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Central Bank Independence and Transparency: Evolution and Effectiveness

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Central Bank Independence and Transparency: Evolution and Effectiveness

Abstract

While central banks have existed since the seventeenth century, their purpose, functions, and operations have evolved over time. Over the past two decades, the pace of reforms in terms of institutional independence and transparency has been particularly brisk. This paper examines the current level of central bank independence (CBI) and transparency in a broad sample of countries using newly constructed measures, and looks at the evolution in both measures from an earlier time period. The legal independence of central banks (measured using an index first constructed by Cukierman, Webb, and Neyapti, 1992) has increased markedly since the 1980s, particularly for emerging market and developing countries, while the rise in transparency since the late 1990s (measured using an index based upon the work of Eijffinger and Geraats, 2006) has been less impressive. Increases in CBI have tended to occur in more democratic countries and in countries with high levels of past inflation. More independent central banks in turn tend to be more transparent, while transparency is also positively correlated with measures of national institutional quality. Exploiting the time dimension of our data to eliminate country fixed effects and using instrumental variable estimation to overcome endogeneity concerns, we present robust evidence that greater CBI is associated with lower inflation. We also find that enhanced transparency practices are associated with the private sector making greater use of information provided by the central bank, consistent with a simple signal extraction model in which the public signal becomes more precise as our transparency measure increases.

Key words: Central bank independence, transparency, monetary policy
JEL codes: E42, E44, E52, E58

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1. Introduction

While central banks have existed since the seventeenth century, their purpose, functions and operations have evolved over time. The pace of reform in recent years has been particularly brisk. This paper focuses on reforms that bear on monetary policy (as opposed to those that relate to financial regulation and supervision, although here too reform has been widespread). Reforms have been focused in three areas in particular. First, the legal statutes governing central banks' operations and relations with other branches of government have been revised or rewritten in many countries, with a focus on increasing institutional independence from the executive. Second, as central banks have become more autonomous, efforts have been made to enhance their accountability. Third, central banks have attempted to become more transparent in their operations. This last change is both a complement to increased accountability and related to changes in how monetary policy is conducted, notably to the introduction of inflation targeting.

In an attempt to quantify some of these developments, this paper details new measures of central bank independence and transparency[1]. It provides a detailed account of the construction of the indices and also relates the indices to underlying economic and sociopolitical variables, as well as analyzing their effects on variables of interest. Two results are particularly worth highlighting. First, controlling for country fixed effects by taking first differences, we find robust evidence that central bank independence (CBI) reduces inflation. This effect is robust to controls for endogeneity and measurement error via instrumental variables estimation. Second, we present evidence that greater central bank transparency leads the private sector to make greater use of information provided by the central bank when making forecasts, consistent with the predictions of a simple signal extraction model.

While there have been some recent measures of transparency and independence for subsets of countries (Eijffinger and Geraats, 2006; Cukierman, Miller, and Neyapti, 2002; Jácome and Vázquez, 2005), the measures here cover a more comprehensive set of countries and offer a more current picture.[2] Our measures also facilitate a comparison over time. In the case of the independence measure, the comparison is between the original index constructed by Cukierman and others (1992) covering the 1980s, and our index which is based on a database of central bank laws held by the IMF and is current through 2003. For our transparency index, which broadly follows the methodology of Geraats (2002) and Eijffinger and Geraats (2006), the comparison is between the late 1990s and 2006. The earlier measure is based on the results of the survey of central banks presented by Fry and others (2000), while the updated measure is based on our reading of central bank transparency practices based on their websites and published documents.

The literature on CBI is voluminous (Eijffinger and de Haan, 1996 and Berger, Eijffinger, and de Haan, 2001 provide useful summaries). Its theoretical impetus came from the time inconsistency problem (Kydland and Prescott, 1977; Barro and Gordon, 1983) and the solution offered by

[1] See also Crowe and Meade (2007).

[2] Some other researchers are producing similar indices with an expanded coverage: see Arnone, Laurens, and Segalotto (2006) and Dincer and Eichengreen (2007).

delegation to a conservative central banker (Rogoff, 1985) or to any independent policymaker with suitable incentives and a well-specified mandate (Walsh, 1995). In practice independence tends to follow one of two models (Debelle and Fischer, 1995; Fischer, 1995): *goal independence* (where the central banker has autonomy to follow his own policy prerogatives, similar to Rogoff's formulation) or *instrument independence* (where the central banker has a narrower mandate to set policy instruments in pursuit of a goal specified by the government, as in Walsh's model).

Central bankers themselves, and some other commentators (Blinder, 1998), have been critical of the academic literature's focus on time inconsistency, arguing that it is not a relevant concern for modern central banks, particularly in industrial countries. The rationale for delegation can then be motivated by other concerns, including political economy factors (Crowe, 2006a; Cukierman and Gerlach, 2003; Goodman, 1991; Hayo, 1998; Lohmann, 1998). Whatever its theoretical merits, the case for CBI appears to have been accepted, with a sharp increase in autonomy since economists first started measuring it seriously in the late 1980s, as outlined in section 2 below. Greater independence has occurred across all groups of countries, but has been particularly marked for developing and emerging market economies.

While the theoretical case for CBI appears to have been accepted, empirical studies have found surprisingly limited evidence of independence delivering its promised anti-inflation benefits in practice. Hence, while the earliest studies of CBI focusing on a fairly narrow subset of industrial countries delivered this result (the best known of which is Alesina and Summers, 1993), later studies covering a wider set of developing and industrial countries have found more equivocal results (see Eijffinger and de Haan, 1996; Berger, Eijffinger, and de Haan, 2001; Klomp and de Haan, 2007). In section 4 of the paper we revisit this relationship exploiting the time dimension of our data and find relatively robust evidence for the negative relationship between CBI and inflation predicted by theory.

As central banks have become more independent, so the demand for transparency has increased, both for reasons of accountability and legitimacy, and to guide the expectations of financial market participants (whose appetite for information has expanded as financial markets have become broader and deeper). With respect to financial markets, central banks have also attempted to increase monetary policy effectiveness by using communication and transparency practices to shape expectations of future policy decisions and hence influence rates across the term structure (not just at the short end, over which they have some direct control). Monetary policy has also become more information-intensive with the increasing popularity of inflation targeting (IT) over simpler policy anchors such as a fixed exchange rate or money aggregate rule. Hence both the supply of and demand for central bank transparency seem to have increased (Blinder and others, 2001; Faust and Svensson, 2001; Geraats, 2002).

However, section 3 of this paper presents evidence that, over the subset of industrial and emerging market economies analyzed here, overall levels of transparency have not increased significantly since the late 1990s. This result may reflect the short time period over which we measure the change and may be biased by some sharp drops in reported transparency which, in some cases, could be related to

the different methodologies used to collect the underlying data in 1998 compared to 2006.[3] Some specific examples of institutional reform – notably the creation of the European Central Bank (ECB) out of eleven (now thirteen) national central banks and the introduction of IT in a number of countries since 1998 – are associated with large and statistically significant increases in recorded transparency (Crowe and Meade, 2007).[4]

Increased central bank transparency can have a number of implications for macroeconomic variables (Geraats, 2002, provides a survey) but these tend to be rather model-specific and general lessons are hard to tease out. Transparency tends to be beneficial when information asymmetries are themselves the cause of inefficiencies in the economy, but can be costly in a second-best environment where the central bank is able to offset other inefficiencies by exploiting its informational advantage.[5] Ultimately, however, the question of whether central bank transparency delivers tangible benefits is an empirical one, and one that we address in section 5 of the paper. We find that greater transparency – in particular relating to the release of forecasts – is associated with the private sector making greater use of public rather than private information.

2. Measures of Central Bank Independence

Several measures of central bank independence have been proposed in the literature (Bade and Parkin, 1982; Grilli, Masciandaro, and Tabellini, 1991; Alesina and Summers, 1993; Cukierman, Webb, and Neyapti, 1992). This paper focuses on the Cukierman, Webb, and Neyapti (henceforth CWN) measure. Its principal advantage is that the authors compute their index for a large and comprehensive set of countries, including developing economies, allowing for comparison over time with our new measure. Their index is also comprehensive in terms of its elements and is relatively easy to replicate since the authors provide a thorough guide to coding the various subcomponents. We compute an updated index for all but three of the seventy-two countries in the original CWN sample (we were unable to code these three countries due to the unavailability of the central bank legislation in the IMF's central bank law database (CBLD), our source for the coding). We code an additional twenty-seven countries not included in the CWN sample (selected for their economic significance and

[3] In particular, the self-reported nature of the 1998 data and language barriers in interpreting the degree of transparency in 2006 may have introduced upward biases in recorded transparency in the earlier period and downward biases in the later period.

[4] Dincer and Eichengreen (2007) do find that transparency has increased generally, although their unlikely finding that no country's central bank has seen a decrease in transparency between 1998 and 2006 might lead one to question their methodology.

[5] Not all contributions fall into this categorization. For instance, Morris and Shin (2002) argue that transparency could be costly if private sector agents put too much weight on the central bank's public signal because they are attempting to second-guess each other and the public signal acts as a focal point for higher order beliefs. This model is related to models of strategic forecasting (see, for instance, Ottaviani and Sørensen, 2006). Note though that Svensson (2006) raises doubts over whether the parameter range necessary to deliver costly transparency in Morris and Shin's model is likely to hold in reality – although Morris, Shin, and Tong (2006) provide some counter-arguments.

inclusion in the CBLD). The CBLD contains national central bank legislation, and was current through end-2003 at the time the index was computed.

The CWN index has four components, relating to, respectively, appointment procedures for the head of the central bank, the resolution of conflict between the central bank and the executive branch of government, the use of an explicit policy target, and rules limiting lending to government (see Appendix Table A1 for a thorough description of the index and its subcomponents).[6] One feature of the index is that the first and third components are more closely related to the internal workings of the central bank (its procedures and policies), whereas the second and fourth components deal with relations between the central bank and the executive branch (disputes and financial relations between the two). Table 1 presents the mean scores for each component and for the overall index, for all countries in the sample and for two subgroups: advanced economies and developing and emerging market economies.[7]

The most significant increase in measured independence has occurred for developing and emerging market economies, although overall independence has also increased for advanced economies. For the former group, all components have shown a statistically significant increase since the 1980s. However, for advanced economies only the second and fourth components (covering disputes with the executive and lending to government, respectively) have shown a significant increase. This owes to the fact that the scores on the first and third components (relating to the appointment of the central bank head and the existence of a codified objective for monetary policy, respectively) were already relatively high, and so the recorded increase is relatively modest. Hence, the key reforms have focused on relations between the central bank and the executive, rather than the central bank's own goals and procedures. For emerging market and developing countries, on the other hand, reforms have been more comprehensive, addressing all four areas covered by the CWN index.

Regression analysis of reforms to independence in relation to the initial conditions in each country yields some interesting patterns. Table 2 presents OLS and Tobit estimates of the determinants of the change in the CWN index (D.CBI) between the two time periods. The change in independence is explained by initial period values for independence (CBI0) and transformed inflation (INF0), real GDP per capita (GDP0), and measures of democracy (DEMOC0), openness (OPEN0), and the exchange rate regime (REGIME0). (Higher values for the DEMOC, OPEN, and REGIME variables represent greater democracy, openness, and flexibility of the exchange rate regime.) Tobit estimation explicitly controls for the fact that D.CBI is bounded to lie on the interval (-1,+1); this methodology delivers more accurate estimates of the standard errors than OLS while leaving the coefficient estimates unaffected since there are no observations at the limits.

Reform appears to be related to low initial levels of CBI and high prior inflation (columns 1 and 2). This suggests that reform has been prompted by the failure of past anti-inflation policies coupled with

[6] We adopt the weighted version of their overall index in our analysis.

[7] The country groupings follow those in the IMF's *World Economic Outlook*: see Crowe and Meade, 2007, for details on the country groupings.

a belief that CBI will help deliver lower inflation in the future (a belief possibly even encouraged by the empirical literature on CBI that appeared to find such an effect).[8]

Reform is more likely in countries with an initially more democratic political system. Two alternative hypotheses could explain this. The first is that democratic governments might generate a more pronounced inflation bias, requiring greater delegation of authority. The second is that democratic government is more open and pluralistic, involving more checks and balances, and therefore more amenable to delegation within the political system. To attempt to differentiate between these competing hypotheses, column 3 presents results with the democracy score interacted with the initial level of transformed inflation (INF0*DEMOC0). Under the first hypothesis, one might expect to see more reform when democracy is combined with a higher inflation bias, and therefore a positive interaction term. In fact the interaction term is not significantly different from zero, suggesting that the first hypothesis is not likely the correct one.

There is no evidence that reform is more likely in initially richer or more open economies. However, reforms appear to be more ambitious in countries with less flexible initial exchange rate regimes. One explanation for this is that countries with more fixed exchange rate regimes in the early 1990s might have been more prone to subsequent crises, necessitating a move to more flexible arrangements combined with an attempt to provide a substitute nominal anchor via CBI. A second explanation is that CBI and fixed exchange rate arrangements are complimentary and mutually reinforcing sources of nominal stability. To attempt to differentiate between these competing hypotheses, the change in the exchange rate flexibility index (D.REGIME) is also included in column 4, since under the first hypothesis a move to a more flexible exchange rate regime (an increase in the index) should be associated with an increase in CBI. In fact, the opposite holds – the coefficient is negative and statistically significant, while the coefficient on the initial exchange rate regime index remains negative and statistically significant – suggesting that the first hypothesis is not likely.[9]

3. Measures of Central Bank Transparency

Geraats (2002) provides a taxonomy for analyzing the transparency of monetary policy, focusing on five distinct aspects of transparency processes relating to different parts of the policymaking process. This taxonomy has become the benchmark for analyzing central bank transparency (see Eijffinger and Geraats, 2006, and Dincer and Eichengreen, 2007), and we also adopt it in computing our transparency index.[10]

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[8] One should exercise some caution in interpreting the negative coefficient on initial independence, since this is also consistent with mean reversion (perhaps due to initial independence being measured with error).

[9] Note though that endogeneity problems are likely to be particularly pronounced when including a contemporaneous change in one of the explanatory variables.

[10] Chortarareas, Stasavage, and Sterne (2002; 2003) adopt a slightly different approach, focusing on two aspects of central bank transparency (the publication of forecasts and the release of information on the monetary policy decision – these correspond broadly to the categories of *economic transparency* and *policy transparency*, respectively, in the Geraats terminology).

The first of the five areas of transparency relates to the relationship between the executive and the central bank (*political transparency*), and in particular on whether the delineation of roles and responsibilities is transparently codified and embodied in measurable objectives of the central bank, such as specific policy targets. The second area (*economic transparency*) relates to the release of economic information, including forecasts, by the central bank, to allow independent assessment and scrutiny of its decisions by the private sector. The third area relates to the internal decision-making of the central bank (*procedural transparency*): in particular, whether the central bank publishes information on how it arrives at its policy decisions, including via transcripts, minutes or voting decisions of the relevant policy committees. The fourth area, *policy transparency*, refers to the release of information on the policy decision once it is arrived at: is the public informed immediately, with a detailed account of the thinking underlying the decision, following the relevant policy meeting (including when policy is not changed). The final area, *operational transparency*, covers the issue of the transmission of the policy decision in practice, and in particular whether the central bank publishes information on the monetary transmission mechanism, assessing the accuracy of its past forecasts and accounting for past errors in policy or unanticipated economic shocks.

In choosing the core issues to consider in constructing the index, we traded off among three objectives. The first was to find issues that matched up well with the core aspects of the five components outlined above. The second was to focus on issues that were fairly easy to codify objectively from information available publicly on central banks' websites and in their publications.[11] The third objective was to provide some account of the evolution of transparency practices over time. For this reason, we restricted our attention to questions that had been covered in the Fry and others (2000) survey of central banks (carried out in 1998).[12]

Trading off these three objectives, we arrived at two questions for each of the five components of the index, delivering a total of ten questions, most of which we interpreted as simple binary questions in order to simplify the data collection process and reduce areas of subjectivity inherent with more graduated codings (and modifying the responses from the 1998 coding as appropriate). The ten questions are outlined in the data appendix.

Table 3 presents the evolution of the transparency indices between 1998 and 2006. The overall increase in transparency scores is not statistically significant for all countries, but advanced economies have experienced a statistically significant increase in measured transparency. Two components (economic and policy transparency) show large increases – the latter is statistically

[11] Relying on publicly available information for assessing transparency practices is less problematic than for assessing other areas, since by definition if information is not available publicly then it is not transparent. However, one weakness of this approach is that some central banks make much more information available in the native language version of their websites and documents than in the English language version. We generally relied on English-language availability for coding the transparency index, which might account for the low scores for some countries. Despite this problem, it may be legitimate to question the transparency of information provided only in a native language, in light of the global nature of financial markets and the widespread use of English in those markets. Coding was carried out in 2006 with some additional cross-checking in 2007.

[12] Geraats (2006) makes use of the same dataset.

significant for all countries, while the former is statistically significant for advanced economies but not for developing and emerging economies.

Note that unlike central bank independence, where it was the emerging market and developing countries that showed the most significant increase in the relevant index, with respect to transparency it is the advanced economies where the scores have improved most. One interpretation of this result is that the advantages of CBI are better – and more widely – understood, leading to a widespread adoption of 'best practice' worldwide. Since advanced economy central banks were generally already more independent in the 1980s, they have experienced a less dramatic increase. However, the benefits of transparency are more controversial and less well understood, so that only 'first movers' (more likely to be drawn from advanced economy institutions) are likely to have fully embraced it. Moreover, enhanced transparency practices require significant resources in terms of gathering and processing information and disseminating it to the public. The demand for transparency from market participants is also likely to be greater in countries with larger and more developed financial markets. All these factors point to the likelihood of a greater increase in transparency among advanced-economy central banks. At the same time, the relatively short time period under consideration implies that any changes are likely to be smaller than for the independence measure.

Having said this, the measured decline in transparency for some developing and transition countries – of 0.5 or above in China and Russia – seems excessive.[13] There are three possible explanations for these measured declines. The first is that we have correctly captured actual declines. The second is that the 2006 scores are too low – the most likely explanation for this is the language issue (see footnote 12). The third explanation is to note that because the 1998 coding is self-reported (via the Bank of England's survey of central banks), some of the responses may have overstated the initial level of transparency practices, possibly by reporting ideal or desired practices which are not generally adhered to, or by interpreting the question differently. We believe that a combination of these three explanations likely lies behind the steep recorded decline in transparency for China and Russia, and that for these countries the change in the scores should be interpreted with caution. However, even after dropping these two countries, the general message – that there is no statistically significant increase in transparency scores for the emerging market and developing countries in our sample – remains.

Table 4 presents regression analysis of what might explain the wide variance in transparency practices uncovered by our coding. The regressions focus on the current period transparency index (TRANS1), rather than the change in the index, as with the independence measure, for two reasons. First, the difference in data collection methods between the earlier and later data introduces additional measurement error. Second, the change is over a shorter time period (only 8 years, compared to around 20 years with the independence data), providing less interesting variation in the data. We look at a number of potential correlates with the transparency score, including independence (CBI1), real per capital income (GDP1), openness (OPEN1), the exchange rate regime (REGIME1), and two governance measures, one that captures regulatory quality (RQ1) and another that captures voice and accountability (VA1).

[13] Much smaller declines were recorded for central banks in India, Singapore, and the United States.

The first two columns use the full set of exogenous variables, including the two different governance measures. Only real per capita income and openness are not found to be consistently correlated with transparency. Greater transparency is associated with more independent central banks, better governance (defined as either better regulatory quality or greater voice and accountability), and a more flexible exchange rate regime. These findings are in accordance with our priors. First, greater CBI has been widely credited in the literature with creating more incentives for transparency – both for accountability reasons and because the central bank has more incentive to communicate its policy preferences clearly when it has greater control over policy.[14] Second, given that institutional quality is likely to be correlated across institutions within each country, one would expect that general measures of regulatory quality and accountability would be positively correlated with transparency within the central bank. Finally, more flexible exchange rate regimes tend to be correlated with more transparent monetary policy regimes (such as inflation targeting).[15]

Column three analyzes whether any particular component of the CBI index (CBI1.1, CBI2.1, CBI3.1, CBI4.1) is particularly correlated with transparency, and shows that the most robust correlation is with the third component (pertaining to the existence of a well-defined target for monetary policy). This is not surprising, since it is arguably the independence component with the most significant transparency dimension (particularly related to political transparency).[16] There is a borderline (positive) correlation with the first CBI component (appointment procedures for the governor), which is also easy to rationalize, particularly with respect to political transparency. Columns four and five replicate columns one and three for a more parsimonious set of controls, replicating and strengthening the earlier results. Column six replicates column one but uses a Tobit estimation procedure, to capture the fact that the transparency index is bounded to lie in the unit interval. It confirms and strengthens the earlier results.

4. Effects of Central Bank Independence

One explanation for the weak empirical relationship between CBI and inflation is that the de jure measure of independence offered by the CBI indices widely used in the literature fails to capture de facto independence, particularly in developing countries where institutions and the rule of law might be weaker. Hence, Cukierman, Webb and Neyapti (1992) find that a proxy for de facto independence – the turnover rate of central bank governors – is related to inflation, with the predicted sign, for developing countries. In fact the de jure/de facto distinction (essentially a form of measurement error) is only one empirical problem facing the researcher. Endogeneity and omitted variable bias are

[14] Using the change in the independence score rather than the current level – under the hypothesis that transparency-enhancing reforms may be associated with reforms to overall central bank governance associated with increased independence – delivers very similar (in fact marginally stronger) results.

[15] Dincer and Eichengreen (2007) report a similar result.

[16] In fact, the component accounting for half of the political transparency score is directly linked to the third component of the updated CBI index by construction (see Appendix), so some correlation is to be expected.

arguably at least as important, and either could explain the failure to find the predicted negative relationship between CBI and inflation consistently across all countries.[17]

The first two columns of Table 5 estimate the relationship between CBI and inflation for the 1980s and current period, respectively, and confirm the puzzlingly weak or non-existent relationship between CBI and inflation found in the literature. Controls include real GDP per capita, openness, and the exchange rate regime. The first specification replicates earlier work, confirming that while the de facto independence measure (the turnover rate, TURNOVER) is related to inflation (with the predicted sign), the de jure measure is not statistically significant for the full country sample. The second specification replicates this exercise for the current period, and finds that even the turnover rate is not significantly correlated with our transformed inflation measure.

The remaining columns of the table show results for a first differenced specification, exploiting the fact that we now have two data points for each country, with some considerable variation in both inflation performance and independence measures over time. This first differenced specification eliminates unobservable and omitted country fixed effects that are likely to be correlated with the levels of CBI. The specification in column three includes both the de jure and de facto independence measures (in first differences) – and both now have the predicted effect on inflation.[18]

Column four repeats this exercise but breaks the de jure measure out into its four components. The results of this specification suggest that the third component (having a single, well-specified, ideally numerical inflation or price level target for the central bank) is the aspect of overall independence most likely to deliver low inflation. Hence, central banks' legal objectives do not appear to be cheap talk, but may help the central bank to commit to its inflationary objectives. Columns five and six repeat the exercise in column three, for the de jure and de facto measures separately, to confirm their significant effect on inflation. The results are quantitatively significant, suggesting, for instance, that the average increase in de jure CBI (around .25) is associated with a drop in inflation of more than 5 percentage points compared to a situation where CBI does not increase at all (for countries whose inflation was already in single digits; with a greater drop for countries with higher initial inflation).

While the results in Table 5 are suggestive, and partially assuage concerns over omitted variable bias (to the extent that these omitted variables are time-invariant), other econometric problems, particularly biases introduced by endogeneity or measurement error, remain. Table 6 presents some

[17] Crowe (2006a) shows that endogeneity leads to attenuation (bias toward zero) in the measured effect of CBI on inflation. Using political economy instruments for independence, one is able to uncover a strongly negative and statistically significant effect.

[18] Note that there is a concern with this result, similar to Ball and Sheridan's (2005) criticism of studies showing a fall in inflation following the introduction of IT, that high initial inflation could lead to the endogenous adoption of institutional reform *and* to a fall in inflation (through simple mean reversion), so that the measured correlation is spurious. Indeed, when initial inflation is included, there is no significant effect from the change in CBI. However, this explanation is observationally equivalent to the alternative explanation that high initial inflation does lead to the adoption of reforms, but that it is the reforms that then drive down inflation. A superior method of controlling for the endogeneity concerns underlying this criticism is through instrumental variable (IV) estimation, as in Table 6, in which the negative effect in first differences is upheld.

estimates via instrumental variables that attempt to deal with these problems. The results focus on the de jure measure, since we were unable to find strong instruments for the turnover rate. Column one presents results estimated via two-stage least squares (2SLS) and with de jure independence instrumented using two governance measures: the rule of law and voice and accountability.[19] The estimated effect of independence is now somewhat stronger than that estimated via OLS in table 5, and remains negative.

The instruments perform well in terms of identification and exogeneity, however there is some evidence that they may be weak – according to the tests using the Cragg-Donald statistic and the critical values tabulated by Stock and Yogo (2002) – which could imply that the estimated effect is unstable and may not be as statistically significant as suggested by the standard z-test. On the other hand, the Anderson-Rubin test of the significance of the endogenous regressor – which should be robust to weak instruments – points to CBI's significant effect at the 1 percent level. Column 2 confirms this, by estimating the same procedure via Limited Information Maximum Likelihood (LIML) – an IV estimation technique that is more robust to weak instruments. These results confirm those in column one. Column three eliminates all controls and finds that the relationship remains negative and statistically significant. Column four replicates column two but replaces the full CWN index with the third component (columns three and four are both estimated via LIML, given evidence of weak instruments using 2SLS). Note that weak instruments appear to be a particular concern for this final specification, although the robust Anderson-Rubin test statistics suggest again that the negative effect remains statistically significant.[20]

As a robustness check, we have also run the regressions reported in Tables 5 and 6 with an unweighted CBI measure (the variable *LVAU* outlined in Cukierman, 1992) rather than the weighted variable that we use for our main results. Substitution of this unweighted CBI index yields nearly identical results.

5. Effects of Transparency

The current empirical literature on the effects of transparency is relatively limited. Chortareas, Stasavage, and Sterne (2002) use the Fry and others (2000) dataset to create a transparency index, and find that increased transparency is associated with lower inflation in a cross section of 82 countries, controlling for other factors including CBI. In a related study (Chortarareas, Stasavage, and Sterne, 2003) the same authors find that increased transparency is associated with a lower sacrifice ratio (unemployment cost of disinflation). Dincer and Eichengreen (2007) find that transparency lowers

[19] Since the governance data does not cover the early period, we instrument the change in de jure independence using the *current-period level* of the governance variables. The theoretical case for instrumenting the change in the CBI index using these institutional measures is that CBI is likely to require certain institutional preconditions (a tradition of an independent civil service, the existence of checks and balances, a strong legal environment) that will be correlated with these institutional indices. Moreover, we assume that these measures are unlikely to exercise a strong independent effect on inflation, but rather will impact on inflation predominantly via their effect on CBI. These instrument relevance and exogeneity assumptions are tested using identification and over-identification tests following the IV estimation, and found to be supported.

[20] No effect was found for the other three subcomponents.

inflation variability in a pooled cross-section time series regression (although the results are weaker when fixed effects are introduced, since transparency practices are highly persistent over time).

Focusing on individual central banks, Ehrmann and Fratzscher (2007) analyze Fed communication and forecasts of future policy and find that more precise or transparent communication can make policy more predictable. However, Meade and Stasavage (2008 forthcoming) and Swank, Swank, and Visser (2006) show that the Fed's decision to publish verbatim transcripts of FOMC meetings (albeit with a five year delay) may have reduced the quality and frankness of discussions or displaced substantive debate to an alternative forum. On the other hand, Gerlach-Kristen (2004) finds that the Bank of England's publication of MPC voting records has helped to make monetary policy more predictable. Crowe (2006b) analyzes the behavior of private sector forecasts of inflation around the time of adoption of IT in eleven countries, to test whether IT has the transparency benefits which its proponents claim. The adoption of IT does appear to improve the forecasting accuracy of the private sector, particularly the worst forecasters, consistent with it delivering a more accurate public signal of future inflation.[21]

We also focus on the behavior of private sector forecasters in this paper, since this seems to us the most fertile ground for assessing the impact of different transparency practices. In particular, we want to test whether more central bank transparency leads to greater use of public as opposed to private information by the private sector. The private sector's forecasts of inflation (the central bank's ultimate objective and the principal object of its communication strategy) seem to us the best place to test this hypothesis.

Our measure of the extent of private information versus public information relied upon by private sector forecasters is the ratio of the variance (VAR) of the private sector forecasts for inflation in the following year to the mean square error (MSE) of the forecasts (using the next year's actual inflation outturn as the measure of the true outcome which the forecasters are attempting to forecast). This measure lies on the unit interval because the mean square error is by definition the sum of the forecast variance and the square of the bias. We show below that this measure is decreasing in the relative accuracy of public information, so that improvements in transparency associated with more accurate public signals are associated with a fall in the VAR/MSE ratio. In other words, when public information is more accurate, all forecasters should place greater weight on it compared to their private information, leading to less variance across forecasters.[22]

To demonstrate this, consider a simple signal extraction framework in which forecasters receive a public signal of x, x^{PUB}, as well as a private signal, x^{PRI}. Both the public and private signals are noisy, with white noise errors η and ε, respectively. Furthermore, the private signals include a mean zero, common component or bias term, denoted by θ, and all error terms are orthogonal. The accuracy of the public and private signals (the inverse of their variances) is denoted α and β, respectively. Thus:

[21] However, Johnson (2002), using similar data but a different methodology, finds that the introduction of IT delivers credibility benefits but does not improve transparency.

[22] Looking at the ratio of the VAR to the MSE controls for the fact that the variance of the forecasts is also determined by the variance of x itself or other factors that make x difficult to forecast.

$$x^{PUB} = x + \eta$$
$$x^{PRI} = x + \theta + \varepsilon^i$$

Then the best linear unbiased estimator of x is given by:

$$\hat{x}^i = x + \frac{\alpha}{\alpha+\beta}\eta + \frac{\beta}{\alpha+\beta}\left(\theta + \varepsilon^i\right)$$

and the MSE and VAR are given by:

$$MSE\left(\hat{x}\right) = \frac{1}{\left(\alpha+\beta\right)}$$

$$VAR\left(\hat{x}\right) = \frac{\gamma\ \beta}{(\alpha+\beta)^2}$$

where $\gamma \equiv \frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^2 + \sigma_\theta^2}$ and the ratio of the VAR to the MSE is therefore given by:

$$r \equiv \frac{VAR\left(\hat{x}\right)}{MSE\left(\hat{x}\right)} = \left(\frac{\gamma\beta}{\alpha+\beta}\right)$$

and:

$$\frac{\partial r}{\partial \alpha} = -\left(\frac{\gamma\beta}{\left(\alpha+\beta\right)^2}\right) \leq 0$$

Table 7 presents regression results, assessing whether the predicted negative correlation between the transparency index and this measure of private information use is observable in the data. The limited coverage of our forecast dataset restricts the sample size to a maximum of 28. Column 1 presents our baseline specification, with a relatively parsimonious set of control variables. The predicted negative correlation is present, indicating that higher transparency is associated with more accurate private sector forecasts, and the estimated effect is both quantitatively and statistically significant.

Columns 2-6 repeat this exercise with the five transparency components included individually (T1.1, T2.1, T3.1, T4.1, T5.1).[23] The most significant effects come from economic and operational transparency. This is instructive, since these are the aspects of our transparency index most closely related to the issuance of the central bank's economic forecasts, and strongly suggests that the estimated effect is not an artifice of the data.

Finally, column seven replicates column one using Tobit estimation, to explicitly account for the fact that the dependent variable is bounded on the unit interval. The coefficient estimates remain

[23] The components are included separately rather than together in the regression since the small sample size necessitates a relatively small set of regressors.

unchanged (since there are no observations with the dependent variable at either upper or lower bound), but the transparency effect has a marginally higher level of statistical significance.

Quantitatively, a one standard deviation increase in the transparency score (around .22) is associated with a nine percentage point decline in the VAR/MSE ratio. In terms of the model outlined above, this could point to a quite substantial increase in the accuracy of public information, α, associated with an increase in the transparency index. For instance, assume that public and private information are initially equally accurate ($\alpha=\beta$) and that the ratio r were initially at its mean value, 0.26. Then the .09 decrease in r corresponds to a doubling in the accuracy of public information.[24]

6. Conclusions

This paper presents in more detail the updated central bank independence (CBI) and transparency measures outlined in Crowe and Meade (2007), and also analyzes whether these new indices are related to causal factors discussed in the literature and whether they have the predicted effects. With respect to CBI, it finds a marked increase since indices were first constructed in the late 1980s, with developing and emerging market economies showing the largest increase, particularly with respect to appointment procedures for the governor and the existence of a well-documented policy target. Areas of independence pertaining to relations between the executive and the monetary authority – notably in terms of dispute resolution and central bank financing of government – demonstrate an increase in both advanced and emerging market and developing economies. Increased independence appears to be related to initial conditions in the economy in question. In particular, reform has been most pronounced in more democratic countries, countries with higher initial inflation, countries with initially less independent central banks, and countries with initially less flexible exchange rate arrangements.

We confirm that central bank legal independence has little measured impact on inflation in either the earlier or later period, but argue that this might be related to econometric problems. We attempt to overcome these problems by estimating the relationship in first differences, and also by instrumenting central bank independence using some measures of countries' overall governance quality. We are able to uncover a statistically significant negative effect of CBI on inflation via these techniques, in support of the theoretical literature that posits an inflation bias absent CBI.

We also document the change over time in transparency practices, using data from 1998 contained in a Bank of England survey of central banks as well as our own data from 2006 based on a reading of central bank documents and websites. We find that transparency scores over this relatively short time period have not demonstrated a significant increase for the sample as a whole, but have for the advanced economies in our sample. Current transparency scores are positively correlated with overall governance quality measures, with central bank independence and with exchange rate flexibility, none of which is surprising but nevertheless is worth documenting.

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[24] Assume two observations {0, 1} with $\Delta r = r_1 - r_0 = -0.09$ (corresponding to observation 1 having a value of the transparency index one standard deviation above that of observation 0). Assume that $r_0 = 0.26$ (the sample mean), $\alpha_0 = \beta$ (public and private signals are initially equally accurate) and the parameters β and γ are the same for both observations. Then simple algebraic manipulation yields that $\gamma = 0.52$ and $\alpha_1 = 2.1*\beta = 2.1*\alpha_0$.

To test whether transparency has any measurable effects, we analyze the relationship between our transparency index and a measure of the private sector's use of private versus public information. We find some robust evidence that greater transparency is associated with more use of public information. The effect seems most pronounced when focusing explicitly on the components of the overall transparency index most closely pertaining to the public release of central bank forecasts. The results suggest a quantitatively significant effect, with a one standard deviation increase in the transparency score implying a doubling in the accuracy of the public signal. This result supports Crowe's (2006b) finding that the introduction of inflation targeting (associated with an increase in our transparency score) is associated with a convergence in forecast errors among the private sector.

We hope that the data presented here will be widely used to test other hypotheses in the area of central bank governance. We also believe that the methodology underlying our transparency index can be easily replicated to extend the country coverage and possibly build a time series going forward. Another fruitful area for future research is developing better instruments for both CBI and transparency measures in order to try to identify causal relationships.

Table 1. Mean level (later period) and change in CBI
(Components and Total Index)

	All Countries		Advanced Economies		Emerging Markets	
	Level	Change	Level	Change	Level	Change
CBI - 1	0.57	.08***	.55	.03	.58	.11***
	(.18)	(.20)	(.18)	(.17)	(.18)	(.21)
CBI - 2	.63	.40***	.69	.46***	.61	.36***
	(.29)	(.35)	(.33)	(.35)	(.27)	(.36)
CBI - 3	.55	.15***	.51	.08	.56	.19***
	(.23)	(.33)	(.22)	(.36)	(.24)	(.31)
CBI - 4	.65	.30***	.67	.34***	.64	.29***
	(.31)	(.32)	(.39)	(.41)	(.27)	(.26)
CBI - Total	.61	.25***	.62	.25***	.61	.24***
	(.20)	(.21)	(.24)	(.25)	(.18)	(.19)
Obs.	99	69	26	26	73	43

Change: * significant at 10%; ** significant at 5%; *** significant at 1%
Standard Deviations (not Standard Errors of Mean) shown in parentheses.

Table 2. Correlates with Change in CBI Index, D.CBI

	I	II	III	IV
	OLS	Tobit	OLS	OLS
CBI0	-0.609***	-0.609***	-0.644***	-0.663***
	(0.206)	(0.203)	(0.204)	(0.197)
INF0	0.227**	0.227**	0.393**	0.288**
	(0.109)	(0.113)	(0.177)	(0.109)
DEMOC0	0.021***	0.021***	0.027***	0.015**
	(0.007)	(0.008)	(0.010)	(0.007)
GDP0	-4.639	-4.639	-5.304	-5.094
	(3.604)	(3.835)	(3.556)	(3.501)
OPEN0	-0.256	-0.256	-0.248	-0.535*
	(0.412)	(0.524)	(0.373)	(0.277)
REGIME0	-0.031**	-0.031**	-0.032**	-0.040***
	(0.013)	(0.014)	(0.013)	(0.010)
INF0*DEMOC0			-0.031	
			(0.030)	
D.REGIME				-0.040***
				(0.010)
CONSTANT	0.511***	0.511***	0.492***	0.637***
	(0.111)	(0.101)	(0.110)	(0.096)
Obs.	61	61	61	61
R^2	0.29	n.a.	0.3	0.46

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Open0 divided by 1,000; GDP0 divided by 1,000,000 to aid presentation of results

Table 3. Mean level (later period) and change in Transparency
(Components and Total Index)

	All Countries		Advanced Economies		Emerging Markets	
	Level	Change	Level	Change	Level	Change
Trans - 1	.83	-.06	.83	-.02	.84	-.12
(Political)	(.31)	(.27)	(.31)	(.24)	(.30)	(.32)
Trans - 2	.75	.12*	.82	.15***	.63	.06
(Economic)	(.31)	(.39)	(.22)	(.26)	(.41)	(.56)
Trans - 3	.21	-.03	.17	-.07	.25	.04
(Procedural)	(.36)	(.34)	(.37)	(.35)	(.33)	(.32)
Trans - 4	.81	.27***	.90	.40***	.64	.04
(Policy)	(.36)	(.45)	(.25)	(.25)	(.46)	(.63)
Trans - 5	.42	-.08	.43	-.10	.39	-.06
(Operational)	(.35)	(.42)	(.33)	(.34)	(.39)	(.55)
Trans	.60	.04	.63	.07**	.55	-.01
(Total)	(.22)	(.23)	(.19)	(.16)	(.27)	(.32)
Obs.	40	36	26	23	14	13

Change: * significant at 10%; ** significant at 5%; *** significant at 1%
Standard Deviations (not Standard Errors of Mean) shown in parentheses.

Table 4. Correlates with Transparency Score, TRANS1

	I	II	III	IV	V	VI
	OLS	OLS	OLS	OLS	OLS	Tobit
CBI1	0.605***	0.485**		0.646***		0.597***
	(0.176)	(0.216)		(0.190)		(0.136)
RQ1	0.251***		0.255***	0.166***	0.175***	0.254***
	(0.064)		(0.074)	(0.037)	(0.040)	(0.059)
OPEN1	-0.954**	-0.331	-0.676			-0.972**
	(0.393)	(0.307)	(0.416)			(0.379)
GDP1	-4.963	0.424	-5.653			-5.014
	(4.599)	(3.853)	(5.285)			(4.276)
REGIME1	0.048***	0.042***	0.034***	0.052***	0.035***	0.048***
	(0.010)	(0.011)	(0.011)	(0.010)	(0.011)	(0.010)
VA1		0.166***				
		(0.050)				
CBI1.1			0.407*		0.442**	
			(0.205)		(0.190)	
CBI2.1			-0.01		-0.042	
			(0.169)		(0.141)	
CBI3.1			0.201**		0.241**	
			(0.096)		(0.097)	
CBI4.1			0.154		0.161	
			(0.115)		(0.104)	
CONSTANT	-0.111	-0.062	-0.111	-0.258	-0.233	-0.106
	(0.188)	(0.220)	(0.154)	(0.172)	(0.140)	(0.157)
Obs.	40	40	40	40	40	40
R^2	0.56	0.48	0.63	0.46	0.57	n.a.

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
Open1 divided by 1,000; GDP1 divided by 1,000,000 to aid presentation of results

Table 5. CBI and Inflation (INF): OLS Regression Results

	I	II	III	IV	V	VI
	Period 0	Period 1	Change	Change	Change	Change
CBI	0.138	-0.022	-0.226**		-0.228**	
	(0.197)	(0.051)	(0.089)		(0.097)	
TURNOVER	0.427**	0.004	0.488***	0.478***		0.409**
	(0.175)	(0.049)	(0.163)	(0.147)		(0.167)
GDP	-6.716**	-2.484***	12.521*	9.851*	17.330***	13.050*
	(2.615)	(0.848)	(6.700)	(5.699)	(6.268)	(7.083)
OPEN	-0.851**	-0.182	-2.837	-3.669*	-1.087	-3.082*
	(0.382)	(0.198)	(1.848)	(1.976)	(1.696)	(1.797)
REGIME	0.017	-0.003	-0.011	-0.009	-0.017**	-0.006
	(0.015)	(0.005)	(0.008)	(0.008)	(0.007)	(0.008)
CBI1				-0.012		
				(0.161)		
CBI2				-0.016		
				(0.058)		
CBI3				-0.196**		
				(0.084)		
CBI4				-0.053		
				(0.086)		
CONSTANT	0.078	0.128	-0.019	0.006	-0.102**	-0.075
	(0.078)	(0.097)	(0.046)	(0.053)	(0.044)	(0.053)
Obs.	68	72	56	56	66	57
R^2	0.37	0.17	0.31	0.36	0.18	0.23

Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

For Period 0 and Period 1 regressions, all variables are in levels.

For Change regressions, all variables are in first differences.

Open divided by 1,000; GDP divided by 1,000,000 to aid presentation of results

Table 6. D.CBI and Inflation (D.INF): IV Regression Results

	I	II	III	IV
	2SLS	LIML	LIML	LIML
D.CBI	-0.937***	-0.938***	-1.466**	
	(0.328)	(0.329)	(0.608)	
D.OPEN	0.083	0.084		-3.174
	(1.751)	(1.752)		(2.125)
D.GDP	12.391**	12.385**		1.428
	(5.953)	(5.955)		(9.031)
D.REGIME	-0.037***	-0.037***		-0.012
	(0.013)	(0.013)		(0.013)
D.CBI3				-0.798**
				(0.352)
CONSTANT	0.083	0.083	0.236	0.053
	(0.082)	(0.082)	(0.150)	(0.111)
Obs.	66	66	66	66
C-D statistic	5.84	5.84	4.57	3.09
A-R [p]	0.007	0.007	0.002	0.007
Id test [p]	0.003	0.003	0.01	0.04
Overid test [p]	0.91	0.91	0.23	0.86

Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

D.Open divided by 1,000; D.GDP divided by 1,000,000 to aid presentation of results

Test statistics and p-values shown are, respectively:

C-D statistic: Cragg Donald statistic (weak instruments test)

A-R [p]: Anderson-Rubin test of significance of D.CBI (F-test version, p-value)

Id test [p]: LR statistic (identification/IV relevance test, p-value)

Overid test [p]: Overid test of all instruments (p-value)

C-D statistic is not heteroskedasticity-robust

Table 7. Transparency and Use of Private Information

	I	II	III	IV	V	VI	VIII
	OLS	OLS	OLS	OLS	OLS	OLS	Tobit
TRANS1	-0.418**						-0.418***
	(0.196)						(0.148)
OPEN1	-1.123**	-0.521	-0.699***	-0.484**	-0.254	-0.885**	-1.123**
	(0.508)	(0.358)	(0.222)	(0.230)	(0.295)	(0.395)	(0.451)
GDP1	-5.892	-0.669	-2.118	0.438	2.181	-5.202	-5.892
	(4.517)	(6.639)	(4.766)	(4.737)	(5.541)	(4.164)	(5.388)
RQ1	0.202**	0.068	0.158**	0.065	0.025	0.190**	0.202**
	(0.076)	(0.063)	(0.068)	(0.049)	(0.069)	(0.071)	(0.083)
REGIME1	0.005	-0.006	0.007	0	-0.003	0.013	0.005
	(0.011)	(0.010)	(0.011)	(0.011)	(0.010)	(0.011)	(0.009)
T1.1		-0.098					
		(0.129)					
T2.1			-0.315**				
			(0.132)				
T3.1				-0.101			
				(0.094)			
T4.1					0.029		
					(0.071)		
T5.1						-0.287***	
						(0.096)	
Constant	0.504***	0.372	0.415***	0.256**	0.220*	0.315***	0.504***
	(0.128)	(0.219)	(0.110)	(0.096)	(0.125)	(0.088)	(0.122)
Obs.	28	28	28	28	28	28	28
R^2	0.31	0.14	0.33	0.16	0.11	0.36	n.a.

Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Open1 divided by 1,000; GDP1 divided by 1,000,000 to aid presentation of results

Dependant Variable is r defined in text.

Appendix: Data Sources and Variables Used

1) Time Periods

Generally, data for the current and initial periods are constructed from averages of the available data (usually at an annual frequency) over the relevant period. The current period is considered to cover 2002-06, although in some cases data is available only through 2005. For the initial period, analysis using the central bank independence and turnover data covers the period 1987-91 and analysis using the transparency data covers the period 1997-2001, unless otherwise stated below.

2) Central Bank Independence (CBI) Data

Data for the 1980s is taken from Cukierman, Webb, and Neyapti (1992). Data for the current period is constructed by the authors using the IMF's *Central Bank Laws Database*, which collates the text of central bank laws and was current through 2003 when the authors constructed the index. The scores reflect the authors' interpretation of the laws' provisions, following Cukierman, Webb, and Neyapti's methodology. Table A1 summarizes the index and its components.

3) Turnover Data

Data for the 1980s (covering 1980-89) taken from Cukierman, Webb, and Neyapti (1992). Data for the current period (covering 1995-2004) constructed by the authors using Morgan Stanley's 2005 *Central Bank Directory*, with some additional material on governors' terms taken from central bank websites.

4) Transparency Data

Data for the late 1990s is taken from Fry and others (2000), which is based on responses by central banks to a survey conducted in 1998 by the Bank of England. Data for the current period was constructed by the authors based on their reading of documents and information available in English on central banks' websites during 2006 and early 2007 (the source for question 1.1 is derived from the CBI measure, and is therefore ultimately based on the central bank law database). The subindices and overall index are constructed using the methodology outlined in Table A2.

5) Political and Institutional Data

Six political and institutional variables are taken from the World Bank's *Aggregate Governance Indicators Dataset* (Kaufmann, Kraay and Mastruzzi, 2006). The original data are annual for 2002-05 and biannual for 1996-2000. For analysis using the CBI/Turnover data, no observations are available for the initial period (1987-1991). For analysis using the transparency data, the measure for the first period (1997-2001) is the average of 1998 and 2000. In all cases, the measure for the second period (2002-2006) is the average of the four available years (2002-05) for each variable. One further political variable – the democracy score – is obtained from the *Polity IV Dataset* (http://www.cidcm.umd.edu/polity/; Marshall and Jaggers, 2001). These variables are available annually through 2004.

6) Real GDP per capita and openness

These variables are taken from the Penn World Tables, version 6.2 (Summers and Heston, 1988). Annual data is available through 2004 (so that current period measures are based on 2002-04 data only); the openness measure is the sum of exports and imports divided by GDP, all at current prices.

7) Exchange Rate Regime

These data are derived from the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*, which adopted the de facto methodology in 1997. The information was retroactively updated in Bubula and Ötker-Robe, 2002. The data is monthly (from January 1990 through June 2004). The authors updated the information to end-2006 using the semi-annual updates available at <http://www.imf.org/external/np/mfd/er/index.asp>. For the initial period (CBI data) the measure is therefore derived only from the 1990-91 data. The data scores the exchange rate regime from 1 to 8, where 1 is the most restrictive (no national currency) and 8 is the least restrictive (independently floating), and each increase in score corresponds to a decrease in the degree of restrictiveness. For each time period considered, the median measure for the period in question is taken.

8) Inflation

Annual inflation data (period average inflation, percent per annum) is taken from the IMF's *International Financial Statistics*. Data is generally available up to 2006. The percentage inflation rate (π) is transformed using the inflation tax transform ($\pi/(100+\pi)$), which reduces heteroskedasticity (and is also preferable from a theoretical perspective, since it has an intuitive derivation, namely the inflation tax paid on unremunerated money balances or other nominal assets).

9) Inflation Forecasts

Forecast data is taken from *Consensus Economics*, covering all available periods. Data for most countries is available monthly; for some countries, only bi-monthly data are available. Coverage commences in different years (mostly during the 1990s) and is available through end-2006. In all cases, the forecast considered here is for the following calendar year.

Table A1. Construction and coding of CBI measure

Component	Sub-components	Coding	Weight in component
1. Governor/CEO	Weight in overall index = 20%		
	a) Length of term in office		25%
	More than 8 years	1.00	
	6 to 8 years	0.75	
	5 years	0.50	
	4 years	0.25	
	Less than 4 years or at discretion of appointer	0.00	
	b) Who appoints?		25%
	CB Board	1.00	
	CB board, executive branch, legislative branch jointly	0.75	
	Parliament or legislative branch	0.50	
	Executive branch	0.25	
	One or two members of executive branch	0.00	
	c) Dismissal		25%
	No provision	1.00	
	Possible only for reasons not related to policy	0.83	
	At the discretion of the CB board	0.67	
	At the discretion of the parliament or legislature	0.50	
	Unconditional dismissal at discretion of parliament or legislature	0.33	
	At the discretion of the executive	0.17	
	Unconditional dismissal at discretion of the executive	0.00	
	d) May CEO hold other offices in government simultaneously?		25%
	No	1.00	
	Only with permission of executive branch	0.50	
	No rule against holding another office	0.00	
2. Policy formulation	Weight in overall index = 15%		
	a) Who formulates monetary policy?		25%
	CB alone	1.00	
	CB participates but has little influence	0.67	
	CB advises government	0.33	
	CB has no say	0.00	
	b) Who has final word in resolution of conflict?		50%
	CB on issues clearly defined in the law as its objectives	1.00	
	Government on policy issues not clearly defined as CB goals or in case of conflict within CB	0.80	
	CB board, executive branch, legislative branch jointly	0.60	
	Legislature or parliament on policy issues	0.40	
	Executive branch on policy issues, subject to due process and possible CB protest	0.20	
	Executive branch	0.00	
	c) Role in government budgetary process		25%
	CB active	1.00	
	CB has no influence	0.00	
3. Policy objective	Weight in overall index = 15%		

	Price stability is the major or only objective, and CB has final word in event of conflict with other government objectives	1.00	
	Price stability is the only objective	0.80	
	Price stability is one objective among multiple compatible objectives	0.60	
	Price stability is one objective among multiple, potentially conflicting, objectives	0.40	
	No objectives stated	0.20	
	Stated objectives do not include price stability	0.00	
4. Lending to government	Weight in overall index = 50%		
	a) Advances		15%
	No advances	1.00	
	Permitted, with strict limits	0.67	
	Permitted, with loose limits	0.33	
	No legal limits on lending	0.00	
	b) Securitized lending		10%
	Not permitted	1.00	
	Permitted, with strict limits	0.67	
	Permitted, with loose limits	0.33	
	No legal limits on lending	0.00	
	c) Terms of lending		10%
	Controlled by CB	1.00	
	Specified in CB law	0.67	
	Agreed between CB and executive branch	0.33	
	Decided by executive branch alone	0.00	
	d) Potential borrowers from CB		5%
	Only the central government	1.00	
	All levels of government	0.67	
	All levels of government plus public enterprises	0.33	
	Public and private sector	0.00	
	e) Limits on CB lending defined in		2.5%
	Specific currency amounts	1.00	
	Shares of CB demand liabilities or capital	0.67	
	Shares of government revenue	0.33	
	Shares of government expenditures	0.00	
	f) Maturity of loans		2.5%
	Within 6 months	1.00	
	Within 1 year	0.67	
	More than 1 year	0.33	
	CB law does not specify maturity	0.00	
	g) Interest rate of loans must be		2.5%
	Above minimum rates	1.00	
	At market rates	0.75	
	Below maximum rates	0.50	
	Interest rate not mentioned in law	0.25	
	No interest charged on government borrowing from CB	0.00	
	h) CB prohibited from buying/selling government securities in primary market?		2.5%
	Yes	1.00	
	No	0.00	

Source: Cukierman, Webb, and Neyapti (1992).

Table A2. Construction and coding of transparency measure

Category of Transparency (from Eijffinger and Geraats, 2006)	Questions (from Fry and others, 2000)	Our coding
(1) Political	1.1: Is there a statutory objective?	1: Single objective of price stability or price stability objective does not conflict with other objectives .5: Price stability objective potentially conflicts with other objectives 0: Objectives do not include price stability or no objective
	1.2: Is there an explicit numerical target for prices or inflation?	1: Yes 0: No
(2) Economic	2.1: Does the central bank publish surveys (conducted by itself or others) that could be used to estimate inflation expectations?	1: Yes 0: No
	2.2: Does central bank publish any forward-looking analyses such as forecasts?	1: Words AND numbers / figures .5: Words OR numbers / figures 0: Neither
(3) Procedural	3.1: Does central bank publish minutes of policy meetings?	1: Yes 0: No
	3.3: Does central bank publish voting patterns of monetary policy committee?	1: Yes 0: No
(4) Policy	4.1: Does central bank publish explanations on day policy changed?	1: Yes 0: No
	4.2: Does central bank publish explanations on day policy does not change?	1: Yes 0: No
(5) Operational	5.1: Does central bank publish discussion of risks to outlook or forecast?	1: Words AND numbers / figures .5: Words OR numbers / figures 0: Neither
	5.2: Does central bank publish discussion of shocks or forecast errors after the fact?	1: Yes 0: No

Source: Source for question 1.1 is from the Crowe-Meade CBI measure based on 2003 law. Source for all other questions are website and publications of the central banks. For some countries, information in English is provided with a delay. We did not consider the language of the information when measuring transparency. Overall transparency index defined as the unweighted average of 5 categories; each category is unweighted average of all subcategories.

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