Central Bank Independence and inflation: the case of Greece

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Abstract. This paper discusses the argument for Central Bank Independence (CBI) in the case of Greece. Using a time series approach and the last data available before Greece joined the EMU, the hypothesis that Central Bank Independence is important for controlling inflation is examined. Employing two indices, which serve as proxies for CBI, *LegalCBI* and *TOR*, the inverse relationship between CBI and inflation was confirmed. The interactions between the variability of inflation and CBI were also investigated. Furthermore, evidence was found to suggest that the rate of turnover Granger causes inflation.

Key words: Central Bank Independence, inflation, Greece.

JEL classification: E58, E52.

Resumen. Este artículo presenta la justificación de la Independencia del Banco Central (CBI) para el caso de Grecia. Para su desarrollo se utiliza un enfoque de series de tiempo y se emplean datos disponibles antes de la unión de Grecia al EMU. La hipótesis que se desarrolla afirma que la Independencia del Banco Central es importante para controlar la inflación. Se emplean dos índices que sirven como variables *proxy* para la CBI: *LegalCBI* y *TOR*. También se confirma una relación inversa entre la CBI y la inflación y se presenta evidencia que sugiere que la tasa de cambio en la gerencia del Banco Central es causante, en el sentido de Granger, de la tasa de inflación.

Palabras clave: Independencia del Banco Central, inflación, Grecia.

Clasificación JEL: E58, E52.

1.　Introduction

Central Bank Independence (CBI) has become one of the central concepts in monetary theory and policy. It is widely believed that a high level of CBI along with an explicit mandate for the bank to restrain inflation is an important institutional strategy to assure price stability. Although one could suggest alternative mechanisms to reach low rates of inflation, CBI is the one most often recommended. Indeed, more and more countries in the OECD and beyond have recently changed their central bank laws accordingly. The theory underlying this view is the time inconsistency model by Kydland and Prescott (1977) and Barro and Gordon (1983). The basic message of this argument is that governments suffer from an inflationary bias and as a result inflation is suboptimal. Rogoff (1985) has proposed delegating monetary policy to an independent and 'conservative' central banker to reduce this inflationary bias. Conservative means that the central banker is more averse to inflation than the government, in the sense that the former places a greater weight on price stability than the government does.

There is a lot of empirical evidence suggesting that countries with more independent central banks have lower rates of inflation. This evidence generally consists of cross-country regressions using proxies for CBI based on the statutes of the central bank and the turnover rate of central bank governors. Berger et al. (2001) provide an up-to-date literature review on this issue. They conclude that the negative relationship between CBI and inflation is quite robust.

On the other hand Hayo and Hefeker (2002) survey critically the argument for CBI and argue that CBI is neither necessary nor sufficient for reaching monetary stability. Other critics, including Goodhart (1994) and Forder (1998), question this approach. The latter points out that: "*The test might appear to show a statistical regularity, say between the content of the statutes of a central bank and the rate of inflation, but in the absence of a theoretical connection that would be of no interest. We might note that the European German-speaking countries (Germany, Switzerland, and Austria) have low inflation. This does not mean that if we all started speaking German, inflation would fall*". A technical criticism of the structure of various CBI indices can be found in Mangano (1998).

Cukierman, Webb and Neyapti (1992) (CWN hereafter), and Cukierman (1994) summarise the empirical regularities in the correlation between CBI on the one hand and inflation and economic growth on the other, as follows:

1. Among industrial countries, the legal CBI index introduced in CWN is negatively correlated with inflation, but the turnover rate (TOR) of central governors has no correlation with inflation.

2. Among developing countries, the legal CBI index of CWN is not correlated with inflation, but the TOR is significantly related to inflation.

A number of authors such as CWN and Grilli, Masciandro and Tabellini (1991), GMT hereafter, have undertaken different types of research for a num-

ber of countries, including Greece, correlating CBI with various macroeconomic variables. Following a cross-section analysis, they found that more independence for the central bank is systematically associated with lower average inflation and less variable inflation. In GMT (1991), Greece is categorized as an industrial country, while in CWN, it is categorized as developing. In this paper we investigate which categorization is justified and compare the results with the findings of CWN for industrialized and developing countries.

A time series approach is followed.[1] Our purpose is to highlight and investigate the relationship between CBI and inflation in the Greek economy over the last five decades using up-to-date data. This would be the last data available since Greece joined the EMU (Economic and Monetary Union) and the Central Bank (CB) participates in the European Central Bank (ECB). We update the legal index constructed by CWN and investigate whether the institutional setup of the CB makes a difference as far as inflation is concerned. Additionally, we study whether the stylized facts reported by CWN and GMT are justified.

The paper is organized as follows: A brief historic note is presented in Section 2. Then, in section 3 is a description of the methods used to construct the Legal index for CBI, the turnover of the Central Bank governor and the inflation variable. The results of the empirical analysis are presented in Section 4 where we test whether CBI can explain the behaviour of inflation and its variability in Greece, and whether there exists Granger causality between the two variables in concern. In the last section there are some conclusions.

2. Brief history

The Bank of Greece was founded on September the 15th, 1927 according to the Geneva Protocol, but it actually began operating May the 14th, 1928. Although the Statute of the Bank of Greece has been repeatedly amended, only recently its traditional operational framework changed (December 1997).

Following liberation from foreign occupation in 1944 and the civil war, Greece's political and economic life was characterized by uncertainty and instability. From 1945 to 1953 five devaluations of drachma against dollar took place and at least four stabilization policies were introduced, none of which were able to accomplish stability and lower inflation. In 1953 a new monetary stabilisation programme was proposed which included the introduction of a new drachma (equal to 1000 "old" drachmas), the participation in the Bretton Woods system of fixed exchange rates and a 50 percent devaluation against dollar and all the currencies that were connected to it. The devaluation and the participation in the Bretton Woods system of fixed exchange rate, helped to maintain a 30 drachmas per dollar rate and low inflation until 1973. Monetary policy decisions were taken by the Currency Committee, which was formed in

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[1]For a different time series approach see also Otero and Ramírez (2006). In this work, inflation is modeled in terms of disequilibria in the monetary sector, the foreign sector and the labor sector.

1946. This was a powerful body whose mission was to control money supply, interest rates, drachma exchange rates and business credit. The Committee's President was the Minister of Coordination (responsible for the Economy) and its members included the Ministers of Finance (responsible for the Budget), Industry, Commerce and Agriculture and the Governor of the Bank of Greece (BoG). The policy guidelines laid by the Currency Committee were expected to be followed by the BoG and its governor was expected to resign when a new government was in office.

Overall, the period between 1953-1973, characterized by Alogoskoufis and Lazaretou (1997) as the "Golden" period of drachma, has been seen as a period of monetary stability and low inflation. On the one hand the participation in the Bretton Woods system of fixed exchange rates kept inflationary pressures low and allowed the monetary authorities to control inflation. On the other hand, the autocratic state exercised tight control over labour cost (trade unions were allowed to operate only in 1982), which resulted in low increases in wages following broadly the increases in productivity.

The collapse of the Bretton Woods system (1972) and the first oil shock (1974) coincided with the transition to democracy (1974). Greece did not participate in the forthcoming European attempts for monetary cooperation and exchange rate stability. The Currency Committee and the BoG continued to aim at a high growth rate, high level of employment and investment, a sustainable current account deficit and, at the same time, to try to meet the financial needs of the public sector. The persisting high inflation of the period 1974-1975 obliged the authorities to control the liquidity of the economy. As a result, in 1976 the Currency Committee introduced for the first time intermediate targets to conduct monetary policy. Specifically, between 1976 and 1982 the BoG set target values for both the rate of growth of M0, the currency in circulation, and the rate of growth of banking credit. Consequently, one might argue that after 1974 Greece's monetary policy has entered a new phase as the country moved from a fixed exchange rate regime to a floating one and monetary targets replace exchange rate ones. A thorough investigation of the rigidities of the financial structure in the 1970's in Greece can be found in Courakis (1981).

In July 1982 the Currency Committee was dissolved by the new government and there was a new distribution of power between the government and the BoG. The latter had to implement policies designed by the former. The 'crawling-peg' exchange rate policy was continued and the drachma did not participate in the Exchange Rate Mechanism (ERM) of the European Monetary System (EMS) created in 1979. Two stabilization programmes, both of which were accompanied by devaluations against the dollar, were announced in the 1980's. The first one, in 1983, devalued the drachma by 15.5 percent against the US dollar as an attempt to: i) control the rising rate of inflation through the stabilization of the exchange rate at a sustainable rate, and, ii) stimulate the competitiveness of Greek products. This proved to be unsuccessful and short-lived. The accumulation of problems and the structural imbalances led to a new programme in 1985. A new devaluation of drachma by 15 percent

was announced together with promises that credit expansion would be limited. The second programme introduced, amongst others, two important changes: the start of the process of financial liberalisation and a shift of the monetary policy towards price stability.

At the beginning of the 90's, the Maastricht treaty was signed and a strong anti-inflationary policy was adopted by all the subsequent governments, conservative and socialist, in order to meet the criteria of the treaty (see Bratsiotis, 2000 for the "metamorphosis" of the socialist party). A policy of reforms, financial liberalisation combined with a *strong drachma policy*[2] led to the reduction of inflation. A detailed discussion on the recent monetary and economic history can be found in Alogoskoufis (1995), Alogoskoufis and Lazaretou (1997), Courakis (1981) and Mourmouras and Argyrou (2000).

As a result, at least four different regimes could be identified. The first one would be before the participation in the Bretton Woods system of exchange rates. The second one would be during the Bretton Woods system, a period characterized by low inflation and monetary stability. The third one would be the period after the fall of Bretton Woods when a flexible exchange rate system was in place. The last regime would have started with the Maastricht treaty when the main goal of the monetary policy was price stability.

3. Measures of central banks' legal independence

3.1. Legal index

The Legal Independence Index for Greece denoted as *LegalCBI* was formulated following CWN. Only written information from the Bank's charters was used and the focus is the degree of independence legislators intended to allocate to the Bank. The four main clusters in which the Bank's relevant legal characteristics can be classified are the following:

- The appointment, dismissal and term of office of the chief executive officer of the Bank, commonly called the Governor.

- The policy-formulation cluster, which concerns the resolution of possible conflicts between the executive branch (government) and the Central Bank over monetary policy, as well as the participation of the Bank in the budget process.

- The objectives of the CB.

- Limitations on the ability of the CB to lend to public sector (limits on volume, maturity, interest rates and conditions on direct advances and lending).

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[2]The rate of depreciation of drachma against the ECU was smaller than the inflation differential between Greece and the rest of the EU countries.

From those four clusters, 16 variables of Legal Independence were generated, coded on a scale between 0 (lowest level of independence) and 1 (highest level of independence).[3]

The values of *LegalCBI* from 1950 to 1989 are obtained from CWN, and, following the same categorization and weighting, values for the next decade were generated (see Figure 1). The procedure of generating these values involved separating the period under consideration in three sub-periods, which are: 1990 to 1994; 1995 to 1997 and 1998 to 1999. As mentioned already, in order to reflect the legal mandate that Central Bank possesses, only information included in the Bank's charter was included. The sub-periods chosen correspond to the time points at which a reform of the legal status of the Bank took place. This implies that the years related to each sub-period exhibit the same characteristics and therefore they exhibit the same value.

However, it should be noted that the reform of 1994 abolished the rights of the Bank to provide the government with any kind of advances or lending. This fact has had an important impact on the way the Legal index was measured (see Figure 1. Legal Central Bank Independence). Following CWN, the 16 sub-indices were aggregated in one single Legal Independence Index.

3.2. Turnover of central bank governor

This index is considered by CWN as an informal indicator of actual independence. This concept is based on the assumption that a more frequent turnover of Central Bank Governors –possibly– creates dependence on the political authorities. It may, actually, indicate the possibility of the Government dismissing whoever is not consistent with its own objectives –including political objectives. In such a case, the Governor may be discouraged from applying a long-term policy.

Accordingly, a more rapid turnover of the Governor is considered to indicate a lower level of independence. Nevertheless, a low turnover does not necessarily imply a higher level of CBI. The turnover rate (TOR) actually indicates the average tenure of the Governor measured in years. Given that the majority of the countries –including Greece– have an electoral cycle of at least four years, it seems plausible to accept this as a critical range for the turnover. Above this value independence declines seriously, such as 0.2 and 0.25 changes per year. This is related to an average tenure of four to five years.

Just as in the case of the Legal Independence variable, the data related to the Turnover variable up to year 1989 were drawn from CWN and the values from 1990 to 1999 were generated by observing the frequency of the Governor's turnover. For that purpose information contained in the *Annual Statistical Bulletin of the Bank of Greece* was used.

More specifically, the turnover rate for those years was found by applying

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[3]For more information on the formulation of the Legal Independence Index see the discussion in CWN.

the following simple formula:

$$Annual\ Turnover\ Rate = \frac{Number\ of\ years}{Number\ of\ Governor\ Changes}$$

The values indicate an average annual turnover rate for the decade, which is measured in years. The outcome corresponding to the decade is then assigned to each year included in the sample sub-period. As already mentioned, a value exceeding the critical range of 0.2 to 0.25 indicates lower independence of the Central Bank. Based on our estimates, values for Greece range between 0.1 and 0.38, half of the time exceeding the critical value.

3.3. The inflation variable

To reduce heteroscedasticity of the error term and improve the efficiency of the model, a transformation of the inflation variable was adopted. The new variable, I, represents the annual real depreciation of a given amount of money, which is given by:

$$I = \frac{\pi}{1 + \pi} \tag{1}$$

where π is the inflation rate and I is the transformed inflation rate (taking values from 0 to 1). The inflation rate was measured as the annual percentage change in the CPI, drawn from the United Nations Statistical Yearbook (the base year being 1980).

Four dummy variables are also employed in order to capture the different policy regimes during this five-decade period. The first dummy variable (called *BBW* –Before Bretton Woods) captures the period before the 1953 devaluation of *drachma* (value 1 from 1951 to 1953 and 0 afterwards). The second dummy (called *BW* –Bretton Woods) would represent the period after the drachma 1953 devaluation and up to 1973. During this period, Greece successfully participated in the fixed exchange rate mechanism established by Bretton Woods. The third dummy (called *FE*, Flexible Exchange Rate Mechanism) captures the period after the restoration of democracy in 1974 up to 1991 before the Maastricht treaty was signed. The last dummy (called *MA*, Maastricht) runs from 1992 to 1999 in order to represent the different policy regime after the Maastricht treaty's signature. These variables have 0 as default value except in the particular years where they took the value of 1.

Having gathered all the information and constructed the variables our next steps are as follows:

i) We calculate the correlation between the two indices of central bank independence (*LegalCBI* and *TOR*).

ii) We then estimate the following model, to investigate the relationship between inflation, *LegalCBI* and *TOR*:

$$I_t = \alpha\,LegalCBI_t + \beta\,TOR_t + \sum_{i=1}^{4} \gamma_i\,DUMMY_i + \varepsilon_t \tag{2}$$

iii) Next, we examine whether our proxies for Central Bank Independence and the dummies affect the variability of inflation.

iv) Finally, we explore the direction of the causality. Does *LegalCBI* Granger cause inflation or is it the other way around?

4.   Results

4.1.   Relationship between indices of independence

Table 1 shows the rank correlation between indices of central bank independence: the legal index and the turnover rate. The two indices (*LegalCBI* and *TOR*) seem to be correlated, and thus could be employed in order to obtain a better measure of overall Central Bank Independence.

Table 1. Spearman's Correlation between the Legal Index and the Rate of turnover.

Correlation pair	
LegalCBI and *TOR*	0.481
Coefficient sig. (2-tailed)	0.000
Observations	50

4.2.   Inflation and Central Bank Independence

Do countries with more independent central banks have lower rates of inflation? The hypothesis that inflation should be negatively related to the legal variable has two bases. First, there is the presumption that central banks are more concerned about price stability compared to political authorities (see e.g. Rogoff 1985). A more independent Central Bank will have a stronger impact on actual policy and a more persistent anti-inflationary policy since the latter is normally the outcome of a compromise between the Central Bank and the government. Secondly, Legal Independence is intentionally structured to reflect, among other things, the extent to which the Central Bank has an explicit mandate to pursue price stability at the expense of other objectives. Central Bank's Legal Independence is neither a necessary nor a sufficient condition for low inflation although, other things being equal, we would expect less legal independence to contribute to higher inflation.

The transformed inflation variable takes values between 0 and 1 and consequently is bounded by definition. The same holds true for the other two variables: the aggregate legal index and the rate of turnover. In order to reinforce our point, we carry out the unit root test, recently proposed by Ng and Perron (2001).

Table 2. Unit Root test for the Transformed Inflation.

		MZa	MZt
Ng-Perron test statistics		−5.933	−1.643
Asymptotic critical values	5%	−8.100	−1.980
	10%	−5.700	−1.620

We were able to accept the hypothesis that the transformed inflation is stationary at the 10 percent significance level.

Table 3 presents the regression of the transformed inflation rate (I) on the aggregate variable of legal Central Bank Independence ($LegalCBI$), the turnover rate (TOR) and the four dummy variables.[4]

Table 3. Model 1 and diagnostics.

$$I = -0.136 \underset{(0.082)^*}{LegalCBI} + 0.11 \underset{(0.072)^{**}}{TOR}$$

$$+ 0.144 \underset{(0.05)^{***}}{BBW} + 0.0949 \underset{(0.044)^{***}}{BW} + 0.198 \underset{(0.049)^{***}}{FE} + 0.138 \underset{(0.064)^{***}}{MA}$$

$R^2 = 0.75$, $Adjusted\ R^2 = 0.72$

$Jarque\text{-}Berra = 6.752\ [0.034]$, $F_{ar} = 6.007\ [0.005]$

$F_{het} = 1.95\ [0.072]$, $F_{arch} = 0.36\ [0.546]$

$McLeod\text{-}Li = 15.96\ [0.719]$, $AIC = -3.829$

The aggregate legal variable has a statistically significant coefficient at the 10 percent significance level with the predicted negative sign; laws seem to make a difference. The negative sign implies an inverse relationship between the aggregate legal index and the transformed inflation: the more independent a central bank is, the lower its inflation is. The turnover rate has a statistically insignificant coefficient (*Prob.* 0.13). However, the rejection of the hypothesis that the coefficient is zero is only marginal at the 10 percent significance level and therefore there is a high probability of having a Type II error. It has also the predicted positive sign: frequent changes of the Central Bank's governor create instability, which results in higher inflation. Both explanatory variables have the predicted sign but only one is statistically significant at the

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[4]Note: The numbers in ( ) are the standard errors. F_{ar} is the LM F test for serial correlation of up to second order. F_{het} is an F test for heteroscedasticity. F_{arch} is the second order ARCH F test. Numbers in [ ] are the p-values of the test statistics. The statistic proposed by McLeod-Li (1983) tests the null hypothesis that the residuals of this model are an *IID* process. The probability using up to 20 lags is reported in [ ]. *AIC* is the Akaike Information Criterion. * indicates significance at the 10 percent level, ** at the 5 percent level, and *** at the 1 percent level.

10 percent significance level. All dummy variables have a positive coefficient and are statistically significant at the 1 percent S.L., capturing the different policy regimes. The *BW* dummy has the lowest coefficient reflecting the low inflation of the period between 1953 and 1974. The second smallest coefficient is found in the period after the Maastricht treaty, from 1992 to 1999.

The value of R^2 is high, indicating that 75 percent of the variation of the transformed inflation can be explained by the variation of the independent variables. The *Jarque-Berra* statistic tests whether the series is normally distributed. The null hypothesis of a normal distribution (*Prob.* 0.034) could be accepted. Additionally, the hypothesis that *heteroscedasticity* is present in the residuals is rejected at the 5 percent significance level. However, there is evidence to suggest that higher order *serial correlation* is present in the residuals. No evidence is found to support the hypothesis that an ARCH type of structure is present in the residuals (All tests were estimated for *two lags*). Also, a *McLeod-Li* test with 20 degrees of freedom was carried out on the residuals of the model. The calculated test statistic is 15.96, which provides strong evidence in favour of the null hypothesis that the series comprises *IID* (Identically Independently Distributed) random variables.

Overall, most of the diagnostic tests suggest that the model is able to explain the behaviour of the transformed inflation.

The negative relationship between inflation and legal independence is mentioned in CWN as a characteristic of industrial countries. In this study Greece is characterised as a developing country. However, the evidence suggests that at least one characteristic of a developed economy was found: the negative correlation between the *LegalCBI* index and inflation.

On the other hand, the turnover rate coefficient is positive as expected, but not statistically significant. The positive relationship between inflation and the turnover rate is also mentioned by CWN as a characteristic of developing countries. The evidence based on *TOR* supports their characterisation for Greece as a developing country as far as this aspect is concerned. However, the positive relationship is not found to be statistically significant.

To sum up, it is found that Legal Independence is systematically and inversely related to inflation. It is also related to the actual frequency of Governors' changes in a positive but not significant way. In the case of Greece, the evidence suggests that an independent central bank and lasting governor permanence would result in a lower inflation.

In Table 4, an alternative model is presented. *TOR* is not included as it was found to be statistically insignificant. The picture does not change. The negative relationship between *LegalCBI* and inflation is confirmed. However, a comparison of the adjusted R^2 and the *AIC* (Akaike Information Criterion), suggest that *Model 1* is preferable.

Table 4. Model 2 and diagnostics.

$$I = -0.128 \underset{(0.0836)*}{LegalCBI} + 0.151 \underset{(0.050)***}{BBW} + 0.102 \underset{(0.044)***}{BW} + 0.224 \underset{(0.046)***}{FE} + 0.165 \underset{(0.062)***}{MA}$$

$R^2 = 0.74,$ $Adjusted\ R^2 = 0.71$

$Jarque\text{-}Berra = 22.42\ [0.00],$ $F_{ar} = 5.907\ [0.005]$

$F_{het} = 0.957\ [0.474],$ $F_{arch} = 0.256\ [0.774]$

$McLeod\text{-}Li = 19.75\ [0.474],$ $AIC = -3.818$

4.3. Central Bank Independence and the variability of inflation

Variability of inflation imposes economic costs. Indeed, many of the costs of high inflation arise because it is usually more variable and uncertain when the average is high. Based on the preceding discussion, we would also expect that inflation would vary when the central bank is less independent. It is therefore important to investigate whether our proxies for Central Bank Independence actually affect the variability of inflation.

As a measure of inflation variability, we take the standard deviation of

$$SD_i = \sqrt{\left[d_i - \bar{d}\right]^2}$$

where d_i is the transformed inflation for $i = 1, \ldots, 50$.

Table 5. Model 3 and diagnostics.

$$SD = 0.04 \underset{(0.011)***}{LegalCBI} + 0.042 \underset{(0.007)***}{BW} + 0.042 \underset{(0.008)***}{FE}$$

$R^2 = 0.31,$ $Adjusted\ R^2 = 0.28$

$Jarque\text{-}Berra = 0.367\ [0.831],$ $F_{ar} = 2.49\ [0.06]$

$F_{het} = 3.32\ [0.01],$ $F_{arch} = 2.95\ [0.07]$

$McLeod\text{-}Li = 37.59\ [0.011],$ $AIC = -4.535$

Our preferred model is presented in Table 5. Keeping only the statistically significant variables and using two well known criteria, the AIC and the *adjusted* R^2, it is found that TOR and the dummies BBW and MA are not contributing to explaining the variability of the dependent variable.

Note that all coefficients are statistically significant at the 1 percent level. R^2 is quite low and indicates that the proposed model can explain only 31 percent of the variation of the standard deviation on transformed inflation. Furthermore, the residuals are normally distributed but the evidence to suggest

that the residuals are *IID* is not very strong. Most of the diagnostics improve when a lagged value of SD is introduced as a dependent variable, but other than that results do not change.

As a result, the variability of inflation can be explained by the aggregate legal index and two dummy variables, one for the period between 1953 and 1973, which represents the Bretton Woods period (BW) and another one, which represents the period between 1974 and 1991 (FE). These two periods capture different features. The BW period is characterized by a low inflation and the FE by high price rises. The aggregate legal index is still an important variable, since it contributes significantly to explaining the variability of the transformed inflation. The coefficient is statistically significant but it does not have the predicted negative sign. However, this result is in line with the findings of CWN for developing countries (their coefficient was positive, but statistically insignificant).

Although the aggregate legal index was found to contribute significantly in explaining the variability of the transformed inflation, a positive relationship between these two variables is uncovered, contrary to our expectations. The two dummy variables, BW and FE are also found to be significant in explaining the behaviour of SD_i.

4.4. Two way causality between inflation and Central Bank Independence

As discussed in the previous part, legal independence is systematically and inversely related to inflation. But it could be possible that there is a two-way causality between inflation and the actual degree of Central Bank Independence. Less independence contributes to higher inflation. However, high inflation is likely to result, at least after a while, in less independence. If inflation affects actual independence, we would expect it to affect the rate of turnover of governors too.

To investigate the causality between inflation and turnover of central bank governors, we perform a simple Granger causality test by estimating the bivariate autoregressive processes for inflation and turnover:

$$y_t = a_0 + a_1 y_{t-1} + \cdots + a_l y_{t-l} + b_1 x_{t-1} + \cdots + b_l x_{t-l} \tag{3}$$

$$x_t = a_0 + a_1 x_{t-1} + \cdots + a_l x_{t-l} + b_1 y_{t-1} + \cdots + b_l y_{t-l} \tag{4}$$

The reported F-statistics are the *Wald* statistics for the joint hypothesis

$$b_1 = \cdots = b_l = 0$$

The null hypothesis is therefore that x does not Granger-cause y in the first regression and that y does not Granger-cause x in the second regression.

We cannot reject the hypothesis that the transformed inflation does not Granger cause the rate of turnover, but we do reject the hypothesis that the rate of turnover does not Grange cause the transformed inflation. Therefore it appears that Granger causality runs one-way from the rate of turnover to the

Table 6. Pairwise Granger causality tests.

Sample: 1951 1999 - Lags: 3			
Null Hypothesis:	**Obs**	**F-Statistic**	**Probability**
Transformed Inflation does not Granger Cause Rate of turnover	46	0.21834	0.88308
Rate of turnover does not Granger Cause the Transformed Inflation		3.07246	0.03883

transformed inflation. A stable (and probably powerful) governor is associated with lower inflation. This evidence is not in line with the findings of the previous section for the significance of the turnover rate for a low inflation.

On the other hand, there is no Granger causality between the transformed inflation and the aggregate legal index (Table 7). In both cases the null hypothesis cannot be rejected. The same tests were carried out for 2, 4 and 5 lags. The results were not altered.

Table 7. Pairwise Granger causality tests.

Sample: 1951 1999 - Lags: 3			
Null Hypothesis:	**Obs**	**F-Statistic**	**Probability**
Aggregate Legal Index does not Granger Cause Transformed Inflation	46	0.21834	0.88308
Transformed inflation does not Granger Cause Aggregate Legal Index		3.07246	0.03883

In this last part, an important relationship between the rate of turnover and the transformed inflation is uncovered. It was found that Granger causality runs from rate of turnover to the transformed inflation. This finding is not in line with the previous results (see Tables 3 and 4), where turnover rate was not found to be statistically significant.

5. Conclusions

Although there is empirical evidence to suggest that countries with more independent central banks have lower inflation, others argue that CBI is neither necessary nor sufficient for reaching monetary stability. Following a time series approach, we updated two proxies for CBI, *LegalCBI* and *TOR*, and use the last data available before Greece joined the Euro zone -the agreement was signed in 2000. Strong evidence is found to suggest that Central Bank Independence is systematically and inversely related to the rate of inflation. The latter is

also positively related to the turnover rate of the Central Bank Governor but this relationship was not found to be statistically significant. It follows that, in the case of Greece, a more independent central bank and less frequent changes of the Central Bank CEO lead to a lower rate of inflation. The *LegalCBI* index is also found significant for the variability of inflation. The systematic anti-inflationary policy followed in the 1990's is confirmed by the results. The dummy variable introduced for this period was found statistically significant in all the cases. Another interesting finding is that *TOR* Granger causes inflation (one-way causality). No evidence is found to suggest that there is a causality relationship between *LegalCBI* and the rate of inflation.

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