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Central bank independence, growth, investment, and real rates*

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Abstract

This paper uses new measures of central bank independence (CBI) for a sample of up to seventy countries in order to investigate the effect of CBI on growth, private investment, productivity growth, and the variability (over time) of growth, controlling for other variables. The proxies for independence are an aggregate index of legal independence based on sixteen specific features of the central banks' charters and the average turnover rate of central bank governors. The paper also addresses the issue of simultaneity between growth and inflation by using an index of political vulnerability of the central bank. This index is the fraction of political transitions which are followed, within a short period of time, by a replacement of the governor of the central bank.

A main finding of the paper is that CBI has a positive effect on growth in LDCs (less-developed countries) and no effect within industrial countries.

The paper also presents evidence on the relation between CBI and the distribution of interest rates.

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1. Introduction

It is generally believed that a high degree of central bank independence (CBI) reduces the inflationary bias of policy and enhances the credibility of stable monetary policies. To the extent that higher and less-stable inflation rates cause inefficient resource allocation and discourage investment, we would therefore expect more CBI to lead to higher growth on average. But, by reducing the scope for policies to maintain full employment and to encourage investment directly, more independence of the central bank (CB) may reduce the average performance of the economy and the long-run rate of growth.¹ Thus it is ambiguous a priori which way central bank independence will affect real growth.

Recent evidence supports the view that there is a clear-cut negative relation between CBI and the level and variability of inflation (Grilli, Masciandaro, and Tabellini (1991), Cukierman, Webb, and Neyapti (1992), Cukierman (1992, Chapter 20) and Alesina and Summers (1993)). The evidence with respect to the relation between growth and CBI is not as clear. Grilli, et al. and Alesina and Summers find no relation between growth and CBI in industrial economies. Delong and Summers (1992), however, find, after controlling for initial GDP, a positive relation between growth and CBI in a sample of 15 industrialized economies.

Obtaining wider and more solid evidence on the relationship between growth and CBI is interesting for several reasons. First, it may shed some light on whether reduced discretion is good or bad for growth. Second, it should make it possible to determine whether the negative effect of inflation on growth found in recent studies like Fischer (1991) is due to unstable macroeconomic policies or to a reverse causality in which negative real shocks, by reducing real output growth, push the price level up.

Measuring CBI is not easy. Existing studies were therefore limited to industrial economies and to proxies of legal independence. Those proxies are poor indicators of actual independence in less-developed countries (LDCs). This paper utilizes new broadly-based and unified measures of CBI for a sample of about sixty countries. Those include aggregate indices of legal independence and the actual turnover of CB governors. Details appear in Cukierman, Webb, and Neyapti (1992) and in Chapter 19 of Cukierman (1992).

Recent literature (Barro, 1991, is a representative example) has identified a number of variables like initial GDP and education that partially account for the cross-sectional variability in rates of growth during the last three decades. After controlling for some of those variables and other time-related

¹Those who advocate such policies must believe that nominal contracts and/or informational asymmetries produce sufficiently long-lasting effects of money on the economy.

variables, like changes in terms of trade, this paper investigates the effect of CBI on growth. Both cross-sectional and pooled cross-section time series (across decades) regressions are tried.

The experiments reported here show no evidence of a relationship between growth and CBI within industrial countries but that growth is positively related to CBI in most LDCs. Differences in CBI also help account for differences in growth residuals between the two groups of countries. This evidence takes the form of a *ceteris paribus* significant negative relationship between growth and two measures of actual CB dependence. One measure is the frequency of turnover of CB governors and the other is the fraction of political transitions that is followed within a short period of time by a replacement of the CB governor. The first measure was found to be a good proxy for inflation in LDCs (Cukierman, Webb, and Neyapti (1992) and Chapter 20 of Cukierman (1992)). The second measure is a proxy for the political vulnerability of the CB. Both measures have a significant negative impact on growth within LDCs as well as in the entire sample of countries.

These proxies for CB dependence are also used to shed more light on the issue of potential reverse causality in growth equations in which inflation is used as a proxy for unstable monetary policy as an explanatory variable. This is done by using turnover, or the index of CB (political) vulnerability, or both as instruments for inflation. Controlling for other determinants of growth, the impact of inflation on growth is still negative, but less significant than in the ordinary least squares regressions. The paper also looks at the relation between private investment, productivity growth, and the intra-country variability of growth on one hand and CBI on the other. New evidence on interest rates and CBI is also presented. Both nominal and real rates are less variable the higher is CBI, and *ex post* real deposit rates are, in many cases, higher on average in countries with more independent central banks.

To make the paper self-contained, Section 2 discusses the construction of the indices of CBI used in the rest of the paper. Section 3 develops a benchmark growth equation and uses it to investigate the effect of CBI on growth. The issue of potential simultaneity between growth, inflation, and Central Bank governors' turnover is investigated empirically in Section 4. Evidence on private investment, productivity growth, and CBI is presented in Section 5. The relation between the intra-country variability of growth and of growth residuals on one hand and CBI on the other is taken up in Section 6. Section 7 presents new evidence on interest rates and CBI. The last section concludes.

2. Measures of central bank independence (CBI) – an overview

Central bank independence depends on many attributes which are not easily quantifiable. As a consequence, existing evidence on the relationship between growth and CBI relies only on legal independence and is restricted to the industrial countries (Grilli, Masciandaro, and Tabellini (1991) and Alesina and Summers (1993)). There often are serious gaps though, between legal independence and actual independence. These gaps are particularly notable in LDCs. Additional indicators of CBI are therefore needed.

For the most part the paper utilizes two proxies for CBI. The first is an aggregate index of legal independence based on sixteen characteristics of central bank charters. The second is the *actual* turnover of central bank governors. To deal with potential simultaneity problems, we also use an index of political vulnerability of the central bank. These indices are available for a sample of up to seventy countries, including all the industrial countries and up to fifty LDCs. We do not claim that these proxies capture all the dimensions of CBI, but they are the most comprehensive systematic measures currently available and probably the only ones that provide information on actual as well as on legal independence. This is particularly important for LDCs, where actual and legal independence differ substantially.

a. Legal independence²

Besides being an essential component of actual independence, legal independence is of independent interest for several reasons. First, it suggests the degree of independence that legislators meant to confer on the central bank (CB). Second, most existing attempts at the systematic characterization of CBI rely solely on legal aspects of independence. Availability of an index of legal independence is therefore needed to establish comparability with previous studies.

The specific features of legal independence, used to construct the aggregate index of legal independence, are constructed in the following manner: A code of independence is assigned to each central bank for each characteristic based on a limited number of narrow but relatively precise legal characteristics. Only the written information from the charters is used. Additional information on how the law is applied in practice is deliberately left out because it is reflected by separate indices.

The coded legal characteristics of “variables” can be divided into four groups: (1) variables concerning the appointment, dismissal, and term of office of the chief executive officer (CEO) of the bank (usually the governor); (2) variables concerning the resolution of conflicts between the executive branch

and the CB and the degree of participation of the CB in the formulation of monetary policy and in the budgetary process; (3) final objectives of the CB as stated in its charter; and (4) legal restrictions on the ability of the public sector to borrow from the CB. Such restrictions take the form of various limitations on the volume, maturity, rates, and width of direct advances and of securitized lending from the CB to the public sector.

In coding various central banks by the degree of independence within each group of characteristics, the following criteria are used: central banks in which the legal term of office of the CEO is longer and in which the executive branch has little legal authority in the appointment or dismissal of the governor are classified as more independent on the CEO dimension. By the same logic, central banks with wider authority to formulate monetary policy and to resist the executive branch in cases of conflict are classified as more independent on the policy formulation dimension.

Central banks in which the only or main objective of policy (as specified in the charter) is price stability are classified as being more independent in this dimension than central banks with a number of objectives in addition to price stability. These banks are in turn classified as being more independent than banks with a large number of objectives or banks in whose charter price stability is not mentioned as an objective at all. This classification of the “objectives” variable is designed to capture the legal mandate of the bank to single-mindedly pursue the objective of price stability. (One of the few central banks in which such an unequivocal legal mandate exists is the Bundesbank.) It does not therefore reflect (as the previous two groups of variables) the general level of independence from government. It indicates, instead, the legal mandate of the CB to elevate the target of price stability above other objectives. In Rogoff’s (1985) terminology, it measures how strong is the “conservative bias” of the CB as embodied in the law.

Similarly we classify banks in which the limitations on lending from the CB to the public sector are stricter as more independent to pursue the objective of price stability. These limitations encompass a number of more detailed variables such as separate limitations on advances and securitized lending and restrictions on maturities and on interest rates. Generally, the stricter the limitation, the higher is the independence coding given to the bank on that dimension. The comparability of various types of limitations is complicated because different countries specify limitations in terms of different reference variables. A few countries specify limitations in absolute cash amounts, and others use a percentage of CB liabilities. The most prevalent type of limitation is formulated as a percentage of revenues, and in a minority of cases as a percentage of government expenditures. The “bite” of these limitations obviously depends on the magnitudes of the reference variables. Other things the same, however, absolute cash limits are more binding than

²This and the following subsection draw on Chapter 19 of Cukierman (1992).

limits in terms of government revenues. The most accommodative limits are those specified in terms of government expenditures. These considerations are embodied in a "type of limit" variable and also influence the coding of the severity of limitations on loans to government via advances and securitized lending.

Limitations on lending are also classified as stricter, the nearer the rates paid by government to market rates and the shorter the maturities of the loans from the CB to the public sector. They are also stricter, the narrower the circle of institutions that are allowed to borrow from the CB and the smaller the discretion of the executive branch in deciding to whom the CB will lend and how much. In addition, central bank laws that prohibit the CB from buying government securities on the primary market are considered, *ceteris paribus*, stricter than laws that do not contain such a prohibition.

Altogether, sixteen different legal variables are coded using a scale ranging between 0 (smallest level of independence) to 1 (highest level of independence). The number of independence levels generally varies across legal variables depending on the fineness of data on alternative legal characteristics. Using a two-step procedure, the sixteen legal variables are aggregated into a single overall measure of legal independence. This overall index is basically a weighted average of the sixteen legal variables. It varies during the eighties, between a maximum of 0.69 (for Germany) and a minimum of 0.10 (for Poland). The median level of legal independence is about the same in developed countries and in LDCs. Further details on the coding of the legal variables appear in Table 19.1 of Cukierman (1992) or in Table 1 of Cukierman, Webb, and Neyapti (1992).

b. The turnover rate of Central Bank Governors as a proxy of actual independence

As most practitioners in the area of monetary policymaking are well aware, the legal status of a central bank is only one of several elements that determines its actual independence. Although there are important variations in the degree of completeness of different CB laws, many are highly incomplete and leave a lot of room for interpretation. As a result, factors such as tradition or the personalities of the governor and other high officials of the bank at least partially shape the actual level of CB independence. Even when the law is quite explicit, it may not be operational if there is a tradition or an understanding within government that things should be done in a different way. A striking example is Argentina, in which the legal term of office of the governor is four years. But there is also an informal tradition that the governor of the CB offers his resignation to the executive whenever there is a change of government or even of the finance minister. Argentinian governors invariably adhered to this tradition. As a consequence, the average actual

term of office of the governor in Argentina during the 1980s was about ten months. Obviously the actual degree of independence of the Argentinian CB is substantially lower than the one implied by measures of legal independence including, in particular, the four-year legal term of office.

There are no obvious indicators of actual, as opposed to legal, CB independence. This is not because the matter is not important, but because it is hard to find systematic indicators of actual independence when it diverges from legal independence. The extreme case of Argentina, though, suggests that at least above some threshold the turnover rate of central bank governors is a proxy of (lack of) actual independence. The average yearly turnover rate between 1950 and 1989 ranges from a minimum of 0.03 (average tenure of 33 years) in Iceland to a maximum of 0.93 (average tenure of about thirteen months) in Argentina. Turnover rates in LDCs tend to spread into a range that has not been experienced in the developed countries (DC). The highest turnover among the DC is 0.2 (average tenure of five years) for Spain and Japan. More than half of the LDCs have turnover rates exceeding this.

Low turnover does not necessarily imply a high level of CB independence - a relatively subservient governor may stay in office longer precisely because he does not stand up to the executive branch. This may be true for countries with exceptionally low turnover rates such as Iceland, Denmark, Britain, and the United States. In such countries turnover is probably unrelated to independence. On the other hand, it is very likely that above some critical turnover rate CB independence is lower the higher the turnover rate of CB governors. One reason is that for sufficiently high turnover rates the tenure of the CB governor is shorter than that of the executive branch. This makes the governor more susceptible to influence by the executive branch and discourages him or her from trying to implement longer-term policies the lower the expected tenure. Since in most countries the electoral cycle is at least four years, it is likely that the threshold turnover is somewhere between 0.2 and 0.25 (average tenure of four to five years). In addition, for very short terms of office such as three years or less (turnover rates of 0.33 or larger), it is generally more difficult to implement long-term policies for any electoral cycle.

The benefits of price stability accrue after a while whereas the employment and high-interest costs of stabilization occur upfront. Similarly, a positive inflationary surprise produces immediate benefits, but the full costs of this policy (in terms of lower credibility and higher inflation) appear later. Central bank governors with shorter horizons in office are therefore more likely to succumb to inflationary temptations. Hence, there should be a positive association, at least above some threshold, between inflation and turnover. The evidence supports this implication for LDCs; for industrial economies the turnover rates are all below the threshold (Cukierman, Webb,

and Neyapti (1992) and Chapter 20 of Cukierman (1992)). This result is consistent with the view that turnover is a reasonable proxy for CBI within LDCs but not necessarily in the group of industrial economies. By contrast legal independence appears to be a reasonable proxy for actual independence in developed economies but not in LDCs.

c. A measure of the political vulnerability of the central bank

A central bank whose chief executive officer is frequently replaced following political transitions is likely to be more dependent on the political authorities than a central bank in which the governor outlives most political changes. This notion is captured by using an index of political vulnerability of the central bank developed in Cukierman and Webb (1993). The index is defined as the fraction of times that a political transition is followed within 6 months by a replacement of the central bank governor. The index ranges between a minimum of zero for a number of countries (including the United States, Canada, and Austria) and a maximum of 1.375 (for Argentina). It is generally lower in developed economies than in LDCs. Within LDCs, it is higher in countries that alternate between democratic and authoritarian regimes. The vulnerability index is used in Section 4 in order to resolve potential problems of simultaneity between growth on one hand and inflation and political instability on the other. Section 4 also contains additional details on the construction of the vulnerability index and on a decomposition of turnover into political and nonpolitical components.

3. Growth and central bank independence

a. Introduction and background

Existing evidence on the relationship between growth and CBI is consistent with the view that growth is independent of CBI (Grilli, Masciandaro, and Tabellini (1991) and Alesina and Summers (1993)). This evidence is nevertheless, restricted to the industrial countries and it does not attempt to control for other important determinants of growth.³ This paper extends the existing literature along three dimensions. First, it controls for other determinants of growth. Second, it enlarges the sample to sixty countries, including LDCs as well as industrial countries. Finally, it utilizes the new measures of CBI described in the previous section. Those measures are uniformly available for industrial and developing economies. An important finding of previous work that utilizes those measures is that legal independence performs relatively well in explaining inflation differentials among industrial

³A recent exception is Delong and Summers (1992) who control for initial GDP for a subset of the industrial countries.

countries, while the turnover rate of central bank governors performs better in explaining those differentials among the LDCs (Cukierman, Webb, and Neyapti (1992) and Chapter 20 of Cukierman (1992)). We therefore presume that legal independence is a better proxy for independence in industrial countries and the turnover rate of Central Bank Governors is a better proxy for LDCs. But we experiment with both proxies for all countries as well. The different meaning of legal independence in industrial and in developing countries is discussed in Chapter 23 of Cukierman (1992). Figure 1 presents a plot of the average per capita rate of growth between 1960 and 1988, from Summers and Heston (1991), against the average turnover rate of Central Bank Governors between 1960 and 1989. The data points are spread all over the plane, corroborating (in a wider sample) the findings of previous work, which found no relation between growth and CBI. A regression of per capita growth on turnover confirms the lack of a relationship. Similar results obtain with the aggregate legal measure of CBI.

b. Controlling for other determinants of differences in growth

Recent literature has identified a number of structural determinants of growth, like initial GDP and initial enrollment ratios for primary and for secondary education (Barro, 1991). In addition, changes in terms of trade, particularly in LDCs, are important for export-led growth. After experimenting with various specifications of growth equations, we finally settled on a benchmark equation in which per capita growth is regressed on initial GDP, initial primary and secondary education enrollment ratios, and a measure of change in terms of trade. The first three regressors are from the Barro-Wolf (1989) data set. The terms of trade are measured as the ratio of export unit values to import unit values from the International Financial Statistics for all the countries for which both of those measures are available. For the remaining countries (up to 15) a similar measure developed in The World Bank is used.⁴ This benchmark regression is run initially on a cross-section of up to 55 countries during the period between 1960 and 1989. Adding either legal CBI or the turnover of Central Bank Governors during the same period does not produce significant coefficients for these proxies of CBI, as can be seen from the first two columns of Table 1.

Cross-section regressions over 30-year periods are likely to be missing the effect of time-dependent shocks on the time profile of growth within each

⁴Further details appear on p. 280 of the World Development Report (1991). We also experimented with other terms of trade measures but settled on this one because it is significant in the largest number of cases. Since most of the LDCs in the sample are small open economies, their terms of trade may be taken as exogenous. This assumption is more problematic for large developed economies like the U.S. and Japan.

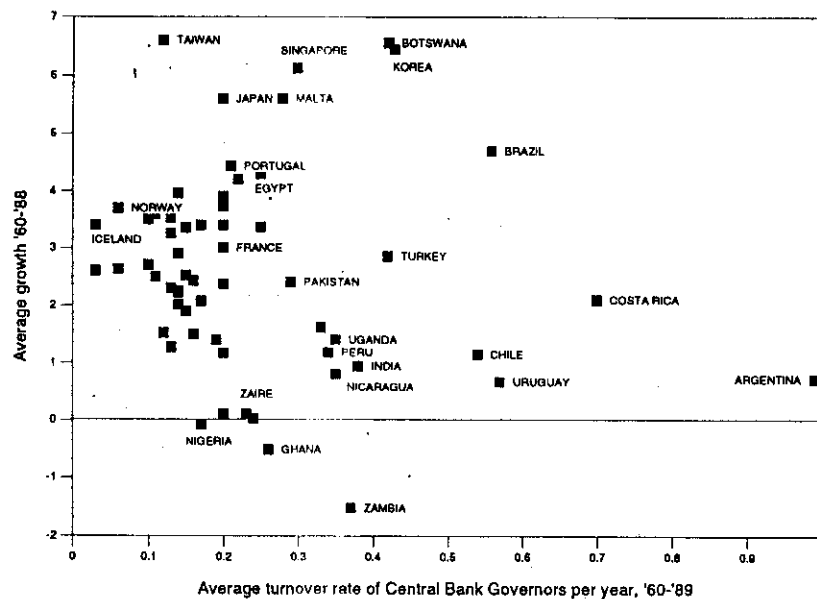


Figure 1
Growth and governors' turnover

Table 1:
Growth and CBI - Cross-Section and Panel

| DEPENDENT VARIABLE: Per Capita Growth Rate | | | | | |
|---|---------------------|--------------------|---|--------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) |
| | Cross-Section | | Pooled Cross-Section Time Series (Panel) | | |
| Constant | 1.37* (1.8) | 2.01* (2.3) | 0.28 (0.3) | 0.62 (0.6) | 0.94 (1.0) |
| Initial GDP | -0.0005** (-3.6) | -0.0003* (-2.1) | -0.0002** (-2.2) | -0.0002* (-2.0) | -0.0002** (-2.6) |
| Change in Terms of Trade | 20.26* (2.1) | 21.44* (2.1) | 28.33** (4.76) | 30.65** (4.71) | 30.01** (5.1) |
| Initial Primary Education Enrollment Ratio | 2.25* (2.4) | 2.19* (2.1) | 0.73 (0.7) | 0.95 (0.9) | 1.12 (1.2) |
| Initial Secondary Education Enrollment Ratio | 3.60* (2.3)* | 1.49 (1.0) | 2.69* (2.1) | 2.55* (1.9) | 2.32* (1.8) |
| Legal Independence | | -1.92 (-1.0) | | -1.48 (-0.9) | |
| Central Bank Governors Turnover Rate | -0.20 (-0.1) | | | | -2.17* (-2.1) |
| Dummy for the '60s | | | 2.41** (4.3) | 2.30** (4.0) | 1.91** (3.4) |
| Dummy for the '70s | | | 1.77** (3.4) | 1.80** (3.4) | 1.56** (3.1) |
| \bar{R}^2 | 0.29 | 0.20 | 0.22 | 0.21 | 0.25 |
| $P(\rho)$ | | | 0.05 | 0.12 | 0.07 |
| No. of Observations | 52 | 52 | 146 | 139 | 141 |

t-statistics are in parentheses under the coefficients.
 $P(\rho)$ is the significance level of a first-order autoregressive coefficient from a regression of the residuals of each country in each decade on the residuals of the same country in the previous decade.
 * significant at the 0.05 level.
 ** significant at the 0.01 level.

country.⁵ In particular it is likely that over such a long period, terms of trade of individual countries move in offsetting directions, obscuring some of the potential effect of terms of trade on growth. To account for such effects we run a pooled cross-section, time-series regression in which the observations for each country are broken down by decades (1960-69, 1970-79, 1980-89). Rates of change are now decade averages and initial GDP and enrollment ratios for primary and for secondary education are now taken at the beginning of each decade. To account for other possible time-specific variations across the broad subperiods, decade dummies are included as well. Such a regression that does not include measures of CBI as regressors is shown in the third column of Table 1 (we refer to it as the benchmark panel regression). It is notable that the decade dummies are highly significant and that, in line with our prior, the rate of change in the terms of trade is substantially more significant than it was in the cross-section regressions. This supports the view that the panel benchmark is a more relevant point of departure.

We then add decade-specific proxies for CBI within each country as regressors. The results are summarized for aggregate legal CBI and for Central Bank Governors turnover in the fourth and fifth columns of Table 1. It is apparent that the first variable is insignificant. But the turnover of Central Bank Governors has a significant negative impact on per capita income growth. The coefficient of turnover implies that a 0.1 increase in turnover (one more per decade) reduces the average rate of growth, other things the same, by about 0.2 percent per year. To illustrate the orders of magnitude involved, consider Chile with an average yearly turnover of 0.54 and Indonesia with a turnover of about 0.22 over the 60-89 period. Taken literally, this implies that about 0.7 percentage points of the difference in average yearly growth rates between these two countries is attributable to the difference in turnover.

One should not interpret this to imply that a reduction of 0.1 in turnover without any other change will raise average yearly growth by 0.2 percent, but it is usually the case that a lower turnover of Central Bank Governors is associated with a more stable macroeconomic policy environment. When this, and other related factors, change in conjunction with the lower turnover, it seems reasonable to expect an increase in the average rate of growth of the order of magnitude implied by the regression results. A parable may sharpen the argument. Measuring turnover is analogous to taking the temperature of a sick patient. A high temperature is a signal that something is wrong. This does not mean that a reduction of temperature by means of aspirin without taking care of the root cause is going to cure the patient. However, after treatment of the root cause, a reduction in temperature is usually taken as

⁵Easterly, Kremer, Prichett, and Summers (1992) show that growth rates are highly unstable over time.

a signal of recovery. Similarly the reduction of turnover at the central bank without doing anything else is tantamount to the treatment of a symptom only. However, when the central bank is given more authority to pursue stable policies, this is normally accompanied by a reduction in turnover. In such cases, turnover is a good proxy for the quality of policymaking institutions.

In summary, although the experiments described in this subsection do not show any effect of legal independence on growth, the lack of actual independence as proxied by turnover does have a significant negative effect on growth when one controls for both cross-sectional and decade-specific factors.

c. The effect of outlier countries

Figure 2 presents a plot of the residuals from the benchmark cross-sectional regression (not shown in Table 1) against the turnover of Central Bank Governors. It is apparent from the figure that Botswana, Brazil, Korea, and Argentina are outliers. But there is a difference between the first three countries and Argentina. Botswana, Korea, and Brazil managed to maintain exceptionally high growth residuals in spite of sizeable turnover rates of Central Bank Governors. Argentina, by contrast, sticks out in that it has the highest turnover of Central Bank Governors and one of the lowest growth residuals.

In order to determine whether outliers are responsible for the existence or the absence of a relationship between growth and CBI, the panel regressions from Table 1 have been rerun without the outliers. The first two columns of Table 2 summarize the results with turnover as a proxy for dependence. Column 1 excludes all four outliers and column 2 only Botswana, Brazil, and Korea. The third column also excludes these three countries but replaces turnover with legal independence. The first two columns show that, independently of whether Argentina is included or excluded, lack of central bank independence as proxied by turnover has a highly significant negative impact on growth. Although significance is reduced somewhat (to 0.0018 and a t-statistic of -3.2) by the exclusion of Argentina, turnover is now still more significant than in the panel regression including the outliers (column 5 of Table 1). The exclusion of outliers also dramatically reduces the significance of cross-decades correlation in the residuals. The third column of the table reconfirms that legal independence is unrelated to growth.

Analysis of the correlation across decades between growth residuals and turnover within the four outlier economies reveals a definite negative correlation in Brazil, a mild negative correlation in Argentina and Korea, and no relation in Botswana.⁶

Equation (2) in Table 2 was reestimated with the addition of alternate measures of political instability, including the Barro-Wolf (1989) assassina-

⁶Observations on Botswana are available for only two of the three decades.

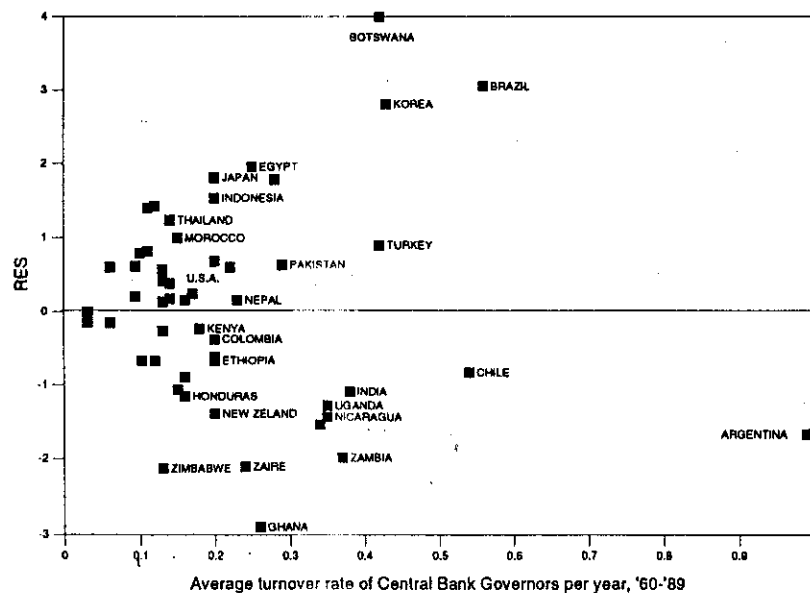


Figure 2

Cross-sectional growth residuals and governors turnover*

* RES are the residuals from a regression of per capita growth on initial values of GDP per capita, primary and secondary enrollment ratios, and the average change in terms of trade.

Table 2:
Growth and CBI Excluding Outliers

| | DEPENDENT VARIABLE: Per Capita Growth Rate | | | |
|--|--|--------------------|-------------------|---------------------|
| | (1) ^a | (2) ^b | (3) ^b | (4) ^b |
| | Pooled Cross-Section | | Time Series | Cross-Section |
| Constant | 1.50 (1.6) | 1.08 (1.3) | 0.24 (0.2) | 1.34* (2.3) |
| Initial GDP | -0.0002* (-2.3) | -0.0002* (-2.2) | -0.0001 (-1.5) | -0.0005** (-4.1) |
| Change in Terms of Trade | 27.53** (4.9) | 28.15** (5.1) | 29.12** (4.6) | 14.84 (1.9) |
| Initial Primary Education Enrollment Ratio | 0.86 (0.9) | 0.99 (1.1) | 0.78 (0.7) | 2.56** (3.4) |
| Initial Secondary Education Enrollment Ratio | 2.09 (1.6) | 2.11 (1.7) | 2.40 (1.8) | 3.23* (2.7) |
| Legal Independence | | | -0.81 (-0.5) | |
| Central Bank Governors Turnover Rate | -4.74** (-3.2) | -3.51** (-3.3) | | -2.52* (-2.2) |
| Dummy for the '60s | 1.82** (3.4) | 1.92** (3.6) | 2.35** (4.1) | |
| Dummy for the '70s | 1.33** (2.7) | 1.39** (2.9) | 1.62** (3.1) | |
| \bar{R}^2 | 0.29 | 0.29 | 0.21 | 0.46 |
| $P(\rho)$ | 0.54 | 0.52 | 0.52 | |
| No. of Observations | 130 | 133 | 131 | 49 |

t-statistics are in parentheses under the coefficients.

$P(\rho)$ is the significance level of a first-order autoregressive coefficient from a regression of the residuals of each country in each decade on the residuals of the same country in the previous decade.

* significant at the 0.05 level.

** significant at the 0.01 level.

^a excluding Argentina, Botswana, Brazil, Korea

^b excluding Botswana, Brazil, Korea

tions and revolutions and coups variables (not shown). In most cases the political instability variables were insignificant, and the sign of Central Bank Governors turnover remained significantly negative.

Thus, turnover of Central Bank Governors is negatively associated with growth for most of the countries in the sample. But for some high growers, like Botswana, Korea, and Brazil, other factors, not accounted for by our regressions, were sufficiently potent to overcome the negative effect of high turnover.⁷ For example, it is likely that the discovery of diamonds in Botswana explains part of its high growth residual. One of the advantages of cross-country studies such as this one is that they focus the attention on special cases which can then be scrutinized more carefully, but we leave this more country-specific task for future work.

d. Growth and CBI within industrial countries and within LDCs

To examine the possibility that the relationship between growth and CBI differs between industrial and less-developed countries, we reestimate the basic regression from Table 2 separately for each group. The first two columns of Table 3 refer to industrial countries, with legal independence and Central Bank Governors turnover used alternately as proxies for CBI. Neither legal independence, nor Central Bank Governors turnover rates help to explain the variations in growth within the group of industrial countries. Since legal independence within those countries is also a reasonable measure of actual independence (Cukierman, Webb, and Neyapti (1992) and Chapters 20, 21 of Cukierman, 1992), this supports previous studies that found growth to be unrelated to CB independence in industrial countries. Grilli, Masciandaro, Tabellini (1991) and Alesina and Summers (1993) find no relation between growth and legal independence within most of the industrial countries, without controlling for other determinants of growth. Hence, our findings validate theirs, even after controlling for other factors that affect growth.

The third column of Table 3 presents the basic panel regression (excluding Botswana, Brazil, and Korea) for LDCs only, with turnover as the proxy for independence. In this group, turnover is negatively and significantly associated with growth. The terms-of-trade variable is extremely significant in LDCs, but insignificant in the regressions for industrial countries. In addition, the primary and secondary education enrollment ratios are insignificant within the subgroups. Initial GDP remains significant and negative, but only for the industrial countries. The significant level, $P(\rho)$, of the first-order coefficient of correlation between residuals of different decades raises the suspicion that there are additional country-specific effects within industrial countries

⁷But the tendency of within country residuals to be negatively related to turnover in some of those countries suggests that lack of CBI did not help growth in those countries.

Table 3:
Growth and CBI Within Industrial and LDCs - Panel

| DEPENDENT VARIABLE: Per Capita Growth Rate | (1) | | (2) | (3) |
|--|---------------------|---------------------|-------------------|-----|
| | Industrial | | LDCs ^a | |
| Constant | 4.10 (1.7) | 4.10 (1.7) | 1.00 (0.8) | |
| Initial GDP | -0.0003** (-2.8) | -0.0003** (-3.2) | -0.0002 (-0.9) | |
| Change in Terms of Trade | -3.72 (-0.3) | -3.92 (-0.4) | 30.45** (4.4) | |
| Initial Primary Education Enrollment Ratio | 0.07 (0.0) | 0.15 (0.1) | 1.13 (0.9) | |
| Initial Secondary Education Enrollment Ratio | 0.87 (0.7) | 0.89 (0.7) | 1.85 (0.8) | |
| Legal Independence | -0.21 (-0.17) | | | |
| Central Bank Governors Turnover Rate | | -0.80 (-0.4) | -3.58** (-2.7) | |
| Dummy for the '60s | 1.00 (1.3) | 0.93 (1.2) | 1.86* (2.1) | |
| Dummy for the '70s | -0.12 (0.8) | -0.14 (-0.2) | 1.58* (2.1) | |
| \bar{R}^2 | 0.40 | 0.40 | 0.26 | |
| $P(\rho)$ | 0.01 | 0.01 | 0.77 | |
| No. of Observations | 48 | 48 | 85 | |

t-statistics are in parentheses under the coefficients.

$P(\rho)$ is the significance level of a first-order autoregressive coefficient from a regression of the residuals of each country in each decade on the residuals of the same country in the previous decade.

* significant at the 0.05 level.

** significant at the 0.01 level.

^a excluding Brazil, Botswana, and Korea.

but not in LDCs.

Taken at face value, the results of this subsection support the view that growth is independent of CBI in industrial countries but that it is positively associated with it in LDCs. However, when both groups are examined together (Subsection c) turnover is even more significantly negative than within LDCs alone. This suggests that, controlling for other variables, turnover may also capture differences in growth between the two groups of countries. This conjecture is also supported by previous work which shows that CBI is substantially higher in developed than in developing countries and that the variability of independence within the second group is much higher.⁸ The conjunction of these findings is consistent with the hypothesis that low independence retards growth in all countries but that this effect is not detected within industrial countries because of the smaller variability of CBI and the smaller number of countries in that group. Another possibility is that dependence has a detectable effect on growth only above a sufficiently high threshold.⁹

Perhaps, part of the negative association between growth and turnover is due to reverse causality—low growth leads to political instability which raises Central Bank Governors turnover. This issue is taken up in the next section.

4. Simultaneity between growth, inflation and Central Bank Governors turnover

a. The problem

The commonly held view of policy-oriented economists — that unstable macroeconomic policies retard growth — evolved from the experience of high-inflation Latin American economies, and is kept alive by recent developments in some Eastern European economies and the former Soviet Union. This view has been tested by adding inflation or its variability as regressors to growth equations. When this is done, inflation and its variability are found to have a significant negative impact on growth. See for example equation (7) in Fischer (1991) and the literature quoted therein. One problem with this way of testing for the effect of unstable macroeconomic policies is that inflation itself is an endogenous variable. It is affected by monetary policy but is

⁸Table 21.1 in Cukierman (1992) suggests that the overall level of independence is uniformly higher in industrial countries than in LDCs. The effective range of this index in the eighties is from 0.44 (minimum independence) to 0.04 (maximum independence). All the industrial countries in the sample have an overall index of independence below 0.1 and all the LDCs above it. The variability in the index is also substantially larger within the group of LDCs than within the group of industrial countries. The standard deviation of the index is 0.078 in the first group and only 0.022 in the second.

⁹It is possible that the insignificant effect of turnover within industrial countries may also be due to its weaker link with actual independence in that group of countries.

also influenced by other nonpolicy variables. In particular, a negative supply shock will lower the rate of growth and, given policy, raise the measured rate of inflation. Hence, the negative coefficient of inflation in the growth equation may be at least partly due to reverse causality — from growth to inflation.

A similar but perhaps more roundabout simultaneity problem may arise when Central Bank Governors turnover is used as a regressor in growth equations as is the case in the previous section. At least part of Central Bank Governors turnover is due to political instability. There is evidence that low growth increases political instability and that political instability reduces growth (Alesina, Ozler, Roubini, and Swagel (1991)). Hence, to the extent that part of Central Bank Governors turnover is related to political instability, its negative coefficient could be reflecting the negative effect of growth on political instability, and through it on turnover, rather than the effect of low independence on growth.

This section proposes and implements an empirical procedure that overcomes both simultaneity problems. The procedure and its logic are described in Subsection b. It is applied to our growth equations in Subsection c and to growth equations with inflation as a regressor in Subsection d.

b. A resolution of the simultaneity problem

To overcome possible reverse causality from growth to Central Bank Governors turnover via political instability we need measures of CBI that are independent of political instability. Such measures are developed in Cukierman and Webb (1993). They are based on a decomposition of Central Bank Governors turnover into a political component and a nonpolitical component. Any Central Bank Governors change that occurs within 6 months of a change in regime, a coup, a change of party, or a change in head of government is identified as a politically-induced change. Any change in Central Bank Governors that is not preceded within 6 months by one of the political transitions above is identified as being nonpolitical.

The nonpolitical component of Central Bank Governors turnover represents, by construction, that part of turnover that is orthogonal to political instability. A second measure of CBI that is independent from political instability may be obtained by decomposing the political component of Central Bank Governors turnover as follows:

$$TORP = VP$$

where *TORP* is the politically induced component of Central Bank Governors turnover, *V* is the average number of politically-induced Central Bank Governors changes per political transition, and *P* is the average number of

political transitions per unit of time. This decomposition states that the political component of Central Bank Governors turnover is due to two quite different components. One is the frequency, P , of political transitions. The other - V - is an index of the vulnerability of the governor of the central bank in the face of political changes. The lower V , the higher the institutional independence of the central bank. V is therefore a measure of CBI. Furthermore, it is much less likely to be correlated with political instability than $TORP$, since the effect of political instability on $TORP$ is captured, given V , through the variable P .

The nonpolitical turnover rate and the index of vulnerability provide additional measures of CBI that are largely independent of the degree of political instability. Since they are also positively correlated with turnover they may, alternatively, be used as instrumental variables for total turnover. Another advantage of V is that it is more likely than turnover to be proxying for CBI in low as well as in high ranges of the index. This extends its range of applicability to industrial economies, in addition to LDCs. The nonpolitical component of Central Bank Governors turnover and the index of vulnerability can also be used as instruments for inflation in Fischer (1991)-type growth equations, in which inflation is used as a proxy for unstable macroeconomic policies. Both instruments are correlated with inflation (Cukierman and Webb, 1993), but they derive from largely exogenous institutional characteristics of the central bank. They are, therefore, less likely to be subject to reverse causality than inflation.

c. Reestimation of growth equations using nonpolitical turnover and the index of CB vulnerability instead of turnover

This subsection focuses on the following question: How much of the significant negative impact of Central Bank Governors turnover on growth (found in Section 3) is due to reverse causality from growth to turnover. To answer this question we focus on the equations in which turnover had a significantly negative impact, like the second and the fourth columns of Table 2. Nonpolitical turnover and the index of CB vulnerability are unavailable for a number of observations. In order to separate differences in results due to instrumentation or to different measures of CBI from differences that are due to differing sample coverage, we estimate all equations using the same unified sample. Also, we reestimate some of the equations from Section 3 to establish sample comparability.

Table 4 reports results for the panel regressions. The first column just reproduces the second equation from Table 2, using the smaller sample. Except that the relative significance of primary and of secondary education enrollment ratios is reversed, the two equations essentially tell a similar story. In particular, Central Bank Governors turnover has a significant negative

impact on growth in both. The second column presents an instrumental variables estimation of the same equation. The instruments are nonpolitical turnover, the index of central bank vulnerability, and all the remaining regressors except turnover. The effect of turnover, instrumented, on growth is still significant and negative; the level of significance only changes from 0.001 to 0.016. The effects of the other variables remain very similar. The third column shows a reestimation of the same equation with nonpolitical turnover and the index of CB vulnerability, instead of turnover. Nonpolitical turnover is insignificant but vulnerability has a significant negative impact on growth. The effects of the remaining variables are virtually unchanged. The fourth column is a reestimation of the third without the insignificant effect of nonpolitical turnover.¹⁰ The four regressions in Table 4 were also reestimated for a unified sample composed of LDCs only (not shown). The qualitative results were similar to those shown in Table 4 for the whole sample.

Table 5 repeats some of the experiments in Table 4 for cross-sectional regressions. The first column reproduces the fourth regression from Table 2 for the unified sample. The second is an instrumental variables estimation of the first using nonpolitical turnover, CB vulnerability, and all remaining regressors except turnover as instruments. The third replaces turnover with CB vulnerability. In all equations a lower index of CBI is associated with less growth. Turnover has a significant negative impact on growth in the ordinary least squares as well as in the instrumental variables equations. The index of CB vulnerability also has a significant negative impact on growth.

The next two columns of Table 5 repeat the experiments in the second and in the third columns of the table only for LDCs. This severely reduces the number of observations (from 43 to 27). Both instrumented turnover and CB vulnerability are still negative. The first variable is significant, but the second only marginally so.

The main conclusion from this subsection is that the finding of Section 2 - that a low degree of CBI has a negative impact on growth - is robust to instrumental variables reestimation and to the introduction of alternate measures of CBI.

d. Instrumental variables estimation of growth equations with inflation as a regressor

Table 6 presents a sequence of panel experiments taking as a benchmark the second equation of Table 2 with inflation replacing turnover as a regressor. The first equation is the benchmark. It is meant to represent the family of growth equations in which (as in Fischer (1991) and in the literature quoted

¹⁰The cross-decades first-order coefficients of correlation between residuals are insignificant for all the regressions in Table 4.

Table 6:
Instrumental Variables Estimation of Growth Equations
with Inflation as a Regressor
(Panel)^a

| | Instrumental Variables Estimation ^b | | | |
|---|--|-------------------|--------------------|--------------------|
| | OLS (1) | (2) | (3) | (4) |
| Constant | 0.69 (0.9) | 1.21 (0.6) | 1.45 (1.2) | 1.46 (1.6) |
| Initial GDP | -0.0002* (-2.3) | -0.0002 (-1.3) | -0.0002* (-2.3) | -0.0002* (-2.5) |
| Change in Terms of Trade | 30.14** (5.6) | 30.99** (3.6) | 32.12** (5.0) | 29.80** (4.8) |
| Initial Primary Education Enrollment Ratio | 1.21 (1.3) | 1.53 (0.6) | 1.90 (1.6) | 2.47* (2.3) |
| Initial Secondary Education Enrollment Ratio | 2.00 (1.6) | 1.65 (0.8) | 1.46 (1.0) | 0.62 (0.4) |
| Inflation | -1.87** (-3.9) | -3.26 (-0.5) | -5.45 (-1.3) | -4.57* (-2.5) |
| Dummy for the '60s | 1.58** (3.0) | 1.12 (0.4) | 0.73 (0.8) | 0.62 (0.9) |
| Dummy for the '70s | 1.35** (2.9) | 1.03 (0.7) | 1.1 (1.8) | 1.03 (1.9) |
| \bar{R}^2 | 0.36 | 0.29 | 0.01 | 0.07 |
| No. of Observations | 133 | 128 | 124 | 117 |

^a Excluding Botswana, Brazil, and Korea.

^b All regressors excluding inflation are used as instruments for inflation in equations (2)-(4). In addition, legal independence is used as an instrument in regression (2), nonpolitical turnover in regression (3), and CB vulnerability in regression (4).

t-statistics are in parentheses under the coefficients.

*designates significance at the 0.05 level.

**designates significance at the 0.01 level.

therein) inflation is used as a measure of unstable or "undesirable" macroeconomic policies. As in many equations of this type, inflation has a highly significant negative coefficient. But, as argued at the beginning of this section, this may be due to reverse causality running from growth to measured inflation. To explore this possibility the benchmark growth equation is reestimated, using legal independence and all the remaining regressors except inflation as instruments. The result appears in the second column of Table 6. The third column is similar in all respects to the second except that nonpolitical turnover is used as an instrument instead of legal independence. In the last column the index of CB vulnerability replaces nonpolitical turnover and everything else remains as in the third column.

With legal independence as the instrumental variable, inflation completely loses significance. This is at least partly because legal independence is a poor proxy for actual independence, particularly in LDCs. When nonpolitical turnover is used as an instrument, inflation again becomes less significant, although not as dramatically. But when the index of CB vulnerability is used as an instrument, the coefficient of inflation remains significantly negative.¹¹ The last index seems the best on a priori grounds, since it is likely to be a good proxy for CB independence in most countries. The significant correlation between residuals across adjacent decades, however, points to the existence of country specific effects.

To sum up: when inflation is instrumented with the best instruments, in terms of explaining inflation, it appears still to have a clear negative effect on growth, although not as strong as in the ordinary least squares estimates. We did not exhaustively conduct massive tests for robustness along the lines of Levine and Renelt (1992). Future work could usefully apply their robustness procedures to the measures of CBI used in this paper. We also did not control for the potential effect of exchange rate commitments on growth. It is likely that such commitments, to the extent that they are credible, are more important in countries with relatively low CBI.

5. Some evidence on private investment, productivity growth, and CBI

a. Private investment and CBI

The results in Section 3 show a positive association between growth and CBI. One of the possible channels through which it arises is that macroeconomic instability, which is caused by or reflected through low CBI, deters private investment. To examine this hypothesis, this section regresses pri-

¹¹ But it is not as significant as in the benchmark ordinary least squares regression. There is also a substantial deterioration in the goodness of fit in comparison to this benchmark.

vate investment on CBI and other variables that are likely to be important for investment. The range of experiments performed is dictated largely by the availability of data. We first tried to regress the share of private investment from the Barro-Wolf (1989) data set on initial GDP, primary and secondary education initial enrollment ratios, the change in terms of trade, Central Bank Governors turnover, and legal CBI, in cross-section for the period 1970-85. In some cases, the Barro-Wolf measures of assassinations and of revolutions and coups were added too. The number of countries was about 50. None of the variables had significant coefficients, including the measures of CBI.

We also experimented with data on private investment as a share of GDP for developing countries between 1970 and 1990. These data were recently compiled by the IFC (Pfeffermann and Madarassy, 1992). Regressions similar to these described above were tried with decade (seventies and eighties) panel data with a decade dummy for the seventies. Availability of data limited the sample to 30 countries.¹² Legal independence was always insignificant but the turnover of Central Bank Governors had a significant negative effect on private investment in a number of cases. Results using turnover as the index of CBI are summarized in Table 7. The first column is the basic benchmark regression. The Barro-Wolf assassination, revolution, and coups variables are added in the second column. The third and fourth columns reproduce the first two without Brazil and Korea. In the benchmark regression, three variables are significant: secondary education, the dummy for the seventies, and CB turnover, with a negative sign. The addition of assassinations and revolution and coups variables reduces the significance of turnover. When Brazil and Korea are excluded, the significance of turnover rises, and it remains significant even in the presence of the Barro-Wolf measures of political instability.

Additional separate regressions (not shown) for the seventies and the eighties reveal a significant negative effect of turnover on investment during the seventies but not the eighties.

b. Productivity growth and CBI

Another channel through which CBI could affect growth is productivity growth. To examine this possibility we regressed the Solow residuals for a group of (up to) 38 developing countries plus Spain in pooled cross-section time series regressions using the same variables that were used to account

¹²The countries are: Argentina, Brazil, Chile, Costa Rica, Ethiopia, Ghana, India, Indonesia, Kenya, Korea, Malaysia, Mexico, Morocco, Nepal, Nigeria, Pakistan, Peru, Philippines, Singapore, Tanzania, Thailand, Turkey, Uruguay, Venezuela and Zimbabwe. Data for Indonesia, Morocco, Nigeria, and Peru are available only during the eighties.

Table 7:
Private Investment, Productivity Growth and CBI in LDCs

| | Dependent Variable: Private Investment (% of GDP) | | | Dependent Variable: (Solow Residuals) | | |
|--|--|-----------------|--------------------|--|-------------------|-------------------|
| | (1) | (2) | (3) ^a | (4) ^a | (5) ^b | (6) ^b |
| Constant | 5.23 (1.8) | 4.34 (1.3) | 5.67* (2.1) | 7.17* (2.29) | -0.01 (-1.2) | -0.00 (-0.6) |
| Initial GDP | 0.0008 (0.9) | 0.0006 (0.6) | 0.0008 (0.9) | 0.001 (1.2) | -0.0000 (-0.2) | -0.0000 (-1.0) |
| Change in Terms of Trade | -4.65 (-0.2) | -3.08 (-0.1) | -16.88 (-0.9) | -23.19 (-1.1) | 0.07 (1.3) | 0.07 (1.4) |
| Initial Primary Education Enrollment Ratio | 2.36 (0.6) | 3.35 (0.8) | 3.99 (0.3) | 2.50 (0.7) | 0.001 (0.1) | 0.000 (0.0) |
| Initial Secondary Education Enrollment Ratio | 12.30* (2.4) | 12.52* (2.3) | 6.09 (0.9) | 4.83 (0.7) | 0.03* (2.1) | 0.03* (2.4) |
| Central Bank Governors Turnover Rate | -9.22* (-2.5) | -7.27 (-1.5) | -10.15** (-2.9) | -14.20** (-2.9) | -0.01 (-1.5) | -0.01 (-0.6) |
| Assassinations | | -1.27 (-0.6) | | 2.11 (1.0) | | 0.00 (0.5) |
| Revolutions and Coups | | 0.41 (0.1) | | 0.10 (0.0) | | -0.03* (-2.2) |
| Dummy for the '60s | | | | | 0.01 (1.7) | 0.01 (1.6) |
| Dummy for the '70s | 2.99 (1.9) | 3.28 (1.9) | 2.15 (1.3) | 1.58 (0.9) | 0.01 (1.8) | 0.01 (1.9) |
| \bar{R}^2 | 0.33 | 0.29 | 0.34 | 0.32 | 0.08 | 0.12 |
| No. of Observations | 34 | 34 | 30 | 30 | 77 | 77 |

^a Excluding Botswana, Brazil, and Korea.

^b Excluding Japan.

t-statistics are in parentheses under the coefficients.

*designates significance at the 0.05 level.

**designates significance at the 0.01 level.

for the behavior of investment.¹³ As with the growth equations, the observations for each country are broken down into three decades (1960–69, 1970–79, 1980–89). Legal CBI is found to have no effect, and turnover has a marginally significant negative effect on productivity growth (see column five of Table 7). But when the Barro-Wolf political instability variables are added, turnover becomes insignificant (the last column of Table 7), and the effect of revolutions and coups is significantly negative. In other words, any negative effect that Central Bank Governors turnover might have had on productivity growth disappears once proxies for political instability are used along with it.

c. The share of investment in equipment and CBI

Delong and Summers (1991) have shown that countries with higher shares (in GDP) of equipment investment grow faster. A possible channel through which CBI affects growth is via an effect on equipment investment. To examine this possibility, we estimated a cross-sectional equation in which the average share of equipment investment between 1960 and 1985 was regressed on initial GDP, initial primary and secondary education enrollment ratios, average labor-force growth between 1960 and 1985, the initial GDP per worker gap, and Central Bank Governors turnover between 1960 and 1989. We also experimented with a version of the same equation adding a measure of the average change in the terms of trade.¹⁴ Most variables were insignificant. But the coefficient of turnover was negative and significant at the 0.016 level in the first case and at the 0.066 level in the second.

d. Replacing turnover by CB vulnerability in investment equations

The four investment equations in Table 7 were reestimated using the index of CB vulnerability instead of turnover as a measure of CBI. Results (not shown) are similar to those in Table 7. The index of vulnerability has a significant negative impact on growth in all equations except in the counterpart of equation (2) in Table 7. This equation includes Brazil and Botswana in the sample as well as the assassination and revolution variables.

¹³As is well-known, the Solow residuals are the residuals from a logarithmic regression of output on labor and capital inputs. They were kindly supplied by Stan Fischer. The countries in the sample are those in the previous footnote plus Egypt, Greece, Hungary, Israel, Malta, Nicaragua, Panama, Portugal, Spain, Taiwan, Uganda, Yugoslavia, Zaire, and Zambia, minus Nepal, Singapore, and Uruguay. Not all decade-by-decade observations are available for all the 38 countries.

¹⁴In both cases Botswana, Brazil, and Korea were excluded.

e. Conclusions

The evidence yields some support for the view that, when CBI is sufficiently low, the lack of CBI retards private investment and reduces the share of equipment investment in GDP. There is also a weaker negative effect of CB dependence on productivity growth, but this effect appears to be proxying for the effect of political instability on productivity.

6. The intra-country variability of growth, CBI, and the level of development

Recent evidence (Easterly, Kremer, Prichett, and Summers (1992)) suggests that there are substantial variations over time in the rate of growth within a given country. This section presents preliminary evidence on possible links between the magnitude of these variations and the independence of the central bank.

Countries with more dependent central banks normally conduct more activist monetary policies in order to affect aggregate demand. It is an open issue, though, whether such activism actually dampens or increases the amplitude of business cycles. Political authorities are more likely than the central bank to pursue a variety of objectives besides dampening of the cycle. For instance, they might produce a political cycle (for a recent empirical survey see Alesina, Cohen and Roubini (1992)). Even when they aim to dampen the cycle, politicians may exacerbate it, along the lines of Friedman's long and variable lags argument (see also Meltzer (1987)). Hence, there are conflicting theoretical predictions about the relationship between a country's growth-rate variability and the independence of its central bank.¹⁵ The type of relationship, if any, between the variability of growth and the level of CBI is an empirical matter, to which we now turn.

First, we calculate the variability over time in the per capita rate of growth for each country and then regress the resulting variances on legal independence and on turnover across countries. The time period is from 1960 to 1988. The same experiment is repeated for industrial countries and for LDCs separately. Legal independence is insignificant in all the experiments. For the entire sample of countries the turnover of Central Bank Governors has a significant positive effect on the variance of growth. The estimated relation is:

$$\begin{aligned} \text{Var}(G_i) &= 0.001 + 0.005\text{TOR}_i \\ &\quad (1.9) \quad (2.2) \\ \bar{R}^2 &= 0.06, DW = 1.94, \text{ number of countries} = 63 \end{aligned}$$

¹⁵But theory does imply that, other things the same, policy is more activist the more dependent is the CB (Cukierman (1992) p. 355).

Here $Var(G_i)$ denotes the variance of the growth rate in country i and TOR_i denotes the turnover of Central Bank Governors within that country. t -statistics are in parenthesis under the coefficients. The relationship vanishes when reestimated separately within industrial countries and within LDCs. This suggests that turnover is proxying for some basic institutional differences (that matter for growth) between the two groups of countries but not within each group.

We saw in Section 3 that growth is affected by changes in a country's terms of trade. This is particularly true for LDCs in which fluctuations in terms of trade have a sizeable effect on growth. In order to make sure that this effect is not confounded with the effect of CBI on the variance of growth, we repeat the above regression with the standard deviation of growth residuals (after elimination of the variability that is due to a change in terms of trade) instead of the variance of growth. The standard deviations of growth residuals are calculated in the following manner. Regressions of yearly growth rates on yearly changes in terms of trade are estimated for each country separately. The net (of variations in terms of trade) variability of growth is proxied by the standard deviations of growth residuals from those country regressions. These standard deviations are then regressed (in cross-section) on turnover. The resulting equation is:

$$SD(RG_i) = 0.032 + 0.050TOR_i$$

(5.8) (2.5)

$$R^2 = 0.09, DW = 1.56, \text{number of countries} = 54$$

Here $SD(RG_i)$ is the standard deviation of growth residuals from the first-stage regression in country i . Again, the central bank's legal independence is insignificant. When the above regression is repeated separately for industrial countries and for LDCs, turnover becomes insignificant as was the case when $Var(G_i)$ was the dependent variable.

The results support the view that, even after controlling for differences in the impact of terms of trade shocks, there is a negative relation between the variability of growth and CBI as proxied by Central Bank Governors turnover. But this relation seems to be capturing mostly differences between industrial countries and LDCs rather than differences between countries within each group. Stated somewhat loosely, the association between the variability of growth and Central Bank Governors turnover reflects that the average value of both variables is substantially lower in developed economies than in LDCs. When one controls for initial GDP, this variable has a significantly negative impact on the variability of growth (and of its residuals) and turnover becomes insignificant. We conclude that the general level of development has a stronger (negative) association with the variability of growth than CBI.

7. Interest rates and CBI

This section examines whether there are systematic relationships between the distribution of ex post real rates and CBI. Due to data limitations we experiment only with returns paid to savers. Most of the rates are real short-term deposit rates, whose maturity varies across countries. They were originally compiled by Gelb (1989) and extended in Easterly, Rodriguez and Schmidt-Hebbel (1992). The basic data are from the International Financial Statistics and from internal World Bank sources. The nominal interest rate is the average deposit (or passive) rate in the banking system for maturities which vary between 30 days and 18 months. The ex post real rate is obtained by adjusting the nominal rate by the actual rate of inflation over the appropriate maturity. Some of those rates are regulated to various extents. Hence, their relation with CBI also reflects differences in policy across central banks with different levels of autonomy.

The only existing attempt to uncover possible associations between real rates and CBI is in Alesina and Summers (1993). Using the Alesina (1988) legal measures of CBI for a sample of 18 countries, they find that: (1) there is no (cross-country) association between the level of ex post real rates and CBI; (2) the (intra-country) variability of real rates is inversely related to CBI. They attribute this finding to the negative association between the variability of inflation and CBI.¹⁶

a. The variability of interest rates and CBI

Table 8 presents regressions of the yearly standard deviation of the ex post real rate on legal independence and on Central Bank Governors turnover for all countries in the sample as well as for the subgroups of industrial and developing countries.¹⁷ The first column of the table reveals a very strong positive association between real rates variability and turnover in the entire sample of countries (about 40). Although it has the expected negative effect on the variability of real rates, legal independence is not significant. The same regression is repeated separately for industrial countries and for LDCs in the second and third columns of the table. Results for LDCs are similar to the results for the combined sample. But the relative significance of legal independence and of turnover is reversed within the group of industrial countries. Legal independence has a negative and significant impact on the variability of real rates but turnover is insignificant within industrial countries.

¹⁶This association is quite strong. It obtains in the Alesina-Summers sample as well as in wider samples that also include LDCs (Chapter 22 of Cukierman (1992)).

¹⁷The regressions cover the period between 1965 and 1989. But the data span is shorter than that for some countries.

Table 8:
The Variability of Real Rates and CBI - Cross-Section

| | DEPENDENT VARIABLE: Standard Deviation of the Ex Post Real Deposit Rate | | | | |
|---|---|-------------------|-------------------|-------------------|------------------|
| | (1) All Countries | (2) Industrial | (3) LDCs | (4) Industrial | (5) LDCs |
| Constant | 3.16 (1.0) | -3.92** (4.4) | 9.49 (1.5) | 4.23** (8.2) | 2.60 (0.9) |
| Legal Independence | -7.88 (-1.0) | -3.97* (-2.8) | -20.18 (-1.2) | -4.13** (-3.1) | |
| Central Bank Governors Turnover Rate | 31.00** (5.55) | 1.90 (0.4) | 27.92** (3.39) | | 27.27** (3.4) |
| \bar{R}^2 | 0.44 | 0.32 | 0.32 | 0.36 | 0.31 |
| No. of Observations | 39 | 16 | 23 | 16 | 24 |

t Statistics are in parentheses under the coefficients.

* significant at the 0.05 level.

** significant at the 0.01 level.

Those findings support the conclusion of Alesina and Summers that real-rate variability is higher when CBI is lower. They also support the conclusion that the appropriate measure of CBI is legal independence for industrial countries and Central Bank Governors turnover for LDCs (Cukierman, Webb, and Neyapti (1992) and Chapter 20 of Cukierman (1992)). The last two columns of Table 8 repeat the subgroup regressions only with the appropriate measures of CBI for each group - legal independence for industrial and turnover for developing countries.

To examine the relation of CBI and the variability of nominal rates, we used three different nominal rates (all from the International Financial Statistics): the discount rate, the deposit rate, and the bond rate. The sample period and the number of countries vary across the different rates. The discount rate data cover the period from 1970 to 1989. The data for the remaining two rates range from 1978 to 1989. The number of countries is 54 for the discount rate, 57 for the deposit rate, and 33 for the bond rate. Table 9 presents regressions of the standard deviation of each of those nominal rates on legal independence and on Central Bank Governors turnover. The indices of CBI are adjusted in each case to cover roughly the same periods as the different nominal rates.

Table 9:
The Variability of Nominal Rates and CBI - Cross-Section

| | DEPENDENT VARIABLE: Standard Deviation of Designated Nominal Rate | | |
|---|---|---------------------|------------------|
| | (1) Discount Rate | (2) Deposit Rate | (3) Bond Rate |
| Constant | 225.7 (0.5) | 12.2 (0.0) | 1.75 (1.3) |
| Legal Independence | -1593.7 (-1.5) | -1518.0 (-1.2) | 0.13 (0.0) |
| Central Bank Governors Turnover Rate | 2419.7* (2.5) | 3004.5** (3.8) | 2.71 (0.7) |
| \bar{R}^2 | 0.11 | 0.20 | -0.05 |
| No. of Observations | 54 | 57 | 33 |

t Statistics are in parentheses under the coefficients.

* significant at the 0.05 level.

** significant at the 0.01 level.

For the discount rate and the deposit rate, which are short-term instru-

ments, turnover is found to have a positive and significant effect on nominal rate variability. Legal independence has the expected negative sign but is not significant. This is not surprising, since the sample includes both industrial and developing countries. No association is found between the longer-term bond rate and either index of CBI.

These findings suggest that the level of independence affects the variability of short-term nominal rates but not that of long-term rates. They also suggest that the relationship between CBI and the variability of real rates, detected above, is due not only to the effect of CBI on inflation variance but also to its association with the variability of nominal rates. A full empirical investigation of the channels through which CBI affects short-term real-rate variability would also have to consider its possible effect on the covariance between nominal rates and inflation. This is left for future work.

b. The level of real rates and CBI.

Table 10 reports the average ex post real deposit rates and their standard deviations for the countries in the sample. The countries within each subgroup (industrial and developing) are arranged by the size of their standard deviations. Several facts are noteworthy. First, average real rates are negative in many countries. Second, the average level of real deposit rates in LDCs is substantially lower than in industrial countries (-3.2 percent versus 0.2 percent). Third, a comparison of the means and the variances in Table 10 suggests a negative correlation between them across countries. Simple regressions confirm that this relationship is significant for the whole sample of countries as well as within subgroups.

Figures 3 and 4 present plots of real rates on legal independence within industrial economies. Figure 3 covers the period from '65 to '89 and Figure 4 only the eighties. In both cases a clear positive relation emerges between the average real rate and legal independence. A regression of average real deposit rates between '65 and '89 on legal independence within industrial countries confirms this positive relationship at the 0.1 level of significance (first column of Table 11). Ireland appears to be an outlier. When it is excluded from the sample, the level of significance increases to 0.03 and the coefficient on legal independence increases, too (second column of Table 11).

To examine the relation between the real rate and CBI in LDCs, turnover is used to proxy CBI. The third column of Table 11 reports the corresponding regression. As in the case of industrial countries, there is a positive and significant association between the real rate and CBI in LDCs (recall that turnover is a measure of central bank dependence). But when Argentina, which is an outlier, is excluded the relation becomes insignificant.

In summary, there is a positive relation between the average return to savers and CBI in industrial economies and, depending on whether Argentina

Table 10:
Real Ex Post Deposit Rates - Mean Levels and Within Country Variabilities
(Percentages)

| Country | Mean | Standard Deviation | Country | Mean | Standard Deviation |
|-------------------|------|--------------------|---------------------|-------|--------------------|
| <u>Industrial</u> | | | | | |
| Austria | 0.4 | 1.2 | | | |
| Germany | 2.2 | 1.2 | | | |
| Netherlands | 1.6 | 1.5 | | | |
| Denmark | 2.4 | 1.6 | | | |
| Finland | 1.5 | 1.9 | | | |
| Canada | 3.1 | 2.5 | | | |
| Belgium | -0.1 | 2.6 | | | |
| Spain | 0.4 | 2.8 | | | |
| Sweden | 0.7 | 2.8 | | | |
| France | -1.8 | 3.2 | | | |
| Italy | -0.8 | 3.3 | | | |
| Japan | -1.7 | 3.7 | | | |
| Norway | -0.0 | 4.6 | | | |
| UK | -1.8 | 4.0 | | | |
| Ireland | -2.7 | 3.8 | | | |
| Australia | 0.3 | 4.0 | | | |
| Average | 0.2 | | | | |
| <u>LDCs</u> | | | <u>LDCs (cont.)</u> | | |
| Honduras | 4.5 | 2.0 | Zambia | -7.5 | 8.8 |
| Malaysia | 3.1 | 3.9 | Mexico | -3.3 | 9.3 |
| Morocco | -0.3 | 4.1 | Venezuela | -1.3 | 9.3 |
| Zimbabwe | -4.1 | 4.8 | Peru | -10.9 | 9.5 |
| Greece | -2.3 | 5.4 | Turkey | -8.0 | 11.5 |
| Colombia | 0.1 | 5.5 | Indonesia | 5.1 | 12.9 |
| Kenya | -2.2 | 5.7 | Zaire | -15.1 | 16.6 |
| Thailand | 3.0 | 5.8 | Ghana | -15.7 | 17.3 |
| Pakistan | -1.6 | 6.0 | Argentina | -18.6 | 19.0 |
| Korea | 4.7 | 6.2 | Chile | -5.2 | 25.1 |
| India | -0.7 | 6.9 | Brazil | 7.3 | 44.9 |
| Nigeria | -6.3 | 8.1 | | | |
| Philippines | -0.7 | 8.7 | | | |
| | | | Average | -3.2 | |

Source: Calculated from Tables 4A and 4B (Statistical Appendix) in Easterly, Rodriguez, and Schmidt-Hebbel (1992).

Table 11:
Real Rate Levels and CBI - Cross-Section

| Dependent Variable: Mean ex post real deposit rate | Industrial | | |
|--|-----------------|-------------------------------|-------------------|
| | Industrial | Industrial (excl. Ireland) | LDCs |
| Constant | -1.26 (-1.3) | -1.31 (-1.7) | 0.84 (0.3) |
| Legal Independence | 4.27 (1.7) | 5.07** (2.4) | |
| Central Bank Governors Turnover Rate | | | -13.48* (-2.0) |
| \bar{R}^2 | 0.12 | 0.26 | 0.11 |
| No. of Observations | 16 | 15 | 24 |

t statistics are in parentheses under the coefficients.

* significant at the 0.07 level

** significant at the 0.03 level.

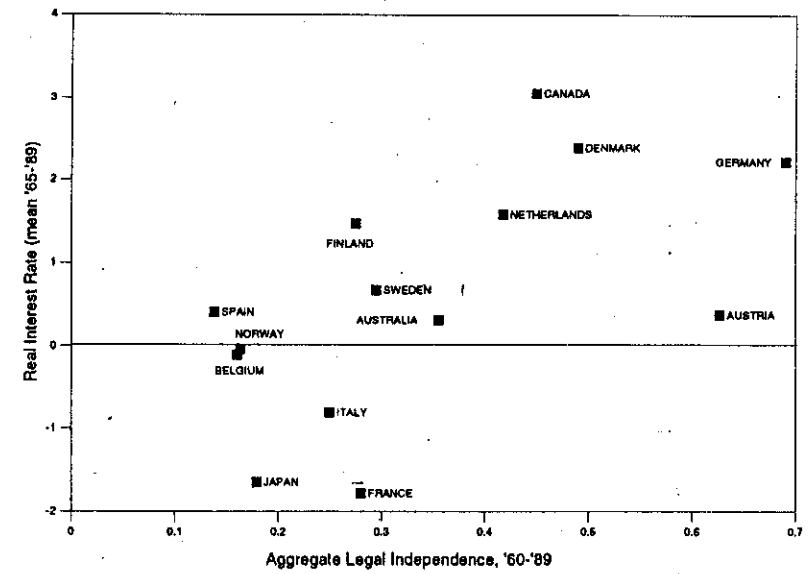


Figure 3

Average real ex post deposit rates and legal independence - industrial countries '60-'89

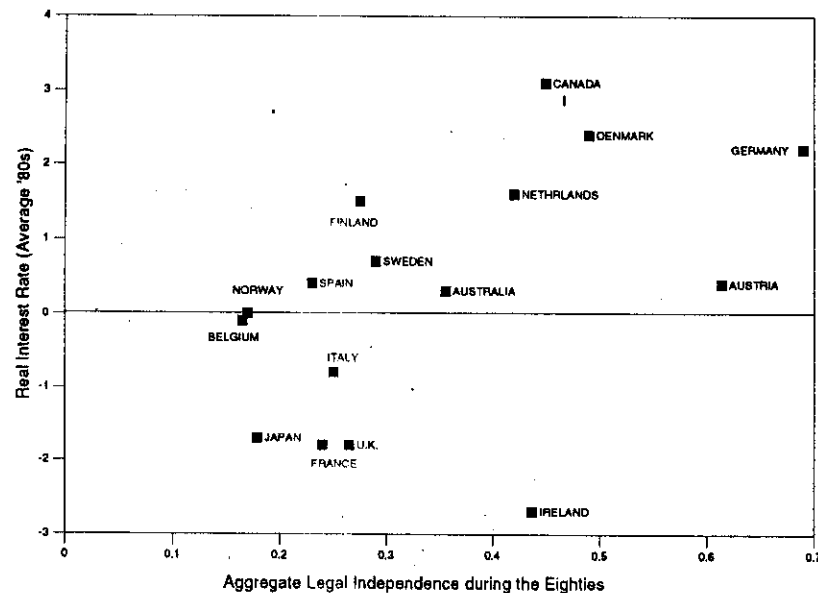


Figure 4

Average real ex post deposit rates and legal independence during the Eighties in Industrial Countries

is included or excluded, a similar relation or no relation in LDCs. These findings are consistent with the view that the negative relation between the average real rate and its variability across countries results from the positive association of the real rate with CBI in conjunction with the negative association of CBI with the variability of the real rate.

c. Why is there a positive relation between the average real rate and CBI?

A likely explanation for the positive association between the real deposit rate and CBI is that in most countries the real return to savers in short-term financial assets is below its competitive equilibrium level because of government regulation and periodic inflationary surprises. The lower the degree of CBI, the farther below its equilibrium value is the real return to savers. Figure 5 illustrates this idea graphically. Except for a small number of industrial countries, short-term financial savings in most countries can be represented as being on the portion of the supply-of-savings curve below equilibrium. The lower the level of CBI, the higher the interference of government with the short-term return to nominal savings through regulation and inflationary surprises. As a consequence, the realized return to savers is lower the lower CBI. Points H and L along the supply curve in Figure 5 illustrate this idea graphically. This view is consistent with the McKinnon and Shaw notion of financial repression (McKinnon (1973)). They developed this argument mostly for LDCs. Our finding that real returns to savers are substantially lower in LDCs is consistent with this view (see Figure 5). But our findings also point to some financial repression within industrial countries, as well as to the conclusion that, within this group, the level of financial repression goes down as CBI rises.

The relatively weak relationship between the real return to savers and CBI within LDCs may be explained as the consequence of two offsetting effects. A rise in CBI is associated with a reduced divergence between deposit rates and their equilibrium levels. This tends to push real rates up. On the other hand, by reducing real-rate variability, an increase in CBI may reduce risk premia and this tends to reduce real rates.¹⁸ The second effect is probably more important in explaining differences in rates within LDCs because of the higher spread in variabilities within this group. (The standard deviation across countries of the real-rate variability within countries is about ten times larger among LDCs than among industrial countries.)

The type of financial repression associated with low CBI depresses the real level of savings and reduces the allocative efficiency of financial markets.

¹⁸This argument implicitly assumes that risk premia on real deposit rates rise on balance with the variability of these rates. This is the case only under some circumstances, since borrowers are willing to pay less when variability is higher and this tends to reduce real deposit rates.

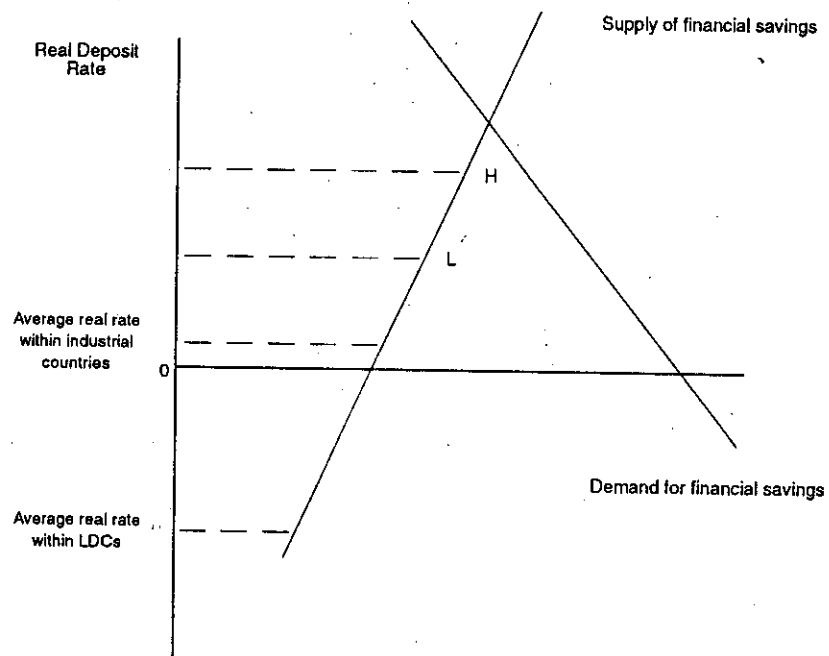


Figure 5
Central bank independence and real rates.

Recent evidence is consistent with the view that financial repression reduces growth (Gelb (1989) and Easterly (1991)). This may be yet another channel through which low CBI retards growth.

d. An intriguing empirical regularity

We also regressed the average real rate in each country on growth and the appropriate index of CBI (legal independence for industrial and Central Bank Governors turnover for LDCs). Results are summarized in Table 12. They corroborate the positive effect of independence on real deposit rates within industrial countries, even controlling for growth, which is insignificant. The opposite happens within LDCs, where the ex post real return to saving is positively associated with growth but the effect of CBI is insignificant.

Table 12:
The Real Rate, Growth, and CBI

| | Industrial | LDCs |
|---|-----------------|-----------------|
| Constant | -0.13 (-0.1) | -6.98 (-3.2) |
| Legal Independence | 4.41* (1.9) | |
| Central Bank Governors Turnover Rate | | -0.97 (-0.2) |
| Per Capita Growth Rate | -0.30 (-0.6) | 2.32** (4.7) |
| \bar{R}^2 | 0.23 | 0.50 |
| No. of Observations | 15 | 25 |

t statistics are in parentheses under the coefficients.

* significant at the 0.09 level

** significant at the 0.0001 level.

What is the meaning of the results for LDCs? One possibility is that governments of nations that grow faster tolerate more competitive returns to short-term financial assets. But causality may also be running in the opposite

direction. Countries that tolerate more liberal financial markets grow faster. Clearly the issue deserves further work.

8. Concluding remarks

The empirical results of this paper in conjunction with earlier work support the view that higher CBI is associated with less inflation and more growth in LDCs, but only with less inflation in industrial economies. This difference in findings between the two groups of countries is consistent with the view that dependence on political authorities is bad for growth only when the level of dependence is sufficiently high. All industrial countries have more CBI than most LDCs.

What are the channels through which more CBI stimulates growth? This paper does not pretend to provide a full answer to this question, but the evidence in Section 5 suggests that, other things the same, private investment is lower the lower is independence, as proxied by turnover or by CB vulnerability. The results concerning the level of deposit rates and CBI also provide a possible channel. In economies with more dependent central banks, governments interfere more heavily in the capital market. This involvement reduces the allocative efficiency of the capital market and may reduce growth. The empirical work of Gelb (1989) and Easterly (1991) provides further support for this view.

Wider capital markets are also conducive to higher growth. King and Levine (1993) present evidence that the initial level of a country's financial development is one of the most reliable predictors of its subsequent rate of growth. To the extent that CBI and financial development are positively related, this provides another channel through which CBI and growth interact. But this should not be construed to imply that causality runs only from CBI to financial development - to growth. Deep capital markets and an elastic supply of funds to government may cause both higher growth and higher CBI. Thus, broad capital markets may well be enhancing growth directly as well as indirectly - by leading political authorities to delegate more authority to the central bank.¹⁹

The result that, *ceteris paribus*, growth is positively associated with CBI in LDCs seems reasonably robust. We have experimented with alternative measures of terms of trade and also repeated the regressions with and without outliers. To examine the possibility that our measures of CBI reflect the effect of political instability on growth rather than that of CBI, we added several measures of political instability in addition to the proxies for CBI. To disentangle more sharply the two effects, we also experimented with an

¹⁹A precise analysis of the last causal link appears in Cukierman (1993) and a broad discussion in Chapter 23 of Cukierman (1992).

index of the political vulnerability of the central bank. This index excludes, by construction, the direct effect of political instability on Central Bank Governors turnover and is therefore more likely to reflect CBI net of political instability. It is still possible that central bank vulnerability and political instability are positively correlated across countries. This actually turns out to be the case for regime instability. Even in that case the correlation between the two is small (Cukierman and Webb (1993)). We are therefore fairly confident that the effects of CBI on growth found here reflect more than just the effect of political instability.

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Central bank independence, growth, investment, and real rates A comment

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Alex Cukierman has worked hard for the last few years examining the institutional characteristics of central banks and developing measures of central bank independence (or CBI). Now, with the publication of his book by MIT Press, and with the help of several coauthors, we are beginning to see the fruits of his labors. The present paper is an interesting and suggestive investigation of the effects of CBI on growth, investment, and interest rates across some 60 countries.

There are many, many results reported in this paper. So, I will begin by summarizing what I take to be the main findings (and suggesting an alternative measure of CBI for developed countries). After the summary, I will discuss the robustness issue, the theoretical foundations needed for a more structural approach to empirical work in this area, and finally the broad way in which the results of this paper should be interpreted...

A brief summary

Section 2 introduces us to the measures of CBI that Cukierman and his colleagues have developed. The legal independence (LI) measure comes from official descriptions of the central bank's institutional structure (in bank charters, etc.), and the authors point out that operational practice can differ substantially from official statute. Another (inverse) measure of CBI, the governor turnover rate (GTR), is introduced to capture operational independence, and it seems to work well in the case of LDCs. However, there is

*I wish to thank (without implicating) James Tybout for his helpful comments on the growth literature.

evidently very little variation in GTR for the DCs, and the new measure does not seem to have much explanatory power for them.

The author's view is that LI is a good measure of CBI for the DCs, and indeed it could be that the distinction between official and operational independence is not significant for them. However, it could also be that GTR is a bad measure of operational independence for the DCs. I would suggest (if the authors have any energy left to listen to suggestions) that a behavioral measure of CBI might be significant for the DCs. Reputation and tradition may play a role that adds to or subtracts from the LI measure. For example, Paul Volcker's behavior in the early 1980s may have given the Fed more independence under him than it had under some of his predecessors, and the Bundesbank's traditional hard line on inflation may have enhanced whatever appears in its charter.

Section 3 reports the basic results for growth and CBI. The authors find that neither LI nor GTR has a significant effect on growth in the DCs, but that GTR has a significant effect in the LDCs. Section 4 tries to control for "reverse causality"; this is unusual, and therefore a welcome addition to this literature. Section 5 reports the results for private investment and CBI. The authors find that LI has no effect while GTR has a significant effect on the LDCs; no results were reported for the DCs. Section 7 reports the results for interest rates and CBI. The authors find that LI raises the level and lowers the variability of real interest rates in the DCs, while the GTR measure has the same implications for the LDCs (with some qualifications). Moving to nominal rates, the authors find that the GTR measure of CBI lowers variability in the whole sample; no breakdown between DCs and LDCs was reported.

The robustness issue

In studies of this kind, there will always be a degree of adhocery and a question of robustness. No structural model is specified in any detail; t-statistics are often marginal; conditioning variables come and go with little explanation (for example, the terms-of-trade variable appears in the growth equations but not in the interest-rate equations); outliers are routinely thrown out. The authors are painstakingly honest about all of this, and they report many experiments that failed. So, reading through the paper, one gets some overall feeling for the robustness of the results. The question is, can we approach the robustness issue in a more systematic way?

Levine and Renelt (1992) study the exploding literature on growth equations from just this perspective. The problem, as I understand it, is that this literature has been embarrassingly successful; Levine and Renelt report that over fifty variables have been found to have significant effects on growth.

(It makes the nonspecialist wonder why growth is so hard to achieve when there are so many levers to pull.) Levine and Renelt call a relationship "robust" if the variable in question "remains statistically significant and of the theoretically predicted sign when the conditioning set of variables in the regression changes." Otherwise, they call the relationship "fragile." Using cross-sectional data on some 60 countries, Levine and Renelt find that few relationships are robust. In particular, they find that the relationships between growth and the rate of inflation, the variability of inflation, the rate of domestic credit growth, and the variability of domestic credit growth are all fragile.

Can the relationships in the present paper pass the Levine and Renelt test? I admit that the Levine and Renelt procedure is itself somewhat ad-hoc, and it may also be overly rigorous. However, it does provide a more systematic way of constructing a robustness argument, and I would like to see it tried.

Another way of addressing these problems is to take a more structural approach in the estimation. However, this is clearly beyond the scope of the present paper, since very little theory was presented.

Theoretical foundations

In fact, I think it would be very difficult to take a more structural approach to using the measures of CBI that Cukierman and his colleagues have developed. We simply do not have a good theoretical model for this purpose. Let me depart from the present paper for a moment to outline what I think such a modeling effort would entail.

First, I would note that the Barro-Gordon model is just not up to the task. It does not discuss governments or political processes. So, it does not model the pressures that CBI is supposed to protect a central bank from. We have models of deficit bias, and we have models of inflation bias, but I know of no formal model that successfully combines a deficit bias with an inflation bias. The model we seek would include three features: (1) a bias towards fiscal deficits, and inflation when the central bank is directly under the control of the government; (2) a money transmission mechanism that implies some constituency is hurt by inflation; and (3) a specification of the processes by which the central bank interacts with the government and the government interacts with the public. This is unfortunately a pretty tall order, despite the long literature on CBI.

A broad interpretation of the results

The correlations reported in this paper are certainly intriguing, and there may be a temptation to draw hasty and narrow conclusions from them. However, I (and the authors, too) would argue that the correlations must be interpreted with care. The authors discuss "reverse causality" at some length, but in studies like this I am often more concerned that some third force may actually be driving the correlations.

Consider the correlation between CBI and low inflation (that has been reported by others). Some would argue that in Germany it is a broad public consensus that has produced both an independent central bank and a low-inflation policy. (Would Bundesbank policy have been much different if it had labored under the institutional arrangements of the Banque de France or the Banca d'Italia?) Some critics of EMU have also questioned the political support for a low inflation policy across the EC as a whole. (It is clear that the central bankers who wrote the Delors Report did not think tough draft statutes were sufficient; they called for constraints on fiscal policy to lessen the political pressure for monetization of deficits.)

One can similarly ask if broader factors are producing the correlations between CBI and growth, or between CBI and the financial variables. In particular, a general move toward financial liberalization may be producing all of these results.

The basic point here is that the correlations should not be interpreted too narrowly. There is little or no reason to think that a country can increase its growth rate by merely making its central bank independent.

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