrowing being broken.
12. The obvious disadvantage of the Ball method involves the fact that it does not control for additional factors which may influence the unemployment rate or the output gap. Cecchetti and Rich (2001) construct sacrifice ratio estimates using three different structural VAR models. They remain sceptical, however, about the ability of current econometric techniques to provide an accurate measurement of disinflation costs.
13. With the output gap representing the percentage difference between real GDP and trend real GDP.
14. These included measures of central bank independence from FJMRS (2000), centralization of wage bargaining, a dummy for those countries that focus policy on inflation targets.
15. In this and the other regressions shown in Table 5 the results are robust to the exclusion of outliers.
16. Chortareas *et al.* (2002) conduct a raft of robustness checks to address this point.

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