Legal central bank independence and inflation in various phases of transition

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The transition environment of 11 EU member countries has created an exceptional opportunity for research on the influence of legal central bank independence (LCBI) on inflation within significantly different circumstances in comparison to developed Western countries. I construct my own transformed GMT (TGMT) model for estimation of the LCBI, researching transition in its early stages and later on, thus comprising the total period of transition. Even in early stages of the transition LCBI has significantly negative effects on inflation. In later phases all the countries show evidently high levels of the LCBI and low inflation rates, but in this phase increasing the LCBI would not result in decreasing the inflation rate. Only studying the entire period of the transition would show that LCBI has significant negative influence on inflation, clearly showing different levels of the LCBI and inflation, which was not so obvious in shorter intervals. Moreover, negative influence of the LCBI on inflation does not change even if I add budget deficit as an independent variable to my research.

Keywords: central bank independence (CBI); transformed GMT (TGMT) index; inflation; transition countries; budget deficit

JEL classification: E52, E58.

1. Introduction

The dilemma of choosing between the government and the central bank as the authority for conducting monetary policy was, after a long time, resolved in favour of the latter. The era of high inflation rates during the 1970s has influenced a very successful institutionally designed conduct of monetary policy. Therefore, the last few decades brought strong ideas and theoretical attitudes of central bank independence (CBI) and its role in maintaining monetary stability. Experiences acquired inspired reaching of broader consensus of politicians and economists accepting the neutral position of monetary policy in the long-run regarding achievement of certain macroeconomic goals.

The historical phenomenon of the transition of planned-administrative economies into modern market economies created unique opportunities for research on the influence of CBI on inflation in quite different circumstances of those in developed Western countries. I believe that 11 observed countries are suitable for such research due to the similarity of the transition path, EU membership, etc. Using such an opportunity, I created my own model for evaluating the legal central bank independence (LCBI) in order to explore its influence on inflation in early and later stages of transition, namely

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establishing that it has a negative effect on inflation, taking into consideration the whole period of transition.

2.   Theoretical attitudes on the CBI and an outline of the empiric research

Contemporary ideas of the CBI exist since Tinbergen's (1954) research. He proved that if there were few economic goals in conflict, each of the economic goals had to be solved by an independent specialised institution. Nevertheless, the most important reason for establishing a central bank with a high level of independency is a time-inconsistency problem of the monetary policy. According to Kydland and Prescott (1977), the creators of the economic policy shall, by accepting the rules of the game, disable inflationary surprises, and so make their policy credible to the economic participants. Lucas and Sargent (1981) have given a serious warning to creators of economic policy that behaviour of the economic participants could be significantly changed if the concept of the policy relied too much on the previous patterns, while Rogoff (1985) has shown that time-inconsistency problems of monetary policy could be avoided by delegating authority for its conduct to the conservative central banker.

Neumann (1991) has established specific elements for achieving CBI, such as prohibition of granting loans to the public sector, independence of governmental instructions, prohibition to support governmental economic programmes, etc. The author suggests that CBI should be given a clear constitutional category and introduces the idea of central bank responsibility. Bade and Parkin (1988) used a four grade index for measuring the CBI. Some other authors consider CBI to be the best first step in achieving low inflation rates, based on the work of Grilli, Masciandaro, and Tabellini (1991), Cukierman (1992), Alesina and Summers (1993), Eijffinger and Schaling (1993), Briault, Haldane, and King (1996), among others. The previously mentioned authors provide various models for measuring levels of CBI and for establishing the correlation between CBI and inflation in some Western countries. Thus, Grilli et al. (1991) developed a more complex index of the CBI, comprising the sub-index of the political independency of eight indicators, and the sub-index of the economic independency of seven indicators.

Debelle and Fischer (1995) recognised two types of CBI: intended independency and instrumental independency. De Haan and Kooi (2000) decomposed indicators made by Cukierman (1992) and Grilli et al. (1991) turning them into indicators of the conservative tendencies of the central bank incorporated into a legal frame. Banaian, Burdekin, and Willett (1998) also observed components of Cukierman's index and concluded that one part of the index components has no significant relationship to inflation movements. Moser (1999) explored the influence of the parliamentary representatives to the credibility of the central bank. Keefer and Stasavage (1999) were proving that indicators of the LCBI in developing countries were not in correlation with inflation, and that correlation is possible only under appropriate surveillance and balance. Furthermore, Hayo (1998) in his work was proving that CBI could be in correlation with public opinion and its inclination to inflation. Hayo and Hefeker (2002) used historic data showing that the CBI is not a necessary source for price stability in many countries. Forder (1988) proves that upon correction of certain subjective inclinations, negative correlation between CBI and inflation could even disappear. Mangano (1998) came to the similar conclusion, while Posen (1998) and Jordan (1997) explain that a higher grade of CBI is connected to the periods of higher expenses of disinflation. The central bank and the government can be involved in a 'game of chicken', specifically explained in the works of Buiter (1999) and Kutsoati (2002). Walsh (1999) points out

that CBI is a long-term guarantee that might set monetary policy free of the political pressure, but also poses the questions of its transparency. Arnone, Laurens, and Segalotto (2006) have researched CBI in OECD countries, emerging markets and developing countries based on the methodologies developed by Grilli et al. (1991) and the methodology used by Cukierman (1992). Their research for the 18 OECD countries is analysed in the index by Grilli, Masciandaro, and Tabellini; (GMT; full index) and they also converted the Cukierman data into the GMT index for the remaining 50 countries (narrow index). Arnone et al. underline the significant rise in CBI in recent decades. Imperato (2002) has shown that greater grades of CBI can lead to moral hazards towards the part of the public, encouraging again the process of inflation.

One of the most complete pieces of research about CBI and its influence to some macro-economic aggregates in transition countries was conducted by Cukierman, Miller, and Neyapti (2002). The authors used two measurements of CBI, and have found out that the most important influence on the level of CBI in transition countries has: allocation of the authorities in conducting monetary policy, procedure of resolving the conflict between the government and the central bank, and recognises the importance of the price stability in central bank legislation. Maliszewski (2000) used GMT index comprising 20 countries in his research. He found that political CBI has been in stronger negative correlation to inflation than the economic independency itself. Radzyner and Riesinger (1997) were researching central bank legislation of the Middle European transition countries and established that they have relatively high levels of legal independency, even if they used the provisions of the Maastricht Treaty as a criterion. By researching actual CBI, the authors concluded that some of the countries were still not free from the political interference. Lybek (1999) used as a measurement an index which constituted 21 indicators, including the elements of measuring central banks' responsibility. The author has established that countries with higher levels of *de jure* independence and the responsibility of the respective central banks have lower inflation rates in the period 1995–1997. Dvorsky (2004) was researching legislation from Middle East Europe and concluded that the central banks were not free from political interference in practice.

The main imperfections of the conducted research lie in the fact that they have not taken into consideration that the process of transition is not consistent in terms of time in relevant countries and it has different dynamic, therefore it should be divided into separate entities that all have their own specific qualities. In some countries it could take less time and still be more effective, while in other countries it could last longer and be less effective. In some countries transition is reaching its end, however some transition countries may still be far from that. Therefore remarks may be made in respect to the observed countries, because they should be divided into separate groups regarding their level of economic development, geographic position, and historical circumstances at the time.

3. Creating the TGMT model for measuring the LCBI

In this work I shall compose a transformed GMT model (TGMT), based on the model created by Grilli et al. and ideas from Neuman's theoretical considerations. In the part of the GMT model related to the procedure of the appointment and relieving of the central bank governor and board it is stated that they must not be appointed by the government. I consider that the president of the country should not participate in the appointment, since some part of the administration is under his jurisdiction.

Furthermore, Neuman has outlined that the mandate of the governor should exceed the election period (four years). This one year of mandate, requested by the GMT method, should not make us give negative grades to CBI, in case the mandate of the governor and the board lasted slightly less than five years and yet longer than the election period of the country.

I will also introduce indicators requesting that reasons of relieving the governor and the board members should not be politically motivated and two indicators related to personal independence of the governor and board members, who all should comprise high professional and moral competence (Neumann). The GMT model shall also be updated by indicators showing that central bank does not have to support the government's economic policy, its active role in budget creating, bank responsibility to the parliament, and transparency of its work. Consequently, indicators of the political independency would be as follows (with differences from GMT and the Cukierman index as the basis of the index constructed by Arnone et al.):

(1) The governor is not appointed by government or the president (without president in GMT, executive and legislative branch in Cukierman)

(2) The governor is appointed for longer than four years (five in GMT, more in Cukierman)

(3) Not all the board is appointed by government or the president (without president in GMT, no provisions in Cukierman)

(4) The board is appointed for longer than four years (five in GMT, no provisions in Cukierman)

(5) The termination of the mandate of the governor and the board are not political (no provisions in GMT, provisions for governor and not for a board in Cukierman)

(6) The governor and the board members have high professional and moral competence (no provisions in GMT, no provisions in Cukierman)

(7) Financial circumstances in the central bank are better in comparison to other financial institutions (no provisions in GMT, no provisions in Cukierman)

(8) No mandatory representatives of the government on the board (same in GMT, only provisions for governor in Cukierman)

(9) The government's approval of the monetary policy is not mandatory (same in GMT, similar in Cukierman)

(10) The central bank does not support government economic policy (no provisions in GMT, no provisions in Cukierman)

(11) The central bank is actively involved in creating the budget (no provisions in GMT, no provisions in Cukierman)

(12) The central bank claims maintaining the monetary stability is a primary goal (same in GMT, similar in Cukierman)

(13) Legal provisions give strength to the central bank in case of dispute with the government (same in GMT, similar in Cukierman)

(14) The central bank is responsible to the parliament (no provisions in GMT, no provisions in Cukierman)

(15) The central bank is obliged to regularly report on its activities (no provisions in GMT, no provisions in Cukierman)

The first five indicators of the independence of the GMT index related to the monetary finance of the public debt would remain unchanged. However, a new indicator should be introduced, related to CBI in the conducting of the exchange rate policy. The authority of the central bank to define interest rates would be extended to the authority to dispose with the instruments of the monetary policy. Regarding the last indicator that requested surveillance of the central bank to be given to an authorised special agency, there are conflict opinions on the matter, so I excluded this request from TGMT model. Consequently, transformed measure of the economic CBI would be as follows:

(1) Direct credit facility is not automatic (same in GMT, similar in Cukierman)
(2) Direct credit facility is at a market interest rate (same in GMT, similar in Cukierman)
(3) Direct credit facility is temporary (same in GMT, similar in Cukierman)
(4) Direct credit facility is at limited amount (same in GMT, similar in Cukierman)
(5) The central bank doesn't participate in primary market for public debt (same in GMT, same in Cukierman)
(6) The central bank has a full sovereignty in conducting the exchange rate policy (same in GMT, no provisions in Cukierman)
(7) The central bank disposes of relevant instruments of the monetary policy (no provisions in GMT, no provisions in Cukierman)

4. The application of the TGMT model in research of the influence of the CBI on the inflation in the early period of the transition

In the early period of the transition in the observed countries, there are essential differences in the ways of choice of the central bank governor and council members, as well as duration of their mandates. Thus, in Estonia the governor of the central bank is appointed by the president on the basis of the suggestion of the chairman of the board, while members of the board are appointed by the parliament on the basis of the president's motion, all for a term of five years. In Latvia, the choice of the governor and the board is in the parliament's jurisdiction for a term of six years. Lithuanian president proposes the governor for a five year term of service while the board is elected for a term of nine years, by the president himself on the governor's proposal. Polish president proposes appointment of the governor for a six years term of service, while the board is elected by him personally, for a period longer than four years. The Czech president is directly involved in the choice of the governor and seven members of the board for a period of six years. Slovakian parliament proposes the governor, the vice-governor and executive directors who are appointed by the president for a period of six years, while the board is appointed by the president, based on the proposal of the government upon the approval of the parliament, for a period of four years. The Romanian president proposes the governor, while the prime minister proposes the board members for a period of eight years. Hungarian government proposes the governor for appointment for a period of six years, while the board is appointed by the president on the government's proposal and the prime minister's approval. The board has up to 11 members, and vice-governors are elected for a six year period, while the rest of the board members are elected for a period of three years. The Slovenian president proposes the appointment of the governor for a period of six years, while the parliament elects the governor's deputy and three vice-governors, based on the president's proposal and six members of the

board for a period of six years. The Croatian governor and the board members are appointed by parliament for a period of six years, while the governor proposes his deputy and vice-governors.

Most of the transition countries have agreed that the reason for early termination of the governors' or board members' mandate should be of a non-political nature, such as article 12 of Estonian law, or in accordance with article 58 of Hungarian law and the like, but there are no such provisions in Slovenian, Romanian and Croatian laws. In Latvian, Lithuanian, Polish, and other countries' legislations there are no provisions that would define personal independence of the governor and the board. The Estonian finance minister is a member of the board, while the Latvian finance minister attends meetings of the board with suspended decision-making authority. Furthermore, Polish, Czech, Slovakian and Hungarian finance ministers also attend the board meetings. In Estonia there is a certain advisory relationship of the central bank and the government and it is stated in article 4, that the central bank should support the government's economic policy. There is a similar relationship between the Latvian central bank and its government, while in Lithuania and Romania governmental approval of the monetary policy is mandatory.

The National Bank of Poland is obliged to cooperate with the government in the conducting of monetary policy and it has an advisory position. Also, in the Czech Republic the relationship between the central bank and the government is of advisory nature, while in Hungary the relationship between the central bank and the government is regulated as collaboration in conducting the monetary policy. The central bank should support governmental economic policy in Estonia (article 4 of the law), Hungary and Poland (article 3), and also in Slovakia, Croatia, Bulgaria, etc. Only the central banks of Estonia, Poland and Hungary participate in the creating of the budget. The monetary stability is a primary goal of the monetary policy in all the observed transition countries. Some countries haven't in the legislative provisions strengthening the position of the central bank in case of the dispute with the government like Lithuania, Poland, Hungary, etc., but in Latvia, the finance minister is authorised to withhold the decision of the board for up to 10 days. The central banks of Estonia, Latvia, Lithuania and Hungary are responsible to the parliament for their work. Also, the central banks of Estonia, Latvia, Lithuania, Poland, etc. regularly report their activities to the public.

In the early period of the transition, Estonian legislation prohibits direct granting of loans to the government, while in Latvia there is a quantity limitation of the governmental crediting in the amount of 1/12 of planned budget funds, but without applying the market interest rate. Czech and Slovakian central banks can directly grant loans to the government for a period up to three months in a limited quantity of 5% of the previous year's budget. The Hungarian central bank can grant the government direct loan privileges at a basic interest rate for a period of 15 days, while the debt must be covered before the end of the budget year. The Slovenian central bank can directly grant loans to the government at the market interest rate and up to 5% of the budget or 20% of the budget deficit and the debt must be covered by the end of the budget year. The Romanian central bank can directly grant loans to the government at the market interest rate without time limitations, but only up to 10% of the amount of the budget value, i.e. up to two times the capital and reserves of the central bank. The Croatian National Bank can grant short-term loans to the government at an interest rate lower than the market rate, the term of payment is by the end of the budget year and up to 5% of the budget.

Furthermore, the Estonian central bank does not participate in the direct granting of loans to the government, while central banks of Lithuania, Poland and Czech Republic can do so. Polish legislation states in article 24 that the National Bank of Poland

collaborate with the Cabinet, bringing together the decisions of conducting the exchange rate policy. Also, Hungarian legislation states that the exchange rate should be defined by the government in collaboration with the central bank. The central banks of Estonia, Latvia, the Czech Republic, Slovenia and some other countries have full sovereignty in conducting the exchange rate policy and disposing monetary policy instruments.

CBI of the transition countries, showed by TGMT indicators, will be related to the inflation, expressed by the indicator of the depreciation of the real value of money $\pi/1+\pi$; where π represents the measurement of the inflation. I note that indicator of the depreciation of the real value of money has also been introduced in Cukierman (1992), Cukierman et al. (2002), among others. I observe inflation during the period 1994–2002, which is marked by a series of economic reforms, not taking into account the highest and lowest rates in order to preserve the stability of the series. Furthermore, it is obvious that the value of the cumulative liberalisation index after 1994 in all of the observed countries was higher than two. Cumulative liberalization index (CLI) has been used in Cukierman et al. (2002), and Loungani and Sheets (1997) etc. too. See Tables 1–10 and Figures 1–3.

In my research I used the TGMT model, which resulted in a clearer stochastic connection expressed as a negative linear correlation between LCBI of the observed transition countries and the inflation ($r = -0.41$). With higher LCBI, the equation of the regression line obviously shows declining of the inflation indicators ($Y = 13.6047–10.5047x$). As I have already stated, even in early stages of the transition, the observed countries have a different degree of the CBI, in which process the countries with a higher degree of bank independence have a somewhat lower inflation rate. However, the research has been done in a period when dramatic economic changes occurred, with a limited range and number of the observed elements, therefore it demands studying of the influence of the CBI to the inflation in the whole period of transition. On top of this, some of the countries in the early stages of transition fall behind others in the realisation of economic reforms, which confuses the homogeneity within the observed set. Thus it is obvious that even the slightest deviation can produce a somewhat different result.

5. Application of the TGMT model in the research on the influence of the LCBI on inflation in the later period of the transition

In the later period of transition Estonian legislation states that the president appoints the governor based on the supervisory board's proposition, for a period of seven years, while the choice of the remaining members is made by the supervisory board of the central bank at the governor's proposition. The Latvian parliament (Saeima) appoints the governor on the basis of the proposition of at least 10 members of the parliament, while the board is appointed by the top executive council at the governor's proposition, all for a period of six years. The Lithuanian governor is still appointed by the parliament (Seim) at the president's proposal for a five year mandate. Mandate of the board still lasts for nine years. The nine Polish members of the board, now in equal proportions, are appointed by the president, the parliament (Sejm) and the senate for a period of six years. The Czech president appoints the governor and the board for a period of six years. The Slovakian governor is still appointed by the president at the government's proposal and with the recommendation of the Slovakian National Council, but now for a period of five years. The Slovenian president proposes the governor, the vice-governors and the board, who are appointed by the National Council for a period of six years. The Bulgarian governor is appointed by the National Council for a period of six years. The governor's deputy is also appointed by the National Council at the

Table 1. Political CBI in the early period of the transition (1994–2002).

Countries	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Estonia	–	*	–	*	*	*	–	–	*	–	*	*	*	*	*	10
Latvia	*	*	*	*	*	–	–	–	*	*	–	*	*	*	*	11
Lithuania	–	*	–	*	*	–	–	*	–	–	*	*	–	*	*	7
Poland	–	*	–	*	*	–	–	–	–	–	–	*	–	–	*	6
Czech R.	–	*	–	*	*	–	–	–	*	–	–	*	*	–	*	7
Slovakia	–	*	–	–	*	–	–	–	*	–	–	*	*	–	*	6
Hungary	–	*	–	–	*	–	–	–	–	–	*	*	–	*	*	6
Slovenia	–	*	–	*	–	–	–	*	*	*	–	*	–	*	*	8
Bulgaria	*	*	*	*	*	–	–	*	–	–	–	*	–	–	*	8
Romania	–	*	–	*	–	–	–	*	–	–	–	*	–	–	*	5
Croatia	*	*	*	*	–	–	–	*	*	–	–	*	*	*	*	10

Source: National legislation, author's calculation.

Table 2. Economic CBI in the early period of transition (1994–2002).

Countries	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estonia	*	*	*	*	*	*	*	7
Latvia	*	–	–	*	–	*	*	4
Lithuania	–	–	–	*	–	*	*	3
Poland	*	–	–	*	–	–	*	3
Czech R.	*	–	*	*	–	*	*	5
Slovakia	*	–	*	*	–	*	*	5
Hungary	*	*	*	*	–	–	*	5
Slovenia	*	–	*	*	–	*	*	5
Bulgaria	*	–	*	*	*	–	*	5
Romania	*	–	–	*	–	–	*	3
Croatia	*	–	*	*	–	*	*	5

Source: National legislation, author's calculation.

Table 3. CBI, inflation, and CLI in the early period of transition (1994–2002).

Countries	TGMT	Inflation (average 1994–2002)	$\frac{\pi}{1+\pi}$	CLI (1994)
Estonia	17	12.1	0.11	2.93
Latvia	15	9.0	0.08	2.45
Lithuania	10	11.6	0.10	2.72
Poland	9	13.9	0.12	4.14
Czech R.	12	6.7	0.06	3.64
Slovakia	11	8.3	0.08	3.47
Hungary	11	14.9	0.13	4.11
Slovenia	13	9.2	0.08	4.16
Bulgaria	13	46.7	0.32	2.90
Romania	8	58.6	0.37	2.29
Croatia	15	3.8	0.04	3.98

Source: WEO, National legislation, Cukierman et al. (2002), author's calculation.

Table 4. CBI and the inflation in the early period of transition (1994–2002).

Dependent-inflation	$R = 0{,}41009355$	$F = 1{,}819606$
$R2 = 0{,}16817672$	df = 1,9	std. error of estimate: 0,103218505
No. of cases: 11	Adjusted r2 = 0,07575191	$p = 0{,}210318$
intercept: 0,330480769	Std.error: 0,1478903	$t(9) = 2{,}2346$
beta (CBI) = −0,41	$p = 0{,}0523$	

Source: Author's calculation.

governor's proposal, while the board is appointed by the president for a period of six years. The Romanian parliament appoints the governor and board for a period of five years. The Croatian governor, as well as the external members of the council, is appointed by the parliament at the proposal of the Committee for Election, Appointments and Administrative Procedures with the advice of the finance and budget council. While the deputy and the vice-governors are appointed by the parliament at the governor's proposal. In the meantime Estonia, Slovakia and Slovenia have transferred their monetary sovereignty to the European Central Bank (ECB), but there is still a certain role of their respective central banks with the European System of Central Banks (ESCB) 'within the scope of their activity'.

Table 5. Political CBI in the later period of transition (2003–2012).

Countries	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Estonia	–	*	*	*	*	*	–	*	*	–	*	*	*	*	*	12
Latvia	*	*	*	*	*	*	–	*	*	*	–	*	*	*	*	13
Lithuania	–	*	–	*	*	*	*	*	*	–	–	*	*	*	*	11
Poland	–	*	–	*	*	*	–	*	*	–	*	*	*	*	*	11
Czech R.	–	*	–	*	*	*	–	*	*	–	–	*	*	*	*	10
Slovakia	–	*	–	*	*	*	–	*	*	*	–	*	*	*	*	11
Hungary	–	*	–	*	*	*	*	*	*	–	*	*	*	*	*	12
Slovenia	–	*	–	*	*	*	–	*	*	–	–	*	*	*	*	10
Bulgaria	*	*	–	*	*	*	*	*	*	–	–	*	*	*	*	12
Romania	*	*	*	*	*	*	–	*	*	–	–	*	*	*	*	12
Croatia	*	*	*	*	*	*	–	*	*	–	–	*	*	*	*	12

Table 6. Economic CBI in later periods of transition (2003–2012).

Countries	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estonia	*	*	*	*	*	*	*	7
Latvia	*	*	*	*	*	*	*	7
Lithuania	*	*	*	*	*	*	*	7
Poland	*	*	*	*	*	*	*	7
Czech R.	*	*	*	*	*	–	*	6
Slovakia	*	*	*	*	*	*	*	7
Hungary	*	*	*	*	*	–	*	6
Slovenia	*	*	*	*	*	*	*	7
Bulgaria	*	*	*	*	*	–	*	6
Romania	*	*	*	*	*	*	*	7
Croatia	*	*	*	*	*	*	*	7

Source: National legislation, author's calculation.

Table 7. CBI and inflation in later periods of transition (2003–2012).

Countries	TGMT	Inflation (average 2003–2012)	$\frac{\pi}{1+\pi}$
Estonia	19	3.8	0.04
Latvia	20	5.0	0.05
Lithuania	18	3.4	0.03
Poland	18	2.7	0.03
Czech R.	16	2.3	0.02
Slovakia	18	3.7	0.04
Hungary	18	4.9	0.05
Slovenia	17	3.2	0.03
Bulgaria	18	4.6	0.04
Romania	19	7.2	0.07
Croatia	19	2.7	0.03

Source: WEO, National legislation, author's calculation.

Table 8. CBI and inflation in the later period of transition (2003–2012).

Dependent- inflation	$R = 0.61899155$	$F = 5.590270$
$R2 = 0,38315054$	df = 1,9	Std. error of estimate: 0.011384230
No. of cases: 11	Adjusted R2 = 0.31461171	$p = 0.042297$
Intercept: −0.104375	Std. Error: 0.0607752	$t(9) = -1.717$
Beta (CBI) = 0.619	$p = 0.12$	

Source: Author's calculation.

Table 9. CBI and inflation in the entire period of transition (1994–2012).

Dependent-inflation	$R = 0.62056398$	$F = 12.5256$
$R2 = 0.38509966$	df = 1.2	Std. error of estimate: 0.071919607
No. of cases: 22	Adjusted R2 = 0.35435464	$p = 0.00206$
Intercept: 0.316064372	Std. Error: 0.0664395	$t(20) = 4.7572$
Beta (CBI) = −0.62	$p = 0.0001$	

Source: Author's calculation.

Table 10.   CBI, budget deficit and inflation in the whole period of transition (1994–2012).

Dependent-inflation	Multiple R= 0.66614646	$F = 7.578686$
R2 = 0.44375111	df = 2,19	Std. error of estimate: 0.070180703
No. of cases: 22	Adjusted R2 = 0,38,519,860	$p = 0.003802$
Intercept: 0.369690079	Std.error: 0.0750917	$t(19) = 4,9232$
Beta (CBI) = −0.70	Beta (BD) = 0.254	$p = 0.0001$

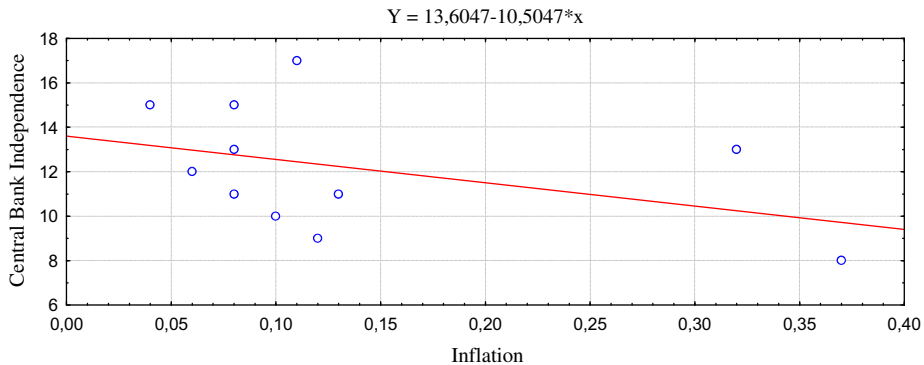Source: Author's calculation.

Figure 1.   Central bank independence and inflation in the early period of transition (1994–2002). Source: WEO, National legislation, author's calculation.
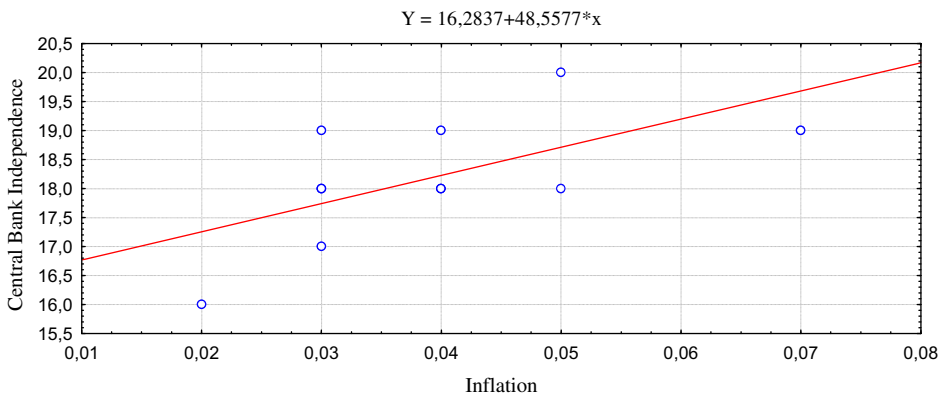

Figure 2.   Central bank independence and inflation in the later period of transition (2003–2012). Source: WEO, National legislation, author's calculation.

Non-political reasons for termination of the mandate of governor and board, as well as the provisions defining their high professional expertise and moral qualities are incorporated in the legislations of Estonia, Latvia, Lithuania, Poland and the Czech Republic. In these countries there are no mandatory representatives of the government within the board, nor the governmental obligation to approve the monetary policy. However the central bank does not support economic policy of the government in Latvia and Slovakia, and participates in creation of the budget only in Estonia, Poland and
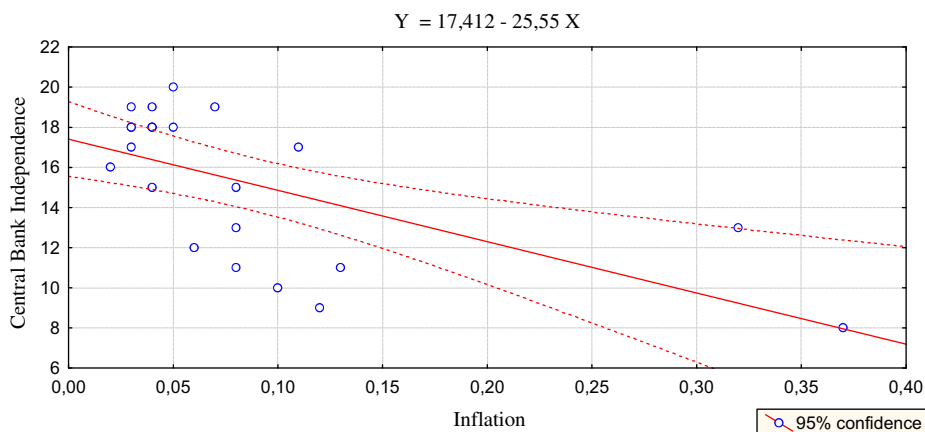
$$Y = 17,412 - 25,55\ X$$

Figure 3. Central bank independence and inflation in the entire period of transition (1994–2012). Source: WEO, National legislation, author's calculation.

Hungary. Monetary stability is the primary goal of the monetary policy in all of the observed countries. Nowadays, the position of all the central banks is strengthened in possible disputes with the government, and banks regularly publish information on their activities on their respective web pages, issuing bulletins, etc.

Let me now analyse the economic side of the TGMT Model. In Estonia, the direct credit facility of the government is completely prohibited, and is now applied to all the institutions and agencies of the EU and the member countries. There are no changes regarding the fifth and sixth indicators, while the last one is also positive, since the bank disposes with the instruments of the monetary policy. The Bank of Latvia is prohibited from granting loans to the government and participating at the primary market for covering the public debt. The bank also establishes the exchange rate and disposes with the adequate instruments of the monetary policy.

The Lithuanian central bank is prohibited from granting loans to the government bodies and institutions of the EU, etc., while the government and the bank must not trade securities on the primary market. The bank has a full sovereignty in conducting the exchange rate policy and the instruments of the monetary policy. The National Bank of Poland does not grant loan privileges to the government anymore, nor does it participate in the primary market for covering the public debt. The bank establishes the exchange rate and disposes with instruments of monetary policy. The Czech central bank is prohibited from granting loans to the government, or trading securities on the primary market for covering the public debt. The bank collaborates with the government in conducting the exchange rate policy (article 35), but still disposes with adequate instruments of the monetary policy. Slovakia prohibits any direct privileged loans to the government bodies and institutions of the EU and the bank does not participate in the primary market for covering the public debt. The bank establishes the exchange rate and disposes with instruments of the monetary policy.

The Hungarian central bank is prohibited from granting loans to central, regional or local administration bodies and institutions of the EU and from directly buying governmental securities. The bank must collaborate with the government in conducting the exchange rate policy (article 11), while disposing with instruments of the monetary policy. The National Bank of Slovenia is also prohibited from granting direct loans to the govern-

ment, etc. The bank does not participate on the primary market for covering the public debt; it has sovereignty in establishing the exchange rate and disposes the instruments of the monetary policy. The Bulgarian central bank is not permitted to grant loans to the government, while the bank and the government must not trade between themselves in the primary market for covering the public debt. The Bulgarian situation was specific due to the introduction of the typical currency-board (article 30). The National Bank of Romania is prohibited from granting direct credit facilities to the government and it could not participate in the primary market for covering the public debt. The bank still disposes with instruments of the monetary policy and conducts the exchange rate policy. The Croatian National Bank shows all positive indicators of the economic independence.

In the later period of transition (2003–2012) the TGMT Model has showed very high LCBI of the observed countries, which is in accordance to the low level of the inflation, not taking into account its lowest and highest rate to preserve the stability of the series. But, if I relate the LCBI to the inflation, expressed by the indicator of the depreciation of the real value of money $\pi/1 + \pi$, I come to a very interesting result. Namely the TGMT Model showed completely different relationship of the LCBI and the inflation in the later phase of transition, but it does not change the confirmation of my hypothesis that transition countries have a high level of the LCBI and a low inflation rate. Thus, in this case the linear regression equation is even positive ($Y = 48.5577X + 16.2837$), just like the coefficient of the correlation which is also very high ($r = 0.619$). At first it could be said that the CBI significantly influences the growth of the inflation, but this is, of course, wrong. The reason for such a relationship lies in the fact that once I have obtained a high level of the CBI and a low inflation rate, it is not possible to observe the 'fine nuances' of their correlation in the same, above described way, nor it is possible to precisely express the LCBI by TGMT Model (or any other models). Of course, when observing the whole period of the transition, I see that the relationship of the TGMT Model and inflation is completely different, which is logical considering the application of the model on the longer period and with clearly expressed levels of the CBI and of inflation, that is less obvious in short-term intervals.

6.   Application of the TGMT model in research of the influence of the LCBI on the inflation for the whole period of transition

The CBI of the transition countries, expressed in the TGMT Model, will be once more put into relation to the inflation, expressed by the indicator of the depreciation of the real value of money $\pi/1 + \pi$, but now for the whole period of the transition since 1994–2012, by uniting early and later periods of transition.

The linear regression equation ($Y = -25.55 + 17.412$) clearly depicts decreasing of the inflation values with increasing of the TGMT values. Only by taking into consideration the whole period of the transition and with more cases observed, with clearly defined different levels of lower and higher CBI, it was possible to determine negative influence of the LCBI to the inflation ($r = - 0.62$). Moreover, the TGMT Model is shown as a very convenient model for measuring of CBI and proving of my basic starting hypothesis. Furthermore, the completed TGMT Model shows clearly that the legal provisions of the CBI are a significant factor securing monetary stability of the transition countries as a premise of conducting a 'healthy' macro-economic policy. Therefore, logically it is necessary to remove all possible political pressures aiming to diminish the LCBI of the observed countries, because the monetary stability is set out to be the primary goal of their monetary policies.

Since the prohibition of financing the government by the central banks is a very important component of the thesis, the statement that TGMT has a negative influence on inflation shall be additionally supported by including the variable of the budget deficit (surplus) in correlation to the GDP, as a possible influence on inflation. The results of multiple regression from Table 10 will clearly show that the budget deficit has no significant influence on the inflation of the transition countries (r = −0.254), while the influence of TGMT on inflation remains significant and negative (–0.7). The correlation between TGMT and the budget deficit is also weak (r = 0.299). Thus I have additionally supported my starting hypothesis that LCBI negatively influences the inflation of the EU transition member countries.

7. Conclusion

The economic theories that support the strengthening of the CBI are based on researching the time-inconsistency problem of the monetary policy, conducted firstly in developed market economies and later applied in practice and resulting in institutional solutions and the decreasing of inflation rates. In my research, I explored whether the strengthening of CBI had negative influence on the inflation in 11 transition countries – members of the EU – concerning the fact that the conditions of the transition are significantly different to those in developed free market economies. I measured the CBI by the TGMT index, and already in the early period of the transition I can confirm the results of Grilli et al. Cukierman et al. Arnone et al. etc. that CBI has a negative influence on inflation. In the later period of the transition, I established a very high LCBI and a low inflation rate in the observed countries, but I did not confirm the results of mentioned authors because the strengthening of CBI on this level does not have a negative influence to the inflation. When there is a high degree of CBI and low inflation, the further increasing of CBI does not affect the reduction of inflation in transition countries, EU members. Only by considering the whole period of the transition can a significant negative influence of the LCBI to the inflation be clearly noted, even if I include budget deficit as an additional variable into the research. Therefore it is necessary to disable political pressure to the central bank aimed to diminish the LCBI if price stability is the primary goal of the respective countries' monetary policies.

Disclosure statement

National legislation
Act on the Bank of Slovenia, Official Gazette of the Republic of Slovenia No. 1/91-I, No. 58/02, No. 72/06, Act Amending ZBS-1B.

Act on the Croatian National Bank NN br. 9/91, br. 74/92, NN br.79/93, NN br. 7/95, NN br. 35/95, NN br. 36/01., NN br. 135/06, NN br. 75/08, NN br. 54/13.

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Appendix

Table A1. Predicted and residual values in the early period of transition (1994–2002).

TGMT	$\pi/1+\pi$	Predicted - value	Residual	Standard - pred. v.	Standard - residual	Std.err. - pred.val	Mahalanobis - dist.	Deleted - residual	Cook's -distance
17	0,110	0,058	0,052	−1,752	0,500	0,065	3,069	0,086	0,138
15	0,080	0,090	−0,010,337	−1,024	−0,100	0,046	1,050	−0,013	0,002
10	0,100	0,170	−0,070	0,793	−0,682	0,040	0,629	−0,083	0,050
9	0,120	0,186	−0,066	1,157	−0,643	0,049	1,338	−0,086	0,077
12	0,060	0,138	−0,078	0,066	−0,759	0,031	0,004	−0,086	0,032
11	0,080	0,154	−0,074	0,430	−0,721	0,034	0,185	−0,084	0,036
11	0,130	0,154	−0,024	0,430	−0,236	0,034	0,185	−0,027	0,004
13	0,080	0,122	−0,042	−0,297	−0,410	0,033	0,088	−0,047	0,010
13	0,320	0,122	0,198	−0,297	1,915	0,033	0,088	0,219	0,226
8	0,370	0,202	0,167	1,520	1,624	0,058	2,312	0,247	0,924
15	0,040	0,090	−0,050	−1,024	−0,488	0,046	1,050	−0,063	0,036
Mean	0,135	0,135	−0,000	0,000	−0,000	0,043	0,909	0,006	0,139
Median	0,100	0,138	−0,042	0,066	−0,410	0,040	0,629	−0,047	0,036

Table A2. Predicted and residual values in the later period of transition (2003–2012).

TGMT	$\pi/1+\pi$	Predicted-value	Residual	Standard-pred. v.	Standard-residual	Std.err.-pred.val	Mahalanobis-dist.	Deleted-residual	Cook's-distance
19	0,040	0,046	−0,006	0,76	−0,49	0,004	0,575	−0,007	0,024
20	0,050	0,053	−0,003	1,69	−0,30	0,007	2,841	−0,006	0,044
18	0,030	0,038	−0,008	−0,17	−0,67	0,003	0,028	−0,008	0,026
18	0,030	0,038	−0,008	−0,17	−0,67	0,003	0,028	−0,008	0,026
16	0,020	0,022	−0,002	−2,02	−0,16	0,008	4,091	−0,004	0,027
18	0,040	0,038	0,002	−0,17	0,21	0,003	0,028	0,003	0,002
18	0,050	0,038	0,012	−0,17	1,08	0,003	0,028	0,014	0,067
17	0,030	0,030	0,000	−1,10	0,02	0,005	1,200	0,000	0,000
18	0,040	0,038	0,002	−0,17	0,21	0,003	0,028	0,003	0,002
19	0,070	0,046	0,024	0,76	2,15	0,004	0,575	0,029	0,472
19	0,030	0,046	−0,016	0,76	−1,37	0,004	0,575	−0,018	0,191
Mean	0,039	0,039	−0,000	−0,00	−0,00	0,005	0,909	−0,000	0,080
Median	0,040	0,038	−0,002	−0,17	−0,16	0,004	0,575	−0,004	0,026

Table A3. Predicted & residual values in entire period of transition (1994–2012).

TGMT	π/1+π	Predicted - value	Residual	Standard - pred. v.	Standard - residual	Std.err. - pred.val	Mahalanobis - dist.	Deleted - residual	Cook's - distance
17	0,110	0,060	0,050	-0,49	0,70	0,017	0,243	0,053	0,016
15	0,080	0,090	-0,010	0,05	-0,14	0,015	0,002	-0,010	0,000
10	0,100	0,165	-0,065	1,41	-0,91	0,027	1,977	-0,076	0,078
9	0,120	0,180	-0,060	1,68	-0,84	0,030	2,813	-0,074	0,094
12	0,060	0,135	-0,075	0,86	-1,05	0,020	0,745	-0,082	0,052
11	0,080	0,150	-0,070	1,13	-0,98	0,023	1,287	-0,079	0,064
11	0,130	0,150	-0,020	1,13	-0,28	0,023	1,287	-0,023	0,005
13	0,080	0,120	-0,040	0,59	-0,56	0,018	0,350	-0,043	0,011
13	0,320	0,120	0,200	0,59	2,78	0,018	0,350	0,213	0,273
8	0,370	0,196	0,174	1,95	2,43	0,034	3,797	0,226	1,112
15	0,040	0,090	-0,050	0,05	-0,70	0,015	0,002	-0,052	0,012
19	0,040	0,030	0,010	-1,04	0,14	0,022	1,073	0,011	0,001
20	0,050	0,015	0,035	-1,31	0,49	0,026	1,709	0,040	0,020
18	0,030	0,045	-0,015	-0,76	-0,21	0,019	0,585	-0,016	0,002
18	0,030	0,045	-0,015	-0,76	-0,21	0,019	0,585	-0,016	0,002
16	0,020	0,075	-0,055	-0,22	-0,76	0,016	0,049	-0,058	0,015
18	0,040	0,045	-0,005	-0,76	-0,07	0,019	0,585	-0,005	0,000
18	0,050	0,045	0,005	-0,76	0,07	0,019	0,585	0,006	0,000
17	0,030	0,060	-0,030	-0,49	-0,42	0,017	0,243	-0,032	0,006
18	0,040	0,045	-0,005	-0,76	-0,07	0,019	0,585	-0,005	0,000
19	0,070	0,030	0,040	-1,04	0,56	0,022	1,073	0,045	0,019
19	0,030	0,030	0,000	-1,04	0,00	0,022	1,073	0,000	0,000
Mean	0,087	0,087	-0,000	-0,00	-0,00	0,021	0,955	0,001	0,081
Median	0,055	0,067	-0,012	-0,36	-0,17	0,019	0,585	-0,013	0,012