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Giovanni Di Bartolomeo and Enrico Marchetti

CENTRAL BANKS AND INFORMATION PROVIDED TO THE PRIVATE SECTOR

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Abstract

This paper examines the information provided to the private sector by central banks. By using the principal component analysis, we investigated the variance of the procedural rules followed by nine major central banks about information treatments. We investigate problems related to the information coming from the central banks by focusing on the quantity and quality perspectives and highlight the methodological complexity of the investigation. We find that a synthetic quantitative index of transparency is not enough to represent the phenomenon since it can result misleading in understanding the behavior of institutionally different central banks associated with the same index values.

Keywords: Central bank transparency, principal components, monetary policy.

JEL codes: E52 and E58.

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1. Introduction

The issue of central bank transparency has recently acquired a growing importance in the macroeconomic literature on monetary policy. Reasons are of varied nature.

On the one hand, it is generally acknowledged that significant suboptimal outcomes in the action of public authorities and institutions can be blamed to information asymmetries between authorities or institutions and the general public. Thus, an enquiry on the behavior regarding global information disclosure (transparency) could be important both on the positive side (helping to detect or explain major sources of non-market failures) and on the normative side (pointing out the direction of some possible solution to those market failures).[1]

On the other hand, the problem of central bank transparency is relevant for the analysis and evaluation of monetary policy. There exist well known arguments generally

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[1] The importance of the openness of central bank decision making has been highlighted by, among the others, Blinder *et al*. (2001). However, following the seminal Canzoneri's (1985) contribution, more recent theoretical studies emphasize the strategic use of information. See, e.g., Faust and Svensson (2001) and (2002), Cukierman (2002), Gürner (2002), and Walsh (2003). Empirical evidence on the effects of transparency is provided by Demertitzis and Hughes-Hallet (2003). They find that the transparency does not affect the average level of inflation and output gap, but it seems to have an effect on their volatilities.

favoring an explicit commitment by monetary authorities to a predefined course of action and/or a preference for a relevant degree of independence for the same institutions.[2] The commitment to particular policies should be supported and, thus, verifiable by the public. A particular attitude of the central bank towards information disclosure is hence required. Central bank independence poses analogous problems. A central bank endowed with strong independence from the control of other institutions could be tented to pursue goals different form social welfare improvement. Such a temptation could be higher the lower is the central bank's transparency (and accountability).

In order to develop the analysis of monetary authorities' behavior towards information disclosure, apart from theoretical studies, an empirical appraisal of central banks' transparency is certainly needed. This theme has been effectively tackled by several authors, (e.g. Bernake *et al.*, 1999; Fry *et al.*, 2000; and Blinder *et al.*, 2001). In a recent contribution Eijffinger and Geraats, EG henceforth, (2002) propose an index explicitly built to summarize the information disclosure practices adopted by central banks. This general index is a highly composite one (made up of 15 different sub-indexes in order to include different facets of information disclosure;[3] it can be justified by reckoning that transparency or information disclosure are markedly multifaceted and multidimensional phenomena. EG then apply their index to nine major central banks for which it have been possible to collect the relevant information.[4] They find that the most transparent central banks are the Reserve Bank of New Zealand, the Bank of England, and the Swedish Riksbank. An intermediate level of transparency is associated with the Bank of Canada, the European Central Bank, and the US Federal Reserve. The least transparent central banks are the Reserve Bank of Australia, the Bank of Japan, and the Swiss National Bank.

Our aim is to further elaborate the EG's analysis by investigating more deeply the multidimensional aspect of the problem. In other words, we consider the disclosure practices in more general terms and to better qualify the nature of their variability

[2] The arguments for commitment stem from Barro and Gordon (1983), while those for central bank independence (as long as it ensures a high degree of inflation aversion) are traditionally due to Rogoff (1985). Those issues have been extensively debated and the standard arguments supporting commitment/independence have also undergone significant criticism and qualifications (cf. among the others, Gylfason and Lindbeck, 1994; Guzzo and Velasco, 1999; Cukierman and Lippi, 1999; Berger *et al*., 2001; and Lawler, 2001).

[3] See Appendix A.

[4] They first collected all the relevant information freely available in English as of in June 2001. Afterwards, for each central bank, they sent the scores obtained for that central bank (together with a description of the index) to an officer of the same institution, and asked for a review of the score itself. Finally, they used the responses to reassess and slightly modify the scores. Although the time span of the data collected is not clearly assessed, it can be thought that they cover a short-medium run period of some year.

among national central banks. By applying principal component analysis (PCA) to the original EG's dataset, we tackle a twofold target. First, using a "non-centered" PCA, section 3 refines the EG's general index by cleaning it from some non-informative correlation between its sub-indexes. The "cleaning" action produces a neater general index for transparency which provides information on the absolute *quantity* of information disclosed by the central banks. Second, by using a "centered" PCA, we break down and recompose the original general EG's index in order to single out different perspectives, or points of view, under which the transparency behavior can be seen. This procedure gives rise to three specific indexes[5] synthesizing those perspectives. An analysis of the central banks' scores under those indexes allows to cluster the sample of monetary authorities in four groups, each characterized by composite and different characteristics under the multiple dimensions of transparency. The next section describes and discusses EG's dataset, also used in our study. Section 3, after explaining the difference between non-centered and centered PCA, illustrates our results in both cases and gives our interpretation of the principal components. Section 4 concludes.

2. Transparency and the EG's dataset

In the construction of their index of transparency, EG (2002) follow this strategy: they assume that transparency is mainly given by the total amount of information that a central bank discloses to the public. Since such information can be of varied nature, they define five major categories under which classifying the different types of transparency. Subsequently, each category is further partitioned into three specific values to obtain a finer classification of the various types of information flows. The five main categories are: political transparency; economic transparency; procedural transparency; policy transparency; and operational transparency.

1) Political transparency refers to openness about policy objectives. In a standard model of monetary policy game, it could be seen as the attitude of the central bank in communicating the form of its objective function, the values of its parameters and of its eventual target values for the main objective variable (e.g. inflation). Political transparency is decomposed into three sub-indexes:

- *Formal objectives*: It indicates the explicit communication of final targets and an explicit prioritization in case of potentially conflicting goals. If a central bank

[5] Which are determined by factorial axis, see Okamoto (1997) and Lebart *et al*. (1995).

declares a single objective with explicit priority, it scores one. If it declares multiple objectives without priority, it scores 0.5. If declares no objective, it scores zero.

- *Quantitative targets*: If there is a quantification of the targets, the central bank's score is one, zero otherwise.
- *Institutional arrangements*: It signals the presence of explicit contracts or institutional arrangements between central bank and government; it also concerns guarantee on the instruments independence for the monetary authorities. If there are such contracts (possibly subject to explicit override mechanisms), the score is one, if there is no formal instrument independence, the score is 0.5, the total absence of institutional arrangements scores zero.

2) Economic transparency is related to economic information used in setting the monetary policy. Considering the standard game-theoretic setup, it refers to the information that the central banks gives on the model of the economy (any theoretical scheme synthesizing the functioning of the economic system); it also includes economic data and the knowledge of the shocks hitting the economy (both for demand and supply). If a monetary authority fully discloses such information, then central bank and private sector presumably have the same knowledge of the relevant economic facts. The sub-indexes are:

- *Economic data*: It includes the provision of data on money supply, inflation, GDP, unemployment rate, and capacity utilization. If quarterly data of no more than two out of the five variables are public, the score is zero. If quarterly data for three or four of the variables are public, the score is 0.5. Quarterly data publicly available for all the variable implies a value equal to one.
- *Policy models*: If the central bank discloses the formal macroeconomic model(s) used for its policy analysis (to constructs forecast and to evaluate the impact of monetary policy), the score is one, zero otherwise.
- *Internal forecasts*: It refers to communication of the central bank forecasts. Forecasts are important since monetary policy actions are known to take effect only after substantial lags. Hence, the central bank's actions are likely to reflect anticipated developments. If the central bank does not regularly publish its macroeconomic forecasts on inflation and output, the score is zero. If forecasts for inflation and output are published at a less than quarterly frequency, the score is 0.5. The provision of information on quarterly forecasts for medium-run inflation

and output (specifying the assumptions about the monetary instrument – conditional or unconditional forecasts) implies an entry equal to one.

3) Procedural transparency is about the way monetary policy decisions are taken. It is important as it signals how the central bank discloses its *strategy rule* to the public. If, for instance, if a central banks uses a Taylor-kind rule to set monetary policy, procedural transparency would require the communication of the general relation between the monetary policy instrument (interest rates in the case) and the main target or endogenous variables of the economic system. It involves:

- *Explicit strategy*: If the central bank provides an explicit description of its policy rule or strategy that describes its monetary policy framework, the score is one, zero otherwise.
- *Minutes* of decisional boards (or explanations in the case of a single central banker): It constitutes comprehensive accounts of the policy deliberations. If a central bank doesn't release such documents within a reasonable amount of time (eight weeks), the score is zero; by contrast, if the minutes are released without substantial lags, the score is one.
- *Voting records*: It gives important information on the strategy rule can be provided by showing how each decision on the level of policy instruments was reached. If a central bank does not publish voting records (or if they are released after a substantial lag – eight weeks), the score is zero; if voting records are given, the score is one.

4) Policy transparency involves the quickness in the communication of policy decision. Given the lags in the impact of monetary policies, a rapid communication of policy decision can play a crucial role in informing the public on the monetary strategies. Furthermore, monetary policy actions are typically made in discrete steps; a central bank may be inclined to change the policy instrument, but decide to wait until further evidence warrants moving a full step. Policy transparency is also about explanation of decision and clear indication for future policy actions. The sub-indexes are:

- *Prompt announcement*: If decisions on the main instrument or target are promptly announced (at the latest day of implementation) the score is one; announcements occurring with a significant lag scores zero.
- *Policy explanations*: If the central bank provide an explanation of its announced decisions (always including forward-looking assessment), the score is one; if it

provides explanations only when policy changes or in a superficial fashion, the score is 0.5; for no explanations the score is zero.

- *Policy inclination*: If the central bank discloses explicit policy inclination or indication of likely future policy actions, the score is one, otherwise zero.

5) Operational transparency refers to information on the implementation of monetary policy. The main feature of this type of transparency concerns the way in which policy actions are evaluated, taking into account of eventual errors and disturbances affecting the transmission mechanism of monetary policies. It refers to information provision on possible justifications (ex-post) of policy actions. This category is partitioned into:

- *Control errors*: It refers to extent to which a central bank provides evaluations of outcomes of its policy actions (i.e. if the operating targets have been achieved); if such controls are performed accounting for significant deviation from targets (if any) the score is one; if the controls are performed without providing explanations for eventual deviations, the score is 0.5; in case of no (or very seldom) controls the score is zero.
- *Transmission disturbances*: If the central bank provides regularly information on (unanticipated) macroeconomic disturbances affecting the transmission process, the score is one; if such information are provided, but only through short term forecasts or analysis, the score is 0.5; if no information is provided (or very seldom), the score is zero.
- *Evaluation of policy outcome*: When the central bank regularly provide an evaluation of the policies in light of its macroeconomic objectives (including an explicit account of deviations between outcomes and objectives) it scores one; when such evaluation is provided without explanations for deviations, the scores is 0.5; no evaluation provided (or very seldom) scores zero.

The procedure of aggregation of the 15 sub-indexes followed by EG is straightforward: they simply sum up the indexes for each country.[6] Although the partition elaborated by EG is rather fine and comprehensive, the possibility of correlations between the recorded scores for each variable (sub-index) and the strong multidimensionality of the phenomenon calls for a further analysis. To this aim, the standard methods of multivariate eigenanalysis (the most classical of which is the PCA) appear particularly suited.

[6] See Appendix A: Table A1.

3. The statistical model and results

3.1 *The methodology*

The main idea of PCA is to reduce the dimensionality of a dataset that may contain correlated variables, while retaining as much as possible of its variability. More in detail, PCA searches for a few uncorrelated linear combinations (principal components) of the original variables that capture most of the information in the original variables.

Formally, given the dataset $X \in \Re^{n \times m}$ (formed by *n* rows namely, cases, and *m* columns, namely variables), PCA is applicable to any product moment matrix of the form $Z = XX'$ or $Z = X'X$. Given a vector $b_1 \in \Re^m$ of unknown weights (loading), the first principal component is obtained by maximizing the variance of $Z_1 = Xb_1'$ under the constraint $b_1 b_1' = 1$. The second component is obtained in a similar manner by introducing the additional restriction that the second component is uncorrelated with the first one. This process is continued until as many components as variables have been calculated.[7]

The principal components are usually derived from the centered original data matrix (i.e. scores are considered as deviations from the mean of the variables). Centered analysis is obtained in a similar way as the non-centered one, above described, by using the similarity (covariance) matrix $S_C = YY'$ of the transformed data set *Y*, where $y_{ik} = x_{ik} - \frac{1}{m}\sum_{k=1}^{m} x_{ik}$. Principal components can be also derived by centering the original data with respect to the variable (column) mean. The difference between the two procedures is however not trivial and, being relevant for our investigation, we need to discuss it.[8]

Non-centered principal components analysis implies an all-zero point (vector) of reference: a non-transparent central bank. The multivariate analysis uses and describes all the departures from this absolute zero. By contrast, centering by variables transfers

[7] See, e.g., Dunteman (1989).

[8] Notice also that principal components are often calculated after data standardization. This procedure is needed when the variables are expressed in different units of measure. In our case, we do not standardize the data implicitly assuming the same metric used by EG.

the reference point (origin) to a hypothetical average stand. Stands now contribute information only as far as they depart from this average composition. In other words, it is assumed that a "uniform distributed kind" of central bank exists and deviations from it are studied.[9]

The two procedures describe different situations. The decision about which is the more appropriate depends on the kind of variability that one wants to explain. Moreover, an advantage of non-centered analysis is that it distinguishes disjunction from mere difference in between-axes from within-axes heterogeneity of clusters. Within-axes heterogeneity means that the same set of axes (variables) are relevant to the explanation of the variability of all the clusters of central banks. Between-axes heterogeneity means that each cluster (or group of clusters) has a significant non-zero projection only on a subset of axes, i.e. the variability associated to each cluster is mainly explained by some axes only. In the case of within-axes heterogeneity non-centered ordination results in a single "general" unipolar component. In the case of in between-axes heterogeneity non-centered ordination results in several unipolar components.[10]

In order to obtain an index of transparency comparable with that of EG, we first perform a non-centered multivariate analysis since it means that our reference point is a non-transparent central bank. The advantage of obtaining an index in this way is clear with respect to a simple additive index. In fact, it eliminates redundant information in the dataset and gives additional information (e.g. the second component) about the phenomenon investigated, which can be useful to explain the nature of information derived from the data. By contrast, performing centered PCA we implicitly accept the EG' index and study the variability of the data on their mean. In other words, in the non-centered analysis the reference point is a "non-transparent" central bank. In the centered analysis the reference point is an "average kind" of central bank.

Our investigation strategy is as follows. First, we use a non-centered PCA to derive a quantitative index of transparency (the first unipolar principal component), which is comparable to that of EG. In doing that, we also give an interpretation to other components found. Second, we perform the PCA by centering the data with respect to variable means in order to study the information provided by the central banks under a more qualitative perspective.

[9] Of course, information regarding the absolute values is not lost, but is synthesized in the means that in such a case have to be taken into account in the data analysis (see Noy-Meir, 1973).
[10] An extensive discussion on centering (with respect different means) and non-centering is Noy-Meir (1973).

3.2 *Non-centered analysis*

The non-centered PCA individuates two principal components that explain about the 95% of the dataset variability. As usual in non-centered analysis, the first component is unipolar and explains a large part of the variability (85%). The second component, however, still explains about the 9% of data variability. Factor loadings individuate two components. The weights[11] associated with these two components are reported in table 1.

Table 1 – Multivariate transparency indexes weights (first two components)

	First component	Second component
Formal Objectives	0.304	0.119
Quantitative Targets	0.288	0.372
Institutional Arrangements	0.335	0.111
Economic Data	0.288	–0.001
Policy Models	0.210	–0.184
Central Bank Forecasts	0.246	–0.058
Explicit Strategy	0.288	0.372
Minutes	0.204	–0.487
Voting Records	0.158	–0.536
Prompt Announcement	0.352	–0.007
Policy Explanation	0.277	–0.036
Policy Inclination	0.082	–0.345
Control Errors	0.321	0.000
Transmission Disturbances	0.189	0.051
Evaluation Policy Outcome	0.166	–0.114

The first component individuates a quantitative index, *information sharing index* (*IS index*, or *transparency index*), which is comparable to that of EG.[12] The index differs from that of EG with respect to the weights (which in EG's index are all the same). In our index *prompt announcement*, *institutional arrangements*, *control errors*, and *formal objectives* are more relevant than in the EG's index. By contrast, *policy inclination*, *voting records*, *evaluation policy outcome*, *transmission disturbances* result less relevant.

Regarding the second component, a possible interpretation is to relate it to the relative quantity of information about the *political transparency* vs. the

[11] The software we used, MVSP, performs an R-mode PCA. The component loadings are scaled to unity, so that the sum of squares of an eigenvector equals one, and the component scores are scaled so that the sum of squares equals the eigenvalue.

[12] Recall that non-centered PCA explain the variability of the central banks with respect to the case of central bank associated with all zero score (i.e. a completely non transparent central bank).

procedural transparency.[13] In fact, central banks that give relatively more quantitative information about their objective or reaction function (in terms of targets, form, or marginal rate of substitution) have high index values. By contrast, central banks disclosing more information about the way monetary policy decisions are taken (i.e. providing minutes and voting records) score low.[14] EG (2002) refer to explicit strategies as an indicator *procedural transparency*. By contrast, in our view it is an indicator of *political transparency* since it is related to the form of the policy function of the central bank (e.g. the adoption of a Taylor-kind rule to set monetary policy). We then refer to this index as *procedural/political index* (*PP*).

According to the loading found in table 2, central banks can be ranked as follows.

Table 2 – Transparency indexes among industrialized countries

Information sharing (IS) index			*Political/Procedural (PP) index*	
New Zealand	1.198	(1.35)	Australia	0.334
UK	1.154	(1.25)	Switzerland	0.297
Sweden	1.153	(1.20)	Euro zone	0.248
Canada	1.049	(1.05)	Canada	0.242
Euro zone	1.000	(1.00)	Sweden	0.113
US	0.856	(1.00)	UK	–0.114
Australia	0.845	(0.80)	New Zealand	–0.252
Switzerland	0.801	(0.75)	Japan	–0.332
Japan	0.739	(0.80)	US	–0.554

The first index of table 2 (*IS*) reflects the index of EG, which is indicated in the table between brackets (original index divided by 10 to facilitate the comparison).

The second index (*PP*) indicates the kind of information that central banks supply about how monetary policy is set, as the ratio between information associated with the debate inside the central bank in the policymaking process (*procedural transparency*) and quantitative information associated with the central bank targets (*political transparency*). Countries such as the United States, Japan, New Zealand, and the United Kingdom give a relative more relevance on the information related to the formation of the monetary policymaking process. By contrast, Australia, Switzerland,

[13] As defined by EG (2002), see our Section 2.

[14] More in detail, the second component is mainly determined (with a positive weight) by *explicit strategy*, *quantitative targets*, *formal objectives*, and *institutional arrangements*, and (with a negative weight) by the following variable *voting records*, *minutes*, *policy inclination*, *policy models*, and *evaluation policy outcome*.

Canada, the European Central Bank, and Sweden place a more relative emphasis on the quantitative information regarding their targets.

This subsection has investigated the variability of the data set with respect to the non-transparent central bank, and therefore, it has focused on the quantity of information. According to our results, data are mainly associated with within-axes heterogeneity since the weights of first component are all positive while the second component is not unipolar. This means that the same set of variables is relevant to all the clusters of central banks and principal components do not show the evidence of compositional disjunction in the sample. Hence, in order to understand and describe the data variance under a more qualitative point of view, centered PCA may result more useful than the non centered one.[15] In the next subsection, centered PCA by focusing on the quality of information tries to introduce an additional-value to our investigation.

3.3 *Centered PCA*

The first three components of our centered PCA are reported in Table 3.[16] Since the first three eigenvalues explain about the 80% of the variance,[17] we can restrict our analysis to these components.

Table 3 – Centered principal component analysis (loading)

	Component 1	Component 2	Component 3
Formal Objectives	0.130	0.293	0.033
Quantitative Targets	0.384	0.360	–0.015
Institutional Arrangements	0.119	0.053	*0.131*
Economic Data	0.003	–0.205	–0.034
Policy Models	–0.172	0.477	–0.594
Central Bank Forecasts	–0.047	0.291	0.206
Explicit Strategy	0.384	0.360	–0.015
Minutes	–0.479	0.223	0.427
Voting Records	–0.530	0.135	0.057
Prompt Announcement	0.000	0.000	0.000
Policy Explanation	–0.030	0.024	–0.141
Policy Inclination	–0.341	0.140	–0.372
Control Errors	0.011	0.240	–0.098
Transmission Disturbances	0.061	0.334	*0.432*
Evaluation Policy Outcome	–0.107	0.199	*0.212*

[15] See Noy-Meir (1973) for a more technical discussion about principal component analysis and between and within heterogeneity.
[16] Also for centered PCA holds the normalization adopted for the non-centered analysis of the previous section (see footnote 8).
[17] The relative contribution of each variable is reported in detail in Table B1: Appendix B.

The first component explains the 42% of the variance. It mainly depends on *quantitative targets, explicit strategies, formal objectives, institutional arrangements* (with positive contribution) and *voting records, minutes, policy inclination* (negative contribution).[18] Notice the correlation between the first component and the *PP* index of Table 2. Hence, our interpretation of the first component[19] is to see it as an index of the information on the "discussion process" that determines the monetary policy vs. the information on the final outcomes of this discussion process.[20] A central bank with a high score in the first component *ceteris paribus* attaches proportionally a high importance on providing information on its formal objectives and institutional constraints, relative to the disclosure of the internal decision process's outcomes.

The second component groups with a positive sign *policy models, forecasts, transmission disturbances,* and *control errors* and it is negatively affected by only the variable *economic data*. Notice the correlation between this component and the *IS* index. It opposes central banks that give quantitative information about their reaction functions to central banks that do not do it. In fact the index is negatively associated with only economic data, which has a very low variability within central banks.

The third component explains the 16% of the variance. It is mainly determined by *transmission disturbances*, *minutes*, and *evaluation of policy outcomes* (positive sign) and *policy models*, *policy inclination*, and *policy explanation* (negative sign). The first group of variables (positive) seems to be associated with the ex post appraisal of the monetary policy (*operational transparency*) whereas the second group (negative) can be related to the ex ante appraisal (*policy transparency*).[21] In general terms, it can be said that the former represents information relevant to understand the effects of monetary policy and the latter information useful to interpret the central bank's strategies.

[18] Relevant variables are determined by using a rule of thumb on their weight. However, principal component analysis can be also interpreted as a statistical model more than a merely descriptive one and relevance statistical determined (see Appendix D).

[19] The component interpretation has to be based on the correlations between the variables and the components themselves; these correlations can be obtained by direct calculation and are shown in Appendix B: Figure B1.

[20] According to our view in contrast with EG, the variable *explained strategies* plays a different role. It indicates the quick communication of the rules or strategies of the monetary policy. EG consider *explained strategies* as an indicator of the procedural transparency. In our case, it is more related to the *political transparency* if its relevance in the determination of the first component is considered (together with *quantitative targets*, *explained strategies*, *formal objectives*, and *institutional arrangements*).

[21] Notice that also minutes has a relevant weight in explaining the index. *Minutes* is also related to the *policy transparency* since it refers to the publication of board minutes in reasonable times.

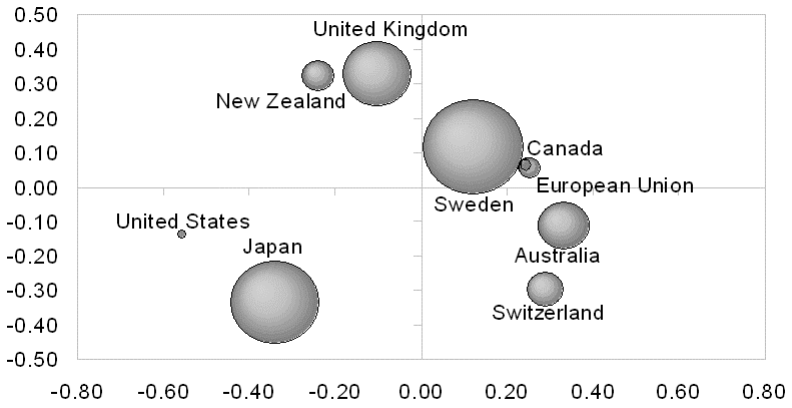
Summarizing, the first component highlights the way used by the central banks to communicate their strategies. It opposes quantitative indexes to more articulated information, which can be used to indirectly determine the central banks' strategies. The second component individuates central banks which provide quantitative data on their policy reaction function. The third component indicates the information associated with the ex ante analysis of the monetary policy vs. its ex post analysis. According to the above view, we refer to the three found components as the *strategy communication* (*SC*) index, *reaction parameter* (*RP*) index, and *timing-of-disclosure* (*TD*) index, respectively. Table 4 reports them.

Table 4 – Centered principal component analysis (scores)

	SC	*RP*	*TD*
Australia	0.33	–0.11	0.02
Canada	0.25	0.06	–0.18
Euro zone	0.25	0.06	–0.16
Japan	–0.34	–0.34	0.25
New Zealand	–0.24	0.32	–0.10
Sweden	0.12	0.12	0.33
Switzerland	0.29	–0.30	–0.07
UK	–0.10	0.33	0.14
US	–0.56	–0.14	–0.24

Figure 1 describes the relationship between central banks and the first three components:

Figure 1 – Central bank information (qualitative analysis)



Legend: the horizontal axis represent *SC*, the vertical axis represent *RP* whereas the areas of pointers are correlated with the *TD*.

An inspection of the above figure allows a tentative classification and interpretation of the nature of information provided by the nine central banks. By considering the first two components, there could be pointed out four groups of countries.

A) A first group is formed by all central banks scoring a positive *RP* index. These central banks currently (or attempt to) pursue a commitment behavior by providing information on their reaction functions. Regarding the *SC* index they show not extreme absolute values. New Zealand and the United Kingdom have an established tradition of inflation targeting (a strong form of commitment). By contrast, Canada and Sweden are attempting to build a reputation on a credible inflation targeting regime. This explains the relative difference in the *SC* index; in fact, Canada and Sweden focus their relative information on the quantitative variables. European Union can be also included in this group as it also attempts to increase its reputation in order to establish commitment regime although without a formal inflation targeting.[22]

B) Other central banks are more extreme regarding the *SC* index. The United States and Japan form another group. Their information disclosure appears coherent with a general propensity for discretion in the monetary policy. In fact, they show low levels of the indexes. As for the *SC* index their information policy appears relatively more oriented to explaining the monetary strategies without providing the quantitative variables. However, the *RP* index signals

[22] Inflation targeting regime is not the only form of commitment for a central bank.

that their information policy is procedural-oriented not only in relative terms but also in absolute ones, since the Fed and the Bank of Japan provide low quantitative data on their policy reaction function.

C) The last group is formed by Australia and Switzerland. The information disclosure associated with these central banks appears somehow unbalanced. They provide relatively more information on *political transparency* than on *procedural transparency*, but are associated with poor scores in the provision of information regarding quantitative data of their policy. Hence they can be associated with a low standard of general transparency.

This grouping of countries well-describe the relation between central banks and information disclosure focusing on the different monetary policy regime (i.e. discretionary or commitment). However, the third component (*TD* index) helps to point out a further dimension of the information disclosure, transversal with respect to our grouping. Countries as the United Kingdom, Sweden and Japan, which for mandatory or cultural reasons are more inclined to be involved in a more general (coordinate) setting of the economic policy, show higher values of the *TD* index, as result of the ex post evaluation of the monetary policy. It could be thought that in a centralized economic policy framework[23] an ex post revision of the policy measures on the basis of their effects is needed. The lack of a fiscal coordination among the European Union members seems to confirm our intuition. The European Central Bank scores low *TD* index, hence it provides more ex ante information than ex post as expected if coordination is not present (an analogous claim can be made for the United States).

Finally, the proposed centered PCA should be evaluated with respect to the quality of the representation on the chosen factorial axis. The inspection of the total absolute contribution and of the representation quality sufficiently confirms the validity of the centered PCA (see Appendix C). With respect to the first component, it should be noticed the particular weight of the United States that contributes to explain the variance of the first component about for 37%. This is confirmed also by a visual inspection of Figure 2, in which the position of the United States appears to be rather an outlier. Anyway, the impact of the United States is not outside the usual range accepted for this kind of analysis. For the second and third component, the impact of the various countries is more evenly distributed.

[23] That could also involve social partners, as, e.g., centralized trade unions and business organizations.

As for the representation quality, the first three components absorb a significant percentage of the variance among the countries, ranging form a minimum of 69% for Australia to a maximum of 96% for the United States. This confirms the quality of the representation assured by the first three components. The results of the PCA highly depends upon the structure of the data matrix (see Table A1: Appendix A), a direct inspection of this dataset shows the relative low impact of certain variables, due to their uniformity of distribution among countries. For instance, *prompt announcement* plays no role, for its score is one for all the countries. Similarly, *institutional arrangements*, *quantitative targets* and *control errors* have only a minor impact for they are quite evenly distributed among countries.

4. Conclusions

In this paper we have investigated the information provided by the central bank to the public on both a quantitative and a qualitative side. We found that a simple index as that elaborate by EG (refined in our non centered PCA by the *IS* general index) performs well in synthesizing information about the general quantity of transparency. However, being the information strategic, single indexes are not sufficient to fully understand the central bank's information issue. Multiple indexes are needed. In particular, by running a qualitative analysis (namely centered PCA) we individuate three indexes that better characterize the central banks and explain some difference in the information that they produce.

We construct three indexes: *strategic communication* (*SC*) *index*, *reaction parameter* (*RP*) *index*, and *timing-of-disclosure* (*TD*) *index*, highlighting different perspectives of the multifaceted problem of transparency. The *SC* index is linked with way used by the central banks to communicate their strategies. Quantitative indexes are opposed to more articulated information, which can be used to indirectly determine the central banks' strategies. The *RP* index is a general index of quantitative (*political*) transparency, which individuates central banks associated with high provision of quantitative data about their policy reaction function. The third index, *TD*, indicates the information associated with the ex ante analysis of the monetary policy vs. its ex post analysis.

By taking account of the above three indexes, the nine central banks considered can be clustered into three groups with respect to the monetary policy regime adopted and further differentiated according to the general propensity of policy coordination due to cultural or political reasons.

The first group is made up of central banks associated with a commitment regime (New Zealand, the United Kingdom, the Euro Area, Canada and Sweden), which provide information on quantitative transparency (high or positive *RP* index) and balanced information regarding *procedural* and *political transparency* (an *SC* index with small absolute values). This group can be further partitioned into three subgroups. In the first, those central banks possessing a well established anti-inflation reputation, as New Zealand and United Kingdom, which adopt a formal inflation targeting regime. The second group includes monetary authorities, such as Canada and Sweden, which are trying to build a reputation on a credible inflation targeting regime. According this view, central banks of Canada and Sweden tend to convey more information on the quantitative variables rather than on the procedural ones. Finally, the European Central Bank can be considered as a special case: it also appears inclined to build a reputation of commitment, although it is not embedded in a formal inflation targeting regime.

The second group, Japan and the United States, is formed by "discretionary" central banks: their information disclosure and transparency behavior appear to be coherent with a less committed and embedded arrangement. They score negative values on both *SC* and *RD* index, so that their policy on information disclosure is more oriented in explaining the monetary strategies without providing the formal and quantitative objectives (low *SC* index), and in conveying a low level of overall information (low *RP* index).

The last group, including Australia and Switzerland, can be described as characterized by a kind of unbalance in the behavior of information disclosure. Australia and Switzerland provide relatively less overall information, as signaled by the low level of *RP* index, but also convey relatively more information on their *political transparency* than on *procedural transparency*. Their behavior appears thus less clearly identifiable with a general monetary regime (commitment-inflation targeting or discretion) as was the case for the other two groups. Moreover, their information disclosure appears to be relatively poor.

A third index (*TD*) allows us to develop a further and transversal classification. As the *TD* index indicates the prevalence of ex post vs. ex ante information provision on policy analysis, it can be related to the general, social and political, environment in which monetary policy takes place. Countries, which present a general climate favorable to a coordination in the setting of the overall economic policy, such as Sweden, Japan and United Kingdom,[24] also present a high level of the *TD* index; i.e. a

[24] In the case of the latter the policy coordination is due to the political arrangements more than social factors. The Bank of England has a low level of independence in determining its target, which is influenced by the government.

relatively higher presence of ex post information on the evaluation and analysis of monetary policy. This could be due to the need in a coordinated framework for an ex post revision of the policy measures. By contrast, in the United States and the Euro Area, due to the lack of such a general coordination, central banks prefer to spread more ex-ante information.

Our analysis is a step further in the recent transparency debate by highlighting the quantitative perspective from an empirical point of view. Moreover, since our indexes, derived from PCA, are by construction uncorrelated, they can be fruitful used in further studies, as panel or cross-country econometric investigations. Regarding our further steps toward, we aim to investigate more in general the variability of central bank procedures regarding not only transparency but also accountability and independence in order to better understand the central bank institutional design.

Appendix A – Dataset and data matrices

Table A1 – Dataset (Eijffinger and Geraats, 2002)

	Aus	Can	Eur	Jap	NZ	Swe	Swi	UK	US
Formal Objectives	1	1	1	0.5	1	1	0.5	1	0.5
Quantitative Targets	1	1	1	0	1	1	1	1	0
Institutional Arrang.	1	1	1	1	1	1	1	1	0.5
Economic Data	0.5	1	1	1	0.5	1	1	0.5	1
Policy Models	0	1	1	0	1	0	0	1	1
Central Bank Forecasts	0.5	0.5	0.5	0.5	1	1	0.5	1	0.5
Explicit Strategy	1	1	1	0	1	1	1	1	0
Minutes	0	0	0	1	1	1	0	1	1
Voting Records	0	0	0	1	1	0	0	1	1
Prompt Announcement	1	1	1	1	1	1	1	1	1
Policy Explanation	0.5	1	0.5	0.5	1	1	1	0.5	1
Policy Inclination	0	0	0	0	1	0	0	0	1
Control Errors	1	1	1	0.5	1	1	0.5	1	1
Transmission Disturb.	0.5	0.5	0.5	0.5	0.5	1	0	1	0
Evaluation Policy Out.	0	0.5	0.5	0.5	0.5	1	0	0.5	0.5

Legend. Aus: Australia; Can: Canada; Eur: Euro Zone; Jap: Japan; NZ: New Zealand; Swe: Sweden; UK: United Kingdom; US: United States.

Table A2 – Centered data form Table A1

	Aus	Can	Eur	Jap	NZ	Swe	Swi	UK	US
Formal Objectives	0,166	0,166	0,166	-0,33	0,166	0,166	-0,33	0,166	-0,33
Quantitative Targets	0,222	0,222	0,222	-0,77	0,222	0,222	0,222	0,222	-0,77
Institutional Arrang.	0,055	0,055	0,055	0,055	0,055	0,055	0,055	0,055	-0,44
Economic Data	-0,33	0,166	0,166	0,166	-0,33	0,166	0,166	-0,33	0,166
Policy Models	-0,55	0,444	0,444	-0,55	0,444	-0,55	-0,55	0,444	0,444
Central Bank Forecasts	-0,16	-0,16	-0,16	-0,16	0,333	0,333	-0,16	0,333	-0,16
Explicit Strategy	0,222	0,222	0,222	-0,77	0,222	0,222	0,222	0,222	-0,77
Minutes	-0,55	-0,55	-0,55	0,444	0,444	0,444	-0,55	0,444	0,444
Voting Records	-0,44	-0,44	-0,44	0,555	0,555	-0,44	-0,44	0,555	0,555
Prompt Announcement	0	0	0	0	0	0	0	0	0
Policy Explanation	-0,27	0,222	-0,27	-0,27	0,222	0,222	0,222	-0,27	0,222
Policy Inclination	-0,22	-0,22	-0,22	-0,22	0,777	-0,22	-0,22	-0,22	0,777
Control Errors	0,111	0,111	0,111	-0,38	0,111	0,111	-0,38	0,111	0,111
Transmission Disturbances	0	0	0	0	0	0,5	-0,5	0,5	-0,5
Evaluation Policy Out.	-0,44	0,055	0,055	0,055	0,055	0,555	-0,44	0,055	0,055

Table A3 – Similarity matrix (non-centered PCA)

	FO	QT	IA	ED	PM	CBF	ES	M	VR	PA	PE	PI	CE	TD	EPO
FO	0.844														
QT	0.813	0.875													
IA	0.906	0.875	1.031												
ED	0.750	0.688	0.875	0.844											
PM	0.563	0.500	0.563	0.500	0.625										
CBF	0.656	0.625	0.719	0.594	0.438	0.563									
ES	0.813	0.875	0.875	0.688	0.500	0.625	0.875								
M	0.500	0.375	0.563	0.500	0.375	0.500	0.375	0.625							
VR	0.375	0.250	0.438	0.375	0.375	0.375	0.250	0.500	0.500						
PA	0.938	0.875	1.063	0.938	0.625	0.750	0.875	0.625	0.500	1.125					
PE	0.719	0.688	0.813	0.750	0.500	0.594	0.688	0.500	0.375	0.875	0.750				
PI	0.188	0.125	0.188	0.188	0.250	0.188	0.125	0.250	0.250	0.250	0.250	0.250			
CE	0.875	0.813	0.938	0.813	0.625	0.688	0.813	0.563	0.438	1.000	0.781	0.250	0.938		
TD	0.531	0.500	0.563	0.438	0.313	0.438	0.500	0.375	0.250	0.563	0.406	0.063	0.531	0.406	
EPO	0.438	0.375	0.469	0.438	0.313	0.375	0.375	0.375	0.250	0.500	0.406	0.125	0.469	0.313	0.313

Legend. FO: formal objectives, QT: quantitative targets; IA: institutional arrangements; ED: economic data; PM: policy models; CBF: central bank forecasts; ES: explicit strategy; M: minutes; VR: voting records; PA: prompt announcement; PE: policy explanation; PI: policy inclination; CE: control errors; TD: transmission disturbances; and EPO: evaluation policy outcomes.

Table A4 – Covariance matrix (centered PCA)

	FO	QT	IA	ED	PM	CBF	ES	M	VR	PA	PE	PI	CE	TD	EPO
FO	0.06														
QT	0.08	0.19													
IA	0.02	0.05	0.03												
ED	-0.03	-0.04	-0.01	0.06											
PM	0.04	0.01	-0.03	-0.02	0.28										
CBF	0.03	0.04	0.01	-0.03	0.02	0.06									
ES	0.08	0.19	0.05	-0.04	0.01	0.04	0.19								
M	-0.02	-0.11	-0.03	-0.02	0.03	0.08	-0.11	0.28							
VR	-0.04	-0.14	-0.04	-0.04	0.10	0.04	-0.14	0.22	0.28						
PA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
PE	-0.01	0.01	-0.01	0.02	0.01	0.01	0.01	0.01	-0.01	0.00	0.07				
PI	-0.02	-0.07	-0.05	-0.02	0.11	0.02	-0.07	0.11	0.14	0.00	0.06	0.19			
CE	0.04	0.04	-0.01	-0.02	0.07	0.02	0.04	0.01	-0.01	0.00	0.00	0.03	0.05		
TD	0.06	0.06	0.03	-0.03	0.00	0.06	0.06	0.06	0.00	0.00	-0.03	-0.06	0.03	0.13	
EPO	0.02	-0.01	0.00	0.02	0.04	0.04	-0.01	0.10	0.03	0.00	0.02	0.01	0.02	0.06	0.09

Appendix B – Centered PCA

The principal components in the centered PCA (the first three of which are shown in Table 3) are obtained as eigenvectors *b* of the equation: $X'Xb = \lambda b$, where X' is the centered data matrix of Table A2; the resulting eigenvalues λ are shown in Tab. B1 (the last seven eigenevalues are all zero).

Table B1 - Eigenvalues of matrix *X'X* and explained variance (percentage and cumulative percentage)

	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6	Component 7	Component 8
Eigenvalues	0,827	0,466	0,317	0,145	0,14	0,05	0,012	0,009
Percentage	42,072	23,711	16,108	7,391	7,117	2,551	0,615	0,436
Cum. Percent.	42,072	65,783	81,891	89,282	96,399	98,949	99,564	100

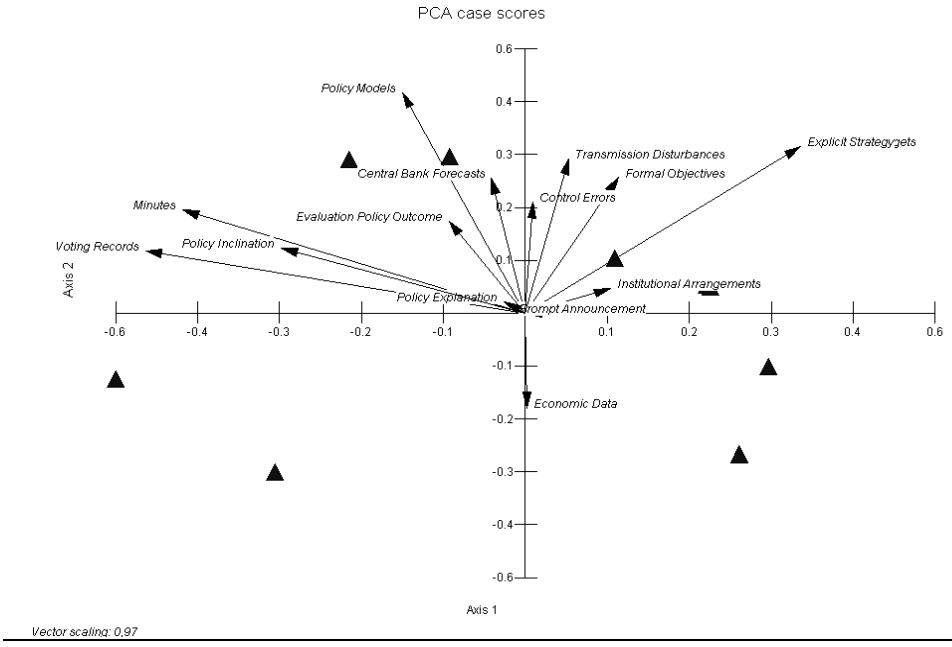
The above mentioned problem has a dual in the space of the units, i.e. $XX'c = \mu c$, so that λ and μ are identical. An indication of the correlation between variables (columns of *X*) can be obtained by the definition of the components *c* in the space of

the units (cfr. Lebart 1995); the *j*-th element of *c* relative to α-th eigenvalue μ_α, i.e. $c_\alpha(j)$, is given by:

$$c_\alpha(j) = \frac{1}{\sqrt{\lambda_\alpha}} x'_j b_\alpha = \sum_{i=1}^{n} \frac{x_{ij} b_\alpha(i)}{\sqrt{\lambda_\alpha}} = s_j \; corr(j, b_\alpha)$$

where s_j is the standard deviation of variable *j* computed form Table A1. Figure B1 plots the values of $c_\alpha(j)$ for the two first eigenvalues (1st and 2nd Components in Table B1):

Figure B1 – Non-centered principal component analysis (Euclidean biplot)



Variables which span a small angle with the first component (axis) b_1 are those more correlated with the same factorial axis, and determine the interpretation of the latter.

Appendix C – Total contributions and representation quality for centered PCA

The main instrument to control the quality of a PCA are the Total absolute contribution index (TAC) and the Representation quality (RQ). The first index is given by the formula:

$$TAC_\alpha(i) = \frac{c_\alpha(i)^2}{\sum_{i=1}^{n} c_\alpha(i)^2} = \frac{c_\alpha(i)^2}{\lambda_\alpha}$$

where $c_\alpha(i)$ is the score of country *i* under the α-th component. It explains how much of the variance explained by the α component is due to the *i*-th unit, so signaling potentials outliers. Table C1 shows the TAC values for the first eight non zero components.

Table C1 – TAC values for the centered PCA

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Australia	0,1324	0,02691	0,0018	0,08193	0,13211	0,48672	0,01008	0,0160
Canada	0,0731	0,00772	0,1022	0,00662	0,15857	0,02738	0,00208	0,4840
EU	0,0767	0,00673	0,0757	0,03879	0,20160	0,00288	0,14700	0,3240
Japan	0,1406	0,24226	0,1940	0,08962	0,02160	0,01800	0,14700	0,0360
N. Zealand	0,0696	0,22527	0,0302	0,02400	0,26606	0,00242	0,26133	0,0090
Sweden	0,0177	0,02887	0,3477	0,42075	0,03500	0,02178	0,00533	0,0111
Switzerland	0,1016	0,18929	0,0163	0,03283	0,17160	0,30258	0,03333	0,0401
UK	0,0128	0,23227	0,0574	0,25689	2,86E-05	0,07200	0,25208	0,0090
US	0,3751	0,04146	0,1742	0,04982	0,01446	0,06962	0,14700	0,0187

The representation quality index is given by:

$$RQ_\alpha(i) = \frac{c_\alpha(i)^2}{\sum_{\alpha=1}^{p} c_\alpha(i)^2}$$

where p is the number of the significant eigenvalues λ considered in the analysis. It gives a measure for contribution of the α-th factor in the representation (or explanation) of the i-th element. The RQ values for the centered PCA are given in Table C2:

Table C2 – RQ values for the centered PCA

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Australia	0,61669	0,07060	0,00324	0,06687	0,10411	0,13698	0,00068	0,00081
Canada	0,48247	0,02870	0,25831	0,00766	0,17700	0,01091	0,00019	0,03472
EU	0,49099	0,02424	0,18575	0,04349	0,21821	0,00111	0,01363	0,02254
Japan	0,37547	0,36454	0,19859	0,04196	0,00976	0,00290	0,00569	0,00104
New Zealand	0,26636	0,48544	0,04441	0,01609	0,17225	0,00056	0,01450	0,00037
Sweden	0,07125	0,06548	0,53641	0,29690	0,02384	0,00530	0,00031	0,00048
Switzerland	0,37854	0,39703	0,02333	0,02143	0,10813	0,06809	0,00180	0,00162
UK	0,05860	0,59790	0,10067	0,20575	2,21E-05	0,01988	0,01671	0,00044
US	0,77667	0,04836	0,13824	0,01808	0,00506	0,00871	0,00441	0,00042

Appendix D – Centered principal component analysis: The statistical model[25]

Principal component analysis is a descriptive tool. However, it can also be interpreted as a statistical model, and therefore, its asymptotic standard errors for covariance matrix and the percentage of explained variance can be computed.[26] The principal component model can be written in matrix terms as:

(d.1) $X = AB' + \varepsilon$

where $X \in \Re^{n \times m}$ is the matrix of observations, $A \in \Re^{n \times f}$ is a matrix of factor scores, $B \in \Re^{m \times f}$ is a matrix of factor loadings, and $\varepsilon \in \Re^{n \times m}$ is a matrix of (normal distributed) residuals. In the principal component analysis model, A are unknown parameters (*fixed effects*) to be estimated, and so X is restricted to belong to be of rank k computes asymptotic standard errors of the principal components model for covariance and correlation matrices and the percentage of explained variance. Identification and parameterization of rank models is non-trivial. Let $L \in \Re^{f \times f}$ be a regular (invertible) matrix, then

[25] Principal components are computed by using *STATA* with a freeware ado-file written by Jeroen Weesie (Department of Sociology, Utrecht University) and *MVSP* of Kovach Computers.
[26] See Anderson (1963) and Tyler (1981).

(d.2) $AB' = (AL)(L^{-1}B')$

Thus, there is considerable freedom to transform ("rotate") *A* and *B* into a standardized format. We use an identifying restriction that *B* is row-wise orthogonal, i.e., the columns of *B* have norm 1, and are uncorrelated with each other.

Principal component analysis are computed as maximum-likelihood estimators based on the assumption that the ε_{ij} are independently and identically normal distributed with a common variance σ (see Andersen, 1963). Estimates may be sensitive to violations of the normality assumption, and therefore, asymptotic results should be interpreted cautiously. Results of principal component analysis are reported in the following tables. Prompt Announcement has been removed since its variability in the sample is zero.

Table D1 – Principal components of covariance matrix

Components	1	2	3	4	5	6	7	8
Eigenvalues	0.827	0.466	0.317	0.145	0.140	0.050	0.012	0.009
var explained (%)	0.421	0.237	0.161	0.074	0.071	0.026	0.006	0.004
cum var explained (%)	0.421	0.658	0.819	0.893	0.964	0.990	0.996	1.000
Standard errors	0.130	0.098	0.060	0.041	0.015	0.004	0.002	0.000

Number of observations 14, number of factors 4 (ρ = 0.893%, std. err. 0,041). Notice that components from 9 to 14 are ruled out since the first 8 components explain about the 100% of the variance. Standard errors are based on multivariate normality.

Table D2 (a) – First component (detail)

	coefficient	std err	Z	P>|z|	95% confidence interval	
Formal Objectives	-0.130	0.172	-0.755	0.451	-0.467	0.207
Quantitative Targets	-0.384	0.212	-1.810	0.070	-0.799	0.032
Institutional Arrang.	-0.119	0.065	-1.821	0.069	-0.247	0.009
Economic Data	-0.003	0.148	-0.017	0.986	-0.294	0.288
Policy Models	0.172	0.348	0.494	0.621	-0.510	0.854
C.B.Forecasts	0.047	0.185	0.256	0.798	-0.315	0.409
Explicit Strategy	-0.384	0.212	-1.810	0.070	-0.799	0.032
Minutes	0.479	0.195	2.451	0.014	0.096	0.861
Voting Records	0.530	0.115	4.628	0.000	0.306	0.755
Prompt Announc.	0.030	0.119	0.248	0.804	-0.204	0.263
Policy Explanation	0.341	0.174	1.953	0.051	-0.001	0.682
Policy Inclination	-0.011	0.152	-0.071	0.943	-0.308	0.286
Control Errors	-0.061	0.244	-0.249	0.803	-0.540	0.418
Transmission Dist.	0.107	0.166	0.645	0.519	-0.218	0.431
Eval. Policy Out.	-0.130	0.172	-0.755	0.451	-0.467	0.207

Table D2 (b) –Second component (detail)

	coefficient	std err	z	P>|z|	95% confidence interval	
Formal Objectives	0.293	0.094	3.103	0.002	0.108	0.478
Quantitative Targets	0.360	0.232	1.551	0.121	-0.095	0.816
Institutional Arrang.	0.053	0.142	0.371	0.710	-0.226	0.332
Economic Data	-0.205	0.144	-1.425	0.154	-0.487	0.077
Policy Models	0.477	0.534	0.893	0.372	-0.570	1.525
C.B. Forecasts	0.291	0.188	1.549	0.121	-0.077	0.660
Explicit Strategy	0.360	0.232	1.551	0.121	-0.095	0.816
Minutes	0.223	0.461	0.483	0.629	-0.681	1.126
Voting Records	0.135	0.334	0.403	0.687	-0.520	0.790
Prompt Announc.	0.024	0.210	0.113	0.910	-0.388	0.436
Policy Explanation	0.140	0.400	0.349	0.727	-0.645	0.925
Policy Inclination	0.240	0.115	2.092	0.036	0.015	0.465
Control Errors	0.334	0.378	0.884	0.377	-0.407	1.076
Transmission Dist.	0.199	0.245	0.812	0.417	-0.281	0.680
Eval. Policy Out.	0.293	0.094	3.103	0.002	0.108	0.478

Table D2 (b) – Third component (detail)

	Coefficient	std err	z	P>|z|	95% confidence interval	
	0.033	0.263	0.124	0.901	-0.484	0.549
Formal Objectives	-0.015	0.352	-0.042	0.967	-0.704	0.675
Quantitative Targets	0.131	0.095	1.381	0.167	-0.055	0.318
Institutional Arrang.	-0.034	0.276	-0.124	0.901	-0.575	0.507
Economic Data	-0.594	0.457	-1.300	0.194	-1.490	0.302
Policy Models	0.206	0.265	0.777	0.437	-0.314	0.726
C.B. Forecasts	-0.015	0.352	-0.042	0.967	-0.704	0.675
Explicit Strategy	0.427	0.265	1.611	0.107	-0.093	0.946
Minutes	0.057	0.289	0.196	0.845	-0.510	0.623
Voting Records	-0.141	0.261	-0.540	0.589	-0.653	0.371
Prompt Announc.	-0.372	0.273	-1.361	0.174	-0.907	0.164
Policy Explanation	-0.098	0.230	-0.427	0.669	-0.550	0.353
Policy Inclination	0.432	0.306	1.411	0.158	-0.168	1.032
Control Errors	0.212	0.291	0.727	0.467	-0.359	0.783
Transmission Dist.	0.033	0.263	0.124	0.901	-0.484	0.549
Eval. Policy Out.	0.033	0.263	0.124	0.901	-0.484	0.549

Table D2 (c) –Fourth component (detail)

	Coefficient	std err	z	P>|z|	95% confidence interval	
	-0.049	0.633	-0.077	0.938	-1.290	1.192
Formal Objectives	0.071	2.223	0.032	0.975	-4.287	4.428
Quantitative Targets	-0.104	0.512	-0.203	0.839	-1.108	0.900
Institutional Arrang.	0.296	3.674	0.081	0.936	-6.905	7.498
Economic Data	-0.225	3.712	-0.061	0.952	-7.499	7.050
Policy Models	0.137	1.397	0.098	0.922	-2.600	2.875
C.B. Forecasts	0.071	2.223	0.032	0.975	-4.287	4.428
Explicit Strategy	0.204	0.600	0.340	0.734	-0.972	1.380
Minutes	-0.397	2.118	-0.188	0.851	-4.548	3.753
Voting Records	0.598	0.953	0.627	0.530	-1.270	2.466
Prompt Announc.	0.351	3.296	0.106	0.915	-6.109	6.811
Policy Explanation	0.055	1.134	0.049	0.961	-2.167	2.277
Policy Inclination	-0.122	1.993	-0.061	0.951	-4.028	3.783
Control Errors	0.349	4.011	0.087	0.931	-7.512	8.211
Transmission Dist.	-0.049	0.633	-0.077	0.938	-1.290	1.192
Eval. Policy Out.	-0.049	0.633	-0.077	0.938	-1.290	1.192

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