

Assessing the Macroeconomic Impact of Central Bank Transparency in Emerging Countries: New Index and Empirical Evidence*

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Abstract

In this paper, using a cross-sectional analysis and instrumental variables technique, we analyze the impact of central bank transparency on macroeconomic outcomes in emerging economies. We build a new index of transparency that combines some aspects of the overall Eijffinger and Geraats (2006) transparency index, with those of monetary policy committee transparency developed in Hayo and Mazhar (2011). Moreover, we analyze the individual role of each component of the new index in mitigating inflation and its volatility, as well as output volatility. We interestingly find that the overall new index of transparency as well as its political, economic, procedural, and policy aspects negatively impact the average level of inflation, but

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not its volatility in these countries. The unique component of the new index that reduces the volatility of both inflation and output is operational transparency, and these results are robust to different econometric and instruments setting specifications.

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1 Introduction

This paper contributes to the debate on central bank transparency by empirically investigating the determinants of transparency, as well as its effects on macroeconomic outcomes in emerging countries. Our focus on these specific countries is motivated by the fact that, they are generally characterized by higher inflation level and greater macroeconomic volatility, compared to developed countries. So, it seems interesting to explore how central bankers of these economies can deal with the mentioned macroeconomic issues.

In their recommendations for monetary policy effectiveness in emerging countries, Fraga et al. (2003) put forward enhancing communication and transparency. However, at least one question remains. Which aspects of transparency have to be enhanced, and should central banks of these countries increase them regardless their policy preferences? Hence in the continuity of their study, we aim at dealing with this important question. Our goal here is to provide to central banks of these economies some indications in making their monetary policy, in order for them to experience higher macroeconomic performances.

To the best of our knowledge, this paper is **the first to explicitly analyze the effects of the different aspects of transparency in emerging economies**. We depart from the previous literature on central bank transparency in two aspects. First, we aim at building a new index of central bank transparency which conciliates some aspects of the overall Eijffinger and Geraats (2006)'s transparency index, with those of monetary policy committee transparency developed in Hayo and Mazhar (2011). Second,

we analyze the role of each component of the new index in lowering average level of inflation, as well as the volatility of inflation and output in emerging countries.

Our results indicate some interesting insights. Indeed, we find that the new index of transparency as well as its political, economic, procedural, and policy aspects negatively impact the average level of inflation, but not its volatility in these countries. This is in contrast with the previous literature which suggests that transparency has no impact on the level of inflation, but only on its volatility. We also find that the sole component of the new index that reduces the volatility of both inflation and output, is the operational aspect of transparency.

The rest of the paper is organized in the following way. Section 2 presents a brief literature review on central bank transparency. Section 3 explains the construction of the new index of transparency that conciliates the overall Eijffinger and Geraats (2006)'s transparency index, with those of monetary policy committee transparency developed in Hayo and Mazhar (2011). Section 4 describes our sample of emerging countries, as well as the macroeconomic and political variables' dataset that will be used in our analysis. Section 5 presents the results of the determinants of total transparency as well as those of its different components. Section 6 presents the results with robustness checks of the effects of transparency on macroeconomic outcomes, as well as those of its different aspects. Finally, we present the conclusion of the paper in Section 7.

2 Literature review

One of the most important changes in the practice of central banks in the last two decades, is their evolution towards greater transparency. The main argument put forward in the literature to explain this fact is that, transparency has positive effects on macroeconomic outcomes. The literature supporting this view includes Eijffinger and Geraats (2006), Demertzis and Hallett (2007), Crowe and Meade (2008), Dincer and Eichengreen (2010), and Hayo and Mazhar (2011) among other papers. However, some of the theoretical and empirical studies led to another conclusion. For instance Morris and Shin (2002), Cruijssen et al. (2010), Baeriswyl and Cornand (2010), Dale et al. (2011), and James and Lawler (2011) find either that greater transparency is detrimental, or, that it has ambiguous

effects on social welfare.

Given the emphasis on transparency in monetary policy making, a large part of empirical papers including Dincer and Eichengreen (2010), and Hayo and Mazhar (2011) analyze both the determinants of transparency, and the effects it has on macroeconomic outcomes. Using the conventional Eijffinger and Geraats (2006)'s transparency index (hence, EG index), expanding it to 100 central banks around the world and updating it up to 2006, Dincer and Eichengreen (2010) robustly find that greater transparency is associated with less inflation volatility, but do not find significant impact of transparency on inflation persistence.

The EG index has become the most widely used transparency index in the literature on central bank transparency. However, this index has been subject to some criticisms. For instance, Claussen (2008) argues that the EG index can be misleading, because the equal weighting in its components does not take into account the fact that some aspects are more important for transparency than others. Moreover, transparency on monetary policy committee's members may have an important impact on macroeconomic outcomes, and this kind of transparency is not taken into account in the EG index. Indeed, some aspects of the EG index are too technical for non-experts agents, so providing agents with some basic information about policy makers and their experiences, may be helpful for agents expectations. In line with the latter argument, Hayo and Mazhar (2011) construct an index (hence, HM index) that accounts for Monetary Policy Committee Transparency (MPCT). Their index measures committee members educational and professional backgrounds as disclosed through central bank websites, and covers 75 central banks around the world. Analyzing the effects of MPCT on inflation volatility using instrumental variables technique, these authors find that MPCT has a robust and significantly negative impact on inflation volatility.

In our view, both indices are determinant for monetary policy, and considering only one of these two index is actually misleading. This is why, trying to conciliate some aspects of the EG index with those of HM index in order to get a general and most relevant index for transparency, appears to be an interesting task. This is the aim of the next section.

3 Constructing the new index of transparency

This section presents and explains how we build the new index of transparency that will be used in our econometric analysis. As mentioned above, this new index harmonizes some aspects of the EG index with those of the HM index. We first briefly present the EG index, and then present the HM committee index. Finally, we present our new general index of transparency.

3.1 The EG index of transparency

The EG transparency index encompasses five components which are summarized below¹.

- **Political transparency** consists at providing the public with information about monetary policy objectives (for instance, announcing quantitative central bank's targets to the public). Moreover, this aspect of transparency provides clear information on the existing relationship between government and the central bank regarding the stated objectives.
- **Economic transparency** emerges when the central bank discloses to the private sector, its knowledge about economic conditions by providing information on economic data, the model of the economy it uses, or its economic forecasts.
- **Procedural transparency** describes the way monetary policy decisions are taken. This includes the explanation of how central bank's strategies are set by means of the publication of minutes and voting records.
- **Policy transparency** consists at promptly announcing policy decisions. This type of transparency requires that monetary policy inclination is clearly explained, the policy changes are immediately announced, and future policies of the central bank are known in advance.
- **Operational transparency** concerns the implementation of monetary policy actions. It explains policy control errors, and how unanticipated macroeconomic shocks affect the transmission channels of monetary policy.

¹See Eijffinger and Geraats (2006) for the details of the construction of their index.

Each of the five aspects of the EG index has also three sub-indices. Hence, 15 sub-indices compose the general EG index. The minimum score of each sub-index is 0, and the maximum one is 1, with higher score corresponding to higher level of transparency. Summing all the 15 sub-indices' scores yields the general EG index. Consequently, the EG index has a minimum of 0, and a maximum of 15.

3.2 The HM index of transparency

Unlike Eijffinger and Geraats (2006), Hayo and Mazhar (2011) construct a transparency index that only accounts for information about monetary policy committee's members². Their index measures the degree of central bank transparency based on the committee members name, age, education level, and professional background. To the extent that these features are likely to influence policy makers' decisions, rational private agents may find in this information, a crucial mean to better predict future policy actions. The HM index contains five sub-indices which gather information about the size of the committee, different attributes of committee members, as well as information about the head of the committee. The minimum score of each sub-index is 0, and the maximum one is 1. Summing the five sub-indices' scores yields the HM index. Hence, the minimum score of HM index is 0, and the maximum score is 5. However, for comparison purpose with the EG index, Hayo and Mazhar multiplied their index by 3 in order to obtain a maximum score of 15.

3.3 The new index of transparency

We now turn to the construction of our new index of transparency. When scrutinizing the HM index, we can observe that this index could be mixed with the *procedural aspect* of the EG index, as committee members are those who decide policy strategies, and release minutes and voting records. This is what we do in constructing the new index. Our simple methodology of constructing the new index is the following. First, we maintain all other aspects of the EG index as well as their sub-indices and scores, excepting its procedural component. Second, we mix the three sub-indices of the EG procedural transparency,

²See Hayo and Mazhar (2011) for the details of the construction of their index.

with three of the five sub-indices of the HM index. Finally, we sum the scores of the other aspects of EG index, with those of the new procedural transparency in order to get the new general and most relevant transparency index.

The three sub-indices of the EG procedural transparency, and their min-max scores can be summarized as follows.

EG procedural transparency

- Does the central bank provide an explicit rule or strategy that describes its monetary policy framework? (score: 0 or 1)
- Does the central bank disclose comprehensive policy deliberations? (score: 0 or 1)
- Does the central bank provide voting records of its policy committee? (score: 0, 0.5, or 1)

The three main sub-indices as well as their min-max scores we chose from the HM index can be defined as follows³.

- Who are committee members? (score: 0, 0.5, or 1)
- Are the CVs of the members given? (score: 0, 0.25, 0.5, or 1)
- Is the qualification of the head of the committee mentioned? (score: 0 or 1)

What we do is the following. As each of the aspects of the original EG index has a maximum score of 3, we need to border the new procedural transparency to a maximum score of 3 also. In this way, the generated new index which is the sum of all the five aspects will be in accordance with the Eijffinger and Geraats's methodology. As mentioned above, we have 6 sub-indices (3 from EG index, and 3 from HM index) with a maximum score of 1 each. So we equally modify the scoring of these 6 sub-indices, in order to have a maximum score of 3 when summing them. Consequently, the maximum score of each of our 6 sub-indices above turns to 0.5 (instead of 1), and the minimum score is 0. The new procedural transparency, as well as its 6 sub-indices with their new scores are presented below.

³We choose these three sub-indices in the total of five in HM index, because they give the most important information about committee members.

The new procedural transparency (min score=0, and max score=3)

- Does the central bank provide an explicit rule or strategy that describes its monetary policy framework? (score: 0 or 0.5)
- Does the central bank disclose comprehensive policy deliberations? (score: 0 or 0.5)
- Does the central bank provide voting records of its policy committee? (score: 0, 0.25, or 0.5)
- Who are committee members? (score: 0, 0.25, or 0.5)
- Are the CVs of the members given? (score: 0, 0.125, 0.25, or 0.5)
- Is the qualification of the head of the committee mentioned? (score: 0 or 0.5)

Therefore, the new general index of transparency is composed of this new procedural component of transparency, added to the other 4 components of the EG index which have been maintained unchanged. **Appendix A** presents with more details the new index of transparency.

Our particular interest here is to compare the new procedural transparency with the original EG procedural transparency index, in order to assess its relevance. As can be seen in Figure 1 from Appendix A, procedural transparency (and consequently total transparency) increases when we take into account transparency on committee members. This finding confirms our view that taking into account only one of the mentioned index of transparency is actually misleading. For instance, some countries which are under classified according to the EG index, can be over classified when taking into account the new index of transparency.

4 Describing sample and data set

In this section, we present our sample of emerging countries, as well as macroeconomic and political variables that will be used in our empirical analysis. In order to be consistent in building the new index, our sample covers emerging countries that are common to

both Dincer and Eichengreen (2010) and Hayo and Mazhar (2011) samples⁴. Therefore, the sample we consider includes 38 emerging countries which are the most representative emerging countries around the world. These countries encompass **7 European countries** (Croatia, Hungary, Latvia, Poland, Romania, Russia, Turkey), **7 Middle East countries** (Bahrain, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates), **8 Caribbean and Latin American countries** (Argentina, Brazil, Chile, Colombia, Eastern Caribbean Union, Jamaica, Mexico, Peru), **10 Asian countries** (China, India, Indonesia, Kazakhstan, Malaysia, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Thailand), and finally **6 African countries** (Egypt, Ghana, Mauritius, Nigeria, Tunisia, South Africa). The analysis concerns the period from 1998 to 2009.

We divide the macroeconomic variables into two groups. The first group accounts for the explained (dependent) variables of our empirical study. These explained variables are the average inflation rate (defined as the average over 1998-2009, of the log first difference of the consumer price index), inflation volatility (defined as the standard deviation of the inflation rate), and finally output volatility (defined as the standard deviation of real GDP). The second group of macroeconomic variables concerns some of the explanatory variables of the analysis. These variables include past inflation (the lagged average inflation rate), real GDP per capita (average of the log of real GDP per capita), the de facto exchange rate regime (the Reinhart and Rogoff (2004) version as updated by Eichengreen and Razo-Garcia, 2006), and trade openness (the sum of exports and imports as a percentage of GDP).

Following the previous literature, we also consider a set of political and institutional variables that accounts for the environment in which monetary authorities operate. These variables include voice and accountability, rule of law, regulatory quality, political stability, government efficiency (all taken from Kaufmann, Kraay and Mastruzzi, 2008), and a measure of country's corruption (taken from Transparency International). Moreover, we include a variable (Internet users taken from the World bank's website) which measures the share of the country's population which has access to the Internet, as Hayo and

⁴We select common emerging countries that are included in both Dincer and Eichengreen (2010) sample of 100 central banks as updated by Siklos (2011), and Hayo and Mazhar (2011)'s sample of 75 central banks.

Mazhar find in their analysis that this variable is an important determinant of the HM index. All these variables definitions and sources are described in **Appendix B**.

5 Analysis of the determinants of transparency

In this section, we explore by means of econometric regressions, the determinants of central bank transparency in emerging countries, given our data set. As in Dincer and Eichengreen (2010), the goal here is twofold. Finding which variables are relevant to explain transparency on the one hand, and identifying instruments that will be used to analyze the effects of central bank transparency on macroeconomic outcomes on the other hand.

As stressed earlier, the cross-sectional analysis presented here covers the period from 1998 to 2009, with all variables averaged over this period excepting our new index of transparency⁵. Using White-consistent OLS estimation, we regress overall transparency as well as each of its five components on the macroeconomic and political variables stressed in the previous section. **Appendix C** presents the results of our regressions. As can be observed from political variables' correlation table in this Appendix (table C1), these variables are strongly correlated with one another, so we include them one at a time.

Table C2 from Appendix C shows that in terms of economic variables, exchange rate regime appears to be a robust determinant of total transparency. Countries with more flexible exchange rate tend to experience a high degree of transparency. This finding supports those of the previous literature⁶. One evidence supporting this finding, is the case of inflation targeting central banks which are found to be on average the most transparent ones⁷. Indeed, one of the characteristics of these regimes, is to allow for exchange rate flexibility in order to be consistent with the stated policy. However and unlike Dincer and Eichengreen (2010) and Hayo and Mazhar (2011), we find no evidence that GDP

⁵Indeed, the HM index just concerns the year 2009. So, to be able to make consistent building of the new index, we also just take into account the EG index of the year 2009 as updated by Siklos (2011).

⁶Crowe and Meade (2008), Dincer and Eichengreen (2010), and Hayo and Mazhar (2011) *inter alia* find similar results.

⁷See Geraats (2009) for the review of trends in central banks transparency.

per capita does explain transparency in these countries⁸. The level of economic development seems to have no significant impact on the level of transparency in the case of emerging countries. Indeed, we can observe that some of them that experience higher GDP per capita, are among the least transparent central banks. An example can be found in Middle East countries such as United Emirates or Saudi Arabia, which have higher incomes but lower transparency index. Our result stresses that among macroeconomic variables, only exchange rate flexibility is found to have a significant positive impact on total transparency in emerging economies.

Concerning political variables, only voice and accountability, regulatory quality, and government efficiency have significant positive effects in determining overall transparency in emerging countries. The higher the degree of voice and accountability, regulatory quality, or government efficiency in these countries, the greater their overall transparency.

Finally we find that the share of Internet users is significantly and positively relevant in determining overall transparency in emerging countries. This suggests that emerging economies where people are more connected to Internet information, tend to increase their level of transparency. Hayo and Mazhar also find a positive effect of internet users on their index about committee members.

We now turn to the analysis of the determinants of each component of total transparency, using the same technique and explanatory variables as above. As can be learned from tables C3 to C7, exchange rate flexibility is still significantly and positively related to each of the aspects of total transparency apart from operational transparency. Moreover, we interestingly find that trade openness has a significant negative impact on political transparency in emerging countries. The higher the degree of openness, the lower the level of political transparency. A possible explanation for this negative relationship is that, as these economies are relatively very open, they are more frequently subject to external shocks than developed countries. An important aspect of political transparency, is the announcement of quantitative targets such as inflation targets. As Fraga et al. (2003) pointed out, the presence of large and frequent external disturbances generates greater instability in the economy, which may negatively impact the credibility of monetary policy

⁸We also analyzed the impact of GDP per capita growth rate on transparency as in Hayo and Mazhar (2011), but found similar results as for GDP per capita.

by hampering the fulfillment of the targets. Hence, central banks of these countries may find it optimal to limit the degree of political transparency.

Regarding Internet users and political variables, the different aspects of transparency seem to be variously sensitive to them. Only voice and accountability, and regulatory quality appear to be robust determinants of political transparency. Government efficiency is found to have positive impact on economic transparency in addition to factors that impact political transparency. Not surprisingly, the share of Internet users appears to have a positive significant effect on procedural transparency, in addition to voice and accountability. Policy transparency is significantly and positively explained by regulatory quality, government efficiency, the degree of country corruption, as well as the share of Internet users. Turning to operational transparency, we also find positive associations with voice and accountability and internet users, but find negative ones with rule of law, and the degree of corruption in the country. Concerning political stability, this factor is found to have no significant relationship with none of the central bank aspects of transparency in emerging countries.

6 Analysis of the effects of transparency

This section focuses on the main findings of our paper. It presents and analyzes the effects of the new index of transparency on inflation and its volatility, as well as on output volatility in emerging countries. We also apply the same analysis to each of the five aspects of the new index, to get better insights about which of them are mostly important in lowering inflation and its volatility, as well as output volatility. **Appendix D** reports these results⁹. As pointed out earlier, the previous section also aimed at finding instruments for central bank transparency, in order to avoid endogeneity problems when estimating the effects of transparency on macroeconomic outcomes. However, as stressed by Stock and Yogo (2005), one of the main drawbacks in applying instrumental variables (IV) technique, is the weak instruments problem, which can produce bias in IV estimators.

Among the most widely used methods in IV estimations are the Two Stage Least

⁹In all tables presented in this Appendix, asterisks ** and * denote respectively significance at 10%, and 5% confidence levels.

Squares (TSLS), and the Limited Information Maximum Likelihood (LIML). Stock and Yogo (2005) among other papers show that in the presence of weak instruments, LIML estimator is significantly better and consistent than TSLS. Therefore, we proceed as follows in our IV regressions. We consider for robustness checks, different econometric and instruments setting specifications¹⁰. Models where we find strong instruments are estimated by TSLS, whereas models in which there is evidence for weak instruments are estimated by LIML. We first present the effects of each of the 6 transparency indices (the overall new index as well as its five components) on the average inflation rate. Finally, we present the effects of each of them on inflation and output volatility.

6.1 Effects on the level of inflation

As can be observed from Appendix D (tables D1 to D6), the different indices of transparency show the same patterns concerning their impact on the level of inflation, except for operational transparency¹¹. In most of the models we consider, overall index of transparency, as well as its political, economic, procedural, and policy components have significant negative effects on the average inflation in emerging countries. This is in contrast with the findings of Demertzis and Hallett (2007), who found in the case of developed countries that central bank transparency has no impact on the average inflation. A possible explanation of this difference between the two groups of countries is that, developed countries usually experience low and stable inflation which is consistent, or not far from their long term objectives, whereas in the case of emerging countries, the presence of high inflation which deviates far from the long run objective, forces the monetary authorities to be more active in leading inflation expectations towards the long run target.

In terms of their relative importance, policy, economic, and political aspects of transparency are found to be in this order, more relevant in reducing average inflation in

¹⁰As can be seen in Appendix D, the different model specifications go from the most parsimonious model to the less one. Moreover, we apply IV technique in our regressions after controlling for the endogeneity of the transparency index in question, and the exogeneity of its instruments. For each component of transparency, we use instruments that are found to be correlated to it, as shown in the previous section.

¹¹Indeed, operational transparency appears to be statistically insignificant in all models we consider here.

emerging economies¹². However, we find that procedural transparency appears to be less important in mitigating inflation than other components, as it is found to be significant in 2 out of 4 considered models. We also find that past inflation, and trade openness have respectively significant positive and negative impact on the level of inflation. The sensitivity of average inflation to past inflation suggests that in these countries, a large share of private agents form backward looking expectations, which may give rise to persistence in inflation.

From a transparency policy point of view, we can summarize this subsection's finding as follows.

Result 1. *To reduce the level of inflation in emerging countries, the monetary authorities should make greater efforts in improving in the following order: policy, economic, political, and procedural components of transparency, but not its operational component.*

6.2 Effects on inflation and output volatility

We first present the effects of transparency indices on inflation volatility. Interestingly, we find that neither total transparency nor its political, economic, procedural, and policy components appear to have any significant impact on inflation volatility. The unique component of transparency that always has a negative and significant effect on inflation volatility in emerging countries, is operational transparency. These results can be seen from **tables D7 to D12 in Appendix D**¹³. The significant negative impact of operational transparency means that in these countries, providing to the private sector information about how monetary policy is implemented, and how unanticipated macro-

¹²We dealt with the relative importance of each of the mentioned components in lowering average inflation, by proceeding by criteria as follows. We have the same 4 specified models for each component of transparency. First, we check which component is always significant in each of the considered models. The component which remains significant in most, or total of the 4 models is privileged. If there is parity among components, we settle this issue by comparing them in their best specified models (regarding R-Squared, Durbin-Watson stat, and weakness of instruments). If there is still parity, we look at the component which has higher coefficient in reducing inflation.

¹³As can be observed from these tables, all components of transparency are insignificant in all the considered models, excepting operational transparency.

economic shocks affect its transmission channels, is crucial for reducing inflation volatility. To the extent that these countries are frequently affected by large and external shocks, operational transparency appears to be determinant to guide agents' inflation expectations and hence, contributes to mitigate inflation volatility.

Our finding is in line for some aspects with those of Dincer and Eichengreen (2010), and Demertzis and Hallett (2007). Indeed, these papers also find a significant negative impact of operational transparency on inflation volatility. However, our result differs from them in two aspects. First, the referred papers focus either on a sample that encompassing both developed and developing countries, or on a sample that only concerns developed countries, while our focus here is especially on emerging countries. Second, these papers also find negative effects of other components of transparency, while the sole component of transparency we find to have a negative impact on the volatility of inflation is operational transparency.

We now turn to the effects of transparency and its components on output volatility. As can be observed from **tables D13 to D18 in Appendix D**, we also interestingly find the same results as in the case of inflation volatility. The unique aspect of transparency that always has a significant negative impact on output volatility is operational transparency. In terms of policy implications, we can put forward the following recommendation.

Result 2. *If the preference of the monetary authorities in emerging countries is to reduce inflation and/or output volatility, then the sole aspect of transparency they have to increase is operational transparency.*

To summarize, the key finding of this section is to highlight an existing trade-off facing central banks of these countries when choosing their communication strategies. If the preferences of policy makers only focused on reducing the level of inflation, then they should improve all aspects of transparency but operational transparency. By contrast if they only wish to mitigate macroeconomic volatility, then the unique aspect of transparency that matters is operational transparency.

7 Concluding remarks

In this paper, we empirically analyze using a cross-sectional analysis and instrumental variables technique, the impact of central bank transparency on macroeconomic outcomes in emerging economies. The rationale behind this study is that, these countries are generally characterized by high inflation and greater macroeconomic volatility. So, understanding how monetary authorities of these countries can deal with these macroeconomic issues appears to be a great challenge.

The first and novel contribution of our paper is to build a new index of transparency that combines some aspects of the overall Eijffinger and Geraats (2006) transparency index, with those of monetary policy committee transparency developed in Hayo and Mazhar (2011). In our view, this new index is more general and relevant than each of the above mentioned indices taken separately. We hope that this new transparency index will be widely used to deal with other issues in the area of central banking.

The second contribution of the paper is to analyze the individual role of each component of the new index in mitigating inflation and its volatility, as well as output volatility. We interestingly find that the overall new index of transparency as well as its political, economic, procedural, and policy aspects negatively impact the average level of inflation but not its volatility in these countries. The unique component of the new index that reduces the volatility of both inflation and output is operational transparency, and these results are robust to different econometric and instruments setting specifications.

In terms of policy recommendations, we argue that assessing the macroeconomic impact of transparency in emerging economies highly depends on policy makers' preferences. If central banks of these countries just aim at lowering the level of inflation, then they should make greater efforts in improving in this order, policy, economic, political, and procedural aspects of transparency. If instead they wish to reduce the volatility of macroeconomic outcomes (inflation and output), then they have to only increase the operational component of transparency.

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Appendix A: The New Index of Transparency

The new index of transparency encompasses four components of Eijffinger and Geraats index (political, economic, policy, and operational components), and the new procedural transparency that has been computed by us. This new index has a maximum score of 15, and is presented below.

1. Political Transparency (min score=0, and max score=3)

Political transparency refers to openness about policy objectives. This comprises a formal statement of objectives, including an explicit prioritization in case of multiple goals, a quantification of the primary objective(s), and explicit institutional arrangements.

(a) Is there a formal statement of the objective(s) of monetary policy, with an explicit prioritization in case of multiple objectives?

No formal objective(s) = 0.

Multiple objectives without prioritization = 1/2.

One primary objective, or multiple objectives with explicit priority = 1.

(b) Is there a quantification of the primary objective(s)?

No = 0.

Yes = 1.

(c) Are there explicit contacts or other similar institutional arrangements between the monetary authorities and the government?

No central bank contracts or other institutional arrangements = 0.

Central bank without explicit instrument independence or contract = 1/2.

Central bank with explicit instrument independence or central bank contract although possibly subject to an explicit override procedure = 1.

2. Economic Transparency (min score=0, and max score=3)

Economic transparency focuses on the economic information that is used for monetary policy. This includes economic data, the model of the economy that the central bank employs to construct forecasts or evaluate the impact of its decisions, and the internal

forecasts (model based or judgmental) that the central bank relies on.

(a) Is the basic economic data relevant for the conduct of monetary policy publicly available? (The focus is on the following five variables: money supply, inflation, GDP, unemployment rate and capacity utilization.)

Quarterly time series for at most two out of the five variables = 0.

Quarterly time series for three or four out of the five variables = 1/2.

Quarterly time series for all five variables = 1.

(b) Does the central bank disclose the macroeconomic model(s) it uses for policy analysis?

No = 0.

Yes = 1.

(c) Does the central bank regularly publish its own macroeconomic forecasts?

No numerical central bank forecasts for inflation and output = 0.

Numerical central bank forecasts for inflation and/or output published at less than quarterly frequency = 1/2.

Quarterly numerical central bank forecasts for inflation and output for the medium term (one to two years ahead), specifying the assumptions about the policy instrument (conditional or unconditional forecasts) = 1.

3. Procedural Transparency (min score=0, and max score=3)

Procedural transparency is about the way monetary policy decisions are taken.

(a) Does the central bank provide an explicit policy rule or strategy that describes its monetary policy framework?

No = 0.

Yes = 0.5 .

(b) Does the central bank give a comprehensive account of policy deliberations (or explanations in case of a single central banker) within a reasonable amount of time?

No or only after a substantial lag (more than eight weeks) = 0.

Yes, comprehensive minutes (although not necessarily verbatim or attributed) or explanations (in case of a single central banker), including a discussion of backward and forward-looking arguments = 0.5 .

(c) Does the central bank disclose how each decision on the level of its main operating instrument or target was reached?

No voting records, or only after substantial lag (more than eight weeks) = 0.

Non-attributed voting records = 0.25 .

Individual voting records, or decision by single central banker = 0.5 .

(d) Who are committee members?

Both the names and designations are mentioned = 0.5 .

If either names or designations are mentioned = 0.25 .

Neither name nor designations are mentioned = 0.

(e) Are the CVs of the members given?

Yes = 0.5 .

Only of some members = 0.25 .

Only of governor = 0.125 .

No = 0.

(f) Is the qualification of the head of the MPC mentioned?

Yes = 0.5 .

No = 0.

4. Policy Transparency (min score=0, and max score=3)

Policy transparency means prompt disclosure of policy decisions, together with an explanation of the decision, and an explicit policy inclination or indication of likely future policy actions.

(a) Are decisions about adjustments to the main operating instrument or target announced promptly?

No or only after the day of implementation = 0.

Yes, on the day of implementation = 1.

(b) Does the central bank provide an explanation when it announces policy decisions?

No = 0.

Yes, when policy decisions change, or only superficially = 1/2.

Yes, always and including forwarding-looking assessments = 1.

(c) Does the central bank disclose an explicit policy inclination after every policy meeting or an explicit indication of likely future policy actions (at least quarterly)?

No = 0.

Yes = 1.

5. Operational Transparency (min score=0, and max score=3)

Operational transparency concerns the implementation of the central bank's policy actions. It involves a discussion of control errors in achieving operating targets and (unanticipated) macroeconomic disturbances that affect the transmission of monetary policy. Furthermore, the evaluation of the macroeconomic outcomes of monetary policy in light of its objectives is included here as well.

(a) Does the central bank regularly evaluate to what extent its main policy operating targets (if any) have been achieved?

No or not very often (at less than annual frequency) = 0.

Yes but without providing explanations for significant deviations = 1/2.

Yes, accounting for significant deviations from target (if any); or, (nearly) perfect control over main operating instrument/target = 1.

(b) Does the central bank regularly provide information on (unanticipated) macroeconomic disturbances that affect the policy transmission process?

No or not very often = 0.

Yes but only through short-term forecasts or analysis of current macroeconomic developments (at least quarterly) = 1/2.

Yes including a discussion of past forecast errors (at least annually) = 1.

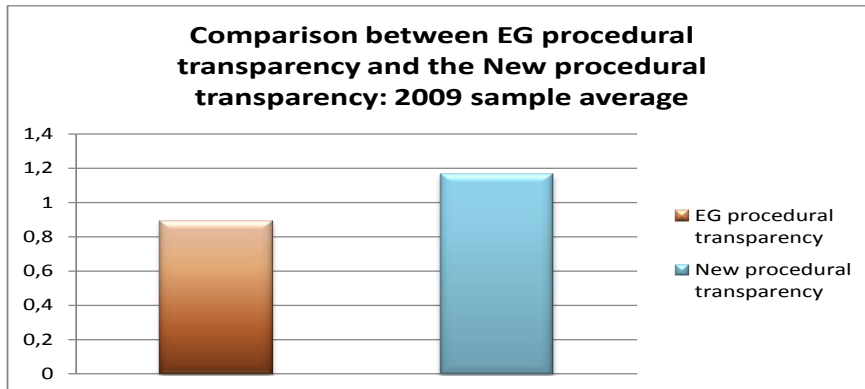
(c) Does the central bank regularly provide an evaluation of the policy outcome in light of its macroeconomic objectives?

No or not very often (at less than annual frequency) = 0.

Yes but superficially = 1/2.

Yes, with an explicit account of the contribution of monetary policy in meeting the objectives = 1.

Figure 1



Appendix B: Used variables' definitions and sources

1. *Voice and Accountability*: measuring perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. Average 1996-2008.

2. *Political Stability and Absence of Violence*: measuring perceptions of the likelihood that the government will be destabilised or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism. Average 1996-2008.

3. *Rule of Law*: measuring perceptions of the extent to which agents have confidence in and abide by the rules of society and, in particular, the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Average 1996-2008.

4. *Regulatory Quality*: capturing perceptions of the government's ability to formulate and implement sound policies and regulations that permit and promote private-sector development. Average 1996-2008.

5. *Government Efficiency (GE)*: measuring perceptions of the quality of public services, the quality of civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

Source of 1, 2, 3, 4, and 5: World Bank aggregate governance indicators, Kaufmann et al (2008).

6. *Corruption Perception Index*: perception of corruption by the business population of a country as measured by Transparency International.

Source: [http : //www.transparency.org/policy_research/surveys_indices/cpi](http://www.transparency.org/policy_research/surveys_indices/cpi).

7. *Internet Users*: number of people in a country having access to the World Wide

Web. Per capita Internet usage is derived by dividing by total population. Source: World Bank website, <http://data.worldbank.org/indicator>.

8. *Real GDP per Capita*: average of the log of annual GDP per capita from 1998 to 2009 at constant 2000 US dollars.

9. *Average Inflation*: defined as the average over 1998-2009, of the annual log first difference of consumer price index.

10. *Inflation volatility*: defined as the standard deviation of average inflation rate.

11. *Past inflation*: defined as the lagged average inflation.

12. *Output volatility*: defined as the standard deviation of the log of real GDP.

Source of 8, 9, 10, 11, 12: IMF, IFS.

13. *Exchange Rate Flexibility*: Eichengreen and Razo-Garcias (2006) update of Reinhart and Rogoff (2004). A higher value indicates more exchange rate flexibility.

14. *Trade openness*: defined as average over 1998-2009, of the sum of exports and imports as a percentage of GDP. Source: Penn World Table.

Appendix C: The determinants of central bank transparency in emerging countries

Table C1. Political variables' correlation table

	VOICE_AND_A CCOUNT	RULE_OF_LA W	REGULATORY _QUALITY	POLITICAL_ST ABILITY	CONTROL_OF _CORRUPTION	GOVERNMENT _EFFICIENCY
VOICE_AND_A CCOUNT	1.000000	0.357299	0.528105	0.408530	0.390271	0.421280
RULE_OF_LA W	0.357299	1.000000	0.830529	0.757349	0.928142	0.843271
REGULATORY _QUALITY	0.528105	0.830529	1.000000	0.630735	0.829068	0.891472
POLITICAL_ST ABILITY	0.408530	0.757349	0.630735	1.000000	0.705856	0.725699
CONTROL_OF _CORRUPTIO N	0.390271	0.928142	0.829068	0.705856	1.000000	0.842853
GOVERNMEN T_EFFICIENCY	0.421280	0.843271	0.891472	0.725699	0.842853	1.000000

Where:

- VOICE_AND_ACCOUNT= Voice and accountability,
- RULE_OF_LAW= Rule of law,
- REGULATORY_QUALITY= Regulatory quality,
- POLITICAL_STABILITY= Political stability,
- CONTROL_OF_CORRUPTION= Degree of corruption,
- GOVERNMENT_EFFICIENCY= Government efficiency.

Table C2. Determinants of total transparency averaged over the period 1998-2009¹

Model	I	II	III	IV	V	VI
Constant	5.09** (1.93)	5.99** (1.69)	7.65* (2.35)	5.18 (1.46)	9.15* (2.55)	5.71 (1.63)
Past inflation	3.10 (0.66)	3.82 (0.70)	5.42 (1.03)	3.34 (0.62)	6.23 (1.16)	3.79 (0.69)
ER Dummy	2.42* (4.05)	3.29* (5.24)	2.85* (4.42)	3.28* (5.18)	2.85* (4.46)	3.27* (5.18)
GDP per Capita	-0.16 (-0.48)	-0.43 (-1.04)	-0.56 (-1.47)	-0.35 (-0.86)	-0.72 (-1.76)	-0.41 (-0.98)
Openness	-0.002 (-0.31)	-0.002 (-0.22)	-0.003 (-0.40)	-0.000 (-0.07)	-0.007 (-0.76)	-0.000 (-0.09)
Internet users	3.46** (1.74)	6.00* (2.81)	4.33** (1.93)	6.06* (2.82)	5.06* (2.41)	5.96* (2.77)
Voice & Account	1.48* (3.60)					
Rule of Law		0.40 (0.61)				
Regulatory Quality			1.53** (1.92)			
Political Stability				0.08 (0.16)		
Government efficiency					1.87* (2.03)	
Degree of Corruption						0.31 (0.47)
Number of observations	38	38	38	38	38	38
R-Squared	0.64	0.53	0.56	0.52	0.57	0.53
Durbin Watson	2.16	1.87	1.94	1.85	1.85	1.87
P-value (Jarque-Bera test)	0.62	0.21	0.18	0.21	0.18	0.22
P-value (White test)	0.96	0.48	0.91	0.69	0.84	0.81

¹ Notes: ** and * denote significance at 10% and 5% respectively. Numbers in parentheses are t-statistics and the dependent variable is total transparency index. Jarque-Bera and White tests indicate that both normality of errors and homoskedasticity hold.

Table C3. Determinants of political transparency averaged over the period 1998-2009¹

Model	I	II	III	IV	V	VI
Constant	1.39 (1.49)	1.93** (1.72)	2.29* (2.22)	1.94** (1.74)	1.93 (1.62)	2.05** (1.87)
Past inflation	0.95 (0.58)	1.27 (0.73)	1.71 (1.02)	1.10 (0.65)	1.39 (0.78)	1.42 (0.83)
ER Dummy	0.69* (3.28)	0.86* (4.31)	0.70* (3.46)	0.84* (4.20)	0.80* (3.74)	0.84* (4.25)
GDP per Capita	0.06 (0.55)	-0.02 (-0.18)	-0.05 (-0.39)	-0.02 (-0.13)	-0.02 (-0.16)	-0.04 (-0.30)
Openness	-0.004** (-1.74)	-0.005** (-1.79)	-0.005** (-1.98)	-0.005** (-1.82)	-0.005** (-1.71)	-0.005** (-1.76)
Internet users	0.30 (0.43)	0.76 (1.13)	0.21 (0.29)	0.74 (1.10)	0.67 (0.96)	0.69 (1.02)
Voice & Account	0.29** (1.97)					
Rule of Law		0.21 (1.00)				
Regulatory Quality			0.52* (2.05)			
Political Stability				0.17 (1.04)		
Government efficiency					0.26 (0.83)	
Degree of Corruption						0.27 (1.29)
Number of observations	38	38	38	38	38	38
R-Squared	0.49	0.45	0.49	0.45	0.45	0.46
Durbin Watson	2.17	2.05	2.02	1.99	2.04	1.96
P-value (Jarque-Bera test)	0.59	0.59	0.72	0.37	0.46	0.48
P-value (White test)	0.79	0.98	0.95	0.99	0.98	0.97

¹ Notes: ** and * denote significance at 10% and 5% respectively. Numbers in parentheses are t-statistics and the dependent variable is political transparency index. Jarque-Bera and White tests indicate that both normality of errors and homoskedasticity hold.

Table C4. Determinants of economic transparency averaged over the period 1998-2009¹

Model	I	II	III	IV	V	VI
Constant	-0.62 (-0.53)	-0.54 (-0.37)	0.42 (0.34)	-1.22 (-0.83)	0.97 (0.80)	-0.59 (-0.41)
Past inflation	-1.11 (-0.53)	-0.98 (-0.43)	-0.20 (-0.08)	-1.16 (-0.53)	0.09 (0.04)	-0.99 (-0.43)
ER Dummy	0.66* (2.49)	0.92* (3.53)	0.74* (2.62)	0.93* (3.60)	0.74* (2.63)	0.91* (3.51)
GDP per Capita	0.15 (1.04)	0.09 (0.52)	0.01 (0.07)	0.15 (0.88)	-0.05 (-0.34)	0.09 (0.55)
Openness	-0.00 (-0.05)	0.00 (0.07)	-0.00 (0.46)	0.00 (0.46)	-0.00 (-0.53)	0.00 (0.12)
Internet users	-0.27 (-0.30)	0.49 (0.55)	-0.21 (-0.23)	0.56 (0.63)	0.09 (0.12)	0.48 (0.54)
Voice & Account	0.43* (2.36)					
Rule of Law		0.05 (0.18)				
Regulatory Quality			0.61* (2.46)			
Political Stability				-0.15 (-0.73)		
Government efficiency					0.72* (2.75)	
Degree of Corruption						0.04 (0.13)
Number of observations	38	38	38	38	38	38
R-Squared	0.37	0.27	0.33	0.28	0.34	0.27
Durbin Watson	2.43	2.33	2.50	2.27	2.44	2.33
P-value (Jarque-Bera test)	0.86	0.60	0.75	0.56	0.93	0.61
P-value (White test)	0.21	0.12	0.11	0.12	0.90	0.78

¹ Notes: ** and * denote significance at 10% and 5% respectively. Numbers in parentheses are t-statistics and the dependent variable is economic transparency index. Jarque-Bera and White tests indicate that both normality of errors and homoskedasticity hold.

Table C5. Determinants of procedural transparency averaged over 1998-2009¹

Model	I	II	III	IV	V	VI
Constant	0.99 (1.21)	1.39 (1.32)	1.08 (1.06)	1.38 (1.31)	1.49 (1.33)	1.05 (0.99)
Past inflation	1.03 (0.75)	1.28 (0.78)	1.16 (0.70)	1.15 (0.71)	1.43 (0.86)	1.12 (0.69)
ER Dummy	0.43* (2.31)	0.59* (3.16)	0.57* (2.82)	0.58* (3.07)	0.54* (2.68)	0.59* (3.11)
GDP per Capita	-0.04 (-0.42)	-0.11 (-0.91)	-0.08 (-0.69)	-0.11 (-0.88)	-0.12 (-0.95)	-0.08 (-0.65)
Openness	-0.00 (-0.19)	-0.00 (-0.31)	-0.00 (-0.07)	-0.00 (-0.36)	-0.00 (-0.31)	-0.00 (-0.04)
Internet users	1.07** (1.74)	1.52* (2.39)	1.47* (2.10)	1.57* (2.37)	1.43* (2.18)	1.54* (2.38)
Voice & Account	0.28** (1.87)					
Rule of Law		0.16 (0.81)				
Regulatory Quality			0.07 (0.29)			
Political Stability				0.12 (0.80)		
Government efficiency					0.24 (0.82)	
Degree of Corruption						0.04 (0.19)
Number of observations	38	38	38	38	38	38
R-Squared	0.40	0.35	0.34	0.35	0.35	0.34
Durbin Watson	1.80	1.65	1.66	1.72	1.68	1.66
P-value (Jarque-Bera test)	0.55	0.46	0.40	0.32	0.46	0.39
P-value (White test)	0.98	0.19	0.90	0.51	0.91	0.21

¹ Notes: ** and * denote significance at 10% and 5% respectively. Numbers in parentheses are t-statistics and the dependent variable is procedural transparency index. Jarque-Bera and White tests indicate that both normality of errors and homoskedasticity hold.

Table C6. Determinants of policy transparency averaged over the period 1998-2009¹

Model	I	II	III	IV	V	VI
Constant	1.12 (1.42)	1.85** (1.78)	2.08* (2.12)	1.36 (1.13)	2.98* (2.60)	1.92* (2.07)
Past inflation	0.07 (0.04)	0.47 (0.30)	0.86 (0.61)	0.15 (0.09)	1.40 (0.82)	0.61 (0.38)
ER Dummy	0.54* (2.95)	0.68* (3.90)	0.52* (2.94)	0.67* (3.84)	0.48* (2.37)	0.66* (3.72)
GDP per Capita	-0.15 (-1.53)	-0.25* (-2.16)	-0.26* (-2.51)	-0.20 (-1.62)	-0.35* (-2.67)	-0.26* (-2.49)
Openness	0.005 (1.79)	0.004 (1.33)	0.004 (1.42)	0.004 (1.52)	0.002 (0.77)	0.004 (1.61)
Internet users	1.20** (1.83)	1.57* (3.03)	1.00** (1.73)	1.60* (3.04)	1.17** (1.75)	1.49* (2.77)
Voice & Account	0.24 (1.48)					
Rule of Law		0.28 (1.55)				
Regulatory Quality			0.55* (2.34)			
Political Stability				0.08 (0.39)		
Government efficiency					0.83* (2.81)	
Degree of Corruption						0.32** (1.90)
Number of observations	38	38	38	38	38	38
R-Squared	0.39	0.38	0.41	0.35	0.46	0.38
Durbin Watson	1.29	1.31	1.35	1.29	1.42	1.35
P-value (Jarque-Bera test)	0.97	0.81	0.89	0.56	0.91	0.83
P-value (White test)	0.86	0.60	0.47	0.79	0.56	0.56

¹ Notes: ** and * denote significance at 10% and 5% respectively. Numbers in parentheses are t-statistics and the dependent variable is policy transparency index. Jarque-Bera and White tests indicate that both normality of errors and homoskedasticity hold.

Table C7. Determinants of operational transparency averaged over 1998-2009¹

Model	I	II	III	IV	V	VI
Constant	2.22* (2.43)	1.37 (1.27)	1.79** (1.71)	1.71 (1.66)	1.79 (1.53)	1.29 (1.22)
Past inflation	2.17 (1.34)	1.79 (0.92)	1.89 (1.11)	2.10 (1.19)	1.92 (1.11)	1.64 (0.84)
ER Dummy	0.10 (0.49)	0.25 (1.29)	0.31 (1.48)	0.26 (1.32)	0.29 (1.38)	0.27 (1.41)
GDP per Capita	-0.19 (-1.64)	-0.14 (-1.12)	-0.18 (-0.48)	-0.18 (-1.55)	-0.18 (-1.34)	-0.13 (-1.00)
Openness	-0.002 (-0.75)	0.00 (0.03)	-0.001 (-0.39)	-0.00 (-0.15)	-0.00 (-0.32)	-0.00 (-0.27)
Internet users	1.16** (1.69)	1.66* (2.85)	1.85* (2.56)	1.65* (2.86)	1.70* (2.49)	1.75* (2.97)
Voice & Account	0.25** (1.72)					
Rule of Law		-0.30** (-1.82)				
Regulatory Quality			-0.22 (-0.85)			
Political Stability				-0.14 (-1.04)		
Government efficiency					-0.17 (-0.51)	
Degree of Corruption						-0.34* (-2.16)
Number of observations	38	38	38	38	38	38
R-Squared	0.29	0.28	0.25	0.25	0.25	0.30
Durbin Watson	1.89	1.54	1.59	1.66	1.65	1.54
P-value (Jarque-Bera test)	0.35	0.73	0.67	0.42	0.52	0.62
P-value (White test)	0.80	0.98	0.98	0.98	0.99	0.97

¹ Notes: ** and * denote significance at 10% and 5% respectively. Numbers in parentheses are t-statistics and the dependent variable is operational transparency index. Jarque-Bera and White tests indicate that both normality of errors and homoskedasticity hold.

Appendix D: The effects of transparency on macro outcomes

I. Effects on average inflation

Table D1. Effects of total transparency on inflation¹

Model	I TSLS	II LIML	III LIML	IV LIML
Constant	0.15* (3.50)	0.009* (3.39)	0.14* (2.61)	0.01* (4.09)
Total transparency	-0.013** (-1.75)	-0.002* (-2.73)	-0.006 (-0.75)	-0.001* (-2.44)
Past inflation		0.96* (75.58)		0.95* (91.10)
Openness			-0.00** (-1.84)	-0.00** (-1.99)
Number of observations	38	38	38	38
R-Squared	-0.68	0.99	-0.16	0.99
Durbin Watson	2.27	2.03	2.14	2.08
P-value (J-statistic)	n.a.	0.34	0.63	0.58
Cragg-Donald Statistic	6.69	3.33	2.84	3.74
Stock-Yogo	n.a.	30% bias=-5.39	30% bias=-5.39	30% bias=-5.39
Critical values	20% size=6.66	25% size=7.80	25% size=7.80	25% size=7.80

¹ Model I is instrumented by regulatory quality. Models II, III and IV are instrumented by regulatory quality, government efficiency and internet users, and are estimated by LIML as there is evidence for weak instruments.

Table D2. Effects of political transparency on inflation¹

Model	I LIML	II LIML	III LIML	IV TSLS
Constant	0.21 (1.37)	0.01* (2.31)	0.01 (1.19)	0.02* (2.66)
Political transparency	-0.07 (-0.91)	-0.006* (-2.03)	-0.006** (-1.76)	-0.002** (-1.98)
Past inflation		0.97* (55.51)		0.95* (84.88)
Openness			-0.00* (-2.10)	-0.00* (-3.21)
Number of observations	38	38	38	38
R-Squared	-1.44	0.99	-0.13	0.99
Durbin Watson	2.12	2.20	2.21	2.08
P-value (J-statistic)	n.a.	n.a.	n.a.	0.58
Cragg-Donald Statistic	2.56	4.95	4.78	10.22
Stock-Yogo	n.a.	n.a.	n.a.	n.a.
Critical values	25% size=5.53	25% size=5.53	25% size=5.53	15% size=8.96

¹ Models I, II, and III are instrumented by regulatory quality. Model IV is instrumented by voice and account and regulatory quality.

Table D3. Effects of economic transparency on inflation¹

Model	I LIML	II LIML	III LIML	IV LIML
Constant	0.11** (5.24)	0.006* (3.37)	0.10 (4.21)	0.007* (4.21)
Economic transparency	-0.04** (-1.89)	-0.005* (-2.46)	0.005 (0.28)	-0.003* (2.31)
Past inflation		0.95* (84.64)		0.94* (103.51)
Openness			-0.00* (2.03)	-0.00* (-2.05)
Number of observations	38	38	38	38
R-Squared	-0.51	0.99	0.10	0.99
Durbin Watson	2.24	2.03	1.78	2.06
P-value (J-statistic)	0.27	0.52	0.17	0.76
Cragg-Donald Statistic	3.15	3.67	5.06	4.35
Stock-Yogo	n.a.	n.a.	30% bias=5.39	n.a.
Critical values	25% size=7.25	25% size=7.25	25% size=7.80	25% size=7.25

¹ Model I and II are instrumented by regulatory quality and government efficiency. Model III instruments are voice and account, regulatory quality and government efficiency. Model IV instruments are government efficiency and regulatory.

Table D4. Effects of procedural transparency on inflation¹

Model	I LIML	II LIML	III TSLS	IV TSLS
Constant	0.13** (1.88)	0.009* (2.49)	0.09* (3.87)	0.007* (3.57)
Procedural transparency	-0.05 (-0.82)	-0.007** (-1.91)	0.02 (0.99)	-0.002** (-1.66)
Past inflation		0.96* (63.72)		0.94* (85.92)
Openness			-0.00* (2.56)	-0.00* (-2.57)
Number of observations	38	38	38	38
R-Squared	-0.54	0.99	0.14	0.99
Durbin Watson	2.28	2.15	1.62	2.19
P-value (J-statistic)	n.a.	n.a.	0.41	0.11
Cragg-Donald Statistic	3.86	5.13	8.37	7.91
Stock-Yogo	n.a.	n.a.	n.a.	n.a.
Critical values	25% size=5.53	25% size=5.53	25% size=7.25	25% size=7.25

¹ Models I and II are instrumented by internet users. Models III and IV are instrumented by voice and account and internet users.

Table D5. Effects of policy transparency on inflation¹

Model	I TSLS	II TSLS	III LIML	IV TSLS
Constant	0.11* (5.44)	0.006* (5.94)	0.12* (4.51)	0.006* (4.60)
Policy transparency	-0.05* (-2.48)	-0.005* (-3.48)	-0.03 (-0.89)	-0.004* (-2.44)
Past inflation		0.95* (102.03)		0.95* (79.79)
Openness			-0.00 (-0.98)	-0.00 (-0.44)
Number of observations	38	38	38	38
R-Squared	-0.58	0.99	-0.19	0.99
Durbin Watson	1.97	2.01	1.99	2.05
P-value (J-statistic)	n.a.	n.a.	0.47	n.a.
Cragg-Donald Statistic	9.68	12.25	3.35	7.84
Stock-Yogo	n.a.	n.a.	n.a.	n.a.
Critical values	15% size=8.96	15% size=8.96	25% size=7.25	20% size=6.66

¹ Models I, II and IV are instrumented by government efficiency. Model III instruments are regulatory and government efficiency.

Table D6. Effects of operational transparency on inflation¹

Model	I LIML	II LIML	III LIML
Constant	0.02 (1.46)	0.01* (2.14)	0.01* (2.14)
Operational transparency	0.05 (0.27)	0.00 (0.43)	0.00 (0.45)
Past inflation		0.94* (71.33)	0.94* (71.34)
Openness			-0.00* (-2.91)
Number of observations	38	38	38
R-Squared	0.007	0.99	0.99
Durbin Watson	1.29	2.21	2.22
P-value (J-statistic)	0.48	0.12	0.11
Cragg-Donald Statistic	7.19	6.45	6.10
Stock-Yogo	10% bias=9.08	20% bias=6.71	20% bias=6.71
Critical values	25% size=7.80	25% size=8.31	25% size=8.31

¹ Model I is instrumented by voice and account, rule of law and degree of corruption. Models II and III are instrumented by voice and account, rule of law, corruption and internet users.

II. Effects on inflation volatility

Table D7. Effects of total transparency on inflation volatility¹

Model	I LIML	II TSLS	III TSLS	IV TSLS
Constant	0.006 (0.61)	-0.007* (-2.09)	0.009 (1.51)	-0.007** (-1.76)
Total transparency	-0.00 (-0.21)	-0.00 (-0.12)	-0.00 (-0.13)	-0.00 (-0.19)
Past inflation		0.16* (5.00)		0.11* (2.67)
Openness			-0.00** (-1.86)	0.00 (0.61)
Output volatility				0.03* (4.28)
Number of observations	38	38	38	38
R-Squared	-0.05	0.74	-0.12	0.78
Durbin Watson	1.83	2.04	1.84	2.25
Prob(J-statistic)	0.45	0.12	n.a.	0.43
Cragg-Donald Statistic	2.13	7.08	6.49	7.74
Stock-Yogo	30% bias=5.39	20% bias=6.71	30% bias=n.a.	20% bias=6.71
Critical values	25% size=7.80	25% size=8.31	25% size=5.53	25% size=8.31

¹ Model I is instrumented by regulatory quality, government efficiency, and internet users. Model II instruments: voice and account + instruments of model I. Model III is instrumented by government efficiency only. Model IV instruments are voice and account, regulatory quality, government efficiency and internet users.

Table D8. Effects of Political transparency on inflation volatility¹

Model	I LIML	II TSLS	III LIML	IV TSLS
Constant	0.009 (0.45)	-0.005 (-1.02)	-0.008** (-1.73)	-0.006 (-0.98)
Political transparency	-0.002 (-0.25)	-0.001 (-0.45)	0.00 (0.37)	-0.001 (-0.80)
Past inflation		0.16* (8.75)	0.10* (3.91)	0.16* (4.74)
Output volatility			0.03* (2.77)	
Openness				0.00 (0.38)
Number of observations	38	38	38	38
R-Squared	-0.12	0.74	0.78	0.74
Durbin Watson	1.83	2.08	2.17	2.06
P-value (J-statistic)	n.a.	n.a.	0.11	n.a.
Cragg-Donald Statistic	2.56	9.65	4.87	12.25
Stock-Yogo	n.a.	n.a.	n.a.	n.a.
Critical values	25% size=5.53	15% size=8.96	25% size=7.25	15% size=8.96

¹ Model I is instrumented by regulatory quality. Models II and IV are instrumented by voice and accountability. Model III instruments: voice and account and regulatory quality.

Table D9. Effects of economic transparency on inflation volatility¹

Model	I LIML	II LIML	III LIML	IV TSLS
Constant	0.006 (1.25)	-0.01* (-3.72)	0.007* (2.40)	-0.007** (-1.93)
Economic transparency	-0.002 (-0.44)	0.004 (1.35)	0.001 (0.61)	-0.00 (-0.44)
Past inflation		0.15* (8.36)		0.11* (2.61)
Openness			-0.00* (-1.83)	0.00 (0.61)
Output volatility				0.03* (4.31)
Number of observations	38	38	38	38
R-Squared	-0.06	0.61	0.04	0.79
Durbin Watson	1.91	1.89	1.70	2.27
P-value (J-statistic)	0.27	0.93	0.72	0.26
Cragg-Donald Statistic	3.15	3.67	5.06	13.39
Stock-Yogo	n.a.	n.a.	30% bias=5.39	n.a.
Critical values	25% size=7.25	25% size=7.25	25% size=7.80	15% size=8.96

¹ Models I and II are instrumented by government efficiency and regulatory quality. Model III instruments: government efficiency, voice and account and regulatory quality. Model IV instruments: voice and account and government efficiency.

Table D10. Effects of procedural transparency on inflation volatility¹

Model	I TSLS	II LIML	III TSLS	IV TSLS
Constant	0.002 (0.67)	-0.01* (-2.53)	0.005 (1.40)	-0.007** (-1.74)
Procedural transparency	0.002 (0.58)	0.006 (1.24)	0.003 (0.90)	-0.00 (-0.44)
Past inflation		0.14* (6.06)		0.11* (2.74)
Openness			-0.00** (-1.82)	0.00 (0.70)
Output volatility				0.03* (4.47)
Number of observations	38	38	38	38
R-Squared	0.02	0.56	0.06	0.78
Durbin Watson	1.63	1.93	1.62	2.26
P-value (J-statistic)	0.88	n.a.	0.72	n.a.
Cragg-Donald Statistic	8.28	5.13	8.37	13.90
Stock-Yogo	n.a.	n.a.	n.a.	n.a.
Critical values	25% size=7.25	25% size=5.53	25% size=7.25	15% size=8.96

¹ Models I and III are instrumented by voice and account and internet users. Model II instrument is internet users. Model IV by voice and account.

Table D11. Effects of policy transparency on inflation volatility¹

Model	I TSLS	II LIML	III LIML	IV LIML
Constant	0.007* (2.13)	-0.009* (-4.41)	0.008** (1.80)	-0.008* (-3.00)
Policy transparency	-0.004 (-1.42)	0.003 (1.33)	0.02 (0.37)	0.002 (0.68)
Past inflation		0.15* (9.98)		0.11* (4.62)
Openness			-0.00 (-1.33)	0.00 (0.01)
Output volatility				0.03* (2.33)
Number of observations	38	38	38	38
R-Squared	-0.14	0.71	0.07	0.77
Durbin Watson	1.90	1.75	1.71	2.01
P-value (J-statistic)	n.a.	0.65	0.74	0.75
Cragg-Donald Statistic	9.68	3.57	2.43	2.44
Stock-Yogo	n.a.	30% bias=5.34	30% bias=5.34	30% bias=5.34
Critical values	15% size=8.96	25% size=8.31	25% size=8.31	25% size=8.31

¹ Model I is instrumented by government efficiency. Models II, III, and IV are instrumented by government efficiency, regulatory quality, corruption, and internet users.

Table D12. Effects of operational transparency on inflation volatility¹

Model	I TSLS	II LIML	III TSLS	IV TSLS
Constant	0.00 (0.18)	-0.004** (-1.99)	-0.004 (-1.29)	-0.005** (-1.84)
Operational transparency	-0.004** (-1.70)	-0.005* (-2.45)	-0.006* (-2.72)	-0.002** (-2.30)
Past inflation		0.17* (5.78)	0.18* (5.73)	0.11* (2.88)
Openness			0.00 (0.35)	0.00 (0.44)
Output volatility				0.03* (4.57)
Number of observations	38	38	38	38
R-Squared	-0.02	0.72	0.71	0.80
Durbin Watson	1.57	1.88	1.82	2.21
P-value (J-statistic)	0.79	0.21	0.19	0.20
Cragg-Donald Statistic	10.71	5.67	8.26	9.16
Stock-Yogo	n.a.	20% bias=6.46	n.a.	10% bias=9.08
Critical values	20% size=8.75	25% size=7.80	25% size=7.25	25% size=7.80

¹ Models I and III are instrumented by voice and account and rule of law. Models II and IV are instrumented by voice and account, rule of law, and the degree of corruption.

III. Effects on output volatility

Table D13. Effects of total transparency on output volatility¹

Model	I TSLS	II TSLS	III TSLS	IV TSLS
Constant	0.08** (1.77)	-0.009 (-0.20)	0.11** (1.90)	0.02 (0.34)
Total transparency	0.002 (0.24)	-0.005 (-0.70)	0.005 (0.70)	-0.004 (-0.65)
Past inflation		1.79* (4.47)		0.95** (1.68)
Openness			-0.00 (-1.44)	0.00 (0.23)
Inflation volatility				5.32 (1.54)
Number of observations	38	38	38	38
R-Squared	0.02	0.62	0.08	0.68
Durbin Watson	1.83	1.61	1.85	1.78
P-value (J-statistic)	n.a.	0.40	0.47	0.27
Cragg-Donald Statistic	32.35	10.68	10.68	10.02
Stock-Yogo	n.a.	10% bias=9.08	10% bias=9.08	10% bias=9.08
Critical values	10% size=16.38	20% size=9.54	20% size=9.54	20% size=9.54

¹ Model I is instrumented by voice and account. Models II and III are instrumented by voice and account, regulatory quality, and internet users. Model IV instruments: voice and account, regulatory quality, and government efficiency.

Table D14. Effects of political transparency on output volatility¹

Model	I TSLS	II TSLS	III TSLS	IV TSLS
Constant	0.07 (0.93)	0.01 (0.20)	0.09 (1.05)	0.04 (0.57)
Political transparency	0.009 (0.24)	-0.03 (-0.74)	0.02 (0.61)	-0.02 (-0.68)
Past inflation		1.84* (4.44)		0.95** (1.72)
Openness			-0.00 (-1.19)	-0.00 (-0.13)
Inflation volatility				5.41 (1.65)
Number of observations	38	38	38	38
R-Squared	0.02	0.63	0.07	0.69
Durbin Watson	1.84	1.56	1.89	1.76
P-value (J-statistic)	0.78	n.a.	0.83	n.a.
Cragg-Donald Statistic	10.49	9.65	13.88	11.92
Stock-Yogo	n.a.	n.a.	n.a.	n.a.
Critical values	15% size=8.96	15% size=8.96	15% size=8.96	15% size=8.96

¹ Model I instruments: voice and account and regulatory quality. Models II and IV are instrumented by voice and account. Model III is instrumented by voice and account and regulatory quality.

Table D15. Effects of economic transparency on output volatility¹

Model	I TSLS	II TSLS	III TSLS	IV TSLS
Constant	0.09* (2.83)	-0.02 (-0.55)	0.13* (2.35)	0.00 (0.02)
Economic transparency	-0.009 (-0.26)	-0.02 (-0.68)	0.01 (0.51)	-0.00 (-0.007)
Past inflation		1.75* (4.39)		0.87** (1.64)
Openness			-0.00 (-1.45)	0.00 (0.17)
Inflation volatility				5.49 (1.61)
Number of observations	38	38	38	38
R-Squared	-0.02	0.61	0.05	0.70
Durbin Watson	1.88	1.68	1.85	1.90
P-value (J-statistic)	0.98	n.a.	n.a.	0.11
Cragg-Donald Statistic	13.47	12.75	13.36	12.02
Stock-Yogo	n.a.	n.a.	n.a.	n.a.
Critical values	15% size=8.96	15% size=8.96	15% size=8.96	15% size=8.96

¹ Model I is instrumented by government efficiency and regulatory quality. Model II and III are instrumented by voice and account. Model IV instruments: voice and account and regulatory quality.

Table D16. Effects of procedural transparency on output volatility¹

Model	I TSLS	II TSLS	III TSLS	IV TSLS
Constant	0.07** (1.74)	-0.009 (-0.21)	0.10** (1.83)	0.02 (0.33)
Procedural transparency	0.01 (0.45)	-0.03 (-0.73)	0.03 (1.00)	-0.02 (-0.65)
Past inflation		1.79* (4.54)		0.97** (1.73)
Openness			-0.00 (-1.46)	0.00 (0.30)
Inflation volatility				5.26 (1.56)
Number of observations	38	38	38	38
R-Squared	0.02	0.62	0.08	0.68
Durbin Watson	1.81	1.55	1.84	1.72
P-value (J-statistic)	0.63	n.a.	0.29	n.a.
Cragg-Donald Statistic	15.65	14.55	15.46	13.18
Stock-Yogo	n.a.	n.a.	n.a.	n.a.
Critical values	15% size=8.96	15% size=8.96	15% size=8.96	15% size=8.96

¹ Models I and III are instrumented by voice and account and internet users. Models II and IV are instrumented by voice and account.

Table D17. Effects of policy transparency on output volatility¹

Model	I LIML	II TSLS	III TSLS	IV TSLS
Constant	0.09* (2.90)	-0.07** (-1.81)	0.13* (2.93)	-0.06 (-1.36)
Policy transparency	-0.008 (-0.26)	0.05 (1.55)	0.03 (0.58)	0.06 (1.67)
Past inflation		1.66* (5.17)		1.60* (5.14)
Openness			-0.00 (-1.27)	-0.00 (-0.76)
Number of observations	38	38	38	38
R-Squared	-0.02	0.61	0.08	0.58
Durbin Watson	1.86	1.77	1.86	1.80
P-value (J-statistic)	0.95	n.a.	0.43	n.a.
Cragg-Donald Statistic	5.05	11.14	6.58	7.41
Stock-Yogo	n.a.	n.a.	n.a.	n.a.
Critical values	25% size=7.25	15% size=8.96	25% size=5.53	20% size=6.66

¹ Model I instruments are government efficiency and regulatory quality. Models II and IV are instrumented by regulatory quality. Model III is instrumented by regulatory quality, government efficiency, and internet users.

Table D18. Effects of operational transparency on output volatility¹

Model	I TSLS	II TSLS	III LIML
Constant	0.02 (0.49)	0.02 (0.28)	0.03 (0.66)
Operational transparency	-0.08** (-1.77)	-0.08* (-1.80)	-0.06** (-1.70)
Past inflation	1.98* (6.86)	1.99* (6.66)	1.26* (2.33)
Openness		0.00 (0.13)	0.00 (0.04)
Inflation volatility			4.20 (1.59)
Number of observations	38	38	38
R-Squared	0.44	0.43	0.55
Durbin Watson	1.64	1.63	1.77
P-value (J-statistic)	0.35	0.34	0.49
Cragg-Donald Statistic	7.98	8.26	6.83
Stock-Yogo	n.a.	n.a.	10% bias=9.08
Critical values	25% size=7.25	25% size=7.25	25% size=7.80

¹ Models I and II are instrumented by voice and account and rule of law. Model III instruments are voice and account, rule of law, and degree of corruption.