The Sensitivity of Central Bank Independence Measurements to Inflation in Iran: A New Approach

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Abstract:
The purpose of this study is finding the sensitivity of central bank independence measurements on its impact on inflation in Iran. To this aim different measurements of the central bank independence were calculated using the indices of Grilli et al. (1991), Cukierman et al. (1992), Mathew (2006) and Dumiter (2009) for the period 1961-2012 . Although results of correlation between CBI index and inflation shows that there is a negative correlation between all CBI index and inflation, but the estimated results using the Autoregressive Distributed Lag (ARDL) show except for the index of Grilli et al. (1991) other indices have similar short run and long run significant negative effect on the inflation in Iran. So the CBI have the sensitivity to definition. Also, results of estimation shows that there isn t any significant differences between the impact of Cukierman et al. (1992), Mathew (2006) and Dumiter (2009) index on the inflation. So this indices can be used interchangeably.
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1 introduction

During 1970s, with the generalized increase in inflation after the end of the Bretton Woods agreements, under which fixed exchange rates worked as nominal anchors, several proposals to achieve price stability were put forward. One of the first came from Milton Friedman. Friedman argued that price stability could be achieved by allowing central banks to pursue a monetary policy based upon a fixed rule announced every year. It can be shown, however, that commitment to such a rule is not an optimal strategy because it makes central banks too inflexible to face unanticipated shocks, particularly supply-side shocks (Meisel and Baron, 2010).

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Another approach to achieve price stability is that postulates an autonomous central bank. In fact, since the 1980s, the idea of an autonomous central bank has gained support (Cukierman, 2008). Part of this support stems from the success of the Bundesbank (one of the most autonomous central banks in the world) in achieving a relatively low rate of inflation for several decades.

Rogoff (1985) notes, dynamic inconsistency theories of inflation of the type developed in Kydland and Prescott (1977) and Barro and Gordon (1983) make it plausible that more independent central banks will reduce the rate of inflation. Delegating monetary policy to an agent whose preferences are more inflation averse than are society s preferences serves as a commitment device that permits sustaining a lower rate of inflation than would otherwise be possible. Alesina and Grilli (1992) develop this argument by showing that the "median voter" would want to appoint a central banker more inflation averse than himself.

However, the "median voter" wants to be "time inconsistent" and recall the central banker, who, ex post, is being too conservative on the inflation front. Insulating monetary policy from the political process avoids this problem and helps enforce the low inflation equilibrium. Without some degree of political independence, it would be impossible to appoint a central banker more inflation averse than a majority of the voters, which is a socially desirable goal.

Central bank independence might improve real economic performance for several reasons. First, an independent central bank that is free from political pressure may behave more predictably, promoting economic stability and reducing risk premia in real interest rates. More specifically, an independent central bank may serve to insulate the economy from political business cycles either by preventing preelection manipulation of monetary policy as in the models of Nordhaus (1975), and Rogoff and Sibert (1988) or by reducing partisan shocks to policy following elections as in the models of Hibbs (1987) and Alesina (1988, 1989). Second, to the extent that high inflation has adverse effects on economic performance either by creating distortions, encouraging rent seeking activity, or by raising risk premia, one would expect central bank independence to improve economic performance. If, as is often suggested most U.S. recessions result from the Federal Reserve cracking down on inflation after it has been allowed to increase too much, one might expect that more consistently inflation-averse policy would be associated with less variable economic performance (Alesina and Summers, 1993).

Nowadays, Central bank independence (CBI) has become one of the central concepts in monetary theory and policy and has been applied in many countries to control inflation and stabilize the economy. In addition to the theoretical literature, empirical literature is an important factor that affecting the development of the idea of the central bank's independence. From 1980 there have been a large empirical literature about the impact of central bank independence of macroeconomic performance. Since the Central bank

independence is a qualitative phenomenon the major problem of this studies is to measuring the independence of central banks. Accordingly, to calculate the degree of independence of the central banks several indicators have been developed. This indices focus on the different aspects of independence and so results to different degree to independence of a central bank. Moreover, selection and weighting of criteria and the interpretation of statutes are responsible for deviations too. Mangano (1997) compares the indices of Grilli et al (1991) and Cukierman et al (1992) with one another and comes to the conclusion with regard to the selection of criteria that 40% of the criteria in the Grilli et al (1991) index are not regarded as relevant in the Cukierman index (vice versa the level is 45 %). These selection and weighting differences must not only be seen critically, but are also desirable if we want to discover which aspects of central bank independence are particularly relevant with regard to macroeconomic variables. Therefore can results different levels of independence to a central bank. So the question is which indices is a better measure of CBI? The better index should have more explanatory power of economic variable specially inflation.

Moreover, this indices measuring CBI according to legal charter of central bank and other monetary and banking laws. Since the institution and structural phenomena of countries are different, the same law may differently be implemented in various countries. So for various central bank one index may the same measure while their de facto independence may be different. Therefore CBI indices should pay attention to the institutions and structural differences in countries.

Accordingly, this study investigate the sensitivity analysis of CBI indices. To this aim indices of Grilli et al (1991), Cukierman et al (1992). Mathew (2006) and Dumiter (2009) have been used. As recommended above according to institutional and structural differences in countries, the better index for a country may not be suitable for another country, so the relationship between CBI index and inflation should be investigating for countries separately.

To measure CBI indices other studies supposed that monetary and banking laws in countries are stable and rarely change. This assumption is suitable for developed countries, but in developing countries laws are often changed furthermore the change in government affect the implementation of laws. So, it is better that the CBI be measured during the time as it has been the case for Iran during 1961-2012.

This study organized in 4 section. In section 2 introduces different indices used in this study. Section 3 describes the data methodology and results Finally, Section 4 contains conclusding remarks.

2. CBI indices

To examine the links between central bank independence and economic performance verifiable criteria for measuring central bank independence have to be found. Measuring central bank independence is mainly based on the interpretation of central bank laws and therefore concerns legal independence only. The construction of so called legal indices is done by structuring those criteria which are regarded as being relevant and valuating the compliance with them on a numerical scale. Actual central bank independence can be differ from legal independence. For example, some central banks in the transition countries are confronted with problems of an adequate implementation of the central bank law and its possibly deviating public assessment (Radzyner, Riesinger 1997, p. 75). The personal characteristics and abilities of central bankers as well as informal relations between the government and the central bank and subtle methods of political influence may also lead to a deviation of actual from legal independence. Furthermore, the extent with which legal independence becomes actual independence may also be characterised by historical experiences which lead to specific "stability cultures" and a general readiness to comply with valid laws or to a respect for laws in general (Kimber and Wagner, 1998).

Index of Bade and Parkin (1988) is the first attempt to measuring CBI. This index differentiate between political independence and financial independence. Alesina (1988, 1989) has extended the Bade and Parkin index by considering additional industrial countries, while Eijffinger and Schaling (1993) place greater emphasis on the significance of policy independence in the Bade and Parkin index. In this study indices from Grilli et al (1991), Cukierman et al (1992), Mathew (2006), and Dumiter (2009) has been used. Therefore in following this indices are introduced.

Grilli, Masciandaro and Tabellini (1991) have developed a legal index for measuring CBI. This index distinguish between political and economic independence. To measures the political independence designed 8 criteria. This Criteria focus on the circumstance of governor and broad member of central bank, condition of central bank in pursue monetary policy and conflict between monetary and fiscal policy. The economic independence focus on the ability of central bank to choose monetary policy instrument without interference of government; time, interest rate and amount of direct credit facility to government; determining discount rate; participating central bank in primary market for public debt and banking supervision.

Cukierman, Webb and Neyapti (1992) introduce an index for calculation CBI. Indices LVAU (Unweighted index of legal Independence) and LVAW (weighted index of legal Independence), take into account 16 characteristics for central bank independence which are divided into 4 clusters. LVAU and LVAW differ from each other through their different weighting of some components. The main groups cover characteristics of the personal independence of the chief executive

officer (CEO) (term of office, appointment, reasons for dismissal), aspects of the central bank's policy independence (policy formulation, resolution of conflicts - PF), the final objectives (OBJ) laid down in the central bank statute and the legal restrictions on the ability of the government to borrow from the central bank (LL)[1].

Mathew (2006) and Dumiter (2009) introduce composite indices to measuring CBI. This indices investigating de jure and de facto independence, transparency and responsibility of central banks.

Mathew (2006) index investigate the central bank independence in monetary policy, personal or political and financial independence. Monetary policy independence that refer to ability of central bank to determine objects and tools contains 6 criteria. This criteria examine the ability of central bank in determine monetary policy objectives, selecting of momentary tools, determine exchange rate, the condition of conflict between monetary and fiscal policy, and supervision of financial market. Personal independence investigate the Circumstances of central bank governor and board member and have 6 criteria investigating the appointments and dismissals and terms of governor and board member of central bank, and dependence of board member to government. The financial independence refer the financial relationship between central bank and government and in this area conditions of lending, restriction of lending, duration, interest rate and restriction in amount of lending to government and condition of central bank to buy government bonds in primary market investigated[2].

Dumiter (2009) introduce an index for measuring the CBI. This index investigating CBI in 3 area contain central bank legal and political independence, central bank governor and conduct of monetary policy, and central bank transparency and accountability. Central bank legal and political independence examine the term of office of governor, legal power to appoint the Governor, Legal power to dismiss governor, turnover rate of governor, political vulnerability of governor, members of the management board of the central bank, appointment and term of the board members. In the central bank governance and conduct of monetary policy criteria contains the position of in objectives, monetary policy strategy, and independence of central bank in choose the targets and instruments monetary policy, how interest and exchange rate determine, general conflict between monetary and fiscal policy, foreign exchange rate market regulation and intervention, financial supervision, lending to government and term, maturity and interest rate of lending. The central bank transparency and accountability investigate the transparency the decisions, policies and performance of central bank. The criteria in this section are: Is a formal statement

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[1] For more detail see Cukierman et al, 1992.
[2] For more detail see Mathew, 2006.

of the objective(s) of monetary policy with an explicit prioritization in case of multiple objectives; is there a quantification of the primary objective; Are there explicit contracts in the similar institutional arrangements between the monetary authorities and the Government; is the basic economic data relevant for the conduct of monetary policy available: money supply, inflation, GDP, unemployment rate and capacity utilization; Does the central bank disclose the macroeconomic model(s) it uses for policy analyses; Does central bank regularly publish its own macroeconomic forecasts; Does the central bank regularly provide an evaluation of the outcome in light of macroeconomic objectives; Does the central bank regularly provide information on macroeconomic disturbances that affect the policy transmission process; Does the central bank disclose on explicit policy inclination after every policy meeting on an explicit indication or likely future policy acts at least quarterly; Does the central bank provide an explanation when it announces policy decisions; Are decisions about adjustments to the main operating instrument or target promptly; Is the central bank activities audited; Accountability of Governor[1].

3 Methodology and Data

After measuring CBI based on introduced indices the relationship between inflation and CBI examined and employed the autoregressive distributed lags (ARDL) method to estimate the impact of CBI on inflation in Iran. The ARDL modeling approach popularized by Pesaran and Pesaran (1997), Pesaran and Smith (1998), Pesaran and Shin (1999), and Pesaran et al. (2001) has numerous advantages. The main advantage of this approach lies in the fact that it can be applied irrespective of whether the variables are I(0) or I(1). Another advantage of this approach is that the model takes sufficient numbers of lags to capture the data generating process in a general-to-specific modeling framework (Laurenceson and Chai 2003). Moreover, a dynamic error correction model (ECM) can be derived from ARDL through a simple linear transformation (Banerjee et al. 1993). The ECM integrates the short-run dynamics with the long-run equilibrium without losing long-run information. It is also argued that using the ARDL approach avoids problems resulting from non-stationary time series data (Laurenceson and Chai 2003).

The ARDL model testing procedure starts with conducting the bound test for the null hypothesis of no cointegration. The calculated F-statistic is compared with the critical value tabulated by Pesaran and Pesaran (1997) or Pesaran et al. (2001). If the test statistic exceeds the upper critical value, the null hypothesis of no long-run relationship can be rejected regardless of whether the underlying orders of integration of the variables are zero or one. Similarly, if the test statistic falls below a lower critical value, the null hypothesis is not rejected. However, if the sample test statistic falls between these two bounds, the result is inconclusive.

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[1] For more detail see Dumiter, 2009.

When the order of integration of the variables is known and all the variables are I(1), the decision is made based on the upper bound. Similarly, if all the variables are I(0), then the decision is made based on the lower bound (Alam and Ahmad, 2010). Openness and GDP per capita are explanatory variables for estimating the relationship between CBI and inflation. Openness is calculated by sum of import and export divided to GDP, and GDP per capita is gross domestic production in constant prices, the period of study is 1961-2012. In this study to estimation the impact of CBI indices on inflation is based on equation No.1.

$$inf_t = \alpha_0 + \alpha_1 CBI_t + \alpha_2 gdpper_t + \alpha_3 open_t + \varepsilon_t \qquad (1)$$

Where CBI is the calculated CBI based on mentioned indices, inf is the inflation rate, gdpper is the GDP per capita, open is the openness and ε_t is the white noise.

4 Results

Figure (1) shows the inflation and degree of CBI based on various indices. Figure shows that decrease in CBI has been associated with increase in inflation. Also. The figure No.1 shows 5 break point for the degree of CBI this points refer to monetary and banking law reform in 1972, the act of whiteout usury banking operation in 1983, starting the developmental plan in 1989, and in decrease in the transparency and responsibility of central bank in 2007. Note that decrease in CBI in 2007 is because of reduce in transparency and responsibility of central bank and just shown in Mathew and Dumiter indices. The Figure also shows after any break point the trend of inflation changed too.

Figure 1. Central bank independence and inflation trend in Iran 1961-2012[1].
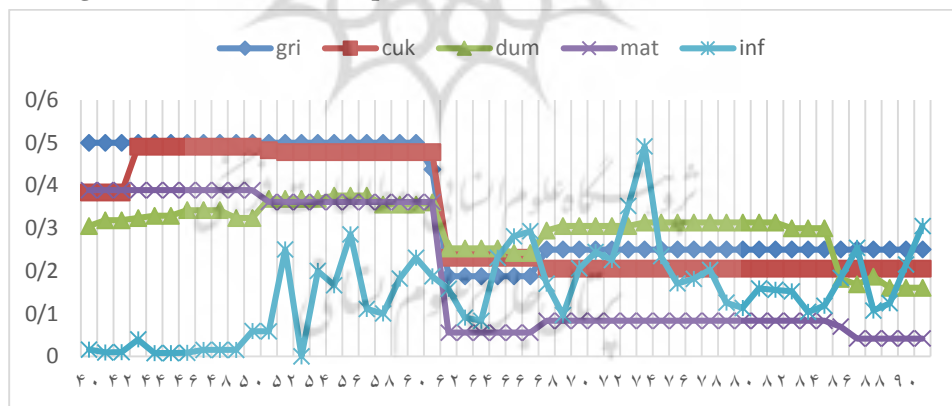
Source: Jafari samimi and Derakhshani (unpublished).

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[1] Note: cuk, gri, mat, dum and inf are respectively abbreviation for Cukierman et al.(1992), Grilli et al.(1991), Mathew (2006), Dumiter (2009), and inflation.

Table no.1 shows the correlation between CBI indices and inflation. Table shows a negative correlation between CBI indices and inflation. Also CBI indices especially Cukierman, Mathew and Dumiter have a high positive correlation.

Table 1. Correlation between CBI indices and inflation

	CUK	MAT	GRI	DUM	INF
CUK	1.000000	0.972991	0.665851	0.963107	-0.460050
MAT	0.972991	1.000000	0.696391	0.987241	-0.516819
GRI	0.665851	0.696391	1.000000	0.672476	-0.223646
DUM	0.963107	0.987241	0.672476	1.000000	-0.488553
INF	-0.460050	-0.516819	-0.223646	-0.488553	1.000000

Source: author s calulation.

In the following the impact of CBI indices on the inflation using ARDL approach is investigated. To investigating the relationship between CBI indices and inflation first estimate the short run model then examined the existence a long run relationship and if a there have been a long run relationship, then the error correction model and long run coefficients estimated. In this article for investigating the long run relationship used the bound test. Because data have the times series structure before estimating the model using ARDL approach should be determine whether variables are stationary or non-stationary. For this aim used the Augmented Dickey Fuller (ADF) unit root test. The results of unit root test shows variables are non-stationary in level and stationary in first differences.

Table 2. Results of unit root test

variable	Test statistics at level	Test statistics at first difference	result
inflation	-1.30	-6.60	I(1)
GDP per capita	0.462	-3.57	I(1)
openness	-1.27	-7.36	I(1)

Source: Authors calculation.
Note: the critical value at 5% significance level is -1.948.

Table No.3 shows the results of estimations. Note that CBI indices taking as exogenous variable in the ARDL model. Results of estimation shows that except Grilli et al. (1991) other studied indices have a short run and long run significant negative impact on the inflation. Also, in short run and long run respectively the indices of Cukierman et al (1992) and Dumiter (2009) have the highest impact on inflation.

Table 3. Results of estimation the impact of CBI indices on the inflation

index	Short run Coefficient (t-statistics) [prob.]	Bound test statistics*	ECM (t-statistics) [prob.]	Long run Coefficient (t-statistics) [prob.]
Grilli et al.(1991)	-0.19 (-0.953) [0.346]	3.51	-0.41 (-3.323) [0.001]	-
Cukierman et al.(1992)	-0.21 (-2.153) [0.0385]	7.47	-0.72 (-4.815) [0.000]	-0.29 (-2.514) [0.0168]
Mathew(2006)	-0.14 (-2.200) [0.0332]	4.90	-0.49 (-3.922) [0.000]	-0.30 (-2.098) [0.0431]
Dumiter (2009)	-0.16 (-2.088) [0.0428]	4.89	-0.48 (-3.965) [0.000]	-0.33 (-2.096) [0.0460]

Source. Author s calulation.

Note:* the lower and upper bound critical value at the significance level of 5% are respectively 3.79 and 4.85

At follow this question examined whether there is a significant different between the impact of indices on the inflation? To answer this question used t-statistics. It is obvious that Grilli et al. (1991) can be excluded because don t have a significant impact on inflation. The results of test shows in table No.4. Results shows that there isn t any significant different between the impact of indices on the inflation.

Table 3. Compare the long run impact of selected index on the inflation.

Compared indices	Calculated t-statistics
Cuk-Mat	-0.28591258
Cuk-Dum	-0.829634171
Mat-Dum	-1.781618887

Source: author s calulation.

5 Conclusions

Results shows that after any break point in the trend of CBI indices, the trend of inflation changed and this shows the importance of stability bin monetary and banking laws. Developmental laws especially after the revolution have the negative impact on the CBI. Although, coordinating between monetary and fiscal policy is necessary for development, but this coordination should be in a circumstance hat do not afect the independence of central bank.

Although results of correlation between CBI index and inflation shows that there is a negative correlation between all CBI index and inflation. But results of estimation the impact of indices on inflation shows that the index of Grilli et al.

(1991) don t have a significant impact on inflation nor in short and long run. So the CBI have the sensitivity to definition.

Also, results of estimation shows that there isn t any significant differences between the impact of Cukierman et al. (1992), Mathew (2006) and Dumiter (2009) index on the inflation. So this indices can be used interchangeably

It should be noted that, whereas the institutional and structural phenomenon of a country affects the functions of laws so the same law may differently be implemented in various countries. Also, institutional and structural phenomenon are country specific so the suitable index for measuring CBI in a country may not be suitable for another country.

References
1- Alam, S., Ahmad,Q.M. (2010). Exchange Rate Volatility and Pakistan s Import Demand: An Application of Autoregressive Distributed Lag Model. International Research Journal of Finance and Economics, 48, 7-22.

2- Alesina, A. (1988). Macroeconomics and Politics. NBER Macroeconomics Annual, Cambridge, MIT Press, 13-62.

3- Alesina, A. (1989), Politics and Business Cycles in Industrial Democracies, Economic Policy, 8, 55-98.

4- Alesina, A., Grilli, V. (1992). The European Central Bank: Reshaping Monetary Policy in Europe. Cambridge University Press

5- Alesina, A., Summers, L. H. (1993). Central Bank Independence and Macroeconomic Performance: Some Comparative Evidence. Journal of Money, Credit and Banking, 25, 157-162.

6- Bade, R. and Parkin, M. (1988). Central Bank Laws and Monetary Policy, mimeo, University of Western Ontario.

7- Banerjee, A., Dolado, J.J., Galbralth, J.W., and Hendry, D.F.(1993). Co-Integration, Error Correction and the Econometric Analysis of Non-Stationary Data, New York: Oxford University Press.

8- Barro, R. J. and Gordon, D. B. (1983). Rules, Discretion, and Reputation in a Model of Monetary Policy, Journal of Monetary Economics 12, 101-20.

9- Cukierman, A. (2006). Central Bank Independence and Monetary Policy Making institutions: Past, Present, and Future. Central Bank of Chile, Working Paper NO. 360.

10- Cukierman, A., Webb, S. B., & Neyapti, B.(1992).Measuring the Independence of Central Banks and Its Effect on Policy Outcomes. The World Bank Economic Review, 6, 353-98.

11- Dumiter, F.C.(2009).Measuring Central Bank Independence and Inflation Targeting in Developed and Developing Countries. Timisoara Journal of Economics, 2(6), 83 ˚ 100

12- Eijffinger, S. C. W., Schaling, E. (1993), Central Bank Independence in
Twelve Industrial Countries, *Banca*

13- Grilli, V., Masciardano, D., & Tabellini, G. (1991). Political and Monetary Institutions and Public Financial Policies in the Industrial Countries. Economic Policy, 13, 341-392.

14- Hibbs, D. (1987).The American Political Economy. Cambridge, Mass: Harvard University Press.

15- Kißmer, F. and Wagner, H. (1998). Central Bank Independence and Macroeconomic Performance: A Survey of the Evidence (Diskussionsbeitrag Nr. 255), London: Routledge.

16- Kydland, F.E., Prescott, E.C.(1977). Rules Rather than Discretion: the Inconsistency of Optimal Plans. The Journal of Political Economy, 85, 473-492.

17- Laurenceson, J., Chai, J.C.H.(2003).Financial Reform and Economic Development in China, Edward Elgar, Cheltenham.

18- Loungani, K.P., Sheets, N. (1997). Central Bank Independence, Inflation, and Growth in Transition Economies, Journal of Money, Credit, and Banking, 29, 381-399.

19- Mangano, G. (1997). Measuring Central Bank Independence: A Tale of Subjectivity and of Its Consequences. Cahiers de recherches economiques 9704, University de Lausanne.

20- Mathew, J.J. (2006). Measuring Central Bank Independence in Twenty- Five Countries: A New Index of Institutional Quality. 8th Annual Conference on Money and Finance in Indian Economy.

21- Meisel, A., Baron, J.D. (2010).A Historical Analysis of Central Bank Independence in Latin America: The Colombian Experience, 1923-2008. Journal of Iberian and Latin American Economic History, 28 (1), 83-102.

22- Nazionale del Lavoro Quarterly Review 184, 49-89.

23- Pesaran, H.M., Pesaran, B. (1997). Working With Microfit 4.0: An Introduction to Econometrics, Oxford University Press, London.

24- Pesaran, M. H., Shin Y.(1999). An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis, Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium, Cambridge, Cambridge University Press.

25- Pesaran, M. H., Shin, Y., and Smith, R.J.(2001). Bounds Testing Approaches to the Analysis of Level Relationships, Journal of Applied Econometrics, 16, pp. 289-326.

26- Pesaran, M. H., Smith, R. P. (1998). Structural Analysis of Cointegrating VARs. Cambridge Working Papers in Economics 9811, Faculty of Economics, University of Cambridge.

27- Radzyner, O. and S. Riesinger (1997). Central Bank Independence in Transition: Legislation and Reality in Central and Eastern Europe, Vienna Focus on Transition 2, 57-90.

28- Rogoff, K. (1985). The Optimal Degree of Commitment to an Intermediate Monetary Target. Quarterly Journal of Economics, 100, 1169-1189.

29- Rogoff, K., Sibert, A. (1988). Equilibrium Political Business Cycles. Review of Economic Studies, 55, 1- 16.

30- Wagner, H. (1998). Central Banking in Transition Countries, IMF Working Paper 98, Washington, D.C.