The Thirteenth Dubrovnik Economic Conference

Organized by the Croatian National Bank

HNB

Iftekhar Hasan and Loretta J. Mester

Corporate Governance and Effective Central Banking: Cross-Country Empirical Evidence

Draft version

Please do not quote

CROATIAN NATIONAL BANK

Corporate Governance and Effective Central Banking:
Cross-Country Empirical Evidence

Iftekhar Hasan
Cary L. Wellington Professor
Rensselaer Polytechnic Institute
and
Bank of Finland

and

Loretta J. Mester
Senior Vice President and Director of Research
Federal Reserve Bank of Philadelphia
and
Adjunct Professor
Finance Department, The Wharton School, University of Pennsylvania

May 7, 2007

VERY PRELIMINARY:
PLEASE DO NOT QUOTE WITHOUT AUTHORS' PERMISSION

Please address correspondence to Hasan at Rensselaer Polytechnic Institute, 110 8th Street, Pittsburgh Building, Troy, NY 12180, USA; phone: +1 518-276-2525; fax: +1 518-276-8661; email: hasan@rpi.edu; and to Mester at Research Department, Federal Reserve Bank of Philadelphia, Ten Independence Mall, Philadelphia, PA 19106-1574, USA; phone: +1 215-574-3807; fax: +1 215-574-4303; email: Loretta.Mester@phil.frb.org.

Corporate Governance and Effective Central Banking:
Cross-Country Empirical Evidence

1. Introduction

Over the last decade, the legal and institutional frameworks governing central banks and financial market regulatory authorities throughout the world have undergone significant changes. New central banks needed to be organized in the aftermath of the Soviet Union's dissolution, and the desire was to establish institutions that would be the most effective in achieving central banking goals. At the same time, attention turned to some alleged corporate governance problems involving central banks (see Frisell, Roszbach, and Spagnolo, 2007), as well as the well publicized governance problems in large corporations like Enron. In addition, many long-established central banks have been examining the methods used to achieve their objectives, and as a result, many central banks have undergone changes to their institutional frameworks or methods of implementing monetary policy or provision of payment services in an attempt to make them more effective.

For example, in 1989, the Reserve Bank of New Zealand was given the ability to implement monetary policy without political influence. In 1997, the Bank of England gained more independence from the government and was given responsibility for setting monetary policy to achieve the government's inflation target. Responsibility for bank supervision, which the Bank of England was given in 1987, was removed from the Bank of England's duties in 1998 (see Lybek and Morris, 1999). In the U.S., the Federal Reserve has recently undertaken a review of its approaches to monetary policy transparency and communication, which it is on record as saying plays an important role in democratic accountability and could help promote policy effectiveness. This review includes the way it communicates its economic objectives, its assessments of expected progress toward those objectives, and its economic projections (see the Minutes of the Federal Open Market Committee Meetings of August 8, 2006 and January 30-31, 2007). There is a growing body of literature that examines what procedures central banks should follow to set monetary policy most effectively, e.g., Blinder, 2004. Moreover, in the

light of the technological change taking place in the payments system from paper checks to check imaging and other electronic forms of payments, U.S. Reserve Banks are having to rethink their role in the payment system and the roles their branches perform within the Federal Reserve System.

This environment of change has created new interest in better understanding the roles played by organizational structures, good governance, accountability, and transparency in increasing the efficiency and effectiveness of central banks in achieving their objectives and ultimately yielding better economic outcomes. Lybek and Morris (2004) survey the central bank laws in 101 countries and find that while central bank autonomy (i.e., independence from the government) and accountability are generally accepted as good practice, there is less consensus regarding the structure, size, and composition of the governing bodies. Frisell, Roszbach and Spagnolo (2007) expanded on this topic by examining the governance structures in a group of mostly European central banks. The authors raise an important question of whether there is a trade off between the accountability of central banks and their independence from the government in setting monetary policy.

While much has been written about the potential role good governance can play in central banks, there has been little in the way of empirical study of this hypothesis. Our paper asks two simple questions: first, can we find a significant statistical relationship between central bank governance and institutional characteristics and the economic outcomes that reflect the performance of central banks; second, do these relationships differ across central banks operating in countries at different stages of economic development. Thus, our study adds to the growing literature on governance, organizational form, and central bank performance in two ways. First, while much of the literature has focused on developing measures of the governance of central banks, we attempt to provide statistical evidence on whether measures of governance and organizational form are significantly related to better economic outcomes. Second, while much of the literature has focused on the relatively developed countries, in this

paper, we provide cross-country evidence.[1] The rest of our paper is organized as follows. Section 2

discusses the responsibilities of central banks, potential methods for achieving the goals, and our

hypotheses. Section 3 discusses our data. Section 4 presents our empirical results. Section 5 concludes.

2. Central Bank Responsibilities and Corporate Governance

Goals. Central banks have several responsibilities and this multiplicity of goals raises interesting

issues about how to measure performance. As the literature suggests, while the tasks assigned to

particular central banks have changed over the years, their key focus remains on macroeconomic stability,

including stable prices (low inflation), stable exchange rates (in some countries), and the fostering of

maximum sustainable growth (which may or may not be explicitly listed as a goal of the central bank in

enabling legislation).[2,3] Most central banks have responsibility for stability of the payments and

settlement system. (In their survey of 25 mostly European central banks, Frisell, Roszbach, and

Spagnolo, 2007, found that 80 percent list formulation and implementation of monetary policy as a major

responsibility, and 75 percent list oversight and regulation of the payments and settlement; see also Barth,

Capiro, and Levine, 2006, and Healey, 2001.) Several central banks have some responsibility for directly

supervising and examining commercial banks for safety and soundness. For example, in the U.S.,

commercial bank examination is spread among three federal agencies (the Federal Reserve, the Office of

the Comptroller of the Currency, and the Federal Deposit Insurance Corporation), with the responsible

agency being determined by the bank's charter. Other countries, like the U.K., have removed bank

---

[1] Our paper is related to Lybek (1999), which examines central bank autonomy, inflation, and economic growth in countries of the former Soviet Union. He was unable to do much in the way of statistical testing because not enough time had passed since the establishment of these new central banks.

[2] See, e.g., Tuladhar (2005), Caprio and Dimitri (1995), Siklos (2004), Mayes (1997), Leybek (2002), Amtembrik (1999), Fischer(2005), McNamara (2002), Healey (2001).

[3] Although monetary policy can affect only prices in the long run and cannot create output, price stability is a necessary condition for the economy to reach its full growth potential. In the U.S., the Federal Reserve Act specifies three goals for Fed monetary policy: maximum employment, stable prices, and moderate long-term interest rates. Achievement of the third goal is expected to follow if the first two goals are achieved, hence, the Fed is usually spoken of as having a dual mandate. Other central banks, e.g., Japan and New Zealand, have price stability as the sole goal of monetary policy.

supervision from the list of central bank responsibilities. Many central banks also deliver banking services to banks; these might include services related to cash, check, credit, and/or electronic payments (Fry, et al., 1999; Flannery, 1996). According to the Frisell, Roszbach, and Spagnolo survey, in addition to monetary policy, the three most frequently mentioned objectives in the statutes of central banks in order are financial stability objectives, payments system objectives, and supervisory objectives.

The multiplicity of objectives makes central banks complicated institutions. They are also public institutions that do not have market profit as the relevant performance benchmark and incentive device. While measuring the performance of any one of the central bank's goal might be doable, measuring performance across the central bank's goals is more difficult, especially given the potential tradeoffs amongst the goals. An important mechanism in the private sector for achieving better governance is market discipline, which requires transparency. Blinder (2004) and others have emphasized the importance of central bank transparency in both helping the central bank achieve its goals and increasing the degree of accountability to which it is subject. By transparency we refer to the central bank communicating to the public and to the markets its goals and its rationale for actions taken to achieve its goals. As the role expectations play in determining economic outcomes has become better understood, the importance of transparency in helping economic agents formulate well founded expectations has risen. Thus, increased transparency can potentially have a direct role in improving economic performance. Transparency can also raise the degree of accountability of the central bank for achieving its goals, which in turn, can positively influence central bank decisionmaking.

The multiplicity of central bank goals and the measurement difficulties suggest, however, that transparency may not be easily achieved, which makes accountability more difficult to impose. This leads one to ask whether there are ways of organizing the central bank as an institution that would lead to better incentives and thereby yield better economic outcomes. This might include structuring the decisionmaking board in a particular way, choosing the degree of autonomy to give to central bank decisionmakers, or choosing the particular goals to assign to a central bank to the extent that there may be conflicts between the goals.

Central Bank Organizational Structure. A significant body of research on developed countries

has examined whether independence of the central bank from the government can increase its

effectiveness in achieving its monetary policy goals (see, e.g., Fischer, 2005, Alesina and Summers, 1993,

Fischer, 1994, Cukierman, 2005). By independence (which is also called "autonomy" in some of the

literature, e.g., Lybek, 1999, 2002, and Lybek and Morris, 2004), we mean that while the goals of the

central bank may be determined by the government, the implementation of monetary policy to achieve

those goals is controlled by the central bank without direct approval of the executive branch of

government. Partly this helps to insulate central bank decisionmaking from potentially conflicting goals

of the government (e.g., a short-run boost to growth at the expense of inflation or higher economic

volatility over the longer run; inflating away the public debt, etc.) Evidence generally suggests that such

independence can enhance central bank effectiveness, and the literature has found that developed

countries that took steps to increase central bank independence after the 1970s experienced lower average

inflation without a detriment to growth (see Lybek, 1999). One of the earliest to do so was the Reserve

Bank of New Zealand, which until 1989 was under the operational control of the Minister of Finance and

since then has been independent. While there has been a trend to greater independence, the degree of

independence varies among central banks. For example, in the U.S., the Federal Reserve's goals are

delineated by the U.S. Congress in the Federal Reserve Act. The U.K.'s inflation target is set by the

Chancellor of the Exchequer. In contrast, the Riksbank and the Reserve Bank of Australia set their own

inflation targets

There appears to be significant variation in organizational structures and institutional

arrangements across central banks.[4] Different organizational structures might be better able to foster such

independence. For example, in the U.S., it is argued that the structure of the Federal Reserve helps to

foster independence. The seven members of the Board of Governors are appointed by the U.S. president

---

[4] Tuladhar (2005) surveys the differences in governing bodies of countries that have adopted inflation targeting to implement monetary policy. In the U.S., it has been argued that the structure of the Federal Reserve helps to foster independence (which ultimately is believed to yield better outcomes.) Frisell, Roszbach and Spagnolo (2007) survey differences in the institutional structures of the central banks in several, mainly European countries.

and confirmed by the Senate, but the Federal Reserve Bank presidents are chosen they their own Boards

of Directors, with approval of the Board of Governors. Terms of the governors are 14 years, considerably

longer than the U.S. president's or senator's terms. Thus, the structure of central bank boards might

affect the ability to achieve central bank goals. Relevant characteristics might include the size of the

board, whether the structure of the board is similar to that of a corporate board with both inside (central

bank staff) and outside directors or whether it is made up of only central bank staff, the length of term and

turnover rate of the board's chair.

The corporate governance literature on private corporations suggests how some, but not all, of

these characteristics should relate to better governance. For example, the literature suggests that boards

with inside and outside directors generally offer stronger governance. However, it is not clear if this is

true in a central bank setting. Moreover, it is not clear, a priori, how some of the organizational

characteristics might relate to performance. For example, a larger board helps to bring a diversity of

views and skills to the decisionmaking process, which can arguably lead to better decisionmaking, but it

also can make it more difficult to reach decisions or dilute accountability among members for the board's

decisions, which could be detrimental to outcomes. Similarly, as Lybek (1999) points out, higher

turnover among governors is typically interpreted as indicating less autonomy, but it might also indicate

that the governor is more embedded and more susceptible to government interference. Or it might

indicate a well functioning imposition of accountability, depending on the reasons for turnover.[5] Our

empirical work discussed below investigates whether there is a significant correlation between several

organizational characteristics and central bank performance as measured by tangible economic outcomes.

---

[5] Different ways to implement monetary policy might also result in better economic outcomes. Inflation targeting,
i.e., the setting of an explicit numerical goal for price stability, has been prominent in the literature (e.g., Bernanke,
Laubach, Mishkin, and Posen (1999), Bernanke and Woodford (2005)), and a number of countries, including
Australia, Canada, New Zealand, Norway, and Sweden have either adopted such targeting. Countries that have
adopted inflation targeting argue that it improves the effectiveness of monetary policy by increasing the central
bank's commitment to price stability, one of its chief goals. Evidence suggests that inflation targeting has been
useful in countries with high inflation rates. There is less evidence of great gains in economies with low inflation
but little evidence that such targeting leads to worse inflation or growth outcomes.

3. Data and Measures

One of the difficulties in implementing our cross-country study is obtaining data on a consistent set of measures across countries. We wanted to include as many countries as we could, but that meant having fewer variables describing central bank organization. Another challenge was assessing the consistency of the data over time. Finally, we had to evaluate the quality of the data, which varies from country to country. We use data from multiple sources. We extensively use the websites of central banks and in some cases information that was provided to us upon our request of individual central banks. Some of our other data sources include the Thomson's (Bureau van Dijk) Bankscope database (also known as Fitch's International Bank Database), IMF *International Financial Statistics*, BIS publications of Blue Books, Orange Books, individual Annual Reports of Central banks, and World Development Indicators. We did substantial editing and cross-checking to produce as clean a dataset as possible. (This is work in progress, and we are continuing to track down data sources so that more countries and more variables can be added.)

The data used in our analysis are annual data from 1996 to 2000. In order to ensure that enough time had elapsed since the establishment of the central banks in our sample, we included countries whose central banks were established in 1993 or earlier (which allowed us to include the countries of the former Soviet Union). We classified the countries into three groups: transition economies, developing economies, and developed economies. Table 1 lists the countries in our analysis.

Our basic regressions, which we estimate via OLS, are of the form:

$$P_{it} = \alpha_0 + \alpha_1 \mathbf{x_{it}} + \alpha_2 T_t + \alpha_3 T_t^2 + \varepsilon_{it},$$

where P_{it} is a performance measure, $\mathbf{x_{it}}$ is a vector of central bank characteristics, T_t is a time trend, and ε_{it} is an error term.[6]

---

[6] Note we are using a quadratic time trend. We also ran the regressions including a set of time dummy variables in place of the trend and trend-squared variables, with little appreciable difference in results in terms of coefficient magnitudes or levels of significance.

Performance Measures. As there are several goals of central banks we examine several different performance measures. All variables are annual for the years t = 1993 – 2000. Table 2 gives the definitions and sources of each variable.

Price stability is viewed as one of the major objectives pursued by central banks. Although a price-level target rather than an inflation target has been pursued by at least one central bank in the past (Sweden in the 1930s) (see Berg and Jonung, 1999), most central banks have opted for trying to control inflation and aim for low and stable inflation. Thus, we investigate the following inflation performance measures:

$INFLAT_{it}$ = annual CPI inflation rate in country i in year t,

$ABSINFL_{it}$ = Absolute value of annual CPI inflation rate in country i in year t, which acknowledges that countries can miss hitting their goal of price stability via deflation as well as inflation.

$STDDEVINFLAT_{it}$ = standard deviation of the inflation rate in country i over the years t−2, t−1, t. (Note that while our regression time frame runs from 1996 to 2000, this measure incorporates annual inflation rates from 1994 and 1995.)

We also examine a measure published by the Heritage Foundation, which is a component of the Foundation's "Economic Freedom Index":

$H\_MONETARY_{it}$ = index which measures the success of a country's monetary policy based on two components, the weighted average inflation rate over the most recent three years and the degree to which a country imposes price controls. The index varies from 0 to 100, with lower inflation and lack of price controls yielding higher scores. (A country with inflation of 10 percent and no price controls would have a score of 80, while a country with inflation of 2 percent would have a score of 91.) (See Beach and Kane, 2007 for further details).

In addition, some central banks have an explicit mandate for achieving an output goal and a stable exchange rate. For example, according to Royal Decree, the Central Bank of Norway's monetary policy "shall be aimed at stability in the Norwegian krone's national and international value, contributing to stable expectations concerning exchange rate developments. At the same time, monetary policy shall

underpin fiscal policy by contributing to stable developments in output and employment." (Royal Decree, March 29, 2001.) The Reserve Bank of Australia is mandated by the Reserve Bank Act ensure that it powers are "exercised in such a manner as, in the opinion of the Reserve Bank Board, will best contribute to: (a) the stability of the currency of Australia; (b) the maintenance of full employment in Australia; and (c) the economic prosperity and welfare of the people of Australia." (Section 10(2) of the Reserve Bank Act of 1959). Other central banks do not have an explicit mandate to stabilize output, but most are expected to run policy to avoid instability in output and to help support sustainable growth.

We examine two output performance measures. Although in the long-run, monetary policy cannot affect real variables, we are interested in examining whether certain organizational characteristics of central banks are associated with higher or lower output, as well as whether they are associated with higher or lower output volatility. Thus, we examine:

$RGDPGR_{it}$ = annual growth rate of real GDP in country i in year t, and,

$STDDEVRGDPGR_{it}$ = standard deviation of annual growth rate of real GDP in country i over the years t−2, t−1, t.[7]

Since there can be short-run tradeoffs between price and output stabilization, we wanted to examine a performance measure that would incorporate both goals. As discussed in Mester (2003), there is a long literature that looks at monetary policy reaction functions, or Taylor-type rules for monetary policy (see Taylor, 1999, for a survey, and Hetzel, 2000, for a critique of the Taylor-rule literature). Such a rule relates the policy instrument to targets for inflation and output gap or the unemployment rate, i.e., it relates the instrument to macroeconomic variables. It also assumes that the economic dynamics imply a tradeoff between inflation and the output gap or unemployment (i.e., it is based on an underlying Philips curve). For example,

$$f_t = r^* + \pi_t + \theta_\pi (\pi_t - \pi^*) + \theta_y \, y_t, \tag{1}$$

---

[7]We note Lybek's (1999) caution that there are measurement issues with using GDP as a measure of output in transition economies before privatization was complete. He suggests that the GDP numbers may have exaggerated real output prior to privatization and understated it after because of the desire of economic agents to evade taxes.

where f_t is the nominal interest rate, π_t is inflation, y_t is the output gap (the percentage deviation of output

from potential output), π^* is the policymaker's inflation target, and r^* is the long-run equilibrium or

"natural" real rate of interest. (Sometimes the rule is written so that the output gap is replaced by the

difference between the unemployment rate and the natural rate of unemployment, $u_t - u^*$.) Taylor's

original specification had $\pi^* = 2$, $r^* = 2$, $\theta_\pi = 1/2$, and $\theta_y = 1/2$. According to Orphanides (1998) and

Taylor (1999), Taylor's rule appears to perform well in a variety of models and appears to be robust to

model specification.[8]

Such a rule can be derived from a model of the economy in which the central bank's goal is to

stabilize output and inflation, i.e., to minimize a weighted sum of the unconditional variances of inflation

and the output gap, $\omega \text{Var}(\pi_t - \pi_t^*) + (1-\omega)\text{Var}(y_t)$, $0<\omega<1$. We do not have a measure of the output gap

for our countries, nor do we know the central banks' weights, ω, but to get at this idea, we assume equal

weights, and examine the measure:

$\text{WSDINFLGDPGR}_{it} = 0.5 \text{ STDDEVINFL}_{it} + 0.5 \text{ STDDEVRGDPGR}_{it}$.

Measures to capture the performance of central banks with respect to their other potential goals

were less available over a wide set of countries and we are still collecting data from various sources. To

get at the issue of financial stability, we examined the performance of the banking system, as given by:

PROBLOAN_{it} = problem loan volume as a percent of total loan volume in country i in year t.

As some central banks are given the mandate to enact policies to stabilize the value of the

country's currency on international markets within an exchange rate regime chosen by the government,

we also examine:

VAREXRATE_{it} = standard deviation of the exchange rate in country i within year t (based on

monthly data).

---

[8] However, the original Taylor rule specification is not necessarily "efficient" in the sense of stabilizing output and inflation at their targets. That is, there are alternative values of the coefficients that yield better performance. In addition, the rules are hard to implement as written, since the policymaker does not have accurate information on the current values of inflation or the output gap when setting the interest rate. Both inflation and the output gap are estimated with considerable noise.

Central Bank Characteristics. We focus on central bank characteristics that are related to governance structure and that could potentially be correlated with the effectiveness of the central bank in achieving its goals as reflected in our performance measures. Getting a consistent set of measures across our countries has been a challenge and we are still in the process of collecting data so that we can expand the set of measures.[9]

Our measures are as follows:

$INDEPENDENT_{it}$ = 1 if the central bank has autonomy from the government in implementing monetary policy (even if it does not necessarily have independence in setting its goals), and 0 otherwise. Evidence on developed countries suggests that central bank independence yields better economic outcomes. And certainly many of the new central banks have been organized with this in mind. We seek to see if we can find this in our data for transition and developing countries, as well as whether we find a significant result for developed countries and for which performance measure.

$DIRECTORS_{it}$ = number of directors on the central bank's board in country i in year t, and

$OUTDIRECTORS\_DIRS_{it}$ = percentage of outside directors on the central bank's governing board in country i in year t.

As discussed above, the number of directors could be positively related to performance to the extent more minds yield better decisionmaking, but at some point the size could hinder decisionmaking by making it difficult to reach a consensus, or making it difficult to achieve individual accountability. The literature suggests that outside directors can help monitor insiders to help achieve better outcomes, but the work of the central bank can be arcane, so finding outsiders with the necessary skills and knowledge might be difficult. This might be especially true in countries that have recently adopted market economies, where the pool of experienced market economists is not large.

---

[9] For example, while we have information for some countries on whether the central bank implements monetary policy via inflation targeting, we do not have this variable for all the countries. We will report some preliminary results using this partial information below. Clearly, this is a measure that we will want to examine as the work progresses.

Some of the literature, e.g., Berger, Hann and Eijffinger (2001) and Cukierman, Webb, and Neyapti (1992), has examined the turnover rate of the central bank governor (or chairman of the board). High turnover may suggest less independence from the government, which might have a negative impact on central bank effectiveness, but it could also signal the exit of less effective management. Hence, its effect on performance, if any, is not a prior clear. Thus, we examine the measure:

$GOV\_TURNOVER_{it}$ = Average rate of turnover of central bank governors since 1993, measured as number of unserved years as percentage of the length of a governor's term specified by law divided by the number of governors since 1993.

Similarly, the length of the governor's term might be related positively to performance if it means less government interference, or negatively to performance if it if means the governor is embedded in the institution and insulated from scrutiny. In some cases, there is no specified length of term for the governor. Thus, we include two variables in the analysis:

$GOV\_TERM\_INDET_{it}$ = 1 if the length of the governor's term in country i in year t is indeterminant and = 0 otherwise, and

$GOV\_TERM\_DET_{it}$ = 0 if the governor's term is indeterminate and = number of years in the governor's term in country i in year t otherwise. Note while this potentially can vary over time if there were changes in the specified term of the governor in a country during our period of study (1996-2000), this does not occur in our sample.

Finally, central banks vary according to whether they have banking supervisory responsibilities along with monetary policy. Indeed, a number of central banks have been reconsidering whether bank supervision and monetary policy create potential conflicts of interest or whether there are synergies between the two. For example, bank supervision was separated from the Bank of England in 1998. To examine this issue, we include an indicator variable:

SUP_MON_{it} = 1 if the central bank has bank supervisory responsibilities as well as monetary policy responsibilities and = 0 otherwise.

4. Statistical Results

Difference-in-Means Tests. Table 3 presents difference-in-means tests for the variables across the three sets of countries in our analysis: transitional economies, developing economies, and developed countries. One might expect that there would be more similarity between the transition and developing countries in terms of economic performance than between the transition and developed countries. It is not clear that that would necessarily be true of the central bank organizational characteristics to the extent that transition countries might look to the more established banks in developed countries as role models.

As shown in the table, many of the performance variables and central bank characteristics are significantly different across the countries in our sample. In particular, not surprisingly, transition economies have significantly higher levels of and variability of inflation than developing or developed countries. The average inflation rate for transition economies in our sample was 20 percent compared with 10 percent for developing economies and slightly above 2 percent for developed countries. In contrast, there is no significant difference across the three groups in terms of annual real GDP growth, which averages about 3.5 to 3.75 percent. But there is a significant difference in variability, with the transition economies experiencing the most volatile and the developed countries experiencing the least volatile output growth. Transition countries experience a higher percentage of problem loans than the other countries, but still a relatively low level at 6.5 percent of total loans. These measures suggest that transition economies experienced a more volatile economic environment during the second half of the 1990s, the time period of study, than did other economies.

In terms of organizational characteristics, central banks do seem to differ across country group. In particular, there is a higher level of independence of the central bank from the executive branch of government in transition and developed countries than in developing countries (21 percent and 78 percent of the central banks in the transition and developed countries, respectively, are independent vs. about 8 percent in developing countries.) This is probably not that surprising as independence is thought to be a best practice among central banks and several of the central banks in the developed world have sought

more independence, while the new central banks in the transition countries organized themselves with high degrees of independence from the beginning.

Board size does not differ than much among the country groups (although the differences are statistically different), with average size ranging from 8 to 10 members. Developed countries tend to have a higher percentage of outside directors on their boards (27 percent) vs. transition and developed countries (14 to 17 percent). Transition countries have the highest percentage of female directors, but it is still a relatively low 13 percent. For those countries that specify a definite term for their central banks governor, the average terms are quite similar across countries, varying between 6 years in transition countries, 4 years in developed countries, and 5 years in developed countries. Turnover rates are quite low in all countries, with the lowest being in developed countries.

In terms of whether the central bank has responsibility for commercial bank supervision as well as monetary policy, it appears that fewer than half have joint responsibility in all three country groups. There is no significant difference between transition and developed countries, where about 40 percent of the central banks have responsibility for both of these tasks. In developing countries, the fraction is significantly lower at 30 percent.

Finally, although we do not use age as an independent regressor, central banks in developed countries are quite a bit older than those in transition or developing countries – not at all a surprise.

The differences in performance measures and central bank governance characteristics across the country groups in our sample suggest that there could be significant differences in the relationship between our central bank institutional variables and performance, if indeed, such a relationship can be uncovered in the data at all.

Regression Analysis. Table 4 presents the regression results. The first thing to notice is that there do appear to be some significant associations between performance and governance characteristics of central banks. But on the whole, it would be difficult to reach a strong definitive conclusion that central bank organizational characteristics have strong correlations with economic performance, either

positively or negatively. The second thing to notice is that the regression coefficients do appear to differ across the three country groups.

Table 5 presents tests of the null hypotheses of equal coefficients across the country groups. These were implemented by estimating for each performance measure a regression that includes all the coefficients allowing them to differ across country groups and then testing, via F-tests, restrictions of equal coefficients across pairs of country groups (reported in the first three columns of the table) and across all three country groups (reported in the last column of the table).[10] As indicated, we could not reject at standard significance levels the null hypothesis of equal coefficients for the problem loan and variance of the exchange rate (PROBLOAN and VAR_EXRATE) performance measures, suggesting there are no significant differences in the relationship between these measures and central bank characteristics across country groups.[11] However, for the other performance measures we reject the null hypothesis of equal coefficients in all cases for the transition countries relative to the developing or developed countries. We also reject the null hypothesis of equal coefficients across developing and developed countries for the performance measures involving inflation.

If instead of testing whether the set of coefficients are equal across country group, we test coefficient by coefficient, we find for each performance measure (including PROBLOAN and VAR_EXRATE) that we can reject the null hypothesis for at least one coefficient.[12] Given these results, we will proceed by examining the results of the regressions that were estimated separately for each country group.

Inflation performance. As shown in Table 4, with regard to inflation and inflation variability, larger boards are associated with higher and more variable inflation for developed countries, but there is an insignificant association for transition and developing countries. Longer governor terms or those with indeterminate length are associated with lower inflation in transition and developing countries. These

---

[10] We did not restrict the coefficients on trend and trend squared to be equal across country groups.
[11] For the variability of the exchange rate, the null hypothesis of equal coefficients for developed and developing countries could be rejected at the 12 percent level of significance.

[12] These results are available from the authors.

longer terms might imply that the governor is less subject to government intervention, which might produce better inflation results. However, when we look at independence of the central bank, we find a significant negative association with inflation only for the transition economies. We find a significantly positive association for developing and developed economies, i.e., central bank independence is associated with worse inflation performance in these countries, which is contrary to the received wisdom. We did not find a significant relationship between independence and inflation variability.

We find some evidence that having the central bank involved in both bank supervision and monetary policy is associated with worse inflation outcomes in terms of level and variability. The coefficient on SUP_MON is significant for developed countries.

The results for the Heritage Foundation's monetary freedom measure, H_MONETARY, reported on the last page of Table 4, are quite similar to those for inflation, although the significance levels are higher.[13] This is not too surprising given that the measure is based on inflation rates (and whether the country uses price controls). (Recall that higher inflation levels are associated with lower levels of H_MONTARY.)

Output performance. In terms of output, we find only marginally significant associations between output level and central bank organizational characteristics. For output performance, perhaps the better measure is variability, as central banks have little influence on the level of output in the longer run. Here we find little association between the size of the board, percentage of outside directors, governor term, or governor turnover and performance. We do find that central bank independence seems to result in lower output variability. This result is the opposite of what one might expect if there is a short-run tradeoff between inflation and output variability and the government favors stabilizing output rather than inflation. Instead, our results suggest independent central banks do not act in a way that neglects output stabilization.

---

[13] The regression adjusted R-squareds are higher for transition and developed countries for performance measure H_MONETARY compared with performance measure INFLAT.

The performance measure WSDINFLGDPGR equally weights output and inflation variability. We find some evidence that independence is negatively associated with overall variability, significantly so in developed countries, with the negative association with output variability dominating the positive association with inflation variability.

Other performance measures. We find little association between health of the commercial banking system as measured by the percentage of problem loans in a country and central bank organizational characteristics. There is a slight negative relationship between the percentage of outside directors on the central bank's governing board and problem loans, however, we don't want to read much into this. The regression adjusted R-squares are very low, and even negative for the developed countries regression.

For exchange rate variability, the most significant associations are found in the transition economies. This is perhaps not surprising given that stabilization of exchange rates is more likely to be an important goal of central banks in these countries compared to those in developed countries. In transition economies, central banks with larger boards, fewer outside directors, and longer governor terms have higher variability. But more turnover among the governors and more independence is associated with more stable exchange rates.

We need to be cautious in interpreting our results, remembering that we have a relatively short time frame in our sample. The lack of strong significance could merely reflect the lack of a long enough time frame over which there was been enough variation in economic outcomes. We also emphasize that these are correlations. Our results do not permit interpretations of causality. Nonetheless, we find that the relationships differ across country groups and some of the significant associations are sufficiently surprising to merit further exploration.

Alternative Specifications. We investigated two alternative specifications of the performance regressions.

(1) The inflation performance measures presented thus far imply that performance deteriorates in a linear fashion as inflation increases. We wanted to investigate another measure of inflation performance

that would penalize inflations and deflations, with larger inflations and larger deflations representing more than proportionate deterioration in performance. Thus we investigated an alternative inflation measure:

INFLSQ = annual CPI inflation squared.

The results differ little from the results for the absolute value of inflation presented above (and the full results are available from the authors).

(2) Corporations often try to have diversity represented on their boards of directors. Indeed, several corporate head-hunting firms have diversity practices that attempt to uncover qualified minority and/or female director candidates. It is not clear whether diversity is sought because of the value added it might bring to results or for more political reasons. We collected data on the number of female directors on the boards of central banks, and included a variable,

$FEMALEDIR\_DIRS_{it}$ = percentage of female directors on the central bank's governing board in country i in year t.

The percentage of female directors ranges from 0 to 50 percent across the central banks in our sample, with the mean percentage being 13 percent of transition countries, 8 percent for developing countries, and 10 percent for developed countries. When we added this variable into the regressions, it was very rarely significant in any of the performance regressions for any group of countries, and including the variable does not change the significance of the other variables in the regressions. Our results suggest that there does not appear to be much gained or lost in terms of economic outcomes by the gender makeup of the board – at least for the values of this variable in our data set. We cannot conclude that a board made up entirely of female members wouldn't yield better performance!

(3) As discussed above, we do not have information on all our countries about whether the central bank implements its monetary policy via inflation targeting, and we intend to pursue this further as the research progresses. Our preliminary results for the countries for which we have collected this information suggests that in most cases it doesn't appear to have a significant relationship to performance outcomes. When it is significant it seems to be more often significant for the developing country group,

and interestingly its correlation is with worse, not better performance (higher inflation and inflation variability, lower output growth and higher output variability). Again, we intend to investigate these associations further.

5. Conclusions

Over the last decade, the legal and institutional frameworks governing central banks and financial market regulatory authorities throughout the world have undergone significant changes. As new central banks have arisen in the aftermath of the Soviet Union's dissolution, as corporate governance problems have surfaced in some central banks, as central banks have had to rethink some of their operations in the wake of changing payment technologies, and as more is learned about effective implementation of monetary policy, the governance of central banks has become an area of research interest. There is new interest in better understanding the roles played by organizational structures, good governance, accountability, and transparency in increasing the efficiency and effectiveness of central banks in achieving their objectives and ultimately yielding better economic outcomes.

While much has been written about the potential role good governance can play in central banks, there has been little in the way of empirical study of this hypothesis. Our paper asks two simple questions: first, can we find a significant statistical relationship between central bank governance and institutional characteristics and the economic outcomes that reflect the performance of central banks; second, do these relationships differ across central banks in operating in countries at different stages of economic development.

In answer to our first question, our findings, which are still preliminary, suggest that there are some significant associations, but that there is not a strong definitive conclusion that central bank organizational structure has strong correlations with economic performance, either positively or negatively. For example, the size of the board and the percentage of outside directors on the board don't appear to have a strong correlation with performance across our performance measures. Moreover, in some cases, the associations are not the expected ones. For example, we find that independence of the central bank from the executive branch of the government is not always significantly related to

performance and in some cases the relationship is the opposite of what one might expect. In developed countries, while independence is significantly associated with lower output variation and with lower weighted price and output variation, we find a positive association between independence and inflation. We also find this positive association for developing countries, while we find a significant negative relationship for the set of transition countries.

In answer to our second question, we do find that the relationship between performance and central bank governance and organizational characteristics differs across countries at different stages of economic development.

We need to be cautious in interpreting our results remembering that we have a relatively short time frame in our sample. The lack of strong significance could merely reflect the lack of a long enough time frame over which there was been enough variation in economic outcomes. Or they could provide an explanation of Lybek and Morris's (2004) finding that there is little consensus among central banks regarding the structure, size, and composition of their governing bodies. Nonetheless, several of the associations we find are sufficiently surprising as to merit further exploration.

Table 1. Countries Included in the Empirical Work

Transition Economies

Albania, Armenia, Belarus, China, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Latvia, Lithuania, Moldova, Mongolia, Poland, Russia, Slovakia, Slovenia, Ukraine

Developing Economies:

Aruba, Bahamas, Bahrain, Barbados, Belize, Botswana, Brazil, Chile, Columbia, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Ethopia, Fiji, Guatemala, Haiti, Indonesia, Jordan, Kenya, Kuwait, Lebanon, Lesotho, Macau, Malawi, Malta, Mexico, Morocco, Mozambique, Nepal, Nicaragua, Nigeria, Oman, Pakistan, Peru, Philippines, Saudi Arabia, Sierra Leone, South Africa, Sri Lanka, Taiwan, Tanzania, Trinidad and Tobago, Turkey, Uganda, United Arab Emirates, Uruguay, Zambia, Zimbabwe

Developed Economies

Australia, Austria, Belgium, Canada, Cyprus, Denmark Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Israel, Italy, Japan, Korea, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States

Table 2. Variable Definitions

Variable Name	Definition	Data Source	Year
Performance Measures			
INFL	Annual CPI inflation rate	Calculation based on World Development Indicators (WDI) 2005 Data Disk	1996-2000
ABSINFL	Absolute value of the annual CPI inflation rate	Calculation based on World Development Indicators (WDI) 2005 Data Disk	1996-2000
INFLSQ	Annual CPI inflation rate squared	Calculation based on WDI 2005 Data Disk	1996-2000
STDDEVINFL	Standard deviation of annual CPI inflation rate over the previous 3 years	Calculation based on WDI 2005 Data Disk	1996-2000
H_MONETARY	An index measuring the success of the country's monetary policy based on the weighted average inflation over the most recent three years and the degree to which a country imposes price controls, as determined by the Heritage Foundation as part of its Index of Economic Freedom	Heritage Foundation Website	1996-2000
RDGPGR	Annual growth rate of real GDP	WDI 2005 Data Disk	1996-2000
STDDEVRGDPGR	Standard deviation of annual real GDP growth over the previous 3 years	Calculation based on WDI 2005 Data Disk	1996-2000
WSDINFLGDPGR	An equally weighted average of the standard deviation of annual CPI inflation over the previous 3 years and the standard deviation of annual GDP growth over the previous 3 years	Calculation based on WDI 2005 Data Disk	1996-2000
PROBLOAN	Problem loan ratio = dollar volume of problem loans as a percent of dollar volume of total loans	Bankscope data base	1996-2000
VAR_EXRATE	Standard deviation of the exchange rate	IMF *International Financial Statistics* (IFS)	1996-2000
Characteristics of the Central Bank			
DIRECTORS	Number of directors on the central bank's board	Calculation based on IMF *International Financial Statistics* (IFS)	1996-2000
OUTSIDEDIRS_DIRS	Number of outside members on the board as a percent of total number of directors on the board	Calculation based on IMF *International Financial Statistics* (IFS)	1996-2000

Variable Name	Definition	Data Source	Year
GOV_TERM_INDET	Indicator variable = 1 if no definite term of the central bank's governor (i.e., chairman of the board) is specified by law; 0 otherwise	Morgan Stanley Central Bank Directory, Individual Websites and E-mails.	1996-2000
GOV_TERM_DET	If a definite term of the central bank's governor is specified by the law, the number of years in a full term; 0 otherwise	Morgan Stanley Central Bank Directory, Individual Websites and E-mails.	1996-2000
GOV_TURNOVER	Turnover of governor = Average rate of turnover of central bank governors since 1993, measured as number of unserved years as percentage of term of the governor divided by total number of governors since 1993	Morgan Stanley Central Bank Directory, Individual Central Bank Websites, and Direct Correspondence via email with the Central Banks	1996-2000
INDEPENDENT	Dummy variable equal to 1 if the central bank is not part of the Ministry of Finance and can implement monetary policy without the direct approval of the government, and equal to zero otherwise.	Websites, Other research papers: Cukierman, (1992), (1994), Cukierman et al. (1992), (1995), De Haan and Kooi (2000) and De Haan and Van't Hag (1995), Mangano (1998), Loungani and Sheets (1997), and EBRD sources	1996-2000
SUP_MON	Dummy variable equal to 1 if the central bank is involved in bank supervision as well as monetary policy, and equal to 0 otherwise	Websites, Other Research Papers (see list for the variable INDEPENDENT), and EBRD sources.	1996-2000
AGE	The number of years since the founding of the central bank	Morgan Stanley Central Bank Directory, Individual Central Bank Websites, and Direct Correspondence via email with the Central Banks	1996-2000
FEMALEDIRS_DIRS	Number of female members on the board as a percent of total number of directors on the board	Calculation based on IMF *International Financial Statistics* (IFS)	1996-2000
INFTARG	Dummy variable = 1 if central bank implements monetary policy by setting a numerical inflation target and = 0 otherwise	Websites, Other Research Papers (see list for the variable INDEPENDENT), and EBRD sources	1996-2000

Table 3. Difference-in-Means Tests Across Country Groups

Variable Name	Mean			Mean Difference		
Country Group →	Transition Countries	Developing Countries	Developed Countries	Transition Country Vs. Developing Country	Transition Country Vs. Developed Country	Developing Country Vs. Developed Country
	(1)	(2)	(3)	(1)-(2)	(1)-(3)	(2)-(3)
INFL	20.01 (36.70)	10.33 (15.54)	2.19 (1.97)	9.69**	17.82***	8.14***
ABSINFL	20.08 (36.67)	10.52 (15.41)	2.33 (1.8)	9.56**	17.75***	8.19***
STDDEVINFL	78.42 (326.84)	9.68 (75.84)	0.88 (0.77)	68.75**	77.54**	8.8*
H_MONETARY	49.49 (27.01)	69.85 (14.55)	83.8 (4.93)	−20.36***	−34.32***	−13.95***
RGDPGR	3.77 (4.37)	3.56 (3.64)	3.59 (2.39)	0.21	0.18	−0.03
STDDEVRGDPGR	3.51 (3.41)	2.64 (2.38)	1.27 (1.3)	0.87**	2.24***	1.37***
WSDINFLGDPGR	40.97 (163.53)	6.28 (39.18)	1.05 (0.85)	34.69**	39.92**	5.23**
PROBLOAN	6.58 (5.62)	5.25 (5.23)	3.82 (4.39)	1.33**	2.76***	1.43***
VAR_EXRATE	7.10 (9.27)	34.51 (231.31)	5.13 (14.51)	−27.41*	1.97	29.38**
DIRECTORS	8.22 (2.62)	7.13 (2.66)	9.48 (4.87)	1.09***	−1.26**	−2.35***
OUTSIDEDIRS_DIRS (%)	14.15 (19.98)	27.17 (29.63)	16.63 (25.75)	−13.02***	−2.48	10.54***
FEMALEDIRS_DIRS (%)	12.69 (12.98)	8.07 (10.95)	10.02 (12.28)	−4.62***	−2.66	−1.96
GOV_TERM_INDET	0.052 (0.224)	0.096 (0.295)	0.111 (0.315)	−0.05	−0.06	−0.01
GOV_TERM_DET	5.58 (1.57)	3.94 (1.70)	5.07 (2.04)	2.03***	0.51**	−1.13***
GOV_TURNOVER	0.292 (0.212)	0.288 (0.207)	0.15 (0.09)	0.03	0.14***	0.14***
INDEPENDENT	0.211 (0.410)	0.077 (0.267)	0.777 (0.417)	0.13***	−0.57***	−0.70***
SUP_MON	0.421 (0.496)	0.31 (0.46)	0.41 (0.49)	0.11**	0.01	−0.10**
AGE	30.63 (30.92)	44.46 (25.21)	119.55 (81.05)	−13.83***	−88.92***	−75.09***

Note: Standard deviation is in parenthesis.

,, *** denote significantly different from zero at the 10%, 5%, 1% level, respectively.

Table 4. Regression Results: Associations Between Central Bank Performance and Central Bank Governance Characteristics

	Dependent Variable								
	Inflation INFLAT			Standard Deviation of Inflation STDDEVINFLAT			Absolute Value of Inflation ABSINFL		
Country Group →	Transition	Developing	Developed	Transition	Developing	Developed	Transition	Developing	Developed
Independent Variable	1	2	3	4	5	6	7	8	9
Intercept	114.30*	22.06	6.41**	1623.21***	137.79*	0.58	114.058	21.86	6.48***
DIRECTORS	0.96	−0.05	0.09**	−20.02	0.67	0.03**	0.95	−0.02	0.11***
OUTSIDEDIRS_DIRS	0.28	0.01	0.00	7.54***	0.03	0.00	0.28	0.02	−0.00
GOV_TERM_INDET	−81.40**	−13.23**	−0.69	−264.33	−36.81	0.46	−80.54**	−12.41**	0.27
GOV_TERM_DET	−11.83**	0.00	−0.24	−51.58	−6.45	−0.05	−11.84**	0.04	−0.23
GOV_TURNOVER	−20.89	−3.58	2.65	−72.74	−25.07	2.80***	−20.75	−3.27	3.20*
INDEPENDENT	−19.49*	24.27***	1.02**	−117.2	5.01	0.04	−19.52*	24.01***	0.54
SUP_MON	16.46**	0.53	1.04***	40.04	11.86	0.45***	16.46**	0.84	1.388***
TREND	−13.32	−3.63	−2.18**	−449.62**	−38.26	−0.33	−13.18	−3.74	−2.27***
TRENDSQ	1.26	0.26	0.20**	36.86**	3.33	0.05	1.25	0.27	0.22***
N	95	240	130	95	240	130	95	240	130
F−Statistics	1.92*	5.47***	3.21***	3.50***	1.08	5.70***	1.90*	5.27***	3.05***
Adjusted R−Squared	0.0807	0.1441	0.1336	0.193	0.003	0.2468	0.0796	0.1385	0.125

,, *** denote significantly different from zero at the 10%, 5%, 1% level, respectively.

Table 4, Con't. Regression Results: Associations Between Central Bank Performance and Central Bank Governance Characteristics

	Dependent Variable								
	Real GDP Growth RGDPGRAT			Standard Deviation of Real GDP Growth STDDEVRGDPGR			Equally weighted average of the standard deviation inflation and the standard deviation of real GDP growth WSDINFLGDPGR		
Country Group →	Transition	Developing	Developed	Transition	Developing	Developed	Transition	Developing	Developed
Independent Variable	1	2	3	4	5	6	7	8	9
Intercept	18.23**	15.75***	0.38	3.4	4.02*	4.09**	813.30***	74.10*	2.75**
DIRECTORS	−0.80***	0.16*	0.13**	0.38	−0.09	−0.04	−9.82	0.36	−0.02
OUTSIDEDIRS_DIRS	0.05*	0.01	−0.004	−0.06**	0.00	0.00	3.74***	0.01	0.00
GOV_TERM_INDET	−0.97	−0.77	3.88***	−0.52	1.70**	−1.15	−132.42	−17.87	−0.4
GOV_TERM_DET	−1.15*	−0.21	0.50**	0.66	0.13	−0.30**	−25.46	−3.06	−0.16**
GOV_TURNOVER	6.35*	−1.06	8.18**	−1.83	1.52**	−0.72	−35.45	−11.95	−0.41
INDEPENDENT	−0.43	0.06	−0.04	−2.72***	−0.39	−1.24***	−59.46	1.22	−0.86***
SUP_MON	0.11	−0.75	0.44	0.01	0.34	0.24	20.03	6.18	0.36
TREND	−2.05	−4.90***	−1.19	−1.49	−0.79	−0.01	−225.56**	−21.07	−0.13
TRENDSQ	0.23	0.46***	0.14	0.1	0.07	0.01	19.48	1.84	0.02
N	95	245	130	95	245	130	95	225	125
F−Statistics	1.80*	2.78***	2.39**	3.70***	1.73*	4.23***	3.51***	1.01	5.67***
Adjusted R−Squared	0.071	0.0615	0.0886	0.2052	0.0262	0.1838	0.1935	0.006	0.2533

Note: Standard deviation is in parenthesis. "***" refers to be significant at 1% level; "**" to be significant at 5% level; and "*" to be significant at 10% level.

Table 4, Con't. Regression Results: Associations Between Central Bank Performance and Central Bank Governance Characteristics

	Dependent Variable								
	Heritage Foundation measure of monetary performance H_MONETARY			Problem Loan to Total Loan Ratio PROBLOAN			Variability of Exchange Rate V_EXRATE		
Country Group →	Transition	Developing	Developed	Transition	Developing	Developed	Transition	Developing	Developed
Independent Variable	1	2	3	4	5	6	7	8	9
Intercept	20.00	50.67***	82.77***	−12.21	4.71	−3.55	−22.10*	167.75	2.59
DIRECTORS	−3.62***	0.30	−0.17*	0.55	−0.09	0.02	1.37**	−9.72*	0.33
OUTSIDEDIRS_DIRS	−0.1	−0.01	0.04**	−0.08**	−0.02*	0.00	−0.16***	0.33	0.08
GOV_TERM_INDET	19.92	22.27***	2.89	1.54	−6.27***	0.40	14.11**	−272.79***	−7.82
GOV_TERM_DET	−1.87	2.06**	0.38	0.5	−1.18***	−0.17	4.86***	−51.11***	−2.79**
GOV_TURNOVER	28.88**	4.61	−9.74**	−1.99	0.44	−3.29	−24.44***	−47.39	0.16
INDEPENDENT	26.59***	−10.87***	3.01***	−2.39	−2.33*	0.28	−4.17**	−11.08	9.37***
SUP_MON	4.26	2.02	−4.85***	−0.63	0.4	0.24	8.51***	19.92	2.63
TREND	9.86	0.35	−0.45	5.89*	2.81	3.56	1.39	60.34	0.52
TRENDSQ	0.14	0.16	0.12	−0.58*	−0.26	−0.35	−0.11	−5.18	0.08
N	88	245	134	95	260	135	95	250	135
F−Statistics	15.60***	4.80***	8.61	1.41	3.81***	0.59	10.68***	2.44**	2.57***
Adjusted R−Squared	0.6017	0.1228	0.34	0.0381	0.0889	−0.0284	0.481	0.0495	0.0959

Note: Standard deviation is in parenthesis. "***" refers to be significant at 1% level; "**" to be significant at 5% level; and "*" to be significant at 10% level.

Table 5. F-Tests of Coefficient Restrictions Across Country Groups

Null Hypothesis: Equality of Coefficients (excluding Trend and Trendsq)
Across Country Groups

Dependent Variable	Transition = Developing F-Statistic *Prob >F*	Transition = Developed F-Statistic *Prob >F*	Developing = Developed F-Statistic *Prob >F*	Transition = Developing= Developed F-Statistic *Prob >F*
INFL	9.01*** *<0.0001*	4.87*** *<0.0001*	2.38** *0.0212*	4.90*** *<0.0001*
STDDEVINFL	7.55*** *<0.0001*	6.66*** *<0.0001*	0.06 *0.9996*	4.34*** *<0.0001*
ABSINFL	8.91*** *<0.0001*	4.80*** *<0.0001*	2.45** *0.0181*	4.87*** *<0.0001*
RGDPGR	2.84*** *0.0066*	3.17*** *0.0028*	0.90 *0.5043*	1.96** *0.0193*
STDDEVRGDPGR	4.73*** *<0.0001*	4.14*** *0.0002*	0.90 *0.5094*	2.88*** *0.0003*
WSDINFLGDPGR	6.93*** *<0.0001*	6.18*** *<0.0001*	0.06 *0.9997*	4.08*** *<0.0001*
H_MONETARY	18.33*** *<0.0001*	12.73*** *<0.0001*	3.50*** *0.0011*	10.55*** *<0.0001*
PROBLOAN	0.65 *0.7172*	1.03 *0.4065*	1.14 *0.3347*	0.99 *0.4598*
VAR_EXRATE	1.01 *0.4265*	0.02 *0.9999*	1.65 *0.1199*	1.09 *0.3663*

,, *** denote significantly different from zero at the 10%, 5%, 1% level, respectively.

References

Ahearne, Alan, Joesph Gagnon, Jane Haltmaier, Steve Kamin, Christopher Erceg, Jon Faust, Luca Guerrieri, Carter Hemphill, Linda Kole, Jennifer Roush, John Rogers, Nathan Sheets, and Jonathan Wright, June 2002, "Preventing Deflation: Lessons From Japan's Experience in the 1900s," Board of Governors of the Federal Reserve System International Finance Discussion Paper, Number 729.

Alesina, A. and L. H. Summers, 1993, "Central Bank Independence and Macroeconomic Performance: Some Comparative Evidence," *Journal of Money, Credit and Banking* 25(2), 151−162.

Amtenbrink, F., 1999, *The Democratic Accountability of Central Banks*, Hart Publishing, Portland, Oregon.

Barth, J.R., G. Caprio, and R. Levine, 2006, "The Design and Governance of Bank Supervision." Paper Presented at the 2006 Riksbank Conference on the Governance of Central Banks.

Beach, William W., and Tim Kane, "Methodology: Measuring the 10 Economic Freedoms," Chapter 3 in *The 2007 Index of Economic Freedom*, The Heritage Foundation, Washington D.C., pp. 37−55 http://www.heritage.org/research/features/index/.

Bernanke, B. S., T. Laubach, et al., 1999, *Inflation Targeting: Lessons from the International Experience*, Princeton University Press, Princeton, New Jersey.

Bernanke, B. S. and M. Woodford, 2005, "The Inflation−Targeting Debate," *NBER Studies in Business Cycles*, 32, University of Chicago Press, Chicago and London.

Blinder, Alan S., 2004, *The Quiet Revolution: Central Banking Goes Modern*, Yale University Press, New Haven, Connecticut.

Berg, Claes, and Lars Jonung, 1999, "Pioneering Price−Level Targeting: The Swedish Experience, 1931−1937," *Journal of Monetary Economics*, 43, pp. 525−551.

Caprio Jr., G. and D. Vittas, 1995, "Financial History: Lessons of the Past for Reformers of the Present." Policy Research Working Paper Series, No.1535.

Clouse, James, Dale Henderson, Athanasios Orphanides, David Small, and Peter Tinsley, November 2000, "Monetary Policy When the Nominal Short−Term Interest Rate is Zero," Board of Governors of the Federal Reserve System Finance and Economics Discussion Series Paper, Number 2000−51.

Cukierman, A., 2005, "Central Bank Independence and Monetary Policymakng Institutions–Past, Present and Future," Distinguished Lecture Delivered at the Annual Meeting of the Chilean Economic Society, September, Tel Aviv University.

Eijffinger, S. C. W. and P. M. Geraats, 2002, "How Transparent are Central Banks?" CEPR Discussion Papers 3188, C.E.P.R. Discussion Papers.

Fishcher, S., 1994, "Modern Central Banking," Chapter 2 in Forrest Capie, et al, *The Future of Central Banking*, Cambridge University Press, Cambridge, UK.

Fishcher, S., 1995, "Central Bank Independence Revisited," *American Economic Review,* Papers and Proceedings, May, 201−206.

Flannery, M., 1996, "Financial Crises, Payment System Problems, and Discount Window Lending," *Journal of Money, Credit and Banking*, August, 273−305.

Flood, R.P. and Marion, N., 1998, "Perspectives on the Recent Currency Crisis Literature," NBER Working Paper No. 6380.

Friedman, M., 1968, "The Role of Monetary Policy," *American Economic Review*, 58, 1−17.

Frisell, L., K. Roszbach, and G. Spagnolo, February 2007, "Governing the Governors: A Clinical Study of Central Banks," Working Paper, Riksbank.

Fry, M.J., I. Kilato, S. Roger, K. Senderowicz, D. Shepard, F. Solis, and J. Trundle, 1999, *Payment Systems in Global Perspective*, Routledge, New York.

Healey, Juliette, 2001, "Financial Stability and the Central Bank: International Evidence," in Brealey ed., *Financial Stability and Central Banks: A Global Perspective*, Routledge, New York.

Hetzel, R.L., 2000, "The Taylor Rule: Is it a Useful Guide to Understanding Monetary Policy?" *Economic Quarterly*, Federal Reserve Bank of Richmond, 86, pp. 1−33.

Lybek, T., 2002, "Central Bank Autonomy, Accountability, and Governance: Conceptual Framework," Paper Presented at the 2002 IMF Seminar on Current Developments in Monetary and Financial Law, Washington, D.C.

Lybek, T. and J. Morris, 2004, "Central Bank Governance: A Survey of Boards and Management." IMF Working Paper No. 04/226.

McNamara, K. R., 2002, "Rational Fictions: Central Bank Independence and the Social Logic of Delegation," *West European Politics*, 25(1), 47−76.

Mester, Loretta J., July 2003, "Applying Efficiency Measurement Techniques to Central Banks," Federal Reserve Bank of Philadelphia Working Paper No. 03−13.

Minutes of the Federal Open Market Committee Meeting of August 8, 2006, www.federalreserve.gov/fomc/minutes/20060808.htm

Minutes of the Federal Open Market Committee Meeting of January 30−31, 2007, www.federalreserve.gov/fomc/minutes/20070131.htm.

Orphanides, A., October 1998, "Monetary Policy Evaluation With Noisy Information," Finance and Economics Discussion Series Paper #1998−50, Federal Reserve Board.

Phelps, E. S., 1967, "'Phillips' Curves, Expectations of Inflation, and Optimal Unemployment Over Time," <u>*Economica*</u>, 34(3), 254−281.

Reserve Bank (of Australia) Act of 1959, http://www.comlaw.gov.au/ComLaw/Legislation/ ActCompilation1.nsf/framelodgmentattachments/F8DF09C6FE46D3BBCA256F71004DA84EA.

Royal Decree, Norway, March 29, 2001, http://www.norges−bank.no/english/nb/legislation/.

Sarel, M., 1996, "Nonlinear Effects of Inflation on Economic Growth," *IMF Staff Papers*, 43(1), 199−215.

Siklos, P. L., 2004, "Frameworks for the Resolution of Government−Central Bank Conflicts: Issues and Answers," *Current Developments in Monetary and Financial Law*, 3.

Svensson, L., 1999, "Price−Level Targeting vs. Inflation Targeting: A Free Lunch?" *Journal of Money, Credit and Banking*, 31(3), 277−295.

Taylor, J.B., 1999, "The Robustness and Efficiency of Monetary Policy Rules as Guidelines for Interest Rate Setting by the European Central Bank," *Journal of Monetary Economics*, 43, pp. 655−679.

Tuladhar, A., 2005, "Governance Structures and Decision−Making Roles in Inflation−Targeting Central Banks," IMF Working Paper No.05/183.