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On the Determinants of Central Bank Independence in Open Economies

by

Marcello D'Amato*
Barbara Pistoresi**
Francesco Salsano***

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* Università degli Studi di Salerno
Dipartimento Scienze Economiche
Via Ponte Don Melillo
84084 Fisciano Salerno
e-mail damato@unisa.it

** Università degli Studi di Modena e Reggio Emilia
Dipartimento di Economia Politica
Via Berengario, 51
41100 Modena (Italia)
e-mail: pistoresi.barbara@unimore.it

*** Birkbeck College ed Università di Salerno
Malet Street London WC1E 7HX
e-mail: f.salsano@econ.bbk.ac.uk

On the determinants of central bank independence in open economies

Marcello D'Amato,
Università di Salerno, Csef, Celpe♦

Barbara Pistoresi,
Università di Modena e Reggio Emilia

Francesco Salsano,
Birkbeck College and Università di Salerno

Abstract

Several studies suggest the idea that central bank independence (CBI) is a way out, possibly a "quick fix", of the inflationary equilibrium outcome. Nevertheless there exist significant variation in CBI across countries. Empirical studies (Romer, 1993, Campillo and Miron,1997) have suggested that CBI does not affect inflation performance in the long run casting doubts on the idea that commitment is empirically relevant in many sub samples of countries. We test some positive implications of the commitment hypothesis for the design of monetary institutions in open economies, by studying the determinants of central bank independence on a sample of 55 countries. We document fairly consistent empirical evidence in support of the hypothesis that strategic commitment (and the forces shaping incentives to adopt it) is indeed important to understand cross country variation in the level of central bank degree of dependence. We also address the related question (Romer 1993) why only highly industrialized countries have relied on such a solution to the inflationary bias of monetary policy whereas others have not. Data suggest that the answer is related to the presence and the size of world-wide common features in the business cycle in each country.

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♦ *Corresponding author:* Dipartimento Scienze Economiche, Via Ponte don Melillo, 84084 Fisciano Salerno. Tel: ++39 089 962074, Fax: ++39 089 962160, E-mail: damato@unisa.it

1. Introduction

Several studies have documented how the independence of the monetary authority is an essential part of the explanation for why inflation rates differ among countries.[1] In particular, Cukierman, Webb and Neyapti (1992) show that inflation is generally higher in the high-income countries with less independent central banks, whereas the relation does not hold for other countries. Moreover, this empirical literature shows that there is no relation between central bank independence and volatility of the real economy, at least in the subset of high income countries. This finding has been interpreted to indicate that guaranteeing the central bank's independence gives a 'free lunch', in that average inflation is reduced without entailing a cost in terms of greater output instability. All these studies suggest the idea that central bank independence is a way out, possibly a "quick fix", of the inflationary equilibrium outcome. Nevertheless there exist significant variation in central bank independence across countries.

The aim of this paper is to contribute to the empirical study of the determinants of central bank independence in open economies. Following the bulk of the literature on this problem, we follow the perspective in Rogoff (1985a) and interpret delegation of monetary policy as a commitment device to eradicate the inflationary bias. Among others, Cukiermann (1994) develops a rich conceptual framework, based on the commitment hypothesis, that allow to formulate hypothesis that can account for cross country variation in Central banker degree of independence in a closed economy.[2] 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 (1824).

Despite the presence of many empirical studies on the determinants of Central Bank independence, the evidence that there is indeed a strategic pre-commitment

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[1] Most notable among them are Bade and Parking (1988), Grilli, Masciandaro and Tabellini (1991), Cukierman, Webb and Neyapti (1992), and Alesina and Summers (1993).

[2] To explain cross country variation in the observed degree of independence the commitment approach (Rogoff 1985a; Lohmann 1992) argues that the costs of an independent Central Bank, from the government's point of view, consist mainly of the loss of flexibility in monetary policymaking. The balance between flexibility and credibility determines the equilibrium degree of central bank independence in a country (see Alesina and Grilli, 1993, for a median voter interpretation of the Rogoff's model). The balance between costs and benefits in delegating the power to manage paper money may depend on many aspects of the economy and on its institutional framework. Any economic factor increasing the inflationary bias and reducing the exogenous source of variability should, coeteris paribus, increase the incentive to commitment. Theoretical studies on central bank independence have focused on both political and economic factors shaping the incentives to commitment. They mainly rely on articulated models of political equilibria, focusing on closed economy determinants of the inflationary bias, on the redistributive aspects of monetary policy and on political institutions (Cukierman, 1992, 1994; Drazen, 2000; De Haan and van't Haag , 1995).

mechanism at the root of the delegated power is not strong. 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) argues that commitment contributed to overcome the inflationary bias only in the most highly industrialized countries. He finds that the same mechanism does not seem to have been at work in other countries and notices that "the data are not at all supportive of the view that the extent to which countries have solved the dynamic inconsistency problem is a smoothly increasing function of their level of development" leaving the question of what drives the incentives to adopt the institutional solution open. Campillo and Miron, (1997) in their detailed empirical study on the determinants of long run inflation conclude that data suggest that there is no quick fix to be exploited for the solution of the inflationary bias, casting some doubts on the empirical relevance of the commitment hypothesis for all the economies in their sample. Daniels et al. (2005) argue that the index of central bank independence is relevant for understanding the relationship between openness and the sacrifice ratio faced by policy makers.

Why then have only some countries solved the dynamic inconsistency problem whereas other have not? Is the commitment hypothesis empirically relevant for our understanding of the institutional framework of monetary policy around the world?

To verify whether the commitment is empirically relevant and to address what incentives may drive its adoption, we study some positive implications of the commitment hypothesis for the design of monetary institutions in open economies testing for the determinants of central bank independence on a sample of 55 countries.

Our approach follows the empirical strategy in Romer (1993) quite closely, relocating his analysis of the inflationary bias at the commitment level. Testing the implications of the commitment hypothesis is as important as testing the implications of the inflationary bias hypothesis, for at least two reasons: on the one hand commitment is one of the most influential policy implications of the inflationary bias literature and testing its empirical relevance is crucial; on the other hand it allows to address important questions like why, as Romer (1993) puts it, only high income countries seem to have solved the credibility problem through commitment?

To this aim we extend previous empirical work in three directions: 1. the role of openness in the incentives to commitment, 2. the related issue of synchronicity of business cycles among countries as a driving force of the institutional design of monetary authorities and 3. the determinants of the effectiveness of the commitment technology . Specifically we study three testable implications of the commitment hypothesis that have not been investigated in previous contributions by focusing on the implications of the game theoretic analysis of the pre-commitment strategies and on the determinants of the inflationary bias and related incentives to commitment in open economies.

The first testable implication is derived from the game theoretic frame of commitment choices. In order to be valuable as a commitment device in the government's hand, a delegated institution has to be visible and credible among the general public. Coeteris paribus, the more transparent[3] to the general public the institution is, the larger the equilibrium level of commitment is expected to be, i.e. the larger the independence and the scope of the delegated power to that institution (Fershtmann and Kalai, 1997).

The other testable implications we focus on refer to specific features of the incentives to commitment of monetary policy in open economies. If theory suggests, and data confirm, that openness is relevant for understanding the inflationary bias, it must be relevant for understanding the incentives to commitment too. Rogoff (1985b) and 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 the implications of openness for the equilibrium degree of commitment of monetary policy.

In particular, the second implication is derived from a straightforward extension of the model in Romer (1993): incentives to commitment have to be inversely related to the degree of openness in the economy since, under flexible exchange rate, the terms of trade mechanisms is a "self built in check" on inflation temptations. The third implication of a commitment model in open economies requires the degree of independence to be positively related to the size of the worldwide common components in the business cycles of each country. This latter hypothesis is a less straightforward implication of the model in Romer (1993) and rests on the idea that, in the presence of common components, stabilization policy provided in one country has a positive spill-over on the amount of stabilization policy provided abroad at no costs in terms of credibility. Because of this strategic externality, each country in the world economy will try to free ride on the stabilization provided by central bankers abroad to save on credibility costs at home and will appoint more independent central bankers, with strong commitment to anti inflationary objectives. The size of this incentive directly depends on the size of the share of the common component over the country specific component of the business cycle in each economy. See D'Amato and Martina, (2005) for further details on this point.

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[3] Geraats (2000) has classified different meanings that the term "transparency" may refer to in the context of monetary policy making. Here we focus on what Geraats (2000) defines as "political transparency", meaning the capacity of the general public to understand policy objectives and institutional arrangements that shape monetary policy reply and then the inflationary bias. 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 other than the degree of transparency of a monetary institution. A detailed discussion of this issue is postponed to the following section.

Our findings show that all the predictions above are supported in the data: controlling for other variables, both openness, the degree of synchronization among business cycles and the measure of institutional transparency among the general public turn out to be significant in the regression for the degree of monetary authority dependence, with the sign predicted by the commitment hypothesis. 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 is consistent with the view that strategic delegation is indeed at the root of the delegated power and objectives of the monetary institutions across all countries. The point is that in some countries it is more effective than in others because of economic and strategic reasons.

The rest of the paper is organized as follows: Section 2 summarizes the theoretical framework and the relevant related literature. Section 3 sets out the empirical results of the analysis, Section 4 presents the conclusions.

2. A framework for the analysis of commitment in open economies 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 (1985a). Cukierman (1994) summarizes testable implications derived from this approach. We reappraise here some of these implications with a specific focus on open economies. To this aim we additionally consider: 1) the determinants of inflationary bias in an open economy 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), Lane (1997) [4]. We use this index because it is reported for the largest number of countries covering both OECD and non OECD economies. On the basis of this framework, the following testable implications can be obtained:

[4] The theoretical literature distinguishes between the political independence and the functional independence of the central bank. Political independence is the freedom of a central bank to pursue a monetary policy strategy consistently with price stability. Functional independence concerns tactics: that is, the freedom to choose the monetary control instruments and techniques which enable achievement of a given objective. The indices used by the empirical literature to measure the degree of a central bank's independence consider both types of independence.

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

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. 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.
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.

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

The size of the world-wide common component in the business cycle will turn out to be a crucial variable for the understanding of why institutional solutions to the inflationary bias problem have been adopted only in highly industrialised countries. To understand why this is relevant consider that when the correlation between shocks to the level of economic activity is positive Governments have to rationally expect their economies to be in the same state of the world (booms or slumps) as foreign economies. Since the inflationary bias hypothesis requires that 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 and gain credibility at home. 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

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[5] Consider the case of bad shocks abroad. An 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 on the CPI index. This mechanism the same as in Romer (1993) and Rogoff (1985b) 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.

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 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[8]. The proxy for the degree of observability of institutions by the general public we use is the average per capita daily circulating newspapers as a measure of the strength of the public opinion. 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 in our equations.

Other factors, already considered in the literature and 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.

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[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.

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 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.
De Haan and van't Hag (1995) and 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.
Both these positions find empirical support. We have no prior about which of the two mechanisms described above has empirical relevance and we leave the answer to our data.

e. Central bank dependence and the political instability

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. From an empirical point of view the ambiguous estimated relation between political instability and Central bank independence mainly depend on the variable used to proxy the instability[11]. For example, Cukierman (1992, 1994) predicts and verifies empirically that a high level of party political instability induces a larger level of independence, whereas the regime political instability has a negative effect on Central Bank independence. A partial list of similar studies, in which different measure of political instability and

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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. On this point also see the literature cited in De Haan and van't Hag (1995).
[11] Party political instability refers to the frequent changes of government between competing political parties democratically elected within a given constitutional context, while regime political instability reflects changes in a country's political-institutional system brought about by non-democratic methods. We consider the regime political instability see the appendix for details.

several indeces of central bank independence are used, includes De Haan and van't Hag (1995), De Haan and Siermann (1996), Bagheri and Habibi (1997), Farvaque (2002) .We use the index of regime political instability as in Romer (1993). A richer analysis of the political determinants of the incentives to commit would have limited the size of our sample severely.

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; 1990; 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. 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, 1992). 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. 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.

g. Central banker dependence and the level of 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 is larger the larger the size of the economy

[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 except for the subsample of "rich countries".

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.

Finally notice that we do not include closed economy determinants of the inflationary bias in our regressions. The reason is twofold. Firstly, due to data constraints, their inclusion would severely limit our sample. Secondly the empirical evidence available for the importance of these variables points against them. De Haan and van't Hag (1995) show that, in regressions for central bank independence as a dependent variable, the coefficients of proxies for average employment-motivated inflationary bias[13] are insignificant in a cross-section of OECD countries.
The next section presents the empirical evidence for the hypotheses formulated above.

3. Empirical specification and results

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: CBD). This index varies between 0 and 1. A high value measures a lower level of central bank independence for a country. This measure is available for a sample of 63 countries. Our study is, however, performed on a sample of 55 countries[14] 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 incentives 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 (DEFICIT), the average government expenditure over the GDP for 1970-79 (EXPENDITURE), the average daily newspapers per-capita for 1972-88 (TRANSPARENCY), the average real GDP per-capita for 1960-79 (DEVELOPMENT), the average level of

[13] The two proxies for the inflationary bias in their study 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.
[14] The list of countries is in the Appendix.

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 CBD. 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 CBD: 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 CBD.
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.

4.1 Empirical results

Table 1 – 2 review the results for the full sample of countries. In particular, Table 1 present the outcome for the specification in levels wherease Table 2 the semilogs specification. Table 3-4 report the results for the OECD sub-sample and Table 5-6 the outcome for the non OECD sub-sample. There is no significant difference, both in terms of signs and precision of the coefficients, between the two specifications (levels and semilogs). In terms of adjusted R square, the specification in levels may be preferred in each sample. Remarkable stability in the sign, size and significance of the coefficients emerges across models within each table.

In particular, Table 1-2 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 hypothesis of commitment, i.e., 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., 2003). 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, this factor 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.

Table 1 All countries
Dependent variable: CBD

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

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

Table 2 All countries. Semilog specification
Dependent variable: CBD
Inflation, Size and Development are in logs

Explanatory variables	**Model 1**	**Model 2***	**Model 3**	**Model 4**	**Model 5**
Constant	-0.134	-0.060	-0.011	0.070*	0.043
	(-1.13)	(-0.63)	(-0.12)	(1.98)	(1.46)
INSTABILITY	0.069	0.070*	0.077*	0.078*	0.082*
	(1.58)	(1.63)	(1.78)	(1.84)	(1.92)
CORRELATION	-0.020	____	____	____	____
	(-0.75)				
INFLATION	0.040	0.041***	0.041***	0.042***	0.047***
	(3.54)***	(3.83)	(3.74)	(3.96)	(4.65)
LIQUIDITY	-0.088*	-0.075*	-0.063	-0.054	____
	(-1.92)	(-1.71)	(-1.45)	(-1.35)	
DEFICIT	-0.003	-0.003	____	____	____
	(-1.38)	(-1.36)			
EXPENDITURE	-0.001	-0.001*	-0.0008	____	____
	(-1.52)	(-1.74)	(-1.08)		
TRANSPARENCY	-0.261***	-0.265***	-0.283***	-0.236***	-0.262***
	(-3.59)	(-3.69)	(-3.98)	(-4.46)	(-5.33)
DEVELOPMENT	0.016	0.020	0.013	____	____
	(1.18)	(1.59)	(1.13)		
SIZE	0.005	____	____	____	____
	(1.05)				
OPENNESS	0.001***	0.001***	0.0012***	0.0012***	0.0012***
	(3.66)	(3.82)	(3.60)	(3.51)	(3.40)
R^2	0.699	0.689	0.676	0.661	0.648
Adjusted – R^2	0.630	0.635	0.628	0.626	0.620
Jarque-Bera/Salmon-Kiefer Test	χ^2 (2)= 0.58 (cv5%=5.99)	χ^2 (2)= 1.03 (cv5%=5.99)	χ^2 (2)= 1.73 (cv5%=5.99)	χ^2 (2)= 1.18 (cv5%=5.99)	χ^2 (2)= 0.70 (cv5%=5.99)
Breusch-Pagan Test	χ^2 (10)=10.70 (cv5%=18.31)	χ^2 (8)= 7.78 (cv5%=15.51)	χ^2 (7)=5.31 (cv5%=14.07)	χ^2 (5)= 11.07 (cv5%=11.07)	χ^2 (4)= 9.49 (cv5%=9.49)
Sample	55	55	55	55	

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

A closer scrutiny of Table 3-6 (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 why 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[15], 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 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 latter countries, strategic commitment is mainly affected by OPENNESS. 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 3-4, 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 (1992). 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 lowers the incentive to commit

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[15] 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:

$$\frac{\frac{GDP_{1,t}-GDP_{1,t-1}}{GDP_{1,t-1}}*GDP_{1,t-1}+\frac{GDP_{2,t}-GDP_{2,t-1}}{GDP_{2,t-1}}*GDP_{2,t-1}+...}{GDP_{1,t-1}+GDP_{2,t-1}+...}$$

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.

Table 3 OECD countries.
Dependent variable: CBD

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	χ^2 (2)= 0.152 (cv5%=5.99)	χ^2 (2)= 0.164 (cv5%=5.99)	χ^2 (2)=0.241 cv5%=5.99)	χ^2 (2)=0.218 cv5%=5.99)
Breusch-Pagan Test	χ^2 (10)=11.20 (cv5%=18.32)	χ^2 (8)=11.08 (cv5%=15.51)	χ^2 (6)=10.05 cv5%=12.9)	χ^2 (4)=8.20 cv5%=9.49)
Sample	23	23	23	23

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

Table 4 OECD countries. Semilog specification
Dependent variable: CBD
Inflation, Size and Development are in logs

Explanatory variables	**Model 1**	**Model 2**	**Model 3**	Model 4*
Constant	0.583	0.107	0.096*	0.055
	(1.039)	(1.52)	(1.70)	(1.36)
INSTABILITY	0.08	0.12	0.120**	0.127**
	(1.00)	(1.75)*	(2.02)	(2.13)
CORRELATION	-0.0265	-0.052**	-0.050**	-0.043**
	(-0.66)	(-2.11)	(-2.23)	(-2.00)
INFLATION	0.006	0.018	0.024	0.033**
	(0.19)	(0.86)	(1.36)	(2.11)
LIQUIDITY	-0.021	-0.004	-0.035	____
	(-0.46)	(-1.03)	(-1.04)	
DEFICIT	-0.0014	-0.0013	____	____
	(0.51)	(-0.55)		
EXPENDITURE	0.0006	0.0002	____	____
	(0.49)	(0.22)		
TRANSPARENCY	-0.008	-0.128**	-0.14***	-0.131**
	(-1.18)	(-2.36)	(-2.92)	(-2.76)
DEVELOPMENT	-0.04	____	____	____
	(-0.88)			
SIZE	-0.003	____	____	_____
	(-0.36)			
OPENNESS	-0.0009	-0.0005	_____	_____
	(-0.72)	(-0.60)		
R^2	0.72	0.701	0.686	0.666
Adjusted – R^2	0.486	0.53	0.59	0.591
Jarque-Bera/Salmon-Kiefer Test	χ^2 (2)= 0.147	χ^2 (2)= 0.157	χ^2 (2)= 0.25	χ^2 (2)= 0.126
	(cv5%=5.99)	(cv5%=5.99)	(cv5%=5.99)	(cv5%=5.99)
Breusch-Pagan Test	χ^2 (10)=13.72	χ^2 (8)= 13.79	χ^2 (5)= 11.03	χ^2 (4)= 11.09
	(cv5%=18.31)	(cv5%=15.51)	(cv5%=11.07)	(cv5%=9.49)
Sample	23	23	23	23

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

Table 5 Non - OECD countries.
Dependent variable: CBD

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

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

Table 6 Non - OECD countries. Semilog specification.
Dependent variable: CBD
Inflation, Size and Development are in logs

Explanatory variables	**Model 1**	**Model 2***	**Model 3**	**Model 4**
Constant	-0.505**	-0.507***	-0.521***	-0.495**
	(-2.73)	(-2.81)	(-2.86)	(-2.78)
INSTABILITY	0.078	____	____	____
	(0.16)			
CORRELATION	0.038	0.039	0.030	____
	(0.98)	(1.05)	(0.82)	
INFLATION	0.048***	0.048***	0.044***	0.043***
	(3.61)	(3.89)	(3.66)	(3.63)
LIQUIDITY	-0.152	-0.151	-0.166*	-0.147*
	(-1.63)	(-1.66)	(-1.82)	(-1.68)
DEFICIT	-0.009*	-0.009**	-0.005*	-0.005*
	(-1.97)	(-2.14)	(-1.82)	(-1.90)
EXPENDITURE	-0.002	-0.002	_____	_____
	(-1.08)	(-1.21)		
TRANSPARENCY	-0.499**	-0.496**	-0.539***	-0.483***
	(-2.68)	(-2.73)	(-3.00)	(-2.92)
DEVELOPMENT	0.052***	0.052***	0.046**	0.043**
	(2.83)	(2.91)	(2.67)	(2.56)
SIZE	0.011	0.011	0.014*	0.014*
	(1.50)	(1.55)	(1.98)	(1.98)
OPENNESS	0.002***	0.002***	0.002***	0.002***
	(3.47)	(3.55)	(3.44)	(3.38)
R^2	0.629	0.628	0.603	0.592
Adjusted – R^2	0.452	0.476	0.465	0.473
Jarque-Bera/Salmon-Kiefer Test	χ^2 (2)= 0.35	χ^2 (2)= 0.31	χ^2 (2)=0.46	χ^2 (2)=0.59
	(cv5%=5.99)	(cv5%=5.99)	cv5%=5.99)	cv5%=5.99)
Breusch-Pagan Test	χ^2 (10)=7.47	χ^2 (9)=6.83	χ^2 (8)=6.35	χ^2 (7)=5.17
	(cv5%=18.31)	(cv5%=16.92)	cv5%=15.51)	cv5%=14.07)
Sample	32	32	32	32

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

Conclusions

In this paper we explored the determinants of central bank independence on a sample of 55 countries. In particular, we studied three testable implications of the commitment hypothesis on the institutional solution to the inflationary bias in monetary policy in open economies. The first testable implication, derives from game theoretical models of commitment and relates to the positive impact of the observability among the general public of governmental choices about monetary policy delegation. This is strongly supported by the data in the full sample (and in each subsample of OECD and non OECD countries). Other two testable

implications are derived from extensions of the Rogoff (1985a) model to open economies. In particular, our data deliver the following results: 1. the degree of independence turns out to be negatively related to openness among the non OECD countries (in accordance with a straightforward extension of the model by Romer, 1993); 2. The degree of independence is positively related to the size of common component in international business cycle in the sub sample of the OECD countries (in accordance with D'Amato and Martina, 2005).

All the findings support the relevance of the commitment hypothesis and also allow us to support the interpretation for the finding in Romer (1993) who documents that openness is not important in affecting average inflation in the long run among the highly industrialized countries. Moreover, our analysis also suggests that the reasons why they are the only ones that seem to have solved the inflationary bias problem of monetary policy through the institutional solution is definitely consistent with the commitment hypothesis. The estimated sign of the coefficients for other control variables also required by the framework adopted do not contradict these results.

Finally, whereas after Rogoff (1985a) the literature has put a lot of emphasis on the politics of Central Bank independence, our results document fairly consistent empirical evidence in support of the hypothesis that institutional solutions to the inflationary bias problem in different countries are indeed affected by the game-theoretical frame of the commitment choice and by the features of the business cycles in the economies where the institution is devised.

Our results show that there seems to be a fix to the inflationary bias problem but it is far from being a "quick fix". How effective the fix is depends on many features of the open economy that affect the balance between costs and benefits of flexibility in monetary policy. Fundamental economic features, like the degree of synchronization between the country business cycle and the world-wide business cycle, and the strategic aspects of the specific game between public governments and private agents seem to be quite important for the empirical explanation of central bank independence. Economic forces and the related strategic issues of the commitment game in the presence of inflationary bias seem to be quite important in the data we analyze and they downplay the role of explanations mainly based on procedural and formal aspects of modern democracies.

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Data definition and source

CBD = Measure of central bank dependence over the period 1980-89. This index, proposed by Cukierman, Webb and Neyaptis (1992), 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 this index are derived by regressions of average inflation on the two variables, using separate regressions for industrialized and non-industrialized countries. This index is also available in Romer (1993).

INSTABILITY = Measure of political instability. It is mean number of revolutions, terrorist attack and coups per year for the period 1960-85. Source: Romer (1993).

DEVELOPMENT = Real GDP per capita, average over the period 1960-79. Source: Penn world tables 6.1.

POP = population (1960-79). Source: Penn world tables 6.1.

SIZE = DEVELOPMENT * POP (1960-79).

CORRELATION = Yearly correlation between US real GDP growth and country-specific real GDP growth (1961-79). Our elaboration.

CORRELATION* =** Yearly correlation between World real GDP growth and Country specific real GDP growth (1961-79). Our elaboration.

TRANSPARENCY = Daily newspaper circulation per capita, average over the period 1972-1987. Source: Banks (1999).

INFLATION = Change in the GDP deflator, average over 1961-1979. For countries for which this series is not available, we use the change in the CPI instead. Source: IMF supplement series, n.12, 1986.

OPENESS = Share of imports over the GDP, average over the period 1970-1979. Source: IMF supplement series, n.4, 1982.

EXPENDITURE = Total government expenditure as percentage of GDP, average over 1970-79. Source: IMF supplement series, n.11, 1986.

DEFICIT = Central government deficit as percentage of GDP, average over 1970-79. Deficit is defined as the total of revenue plus grants minus the total of expenditure plus lending minus repayments. Source: IMF supplement series, n.11, 1986.

LIQUIDITY = M2 over GDP, average over the period 1970-79, where M2 is money plus quasi-money i.e. 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. Source: IMF supplement series, n.5, 1983.

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			