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CENTRAL BANK INSTITUTIONAL STRUCTURE AND EFFECTIVE CENTRAL BANKING: CROSS-COUNTRY EMPIRICAL EVIDENCE

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Central Bank Institutional Structure and Effective Central Banking: Cross-Country Empirical Evidence[*]

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Abstract

Over the last decade, the legal and institutional frameworks governing central banks and financial market regulatory authorities throughout the world have undergone significant changes. This has created new interest in better understanding the roles played by organizational structures, accountability, and transparency, in increasing the efficiency and effectiveness of central banks in achieving their objectives and ultimately yielding better economic outcomes. Although much has been written pointing out the potential role institutional form can play in central bank performance, little empirical work has been done to investigate the hypothesis that institution form is related to performance. This paper attempts to help fill this void.

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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 (Frisell, Roszbach, and Spagnolo, 2007), as well as the widely 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 (Lybek and Morris, 2004). 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). In October 2007, the Federal Reserve announced it would be providing economic projections more often and with a longer forecast horizon, and in 2008, it implemented these changes. There is a growing body of literature that examines what procedures central banks should follow to set monetary

policy most effectively (Blinder, 2004). Moreover, in 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 rethinking their role in the payments 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, 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) expand on this topic by examining the organizational 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 that organizational structure can play in central banks, there has been little in the way of empirical study of the hypothesis that institution form is related to performance. We provide some preliminary evidence. Our paper asks two simple questions: first, can we find a significant statistical relationship between central bank structural characteristics, including board structure and goals, and 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 organizational form and central bank performance in two ways. First, while much of the literature has focused on developing measures of the governance structure of central banks, we attempt to provide statistical evidence on whether measures of structural 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] We emphasize that our results must be viewed as suggestive rather than definitive. We have a relatively short time frame in our sample. Also, it is difficult to disentangle the direction of causality: does organizational form cause good performance, or does good performance lead to particular central bank organizational characteristics? We are limited in our ability to address this causality issue because of our short time series, so our results are best interpreted as correlations. Nonetheless, we believe that some of the significant relationships we find are sufficiently interesting to warrant further research on the important question of whether there is a discernable relationship between central bank institutional structure and economic performance.

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.[2] As the literature suggests, while the tasks assigned to particular central banks have changed over the years, their key focus remains macroeconomic stability, including stable prices (low inflation), stable exchange rates (in some countries), and fostering of maximum sustainable growth (which may or may not be explicitly listed as a goal of the central bank in enabling legislation).[3,4] Most central banks have responsibility for stability of the payments and

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[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] Hüpkes, Quintyn, and Taylor (2006) discuss process-based performance criteria for financial supervisors. This methodology is not used in our paper, since we focus only on outputs.

[3] See, e.g., Tuladhar (2005), Sibert (2003), Lybek (2002), McNamara (2002), and Healey (2001), Amtenbrink (1999), Maier (2007), and Caprio and Vittas (1995).

[4] 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

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, Caprio, 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 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 (2007), 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.

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, 2001). The Reserve Bank of Australia is mandated by the Reserve Bank Act to ensure that its 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.

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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.

The multiplicity of objectives makes central banks complicated institutions. Although central banks and governments care about seigniorage income and operating within their budgets, as public institutions, central banks are much less driven by the profit motive than are private corporations. So market profit does not serve as the relevant performance benchmark and incentive device. While measuring the performance of any one of the central bank's goals might be doable, measuring performance across the central bank's goals is more difficult, especially given the potential trade-offs among 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. Transparency refers 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 that 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 the central bank's accountability for achieving its goals, which in turn, can positively influence central bank decision-making.

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 decision-making board in a particular way, choosing the degree of autonomy to give to central bank decision-makers, 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 a central bank's independence from the government can increase its effectiveness in achieving its monetary policy goals (e.g., Alesina and Summers, 1993, Fischer, 1994, Cukierman,

2005, Maier, 2007). By independence (which is also called "autonomy" in some of the literature, e.g., Lybek, 1999, 2002, Lybek and Morris, 2004, and Hayo and Hefeker, 2007), we mean that while the government may determine the goals of the central bank, the central bank controls the implementation of monetary policy to achieve those goals without direct approval of the executive branch of government. Partly this helps to insulate central bank decision-making 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 (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 toward 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.[5] Different organizational structures might be better able to foster central bank 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 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 a U.S. senator's term. Thus, the structure of a central bank's board might affect its ability to achieve central bank goals. Relevant characteristics might include

[5] Tuladhar (2005) surveyed the differences in governing bodies of countries that have adopted inflation targeting to implement monetary policy. Eijffinger and Geraats (2002) and Frisell, Roszbach and Spagnolo (2007) surveyed differences in the institutional structures of the central banks in several, mainly European, countries.

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, and in turn, to better performance. 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 decision-making process, which can arguably lead to better decision-making, 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. 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.

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 organizations. 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 individual central banks provided to us upon our request. Our other data sources include Thomson's (Bureau van Dijk) Bankscope database (also known as Fitch's

International Bank Database); IMF *International Financial Statistics*; BIS publications of Blue Books and Orange Books; annual reports of individual central banks; World Development Indicators (WDI); the Polity IV project of the Center for International Development and Conflict Management at the University of Maryland; and La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999). We did substantial editing and cross-checking to produce as clean a data set as possible.

The data used in our analysis are annual data from 1996 to 2000. 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). Because how well central banks perform and the relationship between performance and central bank characteristics may differ across countries that vary in the degree of economic development, we classified the countries into three groups: transition economies, developing economies, and developed economies. This might also help to provide some control (admittedly weak) for direction of causality to the extent that the central banks and their characteristics are relatively newer in the transition economies than in the developed economies.[6] (Results for statistical tests of equality of the set of coefficients across the groups of countries are discussed below. We also discuss two robustness tests that use alternative groupings of countries.) Appendix Table A1 lists the countries in our analysis.

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

$$P_{it} = \alpha_0 + \alpha_1 \mathbf{x_{it}} + \alpha_2 Year_{1997} + \alpha_3 Year_{1998} + \alpha_4 Year_{1999} + \alpha_5 Year_{2000} + \varepsilon_{it},$$

where P_{it} is a performance measure, $\mathbf{x_{it}}$ is a vector of central bank characteristics, $Year_t$ is a dummy variable = 1 if the year is t and 0 otherwise (note we omit the 1993 variable), and ε_{it} is an error term.[7]

[6] The direction of causality could be better identified if we had time series data on central bank characteristics and those central bank characteristics varied over time. Unfortunately, such data were not available.

[7] Note we also ran the regressions including a quadratic time trend (i.e., trend and trend-squared variables) instead of the set of time dummy variables, with virtually no difference in results in terms of coefficient magnitudes or levels of significance.

Performance Measures. Since central banks have several goals, we examine several different performance measures. All variables are annual for the years 1996 to 2000. Appendix Table A2 gives the definitions and sources of each variable.[8]

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) (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:

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

$Abs(Inflation)_{it}$ = 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.

Inflation variability$_{it}$ = standard deviation of the inflation rate in country *i* over the years *t-2*, *t-1*, *t*. Since our regression time frame runs from 1996 to 2000, this measure incorporates annual inflation rates from 1994 and 1995, as well as 1996 to 2000.

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

Heritage monetary performance index$_{it}$ = index that 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 (Beach and Kane, 2007).

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[8] In contrast to the performance measures based on economic outcomes that we use here, Hüpkes, Quintyn, and Taylor (2006) discuss process-based performance criteria for financial supervisors.

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:

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

Real growth variability$_{it}$ = standard deviation of annual growth rate of real GDP in country *i* over the years *t-2*, *t-1*, *t*.[9]

Since there can be short-run trade-offs 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 trade-off between inflation and the output gap or unemployment (i.e., it is based on an underlying Philips curve). According to Orphanides (2003) and Taylor (1999), Taylor's rule appears to perform well in a variety of models and appears to be robust to different model specifications.

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). We do not have a measure of the output gap for our countries, nor do we know the central banks' weights, but to get at this idea, we assume equal weights, and examine the performance measure:

Inflation and real growth variability$_{it}$ = 0.5 *Inflation variability*$_{it}$ + 0.5 *Real growth variability*$_{it}$.

[9]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 economic agents' desire to evade taxes.

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

Problem loans$_{it}$ = problem loan volume as a percentage of total loan volume in country *i* in year *t*.

Since 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:

Exchange rate variability$_{it}$ = standard deviation of the exchange rate in country *i* within year *t* based on the monthly data available in *International Financial Statistics* published by the IMF.

Central Bank Characteristics. We focus on central bank characteristics that are related to organizational structure and that could potentially be correlated with the central bank's effectiveness in achieving its goals as reflected in our performance measures.

Our measures, which do not vary over our sample period for the countries included in this study, 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. 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 can find a significant result for developed countries and for which performance measure.

Directors$_i$ = number of directors on the central bank's board in country *i*, and

Outside directors$_i$ = percentage of outside directors on the central bank's governing board in country *i*.

As discussed above, the number of directors could be positively related to performance to the extent that more minds yield better decision-making, but at some point the size could hinder decision-making by making it difficult to reach a consensus or making it difficult to achieve individual accountability. While the finance literature suggests that outside directors can monitor insiders to help

achieve better outcomes, 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. Hence, the relationship between these variables and economic performance is a priori ambiguous.

Some of the literature, e.g., Berger, de Haan 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:

$Turnover_i$ = average rate of turnover of central bank governors since 1993, measured as the total number of unserved years since 1993 as a percentage of the length of a governor's term specified by law divided by the number of governors since 1993.[10]

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 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:

$Term\ unspecified_i$ = 1 if the length of the governor's term in country *i* is unspecified and = 0 otherwise, and,

$Term\ length_i$ = 0 if the governor's term is unspecified and = number of years in the governor's term in country *i*,otherwise. Note that while this can potentially 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

[10] In calculating this variable for countries that do not specify a term length, we assume the term length is 10 years, which is longer than the term length for any country in our sample that specifies a term length.

supervision and monetary policy create potential conflicts of interest or whether there are synergies between the two (Bhattacharya, Boot, and Thakor, 1998). For example, bank supervision was separated from the Bank of England in 1998. To examine this issue, we include an indicator variable:

$Supervision_i$ = 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 1 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 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 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 the country groups. In particular, there is a higher level of central bank independence 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, since independence is thought to be a best practice among central banks. 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 that 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). For those countries that specify a definite term for their central banks governor, the average terms are quite similar across countries, varying between about six years in transition countries, four years in developing countries, and five years in developed countries. The turnover rate of governors since 1993 is quite low in all countries, but lowest in the 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 2 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 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.

We tested the null hypotheses of equal coefficients across the country groups. These were implemented by estimating for each performance measure a regression that includes all of the coefficients, allowing them to differ across country groups and then testing, via F-tests, restrictions of equality of the coefficients on the variables (excluding the year dummy variables) of the pairs of country groups and across all three country groups.[11] We could not reject at standard significance levels the null hypothesis of equal coefficients for the problem loans and the exchange rate variability performance measures, suggesting there are no significant differences in the relationship between these measures and central bank characteristics across country groups.[12] 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 is equal across the country groups, we test coefficient by coefficient, we find that for each performance measure (including problem loans and exchange rate variability), we can reject the null hypothesis for at least one coefficient. Given these results, we will proceed by examining the results of the regressions that were estimated separately for each country group. As a robustness test, we also investigated two other groupings of our countries. These results are discussed below.

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[11] These results are available from the authors upon request.

[12] For exchange rate variability, the null hypothesis of equal coefficients for developed and developing countries could be rejected at the 13 percent level of significance.

Inflation performance. As shown in Table 2, 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 longer terms might imply that the governor is less subject to government intervention, which might produce better inflation results. However, when we look at the 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, since the coefficient on supervision is significant for developed countries in both of these inflation regressions.

The results for the Heritage Foundation's monetary performance index, reported on the last page of Table 2, 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 the index.)

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, since 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 trade-off between inflation and output variability and the government favors stabilizing output

[13] The adjusted R-squareds for transition and developed countries are higher in the regressions using the Heritage monetary performance index than in the regressions using inflation as the performance measure.

rather than inflation. Instead, our results suggest that independent central banks do not act in a way that neglects output stabilization.

We find some evidence that independence is negatively associated with overall variability, as measured by the equally weighted sum of inflation variability and real growth 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-squareds 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 with those in developed countries. In transition economies, central banks with larger boards, fewer outside directors, and longer governor terms have higher variability. But higher turnover among the governors and more central bank independence are 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 has 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 several alternative specifications of the performance regressions.[14]

(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:

$Inflation\ squared_{it}$ = annual CPI inflation squared in country i in year t.

The results differ little from the results for the absolute value of inflation presented.

(2) We investigated whether countries that implement monetary policy via inflation targeting have better outcomes than those that do not use inflation targeting. First, we entered a dummy variable indicator of inflation targeting into the regressions. Second, we estimated separate regressions for the inflation-targeting and non-inflation-targeting countries, by country group. Our results suggest that in most cases inflation targeting doesn't appear to have a significant relationship to performance outcomes or to change results reported in Table 2 in any significantly way. When inflation targeting is significant, it is 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). This might be evidence of reverse causality – countries that have had poor outcomes may have implemented inflation targeting.

(3) Finally, we investigated whether significant correlations would survive if instead of dividing our countries into groups according to the degree of economic development we used some other typology. We investigated two. First, we used data from the Polity IV project of the Center for International Development and Conflict Management at the University of Maryland to divide countries into groupings based on the degree to which their governments are more democratic and less autocratic. The dataset

[14] All of these results are available from the authors upon request.

includes a policy score that is computed by subtracting the autocracy score from the democracy score, yielding a polity score that ranges from −10 (strongly autocratic) to +10 (strongly democratic). We divided the 87 of our 96 countries for which there were polity scores into three groups based on the country's average polity score from 1996-2000. There were 19 countries in the least democratic group (which we defined as average polity score < 0); there were 40 countries in the middle group (with average polity score from 0 to 9); and there were 28 countries in the most democratic group (with average policy score = 10).

We find that at least some central bank characteristics remain significantly related to economic performance in each of the polity country groupings. Which particular variables are significant differs by performance measure, as it did in the regressions based on country groups categorized by level of economic development. There is no particular polity group that exhibits a stronger relationship between central bank characteristics and performance than another polity group; it depends on performance measure.

Our second typology was based on the origin of the country's legal system. A large body of work has found that a country's legal origin is correlated with economic and financial development (see La Porta, Lopez-de-Silanes, and Shleifer, forthcoming). For a large set of countries (which includes all the countries in our analysis), La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999) provide information on whether the origin of the country's legal system is German, Scandinavian, British (i.e., common law), or Socialistic. Since La Porta, Lopez-de-Silanes, Shleifer, and Vishny find that governments in countries with French or Socialistic legal origins performed worse than those with British legal origins, we grouped our countries into three groups: those with German or Scandinavian legal origins (11 of our 96 countries), those with French or Socialistic legal origins (53 of our 96 countries), and those with British legal origins (32 of our 96 countries).

Again we find that some central bank characteristics remain significant in each of the country groups categorized by legal origins.[15] Thus, our general conclusion from this investigation of alternative country groupings is that the significant relationships we found between central bank characteristics and performance for countries grouped by level of economic development were not driven by the country grouping per se.

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 payments technologies, and as more is learned about effective implementation of monetary policy, the organizational structure of central banks has become an area of research interest. There is new interest in better understanding the roles played by organizational structures, accountability, and transparency in increasing the efficiency and effectiveness of central banks in achieving their objectives and ultimately yielding better economic outcomes.

Although much has been written pointing out the potential role institutional form can play in central banks, little empirical work has been done to investigate this hypothesis. To fill this void, our paper asks two simple questions: first, can we find a significant statistical relationship between central bank institutional characteristics and 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?

In answer to our first question, our findings suggest that there are some significant associations, but that there is no definitive conclusion that central bank organizational structure has strong correlations

[15] In the grouping of countries with German and Scandinavian legal origins, the supervision variable, indicating whether the central bank was involved in bank supervision as well as monetary policy, had to be excluded from the regressions since these roles are separated in these countries.

with economic performance, either positively or negatively. For example, we did not find a strong correlation between the size of the board and the percentage of outside directors on the board with performance. Moreover, in some cases, the associations are not the expected ones. For example, we find that the central bank's independence 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 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 sufficiently long time frame over which there has been enough variation in economic outcomes. Or our results 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 future exploration.

Table 1. Difference-in-Means Tests across Country Groups

Variable Name	Mean		
Country Group →	**Transition Countries**	**Developing Countries**	**Developed Countries**
	(1)	**(2)**	**(3)**
Inflation	20.01**, †††	10.33‡‡‡	2.19
	(36.70)	(15.54)	(1.97)
Abs(Inflation)	20.08**, †††	10.52‡‡‡	2.33
	(36.67)	(15.41)	(1.8)
Inflation variability	78.42**, ††	9.68‡	0.88
	(326.84)	(75.84)	(0.77)
Heritage monetary performance index	49.49***, †††	69.85‡‡‡	83.8
	(27.01)	(14.55)	(4.93)
Real growth	3.77	3.56	3.59
	(4.37)	(3.64)	(2.39)
Real growth variability	3.51**, †††	2.64‡‡‡	1.27
	(3.41)	(2.38)	(1.3)
Inflation and real growth variability	40.97**, ††	6.28‡‡	1.05
	(163.53)	(39.18)	(0.85)
Problem loans	6.58**, †††	5.25‡‡‡	3.82
	(5.62)	(5.23)	(4.39)
Exchange rate variability	7.10	34.51‡‡	5.13
	(9.27)	(231.31)	(14.51)
Directors	8.22***, ††	7.13‡‡‡	9.48
	(2.62)	(2.66)	(4.87)
Outside directors (%)	14.15***	27.17‡‡‡	16.63
	(19.98)	(29.63)	(25.75)
Term unspecified	0.052	0.096	0.111
	(0.224)	(0.295)	(0.315)
Term length	5.58***, ††	3.94‡‡‡	5.07
	(1.57)	(1.70)	(2.04)
Turnover	0.292†††	0.288‡‡‡	0.15
	(0.212)	(0.207)	(0.09)
Independent	0.211***,†††	0.077‡‡‡	0.777
	(0.410)	(0.267)	(0.417)
Supervision	0.421**	0.31‡‡	0.41
	(0.496)	(0.46)	(0.49)
Age	30.63***,†††	44.46‡‡‡	119.55
	(30.92)	(25.21)	(81.05)

Note: Standard deviation is in parenthesis.

*, **, *** denote transition country mean significantly different from developing country mean at the 10%, 5%, 1% level, respectively.

†, ††, ††† denote transition country mean significantly different from developed country mean at the 10%, 5%, 1% level, respectively.

‡, ‡‡, ‡‡‡ denote developing country mean significantly different from developed country mean at the 10%, 5%, 1% level, respectively.

Table 2. Regression Results: Associations between Central Bank Performance and Central Bank Governance Characteristics

	Dependent Variable								
	Inflation			Inflation variability			Abs(Inflation)		
Country Group →	**Transition**	**Developing**	**Developed**	**Transition**	**Developing**	**Developed**	**Transition**	**Developing**	**Developed**
Independent Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Intercept	88.87**	14.20**	1.51	649.23**	55.56*	−0.028	88.97**	13.87**	1.51
Directors	0.89	−0.051	0.095**	−20.28	0.67	0.034**	0.87	−0.025	0.11***
Outside directors	0.29	0.016	0.00019	7.56***	0.029	0.000039	0.29	0.019	−0.0036
Term unspecified	−81.61**	−13.23**	−0.70	−264.98	−36.81	0.46	−80.75**	−12.41**	0.27
Term length	−11.88**	0.00	−0.24	−51.76	−6.45	−0.054	−11.90**	0.041	−0.24
Turnover	−20.16	−3.59	2.65	75.01	−25.07	2.80***	−20.02	−3.73	3.20*
Independent	−19.50*	24.27***	1.02**	−116.20	5.01	0.036	−19.52*	24.01***	0.54
Supervision	16.52**	0.53	1.04***	40.23	11.86	0.45***	16.52**	0.84	1.388***
$Year_{1997}$	−10.60	−4.15	−0.36	−249.07**	−23.27	0.015	−10.60	−4.37	−0.36
$Year_{1998}$	−13.77	−2.63	−0.82	−292.58***	−23.71	0.083	−13.68	−2.68	−0.79*
$Year_{1999}$	1.18	−4.18	−1.46	−284.41***	−24.26	0.19	1.34	−4.09	−1.12***
$Year_{2000}$	−9.68	−4.94*	−0.33	−287.26***	−24.15	0.50***	−9.59	−4.97*	0.0084
N	95	240	130	95	240	130	95	240	130
F−Statistic	1.79*	4.56***	2.94***	2.93***	0.92	4.60***	1.78*	4.41***	5.35***
Adjusted R-Squared	0.0846	0.1407	0.1419	0.1839	−0.0036	0.2351	0.0838	0.1357	0.2706

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

Table 2. Regression Results: Associations between Central Bank Performance and Central Bank Governance Characteristics (continued)

	Dependent Variable								
	Real growth			Real growth variability			Inflation and real growth variability		
Country Group →	**Transition**	**Developing**	**Developed**	**Transition**	**Developing**	**Developed**	**Transition**	**Developing**	**Developed**
Independent Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Intercept	13.61***	4.97***	−2.20	−0.23	2.30**	4.18***	324.50**	28.88*	2.55***
Directors	−0.79***	0.16*	0.13**	0.39*	−0.088	−0.039	−9.95	0.36	−0.017
Outside directors	0.053*	0.0086	−0.0048	−0.055**	0.0036	0.00028	3.75***	0.015	0.0011
Term unspecified	−0.95	−0.77	3.88***	−0.52	1.70**	−1.15	−132.75	−17.87	−0.40
Term length	−1.15*	−0.21	0.50**	0.66	0.13	−0.30**	−25.55	−3.06	−0.16**
Turnover	6.29*	−1.06	8.18**	−1.81	1.52**	−0.72	36.60	−11.95	−0.41
Independent	−0.43	0.059	−0.035	−2.72***	−0.39	−1.24***	−59.46	1.22	−0.86***
Supervision	0.10	−0.75	0.44	0.0089	0.34	0.24	20.12	6.18	0.36**
$Year_{1997}$	1.06	−0.99	0.59	−0.55	−0.37	−0.11	−124.81**	−12.79	−0.059
$Year_{1998}$	0.079	−2.24***	−0.20	−1.72*	−0.43	0.19	−147.15***	−13.07	0.12
$Year_{1999}$	−0.38	−2.49***	0.18	−1.54	−0.51	0.11	−142.98***	−13.10	0.12
$Year_{2000}$	2.04	−0.76	1.15*	−2.08**	−0.39	0.24	−144.67***	−13.13	0.30
N	95	245	130	95	245	130	95	225	125
F−Statistic	1.72*	2.45***	2.21**	3.01***	1.41	3.47***	2.93***	0.87	4.62***
Adjusted R-Squared	0.0775	0.0614	0.0934	0.1906	0.0180	0.1740	0.1844	−0.006	0.2429

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

Table 2. Regression Results: Associations between Central Bank Performance and Central Bank Governance Characteristics (continued)

	Dependent Variable								
	Heritage monetary performance index			Problem loans			Exchange rate variability		
Country Group →	**Transition**	**Developing**	**Developed**	**Transition**	**Developing**	**Developed**	**Transition**	**Developing**	**Developed**
Independent Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Intercept	51.92***	53.43***	82.53***	0.371	10.55***	3.74	−19.00***	311.23***	4.36
Directors	−3.65***	0.30	−0.17*	0.54	−0.090	0.023	1.38***	−9.72*	0.33
Outside directors	−0.10	−0.014	0.039**	−0.075*	−0.021*	0.0041	−0.16***	0.33	0.080
Term unspecified	19.84	22.27***	2.89	1.53	−6.27***	0.40	14.11**	−272.79***	−7.82
Term length	−1.90	2.06**	0.38	0.49	−1.18***	−0.17	4.86***	−51.11***	−2.80**
Turnover	29.15**	4.61	−9.75**	−1.94	0.44	−3.30	−24.44***	−47.39	0.16
Independent	26.59***	−10.88***	3.01***	−2.39	−2.33*	0.28	−4.17**	−11.08	9.38***
Supervision	4.29	2.02	−4.85***	−0.63	0.40	0.24	8.50***	19.92	2.63
$Year_{1997}$	9.24	0.67	0.096	1.78	1.74*	2.06*	0.86	1.99	2.52
$Year_{1998}$	19.12***	2.57	1.08	1.98	1.35	0.53	0.91	13.11	2.94
$Year_{1999}$	36.19***	5.92**	1.69	2.59	1.44	2.03*	1.21	65.83	3.06
$Year_{2000}$	42.89***	6.96**	2.79**	0.12	1.11	0.093	1.15	10.76	6.29*
N	88	245	134	95	260	135	95	250	135
F−Statistic	12.76***	3.93***	6.95***	1.17	3.19***	0.79	8.54***	2.16**	2.12**
Adjusted R−Squared	0.5978	0.1168	0.3299	0.0196	0.0852	−0.0172	0.4686	0.0487	0.0840

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

Appendix

Table A1. 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, Colombia, 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 A2. Variable Definitions

Variable Name	Definition	Data Source	Year
Performance Measures			
Inflation	Annual CPI inflation rate	Calculation based on World Development Indicators (WDI) 2005 Data Disk	1996-2000
Abs(Inflation)	Absolute value of the annual CPI inflation rate	Calculation based on World Development Indicators (WDI) 2005 Data Disk	1996-2000
Inflation squared	Annual CPI inflation rate squared	Calculation based on WDI 2005 Data Disk	1996-2000
Inflation variability	Standard deviation of annual CPI inflation rate over the previous 3 years	Calculation based on WDI 2005 Data Disk	1996-2000
Heritage Monetary Index	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
Real growth	Annual growth rate of real GDP	WDI 2005 Data Disk	1996-2000
Real growth variability	Standard deviation of annual real GDP growth over the previous 3 years	Calculation based on WDI 2005 Data Disk	1996-2000
Inflation and real growth variability	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
Problem loans	Problem loan ratio = dollar volume of problem loans as a percent of dollar volume of total loans	Bankscope database	1996-2000
Exchange rate variability	Standard deviation of the exchange rate from monthly data	IMF *International Financial Statistics* (IFS)	1996-2000

Variable Name	Definition	Data Source	Year
Characteristics of the Central Bank			
Directors	Number of directors on the central bank's board	Calculation based on IMF IFS	1996-2000
Outside directors	Number of outside members on the board as a percent of total number of directors on the board	Calculation based on IMF IFS	1996-2000
Term unspecified	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
Term length	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
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 = 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 = 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 the European Bank for Reconstruction and Development (EBRD) source	1996-2000
Supervision	Dummy variable = 1 if the central bank is involved in bank supervision as well as monetary policy, and = 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
Inflation target	Dummy variable = 1 if central bank implements monetary policy by setting a numerical inflation	Websites, Other Research Papers (see list for the variable INDEPENDENT),	1996-2000

Variable Name	Definition	Data Source	Year
	target and = 0 otherwise	and EBRD sources	

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