

# Central Bank Independence and Inflation Performance: Panacea or Placebo? \*

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## 1. Introduction

Lately, much attention has been given to the relationship between central bank independence and economic performance. This research has come to two major conclusions. One, nations with high (low) degrees of independence have low (high) inflation rates (and there is a causal relationship running from the degree of independence to inflation). Two, there is no apparent relationship between the degree of independence and real economic performance (e.g., the level and variance of unemployment).

These conclusions are important because, solely on economic performance grounds, it appears that the benefits of low inflation are achieved without an adverse impact on other variables. As Grilli, Masciandaro, and Tabellini (1991) conclude, "Thus having an independent central bank is almost like having a free lunch; there are benefits but no apparent costs in terms of macroeconomic performance" (p. 375). If correct, these conclusions are important because many nations are groping with the appropriate constitutional relationship between their central bank and government in attempts aimed largely at lowering inflation. These results suggest the design of monetary constitutions to ensure a high degree of central bank autonomy is appropriate. However, if these conclusions are not

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correct, then it may be quite dangerous for policy makers to rely on monetary constitutions alone to generate the desired low inflation.

The purpose of this paper is to investigate the robustness of the stylized fact regarding central bank independence and inflation performance. The analysis up to this point focuses almost exclusively on the degree of central bank independence as the determinant of cross-country inflation differences. If other factors are found to be relevant for explaining cross-country inflation differences, then the models evaluated so far may be mis-specified. If so, this may raise questions regarding the interpretation of the reported independence/inflation stylized fact.

There are a number of reasons to believe the existing models have ignored relevant factors. For one, theory suggests that the inflationary performance of a nation is influenced by such things as the structure of the labour market, the regulatory burden placed on the central bank, and the exchange rate regime in addition to the degree of central bank autonomy. Another reason is that practitioners of monetary policy tell us that the inflationary performance is more complex than the legal relationship between the central bank and the government (see, e.g., Fazio 1991 and Issing 1993).<sup>1</sup>

Still another reason is that studies of inflationary performance within countries suggest several factors determine or cause inflation. Deane (1979, p. 1), examining the history of inflation in the United Kingdom, states "... the explanation for inflation in a historical context is unlikely to be monocausal and that different past episodes must be expected to display different patterns of causation and consequences". If the causes of inflation differ within countries, it is reasonable that causes across countries differ as well.

The remainder of this paper is organized as follows. In Section 2 I outline the stylized fact regarding central bank independence and economic performance, its reception by economists and its importance for policy recommendations. In Section 3 I consider the received theory on inflation and how it matches with institutional features of industrialized nations. In Section 4 I further investigate the independence and inflation link. In Section 5 a model is esti-

<sup>1</sup> In particular, Issing (1995) states that many people view central bank independence as a substitute for a rule-based monetary policy. He contends that such a view is mistaken; independence and a rule-based policy are complementary characteristics of low inflation performance.

mated to explain cross-country inflation differences. Finally, in Section 6 some concluding comments are made.

## 2. The stylized fact: its relevance and acceptance

The relationship between central bank independence and macroeconomic performance has been studied for over a decade. The first formal attempt to quantify degrees of central bank autonomy can be found in Bade and Parkin (1988).<sup>2</sup> They constructed an index of central bank independence for 12 industrialized countries in an attempt to evaluate the importance of central bank independence in cross-country differences in monetary policy (as measured by inflationary performance). By regressing their indicator of independence on inflation and finding a statistically significant coefficient with the hypothesized negative sign, they contend that the level of central bank independence is an important determinant of cross-country inflation differences.

Alesina (1988), in an attempt to evaluate political influences on monetary policy, extended the Bade and Parkin (1988) index by adding four nations. Like Bade and Parkin (1988), Alesina (1988) also contended that there is a link between the level of central bank autonomy and inflationary performance.

Grilli, Masciandaro and Tabellini (1991) (referred to as GMT hereafter) extended this line of research by constructing an index of independence for 18 nations which covers a greater range of the central bank/government relationship than the Bade and Parkin (1988) and Alesina (1988) indices. They also contend that the degree of independence is an important determinant of inflation differences. In addition to using their index to explain cross-country inflation rate differences, they examine the relationship between central bank independence and real economic factors; none is found. For example, they find no relationship between output growth and the level of independence. Thus, they conclude that the degree of central bank autonomy has a significant impact on inflation, but little or no impact on real variables. As stated earlier, they argue that there is a "free lunch"

<sup>2</sup> Earlier versions of this paper were circulated in 1980 and 1982.

associated with independent central banks, i.e., low inflation with no adverse impact on real variables.

Cukierman, Webb and Neyapti (1992; referred to as CWN hereafter) created an index of central bank independence for 72 nations. It has been argued that this index exceeds the previous attempts at quantifying independence on grounds of both breadth and depth. Moreover, their index is computed over 4 time intervals, so it captures the (albeit infrequent) changes in central bank charters. They contend that there is a significant and negative relationship between independence and inflation for industrialised countries, but no such relationship exists for developing countries.

Eijffinger and Schaling (1993) and Eijffinger and van Keulen (1995) developed an index of independence which focuses on the policy independence of central banks. As such, their index is particularly relevant for assessing policy actions. They then compared their index with those previously mentioned. All of these indices are reported in Table 1.

Alesina and Summers (1993; referred to as AS hereafter) provide an elegant summary of the existing literature in the inflation/independence relationship (as such, it will be the standard for comparison with the remainder of this paper). Employing what they term an "extremely simple" empirical procedure – plots of economic variables, such as inflation, against a measure of central bank independence – they also conclude that cross-country differences in inflation can, to a large degree, be explained by differences in central bank independence. Also, real variables appear unrelated to the degree of independence.

Figure 1 is reproduced from the data in the AS paper; it is a plot of a measure of independence versus the average inflation rate of the sample nations.<sup>3</sup> Although no quantitative empirical analysis is performed, it is clear that there is a strong negative correlation between the measure of independence and inflation rates.

<sup>3</sup> Their sample countries are Australia, Belgium, Canada, Denmark, France, Germany, Great Britain, Italy, Japan, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, and United States. They choose two sample periods, 1955-1988 and 1973-1988. They argue that their results are not sensitive to choice of sample period. The 1973-1988 period sample is used here and throughout the study (unless otherwise noted) for data availability reasons. Their measure of independence is an average of Bade and Parkin (1988) and Grilli, Masciandaro and Tabellini (1991) indices, both are listed in Table 1.

TABLE 1

## VALUES OF CENTRAL BANK INDEPENDENCE

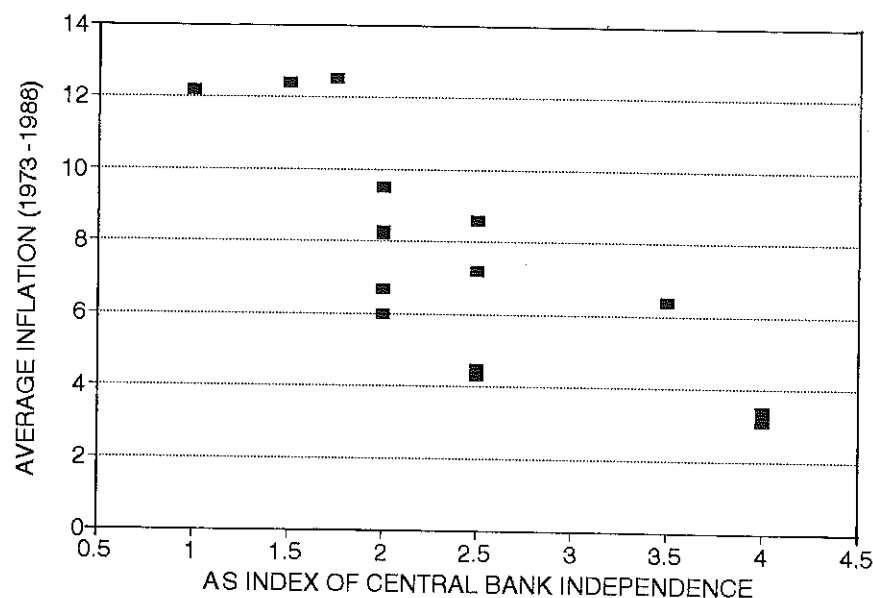
Index	CWN	CWN	BP	GMT	ES/EK
Country	1972-1979	1980-1989			
Australia	.36	.36	1	9	1
Austria	.61	.61	n/a	n/a	3
Belgium	.17	.17	2	7	3
Canada	.45	.45	2	11	1
Denmark	.50	.50	2	8	4
Finland	.28	.28	n/a	n/a	n/a
France	.24	.24	2	7	2
Germany	.69	.69	4	13	5
Iceland	.34	.34	n/a	n/a	n/a
Ireland	.44	.44	n/a	n/a	n/a
Italy	.25	.25	1.5	5	2
Japan	.18	.18	3	6	3
Luxembourg	n/a	.33	n/a	n/a	2
Netherlands	.42	.42	2	10	4
New Zealand	.24	.24	1	3	3
Norway	.17	.17	2	n/a	2
Spain	.09	.23	1	5	1
Sweden	.29	.29	2	n/a	2
Switzerland	.53	.64	4	12	5
United Kingdom	.27	.27	2	6	2
United States	.48	.48	3	12	3

Notes: CWN indicates the codes for Cukierman, Webb and Neyapti; BP denotes the Bade and Parkin index; GMT indicates the values from Grilli, Masciandaro and Tabellini. ES/EK is the index in Eijffinger and Schaling and Eijffinger and van Keulen (pre-1994 values). In all cases, higher values indicate a more independent central bank.

AS also provided a similar comparison between the measure of independence and real economic variables: no relationship is evident.<sup>4</sup> This line of research has gained a wide audience. In a popular undergraduate money and banking text (Mishkin 1992), a bar chart that reproduces the AS research appears in a section entitled "case for independence" (p. 402). Mishkin notes the strong negative correla-

<sup>4</sup> The real variables they consider are the unemployment rate, the growth of real GNP (or GDP), the growth of real per capita GNP (or GDP), and a real interest rate.

FIGURE 1



tion between independence and inflation. Also noted by Mishkin is that there does not appear to be any relationship between real variables and independence.<sup>5</sup> An article appeared in *The Economist* (20 April 1991, pp. 17-18) with a similar chart. The authors of that article refer to the chart as evidence that central bankers "... need some form of formal independence ... They need, in short, to be like judges – not above the law, but administering it. In this case, their brief would be for stable prices". Additionally, *The Washington Post* and *The Guardian* (UK) have also noted the results of this study.<sup>6</sup>

<sup>5</sup> To be fair to Mishkin, it must be noted that he does discuss some potential costs of an independent central bank; however, these are political costs and are not real economic costs.

<sup>6</sup> See "More independence means lower inflation, studies show", by John Berry in the 17 February 1993 issue of the *Washington Post* and "Time to make the idea of independence a reality" in the 10 June 1994 issue of *The Guardian*.

### 3. The received theory on inflation and its performance

Economic theorists, for decades, have been building models to explain the relationship between monetary policy and economic variables. This section focuses on models which concentrate on inflation performance. While most of this research has been explicitly aimed at explaining inflation within a country, the implications of these models are important for our empirical understanding and exploration of cross-country inflationary performance differences. In this section I first consider theory that links independence and inflation. I then examine theory and some data that link inflation performances to other institutional constraints on central bank policies.

#### 3.1. Theory that links independence and inflation

The seminal work of Kydland and Prescott (1977), which was elaborated on by Barro and Gordon (1983), demonstrated that in a rational expectations model where the monetary authorities view positive shocks to output as welfare improving, discretionary policy will generate an inflationary bias.

Backus and Driffill (1985) presented this model in terms of a game between policy makers and the public. With the public's goal to minimize forecast errors, it is shown that the resulting monetary policy actions/results can be demonstrated in the form of a prisoner's dilemma. For policy makers, an inflationary policy dominates a zero inflation generating policy.

This model has been extended in a number of directions (see Blackburn and Christensen 1989 for a survey of the literature on these models). Several studies have modelled monetary policy as a game between two competing political institutions, often explicitly the government and the central bank (which of course bears on the degree of central bank independence). Among these are Alesina (1987 and 1988), Blinder (1982), Anderson and Schneider (1986), Bradley and Porter (1986), Tabellini (1986), Waller (1987, 1989, and 1991), Dixit and Nalebuff (1991) and Cukierman (1992). A common theme in these models is differences in rates of time preference between



government officials and central bankers. It is commonly assumed that government officials are more concerned with short-run goals such as unemployment and deviations of growth from its natural rate; therefore, more apt toward discretionary policy, whereas central bankers are more concerned with long-run goals, usually the inflation rate.<sup>7</sup> In fact, for the Cukierman model (1992), the difference among preferences in the model is explicitly the rate of time preference.

### 3.2. *The labour market structure and inflation*

The basic model, described above, has also been extended to explicitly include the structure of the labour market (see, e.g., Cukierman 1991 and 1992; Bruno and Sachs 1985 provide a detailed summary of the literature on the impact of labour market structure on inflationary performance). This is important because one of the leading candidates for the distortion preventing the labour market from reaching its perfectly competitive equilibrium, the driving force behind the choice of a discretionary policy, is the presence of union wage bargaining. If organized workers succeed in raising real wages above the competitive equilibrium and the short-side prevails in the labour market, then output will be below the socially desirable level. This encourages the monetary authority to pursue a more expansionary (i.e., inflationary) policy to boost output. For policy makers, an inflationary policy dominates a zero inflation generating policy.

This model has been extended in a number of directions (see Blackburn and Christensen 1989 for a survey of the literature on these models). Several studies have modelled monetary policy as a game between two competing political institutions, often explicitly the government and the central bank (which of course bears on the degree of central bank independence). Among these are Alesina (1987 and 1988), Blinder (1982), Anderson and Schneider (1986), Bradley and Porter (1986), Tabellini (1986), Waller (1987, 1989, and 1991), Dixit and Nalebuff (1991) and Cukierman (1992). A common theme in these models is differences in rates of time preference between

Corporatism is concerned with the centralization of organized labour power. Economies are termed corporatist if national labour organizations play a dominant role in wage bargaining. This can be contrasted with non-corporatist economies where wage bargaining takes place on a local or plant level.

In this context, Tarantelli (1986) considered price level stability a public good and argued that in decentralized wage bargaining economies, workers have greater incentives to act as "free riders" resulting in greater inflation.

In a decentralised system of industrialized relations, money wage stability may be thwarted by a kind of "free-riding" behaviour. Each single group of workers of company A and/or each single union may attempt to avoid paying its "tax" for our public good – wage and price stability – by avoiding lower wage requests ... of course, the more decentralized is the system of industrial relations, the greater is the number of agents who will attempt to free ride. The result may be higher inflation ... (p. 3).

Figure 2 is a plot of inflation (1973 to 1988 period) versus the Tarantelli index of social corporatism. As with independence, there appears to be a clear (linear) relationship between inflation performance and the level of corporatism. In fact, the correlation coefficient between the measure of corporatism and average inflation is  $-.45$  with a  $t$ -ratio of 1.88.

FIGURE 2

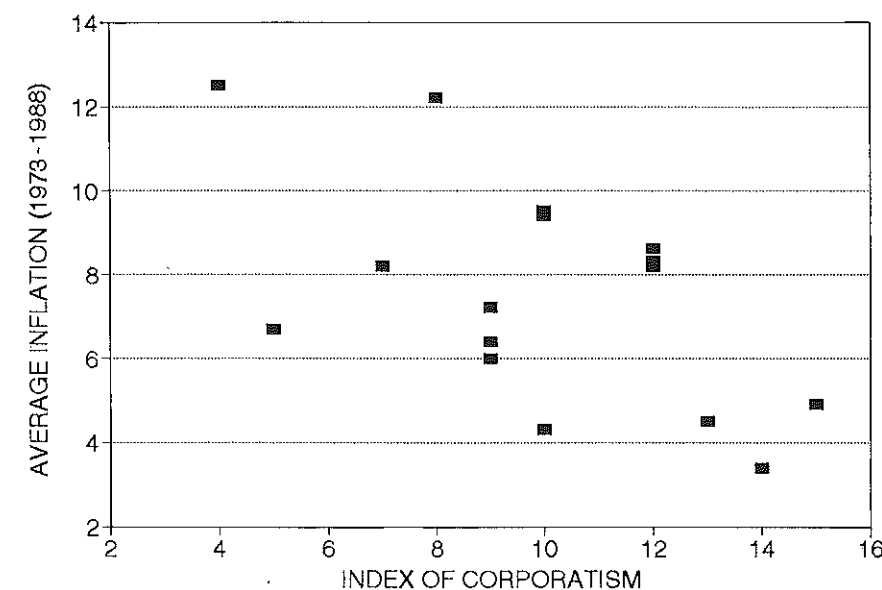


Table 2 lists Tarantelli's index of corporatism for 16 nations along with their respective inflation performance for the 1973-1988 period. This analysis reveals that the nations with the most corporatist labour markets generally have the lowest average inflation rates. In fact, the nations with the three lowest average inflation rates, Austria, Germany and Japan, have the highest degrees of corporatism. At the other end of the corporatist ranking, the least corporatist economies tend to have the highest inflation rates. Italy, New Zealand and Great Britain have the highest inflation rates and are three of the four least corporatist economies in this sample.

TABLE 2  
INFLATIONARY PERFORMANCE (1973 TO 1988)  
AND DEGREE OF CORPORATISM

Country	Average inflation	Index of corporatism
Austria	4.8	15
Germany	3.6	14
Japan	5.5	13
Denmark	8.2	12
Norway	8.2	12
Sweden	8.3	12
Australia	9.5	10
Finland	9.1	10
Belgium	6.1	9
United States	6.5	9
Canada	7.4	9
New Zealand	11.9	8
France	8.3	7
United Kingdom	9.9	5
Italy	12.3	4

Note: Source of index of corporatism is Tarantelli (1986). The index uses three criteria: (1) centralization of wage bargaining; (2) rules concerning arbitration; (3) political consensus.

These results, along with the theoretical modelling outlined above are highly suggestive of the role that the structure of the labour market can play on a nation's inflationary performance. Therefore, analysis of cross-country inflation differences neglecting the labour market structure may be omitting relevant and important information.

### 3.3. Central bank regulation burden

Arguments have been made that heavy bank supervision and regulation burdens placed on some central banks may constrain their ability to pursue an anti-inflationary policy. Cargill (1989) makes this argument for the particular comparison between the Federal Reserve and the Bank of Japan. Goodhart and Shoenmaker (1995) consider the specific issue of the separation of monetary policy and banking supervision responsibilities, where it is noted that the main argument for the separation of these responsibilities is the "conflict of interest" that arises in cases of these dual responsibilities. The impact of monetary policy on commercial bank activities is of paramount interest to those who argue that there is a "lending channel" of the transmission mechanism (see Kashyap and Stein, forthcoming, for a survey of the literature on the lending channel). For example, in a multi-asset model such as Bernanke and Blinder (1988), monetary policy actions can have significant effects on the difference between interest rates on bonds and commercial bank loans, thus affecting the attractiveness of commercial bank lending to a method of direct finance.

There are a number of reasons such a conflict of interest may exist, particularly at times of need for a contractionary policy to constrain inflationary pressures: 1) banks generally have negative gaps. Rises in interest rates, from tight, anti-inflationary monetary policy, will reduce bank profits; 2) banks hold portfolios of assets that include a significant amount of marketable bonds. Rises in interest rates will lower the value of these portfolios; 3) central banks have limited resources. Resources aimed at bank regulation detract from resources that can be spent on price-level stability. Lastly, Cargill (1989) argues that bank regulation is inherently short-run oriented. Thus, it conflicts with the goal of long-run price stability.

Pecchioli (1987) compares and contrasts banking regulatory responsibilities for the OECD nations.<sup>8</sup> Table 3 lists, using data from Pecchioli (1987), nations whose central banks have sole regulatory burden for regulation of deposit institutions along with inflationary performance over the 1973-1988 sample period.

<sup>8</sup> This study does not include Iceland. The regulation burden for Iceland can be found in Central Bank of Iceland (1994).

TABLE 3  
INFLATION PERFORMANCE (1973 TO 1988)  
AND BANK REGULATION BURDEN

Country	Average inflation	Central bank sole regulator of banks
Iceland	32.6	yes
Spain	12.6	no
Italy	12.3	yes
New Zealand	11.9	yes
Ireland	11.0	yes
United Kingdom	9.9	yes
Australia	9.5	yes
Finland	9.1	no
France	8.3	no
Sweden	8.3	no
Denmark	8.2	no
Norway	8.2	no
Canada	7.4	no
United States	6.5	no
Belgium	6.1	no
Luxembourg	5.6	no*
Japan	5.5	no
Austria	4.9	no
Netherlands	4.6	yes
Switzerland	3.7	no
Germany	3.6	no

\* Luxembourg changed its regulatory structure in June 1985 to give its central bank sole burden.

Sources: Bank regulation burden is Pecchioli (1987) and Central Bank of Iceland (1994).

These data show that six of the seven nations with the highest inflation rates have central banks with heavy regulatory burdens. The one exception to this group is Spain. Moreover, only one nation whose central bank does have sole regulatory responsibility has low inflation, the Netherlands.<sup>9</sup>

<sup>9</sup> Also noteworthy here is that the 1990 act in New Zealand granted the central bank (the Reserve Bank of New Zealand) much more autonomy from the government. This was done largely in an attempt to improve on New Zealand's inflation performance. However, the same act also reduced the regulatory burden on the Reserve Bank. This was also aimed at freeing the hands of the central bank to fight inflation.

### 3.4. Inflationary performance under coordinated policies

It has been recognized for decades that the exchange rate regime of a nation can impact its inflationary performance. Mundell (1962) showed that monetary policy for nations involved in a fixed exchange rate regime, with high degrees of capital mobility, is endogenously determined (except for the nation with the reserve currency). Hence, under a fixed exchange rate (and high capital mobility), we expect the inflationary performance of nations to be largely determined by policies of the nation which holds the reserve currency.

Cukierman (1992) formally extends the type of model described in Section 3.1 to incorporate the exchange rate regime of the EMS. There it is shown that monetary policy is affected by the presence of a coordinated exchange rate policy. In particular, the inflation performance of the otherwise high inflation nations is improved. This is consistent with many who argue that the EMS is an exchange rate system where member nations can enjoy the inflationary performance of the Bundesbank. The transmission and coordination of inflation policies of the EMS has received a great deal of attention. Guitian (1988) and Russo and Tullio (1988) discuss the policy coordination aspect of the EMS. Ungerer *et al.* (1986) discuss the impact of the EMS on inflationary performance of member nations.

Extending the analysis of Russo and Tullio (1988), data are provided in Table 4 regarding the convergence of the inflation performance of the EMS nations over the decade of the 1980s. These results suggest that there has been a general convergence of inflationary performance for the EMS nations over the period of the ERM. Moreover, there has been a specific convergence to the performance of (and therefore policies of) Germany.<sup>10</sup>

<sup>10</sup> Of course, this pattern is not specific to the EMS nations. For industrialized economies as a whole, inflation rates have fallen over the period. This is consistent with Russo and Tullio's (1988) contention that the ERM has had a significant impact on non-EMS countries: Austria, Switzerland, Spain (at the time not a participant), Norway, and Sweden in particular. Though, some may argue that the fall in average inflation rates is due to factors other than the EMS. Fratianni and von Hagen (1990) argue that inflation rates fell in the industrialized countries because of a common dissatisfaction with the high inflation policies of the 1970s and a fall in the price of oil. Tarantelli (1986) shows that uncertainty regarding future inflation plays a role in his model with corporatism (less uncertainty - no oil shocks - yields lower inflation); thus the corporatist model of inflationary performance also suggests this result. It is not the case, however, that changes in the legal degree of central bank autonomy play a role in the trend.



TABLE 4

CONVERGENCE OF INFLATION RATES  
IN THE EMS NATIONS

Year	Deviation (from mean)	Deviation (from Germany)
1980	5.4	7.7
1981	4.8	6.9
1982	4.0	6.6
1983	3.6	5.9
1984	2.8	4.8
1985	2.1	4.6
1986	2.1	3.1
1987	2.0	2.6
1988	1.6	1.9
1989	1.5	1.7
1990	1.2	1.5

Monetary coordination by definition places constraints on the ability of central banks to independently pursue policies. Thus, such a rule creates another sort of dependence for the central bank. However, it may be argued that monetary coordination insulates central banks from government pressure regarding monetary policy. The EMS nations, by tying their currencies to the D Mark, have been able to withstand government favoured policies geared toward the short-run, thus lessening the constitutional authority that the government has to control/direct monetary policy. In other words, coordination of monetary policies may loosen the independence/inflation link.

#### 4. Analysis of independence/inflation relationship

The purpose of this section is to evaluate the independence/inflation stylized fact. In particular, attention will be paid to the specification of models employed. To make comparisons, it will be useful to quantify the Alesina-Summers analysis. This has been done by computing a correlation coefficient for their data on independence and inflation (for the 1973-1988 period). This correlation coefficient

is  $-.80$ ; additionally the t-ratio for the correlation (4.98) is significant at the 1% level. This is consistent with their contention that there is a strong link between independence and inflation.

#### 4.1. Using the CWN Index

Next I compare cross-country inflation performances with the CWN index of independence. This is done for several reasons: 1) to see if the AS relationship is robust to an alternative index; 2) the CWN index is computed for many nations not included in the AS analysis, so that using the CWN index allows for the testing of the independence/inflation relationship with out of sample countries; 3) one of the features to be evaluated below is the impact of the EMS on inflation performance. The CWN index is particularly well suited for this because one of its interval breaks appears in 1979.

Figure 3 is a plot of independence versus inflation using the CWN index, to be consistent with AS, the sample period is 1973-1988; alternative sample periods are considered in the Appendix (Cargill 1995 suggests that the independence/inflation link is not robust to alternative sample periods). A negative correlation is still discernable; however, it is less clear with the CWN measure of independence. The correlation coefficient is now  $-.53$  with a t-ratio of 2.34 (which is significant at the 5% level, but no longer at the 1% level). Thus, with this new measure of independence, the independence/inflation correlation is less tight than as reported in the AS study.

#### 4.2. Performance with non-sample nations

The CWN measure allows us to add the nations of Austria, Finland, Iceland, Ireland and Luxembourg to the sample.<sup>11</sup> Adding these nations will allow us to evaluate the predictive validity, or out of sample properties, of the AS type model (LDCs are considered in the Appendix).

<sup>11</sup> By adding these countries, we now use all nations identified by Cukierman *et al.* to be "developed".



FIGURE 3

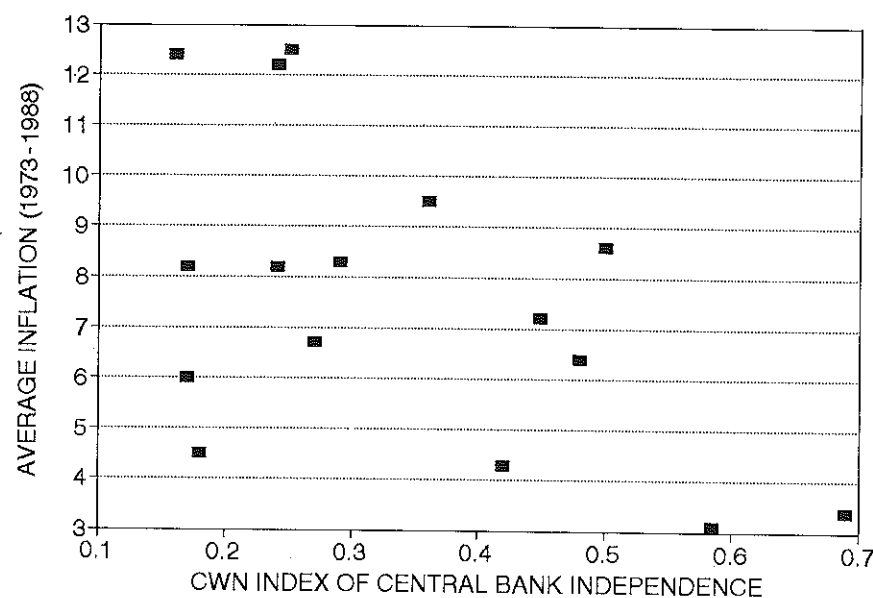


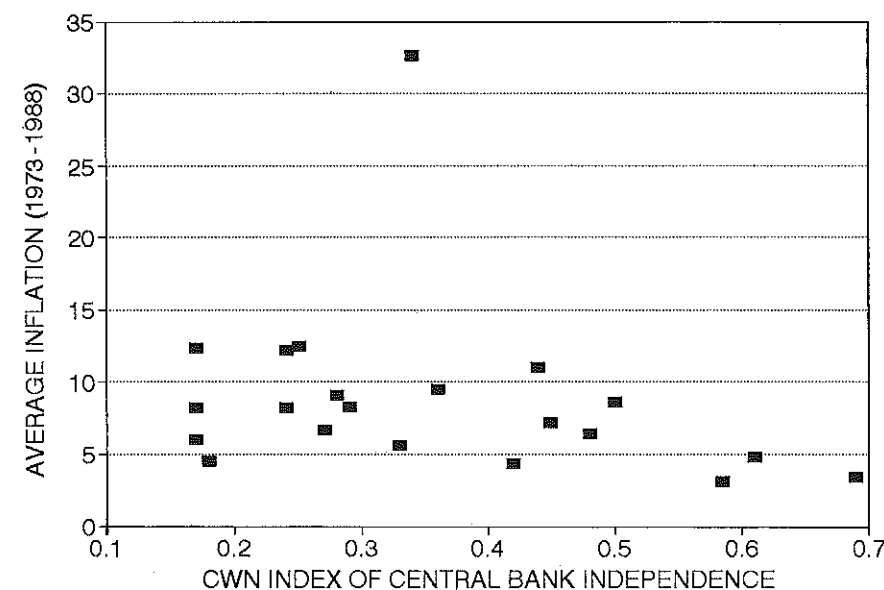
Figure 4 is a plot of the inflation/independence relationship with the additional nations. Although a negative relationship is discernable, it is apparent that the relationship is much less clear. In fact, the correlation coefficient now is only  $-.23$ , less than a third of the correlation in the AS' analysis. Additionally the t-ratio is only  $.88$  which is not significant at the standard levels (1, 5 or even 10%).

Clearly, the non-sample nations pose a problem for the models often employed to explain cross-country inflation differences. Recall in section 3 a review of theory suggested that a number of factors other than the degree of central bank autonomy may be important determinants of a country's inflationary performance, and therefore, important factors to explain cross-country inflation differences. Thus, on both theoretical and empirical grounds we have reason to question the specification of the existing models. In particular, these models may suffer from an omission of relevant variables.

An omission of relevant variables is important because it can have serious implications for our interpretations of the results from models of cross-country inflation differences. Several of the studies of the independence/inflation relationship (Bade and Parkin 1988, Grilli, Masciandaro and Tabellini 1991, and Cukierman *et al.*

1992 rely on regression analysis to determine the importance of independence in explaining inflation differences. An omitted variable bias means that, in addition to biased parameter estimates, the standard errors of the parameter estimates for the included variable(s), independence in this case, will be smaller than in a correctly specified model.<sup>12</sup> Therefore, it has implications for hypothesis tests regarding the significance of the included variable, independence.

FIGURE 4



##### 5. Cross-country model estimation

In this section a model of cross-country inflation differences is estimated. This sample period is divided into two periods, 1973-79 and 1980-88, to match the measure of independence. This division of the sample period is needed because the level of central bank autonomy changed between these two periods for some sample coun-

<sup>12</sup> This assumes that the included and excluded variables are correlated. If they are not correlated, then this problem does not exist.

tries. Moreover, this breakdown of the sample is convenient for testing the role of the EMS. Using the 21 nations employed in Section 4, we have 41 total observations. (There should be a total of 42 observations, 21 nations times the two sample periods. However, because of the central bank structure of Luxembourg, there is a measure of central bank independence for Luxembourg for the 1980 to 1988 period only.)

Table 5 lists OLS estimates of models explaining cross-country inflation differences. The dependent variable is average inflation and the explanatory variables are as listed. Specification 1 employs only the level of central bank independence, CBI, as an explanatory variable.<sup>13</sup> As suggested in section 4, this specification of the model does not perform well. The central bank independence variable is marginally significant (significant at the 10% but not at 5% level) with the correct sign; however, the  $R^2$  is a relatively low .08.

Cukierman *et al.* (1992) suggest that there may be a difference between legal independence and actual independence. For example, a large component of their measure of independence is the term of office of the central bank head. It is possible for nations to have a central bank charter such that the legal term of the central bank head is long (suggesting a legally independent central bank); however, in practice the actual turnover of the central bank head is much more frequent than the charter specifies (suggesting less independence in practice). To account for this factor, they add to the model the actual turnover frequency of central bank heads. This variable is denoted TURN and is included in specification 2. Note that TURN is marginally significant.<sup>14</sup>

To capture the regulatory burden of the central bank, a dummy variable DREG (which has the value of 1 in cases of heavy regulation, 0 otherwise) signifies those central banks who have sole regulatory burden of banks from those that do not. DREG is included in specification 3. DREG has the expected positive sign, indicating that central banks having heavy regulatory burdens have poorer inflationary performances. Also, DREG is highly significant.

<sup>13</sup> This is the model of Bade and Parkin (1988) and the implied model of Alesina and Summers (1993).

<sup>14</sup> Noteworthy is that CBI is now significant at the 5% level. Cukierman *et al.* (1992) find this as well. However when they use the disaggregated measures of independence, instead of the average as used here, they find that *none* of the individual components of independence is significant at the 5% level and the measures collectively are not significant at the 10% level.

TABLE 5  
OLS ESTIMATES OF CROSS-COUNTRY INFLATION DIFFERENCES  
Dependent variable: average inflation

Specification	(1)	(2)	(3)	(4)	(5)
Constant	13.37** (5.24)	16.17** (5.55)	13.01** (4.55)	17.29** (6.03)	14.10** (5.13)
CBI	-11.38* (1.78)	-12.82* (2.04)	-10.59# (1.84)	-12.5# (2.01)	-9.86# (1.81)
TURN		-17.05* (1.70)	-13.52 (1.47)	-20.27* (2.07)	-16.81# (1.90)
DREG			5.57** (2.98)		5.66** (3.20)
DEMS				-4.71# (1.98)	-4.86* (2.29)
R <sup>2</sup>	.08	.14	.31	.22	.40
S.E.E.	6.28	6.14	5.59	5.91	5.23
D.W.	1.71	1.58	1.61	1.51	1.60
Het p-value	0.48	0.16	0.01**	0.50	0.02*
RESET p-value	0.09#				

Notes: \*\*, \*, and # denote significance at the 1, 5, and 10% levels respectively. Absolute values of t-ratios in parentheses. The sample period is 1973-1988, the sample nations are the 21 industrialized nations listed in the text.

Sources: inflation, OECD-MEI; CBI, Cukierman *et al.* (1992); TURN, Cukierman *et al.* (1992); DREG, Pecchioli (1987) and Central Bank of Iceland (1994). The DEMS nations are Germany, Belgium, France, Ireland, the Netherlands, Denmark, Luxembourg, and Italy. White's test for heteroscedasticity was performed and the p-values are reported in the penultimate row. The last row reports the p-value of Ramsey's RESET specification test for selected specifications.

It was previously pointed out that coordination of monetary policies may be an important determinant of cross-country inflation differences. In the second period (1980-1988), several nations are a part of the EMS. To capture this, a dummy variable DEMS is added to the model (which takes on the value of 1 for EMS nations over the 1980-88 period, 0 otherwise). In specification 4, DEMS has the expected negative sign, suggesting that member countries have been able to lower their inflation. In specification 5 both DREG and DEMS are included. Both maintain their expected sign and are individually significant at the 5% level. An F-test was calculated to test if these two variables are jointly significant. This test statistic is  $F_{(2,36)} = 7.59$ , which is significant at the 1% level.

We now move on to test the role that the corporatist structure of the labour market plays in explaining cross-country inflation differences. Unfortunately, the index of corporatism covers only 16 of the sample nations (these nations are listed in Table 2). Hence we must now restrict our sample to these 16 nations (yielding 32 observations). Table 6 provides results of the model specifications 1-5, as listed in Table 5, for this sample of countries (denoted specifications 6-10 respectively). There is little difference compared to the results of the larger sample.

TABLE 6  
OLS ESTIMATES OF CROSS-COUNTRY INFLATION DIFFERENCES  
Dependent variable: average inflation

Specification	(6)	(7)	(8)	(9)	(10)
Constant	10.99** (8.57)	11.31** (6.93)	9.94** (6.00)	11.97** (7.85)	10.59** (6.79)
CBI	-8.58* (2.56)	-8.78** (3.15)	-7.37** (2.22)	-8.41* (2.56)	-6.95* (2.25)
TURN		-1.78 (0.32)	-0.89 (0.17)	-3.84 (0.75)	-2.97 (0.61)
DREG			2.38* (2.19)		2.43* (2.41)
DEMS				-2.70* (2.08)	-2.78* (2.31)
R <sup>2</sup>	.18	.18	.30	.29	.42
S.E.E.	2.92	2.97	2.79	2.81	3.17
D.W.	1.55	1.56	1.14	1.99	1.54
Het p-value	0.25	0.05*	0.36	0.62	0.43
RESET p-value	0.04*				

Notes: \*\*, \*, and # denote significance at the 1, 5, and 10% levels respectively. Absolute values of t-ratios in parentheses. The sample period is 1973-1988. The sample nations are the 16 for which the corporatist index is available (listed in Table 2).

Sources: inflation, OECD-MEI; CBI, Cukierman *et al.* (1992); TURN, Cukierman *et al.* (1992); DREG, Pecchioli (1987) and Central Bank of Iceland (1994). The DEMS nations are Germany, Belgium, France, Ireland, the Netherlands, Denmark, Luxembourg and Italy. White's test for heteroscedasticity was performed and the p-values are reported in the penultimate row. The last row reports the p-value of Ramsey's RESET specification test for selected specifications.

Table 7 adds the variable CORP to specifications 6 to 10, which is Tarantelli's (1986) index of corporatism. Two important changes appear in these results: 1) in all but one specification CORP is significant at the 5% level and has the expected negative sign; 2) the inclusion of CORP renders CBI insignificant (DREG also becomes insignificant).

TABLE 7  
OLS ESTIMATES OF CROSS-COUNTRY INFLATION DIFFERENCES  
Dependent variable: average inflation

Specification	(11)	(12)	(13)	(14)	(15)
Constant	14.29** (8.45)	14.47** (7.58)	13.04** (5.29)	15.77** (9.01)	14.61** (6.43)
CBI	-4.11 (1.19)	-4.25 (1.19)	-4.65 (1.28)	-3.11 (0.97)	-3.44 (1.06)
TURN		-1.10 (0.21)	-0.82 (0.17)	-3.49 (0.78)	-3.22 (0.71)
DREG			1.18 (0.92)		0.92 (0.81)
DEMS				-3.29** (2.93)	-3.22** (2.84)
CORP	-0.49* (2.70)	-0.49* (2.65)	-0.37 (1.65)	-0.56** (3.40)	-0.47* (2.31)
R <sup>2</sup>	.34	.35	.37	.50	.52
S.E.E.	2.66	2.70	2.71	2.40	2.42
D.W.	1.30	1.32	1.21	1.99	1.88
Het p-value	0.82	0.61	0.53	0.06#	0.18
RESET p-value					0.71

Notes: \*\*, \*, and # denote significance at the 1, 5, and 10% levels respectively. Absolute values of t-ratios in parentheses. The sample period is 1973-1988. The sample nations are the 16 for which the corporatist index is available (listed in Table 2).

Sources: inflation, OECD-MEI; CBI, Cukierman *et al.* (1992); TURN, Cukierman *et al.* (1992); DREG, Pecchioli (1987) and Central Bank of Iceland (1994); CORP, Tarantelli (1986). The DEMS nations are Germany, Belgium, France, Ireland, the Netherlands, Denmark, Luxembourg, and Italy. White's test for heteroscedasticity was performed and the p-values are reported in the penultimate row. The last row reports the p-value of Ramsey's RESET specification test for selected specifications.



Taken as a whole, this regression analysis suggests that the specification of the model of cross-country inflation differences as given by AS (1993) suffers from an omission of relevant variables. T-ratios suggest that individually the degree of corporatism of the labour market, the regulatory burden of the central bank, and coordinated monetary policies may also be relevant. To formalize this idea, an F-test is calculated to test whether CORP, DREG, and DEMS are jointly significant. The test statistic is  $F_{(3,27)} = 5.96$  which is significant at the 1% level.

Finally, the issue of the omission of the variables CORP, DREG, and DEMS is evaluated in these simple econometric models. This is done using Ramsey's (1969) RESET specification test which can suggest an omitted variable problem. The results for the specifications 1 and 6, which include central bank independence as the sole explanatory variable to explain cross-country inflation differences, reveal a mis-specification. However, in specification 15 which includes the additional explanatory variables for corporatism, bank regulation, and exchange rate regime, the result does not suggest a mis-specification.

## 6. Conclusion

This paper has examined the central bank independence/inflation relationship. It has indicated a number of factors which raise doubts regarding the independence/inflation stylized fact: 1) it is suggested that the link between independence and inflation may not be as tight as previously reported; 2) the stylized fact does not score well on predictive validity grounds; 3) tests indicate that cross-country inflation differences relying solely on central bank independence as an explanatory variable suffer from an omission of relevant variables.

This led to a search for what other factors may be significant determinants of cross-country inflation differences. First, economic theory suggests that the structure of the labour market should be important. Also recommended by theory were the regulatory burden of the central bank and the exchange rate regime.

Examinations of the relationships between these issues and inflation indicated that there are significant correlations. Nations with the highest inflation rates tended to be the least corporatist economies and nations with the best inflation performances tended to have the most corporatist economies. Nations whose central banks had heavy regulatory burden of the banking industry were found to have the worst inflation records. Also, it was shown that nations with dependent central banks were found to have improving inflation performances when involved in a coordinated monetary policy.

A model of cross-country inflation rates was then estimated including these additional explanatory variables. Tests suggest that these variables are jointly significant determinants of inflation differences.

These results are important because, as indicated in Section 2, this is a time when many nations are considering the legal relationship between their government and their central bank. The analysis presented here suggests that developing or modifying a central bank charter in an attempt to lower inflation may not be sufficient (or even necessary) to bring about the desired outcome.



## APPENDIX

## 1. Alternative sample periods

Unlike other attempts at quantifying independence, the CWN measure is broken down into several time periods; this will allow for comparisons over different time spans. Figures A1, A2, and A3 are plots of inflation and independence over the 1960 to 1971, 1972 to 1979, and 1980 to 1989 time periods respectively. As can be seen, what remains of the independence/inflation relationship breaks down in the most recent time span. The correlation coefficient for the decade of the '80s is  $-.22$ . For the 70s and 60s sample periods the correlation coefficients are  $-.31$  and  $-.34$  respectively.

Noteworthy with regard to the '80s sample period is that the correlation coefficient between independence and average unemployment rates, a real variable, is also  $-.19$ . So here, independence is no more correlated with inflation than a real economic variable.

FIGURE A1

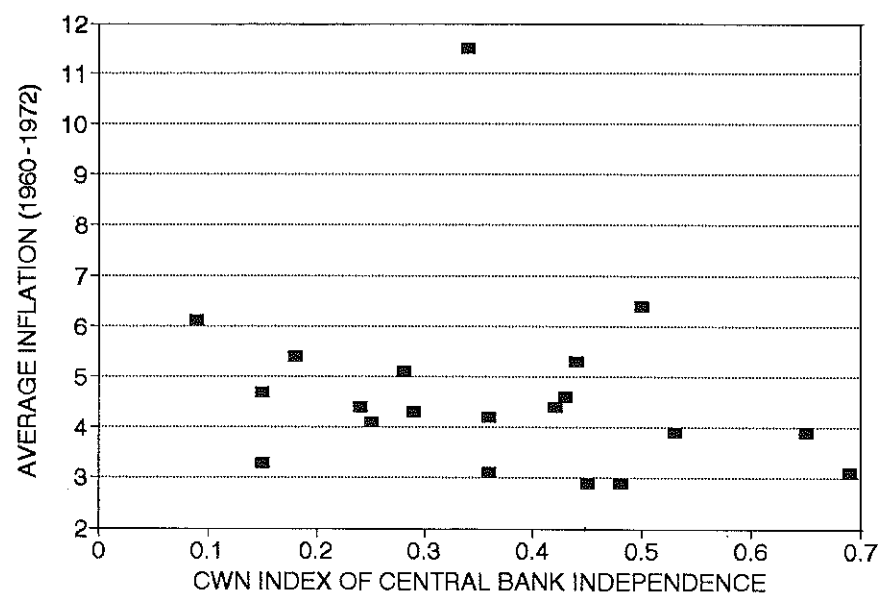


FIGURE A2

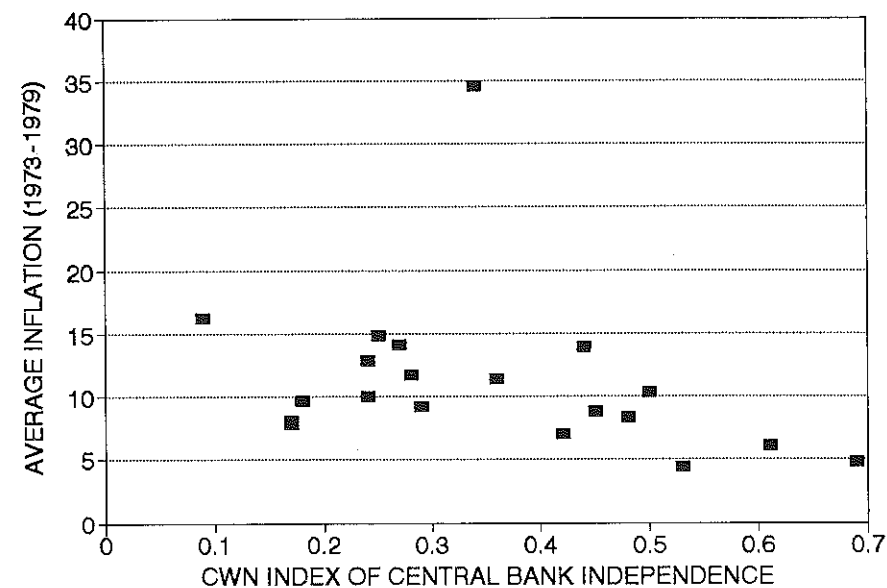
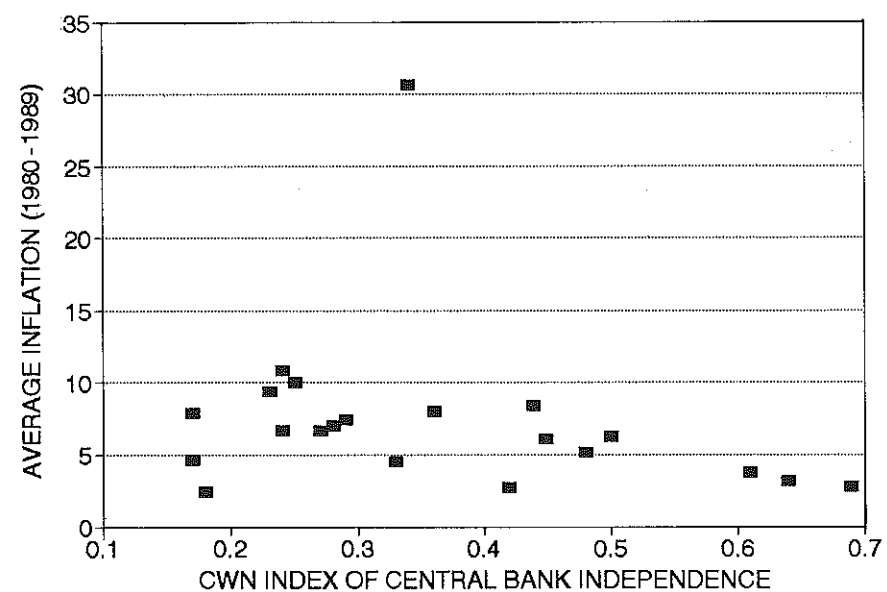


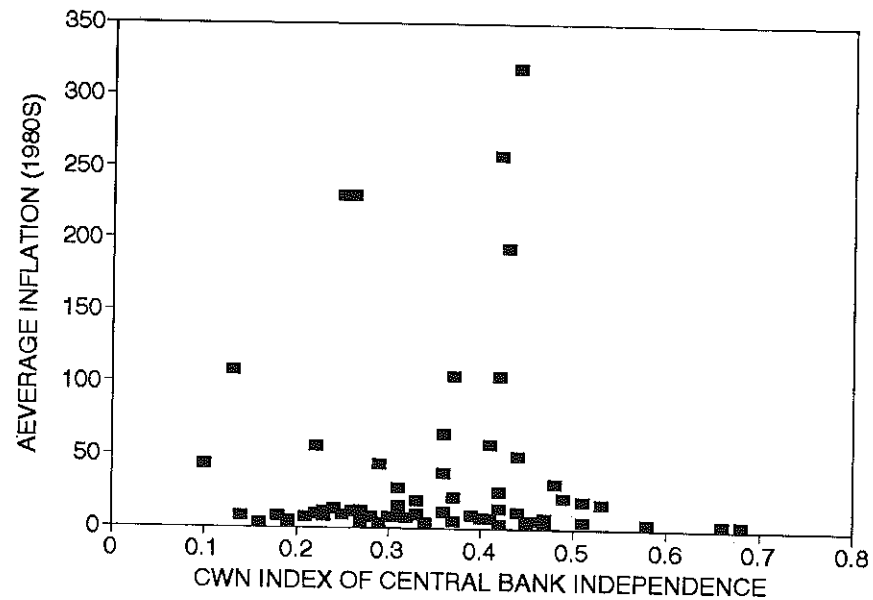
FIGURE A3



## 2. Analysis with developing countries

The CWN measure provides an index of independence for the decade of the 1980s for 68 nations. The majority of these are what we consider developing countries. Figure A4 is the plot of independence and inflation for all 68 nations. Here no clear relationship exists between independence and inflation. The correlation coefficient is a mere .02. Also note that this means for developing countries as a group, the correlation is positive. Although there is most likely no causal role of independence to high inflation, it is important to note that the AS' stylized fact cannot be extended to developing countries.

FIGURE A4



## 3. Ramsey's RESET test for omitted variables

In this essay it has been suggested the model of cross-country inflation differences employed by AS (and others) is mis-specified. In particular, it suffers from an omission of relevant variables. Ramsey (1969) provides a formal test for omitted variables. This test involves estimating the model in question, say:

$$Y_i = X\beta + e_i$$

against

$$Y_i = X\beta + \sum_{j=1}^p (\hat{Y}_i)^{j+1} \alpha_j + u_i$$

where  $\hat{Y}$  is the predicted value from the null model. RESET is an F-test with the null:  $\alpha_1 = \dots = \alpha_p = 0$ . To perform this test,  $p$  must be chosen. Ramsey and Gilbert (1972) show that favourable evidence, via Monte Carlo experiments, is found with  $p = 3$ . This test is performed here with model specifications 1 and 6 (which is the AS specification) and 15 (which includes the addition variables from the analysis of this paper).

These results indicate that specifications 1 and 6, which include only CBI as an explanatory variable, suffer from an omission of relevant variable and specification 15 does not.

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