

Do monetary policy transparency, independence and credibility enhance macro-financial stability?

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Abstract

It is generally agreed that the credibility, independence and transparency of the central bank have produced better overall policy outcomes and reduced the financial market uncertainty. This paper, using panel data approach, evaluates the effect of, respectively, the central bank transparency, independence and credibility on, respectively, the level and variability of realized and expected economic performance. It also analyzes the effects of central banks characteristics on the level and variability of Government bond rate. The results obtained suggest that central bank independence does not influence the realized and expected level and variability of economic performance. As for the central bank transparency, our findings are consistent with the view that greater transparency could have a desirable reputational effect that lowers inflation expectations and long-term nominal interest rates. Finally, our results show that central bank credibility negatively influences the level and variability of Government bond rate.

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1 Introduction

Unambiguously, the role of central bank credibility is of great importance in order to improve macroeconomic and financial outcomes. On the one hand, it

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leads to price stability by anchoring private sector inflationary expectations and is also associated with sustainable growth (Cechetti and Krause, 2002). On the other hand, by lessening monetary policy uncertainty, the central bank influences the behavior of financial agents. In fact, it induces a smaller variability of financial assets since the anchoring of inflation expectations will lead to a reduction in the level of the interest rates (Fisher hypothesis¹). However, the conduct of monetary policy is made in face of tremendous uncertainty concerning the economy as a whole (supply or demand shocks). Kydland and Prescott (1977) showed that only an unanticipated monetary policy could affect macroeconomic variables in an environment where economic agents form their anticipations rationally. In this respect, Barro and Gordon (1983) demonstrated that there is always a trade-off between credibility and flexibility. Indeed, the difference between output stabilization and price stability can be viewed as the main difference between discretion and rules.

In fact, monetary policy rules seem to be optimal in terms of credibility but they lack of flexibility. Therefore, the time consistent monetary policy is the one conducted in a discretionary manner, but it evolves an inflationary bias. Rogoff (1985) proposed to delegate the monetary policy to conservative and independent central banks in order to gain in credibility and be able to reduce the created bias. Both theoretical and empirical researches identify central bank independence as the institutional device associated with lower inflation and no less growth². Indeed, central bank independence is instituted in most of the central banks but raises the question whether it is democratic or not to consider unelected officials in the conduct of monetary policy (Stiglitz, 1998). Hence, the role of central bank transparency appears to be crucial because it renders central bankers accountable but also more credible in the eyes of the public. According to Faust and Svensson (2001), Cukierman (2001) and Geraats et al. (2006), the advantages of greater trans-

¹The Fisher relation (Fisher, 1930) states that the nominal interest rate is expressed as the sum of expected constant real interest rates plus expected rate of inflation.

²An overview of the theoretical and empirical cases for central bank independence can be found in Eijffinger and De Haan (1996), Cukierman (1998) and KISSmer and Wagner (1998).

parency on the credibility, as well as reputation and flexibility, derive from the fact that transparency makes it easier for the private sector to infer the central bank's intentions regarding monetary policy decisions, improving though central bank's credibility. Central bank incentives to build reputation increase as private sector inflation expectations become more sensitive to monetary policy actions and outcomes that are not associated with economic shocks. Simultaneously, central bank flexibility is enhanced by the fact that monetary policy decisions that are intended to offset economic shocks are transparent, leading to a better stabilization of the economy without affecting private sector inflation expectations. Those advantages of transparency should be able to deliver better overall policy outcomes³, reduce uncertainty related to the monetary policy, decrease the heterogeneity in agents' expectations and lower the risk premium related to future inflation and the interest rates level (Geraats et al., 2006).

In the empirical literature, a large strand of empirical research is focused on the effects of central bank credibility, transparency and independence on the macroeconomic variables of inflation and output growth (level and variability). However, these studies do not consider the effect of central bank characteristics on the private sector expectations. The conduct of monetary policy is affected by private sector expectations which also have important macroeconomic implications. In this context, we contribute to literature by taking into account the effect of central bank credibility, transparency and independence on expected inflation and output, respectively. Our second implication rests on the effects of central bank characteristics on the financial market. Alesina and Summers (1993) use cross-section evidence in order to test only the relation between central bank independence and interest rate variability. As for Geraats et al. (2006), they consider only the effects of central bank transparency on the level of interest rates. As we notice, these both studies are very limited compared to our objectives, which consist to analyze the effects of central bank independence, credibility and transparency on the level and the variability of interest rates, respectively. Finally, many of the existing empirical studies are based on very limited country samples (see for

³For instance, Chortareas et al. (2002b), among others, show that a high degree of transparency in economic forecasts is associated with a lower inflation for all countries.

example Demertzis and Hallett, 2007 and Eijffinger and Geraats, 2006) or utilize evidence for a single point in time (see for example Cecchetti and Krause, 2002). However, cross-section approach presents several disadvantages. Cross-section analysis does not permit the inclusion of country fixed effects. In contrast, transparency and economic outcomes may be picking up the effects of other country characteristics that are difficult to detect. In addition, a cross-section approach does not take into account the meaningful temporal variation in existing measures of central bank independence, transparency and credibility and in other variables retained in the estimation. During the early nineties some economies experienced dramatic changes in central bank independence and transparency⁴.

In order to take into account the country specific effects and the meaningful temporal variation in dependent and explanatory variables, we use panel data approach. That way we evaluate the effect of central bank transparency, independence and credibility on the level and the variability of realized and expected economic performance (inflation rate and gross domestic product rate). Furthermore, we analyze also the effects of central banks characteristics on the level and variability of Government bond rates. In particular, we analyze the relation between financial and macroeconomic variables and central bank independence and credibility for the period 1991-1998, respectively. We also analyze the relation between these former variables and central bank transparency for the period 1999-2005.

This paper is structured as follows: Section 2 presents the literature review of central bank independence and transparency, on inflation, output gap and interest rates as provided by previous studies. Section 3 describes the data and the methodology used in our analysis. In Section 4, we present and discuss the results and section 5 concludes.

⁴In addition, in their study on the effect of the transparency degree on the financial market variability, Geraats et al. (2006) notice that the variability of the interest rate and the variability of the transparency index can be very different. As a result, cross-section correlations between the (level or average of the) interest rate and transparency could be very misleading.

2 Literature review

Both theoretical and empirical studies are interested in the relation between monetary policy decisions and economic outcomes. In this section, we consider the effects of independence and transparency⁵ of central banks on macroeconomic and financial variables.

2.1 Effects of central bank independence on inflation and output

Theoretical considerations in favor of central bank independence (Rogoff, 1985) argue that more independent central banks are able to lower inflation but in the detriment of increased output volatility. Hence, there is the famous trade-off between inflation and output stabilization.

Early empirical studies including Bade and Parkin (1982), Alesina (1988; 1989) and Grilli et al. (1991) found that central bank independence is associated with lower levels of inflation⁶. For instance, Cukierman et al. (1992) find that legal independence is an important and statistically significant determinant of price stability in industrial countries but not in developing countries. In contrast to the early empirical studies, Cecchetti and Krause (2002) found no influence of central bank independence on the level and variability of inflation. As for Ismihan and Ozkan (2004), they argue that although central bank independence delivers lower inflation in the short-term, it may be detrimental for future growth. Consequently, central bank independence is less likely to achieve lower inflation in the long-run. In the contrast to the latter authors, Brumm (2006) shows that even if the sample is limited to developing countries, there is always a strong negative relation between central bank independence and inflation⁷. Concerning now the effects of independence on output, Alesina and Summers (1993) found no relation

⁵Geraats (2002) defines transparency as the absence of asymmetric information between the monetary authorities and the private sector.

⁶Cukierman et al. (1992) provides an excellent summary of the empirical work. More recent literature can be found in Eijffinger and de Haan (1996) and Walsh (2003), Chapter 8).

⁷Cukierman et al. (1998) show that the negative relation between central bank independence and inflation vanishes for a sample of developing countries.

between the variability of output growth and the independence of central bank. Recently, Cecchetti and Krause (2002) also find that central bank independence has no significant effect on the variability of output. However, reversing the causality between output and independence, Crosby (1998) argues that countries that have lower output variability are more likely to choose to have an independent central bank.

2.2 Effects of central bank transparency on inflation and output

Central bank transparency is distinguished in five aspects in the sense of Geraats (2002): political, economic, policy, operational and procedural transparency⁸. Most of theoretical studies treat the effects of political or economic transparency on macroeconomic variables. The majority of these studies argues in favor of central bank transparency and the benefits that it exhibits for average inflation and the variability of inflation as well. Nolan and Schaling (1998) and Eijffinger et al. (2000) show that a reduction in uncertainty concerning central bank's preferences for inflation stabilization results in a decrease of the inflation bias. Walsh (1999) shows that announcing a target may be beneficial, leading to a lower inflation bias without affecting the stabilization policy or in other words central bank's ability to react to stochastic shocks that are realized after the public's expectations are formed, but before monetary policy is made. Recently, Demertzis and Hughes Hallett (2007) point out that more transparency about central bank's preferences and/or targets leads to a reduction of the variability of inflation but does not affect the level of inflation. Considering now the effects of economic transparency, Geraats (2005), assuming that central bank forecasts are published, shows

⁸According to Geraats (2002) political transparency corresponds mainly to preference or target transparency. Economic transparency denotes the disclosure of shocks, forecasts and the economic model used by the monetary authorities to implement monetary policy. Procedural transparency concerns openness about the procedures used to make monetary policy decisions. Policy transparency is present when there is no asymmetric information regarding the central bank's policy. Operational transparency is higher when the central bank regularly assesses its performance, and when it is open about the macroeconomic disturbances that influence the transmission process.

how such transparency enhances the reputational effects and reduces the inflation bias of monetary policy.

We are also interested in the effects of central bank transparency on the level and variability of output. Precisely, Chortareas et al. (2003) provide a simple model showing that, in the case of central banks with private information about demand shocks, economic agents are less than fully convinced about the central bank's resolve to disinflate, and consequently the unemployment or output costs of reducing inflation increase. Hoerberichts et al. (2004) show that when the central bank is transparent about the way it evaluates private sector's inflation and output gap expectations, the public can forecast the errors that the central bank makes. Hence the more conservative the central bank, the higher the benefits from transparency in terms of output stabilization. Moreover, Demertzis and Hughes Hallett (2007) find that preference and target uncertainty increases the variance of output in response to supply shocks, but has no implications for the level of the output. In the contrast, Eijffinger et al. (2000; 2003) show that preference uncertainty may be beneficial because it reduces the variability of output. Beetsma and Jensen (2003) however, argue that the main result of their paper is not valuable, even in the case of a central bank that faces a relative higher flexibility problem.

Similarly to the political transparency, the desirability of economic transparency is also under consideration from a theoretical point of view⁹. Garfinkel and Oh (1995) analyze the role of noisy announcements (providing a range on its forecast of the money demand disturbance) in monetary policy. Using a model where the monetary authority's private information gives rise to an unavoidable trade-off between flexibility and credibility, they find that noisy announcements can make that trade-off more favorable. By influencing expectations the monetary authority can stabilize output even when we consider a monetary rule. Cukierman (2001), using a model with a Lucas-Type transmission mechanism, shows that transparency about economic shocks

⁹Issing (1999) opposes the publication of forecasts because there is danger that the public attaches too much weight to them. Cukierman (2001; 2002) argues that transparency about the economic model used may be detrimental because of the absence of consensus within the economic profession about the correct model of the economy.

might lead to social inefficiency. Transparency in this model is apparent when information about supply disturbances is enabled before the formation of inflationary expectations. Thus, the central bank can no longer stabilize these shocks. In the same way, Gersbach (2003) demonstrates that transparency about supply shocks that affect output (e.g. through publishing forecasts and forecasting models) can hamper the central bank's stabilization of output. Moreover, Eijffinger and Tesfaselassie (2007), using a New Keynesian model, show that when a central bank has private information on future shocks, the publication of forecasts of these shocks does not have a positive effect on welfare, and in most cases is not beneficial as it worsens the stabilization of output.

We now focus our analysis on the effects of transparency on macroeconomic variables from an empirical point of view. Cecchetti and Krause (2002) find that the overall measure of transparency constructed by Fry et al. (2000) is associated with better macroeconomic results. Several papers highlighted the beneficial effect of higher political transparency (explicit inflation target) at the level of inflation (Kuttner and Posen, 1999, Fatas et al., 2006) as inflation expectations are better anchored, however output volatility is not affected (Fatas et al., 2006). Similarly, Siklos (2003) shows that inflation expectations decrease, and inflation is easier to predict, when we consider transparency about inflation reports. Chortareas et al. (2002a) find that transparency about the forecasts of central banks is negatively related to average inflation without affecting output volatility. Chortareas et al. (2002b) extended their previous work (Chortareas et al., 2002a) by focusing on transparency about policy decisions, in addition to transparency about forecasts. Once again, they find that increased transparency induces lower average inflation. Demertzis and Hughes Hallett (2007) look at the link between the index of transparency proposed by Eijffinger and Geraats (2006) (for nine central banks) and the level and variability of inflation and output. They only find a significant relation between transparency and the variability of inflation. The most recent empirical work in the transparency literature is that of Dincer and Eichengreen (2007) which extends the index of Eijffinger and Geraats (a larger number of countries and a longer period). They find that inflation variability is negatively correlated to central

bank transparency. They also suggest a negative impact of monetary policy transparency on output variability.

2.3 Effects of central bank independence on financial markets

Alesina and Summers (1993), using cross section evidence, argue that interest rate variability is decreasing with higher central bank independence, suggesting that more credible central banks benefit from less variable interest rates. Several authors analyze the relation between the independence and the response of financial markets to news related to monetary policy (Clare and Courtenay, 2001a, 2001b and Chadha and Nolan, 2001). For instance, Clare and Courtenay investigate whether the reaction of the British futures contracts and exchanges rates to English macroeconomic news announcements has changed since the Bank of England was granted operational independence in May 1997. Their results indicate that there may have been changes in the way that financial markets incorporate key economic data into securities prices. In particular, they document an increase in the speed of the reaction to interest rate announcements.

2.4 Effects of central bank transparency on financial market

There is very little theoretical research on the effects of central bank transparency on financial stability. Geraats et al. (2006) show that a greater transparency should enhance central bank credibility, flexibility and reputation. These effects of transparency should influence the level of interest rates. In particular, enhanced flexibility would allow a reduction in policy and short-term interest rates without increasing long-term nominal interest rates. In addition, improved reputation would reduce inflation expectations and thereby long term nominal interest rates.

Empirically, there is only few studies examining the direct effects of central bank transparency on financial market. Siklos (2004) notices that nominal interest rates are lower for countries with a clear inflation objective. As for Geraats et al. (2006), analyzing the effects of various transparency changes, they found that greater transparency have had a significant ben-

eficial effect on the level of interest rates. As we can notice, there is not a study analyzing the effects of transparency on the volatility of financial market. However, central banks tend to enhance their transparency in order to reduce financial market instability.

Furthermore, there is an important strand of empirical research analyzing the role of transparency on the ability of financial markets to predict monetary policy decisions and on the reaction of financial market to news related to monetary policy. Most of the existing studies show that greater transparency (particularly political¹⁰, policy¹¹ and economic¹²) improves the predictability of central banks decisions. Concerning the reaction of financial market to news, Clare and Courtenay (2001a, b) and Chadha and Nolan (2001)? argue that greater central bank transparency should increase the reaction of interest rate level to news related to monetary policy and reduce the effects of those news on interest rate volatility. In addition, by improving the predictability of central bank decisions, greater transparency should reduce the effects of unexpected monetary policy rate changes on the level and volatility of financial market¹³.

3 Data and method analysis

This paper investigates the relation between financial and macroeconomic variables and central bank independence and credibility, respectively, for the period 1991-1998. We also analyze the relation between these macroeconomic and financial variables and the transparency of central banks for the period 1999-2005. For each analysis, we consider about 20 OCDE countries.

¹⁰See Lildholdt and Wetherilt, 2004; Biefang-Frisancho and Howells, 2006?.

¹¹See Demiralp, 2001; Poole et al., 2002; Rafferty and Tomljanovich, 2002; Kohn and Sack, 2003 and Poole and Rasche, 2003.

¹²For instance, Fujiwara (2005) is interested in the predictability effects of publications of forecasts and Gerlach-Kristen (2004) in those of the voting records. Higher quality inflation reports are associated with smaller market interest rate surprises from monetary policy decisions (Fracasso et al. 2003).

¹³By improving the understanding of the monetary policy conduct by the financial agents, greater transparency should imply a more fully reaction of markets to the macroeconomic announcements that are relevant to monetary policy reaction.

The index of independence

Several methods¹⁴ to construct the index of central bank independence are proposed in the literature (Bade and Parkin, 1982 and Fry et al. 2000). The most widely employed index is due to Cukierman et al. (1992). This index is based on four legal characteristics as described in a central bank's charter. First, if the chief executive is appointed by the central bank board rather than by the prime minister or minister of finance, is not subject to dismissal, and has a long term of office, then the bank is considered as more independent¹⁵. Second, if policy decisions are made independently of government involvement, central bank independence increases. Third, if the central bank's charter states that price stability is the primary goal of monetary policy, then the central bank gains in independence. Fourth, central bank independence is higher, if the government's ability to borrow from the central bank is limited. Cukierman et al. (1992) combine these four aspects into a single measure of legal independence which ranges from zero to one. This latter methodology was used by several authors, as Siklos (1994), Cukierman et al. (1998) and Polillo and Guillén (2005). Particularly, Polillo and Guillén construct an index of independence for a large sample of countries (92 countries) and for a longer period of time (1989-2000). Accordingly, we use their index in our analysis to assess the macroeconomic and financial effects of central bank independence.

The index of transparency

In the literature, there are mainly two types of methods to determine the index of central bank transparency. The first one is proposed by Fry et al. (2000) and Mahadeva and Sterne (2000). These authors measure central bank transparency on the basis of a survey focusing on the information published by central banks that enhances the public understanding of the central bank policy, analysis and forecasts. Contrary to this approach, several authors construct an index of transparency by taking account of the

¹⁴See Eijffinger and De Haan (1996), De Haan (1997) and de Haan et al. (2003) for a literature review on the index of independence.

¹⁵These aspects help insulate the central bank from political pressures.

actual information disclosed by central banks (Bini-Smaghi and Gros, 2001; Siklos, 2002; De Haan et al., 2004; Eijffinger and Geraats, 2006; Dincer and Eichengreen, 2007). These authors construct the index of transparency either for a very limited number of central banks or a single point in time, in the exception of Dincer and Eichengreen. These authors construct an index for a large range of central banks (124) and a long period (1998-2005). Their index is more suitable for cross section time series analysis, and therefore we retain it in our analysis. Specifically, Dincer and Eichengreen used the methodology proposed by Eijffinger and Geraats which use Geraats' (2002) transparency definition¹⁶.

The index of credibility

A central bank is credible if the public believes that the central bank will do what it says (Blinder, 2000). Although the central bank's credibility is relatively easy to define, it is difficult to measure. In the literature there are mainly two types of credibility index. The first one is proposed by Cukierman and Meltzer (1986), which define monetary policy credibility as "the absolute value of the difference between the policymaker's plans and the public's beliefs about those plans". In line with Cukierman and Meltzer's definition, several authors measure the credibility index referring to the gap between inflation expectations of economic agents and the central bank's inflation target or forecast (Faust and Svensson, 2002; Hutchison and Walsh, 1998 and Cecchetti and Krause, 2002). The second approach in measuring central bank credibility based on inflation expectations is proposed by Bomfim and Rudebusch (2000)¹⁷. In their study, credibility is proxied by a

¹⁶Geraats (2002) distinguishes five aspects of monetary policy transparency: political, economic, procedural, policy and operational transparency. These different aspects of transparency are used in order to build this index of transparency which takes values from 0 to 15.

¹⁷In Bomfim and Rudebusch's (2000) model, the credibility parameter (λ) can be express as:

$$\pi_{T/t}^a = \lambda\pi_T^{tar} + (1 - \lambda)\pi_t^0,$$

where $\pi_{T/t}^a$, π_T^{tar} and π_t^0 denote, respectively, the inflation expectations formed in t for the period T , the inflation target for the period T and the most recent inflation known in

weight attached to the central banks' inflation target in the formation of the private sector's long-term inflation expectations. The authors note that this weight may be interpreted as a fraction of the public that expects the target to be attained. Compare to Bomfim and Rudebusch's methodology, Cukierman and Meltzer's methodology is more frequently used in the literature. In addition, our database contains only short-term (1-year) expected inflation and not long-term expected inflation.

For these two reasons, we use the methodology proposed by Cukierman and Meltzer to determine central bank credibility. In this approach, the credibility index can be expressed as:

$$\begin{aligned} Cre &= 1 && \text{if } E(\pi) < \pi^t, \\ Cre &= 1 - \frac{E(\pi) - \pi^t}{0.2 - \pi^t} && \text{if } \pi^t < E(\pi) < 20\%, \\ Cre &= 0 && \text{if } E(\pi) > 20\%. \end{aligned}$$

The more the expected inflation ($E(\pi)$) diverges from the level of the target inflation (π^t), the less credible the central bank is ($Cre \rightarrow 0$). In the same vein, if the expected inflation is smaller or close to the target level of inflation, then the credibility of the central bank attains its maximum value ($Cre \rightarrow 1$).

Some authors, as Cecchetti and Krause (2002), while using this approach, supposed the same level for the inflation target for all the countries they retained in their study. In addition, they also assume that the expected inflation used in order to construct the credibility index is based on the realized inflation of the previous period. Contrary to these authors, we fix the same inflation target for the industrialized countries and the same target for the emerging countries. For the industrialized countries, we suppose that the inflation target is 2.125¹⁸, which corresponds to the average of the target fixed by some central bank of industrialized countries practicing inflation target. As for the emerging countries, we suppose that the inflation target is equal to 3.25. Furthermore, the expected inflation is obtained using data from Datastream¹⁹.

the period t .

¹⁸See Mishkin and Schmidt-Hebbel (2007) for the values of the inflation targets of the industrialized and emerging countries retained in this paper.

¹⁹Table 4 in Appendix displays the value of the credibility index for the countries re-

Macroeconomic and financial variables

Concerning the financial data, we use the level and variation of 5-year and 10-year government bond rates, respectively. As for the macroeconomic variables, we retain the expected and realized inflation and the expected and realized gross domestic product (GDP). All data are annual and extracted from Datastream.

3.1 Model

In order to take into account the country specific effects, the meaningful temporal variation in independence, transparency and credibility index, we use panel data approach to evaluate the effects of the central bank transparency, independence and credibility respectively on the macroeconomic and financial variables respectively. In this model, the dependent variable (y) can be expressed as:

$$y_{j,n,t} = a_{i,j,n,t} + bx_{i,n,t-1} + \epsilon_{i,j,n,t} \quad n = 1, \dots, N; t = 1, \dots, T. \quad (1)$$

With:

i = central bank transparency index, credibility index and independence index.

j = expected inflation, realized inflation, expected GDP, realized GDP, 10-years Government bond rate level, 10-years Government bond rate variation, 5-years Government bond rate level, 5-years Government bond rate variation.

Where $x_{i,n,t}$ denotes explanatory variables that are independent of the error of the equation, ϵ_{it} . In our analysis, the explanatory variables represent the central bank independence, transparency and credibility index, respectively. As for the dependent variables, they correspond to the expected and observed inflation, expected and observed GDP and the interest rates, in addition to the variability of all these variables. We suppose that the explanatory variables of period $t - 1$ are supposed to influence the dependent variables of period t . The regressions are implemented in univariate terms

tained in our study.

in order to examine the effect of the index in question on the moment of a given macroeconomic and financial variable. For instance, we regress the transparency index (i = central bank transparency index) on the 10-years Government bond rate variation (j = 10-years Government bond rate variation).

Assuming that $a_{it} = a$ and $\epsilon_{it} = \epsilon_t$ give the "pooled" model. This model do not permit the inclusion of country specific effects. There exist mainly two variants of this pooled model: the "fixed effects" model and the "random effects" model. In the "fixed effect" model, for each country the parameter a can take different values; a_i . These parameters is an allowance for time-invariant individual heterogeneity. In this model, the innovations ϵ_{it} are Gaussian white noises. As for the mean of the dependent variables ($E(a_i + \epsilon_{it})$), it can differ from one country to another. The "random effects" model takes into account the "time effects" and the "individual" effects. In this model, the innovations ϵ_{it} are composed by three elements: $\epsilon_{it} = \alpha_i + \lambda_t + v_{i,t}$. The "individual effects" component (α_i) is considered as constant for each country but once again it can be different from country to country. The "time effects" (λ_t) consider the influence of the period of study on the dependent variable. The parameter (λ_t) is supposed constant for all countries retained in the estimation. Finally, the last component ($v_{i,t}$) corresponds to the innovations. As in the classic panel data model and in the "fixed effects" model, in the "random effects" model the innovations ($\epsilon_{i,t}$) are supposed to have the following properties: ($E(\epsilon_{i,t}) = 0$; $E(\alpha_i) = E(\lambda_t) = E(v_{i,t}) = 0$). In order to take into account the country specific effect, we use "fixed effects" and "random effects" models. Hausman (1978) test enables us to choose between the "fixed effects" and the "random effects" model.

4 Results

The results of our study are presented in the tables that follow. Moreover, we proceed to a classification of the effects of each index respectively and discuss our findings.

4.1 The effects of central bank independence

The results in table 1 indicate a negative but statistically not significant relation between the central bank independence and the level of realized and expected inflation respectively. Our findings are in line with results obtained by Cecchetti and Krause (2002) and Ismahan and Ozkan (2005). Similarly, we find that the variability of inflation and inflation expectations is not affected by central bank independence. The above results do not confirm previous theoretical suggestions (Rogoff, 1985) and are also in contrast with empirical results obtained by several authors, as Grilli et al. (1991), Cukierman et al. (1992), Alesina and Summers (1993) and more recently by Brumm (2006). Moreover, table 1 shows that the central bank independence does not influence the level of expected and realized GDP growth, and the level and variability of GDP growth respectively. This result is also not consistent with theory (Rogoff, 1985). However, our observations are in line with results obtained by some authors, as Alesina and Summers (1993) and Cecchetti and Krause (2002). Finally, table 1 suggests that central bank independence negatively affects the level and variability of both interest rates. The negative effect on the variability of the interest rate can be explained by the reduction of uncertainty related to monetary policy. As for the reduction of the government rate level, it is obtained through the anchoring of expected long-term inflation.

4.2 The effects of central bank transparency

Several of the existing studies (Demertzis and Hallett, 2007 and Dincer and Eichengreen, 2007) suggest that greater transparency should be associated with a reduction in uncertainty about future policy actions and thus with a reduction in inflation volatility. Our results show that central bank transparency reduces the level of realized inflation and inflation expectations, but has no influence on inflation volatility. These findings are consistent with recent empirically literature (Chortareas et al., 2002b and Mishkin, 2004). However, we cannot determine which component of transparency reduces the level of inflation and inflation expectations since we do not distinguish between the different components of transparency (Geraats, 2002).

According to table 2, more information about monetary policy is not associated with sustainable growth. Indeed, our results show that central bank transparency negatively influences the level of economic growth and the expected economic growth respectively. We observe that our findings are not in line with previous empirical and theoretical studies on this subject (see for instance Demertzis and Hallett, 2007). Concerning now the variability of realized and expected economic growth, we notice that central bank transparency has no implications for both variables. These observations confirm the previous empirical results (Demertzis and Hallett, 2007; Fatas et al., 2006; Chortareas et al. 2002a) but not the theoretical propositions of Demertzis and Hallett. This latter proposition suggests that a more transparent monetary policy may be associated with more output volatility because it prevents the authorities from using policy actively to offset output fluctuations.

Finally, table 2 suggests that central bank transparency is negatively related to 5 years and 10 years Government bond rate level, respectively. The results concerning the level of interest rates are in accordance with theoretical and empirical results obtained by Geraats et al. (2006).

In fact, our findings are consistent with the view that greater transparency could have a desirable reputational effect that lowers inflation expectations and long-term nominal interest rates.

4.3 The effects of central bank credibility

In order to provide a stable environment for financial market, that facilitates the task to the central bank in reaching its target²⁰, central banks seek to reduce the interest rate variability (Goodfriend, 1990; Froyen and Waud, 1995; Goodhart, 1996 and Woodford, 1999)^{21,22}. To reduce the financial instability, central banks started to enhance their credibility (Faust and Svensson,

²⁰The interest rates volatility influences the economic situation and the central bank's target variables, and therefore importunes the monetary policy conduct.

²¹The job of central bankers is to conduct monetary policy in order to promote price stability, sustainable growth, and a stable financial system.

²²An important number of papers documents and analyzes the so-called "interest rate smoothing" (Goodhart, 1996 and Woodford, 1999). See also Sack and Wiedland (2000)? for a literature review.

2001). Greater credibility of central bank leads to the reduction of financial speculation and reduces the heterogeneity of markets operators' expectations about the future monetary authorities' decisions. Thus, greater credibility increases the predictability of central bank decisions and reduces the level of the interest rate and financial market volatility. Results in table 3 confirm the expected impacts of central bank credibility on the financial market. Indeed, according to these results, central bank credibility negatively influences the level and variability of Government bond rates.

Our results also show a negative relation between central bank credibility and observed and expected inflation level. Greater central bank credibility should improve macroeconomic outcomes. Particularly, central bank credibility leads to price stability by anchoring private agents inflationary expectations (Cecchetti and Krause, 2002). Moreover, we find evidence suggesting an increase in the variability of realized and expected inflation. Finally, we find a negative impact of credibility on realized economic growth.

5 Conclusion

The conduct of monetary policy has moved during the past decade to a new paradigm which gives accent to central bank's credibility, independence and transparency. It is generally agreed that the above changes in the central bank's operational framework have produced better overall policy outcomes. In this paper, we investigate the empirical relationships between economic and financial performance, and the central bank characteristics described above.

We find that central bank independence has a negative affect on the level and the variability of both interest rates. Our results do not show statistically significant relations between central bank independence and all the other dependent variables. Considering the effects of central bank transparency on macro-financial variables, our results show that central bank transparency reduces the level of inflation and inflation expectations as well as the level of realized economic growth. We also suggest that central bank transparency is negatively related to 5-years and 10-years Government bond rate level, respectively. Finally, regarding the effects of credibility on macroeconomic

and financial performance, we observe that central bank credibility negatively influences the level and variability of government bond rates as well as the level of inflation and inflation expectations.

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Table 1: The effects of central bank independence on macro-financial variables

Dependent variables	constant	independence t-1	model type	test Hausman
Observed inflation level	6,561* (3,46)	-3,169 (-1,20)	random effect	-3,71
Expected inflation level	2,518 (1,60)	-2,877 (-1,15)	random effect	-0,11
Observed inflation variation	-0,915 (-0,95)	-0,173 (-0,09)	random effect	-88,12
Expected inflation variation	-0,171 (-0,30)	0,009 (0,01)	random effect	-4,67
Observed GDP level	3,914* (2,00)	4,242 (1,34)	random effect	-4,28
Expected GDP level	5,792* (2,78)	4,273 (1,32)	random effect	-0,13
Observed GDP variation	-0,608 (-0,92)	1,685 (1,19)	random effect	0,00
Expected GDP variation	-0,402 (-0,50)	-0,726 (-0,47)	random effect	-5,70
10-y rate level	7,382* (11,16)	-3,710* (-2,92)	random effect	-241,27
5-y rate level	8,212* (12,52)	-4,242* (-3,69)	random effect	-123,22
10-y rate variation	0,683* (8,02)	-0,379* (-2,23)	random effect	-0,06
5-y rate variation	0,792* (8,51)	-0,459* (-2,45)	random effect	-0,13

* and ** indicate that the corresponding coefficient is statistically significant at the 5% and 10 %, respectively.

Table 2: The effects of central bank transparency on macro-financial variables

Dependent variables	constant	transparence t-1	model type	test Haussman
Observed inflation level	6,691* (8,54)	-6,889* (-5,54)	random effect	-415,98
Expected Inflation level	8,032* (6,54)	-8,134* (-4,61)	random effect	-207,49
Observed inflation variation	-0,223 (-0,33)	0,359 (0,32)	random effect	-74,35
Expected inflation variation	-0,577 (-0,66)	0,832 (0,58)	random effect	-72,55
Observed GDP level	25,743* (8,60)	-32,674* (-7,15)	random effect	-55699,20
Expected GDP level	13,379* (6,16)	-13,164* (-3,81)	random effect	-6730,85
Observed GDP variation	-0,023 (-0,01)	-0,747 (-0,27)	random effect	-5620,79
Expected GDP variation	-0,791 (-0,86)	0,964 (0,62)	random effect	1,46E-38
10-y rate level		-9,574* (-9,26)	fixed effect	8,98
5-y rate level	10,119* (10,21)	-10,027* (-7,77)	random effect	-39,00
10-y rate variation	0,224* (6,61)	0,016 (0,30)	random effect	-5,53E-4
5-y rate variation	0,283* (5,78)	-0,009 (-0,12)	random effect	-2,71E-3

* and ** indicate that the corresponding coefficient is statistically significant at the 5% and 10 %, respectively.

Table 3: The effects of central bank credibility on macro-financial variables

Dependent variables	constant	credibility t-1	model type	test Hausman
Observed inflation level	19,293* (4,78)	-14,639* (-3,41)	random effect	-2579.91
Expected inflation level	23,668* (14,87)	-21,748* (-12,59)	random effect	-7949.84
Observed inflation variation	-8,041* (-6,61)	7,884* (5,96)	random effect	-1058.09
Expected inflation variation	-3,013* (-2,38)	3,155* (2,31)	random effect	-174.26
Observed GDP level		-7,913* (-3,06)	fixed effect	2061.20
Expected GDP level	30,256* (7,64)	-24,490* (-5,86)	random effect	-10084.15
Observed GDP variation	-1,519 (-1,12)	1,775 (1,23)	random effect	2e-45
Expected GDP variation	-7,232* (-3,49)	7,080* (3,20)	random effect	-2437.72
10-y rate level	14,733* (3,28)	-8,756** (-1,91)	random effect	-3270.75
5-y rate level	17,090* (4,19)	-10,563* (-2,54)	random effect	-2771.07
10-y rate variation	1,635* (3,10)	-1,167* (-2,17)	random effect	-0.68
5-y rate variation	2,056* (3,48)	-1,520* (-2,53)	random effect	-1.78

* and ** indicate that the corresponding coefficient is statistically significant at the 5% and 10 %, respectively.

Table 4: Central bank credibility index

	1991	1992	1993	1994	1995	1996	1997	1998
Australia	0.99	1.00	1.00	1.00	0.92	1.00	1.00	1.00
Austria	0.97	0.94	0.95	0.97	1.00	1.00	1.00	1.00
Belgium	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Canada	0.85	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Denmark	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Espagne	0.89	0.88	0.92	0.91	0.90	0.95	1.00	1.00
Finlande	0.92	0.98	1.00	1.00	1.00	1.00	1.00	1.00
France	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Germany	0.89	0.89	0.91	0.98	1.00	1.00	1.00	1.00
Greece	0.67	0.68	0.66	0.72	0.76	0.76	0.86	0.88
Hungary	0.87	0.89	0.84	0.83	0.54	0.50	0.53	0.58
Iceland	0.84	0.95	0.94	1.00	1.00	1.00	1.00	1.00
Ireland	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Italy	0.88	0.90	0.92	0.94	0.87	0.92	1.00	1.00
Japon	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Korea	0.86	0.95	1.00	0.92	0.99	0.96	0.97	0.79
Mexique	0.33	0.47	0.67	0.78	0.00	0.00	0.00	0.00
Netherland	0.98	0.98	1.00	0.99	1.00	1.00	1.00	1.00
New zeland	0.99	1.00	1.00	1.00	0.92	0.99	1.00	1.00
Norway	0.97	1.00	1.00	1.00	1.00	1.00	0.99	1.00
Poland	0.78	0.75	0.67	0.56	0.48	0.54	0.61	0.67
Portugal	0.76	0.76	0.84	0.88	0.92	0.97	1.00	0.98
Sweden	0.70	1.00	0.88	1.00	0.99	1.00	1.00	1.00
Switzeland	0.85	0.92	0.95	1.00	1.00	1.00	1.00	1.00
USA	0.94	0.99	0.98	1.00	0.99	0.97	1.00	1.00