

The impact of the functional characteristics of a credit bureau on the level of indebtedness per capita: Evidence from East European countries

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Abstract

The institution of the credit bureau is one of the most important elements in controlling the indebtedness levels of a population. All credit bureaus have specific functional characteristics which are able to influence the development of indebtedness. This research aims to identify the most important characteristics of a credit bureau, to quantify those characteristics and to identify causal relationships between the characteristics of the credit bureau and trends in indebtedness per capita levels. The paper introduces the Credit Bureau Functional Index which presents a quantified value of the functional characteristics of the Credit Bureau. The paper establishes a correlation between this index and indebtedness per capita and finds the formula governing this relationship to be linear. The paper concludes that indebtedness levels can be targeted through a mix of characteristics of a credit bureau. Research on this theme is absent in academic literature to date.

Keywords: credit bureau, credit information, personal indebtedness, coverage ratio, functional characteristic

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1. Introduction

As the consumer credit industry expands and in recognition of the need to conduct efficient monitoring of this market, many central banks are taking measures to prevent the phenomenon of over-indebtedness within a population. The credit bureau is one of the instruments which can limit over-indebtedness. Together with central bank measures relating to credit policy, the characteristics of the credit bureau should direct and control levels of debt.

The primary purpose of a credit bureau is to enable financial institutions to exchange information about credit line users. This reduces the problem of asymmetrical information and eliminates moral hazard. This paper aims to form an index based on the functional characteristics of a credit bureau. This will quantitatively present the functional characteristics of a credit bureau and establish whether a causal relationship exists between those characteristics and levels of debt per capita and will enable prediction of levels of indebtedness on the basis of this relationship. The starting assumption is that credit bureaus will have different impacts and effects on the level of debt per capita based on their functional characteristics.

1.1. Literature review

Research on the issue of the credit bureau and the effects of this form of monitoring on the financial discipline of credit line users has been carried out by a large number of authors.

Jappelli and Pagano (2002) point to the fact that the existence of public credit registers and private credit bureaus has a positive influence on the development of a credit market in a national economy, and that influences a reduction in credit risk. In their opinion, public credit registers will be formed in those economies which do not have a private credit bureau and in which legal regulations to protect creditors' rights are inadequate.

Djankov, McLiesh and Shleifer (2007) show the effectiveness of different institutions for the exchange of credit information varies between countries, depending on the degree of economic development.

Luoto, McIntosh, Wydick (2004) identify three possible levels of exchanging information between credit institutions. The lowest level means no exchange of information occurs. In these circumstances, financial institutions exclusively possess information about users of their own services. The next level means exchange of negative information between creditors; they share information about the unsettled payments and debts of their clients. The most sophisticated level of information exchange between financial institutions is exchange of both positive and negative information on the credit activity of their service users.

The International Finance Corporation, (2006) cites research on Argentina and Brazil showing that exchanging both positive and negative information between creditors on debtors' credit activities leads to a reduction in loan default rates by 22% (in the case of Argentina) and by 45% (in the case of Brazil) in comparison to the situation when lenders only share negative information.

Luoto, McIntosh, Wydick (2004) analyse the effect of introducing a credit bureau in Guatemala. They show that six months following formation of the credit bureau, loan defaults had fallen between 2 and 3.5% according to different credit lines, in comparison with the period before introduction of the credit bureau.

Jentzsch, Gianneti, Spagnolo (2010) point to the fact that differences in the degrees of development of credit bureaus registered between EU countries condition the different degrees of economic growth of those countries..

In addition, the authors show that introducing a credit bureau reduces concentration in the banking sector of a country, while at the same time encouraging competition. Their empirical study shows that public credit registers have a greater impact on competition amongst banks than private credit bureaus, which is a consequence of the coverage ratio and the quality of data held by private credit bureaus. It is clear that a difference exists between the functional characteristics of public credit registers and private credit bureaus, as well as between the functional characteristics inside all of these types of credit bureaus, which causes the different impact of these institutions on different micro and macro indicators.

To date, no research has appeared in the academic literature on the correlation between a credit bureau's functional characteristics and the trend of indebtedness per capita.

2. Research sample and methodology

The research collected information on credit bureaus from the following countries: Greece, Montenegro, Croatia, Bosnia and Herzegovina, Romania, Bulgaria, Estonia, Lithuania, Latvia, the Czech Republic, Slovakia and Serbia. Data on the Greek credit bureau were collected through an emailed form designed to collect data about the functional characteristics of national credit bureaus. Data for the functional characteristics of credit bureaus from the other countries included in the research were collected through telephone interviews, through the websites of credit bureaus, central banks, statistical offices and through analysis of various publications produced by these institutions. A total of 17 credit bureaus have been included in this research (Table 1).

It should be mentioned that in some of the countries included in this research (Bulgaria, Romania and Greece) the international credit system Creditinfo Schufa has recently established private bureaus. However these are in addition to the private credit bureaus already operating in those countries. This research focused on the private credit bureaus which have been active in the national economy over longer periods when analysing the effect of the functional characteristics of credit bureaus on levels of indebtedness.

The methodology used within this paper relies on qualitative analysis of the functional characteristics of the credit bureaus forming the research sample. The functional characteristics identified as those affecting the level of debt per capita were quantified and used for forming the credit bureau functional index – CBFI. The quantified values of the CBFI index for the

countries analysed were compared to the levels of debt per capita in those countries, using a quantitative approach.

Table 1. The sample of credit bureaus.

Country	Credit bureau
Greece	Tiresias SA
Montenegro	Regulatorni kreditni registar Centralne banke Crne Gore
Croatia	Hrvatski registar obaveza po kreditima - HROK
Bosnia and Herzegovina	LRC Inženjering d.o.o. Kreditni biro
Romania	Central information bureau of BNR
Romania	Biroul de Credit
Bulgaria	BNB Central Credit Register
Bulgaria	Experian Bulgaria
Serbia	Kreditni biro Udruženja Banaka Srbije
Czech Republic	Společnost CCB – Czech Credit Bureau
Czech Republic	Centrální registr úvěrů
Slovakia	Spoločnosť SCB – Slovak Credit Bureau
Slovakia	Centralny register
Estonia	Kreditinfo AS
Lithuania	Loan Risk data base
Lithuania	Creditinfo Lietuva
Latvia	Latvijas banka Credit Register

3. Data and analysis

Through collecting and analysing data from a large number of sources, the functional characteristics of credit bureaus have been identified. These characteristics will be analysed to find their effect on the level of indebtedness per capita. Data on the functional characteristics of the sampled credit bureaus are shown in Table 2.

3.1. *Qualitative analysis of credit bureau characteristics*

The level of personal indebtedness is a function of a larger number of micro and macroeconomic factors. As the focus of this analysis is the influence of the functional characteristics of a credit bureau on levels of personal indebtedness, we will point to factors which on a macroeconomic level affect the level of indebtedness.

From a macroeconomic perspective, indebtedness is a function of the level of credit activity, expansion of credit to the private sector and measures taken by the central bank to regulate credit activity on the one hand, and of the functional characteristics of a credit bureau which aims to monitor the financial (in)discipline of credit line users and thereby contribute to making optimal credit decisions on the other hand. The claim that credit bureaus influence

Table 2. The functional characteristics of credit bureaus and the credit information index and index of legal rights for the countries surveyed for the year 2009.

Country	Type of CB	Starting year	Type of data	Categories of users	Creditors in system	CI index	Legal rights Index	Coverage ratio (%)
Bosnia and Herzegovina	Private	2001	Mixed	Individuals and firms	No	5	5	64.3
Romania	Private	2004	Mixed	Individuals and firms	No	5	8	30.2
	Public	2000	Mixed	Individuals and firms	Yes			5.7
Greece	Private	1997	Mixed	Individuals and firms	No	5	3	46.9
Bulgaria	Public	1999	Mixed	Individuals and firms	Yes	6	8	34.8
	Private	2004	Mixed	Individuals and firms	No			6.2
Serbia	Private	2004	Mixed	Individuals and firms	Yes	6	8	94.2
Croatia	Private	2007	Mixed	Individuals	No	4	6	77.0
Montenegro	Public	2008	Negative	Individuals and firms	Yes	2	9	27.6
Czech Republic	Private	2000	Mixed	Individuals and firms	No	5	6	73.1
	Public	2002	Mixed	Individuals and firms	Yes			4.9
Estonia	Private	2001	Negative	Individuals and firms	No	5	6	20.6
Slovakia	Private	2004	Mixed	Individuals	No	4	9	44.0
	Public	1997	Mixed	Firms	Yes			1.4
Lithuania	Private	2000	Mixed	Individuals and firms	No	6	5	18.4
	Public	2003	Mixed	Individuals and firms	Yes			12.1
Latvia	Public	2008	Mixed	Individuals and firms	Yes	5	9	46.5

Source: World Bank Doing Business 2010, web sites of national credit bureaus.

indebtedness levels through their functional characteristics will be tested within this paper. Most of the national economies included in this research are transition economies which in the last two decades have been characterised by an expansion of credit activity. The issue of credit expansion in the countries of Central and Eastern Europe and its effects on macroeconomic stability has been studied by a large number of authors.

Kraft (2006) points out that since 2000 all transition economies of Central and Southeast Europe have seen an expansion in foreign investment in the banking sector. Foreign banks have achieved majority ownership over banking assets in close to all of the countries surveyed. This process has been accompanied by improvements in the system of banking supervision from Central Banks, as well as improvements in legal regulation in this field.

Table 3 shows credit activity in the countries surveyed measured by Domestic credit provided by the banking sector (% of GDP). As stated earlier, since the 1990s all these countries have experienced an expansion in credit activity. This can be understood as a direct consequence of banking sector reforms in each country.

Table 3. Expansion of credit activity in the countries surveyed measured by Domestic credit provided by the banking sector (% of GDP).

Country	Romania	Montenegro	Serbia	Greece	Bosnia and Herzegovina	Bulgaria	Croatia	Slovakia	Estonia	Lithuania	Czech Republic	Latvia
1995	-	-	-	30.01	-	39.9	26.51	36.45	16.22	15.23	70.79	8.11
1996	11.49	-	-	30.99	-	62.97	24.87	43.3	22.11	11.27	68.85	7.17
1997	8.36	-	24.89	32.14	60.23	9.33	31.72	55.62	32.1	11.12	70.26	10.99
1998	11.55	-	26.35	34.07	57.88	10.56	35.27	53.49	31.94	12.56	61.35	14.92
1999	8.07	-	28.15	41.32	48.00	12.08	32.29	54.47	31.89	14.4	55.73	15.68
2000	7.17	-	47.48	46.97	38.55	12.57	32.30	51.1	36.14	13.18	48.98	19.24
2001	8.7	-	32.87	56.89	26.76	14.95	36.58	37.26	39.03	13.53	40.69	26.29
2002	10.14	8.05	16.46	60.45	30.72	19.74	43.71	39.3	44.71	16.13	30.8	32.54
2003	13.73	11.29	18.52	64.56	34.99	27.40	46.15	31.87	50.65	22.78	31.79	40.23
2004	15.67	14.63	22.15	69.92	37.26	36.31	48.85	30.45	60.78	28.75	32.61	50.78
2005	19.97	17.95	27.92	77.74	44.27	43.61	53.03	35.14	69.71	40.92	36.96	68.16
2006	25.87	36.3	28.04	83.41	48.36	47.11	60.15	38.65	83.81	50.05	41.01	87.52
2007	35.07	76.62	34.22	91.85	54.33	66.85	63.09	42.35	93.92	60.31	47.95	88.67
2008	38.47	80.41	38.40	93.50	57.80	74.49	64.94	44.74	97.37	62.71	52.77	90.19

Source: Trading Economics.

The functional characteristics of a credit bureau were analysed according to their effect on debt per capita in the country observed. The method for calculating debt per capita is as follows:

$$IPC = \frac{TLH}{bs} / GDP \times 100 \quad (1)$$

Where:

IPC - Indebtedness per capita as a percentage of GDP

TLH - Total amount of loans to natural persons

Bs - Total population in the country

GDP - Gross domestic product

Before we analyse the effect of the functional characteristics of different credit bureaus on levels of indebtedness, we will rank the populations in the countries surveyed according to the level of personal indebtedness. The level of indebtedness is analysed in relation to GDP per capita and on the basis of collected data, it is possible to rank the countries surveyed according to which population is the most indebted. The calculation was conducted in accordance with Equation 1. Data were collected from reports of the Central banks of the countries surveyed as at 31.12.2009.

The calculated values of indebtedness per capita are shown in Table 4.

Table 4. Indebtedness per capita as a percentage of GDP for year 2009.

Country	IPC	Country	IPC
Estonia	41.81	Czech Republic	21.11
Latvia	36.02	Montenegro	19.06
Greece	35.99	Bosnia and Herzegovina	14.96
Croatia	29.28	Romania	12.93
Lithuania	21.86	Bulgaria	12.45
Slovakia	21.84	Serbia	7.79

Source: Authors' own calculation based on data from the respective Central Bank.

From the perspective of indebtedness of a population, observed as a percentage of GDP per capita, the most indebted populations are those of Estonia, Latvia, Greece and Croatia (with around 30% and higher indebtedness relative to GDP per capita). Serbia stands at the bottom of the list with less than 10% of indebtedness relative to GDP per capita.

In the following analysis, we attempt to determine whether the difference in the levels of indebtedness of the populations in selected countries can be attributed to the functional characteristics of the credit bureaus operating in them.

3.1.1. Characteristics: Type of credit bureau

In this section we analyse the influence of the type of credit bureau on personal indebtedness levels. Do public credit registers or private credit bureaus have a dominant effect on indebtedness levels?

The results show that:

- Of the countries analysed, two (16.68% of the sample) use only a public credit register to monitor the financial discipline of credit line users.
- Private credit bureaus operate in five economies (41.66% of the sample)
- Five of the economies have both a public credit register and a private credit bureau (41/66% of the sample)

Table 5. Comparative summary of types of credit bureaus in each country and indebtedness levels for the year 2009.

Country	Type of Credit Bureau			Debt % of GDP per capita
	Public	Private	Both	
Bosnia and Herzegovina		Yes		14.96
Romania			Yes	12.93
Greece		Yes		35.99
Bulgaria			Yes	12.45
Serbia		Yes		7.79
Croatia		Yes		29.28
Montenegro	Yes			19.06
Czech Republic			Yes	21.11
Estonia		Yes		41.81
Slovakia			Yes	21.84
Lithuania			Yes	21.86
Latvia	Yes			36.02

Source: World Bank Doing Business 2010, authors.

Analysing the data shown in Table 5 we can suggest that private credit bureaus have advantages over public credit registers in maintaining a manageable level of indebtedness.

A question arises about what sort of effect this type of institution for the exchange of credit information has on maintaining indebtedness at a controllable level, given the fact that public credit registers collect data from fewer sources in relation to private credit bureaus, that they collect data about credit line users which are above a specific amount (this amount varies from country to country), that they have a lower coverage ratio in relation to private credit bureaus, that they update their data less often than private credit bureaus which means their data are less current and less accurate. However, analysing the data in Table 5 we will see that public credit registers in combination with private credit bureaus are effective in keeping indebtedness at a low level.

In our opinion, the effect of public credit registers on debt levels can be explained through the stimulated effect which has been defined by McIntosh and Wydick (2004). Introduction of

public credit registers in a country creates awareness amongst users of credit lines about the need for responsible behaviour in servicing debts and eliminating over-indebted applicants from the loan portfolios of banks which indirectly contributes to controlling indebtedness.

In identifying the effect of public credit registers on indebtedness levels we should start from the assertion which Miller (2003) states. This author points to the fact that the influence a public credit register has on macro and micro economic indicators will depend on the primary aim of the register's founding. If the primary aim of the public register is control of solvency and system risk in the banking sector then the minimum size of the loans above which will be recorded in the register will be high. This is because small loans have a small effect on system risk and solvency. If, however, the primary aim of the credit register is to improve the quality and coverage of credit information the register will record loans of smaller amounts. It follows that in these cases the coverage ratio will be higher and the influence on controlling indebtedness will be greater.

Of the countries included in the analysis, two (Montenegro and Latvia) introduced the institution of a public credit register for regulating financial responsibility of credit line users. In both of these economies, the public credit register was formed in 2008. This was late in relation to the start of the credit expansion which started in 2006 in Montenegro and in 2001 in Latvia. These public credit registers do not stipulate a minimum amount above which loan information is recorded. This means that, given the recent starting year of operations, their coverage ratios are quite high; 27.6% for Montenegro, 46.5% for Latvia. The inadequate results of these institutions in controlling the level of indebtedness are a direct result of late introduction of the register in relation to credit expansion within these countries. It should be mentioned that from 2003 to 2008 a Register of Debtors operated in Latvia but that this institution only collected negative information on credit line users resulting in an extremely low coverage ratio (e.g. in 2008 the coverage ratio was 3.5%). For this reason the impact of that institution on indebtedness levels was insignificant.

Of the countries in the sample which have used a private credit bureau to control the financial (in)discipline of credit line users, three have high levels of indebtedness (Estonia, Greece and Croatia), one (Bosnia and Herzegovina) has a mid level of indebtedness and one (Serbia) has a low level of indebtedness. It is clear that a private credit bureau is not the sole, nor a sufficient condition for maintaining control of indebtedness levels. The functional characteristics of each specific bureau can influence the level of indebtedness.

To summarise, we would conclude that the type of credit bureau is of less consequence to the level of indebtedness than the primary motivation behind its creation. If the primary reason for founding a credit bureau is to monitor system risk (characteristically the reason for a public credit register) the impact of this institution on the level of indebtedness will be negligible. If the primary reason is to stimulate exchange of credit information within a country's financial market, regardless of whether this is attempted through a public register or a private bureau, the impact of this institution will be direct, but will be shaped by the functional characteristics of the institution.

3.1.2. *Characteristics: Starting year of business operations*

In six of the countries included in the sample (50% of the sample) the first institution for exchanging credit information, whether a public register or a private bureau, was formed in 2000. Of the countries analysed, Greece and Slovakia have the longest running credit bureaus (Table 6)

This factor has a direct influence on the level of indebtedness. In an economy in which the value of the credit information index is null, in other words, in a country which does not have a credit bureau, the potential for over-indebtedness is large. Users have the possibility to ask for credit lines from a larger number of creditors who, in the absence of a credit bureau are not able to assess the lending risk. This can lead to an over-indebted population and increase loan defaults. Croatia illustrates this. The bureau started operations in 2007 by which time the level of indebtedness of the population had reached a high level.

Table 6. Comparison of the starting year of business operations and indebtedness levels for the year 2009.

Country	Starting year of business operations	Indebtedness as a percentage of GDP
Greece	1997	35.99
Slovenia	1997	21.84
Bulgaria	1999	12.45
Romania	2000	12.93
Lithuania	2000	21.86
Czech Republic	2000	21.11
Bosnia & Herzegovina	2001	14.96
Estonia	2001	41.81
Serbia	2004	7.79
Croatia	2007	29.28
Montenegro	2008	19.06
Latvia	2008	36.02

Source: Web sites of the national credit bureaus, authors.

From the data shown in Table 6 no obviously direct relationship exists between the starting year of the credit bureau and the level of indebtedness. Some countries with a longer history of operations have over-indebted populations, while some countries that recently founded a credit bureau show low levels of indebtedness. This points to the fact that the existence of a credit bureau has a role in preventing over-indebtedness, but that its effectiveness depends on the characteristics of the bureau, as well as other measures put in place by the central bank. Analysing the effect of the starting year of business operations opens the question of when is the optimal time to form a credit bureau in the national economy. The answer is that it should be done in close connection to the expansion of lending activity within the economy. The existence of a credit bureau can contribute to the expansion of lending because it helps

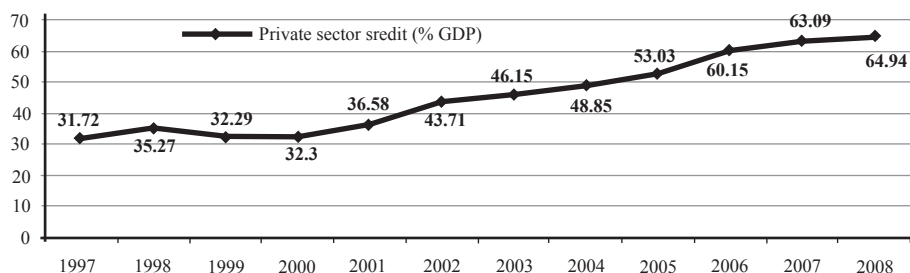
creditors to exchange information about credit line users and therefore more effectively to calculate risk.

Djankov et al. (2007) demonstrate that introduction of a private bureau or public register can result in an increase in private credit. They find evidence of growth from 7 to 8 percentage points (measured as a percentage of GDP) in five years following establishment of a credit bureau.

However in some countries private sector lending expands even in the absence of a credit bureau. The former Yugoslav republics demonstrate a classic case of this. Following independence and after the hyperinflation of 1993 the weak banking sector was restructured and foreign banks entered the market. This situation produced a growth in credit activity, particularly in lending to the private sector.

The relationship between lending activity, establishment of a credit bureau and the effect on the indebtedness level of the population can be explained through the example of two countries in the former Yugoslavia: Croatia and Serbia. The figure below illustrates the expansion in lending to the private sector as a percentage of GDP in Croatia in the period 1997 – 2008.

Figure 1. Expansion of lending to the private sector in Croatia as a percentage of GDP between 1997 and 2008.



Source: Trading Economics.

The expansion of lending activity in Croatia, expressed through credit to the private sector as a percentage of GDP, started in the mid 1990s and is currently continuing on an upward trend. Croatia's credit bureau started business operations in 2007. At that time debt per capita was at 3495€ or 24.5% of GDP. Therefore it could be said that the Croatian population was already over-indebted. If these data are compared with data on indebtedness in the middle of 2010, three years after the credit bureau started to operate, we suggest that in the period observed indebtedness was under control and that a real growth rate of indebtedness of 19.12%, expressed as a percentage of GDP per capita, occurred. This is an average of 6.37% per year (Table 7).

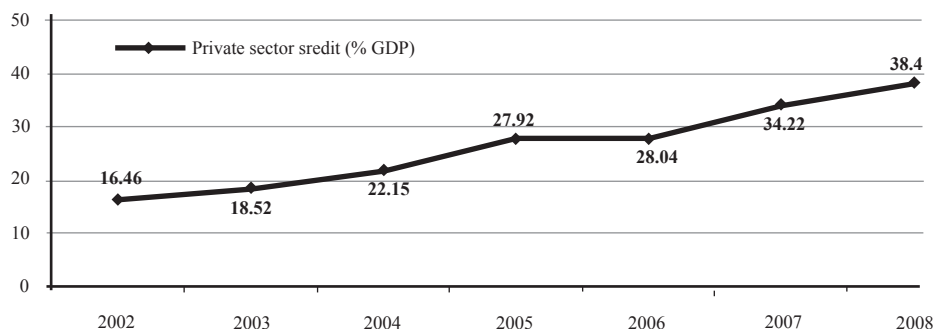
Table 7. Growth of indebtedness in Croatia between 2007 and 2010.

Year	Debt per capita in EUR	Debt as a % of GDP per capita	Growth of debt per capita 2007-2010	Growth of debt % GDP per capita 2007-2010
2007	3 495	24.58	14.45%	19.12%
2010	4 000	29.28		

Source: Central bank of Croatia, authors.

Between 2007 and 2008 lending to the private sector in Croatia, expressed as a percentage of GDP, grew by 2.93%. In the preceding year, before the credit bureau was established, the growth rate was 4.89%. Thus we can conclude that introduction of the bureau contributed to a control in expansion of private sector credit and has resulted in a controlled growth of indebtedness. More efficient control is difficult to achieve because not all banks operating in Croatia are included in the Credit bureau's operations. This means additional and uncontrolled lending remains possible. This issue will be addressed later on in the paper.

Figure 2 shows expansion of the private credit lending as a percentage of GDP in Serbia during the period 2002 – 2008.

Figure 2. Expansion of credit to the private sector in Serbia as a percentage of GDP in Serbia in the period 2002 – 2008.

Source: Trading Economics.

In Serbia, the first signs of an expansion in lending to the private sector appeared in 2003 as a direct result of the radical restructuring of the banking sector which followed the changes of 2000. In 2001 four large state banks were liquidated as well as 19 smaller banks amounting to 66% of the total assets of the banking sector. Since 2003, the lending trend has been cyclical in the sense that following a period of rapid growth in lending activity, the National Bank of Serbia intervenes to limit it. Consequently, private sector credit in 2008 amounted to 38.4% of GDP in Serbia, while in Croatia private sector credit stood at 64.94% of GDP. The situation is similar in other countries in the region, for example in Bulgaria it is about 45% of GDP. From this we can conclude that Serbia, in comparison with neighbouring countries, has room for credit expansion.

In comparison to Croatia, Serbia's Credit Bureau was established at the beginning of the credit expansion. It started business operations in Serbia in 2004 and this relatively short time lag has meant that Serbia's population falls into the category of least indebted of the 12 economies analysed. In 2007, debt per capita in Serbia was 503 Euros, or 6.28% of GDP per capita. If, as with Croatia, these data are compared with debt per capita in 2010, which is six years following the start of business operations of the credit bureau, we can see that debt per capita has grown by 29.22%. This makes an average yearly increase of 9.74%.

Table 8. Growth of population indebtedness in Serbia between 2007 and 2010.

Year	Debt per capita in Euros	Indebtedness as a % of GDP per capita	Growth of debt per capita 2007-2010	Growth of indebtedness as a % of GDP per capita 2007-2010
2007	503	6.28		
2010	650	7.79	29.22%	24.04%

Source: Association of Serbian banks, authors.

In the period 2007 – 2008 the growth of credit in the private sector as a percentage of GDP in Serbia was 12.21%. To make an initial conclusion about the growth of indebtedness from the moment when a credit bureau starts operating, data about indebtedness levels in the two economies in the period 2007 – 2010 have been systematised in Table 9 below.

Table 9. A comparison of indebtedness indicators for the populations of Croatia and Serbia between 2007 -2010.

Country	Growth of indebtedness per capita (%) 2007-2010	Growth of indebtedness % GDP per capita 2007-2010	Average yearly growth in debt as a % of GDP per capita	Growth in credit to the private sector % GDP 2007-2008
Croatia	14.45	19.12	6.37	2.93
Serbia	29.22	24.04	9.74	12.21

Source: Authors.

What is evident from the data shown in Table 9 is that average yearly growth in lending to the private sector in relation to GDP was six times more intensive in Serbia than in Croatia. It could be expected that growth in debt per capita would be six times more intensive in Serbia than in Croatia. However, as we can see from Table 9 that percentage is about two times bigger in Serbia than in Croatia. Also, we can see that the yearly average growth of debt as a percentage of GDP is about 1.5 times bigger in Serbia than in Croatia. This raises the question why the growth in indebtedness in the two economies does not follow the tendency of lending activity. The answer can be found in the way credit bureaus operated in the two countries. Credit bureaus in both countries contributed to controls on indebtedness, since for the period observed (2007-2010) a fully functioning credit bureau existed in both Serbia and Croatia. However the controls were more effective in one case and, despite intensive lending activity, the degree of growth in indebtedness was not proportional to growth in lending. From this we can conclude that other functional characteristics of the credit bureau contributed to controls on indebtedness.

When we compare the functional characteristics of credit bureaus in Serbia and Croatia, shown in Table 2, we will notice the differences that exist between them. The most important difference is that all banks in Serbia participate in the credit bureau system, while this is not the case in Croatia. In our opinion, that is one of the critical factors which reduces the effectiveness of the credit bureau's control over indebtedness in this country.

Based on the preceding comparison we can also suggest that the starting year of operations of the credit bureau is an element which has a direct impact on control of indebtedness. The influence of this element is in direct correlation with the year in which lending activity expanded in the economy. We have shown that in economies which experienced an increase in lending activity before introduction of a credit bureau, the population is over-indebted. On the other hand, in economies in which a credit bureau was formed before or not long after the start of expansion of lending activity, the population's debt level remains under control.

Introducing a credit bureau will keep indebtedness levels under control only if the right mix of functional characteristic is in place. These characteristics and their impact are analysed below.

3.1.3. Characteristics: Type of data collected by a credit bureau

Empirical research from the International Finance Corporation (2006) points to the fact that credit registers can reduce default rates if they store positive and negative data in their databases about the financial (in)discipline of credit line users. This paper asks whether this characteristic can also influence the indebtedness level of a population.

Table 10. Comparison of the type of data collected by credit bureaus and indebtedness levels for the countries surveyed for the year 2009.

Country	Type of Data		Indebtedness % GDP per capita
	Negative	Mixed	
Bosnia and Herzegovina		Yes	14.96%
Romania		Yes	12.93%
Greece		Yes	35.99%
Bulgaria		Yes	12.45%
Serbia		Yes	7.79%
Croatia		Yes	29.28%
Montenegro	Yes		19.06%
Czech Republic		Yes	21.11%
Estonia	Yes		41.81%
Slovakia		Yes	21.84%
Lithuania		Yes	21.86%
Latvia		Yes	36.02%

Source: World Bank Doing Business 2010 (online data base), authors.

The results show that of the 17 credit bureaus analysed, currently 15 of them store both positive and negative data about past conduct of credit line users. This amounts to 88.24% of the

sample. In two of the economies, Montenegro and Estonia, credit bureaus store only negative data. This is 11.76% of the sample.

If only the data shown in table 10 are taken into account it could be argued that the type of data collected by a credit bureau does not affect the level of indebtedness. Table 10 shows that countries with bureaus collecting the same types of data show different levels of indebtedness. However, indebtedness is a function of a larger number of factors and a larger number of functional characteristics of the credit bureau. If creditors base their decisions exclusively on negative data about the credit activities of users of their credit lines, they will not be able to objectively evaluate other obligations which the applicant may have through other credit lines. This increases the possibility of over-indebtedness. It follows that it is necessary that credit bureaus have positive-negative databases about users of credit lines for the effect of these institutions on indebtedness to be significant.

3.1.4. Characteristics: Category of borrowers

A credit bureau can monitor the credit activity of individuals or economic entities. Some bureaus only collect data on individuals, some only collect data on businesses, while in the majority of cases credit bureaus collect data on both these categories of borrowers. The question is whether this characteristic of a credit bureau has an impact on the level of indebtedness. The logical response would be that those credit bureaus which collect data on individuals will have a direct influence on the development of indebtedness within a population. That is one of the main purposes for the existence of a credit bureau. Through collecting and distributing data about the credit activity of natural persons, credit bureaus should help lending institutions make optimal lending decisions with minimal credit risk, but in doing so also help to control indebtedness. The information collected represents part of the 'reputation collateral' of borrowers (Miller 2003) who are motivated to settle their payments and maintain their good reputation. In cases when credit bureaus do not collect data on individuals the possibility arises for uncontrolled borrowing from a greater number of credit institutions and to quickly become over-indebted.

Of the analysed sample the data show that:

- In two economies (Croatia and Slovakia) credit bureaus collect data only on individuals. This is 11.76% of the sample.
- In Slovakia, the public credit register collects information about economic entities, but the private credit bureau collects credit information about individuals.
- 15 credit bureaus in the sample countries store historical data about individual and business users of credit lines. This is 88.24% of the sample.

Table 11. Comparative summary of categories of users recorded by credit bureaus for the countries surveyed for the year 2009.

Country	Category of user		
	Individuals	Legal entities	Both
Bosnia and Herzegovina			Yes
Romania			Yes
Greece			Yes
Bulgaria			Yes
Serbia			Yes
Croatia	Yes		
Montenegro			Yes
Czech Republic			Yes
Estonia			Yes
Slovakia	Yes	Yes	
Lithuania			Yes
Latvia			Yes

Source: World Bank Doing Business 2010 (online data base).

We can suggest that the category of user monitored by the credit bureau has a direct influence on indebtedness levels and that this is independent of the other functional characteristics.

3.1.5. Characteristics: Number of creditors (banks) in the system of the credit bureau.

This functional characteristic of the credit bureau has a direct influence on indebtedness levels. Unless all banks provide data to the credit bureau a borrower can apply for a loan from a bank which is not in the bureau's system, which increases the possibility of over-indebtedness.

Public credit registers operate under Central Banks and therefore have the legal or regulatory framework to oblige banks to provide data to these registers. Consequently it would be rare to find a case where a public credit register did not regularly receive data from all banks operating in the economy. A different set of problems are characteristic for public credit registers. These relate to the fact that banks typically provide data about loans which are above a specified minimum amount and they do so only once a month (in most cases). In contrast, participation by banks in a private credit bureau is based on the principle of reciprocity. Only banks which supply data about their clients' credit activities are able to use data supplied by other creditors and held by the credit bureau. The most frequent reason for not participating in a private credit bureau system is a bank's reluctance to share information about their best clients for fear of losing these clients to competitors.

The data collected has shown that:

- Of the 17 credit bureaus analysed, 9 (52.94% of the sample) did not include all banks in their system.

- For the countries in the sample which had a public credit register, all banks provided data on credit line users to these public registers.
- In the case of private credit bureaus in only one state, Serbia, were all banks included in the system and on a regular basis provided data about the credit activity of credit line users.

Table 12. Types of credit bureau compared by number of creditors in the system and indebtedness levels for the countries surveyed.

Country	Type	Creditors in CB system		Debt %GDP per capita
	Credit Bureau	All	Some	
Bosnia and Herzegovina	Private		Yes	14.96%
Romania	Private		Yes	12.93%
	Public	Yes		
Greece	Private		Yes	35.99%
Bulgaria	Private		Yes	12.45%
	Public	Yes		
Serbia	Private	Yes		7.79%
Croatia	Private		Yes	29.28%
Montenegro	Public	Yes		19.06%
Czech Republic	Private		Yes	21.11%
	Public	Yes		
Estonia	Private		Yes	41.81%
Slovakia	Private		Yes	21.84%
	Public	Yes		
Lithuania	Private		Yes	21.86%
	Public	Yes		
Latvia	Public	Yes		36.02%

Source: World Bank Doing Business 2010, web sites of national credit bureaus, authors.

The data in Table 12 show that, for public credit registers, the condition that all banks be included in the system is not sufficient to keep indebtedness under control. The critical factor is the minimum loan amount above which data are collected by these public credit registers. The larger the minimum loan amount, the lower the coverage ratio and consequently the smaller the impact of the register on indebtedness levels. This statement is confirmed below through comparing the coverage levels of the public credit registers included in the sample (Table 13).

When analysing the impact of a public credit register on controlling indebtedness levels, it must be taken into account that a number of these countries also have a private credit bureau. In the majority of cases the private bureau has the dominant influence on control of indebtedness.

Table 13. Comparison of the coverage ratio of public credit registers in the countries surveyed and indebtedness levels for the year 2009.

Country	Coverage ratio	Indebtedness as a %GDP per capita
Romania	5.7%	12.93%
Bulgaria	34.8%	12.45%
Montenegro	27.6%	19.06%
Czech Republic	4.9%	21.11%
Slovakia	1.4%	21.84%
Lithuania	12.1%	21.86%
Latvia	46.5%	36.02%

Source: World Bank Doing Business 2010, authors.

Romania has both a public credit register and a private credit bureau. Since the public register has a low coverage ratio, its influence on indebtedness levels is negligible. Good results in the domain of controlling indebtedness levels have been achieved through the private bureau whose coverage ratio is 30.2%.

In Bulgaria, the public credit register has a higher coverage ratio (34.8%) than the private bureau (6.2%); therefore the public register has the dominant influence. Montenegro only has a public credit register to control credit users' financial discipline. Although formed in 2008, the register's coverage ratio is fairly high (27.6%) and has a direct influence on controlling indebtedness. The public credit registers in the Czech Republic, Slovakia and Lithuania have significantly lower coverage ratios than the private bureaus, which minimises the impact of these institutions on indebtedness levels. The coverage ratio of Latvia's public credit register is significant (46.5%), but its weak influence on indebtedness levels can be explained by its late formation relative to the expansion of credit activity in this county and the fact that the Register of Debtors which existed before it had a low coverage ratio. The new credit register was founded in 2008, while lending started expanding in 2001.

Since private credit bureaus do not have the data limits characteristic of public registers (minimum loan amounts or category of users) this characteristic is stronger for private bureaus. For example, in Serbia all banks are included in the private credit bureau and the population has the lowest level of debt. Of course indebtedness levels are influenced by a number of factors which cannot be considered in isolation. Adequate results over indebtedness levels can only be achieved through a combination of characteristics, whether these are in a public register or a private bureau.

3.1.6. Characteristics: Coverage ratio

The coverage ratio is defined by the World Bank as an indicator which reports the number of individuals and firms listed by a public credit registry or private credit bureau with information on their borrowing history for the past 5 years. The number is expressed as a percentage of the adult population. When calculating a bureau's coverage ratio of individuals (natural persons) only, the following formula is used.

$$CRnp = \frac{Ncb}{Nap} \times 100 \quad (2)$$

Where:

CRnp is the Coverage Ratio for natural persons

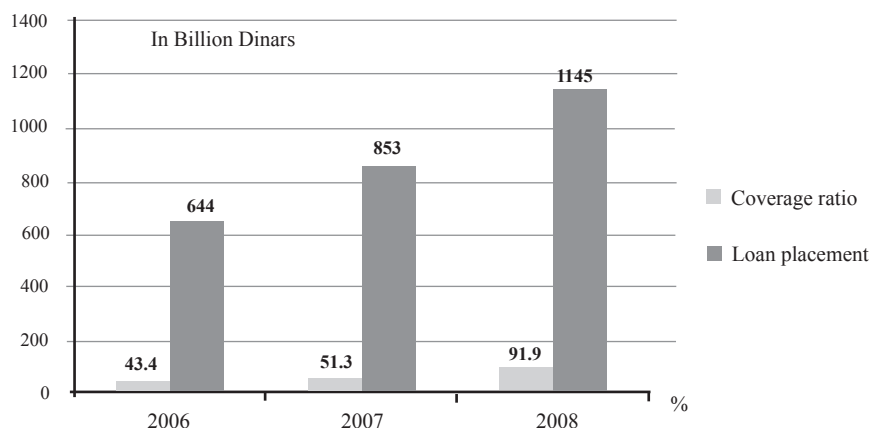
Ncb is the number of natural persons whose credit data are stored in the credit bureau's data base

Nap is the total adult population in a country

To answer the question whether this characteristic has an impact on the level of indebtedness, another question presents itself. Is the coverage ratio conditioned by other characteristics of a credit bureau?

The number of users on whom data are stored will increase if credit activity intensifies. This statement can be confirmed with the example of the Serbian Credit Bureau (Simovic et al. 2009).

Figure 3. Loan placements and coverage ratio of the credit bureau in Serbia in the period 2006-2008.



Source: Simovic et al.2009.

The second important aspect of the coverage ratio is the issue of whether all banks supply data to the credit bureau. If not all banks and creditors are included in the system, data will be kept on fewer natural and legal subjects and the coverage ratio will be lower.

As stated earlier, public credit registers typically hold data on the credit obligations of natural and legal subjects according to loans above a specified level. The level varies from country to country. In countries with higher minimum loan levels, the coverage ratio will be lower and vice versa. Given that private credit bureaus do not typically set minimum loan amounts, this is the critical reason why they have higher coverage ratios than public credit registers.

We can suggest that the dominant influence over the coverage ratio is whether or not all banks provide data to the credit bureau and, in the case of public credit registers, whether there is a minimum loan amount. In addition, the coverage ratio is influenced by the bureau's starting year of business operations and the expansion of lending activity within an economy. The conditions acting on the coverage ratio can be explained by the following relation: In the case of an expansion in lending activity in a country in which all the leading creditors provide data to a bureau, and where limits conditioning the minimum loan amount do not exist, the coverage ratio will be higher and the influence over indebtedness levels will be greater. The accuracy of this statement can be verified through the data from our sample.

Data show that:

- In the case of private credit bureaus, the proportion of banks within an economy which provide data to the credit bureau has a direct influence on the coverage ratio. The best example to support this statement is Serbia; all the banks provide data and the coverage ratio is 94.2%. Serbia has the lowest rate of indebtedness measured as a percentage of GDP. In the other economies, not all banks are included in the credit bureaus' systems, the coverage ratios are lower and levels of indebtedness are higher.
- In the case of public credit registers, the coverage ratio is conditioned by the minimum loan amount above which lenders supply information. Through our discussion above on the number of creditors included in a credit bureau's system we have suggested that when public credit registers have lower minimum loan amount limits they will have a higher degree of coverage and consequently a stronger impact on indebtedness levels.

Table 14. Type of credit bureau, number of creditors in the system, coverage ratio and indebtedness levels for the countries surveyed for the year 2009.

Country	Type of Credit Bureau	All creditors in the CB system	Coverage ratio	Indebtedness as a % GDP per capita
Bosnia and Herzegovina	Private	No	64.3%	14.96
Romania	Private	No	30.2%	12.93
	Public	Yes	5.7%	
Greece	Private	No	46.9%	35.99
Bulgaria	Private	No	6.2%	12.45
	Public	Yes	34.8%	
Serbia	Private	Yes	94.2%	7.79
Croatia	Private	No	77%	29.28
Montenegro	Public	Yes	27.60%	19.06
Czech Republic	Private	No	73.1%	21.11
	Public	Yes	4.9%	
Estonia	Private	No	20.6%	41.81
Slovakia	Private	No	45.4%	21.84
	Public	Yes	1.4%	
Lithuania	Private	No	18.4%	21.86
	Public	Yes	12.1%	
Latvia	Public	Yes	46.5%	36.02

Source: World Bank Doing Business 2010, web sites of national credit bureaus, authors.

However other characteristics of private credit bureaus and public credit registers influence their coverage ratios and consequently the impact this characteristic has on indebtedness levels. These are the starting year of business operations and the category of users included.

This analysis has shown that a bureau's coverage ratio can have an impact on indebtedness levels, provided there is an optimal mix of other functional characteristics of a credit bureau.

3.1.7. The depth of credit information index

The value of this index is calculated on the basis of different characteristics of credit bureaus around the world and in accordance with World Bank methodology. The values of the credit information index are published by the World Bank every year for all nations worldwide. Two of the six elements that constitute this index have been analysed above – the category of borrowers and the type of data collected by the credit bureau. Remaining elements that determine the value of the depth of credit information index are:

1. A greater number of data sources used by the credit bureau (courts, utilities companies, public enterprises for example) enable creditors to objectively evaluate the credit position of the applicant for the credit line and reduce the possibility of overindebtedness.
2. When assessing the creditworthiness of borrowers, it is important for creditors to have historical data over at least two years.
3. The importance of collecting data about all amounts, and not just loans over a certain level.
4. The legal guarantee for borrowers to access their credit records may indirectly impact on indebtedness levels. Studies have indicated that data accuracy is an issue for credit bureaus. It is not rare for inaccurate data to be supplied to the bureau which may result in bad lending decisions and increase the possibility of over indebtedness. If borrowers can access their records, they can verify the accuracy of their data.

It can be argued that the elements contributing to the depth of credit information index have an impact on indebtedness levels. However it is only in combination with the other characteristics of the credit bureau analysed here that good results in controlling indebtedness levels can be achieved.

3.1.8. The strength of legal rights index

The strength of legal rights index does not represent a characteristic of a credit bureau but rates how developed the legislative framework is in terms of protecting creditor and borrower rights. The score for this index ranges between 0 and 10, a higher score indicating a more protected environment for financial rights.

Data show that:

- High scores on the legal rights index have been achieved by three (25%) countries in our sample. Montenegro, Latvia and Slovakia all have a score of 9.
- Greece has the lowest score on the legal rights index (3) and its population belongs to the category of the most indebted.

Table 15. The Legal Rights index and indebtedness levels for the countries surveyed for the year 2009.

Country	Legal rights index	Indebtedness as a % GDP per capita
Greece	3	35.99
Bulgaria	8	12.45
Romania	8	12.93
Bosnia and Herzegovina	5	14.96
Serbia	8	7.79
Croatia	6	29.28
Montenegro	9	19.06
Czech Republic	6	21.11
Estonia	6	41.81
Slovakia	9	21.84
Lithuania	5	21.86
Latvia	9	36.02

Source: World Bank Doing Business 2010, authors.

On the basis of the data shown in Table 15 we can suggest that countries with a high score on the legal rights index, (between 7 and 9) have lower indebtedness levels. Surprisingly, Latvia scores highly on the legal rights index, but has a highly indebted population. The reason for this can be explained through the characteristics of the credit register in this country and the fact that the register did not start business operations until 2008.

On the other hand, the six countries with low scores (between 3 and 6) on the legal rights index have populations which fall into the categories of moderately and highly indebted. This comparison shows that the legal rights index is relevant to control of the indebtedness levels of a population.

4. Results

The qualitative analysis above has shown that indebtedness is conditioned by the functional characteristics of a credit bureau operating within an economy and that no single characteristic determines the level of indebtedness. A bureau can only achieve good results in controlling the indebtedness level of a population through a combination of functional characteristics. Based on previous analysis we can suggest that the level of indebtedness per capita is influenced by the following characteristics of credit bureaus:

- The starting year of business operations
- The type of data collected
- The category of borrower
- The number of creditors in the system
- The coverage ratio
- The elements incorporated in measuring the depth of credit information index

Apart from the main functional characteristics of the credit bureau, indebtedness per capita levels are also influenced by the legal rights index. Therefore we will also take this element into account by constituting the Credit Bureau Functional Index (CBFI).

The World Bank method for attaining a value for the depth of credit information index includes elements that we have looked at separately. These are the type of data collected and the category of borrower included. Therefore we have removed these elements as individual categories of analysis when creating the Credit Bureau Functional Index.

4.1. Quantifying the characteristics of a credit bureau

The aim of this research is to quantify the characteristics of a credit bureau and through this quantification to associate these characteristics with the level of indebtedness per capita in the economies observed. Indebtedness per capita is influenced by many relevant factors such as credit expansion, political stability, competition levels between banks, measures undertaken by central banks, and so on. Having in mind that the aim of this paper is to answer the question whether the functional characteristics of credit bureaus are correlated with levels of personal indebtedness in the countries observed, those other factors were not taken into consideration during the analysis. Our primary goal is not only to identify the functional characteristics of the credit bureau as one of the factors influencing personal indebtedness but also to promote the fact that different functional characteristics can have different impacts on personal indebtedness. Quantification of functional characteristics has been achieved through weighting the observed characteristics of credit bureaus. The characteristics of credit bureaus were quantified through the agreed method of forming weightings and that method was applied to all credit bureaus in the sample. The weightings were determined in the following way.

4.1.1. Starting year of the effect of the credit bureau on lending expansion within the economy

Calculating the quantitative value of the start of the credit bureau's effect on expansion of credit within the economy takes into account the starting year of business operations and the starting year of the growth in lending in the country.

$$SY_{CB} = SY_{BO} - SY_{GL} \quad (3)$$

Where:

SY_{CB} is the starting year of the effect of the credit bureau on growth of lending within the economy

SY_{BO} is the starting year of the credit bureau's business operations

SY_{GL} is the starting year of growth in lending

$$\delta(SY_{CB}) = k \quad (4)$$

$$k = 5, \text{ if } SY_{CB} = 0$$

$$k = 4.5, \text{ if } SY_{CB} = 1$$

$$k = 4, \text{ if } SY_{CB} \leq 2$$

$$k = 3.5, \text{ if } SY_{CB} \leq 3$$

$$\begin{aligned}
 k &= 3, \text{ if } SY_{CB} \leq 4 \\
 k &= 2.5, \text{ if } SY_{CB} \leq 5 \\
 k &= 2, \text{ if } SY_{CB} \leq 6 \\
 k &= 1.5, \text{ if } SY_{CB} \leq 7 \\
 k &= 1, \text{ if } SY_{CB} \leq 8 \\
 k &= 0.5, \text{ if } SY_{CB} \leq 9 \\
 k &= 0, \text{ if } SY_{CB} \geq 10
 \end{aligned}$$

Where:

$\delta(SY_{CB})$ is the quantified value of the effect the starting year of business operations of a credit bureau has on the national economy.

k is the weighted value

The weights of the $\delta(SY_{CB})$ were based on the reciprocity principle, as credit bureau impact is higher on the lending market and indebtedness levels according to the weight of this factor being higher, and vice versa. Guidance on quantification of the impact of the start of the credit bureau's operations on indebtedness per capita within the economy is given in empirical research by Djankov et al. (2007) and Palic (2007). Djankov suggests that, five years after a credit bureau starts its business operations, lending activity on the level of one national economy increases by 7 to 8 percentage points. If a credit bureau is founded alongside credit expansion, its impact on personal indebtedness will be higher and this characteristic will be quantified by 5 in accordance with our methodology.

4.1.2. Creditors in the credit bureau's system

The analysis above proposed that a direct link exists between the level of indebtedness per capita as a percentage of GDP and inclusion by the credit bureau of all major creditors in the market.

$$\omega(CS) = l \quad (5)$$

$$l = 6, \text{ if } CS = \text{Yes (Table 2)}$$

$$l = 3, \text{ if } CS = \text{No (Table 2)}$$

Where:

$\omega(CS)$ is the quantitative value of the effect of including creditors in the credit bureau's system

l is the weighted value.

The weights assigned to the $\omega(CS)$ are based on the World Bank methodology for the Credit information index (the maximum value of this index is 6) and taking into the consideration the empirical research of Tepus (2007). The specific values of this factor were considered to have a more significant impact on the level of indebtedness per capita as a percentage of GDP if major creditors in the market are included in the credit bureau, and thus a higher value of the weight is given and a lower weight is assigned if not all the major creditors in the market are included in the credit bureau. This way the impact of both situations is acknowledged.

4.1.3. Coverage Ratio

When calculating quantitatively the value of the Coverage Ratio, its actual value (as a percentage of the total population) is taken into account. As shown above, a direct link exists between indebtedness and the Coverage Ratio. The quantitative representation of the Coverage Ratio takes into account that link. Therefore the greater the coverage, the higher the Coverage Ratio score, and vice versa.

$$\varepsilon(CR) = m \quad (6)$$

$$m = 10, \text{ if } 100\% \leq CR \leq 91\%$$

$$m = 9, \text{ if } 90\% \leq CR \leq 81\%$$

$$m = 8, \text{ if } 80\% \leq CR \leq 71\%$$

$$m = 7, \text{ if } 70\% \leq CR \leq 61\%$$

$$m = 6, \text{ if } 60\% \leq CR \leq 51\%$$

$$m = 5, \text{ if } 50\% \leq CR \leq 41\%$$

$$m = 4, \text{ if } 40\% \leq CR \leq 31\%$$

$$m = 3, \text{ if } 30\% \leq CR \leq 21\%$$

$$m = 2, \text{ if } 20\% \leq CR \leq 11\%$$

$$m = 1, \text{ if } 10\% \leq CR \leq 1\%$$

$$m = 0, \text{ if } CR \leq 0\%$$

Where:

$\varepsilon(CR)$ is the quantified value of the effect of the Coverage Ratio in the system of a credit bureau within a national economy

m is the weighted value

The weights assigned to the $\varepsilon(CR)$ are based on the percentage of the Coverage Ratio, i.e. 1 weighting point corresponding to a 10% coverage ratio. The methodology overview of Hainz (2008) was considered when quantifying this weight factor. Additionally, the advice and recommendations of the Central Banks of Serbia, Croatia, Montenegro, Estonia, the Czech Republic, Slovakia and Bulgaria, as well as the Association of Serbian banks, based on their empirical researches on this matter, were analyzed and considered.

Quantified representation of the coverage ratio has the highest value of all functional characteristics of a credit bureau. In our opinion this is justified having in mind that this functional characteristic incorporates and depends on all other functional characteristics of a credit bureau.

Table 16. Quantified values of credit bureau characteristics.

Country	$\delta(YS)$	$\omega(CS)$	CI index	SLRI	$\varepsilon(CR)$
Bosnia & Herzegovina	4.5	3	5	5	7
Bulgaria	5	6	6	8	4
Croatia	2	3	4	6	8
Czech Republic	5	3	5	6	8
Estonia	2.5	3	5	6	2
Greece	4.5	3	5	3	5
Latvia	1.5	6	5	9	1
Lithuania	5	3	6	5	2
Montenegro	4	6	2	9	3
Romania	5	3	5	8	3
Serbia	5	6	6	8	10
Slovakia	3.5	3	4	9	5

Source: authors.

4.1.4. Credit Information Index and the strength of legal rights index

The values for the credit information index and the strength of legal rights index are calculated according to the World Bank method and accepted as such.

4.2. The Credit Bureau Functional Index

The quantitative values for the observed characteristics of credit bureaus have been calculated and are shown in the table below. On the basis of the functional characteristics affecting indebtedness levels, it is possible to form a Credit Bureau Functional Index. The formula for calculating the CBFI is:

$$SBFI = \delta(YS_{CB}) + \omega(CS) + \varepsilon(CR) + CI + SLRI \quad (7)$$

Where:

CI is the depth of credit information

$SLRI$ is the strength of the legal rights index

The values of the $CBFI$ of the countries observed are shown in the table below:

Table 17 shows that Serbia has the highest score (35) and that Estonia has the lowest score (16.5). The following work will analyse the relationship between the values of the CBF Index and indebtedness per capita as a percentage of GDP, to identify possible relationships and trends.

Table 17. Values for the Credit Bureau Functional Index.

Country	CBFI
Bosnia & Herzegovina	24.5
Romania	24
Greece	20.5
Bulgaria	29
Serbia	35
Croatia	23
Montenegro	24
Czech Republic	27
Estonia	18.5
Slovakia	24.5
Lithuania	21
Latvia	22.5

Source: authors.

4.3. Analysis of the impact of the CBFI on the trend of indebtedness in the countries observed

The first step in analysing the effect of the CBFI on the level of indebtedness per capita (IPC) is to statistically analyse the correlation between the variables of the CBFI and the IPC score. As the aim is to discover the existence of a relationship between the values of the CBFI and the IPC we will use Spearman's correlation. Spearman's correlation will be calculated with the formula:

$$\rho = 1 - \frac{\sigma \times \sum (CBFI_i - IPC_i)^2}{n \times (n^2 - 1)} \quad (8)$$

ρ is the Spearman correlation coefficient
 n is the number of observed pairs of variables

The calculated value of the Spearman correlation coefficient is shown in Table 18.

Table 18. Spearman's correlation.

		CBFI	IPC
Spearman's rho	CBFI	Correlation Coefficient	1.000
		Sig. (2-tailed)	.000
		N	12
IPC	IPC	Correlation Coefficient	-.860
		Sig. (2-tailed)	.000
		N	12

The value of the Spearman correlation coefficient (-0.860) shows a strong, negative correlation between the CBFi index and debt per capita as a percentage of GDP. The analysis is statistically significant below the 0.01 level, and the value which we received (0.000) shows that the result is statistically significant.

The negative sign indicates that with an increase in the CBFi score, the IPC reduces. Therefore with an increase in the observed quantitative values of the characteristics of the credit bureau there is a decrease in indebtedness calculated as a percentage of GDP, and vice versa. In order to confirm the results of the correlation, we have analysed the potential to predict the value of the IPC on the basis of the CBFi.

For that purpose we have used a nonlinear regression. The result of the exponential regression between the CBFi and the IPC, where the CBFi is the independent variable is shown in the Table 19 below.

Table 19. Non-linear regression analysis.

Dependent	Method	Rsqr	d.f.	Sigf	B0	b1
IPC	EXPREG	.726	10	.000	229.173	-.0986

On the basis of the results of the regression it is possible to conclude that the CBFi significantly influences indebtedness per capita. The value $R^2=0.726$ shows that the IPC is 72.6% dependent on the CBFi. The regression analysis enables us to determine the trend. This means is that on the basis of the CBFi score we can predict the value of the IPC. The formula for the trend of dependency is shown below:

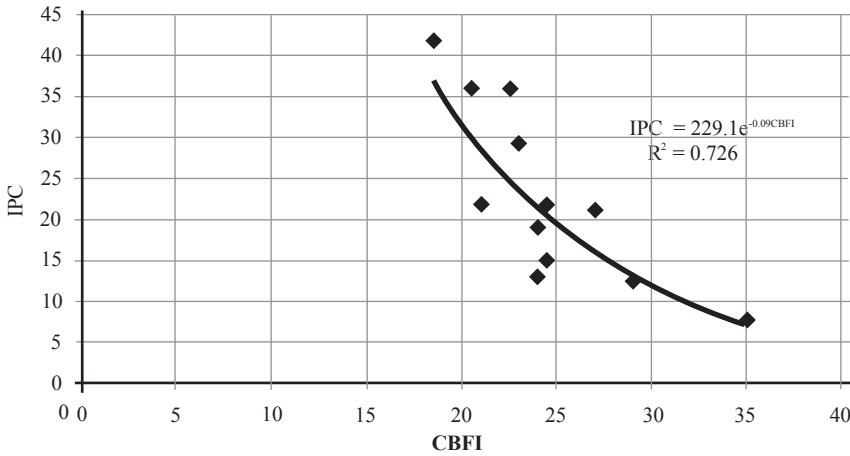
$$IPC = 229.1 \times e^{-0.09 \times CBFi} \quad (9)$$

The values obtained in the exponential regression are presented graphically on the diagram below.

Analysis of the relation between the CBFi and IPC shows an exponential decay function. In other words, with a change in the CBFi value the IPC value also changes according to the equation's function.

Of course there are deviations from the exponential linear trend, but our aim is not and cannot be to calculate the exact level of indebtedness through the CBFi. Each economy is specific and has applied different measures in the areas of credit policies and laws. Our aim is to show the existence of a general trend that as the value of the CBFi increases a reduction occurs in indebtedness. The statistical analysis employed in the research has shown the existence of this trend and has been able to graphically present this finding as well as to produce it in a quantitative equation (9).

Figure 4. Analysis of the level of indebtedness per capita (IPC) on the basis of the Credit Bureau Functional Index (CBFI).



5. Conclusions

Analysis of the influence of credit bureau characteristics on the indebtedness of the population has shown that through certain measures aimed at increasing the quantitative values of credit bureau characteristics, in other words the values of the CBFI, the degree of indebtedness within a population can be affected. Furthermore, the importance of the analysis is that equation (9) can be used to predict development of indebtedness within a population based on the CBFI.

By affecting the specific characteristics of the CBFI the level of indebtedness can be influenced. Different factors will affect the various characteristics. These include Central Bank instruments in the field of credit regulation, for example forming the very institution of the credit bureau, the limits for including credit information, the obligation for banks to provide data to the credit bureau and measures of the legislative and executive powers in the fields of credit and legal regulation, for example measures which affect the strength of the legal rights index or policies of the central bank in the area of lending policy.

Indebtedness can be controlled through credit policy, but also through the corresponding policies of a state and through controlling the characteristics and the activity of the credit bureau. Having established a relationship of dependence, as well as a trend in indebtedness levels, it is possible to strategically plan both the institution of the credit bureau and plans related to the credit bureau and therefore to affect the degree of indebtedness of a population.

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