The determinants of central bank independence

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Abstract

In this paper we explore the determinants of central bank independence on a sample of 55 countries. Our first contribution is to provide evidence that openness is indeed relevant for the understanding of the design of monetary institutions. The second issue we address is the commitment interpretation of monetary policy institutions by testing one of its implications: coeteris paribus, the more transparent to the general public the institution is, the larger the level of commitment is expected to be. Our findings show that both dimensions explored in this study turn out to be relevant in the data for the understanding of the design of monetary institutions across countries: controlling for other variables, both openness and the measure of institutional transparency among the general public turn out to be significant in the regression for the degree of independence of the monetary authority. Therefore, even if the commitment approach does not seem to be relevant in the data for explaining long run inflation in countries other than the highly industrialized ones (Romer, 1993), our exploration of the determinants of independence seems to support the view that strategic delegation is indeed a rational for the delegated power and for the objectives of the monetary institutions across countries.

1. Introduction

Rogoff (1985, b), Romer (1993), have argued and documented that the inflationary bias has specific features in open economies that are not taken into account in the closed economy formulation, due to the interdependence in the stabilization monetary policy. Campillo and Miron (1997) and Lane, (1997) provide additional empirical evidence in support of this view. Dolado, Griffith and Padilla (1994) and D'Amato and Martina (2005) have explored, from the theoretical point of view, the implications of openness for the equilibrium degree of commitment.

The present paper studies two aspects of the commitment hypothesis that have not been investigated in previous contributions by focusing on the determinants of the inflationary bias and related incentives to commitment in open economies on a sample of 55 countries.

Our first contribution here is to provide evidence that openness is indeed relevant for the understanding of the design of monetary institutions. This is important since we show that political equilibria in each country cannot be taken as the unique fundamental source for the explanations of cross country variation in central bank independence: openness does not only establish interdependence at the policy stage but also frames the structure and the objectives that delegated institutions assume in real world and it turns out to be reflected in the data.

The second issue we address in this paper is the commitment interpretation of monetary policy institutions. That central bankers have to be interpreted as a commitment device in the hands of the political body to refrain from inflation temptations has been assumed in the literature on monetary institutions at least since the time of Ricardo (1812). However, to our knowledge, this theoretical hypothesis has not been tested against alternatives (the monetary authority as the outcome of a process of pure functional separation of tasks in modern economies, as lender of last resort for the bank system, as the agent regulating risk pooling among the subjects operating in the financial system, as the government bank managing public debt and so forth). The failure of the indexes of central bank independence to affect long run inflation in countries other than the highly industrialized ones may suggest that commitment is irrelevant in the economies lagging behind in the process of development. In his interpretation of the determinants of long run inflation Romer (1993) suggests that commitment contributed to overcome the inflationary bias only in the most highly industrialized countries. Campillo and Miron, (1997) in their detailed empirical study on the determinants of long run inflation argue that data suggest that there is no quick fix to be exploited for the solution of the inflationary bias.

To test whether commitment is a relevant perspective to understand the design of monetary authorities by governments in economies using paper money we use a simple approach: we start from the very definition of a commitment device for a rational agent. In order to be valuable a commitment device has to be visible and credible. Coeteris paribus, the more transparent to the general public the institution

is, the larger the level of commitment is expected to be (Fershtmann and Kalai, 1997). We use average daily newspaper circulation in a country to measure the degree of visibility of a monetary institution among the general public. This is admittedly quite an approximate measure, specially because it may capture other effects influencing the degree of transparency of a monetary institution, and a discussion is postponed to the following section.

Our findings show that both dimensions explored in this study turn out to be relevant in the data for the understanding of the design of monetary institutions across countries: controlling for other variables, both openness and the measure of institutional transparency among the general public turn out to be significant in the regression for the degree of monetary authority independence. Therefore, even if the commitment approach does not seem to be relevant in the data for explaining long run inflation in countries other than the highly industrialized ones, our exploration of the determinants of independence seems to support the view that strategic delegation is indeed at the root of the delegated power and objectives of the monetary institutions across countries.

The rest of the paper is organized as follows. Section 2 briefly reviews the recent empirical literature. Section 3 discusses some economic and political-social features considered to play a significant role in determining the central bank's degree of independence. Section 4 sets out the empirical results of the analysis, while Section 4 presents the conclusions.

2. Review of the literature

The determinants of central bank independence have been studied in several papers, both empirical and theoretical. In many cases the interest is focused on aspects of the political institution that may affect incentives to commit by government bodies.

The influence of political factors on the strategic design of monetary institutions has been the focus of an interesting analysis by Cukierman (1992), which predicts that: "In countries with a sufficient degree of internal cohesion, more political instability should be associated with a higher degree of central bank independence whereas the reverse should be true in countries with relatively low levels of national consensus".

Cukierman (1992) has tested this combined hypothesis using two indices of political instability. The first index is *party-political instability*, by which is meant constant changes of government between competing political parties democratically elected within a given constitutional context. The second index is *regime political instability* and reflects changes in a country's political-institutional system brought about by non-democratic methods. Cukierman (1992) analyses a sample of fourteen countries[1] to find that party-political instability correlates positively with central bank independence, while regime political instability has a negative correlation with it. Additional empirical studies reported some evidence which support this view. Bagheri and Habini (1998) find that central bank independence is positively

[1] Argentina, Bolivia, Chile, Costa Rica, Egypt, Indonesia, Korea, Mexico, Peru, Philippines, Thailand, Turkey, Uruguay and Venezuela.

correlated with political stability and civil liberty, while Moser (1999) report that the legal independence of the central bank is significantly higher in those OECD countries in which legislative procedures are subject to strong checks and balances. The main focus of the literature above has been on the political framework in which the delegation choice is cast. In our paper, we address the same issue but we do not focus on countries' political-institutional structures, because we believe that economic aspects are crucial to determine the central bank's degree of independence. Few other studies analyse the economic determinants of central bank independence.

For example Cukierman (1994) shows that central bank independence is higher in countries where the average employment is larger, as predicted by the inflationary bias approach. Because in the case of nominal wage contacts, unexpected inflation has positive effects on the level of both production and employment, a higher equilibrium or natural rate of unemployment implies that surprise inflation is more valuable for the governments[2].

De Haan and Van't Hag (1995) test Cukierman's view and other hypotheses to explain variation in central bank independence across countries. In simple cross-section regressions that include central bank independence as a dependent variable, the coefficients of proxies for average employment-motivated inflationary bias in a country[3] are insignificant. The other political-economic determinants of the degree of central bank independence considered are: government debt, the past inflation, political instability, the presence in a country of a universal banking system and the supervision of financial system by central bank. In their regression analysis they find no significant coefficient for the government debt as a percentage of GDP. Indeed they show that a significant and positive relationship exists between very long-term inflation and independence of central bank. In the case of political instability they use both the frequency of government changes and the frequency of significant government changes (that is, the case of another party or coalition coming to office). All measures of central bank independence show a significant and negative relationship for the first index; while the coefficients for the second one are not significant. Finally, they find only a limited support for view that countries with a universal banking system and countries whose central banks do not regulate

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[2] Similiarly, Eijffinger and Shaling (1995) suggest that the higher the natural rate of unemployment, the higher will be the optimal degree of central bank independence The intuition behind this proposition is a follows. A higher natural rate of unemployment leads to higher time-consistent rate of inflation and, consequently, to an increase in a society's credibility problem. Hence, with an unaltered weight placed on inflation stabilization, as opposed to unemployment stabilisation, the monetary authorities' commitment to fighting inflation will now be too low to be effective. These proposition are tested for nineteen industrial countries for the post-Bretton Woods period (1960-93). They find an insignificant coefficient for the natural rate of unemployment.

[3] Proxies for inflationary bias are the equilibrium rate of unemployment, as estimated by Layard, Nickell and Jackman (1991), for nineteen industrial countries and the difference between the actual and the equilibrium rate of unemployment during the 1980s.

financial institutions have more independent central banks[4]. These last results are not in accordance with Posen (1993, 1995). They argues that, in a 'society', the greatest political opposition against inflation is raised by the financial sector. National differences in the extent to which the financial sector is averse to inflation, and its ability to lobby against it, jointly determine both the level of inflation and the monetary authority's degree of independence.
To conclude, all these studies do not consider openness to be a relevant aspect of the institutional design of monetary policy. As stressed in the introduction, a different line of work (Romer, 1993; Campillo and Miron, 1997; Lane, 1997) argues and shows empirically that the credibility issue for monetary policy is less severe for more open economies. This finding has prompted analysis of whether openness effectively represents a substitute for commitment in achieving low inflation rates, and therefore whether the more open countries are those with less independent central banks.
The next section discusses some economic and social determinants that play a significant role to shape the central bank's degree of independence.

3. A framework for the analysis and related literature

In this section we cast a framework for the estimated empirical model. The explanation of cross country differences in central bank degree of independence relies on several variants of the commitment hypothesis put forward by Rogoff (1985). Cukierman (1994) formulates testable implications derived from this approach. We summarise here some of these implications with a specific focus on open economies. To this aim we consider: 1) the determinants of inflationary bias in an open economy, as in Romer (1993) and 2) the degree of observability of the institutional strategic commitment.

Several factors, influencing the inflationary bias, will enter the regression for the degree of dependence as the endogenous variable. The measure of central bank degree of dependence, we consider, is the one constructed by Cukierman, Webb and Neyapti (1992) and also used by Romer (1993), Campillo and Miron (1997), Lane (1997). We use this index because it is reported for the largest number of countries covering both OCED and non OCED economies.

On the basis of this framework, the following testable implications can be obtained:

a. Central bank dependence is larger the larger the degree of openness

[4] For only one of the three indices of independence central banks that they use, they find a significant positive relation with the dummy for universal banking. They report similar finding with respect to the relation between prudential supervision and central bank independence.

Following Romer (1993) and Lane (1997) a larger degree of openness, reduces the inflationary bias for the Central Banker and therefore, as shown in D'Amato and Martina (2005) reduces the incentive to commitment for the Government. The impact of openness on the incentive to commitment also works through an alternative channel: the level of synchronization between the country business cycle and the world business cycle. As a proxy for the degree of openness we use the same index as in Romer (1993), that is the import share over the GDP.

b. Central bank dependence is larger the lower the degree of business cycles synchronization across countries

This is a crucial variable for the explanation for understanding why institutional solutions to the inflationary bias problem have been adopted only in highly industrialised countries.

When the correlation between shocks to the level of economic activity is positive Governments rationally expect their economies to be in the same state of the world (booms or slumps) as foreign economies. Since more stabilisation abroad entails larger flexibility of the policy response by the national Central Banker[5], Governments in each country have a strategic incentive to commit monetary policy to try to free-ride on the stabilisation provided abroad. The larger the degree of correlation among shocks, the larger the incentives to commitment. To proxy the size of the common component in the business cycle in the countries included in our sample, we compute the correlation between real GDP growth rate in each country and the analogous measure for the US[6].

The third testable implication of the commitment hypothesis considered in our analysis relates to the formal game theoretic argument about strategic conditions that make commitment profitable:

c. Central bank dependence is larger, the lower the degree of observability of the delegated institution

This is another crucial variable that enable us to test for the strategic commitment approach to central bank independence. As it is well known, the results obtained in the literature on commitment and observability (Bagwell, 1995; Fershtman and Kalai, 1997) show that the benefits accruing to a player from constraining its actions

[5] Consider the case of bad shocks abroad. Some increase in money supply by the foreign Central Banker reduces the perceived cost of inflation for the CB at home because of the terms of trade effect and the associated deflation. This mechanism the same as in Romer (1993) and Rogoff (1985,b) induces complementarities in the policy response by CBs. See D'Amato and Martina (2005) for further details on this issue and a formal derivation of the result summarized in the text.

[6] A possible alternative proxy is the correlation between the GDP growth in each country and a weighted average of the growth rates of the economies in the sample. As we will see the choice of the proxy does not affect our results.

through commitment (via delegation) are crucially connected with the likelihood that the commitment choice will be observed by other players.[7] In the case of monetary policy, therefore, if the commitment approach to institutional design has empirical relevance, one has to expect that there is a positive relation between the extent to which delegation is observable by the private sector and the equilibrium level of commitment. Intuitively, the larger the degree of observability of the Government's choice the higher will be his incentive to commit (direct effect). There is also an indirect effect: the larger the degree of observability of the Central Banker's objectives the more difficult is to engineer an inflation surprise, the worse the inflationary bias equilibrium from the point of view of the government (indirect effect)[8]. The proxy for the degree of observability of institutions by the general public we use is the average per capita daily circulating newspapers. This is, of course, not close to our ideal proxy for the variable in question. The main problem is that it may be correlated with other variables also affecting the incentive to strategic commitment. In particular, per capita daily newspapers may capture different forces related to the level of development of the economy and its financial system, the efficiency of the tax system and other variables that may influence the inflationary bias. To disentangle these effects we will also include real per capita Gdp as a separate variable.

Other factors influencing the inflationary bias and the delegation choice considered in other papers will be also included as control variables.

d. Central bank dependence and the past experience of inflation

There are two different explanations for why past inflation may be important as a determinant of current institutional arrangements, under the commitment hypothesis.

Following Cukierman (1992), we may argue that inflation, when sufficiently sustained, will erode central bank independence. High and sustained inflation leads to the evolution of automatic or semi-automatic accommodative mechanisms, like indexation of contracts in the labour and capital markets to the general price level or

[7] This is the result obtained by Fershtman and Kalai (1997) and it contrasts with the one obtained by Bagwell (1995). In this latter model, followers face a small probability of error about the leader's action. This small probability makes the information about the action useless: the incentive to commitment collapse. By contrast, in Fershtman and Kalai (1997) model there is also a probability that the player is informed about his opponent's action but and this is the crucial difference, when a player is informed about his opponent's action this information is accurate. This accuracy restores the incentives to commit and commitment is, intuitively, increasing in the probability that one player's action is observed.

[8] This argument follows from a straightforward modification of the streamlined version of the Rogoff (1985a) model along the lines of the model by Fershtman and Kalai (1997) where the delegation choice is observed only by a fraction of agents.

to the price of foreign exchange[9]. Society becomes accustomed to inflation, thereby reducing opposition to inflation and public pressure for an independent central bank. Hayo (1998), on the other hand, has argued that the experience of high levels of inflation, for prolonged periods of time, generates popular support for anti-inflationary monetary policies. Countries which have experienced high rates of inflation in the past may be more aware of its harmful consequences and may therefore develop greater aversion to the problem. This interpretation is frequently adduced in explanation of the low inflation rates recorded in Germany after the Second World War and the independence of the Bundesbank (Issing, 1993).
The idea that, after periods of hyperinflation, a 'culture' in favour of price stability in 'society' may arise (Hayo, 1998)[10] suggests that there is a positive relation between past inflation and the central bank's degree of independence.

We have no prior about which of the two mechanisms described above has empirical relevance and we leave the answer to the data.

e. Central bank dependence and the political instability[11]

The relationship between political instability and the level of dependence is not clear cut in the commitment literature. On one hand, the high variability of the political environment may involve a lower ability to achieve commitment of monetary policy through delegation to an independent institution. On the other hand, a larger political instability may increase the benefits to commitment. As an example of the ambiguous relation between political instability and Central bank independence, Cukierman (1994) predicts that a high level of political instability induces a larger level of independence, provided political polarisation is sufficiently large. We use the index of political instability as in (Barro, 1991) and Romer (1993).

f. Central bank dependence larger the lower the Government's debt and deficit

From the empirical point of view, a large body of evidence (Poterba and Rotemberg; 1989; Grilli, Masciandaro and Tabellini, 1991; Cukierman, 1992) shows that cross-country differences in average inflation rates are consistent with considerations relative to the level of optimal taxation.

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[9] Countries such as Brazil, Argentina, and Israel experienced elaborate indexation for many years. But even in countries with relatively mild inflationary experiences such United States, Italy, France, Britain an increase in the proportion of indexed contracts followed the inflationary experience of the 1970s.
[10] In fact, after Germany's inflation explosion of 1923, monetary stability was not a goal pursued by the Bundesbank alone but a priority for society as a whole.
[11] The political instability considered is regime political instability.

Countries with weak public budget suffer from an eccessive inflationary bias which may increase the interest burden. Therefore, the benefits from commitment will tend to be larger (see Barro, 1983 and Cukierman, 1994).

Similar arguments hold for the expected impact of the share of banking sector credit held by the private sector (i.e. M2/GDP) as a nominal asset and a tax base for the inflation tax.

In our empirical specification we will use the level of public expenditure over GDP, the level of public deficit over the GDP as a measure for the governmental financial position since we were not able to reconstruct public debt for many countries for which index of central bank dependence exist.

g. Central banker dependence and the development

From the point of view of the inflationary bias approach to monetary policy the impact of per capita Gdp on average inflation is not clear cut. On the one hand a higher level of per capita income entails a lower degree of (real and financial) market failures in the economy, a more efficient fiscal system and therefore a lower incentive to surprise inflation from the central banker. On the other hand, economic agents in high income countries might be better hedged against inflation, so their inflation aversion may be lower, (Campillo and Miron, 1997). Opposite effects on the inflationary bias in monetary policy entail opposite effects on the incentives to precommit monetary policy. We consider the real GDP per capita as an indicator of a general measure of development. In Romer (1993, table III, p. 882)) a larger per capita GDP has a negative impact on inflation. In Lane (1997, table 5, p. 343[12]) and Campillo and Miron (1997) a positive sign of log per capita GDP on average inflation, is obtained.

h. Central bank dependence larger the larger the size of the economy

Size captures the importance of the terms of trade effect (Lane, 1997), i.e. the larger the real exchange rate depreciation after monetary surprise, the lower the inflationary bias. A lower inflationary bias reduces the incentives to commit monetary policy. Also notice that since openness and size are correlated variables in the data, omitting size from the regression would introduce a bias into the estimation of the effect of openness on the degree of central bank independence. In the empirical analysis, we use the real total GDP as a proxy for the size.

[12] In Romer (1993) a negative impact of Gdp on average inflation is obtained except for the case of the Asian countries subsample. In Lane (1997) a positive impact of Gdp on average inflation is obtained is obtained except for the subsample of "rich countries".

The next section presents the empirical evidence for the hypotheses formulated above.

4. Results

In this paper we explore the determinants of central bank independence on a sample of 55 countries. In particular, we examine the determinants of central bank degree of dependence as measured by Cukierman, Webb and Neyapti's (1992) overall index for the period 1980-89 (dependent variable: DI). This index varies between 0 and 1. A high value of this index for a country is viewed as an indication of less central bank independence. This measure is available for a sample of 63 countries. Our study is, however, performed on a sample of 55 countries[13] because of limits in the availability in other variables included in the empirical analysis. Moreover, following Romer (1993) and Campillo and Miron (1997), we split our sample into two subsamples, made of 23 OECD countries and 32 non OECD, respectively, to explore the relationship between incentive to commitment and development.

The general specification for our regression contains the following explanatory variables: an index of political instability for the period 1961-85 (INSTABILITY), the correlation between the GDP growth rates of each country and the U.S GDP growth rates for 1961-79 (CORRELATION), the average inflation rate for 1961-1979 (INFLATION), the average stock of M2 over the GDP for 1970-79(LIQUIDITY), the average public deficit over the GDP for 1970-79 (DEF), the average government expenditure over the GDP for 1970-79 (G), the average daily newspapers per-capita for 1972-88 (TRANSPARENCY), the average real GDP per-capita for 1960-79 (DEVELOPMENT), the average level of real GDP for 1960-79 (SIZE), the average share of import over the GDP for the period 1970-79 (OPENNESS). For a detailed definition of the variables and the source of our database see the Appendix.

It may be noticed that, in order to take potential endogeneity problems into account, the time period of some of the independent variables is predetermined with respect to the time period of DI. As for CORRELATION, since the innovation to the GDP growth rate is endogenous with respect to the monetary policy reply, in order to escape this problem, the correlation index has been constructed for the period spanning from 1961 to 1979, whereas the Cukierman index refers to the period 1980-1989. The same strategy has been adopted for all the other variables except for INSTABILITY and TRANSPARENCY which are safely assumed to be exogenous with respect to DI: political turmoils are not likely to depend on the legal framework for monetary authority and the transparency proxied by the daily circulation of newspapers certainly does not depend on DI.

[13] A list of countries is in Appendix (Table 0).

The estimation technique is Ordinary Least Squares. No correction for the estimated standard errors is required, since all our regressions pass the tests for omoshedasticity and normality of the residuals (tests reported in the output tables).

Following Romer (1993), Lane (1995) and Campillo and Miron (1997), we provide different specification using either levels or logs for INFLATION, SIZE and DEVELOPMENT (semilog-specification). Results do not change in a significant way and are reported for the sake of completeness and as an indication of robustness. Another indication of the good performance of our specifications on the data is the relatively high level of the adjusted R-square ranging from a minimum of 0.45 for the non OECD sample to 0.72 for the full sample. For the OECD economies, all the specifications deliver adjusted R-square around 0.6.

Table 1 reviews the results for the full sample of countries. Table 2 reports the results for the OECD sub-sample and Table 3 the outcome for the non OECD sub-sample. Remarkable stability in the sign, size and significance of the coefficients emerges across models within each table.

In particular, Table 1 show that OPENNESS and TRANSPARENCY turn out to be highly significant and have the expected signs consistent with the commitment interpretation of the monetary policy institution. Transparency captures the core of the strategic aspect of the commitment hypothesis, that is its observability. Openness turns out to be a substitute for commitment.

CORRELATION has the expected sign: the larger is the common component in the GDP growth among the economies, the larger is the commitment incentive. However, this variable is not significant. This outcome suggests that commitment by governments in open economies does not take into account, to a sizeable extent, strategic externalities induced by the terms of trade effects at world scale. From the literature on the international business cycle, we know that "Poorer economies are more likely to experience country-specific cycles. Evidently, there is a world business cycle, and, unsurprisingly it reflects economic activity in the developed economies" (Kose et al., 2005). Therefore, we expect correlation to play a major role in the subset of OECD countries.

Past INFLATION is also highly significant and positively affects the degree of dependence suggesting that the persistency of the determinants of current inflation emphasize by Campillo and Miron (1997), is also at work at the institutional design stage.

The measures of SIZE and DEVELOPMENT of an economy are statistically negligible. As for the role of development in affecting the incentive to institutional commitment, the data, as in Romer (1993), do not support the view that the extent to which countries have solved the dynamic inconsistency problem is an increasing

function of their level of development. As in the case of OPENNESS and CORRELATION, a different role for DEVELOPMENT will emerge in the two subsample.

POLITICAL INSTABILITY has a positive sign: the larger the level of instability the lower the incentive of commitment, however it plays a mild role in terms of explanatory power.

The estimated signs for the coefficients of the variables (LIQUIDITY, DEFICIT, G) relating the inflationary bias to considerations regarding public finance, optimal taxation and seignorage, are consistent with the commitment hypothesis: the larger the inflationary bias coming out of public finance considerations the larger the incentive to commit. However, all these estimates are weakly significant.

A closer scrutiny of Table 2-3 (OECD vs non OECD samples) allows us: 1) to support our working hypothesis about the relevance of strategic commitment for understanding monetary institution, and 2) to show that our analysis indeed contributes to the understanding of the institutional solution has been adopted only in highly industrialized countries.

The empirical relevance of strategic commitment emerges in both sub-samples and across models: the degree of observability of institutional objectives of the Central Banker (TRANSPARENCY), the variables related to openness (OPENNESS and CORRELATION) and the effect of past inflation (INFLATION) remain statistically significant and with the expected signs.

As for the explanation of why the institutional solution has been adopted only in highly industrialized countries, a different mechanism appears to operate in relation to the variables related to openness. In the regressions for the OECD, the size of the common component in the international business cycle (CORRELATION) is statistically significant with the expected (negative impact on the dependence) sign. The degree of openness (OPENNESS) also has the correct sign but it is statistically negligible. The opposite pattern emerges among the non OECD countries where the common component in the world business cycle is irrelevant[14], whereas the degree of openness (OPENNESS) is highly significant.
Therefore our analysis supports the view that the level of development is not the right determinant of the incentives to strategic commitment in open economies. The reason why the problem of dynamic inconsistency of optimal monetary policy has

[14] These results do not depend on the proxy for the common component. Similar results are obtained by using as a proxy the correlation between the GDP growth in each country and a weighted average of the growth rates of the economies in the sample. The weights used are the GDP levels in each country delivering the following formula for the world growth rate: $\frac{\frac{GDP_{1,t}-GDP_{1,t-1}}{GDP_{1,t-1}} * GDP_{1,t-1} + \frac{GDP_{2,t}-GDP_{2,t-1}}{GDP_{2,t-1}} * GDP_{2,t-1} + \ldots}{GDP_{1,t-1} + GDP_{2,t-1} + \ldots}$

been solved by strategic commitment only in highly developed countries has to do with the features of the business cycle in these countries. As explained in the previous section, a large degree of synchronization of the business cycle, ceteris paribus, reinforces the incentives to commitment in open economies. In non OECD countries this mechanism does not operate since their degree of integration with the world economy is low. In these countries, strategic commitment is mainly affected by OPENESS. As shown by Romer (1993), a large degree of openness reduces the inflationary bias and in turn weakens the incentives to commit: openness and commitment are substitute in the eyes of the political body delegating monetary policy.

As already mentioned, there are other differences in the relevant variables for the explanation of the observed degree of commitment emerging in the two subsamples. These differences do not contradict the picture emerged so far.

For the OECD sample, Table 2, the variables related to public finance considerations (LIQUIDITY, DEFICIT, G) as well as DEVELOPMENT and SIZE are not significant. Political instability becomes more relevant than in the full sample, confirming the result in Cukiermann (1994). For the non OECD countries, on the other hand, variables related to public finance considerations have the same signs as in the full sample and a larger statistical significance: in the face of less developed fiscal system a commitment mechanism is at work for monetary policy. Also notice that the real GDP percapita, proxy for the level of development (DEVELOPMENT), as a positive and significant effect on the level of dependence. Concerning the positive sign of DEVELOPMENT, this is consistent with the commitment interpretation of the results in Romer (1993) where a larger percapita GDP has negative impact on average inflation that is reduces the inflationary bias. From our point of view, the reduced inflationary bias reduces the incentive to commit with positive impact on the level of dependence of the Central Bank. Also notice that this positive sign squares with evidence discussed above regarding the hypothesis that the level of development has little relevance for understanding commitment in highly industrialized countries.

Conclusions

Our findings show that both dimensions explored in this study turn out to be relevant in the data for the understanding of the design of monetary institutions across countries: controlling for other variables, both openness and the measure of institutional transparency among the general public turn out to be significant in the regression for the degree of monetary authority independence. Therefore, even if the commitment approach does not seem to be relevant in the data for explaining long run inflation in countries other than the highly industrialized ones, our exploration of the determinants of independence seems to support the view that strategic delegation

is indeed at the root of the delegated power and objectives of the monetary institutions across countries.

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Data Appendix and Source

DI = Measure of central bank dependence is Cukierman, Webb, and Neyapti's (1992) overall index for the 1980s (1980-89). Cukierman, Webb and Neyaptis index of central bank of dependence is based on two variables: the turnover rate of central bank of governator and index of legal dependence. The weight on the turnover and legal independence in Cukierman, Webb, and Neyapti's (1992) overall index are determinated by regressions of average inflation on the two variables, using separate regressions for industrialized and non-industrialized countries. Original source (Cukierman A., Webb S. e Neyapti B., 1992); our source is Romer D., (1993), "Openness and Inflation: Theory and Evidence", Quarterly Journal of Economics, vol. 108, pp. 869-903.

INSTPL = Measure of political instability. It is mean number of revolutions, terrorist attack and coups per year (1960-85). Original Source (Barro, 1991), our source is Romer D., (1993), "Openness and Inflation: Theory and Evidence", Quarterly Journal of Economics, vol. 108, pp. 869-903.

Rgdpch = Real GDP per capita (1960-79). Our source is: Penn world tables 6.1, http://pwt.econ.upenn.edu/aboutpwt.html

Pop = population (1960-79). Our source is: Penn world tables 6.1, http://pwt.econ.upenn.edu/aboutpwt.html

gdpch_tot = rgdpch*Pop.(1960-79). Our source is: Penn world tables 6.1, http://pwt.econ.upenn.edu/aboutpwt.html

Corr1 = Yearly correlation between World real GDP growth e Country real GDP growth (1961-79) my source is: Penn world tables 6.1, http://pwt.econ.upenn.edu/aboutpwt.html

Corr2 = Yearly correlation between USA real GDP growth e Country real GDP growth (1961-79) Our source is: Penn world tables 6.1, http://pwt.econ.upenn.edu/aboutpwt.html

DN = Average (1972-1987) Daily Newspaper Circulation Per Capita. My source Banks A. S., (1999), Cross National Time-Series Data Archive, Banner Software, Inc. Binghamton.

INFL = Inflation (1961-1979) is measured as the average annual change in the GDP deflator. For countries for which this series is not available, we use the change in the CPI instead. Our source is IMF supplement series, n.12, 1986.

OPEN = Openness is measured as the average share of imports in GDP over years 1970-1979. Our source is IMF supplement series, n.4, 1982.

Total expenditure as % of GDP = Central government expenditure % GDP (1970-79). Our source is IMF supplement series, n.11, 1986.

Overall deficit/surplus as % of GDP = central government deficit or surplus as %of GDP (1970-79)). Deficit or surplus is defined as the total of revenue plus grants minus the total of expenditure plus lending minus repayments. Our source is IMF supplement series, n.11, 1986.

M2/GDP = NominalM2/NominalGDP (1970-79), where M2 is money plus quasi-money i.e. It comprises the sum of money and time, savings and foreign currency deposit with the monetary authorities and deposit money banks. These deposits exclude deposit by the central government and by non-residents. Our source is IMF supplement series, n.15, 1983.

Table 0 The sample of 55 countries

Country	**OECD *membership***	**Country**	**OECD *membership***
Argentina		Malaysia	
Australia	√	Mexico	
Austria	√	Nepal	
Barbados		Netherlands	√
Belgium	√	New Zealand	√
Botswana		Nicaragua	
Brazil		Norway	√
Canada	√	Pakistan	
Chile		Panama	
Colombia		Peru	
Costa Rica		Philippines	
Denmark	√	Portugal	√
Egypt		Singapore	
Finland	√	South Africa	
France	√	Spain	√
Germany	√	Sweden	√
Ghana		Switzerland	√
Greece	√	Tanzania	
Honduras		Thailand	
Iceland	√	Turkey	√
India		UK	√
Indonesia		USA	√
Ireland	√	Uganda	
Israel		Uruguay	
Italy	√	Venezuela	
Japan	√	Zambia	
Kenya		Zimbabwe	
Korea			

Table 1 All countries
Dependent variable: DI

Explanatory variables	**Model 1**	**Model 2**	**Model 3***	**Model 4**	**Model 5**
Constant	0.164 (6.41)	0.165*** (6.77)	**0.164***** **(6.74)**	0.15*** (6.52)	0.127*** (7.36)
INSTABILITY	0.06 (1.43)	0.060 (1.48)	**0.057** **(1.42)**	0.070* (1.73)	0.081** (2.02)
CORRELATION	-0.020 (-0.78)	-0.020 (-0.87)	____	____	_____
INFLATION	0.0018*** (5.05)	0.0018*** (5.14)	**0.019***** **(5.29)**	0.0019*** (5.63)	0.0019*** (5.45)
LIQUIDITY	-0.045 (-1.04)	-0.051 (-1.36)	**-0.054** **(-1.46)**	_____	____
DEFICIT	-0.028 (-1.007)	-0.003 (-1.28)	**-0.003** **(-1.39)**	____	_____
EXPENDITURE	-0.015 (-1.36)	-0.001 (-1.69)*	**-0.001*** **(-1.84)**	-0.001 (-1.49)	____
TRANSPARENCY	-0.171** (-2.12)	-0.188*** (-3.29)	**-0.189***** **(-3.30)**	-0.253*** (-5.36)	-0.268*** (-5.73)
DEVELOPMENT	-0.935e-06 (-0.33)	____	____	____	____
SIZE	0.301e-11 (0.21)	_____	_____	_____	____
OPENNESS	0.0012*** (3.41)	0.0012*** (3.69)	**0.001***** **(3.85)**	0.001*** (3.49)	0.001*** (3.24)
R^2	0.726	0.725	**0.721**	0.698	0.684
Adjusted – R^2	0.664	0.678	**0.679**	0.667	0.659
Jarque-Bera/Salmon-Kiefer Test	χ(2)= 1.174 (cv5%=5.99)	χ(2)= 1-145 (cv5%=5.99)	c**(2)=0.1.37** **cv5%=5.99)**	χ(2)=1.81 cv5%=5.99)	χ(2)=2.00 cv5%=5.99)
Breusch-Pagan Test	χ(10)=7.93 (cv5%=18.31)	χ(8)=6.59 (cv5%=15.51)	c**(7)=5.90** **cv5%=14.07** **)**	χ(5)=4.23 cv5%=11.07)	χ(4)=2.72 cv5%=9.49)
Sample	55	55	**55**	55	

Notes: ** 10%, ** 5%, ***1% significant level; (t-value; Model*: final specification*

Table 2 OECD countries.
Dependent variable: DI

Explanatory variables	**Model 1**	**Model 2**	**Model 3**	**Model 4***
Constant	0.124* (1.99)	0.123* (2.70)	0.130*** (3.42)	**0.095***** **(4.25)**
INSTABILITY	0.116 (1.42)	0.117* (1.80)	0.115* (1.88)	**0.132**** **(2.31)**
CORRELATION	-0.054 (-1.46)	-0.052** (-2.23)	-0.052** (-2.38)	**-0.044**** **(-2.18)**
INFLATION	0.00245 (1.22)	0.023 (1.33)	0.003* (1.81)	**0.033** **(2.45)****
LIQUIDITY	-0.035 (-0.88)	-0.036 (-1.008)	-0.0035 (-1.08)	____
DEFICIT	-0.0006 (-0.23)	-0.0009 (-0.38)	_____	____
EXPENDITURE	0.0003 (0.29)	0.0003 (0.30)	_____	____
TRANSPARENCY	-0.129* (-1.92)	-0.130** (-2.50)	-0.141*** (-3.01)	**-0.135***** **(-2.96)**
DEVELOPMENT	-0.351e-06 (-0.093)	_____	_____	____
SIZE	0.312e-10 (0.258)	_____	_____	____
OPENNESS	- 0.0004 (-0.469)	-0.0005 (-0.69)	-0.0002 (-0.48)	_____
R^2	0.723	0.721	0.711	**0.687**
Adjusted – R^2	0.492	0.561	0.603	**0.618**
Jarque-Bera/Salmon-Kiefer Test	$\chi(2)$= 0.152 (cv5%=5.99)	$\chi(2)$= 0.164 (cv5%=5.99)	$\chi(2)$=0.241 cv5%=5.99)	c**(2)=0.218** **cv5%=5.99)**
Breusch-Pagan Test	$\chi(10)$=11.20 (cv5%=18.32)	$\chi(8)$=11.08 (cv5%=15.51)	$\chi(6)$=10.05 cv5%=12.9)	c**(4)=8.20** **cv5%=9.49)**
Sample	23	23	23	**23**

Notes: ** 10%, ** 5%, ***1% significant level; (t-value; Model*: final specification*

Table 3 Non - OECD countries.
Dependent variable: DI

Explanatory variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Constant	0.162*** (5.46)	0.159*** (5.47)	0.157*** (5.44)	0.152*** (5.44)
INSTABILITY	-0.120 (-0.24)	____	____	_____
CORRELATION	0.035 (0.88)	0.034 (0.37)	____	_____
INFLATION	0.002*** (4.52)	0.019*** (4.72)	0.019*** (4.77)	0.020*** (5.35)
LIQUIDITY	-0.099 (-1.01)	-0.098 (-1.03)	-0.069 (-0.77)	_____
DEFICIT	-0.010** (-2.09)	-0.010** (-2.18)	-0.009** (-2.12)	-0.009* (-2.02)
EXPENDITURE	-0.004* (-2.00)	-0.004** (-2.12)	-0.003* (-2.01)	-0.003** (-2.16)
TRANSPARENCY	-0.520** (-2.14)	-0.52** (-2.18)	-0.41* (-2.02)	-0.37* (-1.89)
DEVELOPMENT	13.999e-06** (2.25)	13.677e-06** (2.29)	11.607e-06** (2.13)	9.659e-06* (2.02)
SIZE	6.545e-11 (1.10)	6.565e-11 (1.13)	5.7453e-11 (1.09)	5.521e-11 (0.98)
OPENNESS	0.001* (1.81)	0.001*** (3.02)	0.001*** (2.90)	0.001** (2.89)
R^2	0.629	0.628	0.616	0.605
Adjusted – R^2	0.456	0.477	0.482	0.490
Jarque-Bera/Salmon-Kiefer Test	$\chi(2)$= 5.85 (cv5%=5.99)	$\chi(2)$= 4.30 (cv5%=5.99)	$\chi(2)$=2.27 cv5%=5.99)	$\chi(2)$=2.48 cv5%=5.99)
Breusch-Pagan Test	$\chi(10)$=12.83 (cv5%=18.31)	$\chi(9)$=9.70 (cv5%=16.92)	$\chi(8)$=7.16 cv5%=15.51)	$\chi(7)$=6.14 cv5%=14.07)
Sample	32	32	32	32

Notes: ** 10%, ** 5%, ***1% significant level; (t-value; Model*: final specification*