Central Bank Independence and Effects of Oil Price on Monetary Policy

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Abstract

This paper exploits central bank independence to assess empirically the impact of an oil price shock on monetary policy in an oil-exporting country. Two legal central bank independence indices are chosen and calculated for top nine oil-exporting countries. Using a panel data set and a fixed effects model, it is proven that a monetary authority with higher central bank independence implements a more contractionary (or less expansionary) monetary policy after an increase in oil price with respect to another central bank which is more dependent. This result empirically supports that in a non-cooperative solution monetary policy tends to be tightened more after an increase in oil price.

JEL Classification: C23; E52; E58.
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1- Introduction

Jabal Ameli (2008) has explained the reaction of the central bank in an oil-exporting economy to an oil price shock theoretically. It can respond with monetary tightening only in a non-cooperative game or a cooperative game when it has more power with respect to the fiscal authority. The latter situation cannot be found in reality, but the first one is due to an economy with high central bank independence (CBI). In other words, the higher level of central bank independence, the more possibility that the authorities act in a non-cooperative game. Hence, we do expect that an oil-exporting economy with higher independence of the central bank will implement a more contractionary monetary policy relative to another country with less independence after an oil price shock and it is the main hypothesis which should be investigated in this paper.

Changes in CBI degrees illustrate how a game between the fiscal and monetary institutions swaps between a non-cooperative and cooperative conditions. Using CBI in this role is new. So far, as Bibow (2004) indicates central bank independence is supported by theoretical and empirical analyses. Time-inconsistency which was popularised by Kydland and Prescott (1977) and Barro and Gordon (1983), sustains it theoretically. Empirical defence focuses on the negative relationship between inflation and central bank independence in developed and developing countries. There are a lot of papers pro and con on this idea , such as Bade and Parkin (1985), Alesina (1988), Grilli, Masciandaro and Tabellini (1991), Cukierman(1992), Doyle and Weale (1994), Campillo and Miron (1997), Forder (1998), Cukierman, Miller and Neyapti (2001), Jacome and Vazquez (2005), Issing (2006), Brumm (2006) and Crowe (2008). It is true that earlier papers just consider the correlation between CBI and inflation but empirical analyses are not limited to inflation. When some authors have investigated cost of less inflation under the central bank independence situation; others have assessed macroeconomic performance under such circumstances[1]. So, although this paper could be categorised in CBI empirical analyses, it does not intend to investigate macroeconomic performance but analyses the interaction between authorities after an oil shock in oil-exporting countries is its aim.

To examine the hypothesis, the paper considers the top nine oil-exporting countries. Then, a panel data model is used. The reason is that the CBI index is constant for each country for a long time, so to study the impact of it on another variable, it is necessary to gather data from different countries. Moreover, the model also needs time series data to assess the reaction of central bank to changes in oil price. Hence, data should be cross sectional and time series and it means that the paper needs a panel data model.

The reminder of the paper is organised as follows. Section 2 introduces two legal CBI indices which are used in the model and explains why these are better than other proxies of CBI and then calculates indices for all countries in the sample. In Section 3, the econometric model and its virtues are described. Section 4 explains a defect of the original model and modifies it to create a better model based on the first model in section 3 and this modified model will be estimated. Section 5 deals with the time series properties of the variables and examines whether

[1]See, e.g. Parkin (1987), De Long and Summers (1992), Alesina and Summers (1993), Cukierman, Kalaitzidakis, Summers and webb (1993), Cukeirman (1994), Fischer (1995), Cukeiman and Gerlach (2003), Herrendorf and Neumann (2003), Demertzis (2004) and Down (2004).

they are stationary or not. Estimation results and economic interpretations of them are presented in section 6. Section 7 concludes.

2- Indicators of CBI

While CBI is supposed to show the non-cooperative situation between authorities, it is necessary to find a comprehensive index for it. The central bank has its goal and instrument policy in the non-cooperative situation, so an optimal index should cover *goal independence* and *instrument independence*. Some authors believe that CBI is just instrument independence and goal independence is related to the conservative (i.e. inflation aversion) property of the central bank.[2] If we accepted this idea, an optimal index would also need to include the conservativeness because it has to illustrate the non-cooperative situation in which the central bank has its goal and instrument policy. It is interesting because papers usually try to find impacts of CBI but not conservativeness in their models and they have to cancel it from the common indices. However we do need a comprehensive index with two properties of central bank.

This paper considers two famous legal indicators of CBI. The first one has been invented by Cukierman, Webb and Neyapti (1992), and the second one has been proposed by Grilli, Masciandaro and Tabellini (1991) (henceforth, CWN and GMT, respectively). They are more inclusive than alternatives like indices built by Alesina (1988) and Eijffinger and Schaling (1993). CWN and GMT focus on a wide range of issues including the goal of central bank which is essential for the paper.

Tables 1 and 2 show CWN and GMT for the top nine oil-exporting countries. The indices have been calculated for current central banks' rules. It is very important to care that most countries in the sample have modified their regulations to establish more independent central bank during the 1990s, so the indices could illustrated the situation of central banks at the end of 1990s until 2007. CWN includes 16 criteria with different weights (see appendix) and they are coded between 0 (lowest level of independence) and 1 (highest level of independence). CWN is a weighted average of them. GMT covers 15 issues which can be 0 or 1 then it will be made by sum of them. Hence the GMT range is 0 to 15.

Comparing two tables illustrates that ranking of countries are almost similar. This is a good sign that we can neglect the subjective judgment problem stressed by Eijffinger and Schaling (1993) and Mangano (1998). Eijfinger and Schaling (1993) explain "there are three types of choice involved when constructing any such index, in which some degree of personal judgment unavoidably intervenes: (i) which criteria should be included in the index? (ii) How should the legislation be interpreted with respect to each retained criterion (which leads to their individual valuation)? And (iii) what weight should be attributed to each criterion in the

[2] See Hann et al. (2003).

Table 1. CWN Index for the Independence of Central Banks

	Weight	Iran	Kuwait	Mexico	Nigeria	Norway	Russia	Saudi Ara	UAE	Venezuela
Central Bank Governer	0.2	**0.625**	**0.645**	**0.813**	**0.583**	**0.52**	**0.645**	**0.27**	**0.583**	**0.708**
Term of office		0.25	0.5	0.75	0.5	0.75	0.25	0.5	0.25	0.5
Who appoints		0.25	0.25	0.5	0	0	0.5	0.25	0.25	0.5
Dismissal*		1	0.83	1	0.83	0.33	0.83	0.33	0.83	0.83
Other responsibility*		1	1	1	1	1	1	0	1	1
Central Bank primary objective	0.15	**0.4**	**0.4**	**0.6**	**0.6**	**0**	**0.6**	**0.4**	**0.4**	0.6
Price stability		0.4	0.4	0.6	0.6	0	0.6	0.4	0.4	0.6
Policy Formulation	0.15	**0.223**	**0.223**	**0.667**	**0.6**	**0.177**	**0.557**	**0.223**	**0.467**	**0.667**
Who formulates monetary policy		0.67	0.67	1	1	0.33	0.67	0.67	1	1
Conflict resolution		0	0	1	0.8	0.2	0.2	0	0.4	1
Central Bank role government Budget*		0	0	0	0	0	1	0	0	0
Central Bank Lending										
Limits in advances to government*	0.15	**0**	**0.67**	**0.67**	**0.33**	**0**	**1**	**0**	**0.67**	**1**
Limits in loans to government	0.1	**0**	**0.67**	**0.67**	**0.33**	**0**	**0**	**0**	**0.67**	**0.67**
Who decides terms of Lending*	0.1	**0.33**	**0.33**	**1**	**1**	**0**	**0**	**0.33**	**1**	**1**
Beneficiaries*	0.05	**N/A**	**0**	**1**	**0**	**0**	**0.33**	**0**	**0**	**1**
Type of Limits*	0.025	**0**	**0.33**	**0.67**	**0.33**	**N/A**	**N/A**	**N/A**	**0.33**	**0.67**
Maturity of Loans	0.025	**0**	**0.67**	**0**	**0.67**	**0.67**	**0**	**0**	**1**	**N/A**
Restrictions on interest rates	0.025	**0**	**0.5**	**1**	**0.75**	**0.5**	**0.75**	**0**	**0**	**1**
Prohibition lending to government	0.025	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**
CWN Index		**0.259**	**0.46**	**0.754**	**0.523**	**0.17**	**0.49**	**0.184**	**0.55**	**0.803**

*denotes exclusive criteria of CWN

Table 2.GMT Index for the Independence of Central Banks

	Iran	Kuwait	Mexico	Nigeria	Norway	Russia	Saudi Ara	UAE	Venezuela
Index of Political Independence	**1**	**1**	**8**	**1**	**1**	**1**	**1**	**2**	**7**
Government does not appoint Governor	0	0	1	0	0	0	0	0	1
Governor in office more than 5 years	0	0	1	0	1	0	0	0	1
Government does not appoint Board*	0	0	1	0	0	0	0	0	0
Board in office more than 5 years*	0	0	1	0	0	0	0	0	1
Government participation in Board*	0	0	1	0	0	0	0	0	1
Government does not approve mon. policy	0	0	1	0	0	0	0	1	1
Price stability as statutory objective	1	1	1	1	0	1	1	1	1
Power of CB for conflict resolution	0	0	1	0	0	0	0	0	1
Index of Economic Independence	**1**	**5**	**5**	**5**	**3**	**4**	**0**	**4**	**6**
Direct credit not automatic*	0	1	0	1	1	1	0	0	1
Lending to Gov. at market interest rates	0	1	1	1	0	1	0	1	1
Lending maturity to 1 year or less	0	1	1	1	1	0	0	1	1
Limited amount of lending	0	1	1	1	0	1	0	1	0
Primary market participation	0	0	0	0	0	0	0	0	1
Discount rate set by CB*	1	1	1	1	1	1	0	1	1
Banking supervision responsibility*	0	0	1	0	0	0	0	0	1
Total GMT	**2**	**6**	**13**	**6**	**4**	**5**	**1**	**6**	**13**

*denotes exclusive criteria of GMT

composite index?" (p.50). As one focuses on the comprehensive aspect of these indices and similar ranking of them, it could be possible to pass this criticism. Moreover it is possible to calculate the degree of correlation between them. If the correlation is high, one can simply ignore this criticism.

Mangano (1998) splits each index to two proxies which emerge from common and exclusive criteria of CWN and GMT. Tables 1 and 2 show them. Following him, GMT9 and CWN9 show CBI through the common criteria in GMT and CWN respectively and GMTN and CWNN come from the exclusive issues of them.[3] Table 3 indicates degrees of correlation between these 6 indices. As expected the correlation between CWN and GMT is high (0.92) and interestingly CWN9 correlates GMT9 more than it (0.98). In other words, small difference between CWN and GMT is due to the exclusive criteria and the smallest degree in table 3 which is for the correlation between CWNN and GMTN, supports this outcome. Hence, it can be expected that difference between estimation results of two indices would be small and it is just for the exclusive criteria.

Another issue which could be mentioned about using legal independence indices is whether they can show actual independence in developing countries. Cuckierman (1992) mentions that legal CBI indices may better show the actual level of independence in developed countries than developing ones, so he proposes another index which is the turnover of central bank governors. The logic which is behind this proxy is a higher turnover level indicates a lower level of CBI. However, it is clear that this proxy is not suitable for this paper; because it does not include conservativeness which is essential here and it is not as comprehensive as legal indices.

On the other hand, one may point out that it is true the central banks have changed their regulations, however most economies in the sample are developing ones and the law is not obeyed in them as in developed countries, so we need another kind of index. In order to reply, it is useful to see the indices in tables 1 and 2. CWN and GMT illustrates that except Mexico and Venezuela, all countries suffer from low CBI, hence there is no chance that countries have

Table 3. Correlations between indices*

	CWN	CWN9	CWNN	GMT	GMT9	GMTN
CWN	1.00	0.95	0.96	0.92		
CWN9		1.00	0.83		0.98	
CWNN			1.00			0.71
GMT				1.00	0.98	0.95
GMT9					1.00	0.88
GMTN						1.00

* Values of GMT, GMT9 and GMTN have been normalised to be in [0, 1].

[3] Scale of GMT9 is between 0 and 9, GMTN between 0 and 6, but CWN9 and CWNN are like CWN.

modified central banks' regulations for having more CBI but they do not follow it. As a result, the suggested CBI indices can resist in front of criticisms one more time.

3. The Econometric Model

To investigate whether more CBI results in more monetary tightening after an increase in oil prices, this model is to be estimated:

$$M_{i,t} = \alpha_i + \beta_1 O_{i,t-1} + \sum_{l=1}^{3} \beta_{l+1} \pi_{i,t-l} + \gamma_1 O_{i,t-1} I_i + u_{i,t} \quad (1)$$

where M is the annually percentage change in real money, O is the yearly percentage change in oil price, π is the consumer price percentage change per year, I is the central bank independence index, $i = 1, \ldots, N(= 9)$ is the number of countries $t = 1, \ldots, T(= 132)$ is the time-months, and $u_{i,t}$ is the error term that we have $E(u_{i,t}) = 0, E(u_{i,t} u_{j,s}) = \sigma^2$ when $i = j$ and $t = s$, and $E(u_{i,t} u_{j,s}) = 0$ otherwise. As it was mentioned CBI indices are calculated after the regulations reforms in the 1990s, so other data should correspond to this period. The data is from January 1997 until December 2007.[4]

As Bernanke and Mihov (1998) argue, economists use different methods to measure and find the direction of changes in monetary policy and there is not any consensus. In other words, choosing a criterion depends on their research with its aims, bottlenecks and the economic situation. For instance, whereas Romer and Romer (1989) use the minutes of the Federal Open Market Committee to show monetary policy in the US, Bernanke and Blinder (1992) think that federal funds rate is a better indicator; and while Thornton (1988) and Christiano and Eichenbaum (1992) suggest the quantity of non-borrowed reserves as the measure of monetary policy Cosimano and Sheehan (1994) propose borrowed reserves. Hence, the researcher has to find an indicator and justify it.

It is usual to use the interest rate to show monetary policy in a model like this, but as some countries in the sample do not present sufficient data in this area – since the developing problem- and also all countries do not indicate data for one kind of the interest rate, it would be useful to exploit money stock (nominal money).

McCallum (1989) points out that the monetary authority can influence *instrument variables* (such as the interest rate) to reach the *goals* (say real GDP). Yet he explains a two-stage process to approach the goals in monetary policy. First a central bank defines a time path to an *intermediate target* then from this target to the final goal. In other words, he believes that the central bank can affect intermediate targets easier than the goals. When intermediate targets are met, the final goals could be available. So, after instrument variables, the central bank can affect intermediate targets. Since, there is hardly available data about instrument variables for the sample, it is reasonable to put intermediate target in the model; it means that reactions of the

[4] Data have been gathered from International Financial Statistics and central banks' data.

monetary policymaker can be monitored through changes in real money instead of the interest rate. The logic behind it is clear: the central bank changes the interest rate to affect (real) money. It is true that banks and people also influence (real) money, but obviously their impact is weaker than the central bank's. Hence, real money shows monetary policy in the model.

Another group of variables regarding monetary policy is *indicator variables*. McCallum (1989) explains that this category indicates the state of the economy to the policymaker. Whereas inflation is a final goal for the central bank, lags of it could be useful indicator variables for the policymaker. In the model, inflation rates for last quarter display the economy to the authority. It is possible to use more lags, however as the central bank focuses on recent months to know the current situation of the economy, the model applies data for the last three months.

It is expected that the coefficients of inflation lags would be negative. Because (real) money is an intermediate target, one can assume (real) money is a function of the gap between inflation and desired inflation in previous periods:

$$When\ \pi_{t-l} < \pi^* \quad for\ l = 1,2,3 \ \Rightarrow\ \pi_{t-l} - \pi^* < 0 \Rightarrow M_t\ should\ be\ positive \tag{2}$$

$$When\ \pi_{t-l} \geq \pi^* \quad for\ l = 1,2,3 \ \Rightarrow\ \pi_{t-l} - \pi^* \geq 0 \Rightarrow M_t \leq 0.$$

In other words, when inflation is less than the desired level, (real) money will increase in next periods, otherwise will decrease. Hence M_t has a negative relationship with the gap and it means that in a linear equation the coefficients of inflations should be negative.

Oil price and independence index are the main explanatory variables to investigate the reaction of the monetary authority to an oil price shock. The model considers oil price as an individual time-varying variable[5], because each country has its oil price although trends of them are almost the same. However as described CBI proxy (I_i) is a time-invariant. The interactive term represents effect of independence on the respond of the central bank to a change in oil price. Since it is expected that a central bank in a non-cooperative game implements a tightening monetary policy after an oil shock (see the Jabal Ameli (2008)) and a central bank in the non-cooperative situation is an independent one, the main hypothesis to test is $\gamma_1 < 0$.

Another issue about the model specification is that the coefficients are supposed to be common. Is this homogeneity assumption valid in the model? Because the paper considers the average effect of CBI on real money, it is reasonable to follow Zellner (1969) and have a fixed effects model with common slopes. Zellner (1969) points out when one is interested in the average effect of explanatory variables it is the way to find it, another method could be estimating regression for each individual and averaging the slopes. It is not possible, however, to

[5] Hsiao (2003, p27) defines an individual time-varying variable as a variable which varies across cross-sectional units at a given period and shows variations through time.

use the latter method in this case, because CBI is constant for each individual's regression and the model suffers from multicollinearity.

4- The Model Modification

In model (1) the coefficient of oil change depends on the scale of CBI index. For example, one can change GMT scale from 0-15 to 5-20. It affects the main influence of oil change on real money.

Suppose the scale of CBI index has been changed like $I_i^* = I_i - a$, so model (1) will be:

$$M_{i,t} = \alpha_i + (\beta_1 + \gamma_1 a)O_{i,t-1} + \sum_{l=1}^{3} \beta_{l+1}\pi_{i,t-l} + \gamma_1 O_{i,t-1} I_i^* + u_{i,t}\,. \tag{3}$$

Model (3) demonstrates that the main effect of oil change is $\beta_1 + \gamma_1 a$, and if one decides to determine $a = -\frac{\beta_1}{\gamma_1}$ then the main effect will disappear. On the other hand, it is possible to show a strong main effect with choosing a large amount of a. Hence, the main effect of oil varies with different scale of the CBI index. It is obvious that the standardised coefficient and standard error also change. In other words, it is not possible to make a conclusion or test a hypothesis about the main effect.

However, it is very easy to show that the whole effect of oil on real money does not vary with different coding in the CBI index. Model (3) shows:

$$\frac{\partial M_{i,t}}{\partial O_{i,t-1}} = \beta_1 + \gamma_1 a + \gamma_1 I_i^* = \beta_1 + \gamma_1 a + \gamma_1 (I_i - a) = \beta_1 + \gamma_1 I_i\,. \tag{4}$$

So, this partial derivative is like the one for model (1). But, to have a correct specification, it is necessary to find a way in order to vanish depending of the main effect of oil change on the scale of CBI index.

A common method in linear regressions is *mean-centring* form. This could be used in a panel data model. Hence, instead of model (1), one can estimate:

$$M_{i,t} = \alpha_{2i} + \beta_{21} O_{2i,t-1} + \sum_{l=1}^{3} \beta_{l+1}\pi_{i,t-l} + \gamma_{21} O_{2i,t-1} I_{2i} + u_{2i,t} \tag{5}$$

where $O_{2i,t-1} = O_{i,t-1} - \overline{O_{\iota,t}}$ and $I_{2i} = I_i - \overline{I_\iota}$. This model has not the scale problem. Let assume that $I_i^* = I_i - a$, so

$$I_{2i}^{*} = I_i^{*} - \overline{I_i^{*}} = (I_i - a) - (\overline{I_i} - a) = I_i - \overline{I_i} = I_{2i}.$$

It means that I_{2i} has no change after a transformation in the CBI index. Therefore the main effect of oil change is invariant after any change in the scale of CBI index and any hypothesis about it can be done without any statistical obstacle. Model (5) has the properties of model (1) without the scale problem, thus it is estimated to assess the impact of CBI on the relation between monetary policy and oil price. Like model (1), one can expect that $\gamma_{21} < 0$.

5. Time Series Properties

To rely on the results of model (5), it is necessary that all variables have the same order of integration or the order of integration of the dependent variable is like the order of integration of explanatory variables collectively as a co-integrated model. By having this situation, one can make confidence intervals or test hypotheses by usual tables otherwise when $T \to \infty$ standard estimator has nonstandard distribution.

One method to test is using Dickey-Fuller (1979) (DF) test for each individual. The assumption for this test is, when all individual time series are stationary, panel data will be stationary. DF is, however, very weak test for panel data and it cannot often reject non-stationary for an actual stationary time series. Hence many researchers have proposed unit-root tests for panel data such as Levin and Lin (1993), Maddala and Wu (1999), Choi (2002), Levin, Lin and Chu (2002) and Im, Pesaran and Shin (2003). This paper tests the existence of unit-root by Levin and Lin (LL) and Im, Pesaran and Shin (IPS).

Levin and Lin (1993) explain that unit-root tests in panel data require that data has to be independent across individual. To do so, the cross-section average should be subtracted from the observed data. Hence to test the series $\{y_{i,t}\}$, we have:

$$x_{i,t} = y_{i,t} - \frac{1}{N}\sum_{i=1}^{N} y_{i,t}. \qquad (6)$$

The null hypothesis supposes that each individual time series has a unit-root by this model:

$$\Delta x_{i,t} = a_i + \tau_i t + \delta_i x_{i,t-1} + \sum_{d=1}^{p_i} \theta_{id}\, \Delta x_{i,t-d} + \varepsilon_{i,t} \qquad (7)$$

where $\Delta x_{i,t} \equiv x_{i,t} - x_{i,t-1}$. The null and alternative hypotheses are:

$$H_0:\ \delta_1 = \delta_2 = \cdots = \delta_N = 0 \qquad (8a)$$

$$H_1:\ \delta_1 = \delta_2 = \cdots = \delta_N = \delta < 0. \tag{8b}$$

To find the LL test statistic, first stage is calculating two residuals:

$$\hat{e}_{i,t} = \Delta x_{i,t} - \hat{a}_{1i} - \hat{\tau}_{1i} t \ - \sum_{d=1}^{p_i} \theta_{1id}\, \Delta x_{i,t-d} \tag{9}$$

$$\hat{v}_{i,t-1} = x_{i,t-1} - \hat{a}_{2i} - \hat{\tau}_{2i} t \ - \sum_{d=1}^{p_i} \theta_{2id}\, \Delta x_{i,t-d}\ , \tag{10}$$

then δ can be achieved by:

$$\hat{e}_{i,t} = \delta \hat{v}_{i,t-1} + \varepsilon_{i,t}. \tag{11}$$

To control for heterogeneity across i, they normalise $\hat{e}_{i,t}$ and $\hat{v}_{i,t-1}$ by the regression standard error for equation (11):

$$\hat{\sigma}_{ei}{}^2 = \frac{1}{T - p_i - 1} \sum_{t=p_i+2}^{T} (\,\hat{e}_{i,t} - \hat{\delta}\ \hat{v}_{i,t-1})^2 \tag{12}$$

$$\tilde{e}_{i,t} = \frac{\hat{e}_{i,t}}{\hat{\sigma}_{ei}} \quad , \quad \tilde{v}_{i,t-1} = \frac{\hat{v}_{i,t-1}}{\hat{\sigma}_{ei}} \tag{13}$$

then rewrite equation (11):

$$\tilde{e}_{i,t} = \delta\ \tilde{v}_{i,t-1} + \frac{\varepsilon_{i,t}}{\hat{\sigma}_{ei}}\,. \tag{14}$$

The regression t-statistic for $\delta = 0$ is:

$$t_\delta = \frac{\hat{\delta}}{RSE(\hat{\delta})} \tag{15}$$

where $\hat{\delta}$ is the OLS estimate of δ, and $RSE(\hat{\delta})$ is the reported standard error which is:

$$RSE\big(\hat{\delta}\big) = \frac{\sqrt{(N\tilde{T})^{-1} \sum_{i=1}^{N} \sum_{t=2+p_i}^{T} (\tilde{e}_{i,t} - \hat{\delta}\ \tilde{v}_{i,t-1})^2}}{\sqrt{\sum_{i=1}^{N} \sum_{t=2+p_i}^{T} \tilde{v}_{i,t-1}{}^2}} \tag{16}$$

and $\tilde{T} \equiv T - N^{-1} \sum_{i=1}^{N} p_i - 1$ is the average number of observations for each individual. Levin and Lin (1993) adjust this test with:

$$t^* = \frac{t_\delta - N\tilde{T}S_{NT}(\sum_{i=1}^{N}\sum_{t=2+p_i}^{T}\tilde{v}_{i,t-1}{}^2)^{-1}[RSE(\hat{\delta})]^{-1}\mu_{\tilde{T}}}{\sigma_{\tilde{T}}} \tag{17}$$

where $\mu_{\tilde{T}}$ and $\sigma_{\tilde{T}}$ are mean and standard deviation adjustment values and Levin and Lin (1993) calculate them by the Monte Carlo approach. By the way $S_{NT} = N^{-1}\sum_{i=1}^{N}\hat{\sigma}_{xi}\ \hat{\sigma}_{ei}{}^{-1}$ and $\hat{\sigma}_{xi}$ is an estimation for the long-run variance of x_i:

$$\hat{\sigma}_{xi}{}^2 = \frac{1}{T-1}\sum_{t=2}^{T}(\Delta\, x_{i,t} - \overline{\Delta x}_i)^2 + 2\sum_{L=1}^{\bar{K}} w_{\bar{K}L}[\frac{1}{T-1}\sum_{t=2+L}^{T}(\,\Delta x_{i,t} - \overline{\Delta x}_i)(\,\Delta x_{i,t-L} - \overline{\Delta x}_i)] \tag{18}$$

$\overline{\Delta x}_i$ is the average of $\Delta x_{i,t}$ for individual i, and $w_{\bar{K}L}$is the lag kernel to guarantee a positive value of $\hat{\sigma}_{xi}{}^2$, a proposition for it is made by Newey and West (1987):

$$w_{\bar{K}L} = \begin{cases} 1 - \frac{L}{\bar{\bar{K}}} & if\ L < \bar{K} \\ 0 & if\ L \geq \bar{K}. \end{cases} \tag{19}$$

Levin and Lin (1993) indicate that the distribution of t*-statistic has a non-zero mean and it can converge to a normal distribution asymptotically when N and T increase. This converge is more rapidly respect to T than to N. The distribution is just based on T and N but not individual fixed effects.

As mentioned in equation (8), the LL test is based on the assumption of homogeneity (i.e. $\delta_i = \delta_j,\ i \neq j$), but Im, Pesaran and Shin (2003) dismiss this assumption and the alternative hypothesis in their test is:

$$H_1\colon\ \delta_i < 0\quad for\ at\ least\ one\ i. \tag{20}$$

In the IPS procedure, one has to do the unit-root test for each individual and then take the average of them. They especially suggest using the augmented Dickey-Fuller (1981) (ADF) statistic (τ_i) and show the average of ADF statistics ($\bar{\tau}$) converges to a normal distribution under the null hypothesis (Equation (8a)) when $N \to \infty$ and $T \to \infty$. As Im, Pesaran and Shin(2003) point out for each individual $E(\tau_i)$ and $Var(\tau_i)$ depend on the lag length in the ADF model, they find them for different lags. Then by using the Monte Carlo approach, they illustrate that the IPS test is more powerful than the LL test for most cases.

Table 4 illustrates that the LL test cannot reject the null hypothesis for $M_{i,t}$ and $O_{2i,t-1}$, but for other variables it rejects. The IPS test however shows that all variables are stationary and the model balances.

Table 4. Stationary tests

	$M_{i,t}$	$O_{2i,t-1}$	$\pi_{i,t-1}$	$\pi_{i,t-2}$	$\pi_{i,t-3}$
LL statistic	-1.02	0.31	-2.47	-2.51	-2.55
	(0.15)	(0.62)	(0.00)	(0.00)	(0.00)
IPS Statistic	-4.02	-3.13	-2.39	-2.38	-2.40
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Values in parentheses are probabilities to accept the null hypothesis of non-stationarity.

6- Estimation results

Table 5 and 6 illustrate the estimation outcomes of model (5). This model has been estimated with two CBI indices and in three groups. All top nine oil-exporting countries are considered in the first estimation but they are categorised in two groups, OPEC and Non-OPEC, and model (5) is also estimated with them. R^2 in table 5 is not high enough to support the model and implies the specification may have a problem. The Durbin-Watson (D-W) test shows this problem explicitly. The D-W statistic in panel data is:

$$d = \frac{\sum_{i=1}^{N}\sum_{t=2}^{T}\left(u_{2i,t} - u_{2i,t-1}\right)^2}{\sum_{i=1}^{N}\sum_{t=1}^{T}{u_{2i,t}}^2}. \tag{21}$$

As this statistic is near zero, one can conclude that there is a negative relationship between residuals or the model suffers from first order autocorrelation. Hence in table 6, the model is estimated one more time given AR(1):

$$M_{i,t} = \alpha_{2i} + \beta_{21}O_{2i,t-1} + \sum_{l=1}^{3}\beta_{l+1}\pi_{i,t-l} + \gamma_{21}O_{2i,t-1}I_{2i} + u_{2i,t} \tag{22}$$

$$u_{2i,t} = \rho u_{2i,t-1} + \epsilon_{i,t}.$$

It can be seen that the D-W test is much better and there is no negative relation between residuals anymore and R^2 is also high in table 6. Another test which is considered in this paper is $p - value\ (\alpha)$.[6] It displays the probability value of the hypothesis that the intercept in the fixed effects model (5) is common for all individuals. In table 5 all individual intercepts are significant except for Iran in the OPEC model and it is reasonable that $p - value\ (\alpha)$ is zero for all specifications. In table 6 however for some countries, intercepts are not significant and obviously

[6] For more details see Hsiao (2003).

Table 5. Estimation of model (5)

	CWN is the CBI index			GMT is the CBI index		
	All countries	OPEC	Non-OPEC	All countries	OPEC	Non-OPEC
Iran	13.44	-0.40		13.48	-0.36	
	(6.91)**	(-0.14)		(6.93)**	(-0.12)	
Kuwait	11.10	9.30		11.10	9.31	
	(6.41)**	(4.79)**		(6.42)**	(4.79)**	
Nigeria	19.28	8.51		19.31	8.55	
	(10.17)**	(3.24)**		(10.18)**	(3.25)**	
Saudi Arabia	9.16	8.87		9.16	8.87	
	(5.44)**	(4.65)**		(5.35)**	(4.65)**	
UAE	17.56	13.77		17.58	13.78	
	(10.07)**	(6.82)**		(10.09)**	(6.82)**	
Venezuela	41.96	20.52		42.02	20.59	
	(19.14)**	(5.26)**		(19.16)**	(5.28)**	
Mexico	13.64		15.87	13.66		15.91
	(7.65)**		(16.20)**	(7.66)**		(16.36)**
Norway	8.77		9.40	8.76		9.48
	(4.29)**		(8.43)**	(4.28)**		(8.58)**
Russia	29.51		35.23	29.57		35.39
	(13.65)**		(28.55)**	(13.67)**		(28.83)**

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Table 5 (continued)

	CWN is the CBI index			GMT is the CBI index		
	All countries	OPEC	Non-OPEC	All countries	OPEC	Non-OPEC
$O_{2i,t-1}$	1.97	3.36	3.88	2.00	3.47	4.92
	(1.37)	(1.70)	(2.87)**	(1.39)	(1.74)*	(3.41)**
$\pi_{i,t-1}$	-1.58	-1.15	-1.53	-1.58	-1.15	-1.51
	(-6.95)**	(-2.10)**	(-10.87)**	(-6.94)**	(-2.10)**	(-10.77)**
$\pi_{i,t-2}$	0.19	0.33	0.26	0.19	0.33	0.27
	(0.52)	(0.40)	(1.18)	(0.53)	(0.40)	(1.22)
$\pi_{i,t-3}$	0.85	1.18	0.48	0.85	1.18	0.45
	(3.83)**	(2.34)**	(3.38)**	(3.78)**	(2.34)**	(3.14)**
$O_{2i,t-1}I_{2i}$	-4.35	6.16	-3.37	-0.36	0.26	-0.74
	(-0.69)	(0.65)	(-0.59)	(-1.05)	(0.52)	(-2.27)**
R^2	0.22	0.15	0.67	0.23	0.16	0.68
D-W test	0.24	0.21	0.54	0.24	0.21	0.53
$p-value\ (\alpha)$	0.00	0.00	0.00	0.00	0.00	0.00

The table shows the coefficients with t-statistics in parentheses. * and ** illustrate statistical significance at the 10% and 5%, respectively.

Table 6. Estimation of model (5) given AR(1) (Estimation of model (22))

	CWN is the CBI index			GMT is the CBI index		
	All countries	OPEC	Non-OPEC	All countries	OPEC	Non-OPEC
Iran	7.51	4.08		7.48	3.98	
	(1.03)	(0.44)		(1.03)	(0.44)	
Kuwait	10.15	9.58		10.15	9.56	
	(1.46)	(1.27)		(1.46)	(1.27)	
Nigeria	18.90	16.28		18.89	16.29	
	(2.61)**	(1.92)**		(2.61)**	(1.90)*	
Saudi Arabia	9.74	9.41		9.70	9.40	
	(1.41)	(1.27)		(1.41)	(1.26)	
UAE	19.51	18.18		19.50	18.16	
	(2.80)**	(2.38)**		(2.80)**	(2.37)**	
Venezuela	27.16	23.29		27.22	23.23	
	(3.56)**	(2.32)**		(3.57)**	(2.31)**	
Mexico	11.65		15.38	11.57		15.46
	(1.67)*		(30.51)**	(1.69)*		(30.56)**
Norway	7.62		9.23	7.63		9.38
	(0.93)		(16.00)**	(0.93)		(16.26)**
Russia	27.21		34.03	27.15		34.32
	(3.67)**		(53.25)**	(3.66)**		(53.60)**

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Table 6 (continued)

	CWN is the CBI index			GMT is the CBI index		
	All countries	OPEC	Non-OPEC	All countries	OPEC	Non-OPEC
$O_{2i,t-1}$	0.87	0.42	6.31	0.87	-0.07	7.64
	(0.62)	(0.21)	(8.77)**	(0.61)	(-0.04)	(10.11)**
$\pi_{i,t-1}$	-0.19	0.05	-0.19	-0.19	0.05	-0.19
	(-1.99)**	(0.22)	(-2.24)**	(-2.00)**	(0.23)	(-2.28)**
$\pi_{i,t-2}$	0.16	0.58	-1.40	0.16	0.57	-1.36
	(1.58)	(2.44)**	(-10.93)**	(1.59)	(2.46)**	(-10.74)**
$\pi_{i,t-3}$	-0.37	-0.80	-0.86	-0.37	-0.80	-0.80
	(3.95)**	(-3.48)**	(-11.46)**	(-3.95)**	(-3.50)**	(-10.87)**
$O_{2i,t-1}I_{2i}$	-4.93	-15.53	0.12	-0.53	-1.02	-0.93
	(-0.76)	(-1.66)*	(0.04)	(-1.65)*	(-2.10)**	(-5.50)**
R^2	0.87	0.85	0.90	0.87	0.85	0.92
D-W test	2.28	2.34	2.02	2.28	2.35	2.01
$p - value\ (\alpha)$	0.32	0.51	0.00	0.32	0.52	0.00

The table shows the coefficients with t-statistics in parentheses. * and ** illustrate statistical significance at the 10% and 5%, respectively.

$p - value\ (\alpha)$ is greater. However it again rejects the common intercept hypothesis for the Non-OPEC countries.

What are the economic interpretations of the estimation results? It is an important issue that except the sign of $\pi_{i,t-3}$ in table 5 which has AR(1) problem, and $\pi_{i,t-2}$ in table 6 only for the OPEC group, all significant coefficients have the predicted sign. It means that variables affect real money in a way that the theory has mentioned. In table 5 the first lag of inflation has a significant effect on real money in all specifications and it is negative like the prediction in equation (2). In table 6, this variable influence real money significantly in four specifications. The second lag however affects significantly only in the specifications of table 6. The third lag of inflation in model (22) (model (5) without first order autocorrelation problem) has a significantly negative coefficient for all specifications. For instance it is -0.37 in the model with all countries and it implies that if inflation increases for 1 unit, real money will diminish 0.37 percentage points in next three months.

As described the coefficient of the interactive term in model (5) should be negative. All of significant coefficients are negative in tables 5 and 6. Moreover there are just two positive sign whose t-statistics are very small. In table 5, when GMT is used as the CBI index, the coefficient for the Non-OPEC economies is significantly negative. However in table 6 when the model has not the AR(1) problem, all of specifications with GMT have significantly negative coefficients for interactive terms. On the other hand, there is one coefficient which is significant in the CWN specifications. It shows that GMT is a better proxy for CBI and the GMT specifications can support the theory more powerfully than the CWN specifications. This issue can be adopted by reviewing R^2.

It was shown in table 3 that the correlation between two proxies is high and the difference is because of the exclusive criteria in each index. Hence, it is reasonable to conclude that the exclusive criteria of GMT lead better specifications for model (5). Table 7 demonstrates this issue. It shows only the coefficients of model (5) when there is no AR(1) problem. As expected, the model with GMTN (index of exclusive criteria of GMT) is much better than CWNN (index of exclusive criteria of CWN). In the CWNN specifications, there is no truly significant value for the coefficient of the interactive term, but in the GMTN specifications, all coefficients of interactive term are right and significant in the 5% level. Moreover, tables 6 and 7 prove that the GMTN specifications are more significant than the GMT specifications whereas the CWNN models are weaker than the CWN ones.

Although it cannot be ignored that the exclusive criteria are only a part of each CBI index and they are not as comprehensive as original indices and thus no one can interpret their results, table 7 illustrates that the exclusive criteria of GMT cause a superior model and because of them the CWN model is dominated by the GMT one.

Table 7. Model (22) with exclusive criteria of CWN and GMT

	CWNN is the CBI index			GMTN is the CBI index		
	All countries	OPEC	Non-OPEC	All countries	OPEC	Non-OPEC
$O_{2i,t-1}$	0.88	0.44	6.01	0.98	-0.45	9.10
	(0.62)	(0.22)	(8.62)**	(0.70)	(-0.22)	(10.90)**
$\pi_{i,t-1}$	-0.19	0.05	-0.16	-0.19	0.06	-0.19
	(-1.98)**	(0.23)	(-1.91)**	(-1.99)**	(0.26)	(-2.25)**
$\pi_{i,t-2}$	0.15	0.58	-1.40	0.16	0.58	-1.35
	(1.58)	(2.43)**	(-11.19)**	(1.61)	(2.48)**	(-10.72)**
$\pi_{i,t-3}$	-0.37	-0.80	0.81	-0.37	-0.80	-0.79
	(3.96)**	(-3.47)**	(11.13)**	(-3.97)**	(-3.52)**	(-10.65)**
$O_{2i,t-1}I_{2i}$	-13.87	-55.84	68.00	-10.64	-19.08	-18.93
	(-0.54)	(-1.57)	(5.32)**	(-2.07)**	(-2.60)**	(-6.56)**
R^2	0.87	0.85	0.92	0.87	0.85	0.92
D-W test	2.29	2.35	2.04	2.29	2.35	2.02
$p-value\ (\alpha)$	0.32	0.52	0.00	0.32	0.52	0.00

The table shows the coefficients with t-statistics in parentheses. * and ** illustrate statistical significance at the 10% and 5%, respectively.

Table 8.Total effect of oil price

	Model (5)					
	CWN is the CBI index			GMT is the CBI index		
	All countries	OPEC	Non-OPEC	All countries	OPEC	Non-OPEC
Iran	2.91	2.08		3.55	2.37	
	(2.10)	(0.58)		(2.87)*	(0.79)	
Kuwait	2.00	3.32		2.09	3.41	
	(1.93)	(2.84)*		(2.09)	(2.96)*	
Nigeria	1.72	3.71		2.09	3.41	
	(1.36)	(3.24)*		(2.09)	(2.96)*	
Saudi Arabia	3.25	1.62		3.91	2.11	
	(1.87)	(0.24)		(2.75)*	(0.49)	
UAE	1.59	3.88		2.09	3.41	
	(1.10)	(3.25)*		(2.09)	(2.96)*	
Venezuela	0.45	5.44		-0.47	5.22	
	(0.03)	(2.03)		(0.03)	(1.60)	
Mexico	0.67		2.91	-0.47		-0.11
	(0.08)		(2.08)	(0.03)		(0.00)
Norway	3.32		4.87	2.82		6.59
	(1.83)		(4.55)**	(2.88)*		(12.96)**
Russia	1.87		3.80	2.45		5.63
	(1.68)		(7.76)**	(2.62)*		(12.87)**

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Table 8 (continued)

	Model (22)					
	CWN is the CBI index			GMT is the CBI index		
	All countries	OPEC	Non-OPEC	All countries	OPEC	Non-OPEC
Iran	1.89	3.63		3.12	4.24	
	(0.95)	(1.84)		(2.42)	(2.63)*	
Kuwait	0.90	0.51		0.98	0.15	
	(0.41)	(0.07)		(0.49)	(0.01)	
Nigeria	0.59	-0.47		0.98	0.15	
	(0.16)	(0.05)		(0.49)	(0.01)	
Saudi Arabia	2.26	4.80		3.65	5.27	
	(0.96)	(2.25)		(2.63)*	(3.17)*	
UAE	0.46	-0.88		0.98	0.15	
	(0.09)	(0.16)		(0.49)	(0.01)	
Venezuela	-0.79	-4.81		-2.75	-7.01	
	(0.09)	(1.58)		(1.03)	(2.60)	
Mexico	-0.54		6.34	-2.75		1.30
	(0.05)		(36.04)**	(1.03)		(1.30)
Norway	2.33		6.27	2.05		9.72
	(0.96)		(27.88)**	(1.66)		(103.72)**
Russia	0.76		6.31	1.52		8.78
	(0.28)		(77.83)**	(1.07)		(106.79)**

The table shows the coefficients with F-statistics in parentheses. * and ** illustrate statistical significance at the 10% and 5%, respectively.

Another issue which could be achieved from table 5 and 6 is that the model with the Non-OPEC countries is better than the model with the OPEC economies or all countries. All tests are getting improved from the all countries column to the Non-OPEC one. In table 5, R^2 for the Non-OPEC models is more than two times of it for other models and in table 6 the greatest R^2 is for the Non-OPEC countries. The D-W test also shows a weaker autocorrelation in the Non-OPEC countries comparing to the other models in table 5. Table 6 also illustrates that the D-W test for the Non-OPEC models is very close to 2. In table 6 when $p - value\ (\alpha)$ is not zero for the other models, it is zero only for the Non-OPEC economies.

Hence, it sounds reasonable if one compares the last column in table 6 with other columns, it will be concluded that the GMT model with the Non-OPEC countries is the best model. All coefficients are right and significant at the 5% level; individual intercepts are also significant at this level and R^2, D-W test and $p - value\ (\alpha)$ are in the most suitable situation.

Therefore, it was proven that the coefficient of the interactive term is negative in model (5), i.e. the higher central bank independence, the more contractionary monetary policy (or less expansionary monetary policy) after an oil shock. In other words, it can support empirically Jabal Ameli (2008) who points out theoretically that the central bank does a tightening monetary policy after an oil shock in a non-cooperative game or in a cooperative game when the government is dominated by the monetary authority.

Although the paper is eager to focus on the impact of CBI on the relation of oil price and real money, it could be useful if one analyses the total effect of oil price on monetary policy. It is the issue which is illustrated in table 8. Table 8 shows that the total influence of oil price on real money for each individual in the panel data model and indicates which one is significant. The total effect from model (5) is:

$$\frac{\partial M_{i,t}}{\partial O_{i,t-1}} = \beta_{21} + \gamma_{21} I_{2i}.$$

In other words, it is the main effect plus the influence through the CBI index. It is calculated for model (5) and model (22) when there is no first autocorrelation problem.

F-statistic which is mentioned in table 8 simply emerges from comparing restricted and unrestricted forms of the model. To clarify it, suppose the null hypothesis is:

$$H_0: \quad \frac{\partial M_{i,t}}{\partial O_{i,t-1}} = \beta_{21} + \gamma_{21} I_{2i} = 0$$

and RSS_R is the restricted residual sum of squares, i.e. sum of squares of residuals under the null hypothesis and RSS_U is the unrestricted residual sum of squares when the null hypothesis is not imposed. Hence F-statistic can be written as

$$\frac{(RSS_R - RSS_U)/r}{RSS_U/(n-K)} \sim F_{r,n-K},$$

where r is the number of restrictions which is 1, n is total pool observations which is $T.N = (132)9 = 1188$ when all countries are in the model and K is the number of regressors with individual intercepts, (i.e. 5+9=14) . If the model had not any identical slope coefficients, to calculate K, the number of regressors should be multiplied by the number of individuals. Thus F distribution has 1 and 1174 degrees of freedom for the column of all countries in table 8.

Table 8 demonstrates that most signs and all significant values are positive i.e. oil price has a positive impact on real money. It sounds reasonable because most countries in the sample have relatively dependent central banks and Jabal Ameli (2008) has explained that money rises when oil price goes up in this condition. This happens because the dominated central bank follows the government's goal.

If one concentrates on table 8, it will be seen that the countries with less central bank Independence are more likely to have a positive sign which is statically significant. CWN and GMT proxies show that Mexico and Venezuela have the highest CBI, but none of them has a significantly positive value.

In the GMT model which was described as a better model, the countries with the least CBI have a significantly positive relationship between oil price and real money. In model (5) with all countries in the sample, Iran, Saudi Arabia, Norway and Russia which have the least GMT, have significant sign. However in the OPEC column, Kuwait, Nigeria and UAE show significant sign and in the Non-OPEC case, Mexico which is labelled with the highest GMT has not significant coefficient, but Norway and Russia illustrate a positive value which is significant at the level of 5%. Moreover, in the GMT model when the AR(1) problem is eliminated (model (22)), Only Iran, Saudi Arabia, Norway and Russia whose GMT are least have a significantly positive value.

Hence, it can be concluded that as central banks in the sample are relatively dependent, after an oil shock, real money will increase (table 8 proves it), however countries with more CBI has less expantionary monetary policy (table 5 and 6 show it).

7. Conclusions

In this paper, it has been shown that the central bank independence has a crucial role in monetary policy in oil-exporting countries. Since these economies generally suffer from less central bank independence, a monetary expansion emerges after an increase in oil price. This empirical result corresponds to this theory that in the cooperative solution when the central bank is dominated by the government, it implements a more expansionary monetary policy after an increase in oil income.

On the other hand the paper has described that central banks which are more independent implement a less expansionary monetary policy relative to countries with less central bank independence after an increase in oil price. This conclusion also supports empirically the theoretical issue that in the non-cooperative solution the monetary authority tends to do a more contractionary policy after an oil price shock.

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Appendix, *CWN(1992) criteria*

Central Bank Governor

Term of office

- 1.00 when longer than or equal to 8 years
- 0.75 when between 6 years and less than 8 years
- 0.5 when equal to 5 years
- 0.25 when equal to 4 years
- 0.00 when smaller than 4 years

Who appoints

- 1.00 when appointed by CB Board
- 0.75 when appointed by legislative and executive branches of Government and by CB board
- 0.5 when appointed by legislative branch
- 0.25 when appointed by executive branch
- 0.00 when appointed by 1 or 2 members of executive branch

Dismissal

- 1.00 when not provided for
- 0.83 when possible only for nonpolicy reasons
- 0.67 when unconditionally possible by CB Board
- 0.50 when conditionally possible by legislative branch
- 0.33 when unconditionally possible by legislative branch
- 0.17 when conditionally possible by executive branch
- 0.00 when unconditionally possible by executive branch

Other responsibility

- 1.00 when prohibited
- 0.50 when subjected to approval by executive branch
- 0.00 when not prohibited

Central Bank primary objective

Price stability

- 1.00 when only objective and CB has only authority
- 0.80 when only objective
- 0.60 when other non-conflicting objectives
- 0.40 when other conflicting objectives
- 0.20 when no objectives in CB charter
- 0.00 when only other objectives in CB charter

Policy Formulation

Who formulates monetary policy

- 1.00 when granted to CB alone
- 0.67 when granted to both CB and Government
- 0.33 when CB's capacity only advisory
- 0.00 when granted to Government only

Conflict resolution

- 1.00 when attributed to CB for CB's objectives
- 0.80 when attributed to Government only for non-objectives
- 0.60 when attributed to CB Board, legislative and executive branches of Government
- 0.40 when unconditionally attributed to legislative branch
- 0.20 when conditionally attributed to executive branch
- 0.00 when unconditionally attributed to executive branch

Policy Formulation

Central Bank role government Budge

- 1.00 when active role for CB
- 0.00 when no active role for CB

Central Bank Lending

Limits in advances to government

- 1.00 when no advances permitted
- 0.67 when permitted with strict limits
- 0.33 when permitted with accommodative limits
- 0.00 when unlimited

Limits in loans to governr

- 1.00 when not permitted
- 0.67 when permitted with strict limits
- 0.33 when permitted with accommodative limits
- 0.00 when unlimited

Who decides terms of Lendin

- 1.00 when controlled by CB
- 0.67 when specified by the CB charter
- 0.33 when agreed between CB and executive
- 0.00 when decided by executive branch

Beneficiaries

- 1.00 when only for central Government
- 0.67 when for all levels of Government
- 0.33 when all of the above and public firm
- 0.00 when all of the above and private sector

Type of Limits

- 1.00 when absolute cash amount
- 0.67 when percentage of CB capital
- 0.33 when percentage of Government revenues
- 0.00 when percentage of Government expenditures

Maturity of Loans

- 1.00 when limited to 6 months
- 0.67 when limited to 12 months
- 0.33 when limited to more than 12 months
- 0.00 when unlimited

Restrictions on interest rates

- 1.00 when must be at market level
- 0.75 when cannot be lower than a certain floor
- 0.50 when cannot be higher than a certain ceiling
- 0.25 when not restricted
- 0.00 when no interest payment required

Prohibition lending to government

- 1.00 when CB prohibited from buying or selling government securities in the primary market
- 0.00 when CB permitted to buy or sell government securities in the primary market