THE IMPACT OF DEBT ON ECONOMIC GROWTH IN CEE

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by

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Abstract

The study investigates debt impact on economic growth in ten Central and Eastern European countries from 2001 until 2012. In the existing literature, the theoretical and empirical analyses provide contradicting results on the debt influence on economy, while the global financial and sovereign debt crises encourage new investigations in this field. The determination of debt impact on GDP growth is based on the neoclassical Solow growth model and testified with dynamic OLS, FE and differenced and system GMM estimators. The empirical results prove that the level of debt has the most statistically significant impact on physical capital growth and TFP growth. Furthermore, the decomposition of debt indicates that the GDP growth is explained the most accurately by the incorporation of government, corporate and household debts as separate explanatory variables. The corporate debt has the most significant negative effect on the GDP growth, while the impact of public debt is lower but negative as well. The statistically insignificant household debt encourages evaluating the importance of practical significance of this variable. Further research could take this into consideration as well as the inclusion of new instrumental variables in the dynamic GMM models.

Keywords: public debt, private debt, corporate debt, household debt, economic growth, panel data analysis.

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Introduction

The analysis of the total debt can be divided into private and public debts. Both types of debt have two-sided effect. The fund and financial sources are used to fulfill government's obligations for the society. In other words, the government debt ensures the "ability to deliver essential services to its citizens" (Cecchetti, Mohanty, & Zampolli, 2011). The private debt can be used for the increasing consumption or investments. However, the debt has a negative side as well. Nowadays, the majority of the countries and private sectors are dealing with the constantly accumulating debt, which increases the probability of a bailout. It becomes essential to understand the effect of growing debt on economic growth.

In order to determine debt effect on economic growth, the channels, through which economy is affected, have to be specified. The neoclassical Solow growth model divides growth into capital stock, human capital and total factor productivity (TFP). This specification allows testifying influence of debt on economy through different perspectives. The total debt can also be diversified. The majority of the economist discussed the impact of public debt on economy. Authors Douglas W. Elmendorf and N. Gregory Mankiw (1998) have explained the conventional view, which main idea is agreed by majority of economists and policymakers. This theory explains the impact of debt for aggregate demand in the short run, while it emphasizes the crowding out effect in the long run. On the other hand, there is the Ricardian equivalence theory, which explains the neutrality of debt. In more details, the current tax cut will be restored by the higher taxes in the future. However, the public debt is just a part of the total debt. On the one hand, the public debt has a strict requirement in European Union. Based on the Maastricht criteria, the public debt cannot exceed 60 percent of GDP, thus the fluctuations of public debt have boundaries in this region. On the other hand, the private debt can fluctuate easier. Based on the statistical data, the private debt was increasing in the Central and Eastern European (CEE) countries from 2001 until 2009. In addition, the financial crisis, which began 7 years ago, reminds that private debt should be analyzed in more details and the impact of private debt can lead to serious consequences. Thus, the impact of private debt on growth is described in the debt deflation theory as well as in the hypothesis of financial instability. All the theoretical approaches are usually applied for the empirical testing for the advanced economies, however the Central and Eastern European countries are bypassed. Thus, this research is based on this region.

The first part of this paper will cover the concept of debt, identification of growth channels and theories, which explain the impact of private and public debts on the economic growth. First section will be finished with the description of previous empirical researches and their results and determination of the research hypothesis, tested in this paper. Then, the second part will explain the selection of the data for the Central and Eastern European countries and describe the empirical models, which will be applied for the quantitative analysis. The third part will present empirical results of the research, while last part will cover the discussion of the results, their compliance with theoretical literature, limitations of the empirical estimations and implications for further researches. Finally, the conclusions will be provided.

Literature Review

Recent events reveal how important debt is and what kind of impact it has on the whole economy. The crisis in 2007 – 2008 is related to the house bubble, which was encouraged by rapidly increasing private loans. Further, the European debt crisis happened, which included PIIGS (Portugal, Italy, Ireland, Greece, Spain) countries. However, this crisis was related to the growing government debt. Private and public debts lead to the collapse and affect economic growth negatively. However, it is questionable which type of debt has more influence on economy and though which channels debt can influence the level of economic growth. The economists have tried to answer these questions in the previous century, however, the consensus has not been reached. They were concentrated on the public debt impact on economy, while the importance of private debt was left aside. In 1998, Elmendorf and Mankiw distinguished two approaches on public debt: Ricardian theory and conventional view. After the year of 2007, the economists and policy makers have remembered Fisher's ideas and hypothesis of the financial instability presented by Minsky. All these approaches are provided in the following subsections, but the description of the economic growth has to be presented firstly.

Neoclassical and Endogenous Growth Theories

In the 1960s, the economic growth was explained by the neoclassical theory mainly. Ramsey, Solow, Swan and others were the leading developers of the neoclassical growth models. The neoclassical theorists analyze the differences in living standards among countries. They raise the question whether "economies converge over time to one another" (Mankiw, 2002). In more details, if the poor countries with the low GDP per capita level grow faster and reach the growth of rich economies, while the growth of rich countries is slower. This property of faster growth, when the starting point is lower, is called the convergence.

The application of convergence property is based on the analysis of reasons for the differences between countries. If two economies have the same steady state, but the deviation from this state is different, then the poor country will grow faster and will reach the rich country. The historical reasons (for example, wars) can be a reason for different starting point. Thus, “the economy with the smaller capital stock will naturally grow more quickly” (Mankiw, 2002). However, the convergence property cannot be applied if the steady state of two economies differs. This can be caused by the differences in saving ratio, fertility, working conditions, technological abilities or even government policies. In such cases, each of the country will reach its own steady state.

Barro (1996) explained that convergence property is derived from diminishing returns to capital. Previous researches use a broad concept of capital: from physical goods to variables representing human capital (Barro, 1996). The economic growth will be faster if the human to capital ratio is higher. Based on the historical evidence, wars destroy physical capital, however, the human capital allows recreating the losses quite fast due to the combination of existing human capital and foreign technologies. In order to increase human capital, additional education or experience is necessary, thus it takes longer time than improvements in physical capital.

Neoclassical model clarifies that the economic growth stops without advancements in the technologies. However, the analyses of long-term growth in various countries do not support this assumption of the declining growth without technological improvements. Thus, the neoclassical theorists “recognized this modeling deficiency and usually patched it up by assuming that technological progress occurred in an unexplained (exogenous) manner” (Barro, 1996). This can be the reason for constant economic growth in the long run. However, the problem appears due to the growth explanation by the exogenous variable, which means that growth model explains “everything but long-run growth” (Barro, 1996).

The explanation of the technological progress is represented in endogenous growth theory. This theory rejects the assumption of the technological improvements as exogenous variable and includes the new ideas in the definition of the technological progress (Mankiw, 2002). The broader definition of the variable leads to the growing returns to scale, but the evaluation of new ideas becomes difficult and imperfect competition can occur. Thus, later the model assumed that new ideas could spread over society due to its properties of nonrival and public goods. However, Romer (1986) emphasized that the developments, which were achieved on purpose, would be spread among particular part of society and the problem of imperfect competition would arise. Later, Barro and Sala-i-Martin (1995) supplemented this model. They claimed, that if the new ideas keep being created during, the economic growth would be positive in the long run. However, there are factors, which might influence the process of creation of new ideas and shift the economic growth from Pareto optimal point. Those factors are: "governmental actions, such as taxation, maintenance of law and order, provision of infrastructure services, protection of intellectual property rights, and regulations of international trade, financial markets, and other aspects of the economy" (Barro, 1996). However, the convergence property disappears in this model. Barro and Sala-i-Martin (1995) returned this property to the theory based on the assumption that the technological advances from the leading economies can be implemented in the developing countries and it is cheaper and faster to implement something, what already exists, comparing to the creation of new technologies. Thus endogenous growth theory explains economic growth in the long run through the importance of creation of new ideas and production methods, but the neoclassical model, which emphasizes the importance of government, human capital and technological distribution is more often applied in the analysis of economic growth among the countries (Barro, 1996).

Definition of Debt

Debt is the amount of money borrowed by one party from another and obligation to pay it back. The total debt in the country consists of private and public debts. Public debt is the "legal obligation on the part of a government to make interest and/or amortization payments to holders of designated claims in accordance with a defined temporal schedule" (The New Palgrave Dictionary of Economics, 2008). While private debt is "the stock of liabilities held by the sectors non-financial corporations and households and non-profit institutions serving households" (European Commission). Based on the classical model of public debt developed in the XIX century, the concept of public debt does not have essential difference from private debt. "Borrowing is a means of raising revenues that allows the borrower to put off or to postpone payments" (The New Palgrave Dictionary of Economics, 2008). According to the balance sheet analysis, public debt can be identified as the liabilities on the government's balance sheet, while the instruments issued by government (for example bonds) are the assets on the borrowers' balance sheet. Keynesians rejected the equality between public debt and private debt. Specifically, "the argument denied that public debt embodies any shift of burden onto taxpayers in periods of time subsequent to debt issue, a temporal shift that was acknowledged to occur in both private debt and external public debt" (The New Palgrave Dictionary of Economics, 2008). Based on this perspective, it is important to understand the differences between public debt and private debt and how they affect the economic growth. According to the Elmendorf and Mankiw (1998), the public debt can be analyzed though the conventional view perspective or Ricardian equivalence theory. The Ricardian approach emphasizes the irrelevance of the debt, while the conventional view highlights the aggregate demand in the short time period, while the effect of crowding out in the long run.

Public Debt

The Conventional View

The authors Douglas W. Elmendorf and N. Gregory Mankiw (1998) have published the working paper called Government Debt, where they have described the conventional view. They describe it as the approach agreed by the majority of economists and policymakers. Further analysis of this view is based on the assumption that tax reduction is equal to the increase in debt. In the short run, economists agree that lower taxes cause the increase in households' disposable income as well as consumption. Based on the Keynesian theory, the higher aggregate demand increases national income. Keeping prices and wages constant, higher demand affects the production. Thus, government will increase deficit by the tax cut or government spending growth. To conclude, "fiscal policy affects national income only by changing the supply of the factors of production" (Elmendorf & Mankiw, 1998).

In order to recognize the impact of budget debt on economy in the long run, it is important to understand the budget. The budget constraint for the private sector is

$$Y = C + S + T \qquad (1)$$

where Y indicates national income, C – private consumption, S – private savings, while T – taxes less government transfer payments. If national income is equal to national output, then the budget constraint can be analyzed based on spending:

$$Y = C + I + G + NX \qquad (2)$$

where C is private consumption, I – domestic investment, G – government spending and NX – net export of goods and services. By equalization and rearrangement of these two formulas, the final equation is equal to

$$S + (T - G) = I + NX \qquad (3)$$

where private and public savings are equal to the combination of investment and net exports. Furthermore, the "nation's current account balance must equal the negative of its capital account balance" (Elmendorf & Mankiw, 1998). The definition of the current account is based on the sum of net exports and investment. The current account is positive when the country becomes a net lender to the other economies, while the negative current account is indicated when country becomes a borrower. In more details, negative current account represents, that "investment by domestic residents in other countries" is smaller comparing to "domestic investment undertaken by foreign residents", and can be called net foreign investment (NFI) (Elmendorf & Mankiw, 1998). Thus, the following specification stays that net exports (NX) are equal to net foreign investment (NFI). Thus, the final equation is written as:

$$S + (T - G) = I + NFI \qquad (4)$$

where the private and public savings are equal to allocation of those savings as investment in a domestic or foreign country. First of all, if government decides to reduce taxes, it can affect private savings. In order to keep the balance, the private savings should increase by the exact amount of decrease in public savings. This assumption is based on Ricardian equivalence theory, which will be analyzed later in this paper. However the conventional view claims that private savings increase less comparing to the decrease of public savings, thus the difference leads to the fall in national savings. If the result of left side of equation (4) goes down, the right side has to follow in order to keep the correct equality. The decline in the investment affects the domestic capital stock negatively, while the lower capital stock reduces the production level and income. Furthermore, the marginal product of capital will increase as well as the interest rates and returns per capital. On the other hand, the decreasing labor productivity reduces wages and it means that total income of the household will be lower. Based on the definition, the net foreign investment declines due to the contraction of the domestic resident's investments in a foreign countries or the increasing domestic capital by the foreigners. In both situations, "the capital income of domestic residents will fall"

(Elmendorf & Mankiw, 1998). Moreover, the equality between net foreign investment and net exports indicates that the changes in net foreign investment are the same as changes in the net exports. Thus the lower net foreign investments means that trade deficit is growing. The deficit in the government budget and trade balance at the same time is called twin deficits (Mankiw, 2002). The negative trade balance occurs when total imports of goods and services exceed the total exports. This can be caused by the appreciated domestic currency, which means that domestic goods and services become more expensive comparing to foreign production and services.

Moreover, the government debt can have a significant impact on monetary policy. The high debt requires increasing interest rate. The high interest rates can be reduced by the monetary authorities through expansionary policy, however, it works in the short run. In the long run, real interest rates stay almost the same, but inflation is higher, thus nominal interest rates increase as well. Thus, there is a “possible link between the budget deficit and inflation” (Elmendorf & Mankiw, 1998).

Furthermore, high debt can cause difficulties to borrow more money in order to cover increasing deficit or debt. When it is difficult to borrow money from the external sources, government can decide to increase revenues by using seigniorage. It means that monetary authorities issue more money and increase inflation, which can lead to hyperinflation. Likewise, the higher debt requires increasing taxes, however, higher taxes lead to dead-weight loss. Thus, the other problems will be present.

The possibility of borrowing and covering budget deficit or debt reduces the intentions of policy makers to balance the government budget properly. Feldstein (1995) claimed that “only the ‘hard budget constraint’ of having to balance the budget” can encourage policy makers to evaluate if expenditure’s “benefits really justify its costs”.

The high debt level can make country more vulnerable by the financial crisis and it can lead to the default, especially if the debt is held by foreigners (for instance, the case of some Latin America countries in the 1980s). Thus, it can form the poor image and the reliability of the country as the debtor.

Ricardian Equivalence Theory

Another view, which is more contradicting among economists, is the Ricardian equivalence theory. Robert Barro has analyzed this theory in details. The main idea of Ricardian equivalence theory that the level of the debt is not important and it does not have any effect on the economy. If the government decides to reduce taxes, the most economists will explain that the consumption level will increase, savings will be lower, the capital will accumulate and the growth will be slower in the long run (Elmendorf & Mankiw, 1998). However, the Ricardian theory clarifies that it does not affect consumption, capital or even the economic growth. If government reduces taxes now, the government should know that taxes would be increased in the future. Thus, the citizens would not consume more, but they would be saving more in order to pay for the higher taxes later. Thus, the "decrease in public saving (the budget deficit) will coincide with an increase in private saving of precisely the same size" (Elmendorf & Mankiw, 1998). This idea can be summarized as the combination of government budget constrain and the permanent income hypothesis. The government budget constrain explains, that lower taxes today mean higher taxes in the future, keeping the stable level of government spending. The permanent income hypothesis claims that consumers make their decisions on their income evaluated in the long run: they calculate the present value of their cash flows. The same approach can be explained by government bonds. Robert Barro (1974) said, that if citizens buy bonds, they can earn some income based on the interest, however, the interest is paid by the government, which collects their revenues by the taxes paid by the same citizens. At the end, the wealth is equal to zero.

However, there is some critic about Ricardian equivalence theory. First of all, the theory was criticized due to the overlapping-generations. When government is dealing with the debt today, people know that taxes will be higher in the future, however, it does not specify the time in the future. The higher taxes can be transferred for the generation, which is not even born yet. Diamond and Blanchard have discussed the importance of intergeneration redistribution. Barro disagrees with this opinion and explains that not only altruistic people will care about next generations, but also the current consumers' utility function depends on their own consumption as well as the consumption of future generations. This can be expressed in a formula:

$$V_t = U(C_t) + bU(C_{t+1}) + b^2U(C_{t+2}) + b^3U(C_{t+3}) + \ldots \qquad (5)$$

Moreover, Kotlikoff and Summers (1981) claimed that people tend to leave the inheritance than to consume everything, but they are more "accidental than intentional". Authors Bernheim, Shleifer and Summers (1985) presented model strategic bequest motive which claims that person's utility depends on the bequest directly. Thus, there can be other reasons for bequest such as expectations of frequent visits, but not increased taxes in the future.

Although Ricardian equivalence theory is contradicting, there is one more argument why government debt does not matter for the aggregate variables. The lower taxes encourage "consumption, crowd out the capital and raise the real interest rate for some time, but if the family will respond by increasing saving the capital stock and real interest rate return to their former levels" (Elmendorf & Mankiw, 1998). Thus, it explains better the economic behavior in the long run rather short run. However, this argument was criticized by Poterba and Summers (1987), who claimed that there is a possibility that government reduces taxes, issues bonds and after certain period increases taxes on the interest payments. Thus, the government debt can be almost repaid by the same generation, if taxes would be high enough. In this case Ricardian equivalence theory is not valid explanation for the short-term period.

The second argument against Ricardian theory is the market imperfection. The young people, who expect the much higher income in the future, may tend to borrow now for their consumption purposes even with the possibility of default. However, if the expectations do not come true, the higher taxes in future will encourage reducing the consumption or borrowing more. If the government debt should be equal to national income (based on the Ricardian theory if the government debt would be equal to zero), then many citizens' wealth would be negative. Thus, it is likely that public debt encourages the consumption of some households more than they would be consuming otherwise.

Furthermore, the question arises if growth of government debt can be infinite. When government reduces taxes and issues bonds, after some time period government can issue new bonds in order to repay the interest. This example is similar to well known Ponzi scheme, when new instruments are issued to cover the liabilities for the previous investors. In the case of government debt, it is important at which rates the interest rate of government debt and the market are growing. If the interest rate of government debt is growing faster than the growth of economy, the debt will continue to increase and it will be difficult to find new buyers for the bonds. Tirole (1985) claim that it is possible to apply Ponzi scheme for government and it can be beneficial due to the reduced possibility of over-saving. Thus, Ricardian theory leaves the possibility of permanent postponement of tax growth and increasing government debt.

Moreover, the consumer does not evaluate their income uncertainty properly. Such authors as Kimball and Mankiw (1989) claimed that government by reducing taxes does not change the consumers' expectations about future income, but reduces uncertainty in the future. In other words, "consumers discount risky uncertain income and uncertain future taxes at a higher rate than the interest rate on government bonds", thus consumers tend to spend more (Elmendorf & Mankiw, 1998).

The Ricardian theory does not evaluate the effect of myopia. People usually are not foresight and do not think about the tax rates in the future. Thus, the myopia can lead to pure evaluation of consumer's ability to consume and the necessity to save.

Despite all arguments above, there are couple of reasons why it was important to describe this theory. Firstly, this theory contradicts with the majority of the economist views. Thus, it leads to further discussion and debates about the macroeconomic phenomena, which is difficult to testify. Last but not least, this theory can be also understood as the theoretical benchmark, which can be used for the analysis of government debt (Elmendorf & Mankiw, 1998).

The Importance of Private Debt

Researchers such as Kumar and Woo (2010) or Panizza and Presbitero (2012) were concentrated on the analysis of government debt. The high attention for the debt, particularly for the public debt, can be encouraged by Fama, who introduced the concept of efficiency market in 1960s. Fama (1970) explained, that the private debt does not matter for the economy, because the level of private debt is always correct and it does not encourage any market anomalies or bubbles. On the contrary, based on the assumptions of rational expectations and no uncertainty, Stiglitz (1990) claimed that "in the absence of a complete set of futures markets, extending infinitely far into the future, no market forces could ensure that the economy would not set off on a path with a bubble". The idea of the efficient market hypothesis was supported by more economists, evaluating the amount of the papers analyzed the impact of public debt on economy, while claiming that private debt does not have any influence. However, the financial crisis in 2007 – 2008 encouraged reevaluating the insignificance of private debt. The recent European sovereign debt crisis started with the collapse of Iceland's banking system in 2008. As the world became closely integrated and globalized, the collapse of Kaupthing bank (Iceland) followed after the Lehman Brother's collapse in the U.S. Thus, this encourages analyzing the causes of financial crisis in the U.S.

Global financial crisis emerged in the U.S. as a cause of the sub-prime mortgage business failure. Individuals without sufficient income or assets were given high-risk loans by local banks with the assistance of mortgage brokers based on the assumption that housing prices will keep growing. These loans, bonds or assets were bundled into portfolios, called collateralized debt obligations (CDOs), and sold globally. This created the strong connection between East and West and channel for the enormous savings of fast growing economies of Asia, Russia and the Middle East to buy homes and companies in the West. This is the explanation for the impact of the crisis, which begins in the U.S., in the Europe. Due to the investors' losses, the demand for the CDOs declined, while the lending process became stricter even for other banks or institutions. The capital of banks became diminished due to the losses and it created liquidity crisis, which occurred, when it became difficult to obtain cash for the daily operations. Thus, the debt of the private sector led to the financial and economic crisis in the world, which also encouraged the sovereign debt crisis.

In addition, based on the analysis of the Central and Eastern European countries, which belong to the European Union, the countries have signed the Maastricht treaty. According to the criteria of the Maastricht treaty, the public debt in the countries cannot exceed the limit of the 60 percent of gross domestic product (GDP). Based on this criterion, the public debt has the boundaries to fluctuate over the time, however, the private debt can rise and fall unpredictably. The historical data analysis of ten CEE countries proves that public debt on average fluctuates between 25 to 44 percent of GDP for the last 12 years, while the minimum value of the private debt (as the average of the region) reaches 44 percent of GDP and reaches the peak by exceeding the level of 100 percent of GDP (see, Figure 1). Moreover, the private debt was growing from 2001 until the beginning of the financial crisis, while during the same period, the public debt was decreasing.

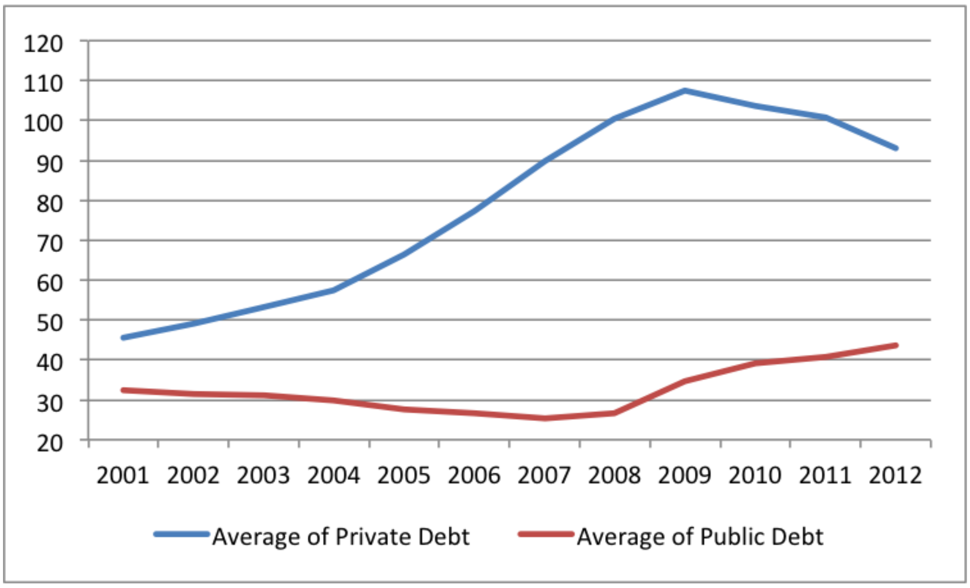

Figure 1. Average of private and public debts in CEE, % of GDP (2001 - 2012). Author's calculations based on the data from Eurostat.

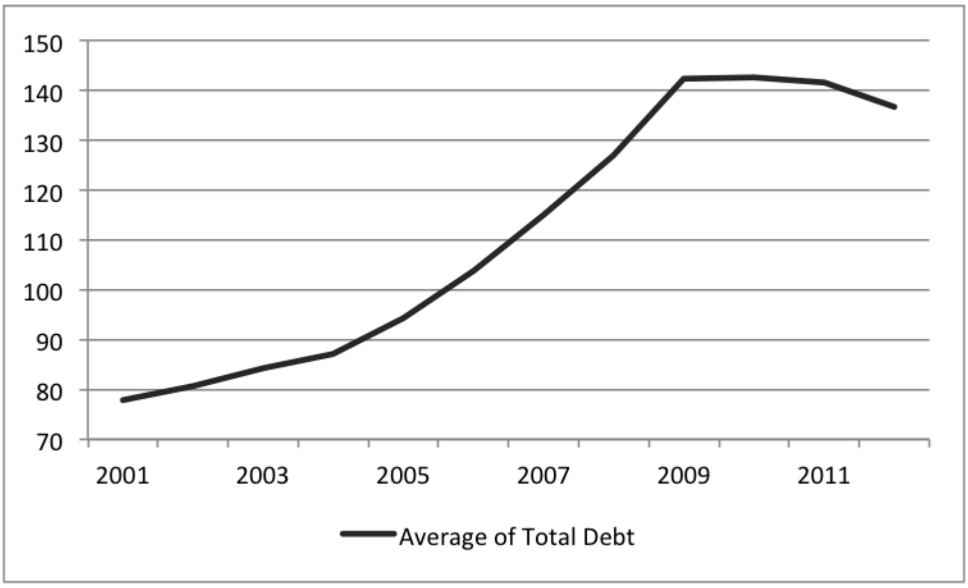

Figure 2. Average of total debt in CEE, % of GDP (2001 - 2012). Author's calculations based on the data from Eurostat.

Despite the difference in movements, the trend for the total debt is increasing (see, Figure 2). After the financial crisis, the private debt started falling down, while the public debt was increasing. When the recession period began the government started to borrow due to declining demand of the private debts. This is the explanation based on the Keynesian approach for the encouragement of aggregate demand during recession.

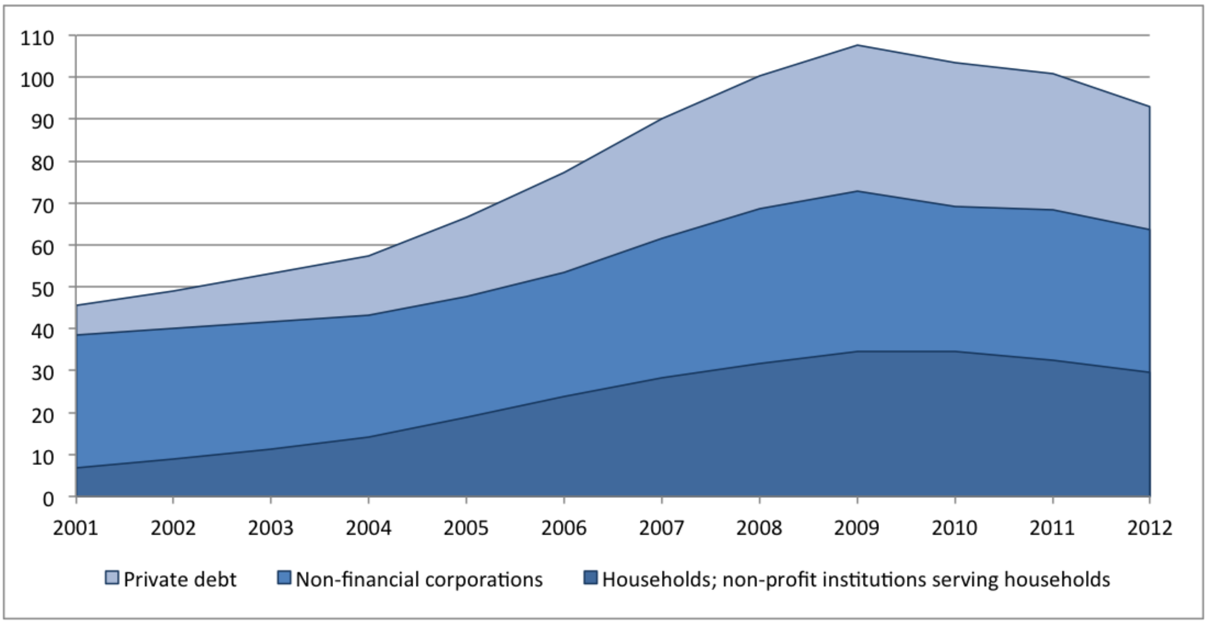

Figure 3. Decomposition of private debt in CEE, % of GDP (2001 - 2012). Author's calculations based on the data from Eurostat.

The difference between private and public debts is based on the growth: private debt grows faster. The separation of private debt into non-financial corporate and household debts reveals that the growth rate of corporate debt as well as the household debt is higher comparing to the growth rate of public debt (see, Appendix 1). Thus, as the debt keeps growing and the growth of private debt is larger, it is necessary to analyze the reasons and consequences of increasing private debt (see, Figure 3).

Financial Instability Hypothesis

People usually borrow money for several reasons: to buy assets such as house or car, pay for losses or previously taken loan or even to cover unexpected expenditures, such as medical expenses. The company can borrow to pay their liabilities for workers, tax authorities, cover their previous loans, but usually the business investment requires additional financial sources. The effect of the private borrowing is described in the hypothesis of financial instability by Hyman Minsky (1992). The financial instability theory is the combination of the Keynes's general theory and J. Schumpeter's credit view of money. Minsky (1992) claimed, "capitalist economies exhibit inflations and debt deflations which seems to have the potential to spin out of control". In such situations, the inflation encourages higher inflation, while the debt deflation encourages the growth of debt deflation. Thus, this idea contradicts with the assumption of sustainable economic system and economic equilibrium.

Minky explained the Keynesians idea of the capital development of the economy through the "exchange of present money for future money" (Minsky, 1992). The present money is used as a resource for the production in order to earn money in the future as a profit. Thus, the present and future money is connected through the time perspective. The money flows from depositors to the corporates represent the expectations of investors for future profit. In the modern society, the financial relations between households, government, international units and corporates become intertwined and volatile. Minsky explained, that the government becomes more integrated into financial relations in order to minimize "the down side vulnerability of aggregate profit flows", but, on the other hand, governmental interventions can encourage higher inflation (Minsky, 1992). In addition, the financial instability theory emphasizes the importance of banking sector. In contrast to quantity theory of money, the banking sector is acting as profit seeking intermediary, which is aware of profitable innovations. Author identifies three types of financing: hedging, speculating and Ponzi financing. First, the hedge financing is based on the fulfillment of obligations by the cash flows: "the greater the weight of equity financing in the liability structure, the greater the likelihood that the unit is a hedge financing unit" (Minsky, 1992). Second, speculative units are those, which can repay their obligations by their income account, even they cannot repay the principal by their cash flows. In such case, the solution is to issue the new debt.

Third, the Ponzi units do not have sufficient finance to pay for principal or interest due to the lack of the cash flows. They might to sell their assets or borrow more, thus the liabilities increase, while the value of equity decreases. As the result, the probability of default increases. These three types of financing have different effect for the economy. It can be proven, that the dominance of hedge financing can lead the equilibrium seeking economy, while speculative and Ponzi financing can encourage the deviation from sustainable economic and equilibrium. To sum up, there can be derived two theorems of the financial instability hypothesis. First, the stability of economy depends on the financing regimes. Second, the stable system of financial relations can become unstable system even in the extended prosperity periods. For instance, during the good times, the hedging can be changed by speculative or Ponzi financing in the capitalist economies. However, the financial instability theorem does not include the exogenous effects into the business cycles. This theory assumes that “business cycles of history are compounded out of (i) the internal dynamics of capitalist economies, and (ii) the system of interventions and regulations that are designed to keep the economy operating within reasonable bounds” (Minsky, 1992).

Debt Deflation

In 1933, Fisher claimed that debt and deflation are more significant variables than the sum of other indicators, such as over-production, under-consumption, over-saving, over-spending, over-investment, or even over-confidence, during the boom and depression periods and analyzed the reasons for over-borrowing. The economist would agree with Minsky, the main cause for borrowing is the prospective profit from new inventions, industries or developments. By analyzing the debt in 1929, the reasons for debt can also be domestic or foreign wars, reconstruction loans or low interest policy. The psychological effect is significant as well. The lending and borrowing can be encouraged by the great dividends or gains in the future, selling (for instance, house) at a profit, expectations of promotion at work or even the downright fraud, when loans are given for trustful public. However, the high debt affects economy significantly. Fisher analyzed the effect of over-indebtedness through nine variables: debts, circulating media, their velocity of circulation, price levels, net worth, profits, trade, business confidence, interest rates (Fisher, 1933). First of all, if debt has to be liquidated, the borrower starts to sell assets in order to fulfill his obligations. The repaid loan leads to contraction of deposit currency and slower velocity of money. As a result, the decreased selling reduces the price level. The lower amount of sales decreases the net worth of the companies and the probability of them going bankrupt increases. In addition, the reduced sales have a negative effect on profit and reduce the production level, trade and employment. All these causes decrease the confidence level and encourage saving more. This means that velocity of circulation slows down even more. Finally, the interest rates become affected: nominal interest rates decline, while the real rates rise. The consequences of over-indebtedness will be lower if the "over-indebtedness stands alone, that is, does not lead to a fall of prices, in other words, when its tendency to do so is counteracted by inflationary forces (whether by accident or design)" (Fisher, 1933). However, one of the Fisher's called diseases – debt or deflation – acts and responds to each other and can have a serious consequences for the economy. The deflation increases debt. In more details, the liquidation reduces the number of money owed, but the value of money increases faster. It leads to a paradox: "the more the debtors pay, the more they owe" (Fisher, 1933). However, economy works in cycles and after the bankruptcies, the debt stops growing and recovery period begins, which later will lead to a new recession. Fisher (1933) identifies it as a "natural" way out of depression with consequential bankruptcies, unemployment and starvation.

Recent Studies Based on the Effect of Debt on Economic Growth

After the financial crisis of 2007 – 2008, the impact of debt on economy becomes one of the most frequent topics for the discussions and many economists try to identify the impact of the debt and the channels through which debt affects economy. The European sovereign debt crisis and financial crisis, which began in 2007 in the U.S., remind that debt can have a significant impact on the economy and researchers started to analyse what is the threshold level, which sets the turning point for the relation between debt and economic growth.

The analysis of public debt began even before the debt crisis. First of all, Patillo, Poirson and Ricci (2004) analyzed weather the “debt affects growth through factor accumulation or total factor productivity” by using data from 61 developing countries. The authors found that the nonlinear relationship between debt and growth exists. In other words, the low debt level has a positive effect on economic growth and there exists a threshold level after which additional percent of debt reduces economic growth. The researchers analyzed debt as a percent of GDP and percent of export. Thus, the threshold level is indicated between 160 – 170 percent of exports or 35 – 40 percent of GDP. Moreover, they found that if the debt would be doubled in countries where debt is already high, the GDP growth would be lower by 1 percent, while physical capital and total factor productivity would decline by even lower percent. Finally, Patillo, Poirson and Ricci suggested to investigate more deeply and analyze even the quality of the policies in the countries and the importance of the debt flows.

In 2004, Alfredo Schclarek analyzed the debt and economic growth in developing and industrial countries and improved Patillo’s research by analyzing the public external debt as well as private external debt. The data set consisted of 59 developing countries and 24 industrial countries. The author applied the GMM dynamic panel data estimator for linear and nonlinear effects on GDP growth and used “robust one-step estimates of the standard errors, which are consistent in the presence of any pattern of heteroskedasticity and autocorrelation within panels” (Schclarek, 2004). The model was tested with four dependent variables in order to identify the determinats of growth: GDP per capita growth rate, total factor productivity growth rate, capital accumulation growth rate, and private savings rate. Schclarek came up with the conclusion that low total external debt levels lead to high growth rates in developing countries. The paper did not find inverted U-shape relationship between debt and growth, but this negative relation is the cause of the public external debt. Furthermore, analysis revealed that the debt is affected mainly thoughout the capital accumulation growth, while the evidence of effect of total factor productivity growth is limited. However, the analysis of industrial countries did not indicate any statistically significant relationship between two variables.

Cordella, Ricci and Ruiz-Arranz (2005) analyzed the debt impact on growth in 79 developing countries. Authors questioned whether highly indebted poor countries (HIPC) suffer from debt. In addition, the researchers tried to answer the question based on the policies applied in the countries. It was recommended in previous paper written by Patillo, Poirson and Ricci (2004). The two dependent variables were analyzed: nominal debt and net present value of total external debt. In order to measure the effect of policy, the new variable with the values of 1 to 5 (5 being the best policies) was introduced as the country policy and institutional assessment index. The OLS regression and General Methods of Moments (GMM) system estimator were tested. Authors chose the GMM model because it "allows to control for unobservable (or omitted) country-specific factors, and reduces the potential bias in the estimated coefficients, at the same time, it controls for the potential endogeneity of some of the explanatory variables" (Cordella, Ricci, & Ruiz-Arranz, 2005). The results indicated that the countries with better policies and institutions "face a debt overhang when debt exceeds 15 – 30 percent of GDP (debt overhang thresholds)", but they are dealing with negative marginal effect of debt until the debt of 70 – 80 percent of GDP (Cordella, Ricci, & Ruiz-Arranz, 2005). When the debt exceeds this limit, the marginal effect of debt on growth becomes zero. The countries with worse policies and institutions have similar thresholds, but at the lower levels. The debt overhang theshold level is between 0 and 20 percent of GDP, while the debt irrelevance threshold is around 15 and 53 percent of GDP. However, authors did not find statistically significant relationship between debt and growth in HIPCs.

After 5 years, Kumar and Woo analyzed the impact of high public debt on the long-run economic growth in developed and developing economies. The pooled OLS, robust regression, between estimators, fixed effects panel regression and system GMM dynamic panel regression models were implemented. Authors ran all these tests in order to reduce the possibility of bias results and other econometric issues. The econometric analysis revealed the inverse relationship between debt and growth. Additional debt of 10 percentage point leads to reduction of annual growth by 0.2 percentage points per year (Kumar & Woo, 2010). The statistically significant negative effect on a growth was found, when the debt exceeds 90 percent of GDP. This effect was identify throughout lower labor productivity, investment and capital stock. The debt effect was stronger on the developing countries rather advanced economies.

The most widely discussed research paper was written by Carmen M. Reinhart and Kenneth S. Rogoff (2010). Authors claimed that the relation between public debt and economic growth is similar in developed and developing countries. The public debt up to 90 percent of the GDP does not have a strong effect on growth, but the higher debt, that exceeds this threshold level, reduces GDP growth by 1 percent. One of the differences between emerging and advanced economies, that inflation level is significantly higher in emerging economies when the public debt exceeds 90 percent of GDP. Another difference is based on the currency of debt. As the developing economies usually have debt in foreign currency, this leads that economic growth in that countries falls down by 2 percent if the gross external debt exceeds the threshold level of 60 percent of GDP. Moreover, if the debt exceeds the boundary of 90 percent of GDP, the economic growth declines by the half of previous growth level. For the advanced countries, which issue debt in their domestic currency, the threshold level is likely to be even higher.

Later, Cecchetti, Mohanty and Zampolli (2011) extended the impact of debt by including the private debt into the analysis as well. The research was based on the regression model, which consisted of regressors such as gross savings, population growth, schooling, dependency ratio, openness to trade, CPI inflation, financial development and dummy variable for banking crises. They found that the threshold level for government debt is 85 percent of GDP, for corporate debt is 90 percent, while for household the threshold level is around 85 percent of GDP. Authors predicted that the ageing of population may reduce the economic growth, increase interest rates and be a cause of debt unsustainability. Thus, the government should be prepared for the unexpected shocks and keep the debt level below the threshold level of 85 percent of GDP, while the private sector should increase their savings.

The negative correlation between growth and debt was found by Panizza and Presbitero in 2012. Authors applied instrumental variable regression model for OECD countries. The instrumental variable regression was chosen based on “the fact that, in the presence of foreign currency debt, changes in a country’s exchange rate have a direct and mechanical effect on the debt-to-GDP ratio” (Panizza & Presbitero, 2012). As analysis did not reveal the structural break or threshold as Reinhart and Rogoff have found, the data were divided into the countries with low and high debt levels. The results proved that the negative correlation between debt and growth dissapears when authors instrumented “debt with a variable that captures valuation effects brought about by the interaction between foreign currency debt and exchange rate volatility” in countries with low debt (Panizza & Presbitero, 2012). However, as authors’ results are contravertial, the debt effect on growth requires more investigation.

Problem Definition

Based on the theoretical and empirical analyses, it is clear that the impact of public debt on growth are widely discussed, but there is not consensus on the debt effect on economy. The governmental authorities implement the restrictions on the public debt, but the private debt is not regulated. The historical data reveal that the public debt fluctuates up to average of 44 percent of GDP in the CEE region, while the strongest impact on total debt has the fluctuations in private debt, which consists of household and corporate debts. In the first half of XX century, Minsky and Fisher explained that the private debt can create booms in economic cycles. The innovations and the ability to earn profit from them encourage the households, companies and even banking sector to borrow and lend. The human expectations and greed motivate to accept more risk and speculate. As Fisher explained, the speculative and Ponzi financing can encourage the deviation from sustainable economic growth and equilibrium. Thus, there arise the couple of questions, which can be answer by the hypotheses testing. First hypothesis testifies whether the debt has impact on economic growth in the CEE region. In order to testify and determine the most affected part of economic growth, the implementation of Solow growth model allows dividing growth into capital stock, human capital and TFP growth. Second hypothesis identifies whether the impact of private debt is significant. The regression analysis would allow identifying which debt, private or public, influences economy more. The more significant impact of private debt encourages thinking about the regulations on the private debt.

Research Methodology

The aim of this section is to present the methodological approach, that will be applied for the empirical testing, and provide the justification of selected methods. This part includes the description of the sample and selection of it, as well as the description of the model applicable for the econometric analysis. The methodological approach is provided in the Figure 4.

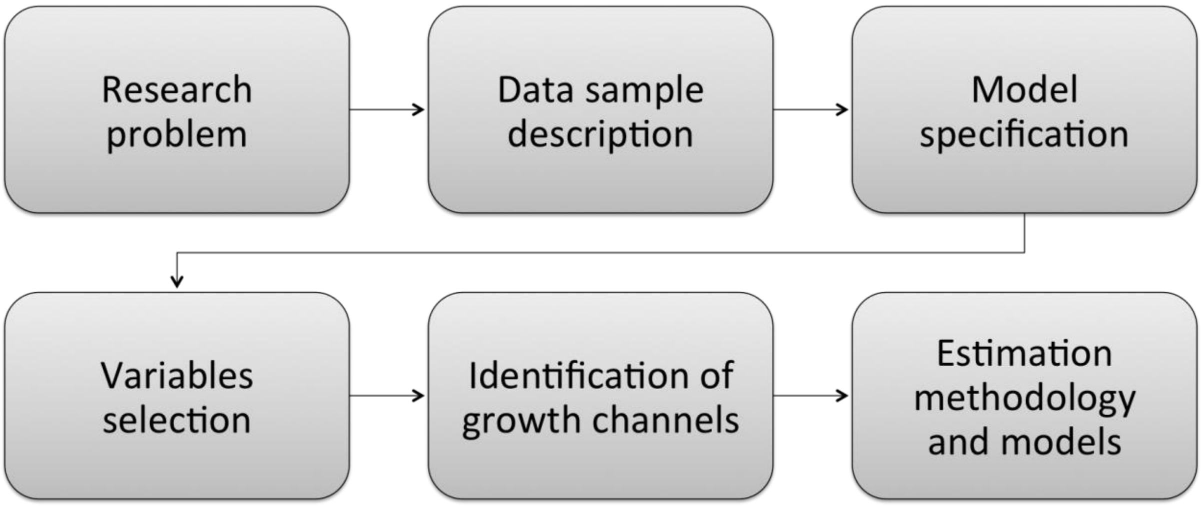

Figure 4. Methodological approach.

Data Selection

The previous analyses covered the majority of the advanced economies, while some of them included emerging economies from South America and Asia. Due to the lack of analysis of Central and Eastern European economies, the ten countries from this area are chosen: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic and Slovenia. Another reason for this choice is the availability of the data. The data for the other Central and Easter European countries are not publicly available. The research is based on the data set of the ten countries from the year 2001 until 2012. The data are provided yearly, thus the analysis consists of 12 periods for each variable.

The data are selected from the statistical databases of Eurostat, World Bank and Central Banks of the chosen countries. The debt, which is divided into public and private, is provided in Eurostat database. The private debt is divided into two categories: non-financial corporations, households and non-profit institutions serving households (NPISHs). The research is based on the debt impact on economic growth, where the definition of debt is based on the ESA 95, where the private debt consists of securities other than shares, excluding financial derivatives, and loans, while the public debt also includes currency and deposits. Other variables including gross savings, population growth, years of schooling, trade openness, dependency ratio, investment and employment necessary for the calculation of total factor productivity, are available in Eurostat database. However, considering the lack of the recent data of gross savings for Romania, the database of World Bank is used. Last but not least, the average year of schooling in Estonia for 2012 needs to be calculated. The predictable value is calculated by the linear regression model.

Model Specification and Description of Variables

The impact of debt on economic growth in the CEE region can be measured by using quantitative research methods. The econometrics means the measurement in economics (Brooks, 2008). Thus, the econometrics implies statistical techniques to solve problems in economics and testify the validation of the theoretical approaches. The quantitative analysis can be divided into three categories by data: time series, cross-sectional and panel data. Time series data are data collected over a time period on one or several variables. Cross-sectional data analysis is based on the data on one or more variables at a certain, particular point in time. The panel or longitudinal data are based on the combination of time series and cross-sectional data: panel data analyze the several variables over a period of time. Thus, the panel data have several advantages over time series or cross-sectional data. First of all, usually the higher degree of freedom leads to the more accurate econometric estimates (Hsiao, 2006). Secondly, the longitudinal data provide the “greater capacity for capturing the complexity of human behavior than a single cross-sectional or time series data” (Hsiao, 2006). In more details, the complicated behavioral hypothesis can be testified. Thirdly, the panel data control the impact of missing or unobserved variables, thus the effect of omitted variables is controlled. Furthermore, the dynamic relationship becomes revealed due to the reduced collinearity between current and lagged values of variables. The representation of the conclusions as well as predictions can be made more accurate based on the analysis of extensive data set rather narrow scope of observations. Last but not least, the panel data can solve the problem of the nonstationary data, while the ability to transform data can lead to unidentified models and eliminate the measurement errors. Thus, the panel data can simplify the calculations and provide statistically significant inference.

The advantages of the usage of longitudinal data suggest analyzing the impact of debt on economic growth by the econometric analysis of panel data. The empirical research consists of the analysis of ten countries from the year 2001 until 2012. The analysis of debt impact on growth indicates that the dependent variable is growth, while debt is one of the explanatory variables. Other independent variables in the regression model are:

- gross savings as a percentage of GDP;
- population growth;
- years spent in school, which indicates the human capital;
- trade openness, which is calculated as the sum of exports and imports of goods and services over GDP;
- fiscal balance measured as percentage of GDP;
- population structure and ageing is expressed by the dependency ratio, which is the percentage of persons aged 65 and over to the persons between 15 and 64 years old;
- investment ratio, which is the gross fixed capital formation over GDP.

The regression equation based on the response variable and listed explanatory variables can be written in a form of:

$$y_{it} = a_{(it)} + \overset{+}{b_1} s_{it} + \overset{-}{b_2} pop_{it} + \overset{+}{b_3} edu_{it} + \overset{+}{b_4} TO_{it} + \overset{+}{b_5} FB_{it} + \overset{-}{b_6} dep_{it} + \overset{+}{b_7} I_{it} + b_8 debt_{it} + e_{it} \qquad (6)$$

where y_{it} represents the growth, s_{it} - gross savings, pop_{it} - population growth, edu_{it} - schooling years, TO_{it} - trade openness, FB_{it} - fiscal balance, dep_{it} - dependency ratio, I_{it} - investment and $debt_{it}$ indicates debt. The signs above the indicators represent the expected influence of a particular variable on economic growth. The descriptive statistics of each variable are provided in Appendix 2.

First of all, the coefficient of gross savings is expected to be positive. The assumption states that higher savings encourage economic growth throughout investments. This hypothesis is supported by Harrod (1939), Domar (1946) and Solow (1956) growth models. However, the economy grows if investments are used for improvements in labor, capital or research and development (Misztal, 2011). On the other hand, the economic growth can be a reason for increased savings. This idea is compatible with Keynesian model.

Secondly, the population growth has a negative impact on economic growth. This idea is consistent with the "pessimistic" theory, which claims that "population growth restricts economic development" (Bloom, Canning, & Sevilla, 2001). In the XVIII century, Thomas Malthus explained that population is growing in geometric trend, while the subsistence in arithmetic way, thus the difference between population and subsistence in the future "would be incalculable" (Bloom, Canning, & Sevilla, 2001). Thus, the growing population will lead to lower standard of living because of comparatively slow technical progress in agricultural sector and limited supply of land (Dao, 2012). The rapid increase in population requires investments in order to supply the needs of people but it does not increase the living conditions.

Third, the economic growth might be stimulated by more years spent at school. The Solow model explains that the output depends on labor and capital, where labor can be analyzed by years of education or, in other words, schooling. This relationship is provided by modified Solow-Swan model in the next section in more details.

Trade openness effects economic growth positively. Romer (1993) claimed that the countries have higher possibility to implement leading technologies from other countries if countries are more open to trade (Gries & Redlin). In addition, Chang, Kaltani and Loayza (2005) emphasized, "openness promotes the efficient allocation of resources through comparative advantage, allows the dissemination of knowledge and technological progress, and encourages competition in domestic and international markets" (Chang, Kaltani, & Loayza, 2005).

Fatima, Ahmed, Rehman (2012) claimed that the balanced fiscal budget is necessary condition in order to achieve sustainable economic growth. According to the Keynesian model, the budget deficit would have a positive impact on economic growth. If increased government expenditure or tax cutting are the reasons for budget deficit, then customers would have more money and the marginal propensity to consume would increases. This leads to the increase in output and demand of money. Such explanation is based on IS-LM graphical analysis.

Dependency ratio is expected to affect economic growth negatively. Higher dependency ratio reduces economic growth through lower savings and investment levels "in both physical capital (such as roads, production facilities) and human capital (such as lower educational attainment and training for each young worker), particularly for an extended period over which the labor force decreases at a faster rate than the pool of dependent people" (Dao, 2012).

Last but not least, the investment encourages economic growth. Capital accumulation "refers to the process of amassing or stocking of assets of value, the increase in wealth or the creation of further wealth" (Ugochukwu & Chinyere, 2013). The combination of capital stock, such as equipment, buildings and intermediate goods, and labor produces goods and provides services. The investment in capital stock increases the capacity for production, which also increases national income. In macroeconomics, consumption and fixed investment are the main indicators, which encourage the aggregate expenditure. Thus, the increased aggregate expenditure will fuel the growth.

In order to understand the channels through which debt affects economic growth, the dependent variable (growth) is divided into smaller categories: physical-capital accumulation, human-capital accumulation, and total factor productivity growth.

Growth Channels

In order to identify the channels through which the debt and other independent variables affect economic growth, the analysis of growth is based on the function:

$$Y = AK^{a} H^{b} L^{1-a-b} \qquad (7)$$

where K represents physical capital, H – human capital and L is the labor force. Such modified neoclassical Solow growth model was presented in previous papers by Mankiw, Romer and Weil (1992), Pattillo, Poirson and Ricci (2004). The implementation of this model requires making assumptions that the physical and human capital incomes shares α and β are equal to 0.33 for the all analyzed countries. The assumption is based on the Mankiw, Romer and Weil (1992) findings, which were represented by the sample of 98 countries for the time period of 25 years. The analysis separated the OECD region, which could be approximate representation of the CEE region.

In order to calculate the total factor productivity, the equation (7) requires modification. First of all, the variables in equation is modified into the new variables: the growth in output per capita, y, the growth in capital per capita, k, the growth in human capital per capita, h, and improvements in total factor productivity, A. Furthermore, the taking of logs and first differences, leads to the following equation:

$$\ln(y_t) - \ln(y_{t-1}) = \alpha\left[\ln(k_t) - \ln(k_{t-1})\right] + \beta\left[\ln(h_t) - \ln(h_{t-1})\right] + \left[\ln(A_t) - \ln(A_{t-1})\right]. \qquad (8)$$

The implementation of this equation requires calculating the growth in human capital. Based on the Pattillo, Poirson and Ricci (2004) and Bosworth and Collins (2007), the gains from education can be measured by equations:

$$H = (1.07)^s L \qquad (9)$$

$$\text{or } h = (1.07)^s \qquad (10)$$

where s indicates the average years of schooling. This form requires the assumption that additional year of schooling increases returns by 7 percent. This assumption is compatible with the results of Psacharopoulos and Patrinos (2002) analysis. Authors analyzed the returns to investment in education and concluded that the average rate of returns on education attainment in European region is 7.1 percent, while in OECD is 7.5 percent (Psacharopoulos & Patrinos, 2002). Thus, the total factor productivity can be calculated as the residuals by rearranging the equation (8) into:

$$\ln(A_t) - \ln(A_{t-1}) = [\ln(y_t) - \ln(y_{t-1})] - \alpha\left[\ln(k_t) - \ln(k_{t-1})\right] - \beta\left[\ln(h_t) - \ln(h_{t-1})\right] \qquad (11).$$

These calculations are applied for the all ten countries for the yearly data from 2000 till 2012.

Estimation Methodology

Regression analysis is the most commonly used tool for the evaluation of the relationship between two or more variables. It explains how the change in explanatory variables influences the change in the outcome variable. Regression analysis can be applied for the panel data, and then the regression equation can be described in the following form:

$$y_{it} = \alpha + \beta x_{it} + u_{it} \qquad (12)$$

where y_{it} is the response variable, α is the intercept term, β is a vector of coefficients to be estimated on the explanatory variables, and x_{it} is a vector of observations on the explanatory variables, the subscripts t and i represent units of time and cross-sectional units (in this research, countries) with the possible values of t = 1, 2, …, T and i = 1, 2, …, N (Brooks, 2008).

The simplest way to analyze longitudinal data is to use single equation for the whole dataset. The ordinary least squares (OLS) model is suitable for this type of estimations. However, as it is the simplest way to proceed, the model has several limitations. Most important, the OLS provides the derived average values of variables and the relationship between them, which does not change over time or across the countries. Despite this drawback, the analysis of longitudinal data allows studying the broader range of problems and determines common results for several cross-sectional units over the particular time period. Furthermore, the precise estimations require the long time period, while it is more difficult for the macroeconomic data analysis, thus the usage of panel data increases the number of observations as well as the degrees of freedom and the results become more efficient. Last but not least, the application of a certain panel data model can eliminate the omitted variables bias. The panel data can be analyzed by using variety of models as OLS, instrumental variables (IV), fixed effects (FE), random effects (RE) models or generalized method of moments (GMM).

Fixed Effect Model for Panel Data

Fixed effect model is used in order to analyze the impact of indicators, which vary over time. This model examines the relationship between dependent and independent variables within an entity. Fixed effect model allows making an assumption that there are other factors, which may have an influence on explanatory variable, thus they have to be controlled. Those factors could be religion, culture, gender, race, or, based on the model presented in this paper, the political system of a country could influence the economic growth. Thus, fixed effect model includes such factors as remainder disturbance (υ_{it}) which together with an individual specific effect (μ_i) present disturbance term (u_{it}):

$$u_{it} = \mu_i + \upsilon_{it}. \qquad (13)$$

The full equation for fixed effect data set can be written:

$$y_{it} = \alpha + \beta x_{it} + \mu_i + \upsilon_{it}. \qquad (14)$$

Another assumption of fixed effect model is based on the uniqueness of specific effect of every country. In more details, individual specific effect (μ_i) represents "all of the variables that affect y_{it} cross-sectionally but do not vary over time" (Brooks, 2008). In this case, the least squares dummy variable (LSDV) approach could be implemented:

$$y_{it} = \beta x_{it} + \mu_1 D1_i + \mu_2 D2_i + \mu_3 D3_i + ... + \mu_N DN_i + \upsilon_{it} \qquad (15)$$

where $D1_i$ is a dummy variable that takes the value 1 for all observations on the first country in a sample and zero otherwise (Brooks, 2008). The equation (15) does not include the intercept (α) due to possible correlation between dummy variables and the constant.

To conclude, the fixed effects model is "designed to study the causes of changes within" an entity (or a country) (Torres-Reyna).

Generalized Method of Moments

As the time span is quite small, the fixed effects estimator can be inconsistent. In such cases, the instrumental variable (IV) estimator and generalized method of moments (GMM) estimator are widely used (Han & Phillips, 2010). The advantage of GMM model is the ability to combine several instruments (Wooldridge, 2002). This dynamic model of panel data was introduced by Anderson and Hsiao (1981), Holtz-Eakin, Newey and Rosen (1988), Arellano and Bond (1991). The estimations of GMM model are based on: first, differencing regressions or instruments in order to control unobserved effects, second, apply the lagged values of explanatory and response variables as instruments (Chang, Kaltani, & Loayza, 2005). Thus, the general form of equation for GMM model can be expressed as:

$$y_{i,t} = \alpha y_{i,t-1} + \beta' X_{i,t} + \eta_i + \varepsilon_{i,t}. \qquad (16)$$

The elimination of country specific effect requires taking the first differences of previous equation:

$$y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta'(X_{i,t} - X_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}). \tag{17}$$

However, this modification leads to the two problems: first, endogeneity of the explanatory variables and, second, the correlation between the new error term ($\varepsilon_{i,t}$ - $\varepsilon_{i,t-1}$) and lagged dependent variable ($y_{i,t}$ - $y_{i,t-1}$). The model requires to make assumptions that there is not serial correlation of the error terms and the independent variables are weakly exogenous, which mean that the independent variables are not correlated with the future values of error term. The following moment conditions are applied for the GMM estimator:

$$E[y_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad for\, s \geq 2; t = 3,...,T \tag{18}$$

$$E[X_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \quad for\, s \geq 2; t = 3,...,T. \tag{19}$$

The GMM estimator with the two conditions provided above is known as the difference estimator. Alonso-Borrego and Arellano (1996) and Blundell and Bond (1997) explained what statistical drawbacks of difference estimator could arise. The lagged levels of explanatory variables are weak instruments, when those explanatory variables are persistent during time period. This can be a reason for biased results especially if the sample is small. In order to solve this problem, the new estimator can be implemented, which is based on the combining the system of regression in differences and regression in levels (Levine, Loayza, & Beck, 2000). In this case, the additional assumption requires no serial correlation between the differences of the variables and the country-specific effect. The causes of this assumption come from stationarity property:

$$E[y_{i,t+p}\eta_i] = E[y_{i,t+q}\eta_i] \; and \; E[X_{i,t+p}\eta_i] = E[X_{i,t+q}\eta_i] \; for\, all\; p \; and \; q. \tag{20}$$

While the additional moment conditions for the regression in levels are:

$$E[(y_{i,t-s} - y_{i,t-s-1})(\eta_i + \varepsilon_{i,t})] = 0 \quad for\, s = 1 \tag{21}$$

$$E[(X_{i,t-s} - X_{i,t-s-1})(\eta_i + \varepsilon_{i,t})] = 0 \quad for\, s = 1. \tag{22}$$

The application of the moment conditions from the equations (18), (19), (21) and (22) allows to use GMM model and expect the efficient results.

According to the previous researches, majority of them analyzes the long time period and divides it into the smaller period of 3 (as Pattillo, Poirson and Ricci, 2004) or 5 years (as Levine, Loayza and Beck, 2000) for the GMM analysis. Based on the comparatively small time period for the CEE countries, the instrumental variables would be the first order lagged values in order to reduce the possibility of over-fitting bias. It is also beneficial to testify both types of GMM estimator: system and differenced. When the instrumental variables become poor instruments in first differenced regressors, it is beneficial to testify system GMM model (Mileva, 2007). The advantage of system GMM is higher number of instruments and the assumption of correlation between instruments and unobserved effects are applied. The results are usually more efficient using system GMM estimator.

Empirical Research Results

The following section of the thesis provides the empirical research results. In order to estimate the relationship and the effect of debt on economic growth in the CEE region, the results will be provided in the following order. First, the statistical data analysis includes the graphical presentation of dependent variable, time trends and correlation between variables. The remaining part of the empirical research results is based on the statistical testing. To begin with, the impact of total non-financial debt is testified for the economic growth by the OLS, FE and differenced and system GMM estimators. The same models are applied for the capital stock, human capital and TFP growth analysis. Further, the most applicable model is used to testify the impact of different types of debt: public and private, while private is also separated into non-financial corporates and household and non-profit institutions serving households (NPISHs). The detailed analysis of the results is provided below together with the theoretical explanations.

Statistical Data Analysis of Selected Variables

Gross Domestic Product (GDP)

The research is based on the debt impact on economic growth, which is indicated by real GDP per capita growth (further GDP growth). Thus the additional analysis of this variable is required. The Figure 5 provides the growth of GDP of each of the analyzing ten countries for the years of 2006, 2009 and 2012. During the time period from 2001 until 2012, the average of the GDP growth reaches the peak in 2006, while the lowest growth was identified in 2009.

The highest economic growth was captured in Latvia and Estonia with the annual economic growth of 12 and 10.3 percent respectively. The strong expansion of Latvian economy begins in 2001, when the annual GDP growth exceeded 8.4 percent and kept growing at average ratio of 9.9 percent for the following 5 years. The main reason for strong economic growth was domestic demand, "while the contribution of net exports to growth remained negative, reflecting strong imports" (European Central Bank, 2006). The EU accession allowed labor migration, which reduces unemployment rate to 6.8 percent in 2006. However, the emigrated labor force and increasing demand caused labor shortages, which encouraged the growth of wages. In addition, the Latvian household sector debt rose significantly as well. In 2006, the debt to income ratio exceeded 70 percent (see, Appendix 3), which was encouraged by low interest rates and consumption smoothing. This could be a reflection of too high expectations about the economic growth potential in the future. The similar forces encouraged the growth of Estonian economy, where the main indicator of economic growth was domestic demand.

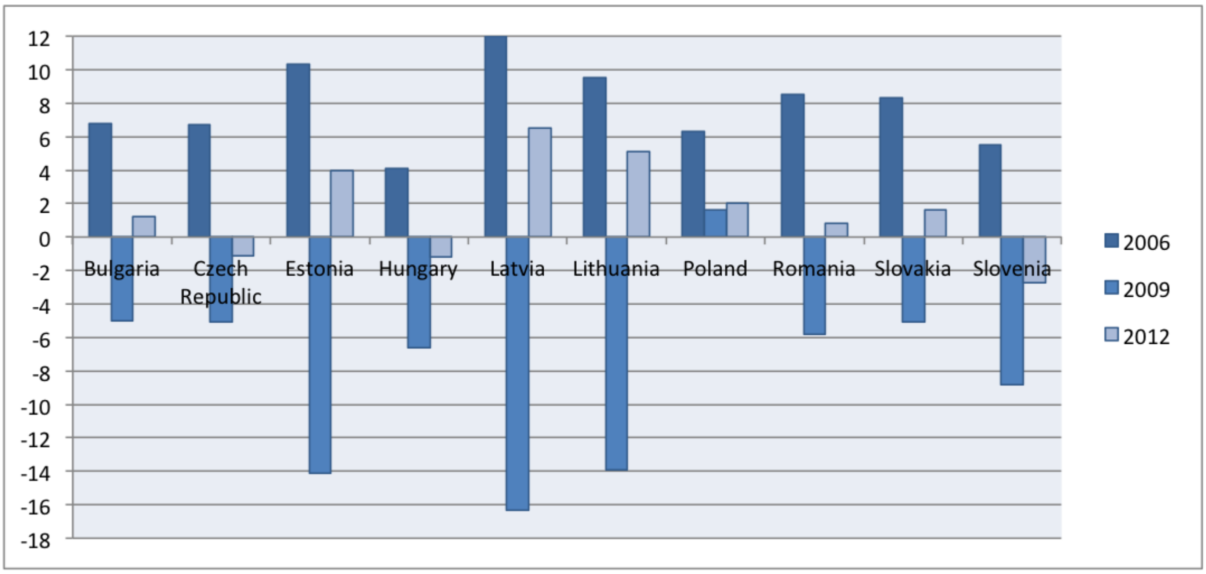

Figure 5. Real GDP per capita growth rates in CEE, (2006, 2009, 2012). From Eurostat.

The strongest consequences of the global economic crisis were noticed in 2009. The GDP growth became negative and reached the average of -7.9 percent in ten CEE countries. Three Baltic countries suffered from the highest decline of GDP growth (-14.1 percent in Estonia, -16.3 percent in Latvia and -13.9 percent in Lithuania). The previous, fast economic growth was a sign of "serious overheating and rising macroeconomic imbalances" (European Central Bank, 2010). In 2007, the Latvian banks reduced lending, while government sought to reduce inflation, thus the economic growth slowed down. The banks faced growing liquidity tensions, which caused balance of payments problems and Latvia was forced to ask for international financial assistance (European Central Bank, 2010). In all three Baltic countries, the consumers' confidence was destroyed and domestic and external demand declined. As a result, the conditions of labor market were affected significantly: wages were reduced, while the unemployment rate jumped to 15.5 percent in Estonia, 17 percent in Latvia and 15.8 percent in Lithuania in 2009. The lower household incomes and the companies' cost-cutting strategy encouraged the consumer prices to go down. The implementation of rigid policies in financial and governmental sectors allowed stabilizing the economic situation in the region.

After 3 years, the economies of three Baltic countries grew at the highest annual rates in CEE. Although, the economy on average grew in all ten countries, the lasting policy adjustments are necessary for many countries. According to the convergence report (2012), the balanced and sustainable economic growth in these countries can be achieved through: 1) lowering public or private indebtedness, which causes the vulnerability of economies and might reduce bank funding; 2) solving the problem of skill mismatches and encouraging labor force participation, "with a focus on high value-added goods and services in the tradable sector"; 3) improving the business environment and the quality of governance institutions.

Time Trends

The aim of this research is to analyze the debt impact on economic growth. The graphical analysis of the total debt in the region reveals that the amount of debt is increasing as the time goes (see, Figure 6). In other words, the ten Central and Eastern European countries become more and more indebted in total. During the twelve years period, the average total debt in the region increased almost twice. Thus, the slope of the trend line is steep with the coefficient of 6.95.

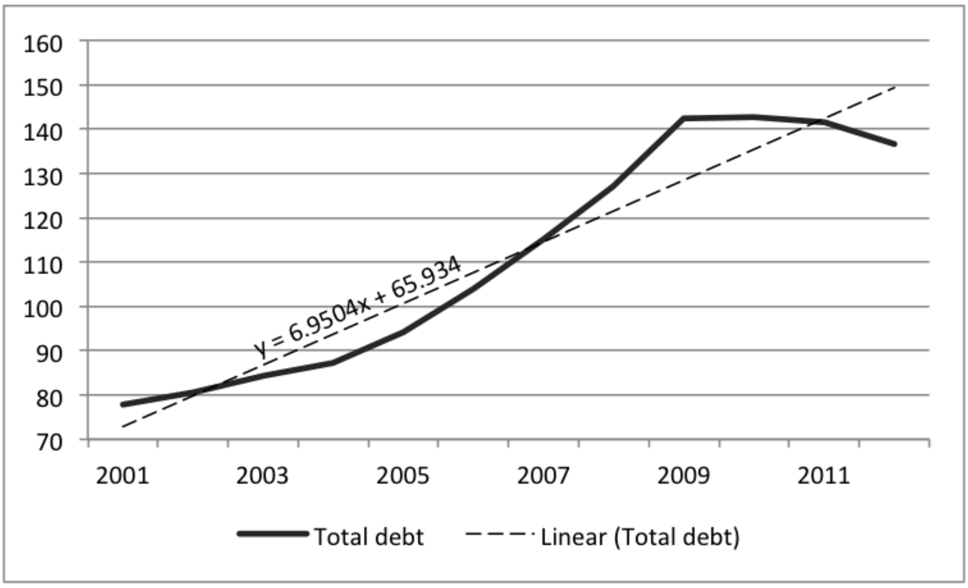

Figure 6. Average of the total debt in CEE with the trend line, % of GDP (2001 - 2012). Author's calculations based on the data from Eurostat.

The deeper analysis of the total debt leads to the debt separation into private and public debts. The trend lines for both types of debt indicate that private and public debts are continuously growing, but the speed of growth is different. The private debt is increasing faster with the slope coefficient of 5.96, while the slope of the trend line for the public debt is only 0.99 (see, Figure 7). However, the graphical analysis of the changes in public and private debts reveals that these two debts move in opposite directions: when the private debt is increasing, the public debt declines and vice versa.

As the research is based on the time period from 2001 till 2012, it includes the global financial crisis. The strongest consequences of this crisis can be distinguished in CEE countries in 2009. Thus, the year 2009 is the breaking point in the graphic, where the public and private debts change the direction of movements. It is important to notice that the movements in private and public debts coincide from 2007 until 2008. The year 2007 was the beginning of the global financial crisis, thus the consequences of financial crisis first hit the public sector. Until the crisis, the curve of private debt was going up with the slope of almost 8, while the public debt went down by 1.

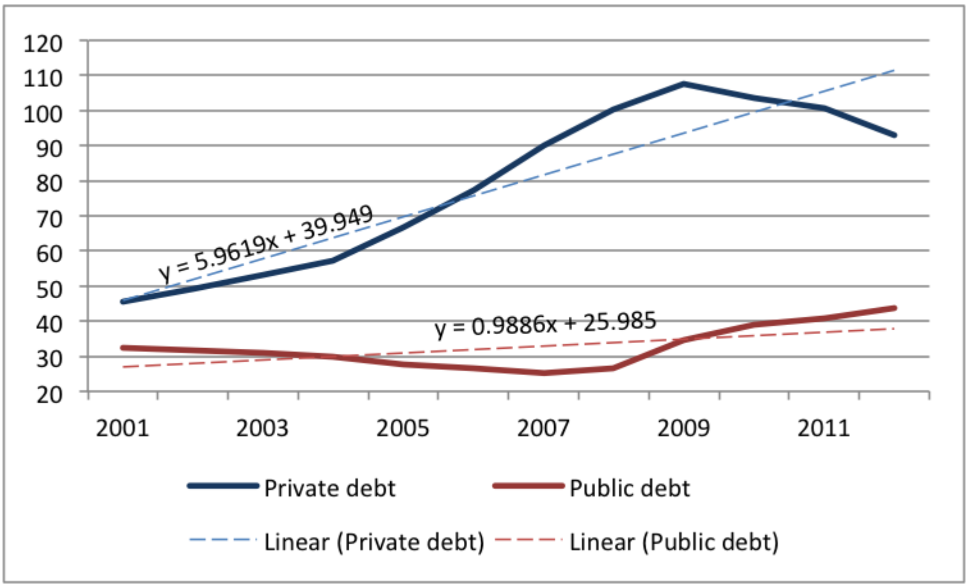

Figure 7. Average of private and public debts in CEE with trend lines, % of GDP (2001 - 2012). Author's calculations based on the data from Eurostat.

The private debt was increasing rapidly due to the growing private consumption spending, which was encouraged by increased wages and disposable incomes and low interest rates. The other part of private debt, the debt of non-financial corporations was stimulated by the low interest rates as well, which create the favorable opportunities to borrow and invest. The decision to invest was strongly supported by the inflows of foreign direct investments and expectations of further growing demand. Based on the convergence criteria for the euro area, “the average nominal long-term interest rate cannot exceed by more than 2 percentage points that of, at most, the three best performing Member States in terms of price stability” (European Central Bank, 2008). During 2007 – 2008 the reference value for long-term interest rate was 6.5 percent, while the interest rates in 4 analyzing countries (Bulgaria, Czech Republic, Lithuania and Slovakia) were lower by more than 2 percent (European Central Bank, 2008). Hungary and Romania exceeded this average by almost 0.5 percent (European Central Bank, 2008). After the crisis, the lending conditions were tighter, thus the slope of trend line for the private debt become negative with the value of -4.64. The reference value for the long-term interest rates was equal to 6 percent after the crisis. However, the long-term interest rates in Latvia and Lithuania fluctuated between 12 and 14 percent during the years 2009 – 2010 (European Central Bank, 2010). The high interest rates caused the higher demand for government bonds. Thus the public debt during that time increased with the slope of trend line equal to 2.81. Later the interest rates became closer to the reference value, while the banks applied "responsible lending guidelines" in order to reduce the risk of new lending booms, thus the lending starts to increase slowly again (European Central Bank, 2012).

Correlations

The trend of the average of total debt in the region is going upwards every year, while the real GDP growth fluctuates from –16.3 to 12 percent during 12 year period. The correlation between real GDP per capita growth and debt measures the degree of linear association between them (Brooks, 2008). The correlation coefficient between two variables is negative and moderately strong (-0.5) (see, Table 1). The separation of debt into the public and private debts reveals that the correlation between public debt and GDP growth is weak with the negative correlation coefficient of –0.29.

The further analysis of private debt separates corporate and household debt. The stronger negative linear association can be distinguished between household debt and GDP growth (see, Appendix 4). Significant positive correlation appears between GDP growth and fiscal balance and investment with the correlation coefficients of 0.52 and 0.32 respectively (see, Table 2). The relationships are logical. First, higher investments encourage the progress of technology and innovations which lead to higher productivity and greater amount of produced output. Second, the government spending is one of the main components of GDP. The aim of expansionary fiscal policy is to stimulate economic growth and reduce unemployment level, while the contractionary fiscal policy seeks to slow down the economic growth. If the government encourages economic growth through expansionary fiscal policy, the government spending increases due to investments. However, the growing expenditure increases current budget deficit, while the deficit can be reduced in the long run. Eisner (1989) explained that the budget deficit stimulates the output, but the effect of growing output can be noticed after one year.

Table 1

Correlation between real GDP growth and debts

	GDP growth	Total non-financial debt	Government debt	Private debt	Corporate debt	Household debt
GDP growth	1.00					
Total non-financial debt	-0.50	1.00				
Government debt	-0.29	0.49	1.00			
Private debt	-0.42	0.88	0.01	1.00		
Corporate debt	-0.37	0.84	0.02	0.96	1.00	
Household debt	-0.40	0.73	0.00	0.84	0.65	1.00

Note. Author’s calculations.

There are other significant correlations among variables. The correlation coefficient between population growth and gross saving is positive, but weak (0.32). This relationship is logically explained based on the increasing need of savings for pensions. The population growth is negatively related with dependency ratio. In more details, the population grows when birth ratio exceeds death rate, thus the dependency ratio declines due to increased population of people aged from 15 till 64 years old comparatively with the changes of population of 65 years and over.

Table 2

Correlation matrix between variables included in regression

	GDP growth	Gross savings	Population growth	Schooling	Trade openness	Fiscal balance	Dependency ratio	Investment	Total non-financial debt
GDP growth	1.00								
Gross savings	-0.19	1.00							
Population growth	-0.18	0.32	1.00						
Schooling	-0.14	0.20	0.21	1.00					
Trade openness	0.02	0.19	0.24	0.24	1.00				
Fiscal balance	0.52	0.02	-0.08	-0.05	0.20	1.00			
Dependency ratio	-0.10	0.01	-0.43	0.26	0.09	0.30	1.00		
Investment	0.32	0.30	0.08	-0.04	0.10	0.37	0.06	1.00	
Total non-financial debt	-0.50	0.08	0.14	0.35	0.42	-0.14	0.42	-0.18	1.00

Note. Author's calculations.

The trade openness creates the possibility to acquire foreign resources for economic development, thus the linear relationship between trade openness and debt level is positive and moderate strength (0.42). The same correlation coefficient is indicated between debt and dependency ratio. The deeper analysis of this correlation reveals that dependency ratio is negatively correlated with public debt (-0.23), while positively correlated with private debt (0.61) (see, Appendix 5). When the dependency ratio increases, more people are requiring pensions benefit (in a case of fixed retirement age), while the amount of people, who are working and paying income taxes, declines. Thus, the taxes have to be increased in order not to increase the debt. On the other hand, the correlation between private debt and dependency ratio is positively strong. The shortage of working people might lead to wage inflation, which requires funding for the salaries. Such allocation of the funds might reduce capital investment and productivity, which means that the economic growth might slow down. As the correlation explains the linear association between variables, the further analysis is based on the regression in order to identify the effect of independent variables on dependent variable.

Panel Data Analysis

The models described in the methodological part are applied for the panel data analysis in order to determine the impact of debt and other variables on GDP growth in CEE. The complete results of the statistical data analysis are provided in the appendices due to the extensive data comparison, while the summarized conclusions are provided in the following subsections. In order to understand impact of debt on economic growth, first, the impact on total growth is analyzed, while the following parts are based on the separate part of growth: capital stock growth, human capital growth and TFP growth. Last but not least, the division of debt into smaller samples indicates which kind of debt affects economic growth significantly.

Real GDP per Capita Growth

The impact of total non-financial debt on economic growth is analyzed by using OLS, fixed effect model and differenced and system GMM models, which provide the comparison of different statistical approaches. The results are provided in Appendix 6. First of all, the OLS model is the most restrictive model, which specifies constant coefficients. If the classical assumptions are violated, the OLS model can provide biased and inefficient results. The problem of inefficiency can be caused by the correlation of errors within unit or time period. Thus, the fixed effect model is more applicable. This conclusion is supported by panel diagnostic, higher R-squared and log-likelihood values.

The differenced GMM model should provide important advantages for the analyzing economic growth. The model eliminates property of biased in estimators, while usage of “instrumental variables allows parameters to be estimated consistently in models which include endogenous right-hand-side variables” (Bond, Hoeffler, & Temple, 2001). Even more plausible results can be provided by using system GMM model. “The system estimator exploits an assumption about the initial conditions to obtain moment conditions that remain informative even for persistent series, and it has been shown to perform well in simulations” (Bond, Hoeffler, & Temple, 2001). Thus, this model is usually recommended for the economic growth analysis. However, the GMM model can be inappropriate if the instrumental variables are weak or number of time series observations is small. The p-values for Sargan test and AR (2) value indicate that there are problems with both GMM estimators (see, Table 3). The null hypothesis of Sargan test identifies if the instrumental variables are valid. The low p-values for Sargan test require to reject this hypothesis. Thus, the model or instrumental variables should be reconsidered. Furthermore, the GMM model provides the values for the Arellano – Bond test. This test is applicable for differenced residuals and testifies whether there is no autocorrelation. The value of AR (1) usually rejects the null hypothesis, thus the AR (2) value is more important due to the identification of autocorrelation in levels (Mileva, 2007). The AR (2) test rejects the null hypothesis of no autocorrelation at 10 percent significant level, while the autocorrelation cannot be rejected at 1 and 5 percent significance levels (see, Table 3). As the model does not satisfy the conditions of proper instrumental variables identification and no autocorrelation of residuals, the most applicable model in this case would be the fixed effect model. The classical assumptions for the fixed effect estimator are testified and the normality of the residuals is provided in Appendix 7.

Table 3

Significance of GMM estimator for GDP growth

	DIFF-GMM	GMM-SYS
Observations	100	110
P-value for Sargan test	0.0073	0.000
AR (2)	0.0955	0.0631

Note. Author’s calculations.

Based on the results of the fixed effect model, the total non-financial debt has negative impact on economic growth (see, Table 4). In more details, 1 percent increase in total debt reduces economic growth by -16 basis points of GDP. The increasing debt can have negative impact on economic growth in both, short and long time periods. In the long run, the increasing budget deficit reduces the public savings, while the increase in the private savings does not cover appeared difference. As the result, the national savings decline as well as the total investment, which has a negative impact on GDP growth. The output decreases due to shrinking capital stock and productivity as well as increasing interest rates. Thus, the distortionary tax system can be a cause of negative debt impact on future's GDP (Panizza & Presbitero, 2013). The total debt can influence GDP growth negatively in the short run due to the increased uncertainty of inflation or financial repressions.

Table 4

Fixed effect model for real GDP per capita growth

Constant	Gross savings	Population growth	Schooling	Trade openness	Fiscal balance	Dependency ratio	Investment	Total non-financial debt	RGDP growth (-1)
-6.28	-0.05	-0.02	-0.47	0.38***	0.57***	0.11	0.59***	-0.16***	-0.39***
(8.159)	(0.159)	(0.070)	(0.823)	(0.067)	(0.163)	(0.586)	(0.121)	(0.016)	(0.078)
Observations			110						
Adj. R-squared			0.79						
Log-likelihood			-246.20						

Note. Standard errors in parentheses: * significant at 10 %; ** significant at 5%; *** significant at 1%. Author's calculations.

The three variables, which determine population and social conditions, are insignificant. The population coefficient is negative, as it was expected, and consistent with pessimistic and Malthusian trap theories, which explained that population growth slows down economic growth. The other two variables (dependency ratio and schooling) provide unexpected results. The additional year of schooling reduces economic GDP growth by -47 basis points. Intuitively, education is important indicator of economic well-being. There can be identified several channels though which education affect economy. First, the neoclassical theory stays that education increases human capital, which encourages productivity and creates more output. Furthermore, the endogenous growth theory explains that education provides new knowledge, ideas and technologies. However, the additional year of education can reduce the economic growth. The government expenditures, spent on the additional year of schooling, reduce the funds, which could be used for other purposes. In other words, the alternative use of the money could be more productive (Aghion, Boustan, Hoxby, & Vandenbussche, 2009). On the contrary, the dependency ratio was expected to be negative, while the results show that 1 percent positive change in dependency ratio encourages economic growth by 11 basis points. The positive effect of the increased old dependency ratio can be explained by the changes in the political policies. Based on the ageing population in Central and Eastern European countries and the increasing life expectancy, the governments can change the policies and allow increasing the retirement age. Such changes would allow keeping the higher amount of working people and increasing economic growth. In addition, the dependency ratio can stimulate economy if the older people tend to work even after the retirement. Based on the trend of the employment rate of older people, the percentage of older workers is increasing during the last decade in the majority of the analyzed countries (see, Appendix 8). Thus even the ageing population can encourage economic growth.

The gross savings affect economic growth negatively. The results cannot be understood as the contradiction for the expectations described in the second part. However, the savings as the investment can increase the economic growth in the long run. It means, that today's savings can become an investment tomorrow, which stimulates the economic growth. However, the result of keeping savings out of the economy can have a negative impact on the economic growth due to the inflation and the time value of money.

The trade openness, fiscal balance and investment have a positive and significant effect on economic growth. The highest positive impact on economy has an increase in investment. One percent increase in investment leads to higher economic growth by 0.59. The investment in equipment increases the productivity and the number of output produced. Thus, the higher investment can increase the economic growth directly through expenditure approach or indirectly through the increased production (production approach).

The higher fiscal surplus, the higher economic growth is in a country. If the government is running a budget surplus, the government does not have to borrow and can encourage economic growth through the efficient investment, social expenditure or other ways of money distribution. However, too high budget surplus does not necessarily encourage economic growth. The economic growth depends on the effectiveness of money distribution.

The trade openness has a positive impact on economy. Trade openness creates the opportunity to implement faster the rapidly improving technologies from the leading countries. Edwards (1997) noted that emerging economies could grow faster than developed economies if it is cheaper to import new technologies than to create them within the country. Moreover, the trade openness helps to allocate the resources in a more efficient way. Thus, the trade openness increases economic growth due to efficient allocation of resources, implementation of new technologies and ideas, but the economy grows at a high rate until the trade openness reaches the equilibrium.

The lagged value of the real GDP growth has a negative but significant impact on economic growth. This result is consistent with the convergence property explained by the neoclassical model. It claims, “the lower the starting level of real per capita gross domestic product the higher is the predicted growth rate” (Barro, 1996). However, the lagged value of the dependent variable identifies everything of the previous year. Even the previous real GDP growth is significant at 1, 5 and 10 percent significance levels and the Akaike, Hannan-Quinn and Schwarz criteria become better, the clarity of the results can be affected due to the quite high explanatory properties.

Last but not least, the intercept has a high value, however it is not significant. The high value of the constant can indicate, that there are some other explanatory variables that could be included in the model and the value of them would be significant. Thus, seeking to understand the economic growth better, the dependent variable (real GDP growth per capita) is divided in three parts and the results of independent variables are provided for each of them separately in the following subsections.

Capital Stock Growth

The growing capital indicates the investment into machinery, equipment or factories, which increase the amount of final output. In other words, the capital can be identified as the input for further wealth creation. As the capital is just the one indicator of the growth, the adjusted R-square, which indicates how well model is explained, declines (see, Appendix 9). The same models (as in the previous analysis for growth) are applied for the capital stock growth (see, Appendix 10). The results are similar. The differenced and system GMM estimators provide low p-values for Sargan test, while the AR (2) tests reject the autocorrelation only at 1 percent significance level (see, Table 5). Thus, the most appropriate model in this case is the fixed effect model. The classical assumptions for the fixed effect model are testified and the normality of the residuals is provided in Appendix 11.

Table 5

Significance of GMM estimator for capital stock growth

	DIFF-GMM	GMM-SYS
Observations	100	110
P-value for Sargan test	0.0074	0.000
AR (2)	0.0277	0.0203

Note. Author's calculations.

The signs of independent variables are the same as in the previous analysis. Gross savings, schooling and the constant have a negative impact on capital stock growth and coefficients are still insignificant (see, Table 6). However, the value of the intercept is significantly lower in this case. The impact of trade openness, fiscal balance, investment, total debt and previous value of capital stock are significant at 1, 5 and 10 percent significance levels, but the coefficients are smaller comparing to the coefficients for the impact on total growth (see, Appendix 9).

Table 6

Fixed effect model for capital stock growth

Constant	Gross savings	Population growth	Schooling	Trade openness	Fiscal balance	Dependency ratio	Investment	Total non-financial debt	Capital stock growth (-1)
-0.54	-0.002	-0.006**	-0.044	0.009***	0.021***	0.039**	0.020***	-0.004***	-0.290***
(0.372)	(0.004)	(0.003)	(0.033)	(0.002)	(0.007)	(0.018)	(0.003)	(0.0005)	(0.048)
Observations			110						
Adj. R-squared			0.65						
Log-likelihood			106.8						

Note. Standard errors in parentheses: * significant at 10 %; ** significant at 5%; *** significant at 1%. Author's calculations.

The population growth and dependency ratio become significant parameters at 1 and 5 percent significance levels in this model. The population growth reduces the capital per worker. Based on the analysis of the steady state, this effect is similar to the depreciation. The increase in population is moving along with depreciation, thus the capital per worker shrinks and the level of income declines. At some point, there would be reached the level, when economy would not be willing to save and invest enough money in order to increase capital. However, increasing dependency ratio does not indicate the declining number of older workers. The higher number of workers requires additional investment into equipment and machineries. In addition, the ageing population is considered as the new investment opportunities. The need of nursing home constructions or medicine is growing along with the trend of ageing population.

Human Capital Growth

The human capital indicates the set of skills of the worker. The highly skilled workers increase the productivity in economy. Thus, it is beneficial to invest into the employee's education and trainings. The human capital is another determinant of economic growth, thus the explanation of the model decreases further keeping the same explanatory variables. The four models are applied for the new dependent variable – human capital growth (see, Appendix 12). The high p-value of AR (2) allows rejecting the hypothesis of autoccorelation using the differenced GMM estimator (see, Table 7). However, the Sargan tests do not prove that the instrumental variables are valid. Thus, the further analysis is based on the most applicable estimator – fixed effect model. The classical assumptions for the fixed effect model are testified and the normality of the residuals is provided in Appendix 13.

The decreased value of R-square is consistent with the lower amount of significant variables. In this model, there are only four significant variables: years of schooling, investment, total debt and lagged human capital growth (see, Table 8). However, the coefficients of five variables – gross savings, schooling, fiscal balance, dependency ratio and investment - change its signs comparing to the total growth model.

Table 7

Significance of GMM estimator for human capital growth

	DIFF-GMM	GMM-SYS
Observations	100	110
P-value for Sargan test	0.0001	0.0000
AR (2)	0.2801	0.0875

Note. Author's calculations.

First of all, savings and years of education have a positive impact on human capital. As it is explained in the theoretical part, human capital depends on the schooling years and returns of each additional year at school. In order to increase the experience and the abilities of the child, parents have to save money for the education and training programs. Thus, the fertility requires increasing savings for the human capital improvements, but it has a negative impact on the total economic growth.

Table 8

Fixed effect model for human capital growth

Constant	Gross savings	Population growth	Schooling	Trade openness	Fiscal balance	Dependency ratio	Investment	Total non-financial debt	Human capital growth (-1)
-0.065	0.00007	-0.0007	0.017**	0.0001	-0.0002	-0.005	-0.002***	-0.0005***	-0.364**
(0.066)	(0.0006)	(0.0006)	(0.009)	(0.0003)	(0.0009)	(0.003)	(0.0007)	(0.0001)	(0.1663)

Observations	110
Adj. R-squared	0.44
Log-likelihood	319.9

Note. Standard errors in parentheses: * significant at 10 %; ** significant at 5%; *** significant at 1%. Author's calculations.

Based on the impact of gross savings, it affects human capital positively, but the negative impact on capital stock growth and total factor productivity exceeds its benefits. The total effect of gross savings on economic growth becomes negative.

The negative effect on human capital has a governmental budget surplus. The surplus exists when revenues of the government exceed expenditures. The priorities of government spending are social and health security as well as education. All these areas are closely related with the wealth of society. Keeping government revenues constant, the decline of government spending affects the human capital growth negatively.

The negative impact on human capital has dependency ratio. This relationship is logically explained based on the higher amount of young participants in education and training programs comparing to the participation of older people. The younger people need fewer efforts to acquire new knowledge and they do it faster.

Last but not least, the additional investment into gross capital fixed formation reduces human capital. If the expenditures on education can be interpreted as the investment on human capital, the gross capital formation would be the competitor in the investment distribution process. Thus, the higher investment into gross fixed capital formation would decrease the possibility of faster development of human skills, even such investment increases the labor productivity. The following section will analyze the impact of explanatory variables on the growth of TFP.

TFP Growth

The total factor productivity is the “portion of output not explained by the amount of inputs used in production” (Comin, 2006). In other words, it shows how efficiently the inputs are used. The TFP growth is calculated by the Solow growth model, where residuals represent TFP. As with the previous dependent variables, the OLS, fixed effect, differenced and system GMM estimators are testified (see, Appendix 14). According to GMM models, the assumption of no autocorrelation of residuals can be rejected at 1 percent significance level (see, Table 9). The low p-values for Sargan tests imply that the model or instrumental variables should be reconsidered. Thus, the pure applicability of GMM models suggests analyzing the fixed effect model for detailed analysis of the total factor productivity growth. The classical assumptions for the fixed effect model are testified and the normality of the residuals is provided in Appendix 15.

The fixed effect model provides the same signs of independent variables as for the total real GDP per capita growth (see, Appendix 9). However, the population and social statistics variables become significant for the determination of the TFP growth.

Table 9

Significance of GMM estimator for TFP growth

	DIFF-GMM	GMM-SYS
Observations	100	110
P-value for Sargan test	0.0065	0.0000
AR (2)	0.0295	0.0196

Note. Author's calculations.

First of all, the population growth has a significant negative effect (see, Table 10). This impact is the highest in the comparison with capital stock growth and human capital growth. The majority of the theories would claim that population growth would increase productivity at least for the four reasons. First, the increasing population requires greater productivity in technique and social organization by itself (Pritchett, 1996). Secondly, the population growth increases the probability of new ideas and knowledge, which can be learned by the greater number of people. Third, the economies of scale indicate that greater number of people might cause the increase in output. Last but not least, the growing population leads to the agglomeration economies, "that is, the density of economic activity accounts for greater productivity" (Pritchett, 1996). However, the empirical evidence for some of these theoretical implication are weak. A little evidence was found by Backus,

Backus and Kehoe (1993) or Pritchett (1996). However, the negative population effect on productivity is not explained by the declining output per person. The negative effect is caused by the labor force participation. The correlation between population growth and productivity is negative, while the correlation between employment rate and productivity is positive (see, Appendix 16). Thus, the productivity growth might be explained better and positively by the growth of labor force.

Table 10

Fixed effect model for TFP growth

Constant	Gross savings	Population growth	Schooling	Trade openness	Fiscal balance	Dependency ratio	Investment	Total non-financial debt	TFP growth (-1)
-0.065	-0.003	-0.007***	-0.053**	0.005***	0.015***	0.036**	0.016***	-0.003***	-0.280***
(0.392)	(0.005)	(0.002)	(0.025)	(0.001)	(0.006)	(0.016)	(0.003)	(0.0006)	(0.046)
Observations			110						
Adj. R-squared			0.57						
Log-likelihood			126.2						

Note. Standard errors in parentheses: * significant at 10 %; ** significant at 5%; *** significant at 1%. Author’s calculations.

Furthermore, the increasing life expectancy and the delayed retirement age encourage older people to keep working longer. Thus, the dependency ratio has a positive sign due to the increasing labor force participation between elder workers. Last but not least, the human capital theory explains that education increases human productivity and leads to a higher earnings. However, there is a negative effect of schooling surplus. Nowadays, there is a common attitude towards the necessity of the undergraduate or graduate diploma. As the more working people have a higher degree of education, there appear more jobs, which require less education. Tsang, Rumberger and Levin (1991), Guironnet (2007) found out that the schooling surplus has a negative impact on job satisfaction and leads to lower degree of productivity.

Decomposition of Debt

The main independent variable in this research is the total debt. The analysis of debt impact on total real GDP per capita growth and its components indicates that the impact of total debt is negative and significant at 1, 5 and 10 percent significance levels in all the cases. The total debt is significant variable even in all GMM tests, despite the pure applicability of these models. However, the total non-financial debt can be divided into subcategories of public and private debt, while the private debt can be divided into non-financial corporations debt and household and non-profit institutions serving households (NPISHs). The previous analysis revealed that the best model for the analysis of debt impact on economic growth is the fixed effect model. Thus, the fixed effect model is applied for the analysis of the each subcategory of debt separately and in various combinations in order to determine, which debt has the most significant impact. This analysis does not include the lagged value of the real GDP per capita growth due to the high explanatory power of the lagged dependent variable, while the aim is to identify the impact of debt. The analysis of the each debt impact reveals that the each type of debt has a negative impact on economic growth. Separately the highest and strongest impact on economy has household debt (see, Table 11). The 1 percent increase in the household debt reduces economic growth by 19 basis points. The weakest impact on economy has government debt. In more details, 1 percent increase in government debt leads to decline in economic growth by 2 basis points. However, this effect is not significant, while the coefficients of other debt are significant at 1, 5 and 10 percent significance levels. The coefficients for the other independent variables are provided in the Appendix 17.

Table 11

Impact of separate type of debt on GDP growth

	(2)	(3)	(4)	(5)	(6)
Total non-financial debt	-0.1085*** (0.01206)				
Government debt		-0.02053 (0.05377)			
Private debt			-0.09903*** (0.01669)		
Corporate debt				-0.1308*** (0.02674)	
Household debt					-0.1916*** (0.06255)
Observations	120	120	120	120	120
Adjusted R-squared	0.7086	0.5866	0.6942	0.6893	0.6439
Log-likelihood	-284.7	-305.7	-287.6	-288.6	-296.8
P- value (F)	0.000	0.000	0.000	0.000	0.000

Note. Standard errors in parentheses: * significant at 10 %; ** significant at 5%; *** significant at 1%. Author’s calculations.

Nowadays, all types of debt exist in the economy, thus it is more likely that the combination of debts would have a higher explanatory power on the economic growth. All possible combinations of public and private debt are provided in a summarized table below (see, Table 12), while the extensive results are provided in Appendix 18. The adjusted R-squared value (0.7137) is the highest for the model with the public debt, corporate debt and household debt. The strongest impact on economic growth has the corporate debt, while the household debt has the weakest negative impact and the coefficient is not significant at all significance levels. These results are compatible with the debt analysis in the region, where the amount of corporate debt as percent of GDP exceeds the amount of public and household debts. At the beginning of the analyzed period the public debt exceeded the household debt, but the growth of household debt was faster, thus before the crisis the household debt takes the lead.

Table 12

Impact of debt combinations on GDP growth

	(7)	(8)	(9)	(10)	(11)
Government debt	-0.09338***	-0.1166***	-0.02790	-0.1092***	
	(0.02828)	(0.03062)	(0.05238)	(0.03755)	
Private debt	-0.1094***				
	(0.01232)				
Corporate debt		-0.1531***		-0.1384***	-0.1103***
		(0.01666)		(0.03018)	(0.03327)
Household debt			-0.1929***	-0.04686	-0.07237
			(0.05894)	(0.05317)	(0.06225)
Observations	120	120	120	120	120
Adjusted R-Squared	0.7091	0.7114	0.6453	**0.7137**	0.6951
Log-likelihood	-284.6	-284.2	-296.5	**-283.7**	-287.5
P- value (F)	0.000	0.000	0.000	0.000	0.000

Note. Standard errors in parentheses: * significant at 10 %; ** significant at 5%; *** significant at 1%. Author’s calculations.

The majority of the previous researches are based on the analysis of the public debt, while the private debt exceeds public debt. Until the latest financial crisis, the predominant view among economist was properly explained by Bernanke (2000). He claimed “since one unit’s liability is another unit’s asset, changes in leverage represented no more than a redistribution from one group (debtors) to another (creditors)”. “Absent implausibly large differences in marginal spending propensities among the groups, it was suggested, pure redistributions should have no significant macroeconomic effects” (Bernanke, 2000). One of the most important indicators in macroeconomics is debt ratio to GDP, while the leverage ratio for the private sector does not have such importance. While economists and policy makers are discussing the importance of debt to income ratio, the latest theoretical and empirical papers provide consequences of too high debt. Eggertson and Krugman (2010), Hall (2011), Philippon and Midrigan (2011) explained that household debt is the reason for decreasing demand. In more details, “heavily indebted households cut back consumption in the face of a sudden shock to assets (such as a fall in house values), but less indebted households do not increase consumption in similar proportion for various reasons (financial frictions, zero lower bounds), thereby causing a recession that cannot easily be remedied by traditional monetary policy” (Mason & Jayadev, 2012). Furthermore, Mason and Jayadev (2013) mentioned the importance of gross liabilities. The importance of gross liabilities increases when it becomes difficult to meet debt responsibilities. Before the crisis all assets and collaterals are assumed to be liquid. However, it becomes difficult to convert asset into money without any loss during the economic downturn. Thus, “if units’ assets are not reliable sources for either funding or market liquidity, then the capacity to service debt out of current income becomes paramount” (Mason & Jayadev, 2012). During the recession, one of the aims is lower leverage ratio. This can be achieved by the lower consumption to income ratio, thus the demand in the market would decline. The high leverage ratio would indicate the lower aggregate demand for a longer time period. Reinhart and Rogoff (2010) noticed that sharp deleveraging periods are related with low GDP growth and higher unemployment rate. Thus, the deleveraging process can be a legacy after the recession, which causes low economic growth for the medium term. The consumer behavior has a significant effect on the leverage ratio. In other words, it depends on the consumer how much he is willing to save and to borrow. However, saving is one of the ways to impact the leverage rate. Mason and Jayadev (2012) suggested controlling indicators of Fisher dynamics: interest rates, growth rates and inflation. To sum up, Taylor (2012) analyzed the correlation between financial crisis and public debt over 140 years in advanced economies, but he did not find any systematic correlation. On the other hand, changes in private debt have a significant impact on economy and are more reliable predictor of financial crisis.

Discussion

This part of the paper provides the overview of the significant findings and interpretation of results. Further, the results are analyzed in the context of existing theories and literature. Lastly, the limitations of the study are discussed and the recommendations for further analysis are provided.

Significant Findings Overview and Interpretation

The extensive analysis of the total non-financial debt impact on economic growth revealed the significant negative effect. The comparison of four applied estimators (OLS, FE and differenced and system GMM estimators) leads to the conclusion that the most applicable model for identification of debt impact for the Central and Eastern European countries is fixed effect model. The fixed effect model is used to analyze the growth by the Solow growth model.

First, the unexpected results provide schooling and dependency ratio. The years of schooling have a negative impact on economic growth, with the exception of positive and significant impact on human capital growth. Based on the theoretical view, the additional year of schooling is expected to increase the human capital, productivity and output. However, the additional year of schooling can have a negative impact due to the overqualified labor force. Based on the analysis results, the question arises if the employees exceed the required boundary in the analyzed ten countries. As the public schooling is dominant in the region, there might be suspects that government does not allocate it’s spending efficiently. In addition, the problem can arise due to the easy access to higher education. In order to come up with the conclusions, the additional research should be done. On the contrary, the dependency ratio impact on economic growth was expected to be negative. The negative dependency ratio was noticed only in human capital growth. The unpredicted results raise a question whether the dependency ratio is the right choice for the analysis. The rapid changes in the technologies and medicine increase the life expectancy. This causes the ageing population problem. However, the government accepts policy changes and delays the retirement age, which means that people are working longer. In addition, one of the government priorities is to increase employment rate, including the employment among elder people. As the calculations of dependency ratio do not change with the retirement age, the ratio includes the employed elder people, while the higher employment ratio influence economy positively. Last but not least, the ageing population (which leads to higher dependency ratio) can be identified as a new field for the investment. In other words, the necessity of such things as medicine or nursing is increasing and investment increases the growth of capital and TFP. To conclude, the proper determination of dependency ratio and schooling impact on economic growth in the region requires additional investigation, which is beyond the scope of this research.

The main aim of this paper is to determine the debt impact on economy. The total non-financial debt has a negative impact on the economic growth as well as on the separate parts of growth: capital stock growth, human capital growth and TFP growth. The detailed analysis of the debt revealed that all types of debt matters. The most precise estimator includes all types of debt: public, non-financial corporate and household debt.

The most significant and negative impact on economy has non-financial corporate debt. The 1 percent increase in debt to GDP ratio reduces economic growth by 13.8 basis points. The significant impact provides government debt as well: 1 percent increase in public debt leads to lower GDP growth by 10.9 basis points. However, the household debt identifies the negative impact on economic growth (-0.047), but this impact is not significant. The lack of statistical significance means that there is a change that the relationship between these two variables does not exist. On the other hand, there is a difference between statistical and practical significance. The results can be statistically significant, but the practical application can be misleading or vice versa. The statistical significance is based on the analysis of the differences in means and assumption that those differences exist due to sampling errors. The large sample with the low or even insignificant differences in population can provide the statistically significant results. As the differences in population are significant in this analysis, it can affect statistical significance. Thus it is important to understand statistical significance and examine the practical significance as well.

All the analyzed cases provide negative impact of debt growth on economy. These results can be statistically and practically explained. The increasing level of debt increases liabilities' side in the balance sheet, however it does not necessarily lead to the growing asset side. It depends how the borrowed money are used. Furthermore, the debt level matters as well. The low debt level is associated with the economic growth due to the possibility to invest those money and, in the case of successful decision-making, the profit can be earned. This is similar to the cash flows of the project or company. However, when the debt level exceeds the asset or the borrower increases his debt in order to repay previous debt, the debt can accumulate and the snowball effect might occur. In that case there is not possibility to repay the debt, thus the borrower will default. The historical events provided plenty examples of private and public sectors defaults (couple of examples, Argentina (2002), U.S. bank - Lehman Brothers (2008)). The law allows bankrupting for the households as well. However, the bankruptcies in the private or public sectors have a serious negative impact on the market. As the world becomes more and more globalized, the effect can be notice in the different countries as well. To continue, as the higher debt level can be an indicator of upcoming default, the confidence of the creditors declines and the cost of borrowing increases. In other words, the higher risk should provide higher returns in order to attract those, who would be willing to borrow. Based on the Keynesian approach, the higher interest rates reduce private investment and the output declines. Thus, the higher interest rates lead to the declining economic growth. As the results of the statistical analysis provide the negative effect of increasing the debt level, the question arises whether the threshold level (the highest debt level, when GDP grows) is exceeded in CEE countries. The majority of the papers agree with Carmen M. Reinhart and Kenneth S. Rogoff (2010) or Kumar and Woo (2010) and provides the threshold level of 90 percent of GDP however, as the public debt does not exceed this boundary in the CEE region (only Hungary exceeded the convergence criteria), it is difficult to identify the threshold level in this region. In addition, the limited number of time series observation makes the calculations difficult.

The differences in the debt impact on economy require deeper explanation why private debt matters more than public. The analysis of the public and private debts movements reveals that debts move in opposite directions. When private debt is increasing, the public debt is declining and vice versa. In addition, Taylor (2012) explained that private debt might have a negative impact on public debt, however if the level of public debt is already high, the government can do little to help out economy. Thus, the high private debt level can be the indicator of upcoming financial crisis. It is important to notice that government can decide to buy worthless private debt. Such decision would be beneficial for the government in order to keep the power and peaceful society, while the private sector would be willing to accept higher risk. Paul De Grauwe (2010) noticed that Spain and Ireland had a small public debt before the global financial crisis. In 2008, the public debt in Spain was below 40 percent, while in Ireland above 20 percent of GDP. However, the private debt has closely related with the real estate bubble and, when the bubble burst, these countries were hit the most. Furthermore, the low interest rates encourage borrowing and lead to high leverage ratio and consumption. The situation would be manageable if the allocation of the capital would be productive. The efficient capital allocation leads to the declining debt to GDP ratio. In more details, the efficient capital allocation leads to rapid economic growth, which exceeds the growth of debt, and the real return on capital becomes positive (Durden). However, the economic situation in the region was opposite: debt was growing faster than GDP growth. The low interest rates can also be indicated as cause for rapidly increasing debt and it creates the possibility to accept riskier decisions, which might lead to capital misallocation as well. Later in 2009, the long-term interest rates were increased significantly. The growth reaches 6 and 8.4 percent in Latvia and Lithuania, thus the borrowing stopped. However, the increase in interest rates lasts from one to two years, but it has significant effect, especially for the private sector. The sudden change in the lending conditions influences the private sector through its limited resources and abilities for the refinancing. It means that companies cannot change the term of loans or reduce repayment amounts. Corporates were forced to reconsider their expenditures and distribution of cash flows. In such cases, companies reduce the labor force, investment and the amount of production declines. This can be identified as another reason for the importance of private debt impact on economic growth.

Thus, it is questionable if it is enough to control the public debt. The European treaty applied convergence criteria in order to ensure market stability. It is wondering whether the boundaries for the public debt are sufficient. The rapid growth of private debt increases the leverage ratio (see, Appendix 3). Until the global financial crisis, the leverage ratio for the non-financial corporations were fluctuating but keeping the growing trend in the region, while the debt to income ratio of household is indicates between 37.66 percent in Lithuania and 80.46 percent in Estonia. Thus, the probability, that high private debt would not be repaid and the financial crisis can occur again, increases with leverage ratio. In order to ensure economic stability, the private sector requires more rigid control. Otherwise, Hudson (2004) noticed that “at least the Babylonians appear to have recognized that over time the debt overhead became more and more intrusive as it tended to exceed the ability to pay, culminating in a concentration of property ownership in the hands of creditors". Thus, the debt should be periodically forgiven.

Discussion of Findings in the Light of Existing Literature

The existing literature on the debt impact on economy analyzes the effects public and private debts separately. The current empirical researches try to combine the impact of public and private debt in one equation and analyze the impact of both debts simultaneously. Thus, this subsection of thesis begins analysis by the compliance of empirical results with the theoretical approaches and ends with the comparison with the previous empirical estimations.

First of all, there are two contradicting theories on the public debt impact on economy. First of all, the Ricardian theory explains the insignificance of debt. In other words, the current public debt will be covered in future with the higher taxes. However, this theory has been criticized widely. The empirical results of this research are contradicting with Ricardian theory. On the other hand, Elmendorf and Mankiw (1998) introduced so called conventional view, which can be applicable for the explanation of empirical findings. The majority of the economist and policy makers support this approach. The conventional view assumes that the government deficit and debt are created by constant spending, but reduced taxes. Based on the Keynesian model, the higher household income encourages demand and increases national income. Thus, the higher household income increases the output in the short run. However, the conventional view agrees with the classical theory in the long run. Increased government deficit and debt would reduce the national savings (–0.3[1]). Furthermore, reduced investment will lead to lower capital stock (0.36[2]), which reduces the

[1] Correlation coefficient from Appendix 5.

[2] Correlation coefficient from Appendix 5.

output (0.84[3]). It is likely that government debt significantly affects aggregate demand in the short run, while capital stock in the long run.

Secondly, the explanation of private debt importance is in compliance with Minsky's idea. Author claimed that current money is a source for the production growth, which earns profit in the future. The shortage of current money requires borrowing. Thus, there could be distinguished three types of financing: hedge, speculative and Ponzi financing. Based on the debt to income ratios, it looks like non-financial corporations and households do not have sufficient finance to pay for principal or interest. This is the idea of Ponzi scheme. Due to increasing liabilities, the probability of default increases. The assumption of sustainable economic system and economic equilibrium becomes violated.

Last but not least, the four estimators used for the identification of debt effect on economic growth identify negative and significant impact. The negative relationship has been noticed by such authors as Patillo, Poirson and Ricci (2004), Schclarek (2004), Cordella, Ricci and Ruiz-Arranz (2005), Kumar and Woo (2010), Reinhart and Rogoff (2010), Cecchetti, Mohanty and Zampolli (2011), Panizza and Presbitero (2012). However, the Solow growth model was applied in papers written by Patillo, Poirson and Ricci (2004), Schclarek (2004), Kumar and Woo (2010), Cecchetti, Mohanty and Zampolli (2011). The applicability of the differenced and system GMM estimators are contradicting with calculations made by Schclarek (2004), Cordella, Ricci and Ruiz-Arranz (2005), Kumar and Woo (2010) who did not reject the null hypothesis of the Sargan test and avoided the autocorrelation in residuals. While the fixed effect model was significant in previous papers written by Kumar and Woo (2010) and Cecchetti, Mohanty and Zampolli (2011). The empirical results prove that the most significant impact debt has on physical capital growth and TFP growth. The same results were achieved earlier by Patillo, Poirson and Ricci (2004).

[3] Correlation coefficient from Appendix 5.

Furthermore, the separation of debt into government, corporate and household debts, indicates that all debts have negative impact, but the significant variables are government and corporate debts. The simmilar approach was applied by Cecchetti, Mohanty and Zampolli (2011). Based on the their regression model with public, corporate and household debts, all three types of debt have negative impact on economic growth. However, the government debt has significant and the most influencial effect on economy. The corporate debt become significant in the economy without including dummy variable of crisis. The significance and importance of the public debt is proven in this paper as well, however, the more significance impact is indicated by the private debt, accurately, non-financial corporate debt. Thus, the findings of this research provides the importance of private debt and raises financial instability hypothesis in the region.

Limitations and Implications of the Research

After the discussion of the results and analysis of empirical findings in the existing literature, there should be explained the limitations of research and suggested implications for further papers.

1) The time series observations are limited for CEE countries. It is suggested to use time series analysis with 50 or more observations, however, panel data can be a solution in this case. The data consists of 12 years period because of the recent countries' independence after the collapse of Soviet Union. There is a possibility to analyze each country separately by using quarterly data. However, such variables as population, years of education and dependency ratio are provided on the yearly basis, thus the Solow growth model for the analysis of capital stock, human capital and TFP growth cannot be applied otherwise.

2) The analyzed time period includes global financial crisis. Before the crisis economy was growing, however the sudden downturn had negative effect on economy and it might have a significant impact on determination of the trend.

3) The macroeconomic data usually violates the classical assumptions for the statistical data analysis. This data set is not exception. First of all, the heteroskedasticity problem is present. The robust standard errors can be a solution. The robust standard errors "address the problem of errors that are not independent and identically distributed", however, they do not "change the coefficient estimates provided by OLS, but they change the standard errors and significance tests" (Williams). Despite included robust standard errors, the heteroskedasticity problem is still present. Another option is to include instrumental variables which have impact on independent variables but do not influence dependent variable. The GMM estimator is applicable in such cases. However, the poor validation of instrumental variables requires to reconsider the model or instrumental variables. There could be testified the validity of such explanatory variables as inflation, liquid liabilities or dummy variable for the banking crisis. Furthermore, the panel data usually violates the assumption of stationarity. This violation is common in a time series data analysis and it causes the non-normal distribution of the "large sample approximation of the distributions of the least-squares or maximum likelihood estimators" (Hsiao, 2006). However if the traditional panel data (with large number of observations, but small time period) are "available, and observations among cross-sectional units are independent, then one can invoke the central limit theorem across cross-sectional units to show that the limiting distributions of many estimators remain asymptotically normal" (Hsiao, 2006). The traditional panel data consist of large number of cross-sectional observations, but small number of time periods, thus this advantage of panel data eliminates non-normality problem.

The limited time series observations restrict the analysis of the debt impact on economic growth in CEE. It would be interesting to observe the effect of public and private debts impact on growth without financial crisis. The longer time series observations would allow analyzing the economic growth in the long run, thus the effect of the financial crisis might be identified as temporary and the significance might be lower. Based on the described situation, the impact of debt might be positive, while the allocation of the capital efficient in the long term. However, these assumptions might be testified in the future research after longer time period.

Conclusions

The aim of the thesis was to testify and verify the two research hypotheses. First, whether the debt has impact on economic growth. Second, whether the private debt has a significant impact on economic growth. The answers to these questions were based on the statistical data analysis of the ten CEE countries from year 2001 till 2012.

The theoretical analysis provides contradicting debt impact on economy in the literature. Ricardian theory rejects the importance of debt on economic growth, while the conventional view highlights the aggregate demand in the short time period, while the effect of crowding out in the long run. In 2007, the economists remembered the debt deflation and financial instability theories. However, the application of the existing theoretical aspects does not provide the consensus in the empirical estimations.

To identify the debt impact on economic growth, the most significant variables were chosen. The significance of the total non-financial debt was noticed in OLS, FE and differenced and system GMM estimators. The diversification of the GDP growth into capital stock, human capital and TFP growth revealed the most significant debt impact on capital stock growth and TFP growth. Moreover, the convergence property from the Neoclassical growth theory was valid with four dependent variables: GDP growth, capital stock growth, human capital growth and TFP growth. Based on the low applicability of OLS and GMM estimators, the FE model was applied for the impact of various debt combinations on economic growth. The best explanation for the economic growth is based on combination of public, non-financial corporate and household debts. The comparison of the results revealed that the most significant negative effect on economy has the corporate debt. There can be distinguished main reasons for negative corporate debt impact: favorable borrowing conditions, unsustainable loans portfolio, capital misallocation, restricted refinance after the financial crisis. Thus, the results prove that changes in the debt are significant for the economy and the negative impact of private debt can lead to the financial instability.

Overall, the importance of the debt encourages further investigations. The pure validity of chosen instrumental variables suggests reconsidering model with different selected variables, such as inflation, liquid liabilities or dummy variable for the banking crisis. Further, the significance of debt also encourages the consideration of regulations or the implementation of new policies. The level of public debt in the European Union is restricted, thus the regulations for the private debt might be debatable as well. Based on the existing empirical results, the increasing debt can encourage economy if funds are allocated efficiently, however, too high level of debt can lead to deviation from sustainable economic growth. However, the analysis of non-linear relationship between debt and economic growth requires longer time series observations. Thus, the recent available data set identify that increasing debt influences economic growth negatively in CEE.

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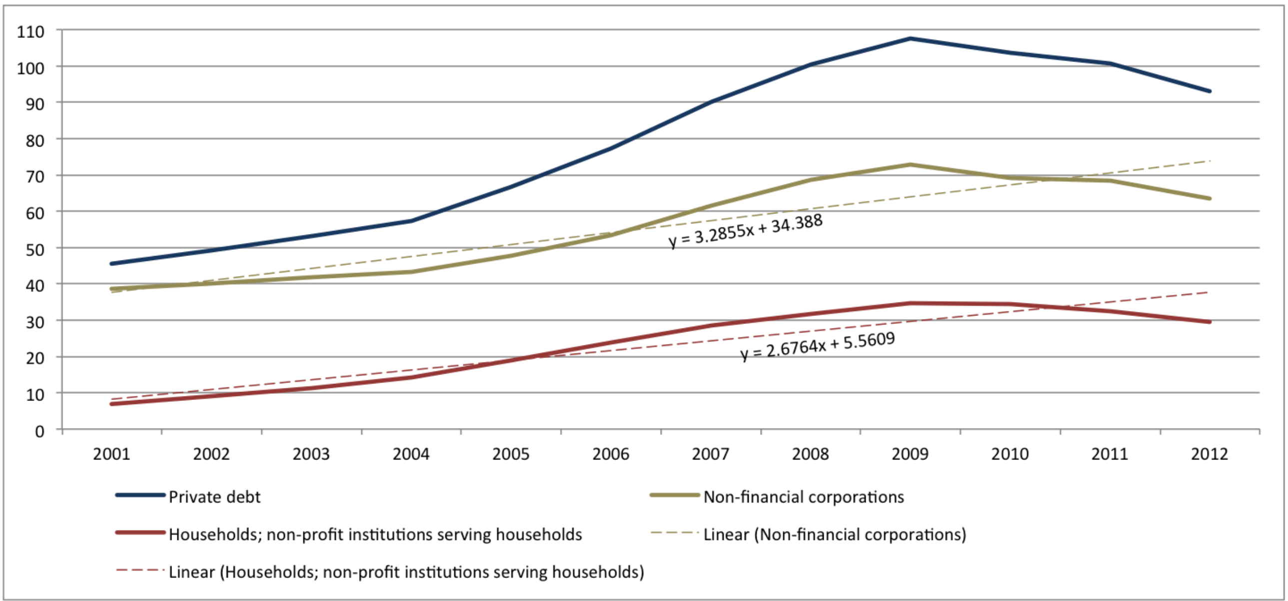
List of Appendices



Appendix 1. Decomposition of private debt with the trend lines in CEE, % of GDP (2001 - 2012).

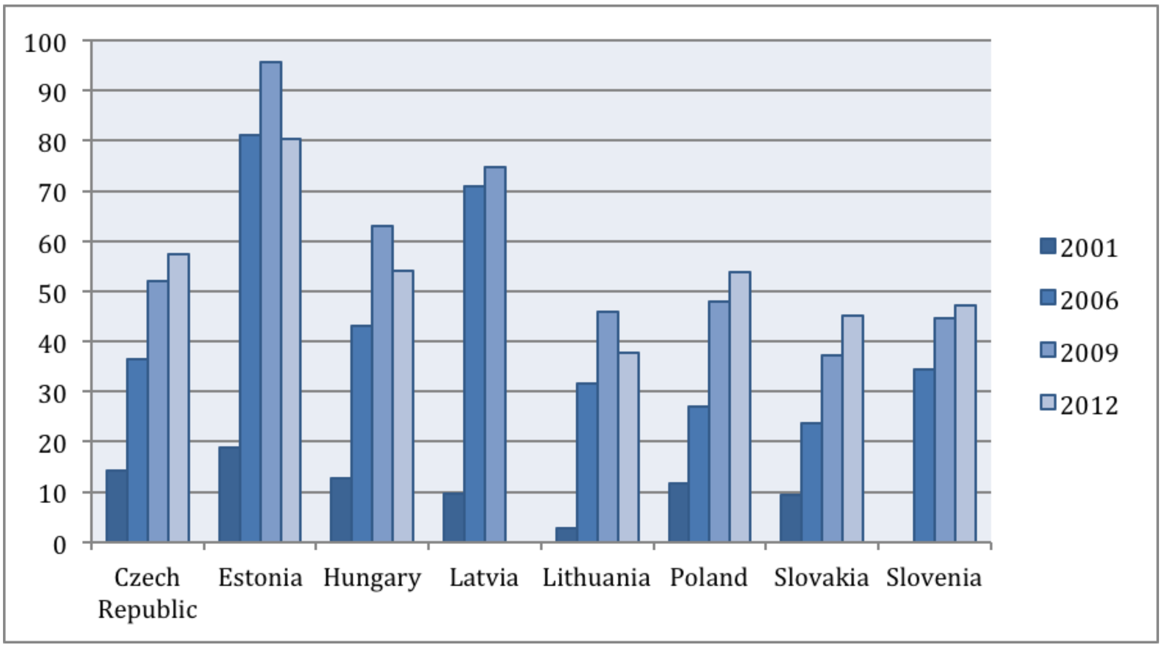
Author's calculations based on the data from Eurostat.

Appendix 2

Descriptive statistics

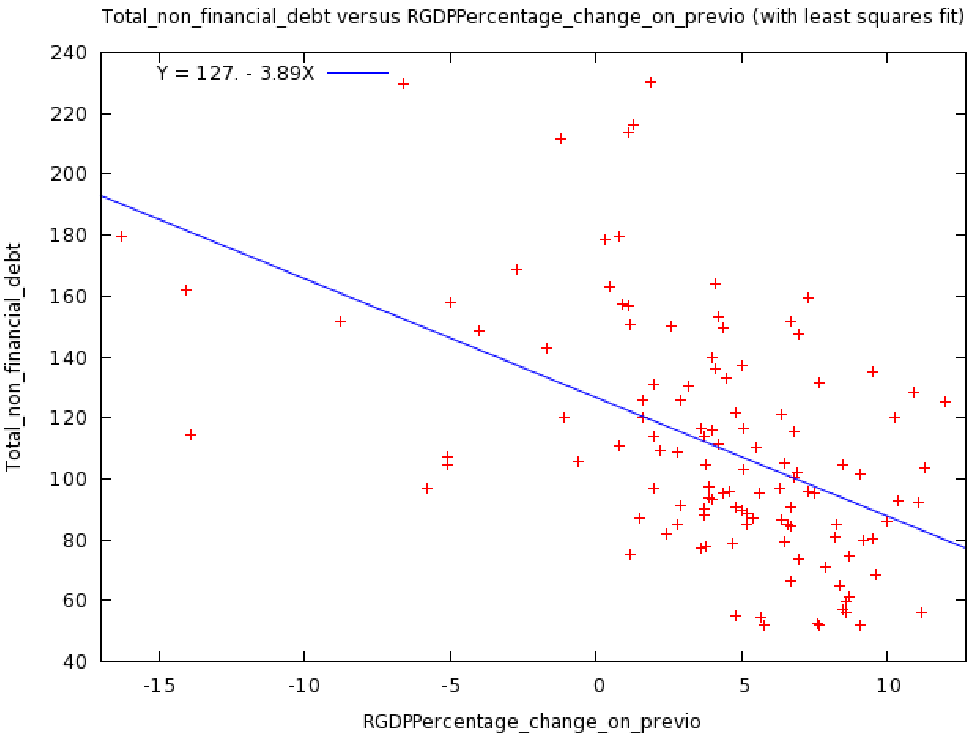
	Mean	Median	Std. dev.	C.V.	Minimum	Maximum
GDP growth	4.018	4.650	5.018	1.249	-16.300	12.000
Capital stock growth	0.067	0.094	0.157	2.333	-0.514	0.402
Human capital growth	0.012	0.014	0.019	1.600	-0.041	0.081
TFP growth	0.094	0.106	0.119	1.269	-0.300	0.378
Gross savings	19.839	19.750	3.751	0.189	8.800	29.100
Population growth	-4.358	-2.600	7.273	1.669	-32.200	10.900
Schooling	17.065	17.500	1.123	0.066	14.100	19.100
Trade openness	61.451	62.800	15.682	0.255	28.900	94.000
Fiscal balance	-3.135	-2.900	2.974	0.948	-9.800	4.300
Dependency ratio	22.347	22.750	2.999	0.134	16.300	27.800
Investment	23.953	23.600	4.317	0.180	16.300	36.000
Total non-financial debt	111.110	104.100	38.888	0.350	52.000	230.400
Government debt	32.411	28.650	18.688	0.577	3.700	82.200
Private debt	78.698	70.900	33.931	0.431	26.500	154.800
Corporate debt	55.743	46.850	24.255	0.435	25.600	114.400
Household debt	22.954	22.750	12.748	0.555	0.900	57.700

Note. Author's calculations.

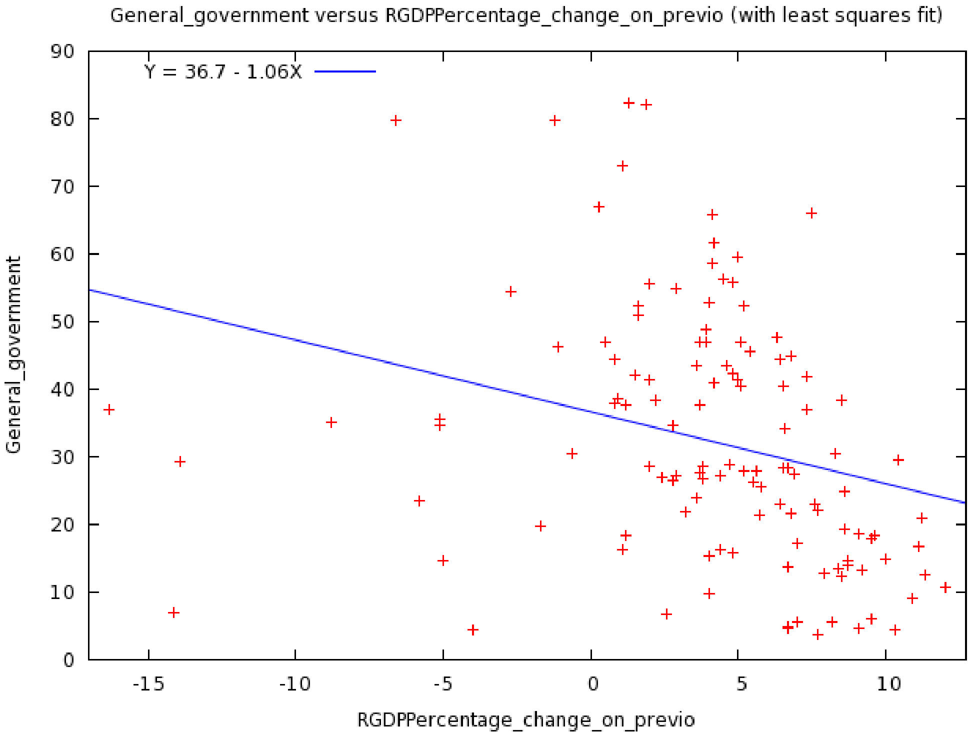


Appendix 3. Gross debt-to-income ratio of households, (2001, 2006, 2009, 2012). From Eurostat.

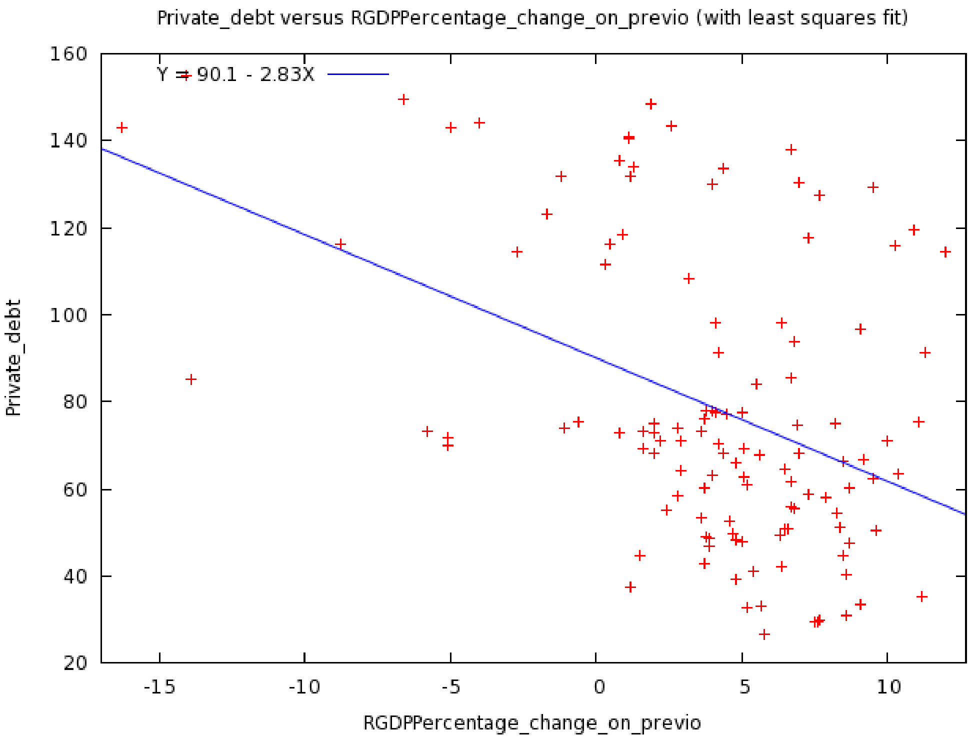
Appendix 4. Correlation between real GDP per capita growth and various debts.



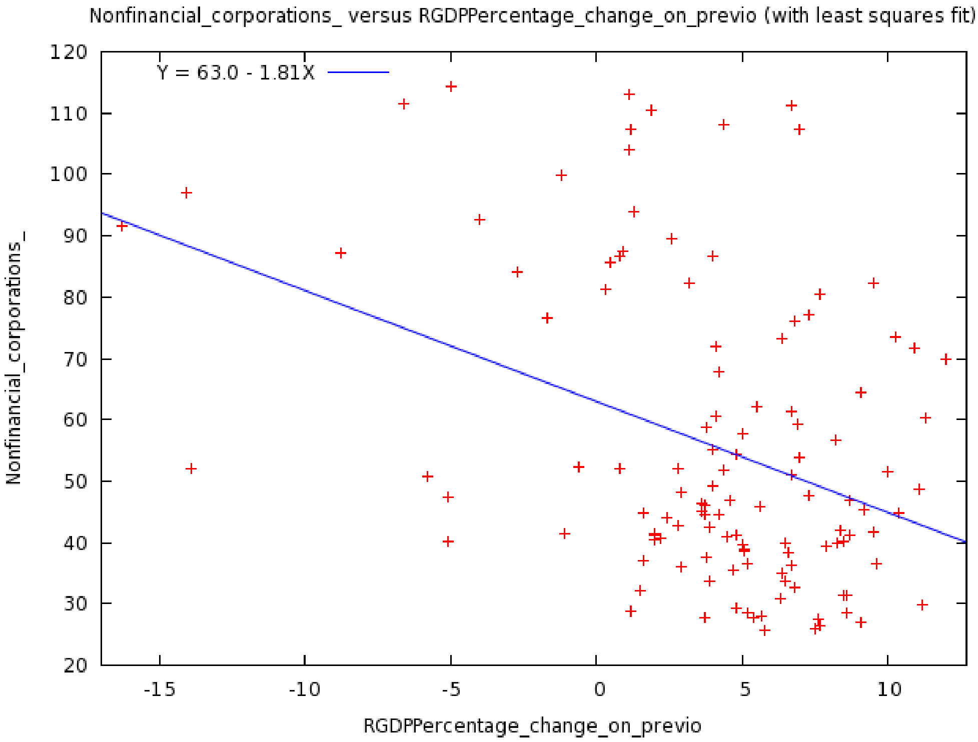
Appendix 4a. Correlation between total debt and GDP growth in CEE, (2001 - 2012). Author's calculations.



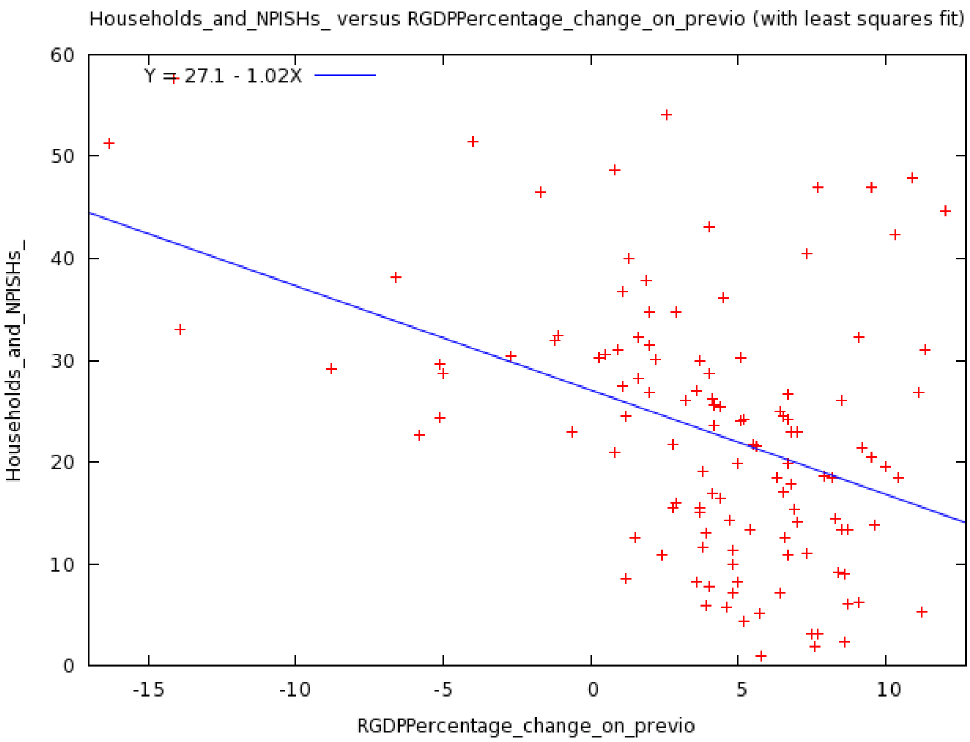
Appendix 4b. Correlation between public debt and GDP growth in CEE, (2001 - 2012). Author's calculations.



Appendix 4c. Correlation between private debt and GDP growth in CEE, (2001 - 2012). Author's calculations.



Appendix 4d. Correlation between non-financial corporate debt and GDP growth in CEE, (2001 - 2012). Author's calculations.



Appendix 4e. Correlation between household and NPISHs debt and GDP growth in CEE, (2001 - 2012). Author's calculations.

Appendix 5 Correlation matrix

	GDP growth	Capital stock growth	Human capital growth	TFP growth	Gross savings	Population growth	Schooling	Trade openness	Fiscal balance	Dependency ratio	Investment	Total non-financial debt	Government debt	Private debt	Corporate debt	Household debt
GDP growth	1.00															
Capital stock growth	0.84	1.00														
Human capital growth	0.30	0.25	1.00													
TFP growth	0.77	0.94	0.21	1.00												
Gross savings	-0.19	-0.11	-0.11	-0.12	1.00											
Population growth	-0.18	-0.20	-0.10	-0.24	0.32	1.00										
Schooling	-0.14	-0.19	-0.11	-0.20	0.20	0.21	1.00									
Trade openness	0.02	-0.03	-0.11	-0.07	0.19	0.24	0.24	1.00								
Fiscal balance	0.52	0.51	0.02	0.45	0.02	-0.08	-0.05	0.20	1.00							
Dependency ratio	-0.10	-0.03	-0.16	0.00	0.01	-0.43	0.26	0.09	0.30	1.00						
Investment	0.32	0.36	-0.09	0.37	0.30	0.08	-0.04	0.10	0.37	0.06	1.00					
Total non-financial debt	-0.50	-0.40	-0.41	-0.39	0.08	0.14	0.35	0.42	-0.14	0.42	-0.18	1.00				
Government debt	-0.29	-0.24	-0.10	-0.30	-0.23	0.18	0.04	0.13	-0.45	-0.23	-0.62	0.49	1.00			
Private debt	-0.42	-0.33	-0.42	-0.28	0.22	0.07	0.38	0.41	0.08	0.61	0.13	0.88	0.01	1.00		
Corporate debt	-0.37	-0.28	-0.33	-0.25	0.18	0.06	0.22	0.42	0.13	0.60	0.14	0.84	0.02	0.96	1.00	
Household debt	-0.40	-0.33	-0.49	-0.28	0.25	0.06	0.58	0.29	-0.02	0.48	0.09	0.73	0.00	0.84	0.65	1.00

Note. Author’s calculations.

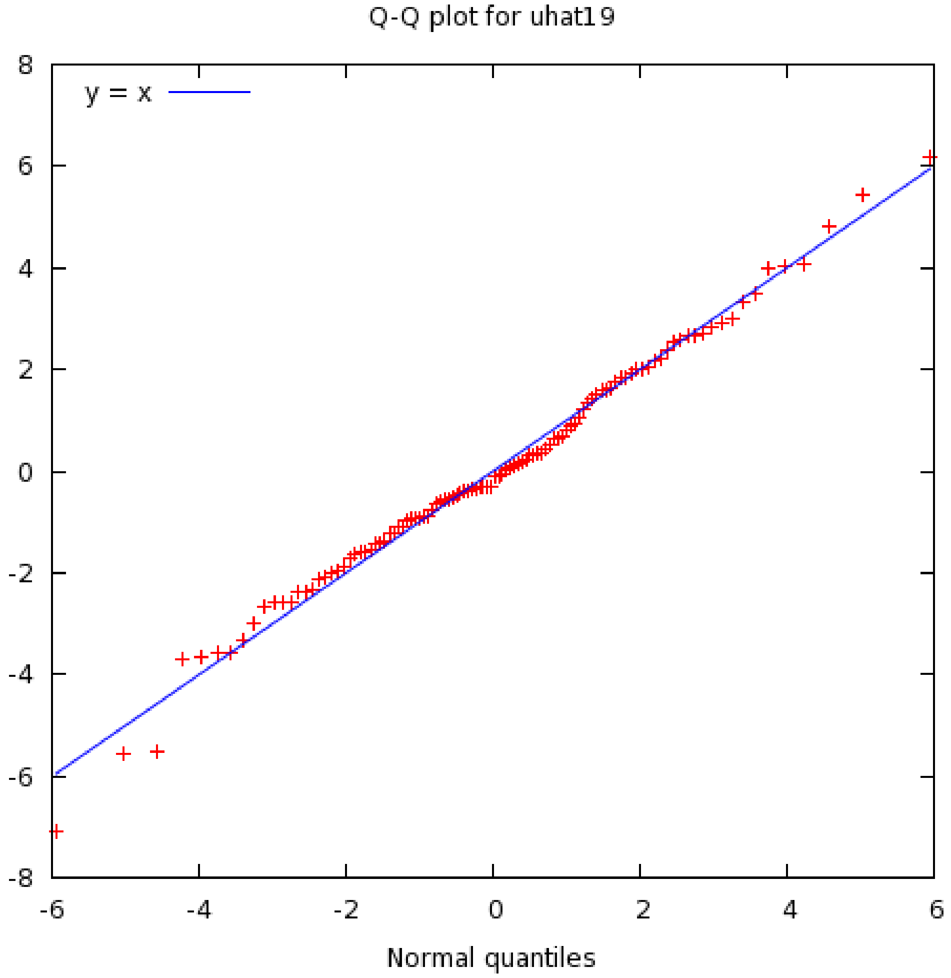
Appendix 6

Impact of total debt on Real GDP per capita growth

	OLS	FE	DIFF-GMM	GMM-SYS
Constant	9.515	-6.278	−0.203702	5.22342
	(5.751)	(8.159)	(0.390541)	(7.04054)
Gross savings	-0.2954**	-0.04943	0.0336549	−0.238467*
	(0.1457)	(0.1587)	(0.147116)	(0.143334)
Population growth	-0.1576**	-0.01917	−0.0219593	−0.153944***
	(0.06094)	(0.07023)	(0.0872438)	(0.0528251)
Schooling	0.5527*	-0.4733	0.721370	0.639086
	(0.2954)	(0.8231)	(1.05543)	(0.422210)
Trade openness	0.04461*	0.3817***	0.436645***	0.0885865**
	(0.02382)	(0.06684)	(0.0879012)	(0.0360399)
Fiscal balance	0.7978***	0.5676***	0.596253***	0.876979***
	(0.2736)	(0.1634)	(0.128566)	(0.245483)
Dependency ratio	-0.4056**	0.1113	0.0827718	−0.360132
	(0.1938)	(0.5863)	(0.891819)	(0.237601)
Investment	0.2206*	0.5948***	0.672113***	0.258903**
	(0.1251)	(0.1206)	(0.100031)	(0.109682)
Total non-financial debt	-0.05201***	-0.1556***	−0.160714***	−0.0728479***
	(0.01023)	(0.01570)	(0.0305225)	(0.0113586)
RGDP growth (-1)	-0.08033	-0.3864***	−0.469682***	−0.161885
	(0.1081)	(0.07825)	(0.0704029)	(0.0997581)
Observations	110	110	100	110
Adjusted R-Square	0.5153	0.7927		
Log-likelihood	-292.0	-246.2		
P-value for Sargan test			0.0073	0.000
AR (2)			0.0955	0.0631

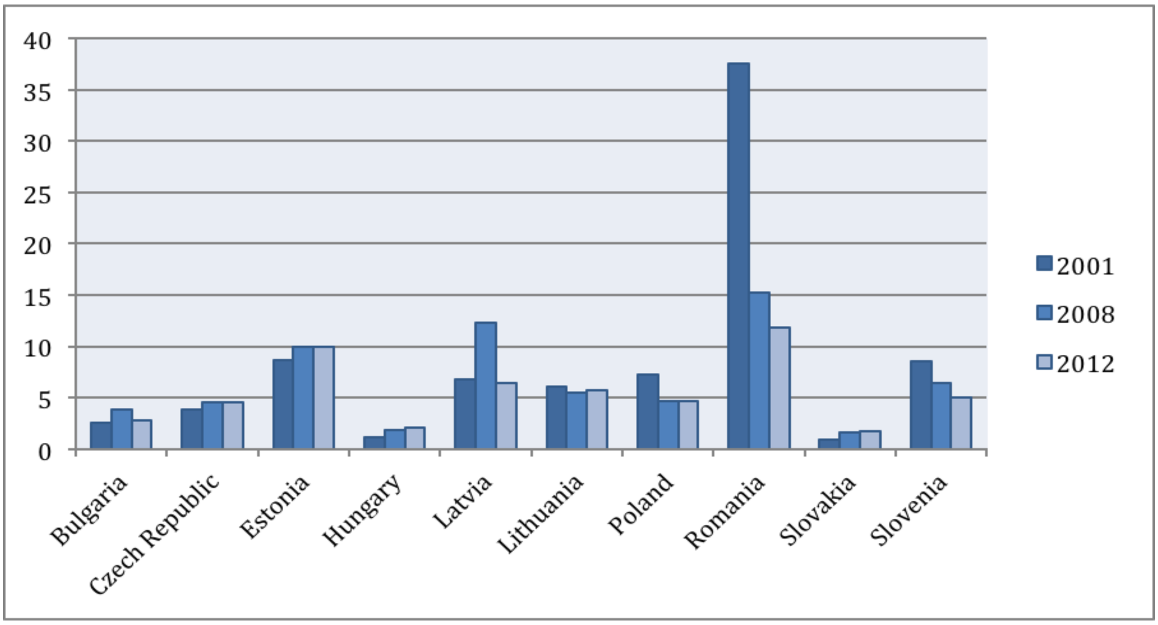
Standard errors in parentheses: * significant at 10 %; ** significant at 5%; *** significant at 1%.

Note. Author’s calculations.



Appendix 7. Normality of residuals for GDP growth in FE model.

Note. Author’s calculations.



Appendix 8. Employment rate for people 65 years and over, (2001, 2008, 2012). From Eurostat.

Appendix 9

Comparison of FE model effect for GDP growth, capital stock growth, human capital growth and TFP growth

	Real GDP growth	Capital stock growth	Human capital growth	TFP growth
Constant	-6.278	-0.5355	-0.06458	-0.06528
	(8.159)	(0.3719)	(0.06644)	(0.3924)
Gross savings	-0.04943	-0.001593	6.533e-05	-0.003489
	(0.1587)	(0.003826)	(0.0006394)	(0.004933)
Population growth	-0.01917	-0.006316**	-0.0006821	-0.006577***
	(0.07023)	(0.002905)	(0.0005760)	(0.002433)
Schooling	-0.4733	-0.04361	0.01700**	-0.05277**
	(0.8231)	(0.03320)	(0.008548)	(0.02548)
Trade openness	0.3817***	0.009001***	0.0001461	0.004835***
	(0.06684)	(0.002299)	(0.0002612)	(0.001400)
Fiscal balance	0.5676***	0.02101***	-0.0001832	0.01531***
	(0.1634)	(0.006965)	(0.0008566)	(0.005802)
Dependency ratio	0.1113	0.03865**	-0.005352	0.03601**
	(0.5863)	(0.01761)	(0.003223)	(0.01599)
Investment	0.5948***	0.02048***	-0.001968***	0.01582***
	(0.1206)	(0.002703)	(0.0006670)	(0.002781)
Total non-financial debt	-0.1556***	-0.004198***	-0.0005129***	-0.002716***
	(0.01570)	(0.0004820)	(0.0001032)	(0.0006142)
RGDP growth (-1)	-0.3864***			
	(0.07825)			
Capital stock growth (-1)		-0.2900***		
		(0.04782)		
Human capital growth (-1)			-0.3644**	
			(0.1663)	
TFP growth (-1)				-0.2801***
				(0.04571)
Observations	110	110	110	110
Adj. R-Squared	0.7927	0.6543	0.4408	0.5693
Log-likelihood	-246.2	106.8	319.9	126.2

Standard errors in parentheses: * significant at 10 %; ** significant at 5%; *** significant at 1%.

Note. Author’s calculations.

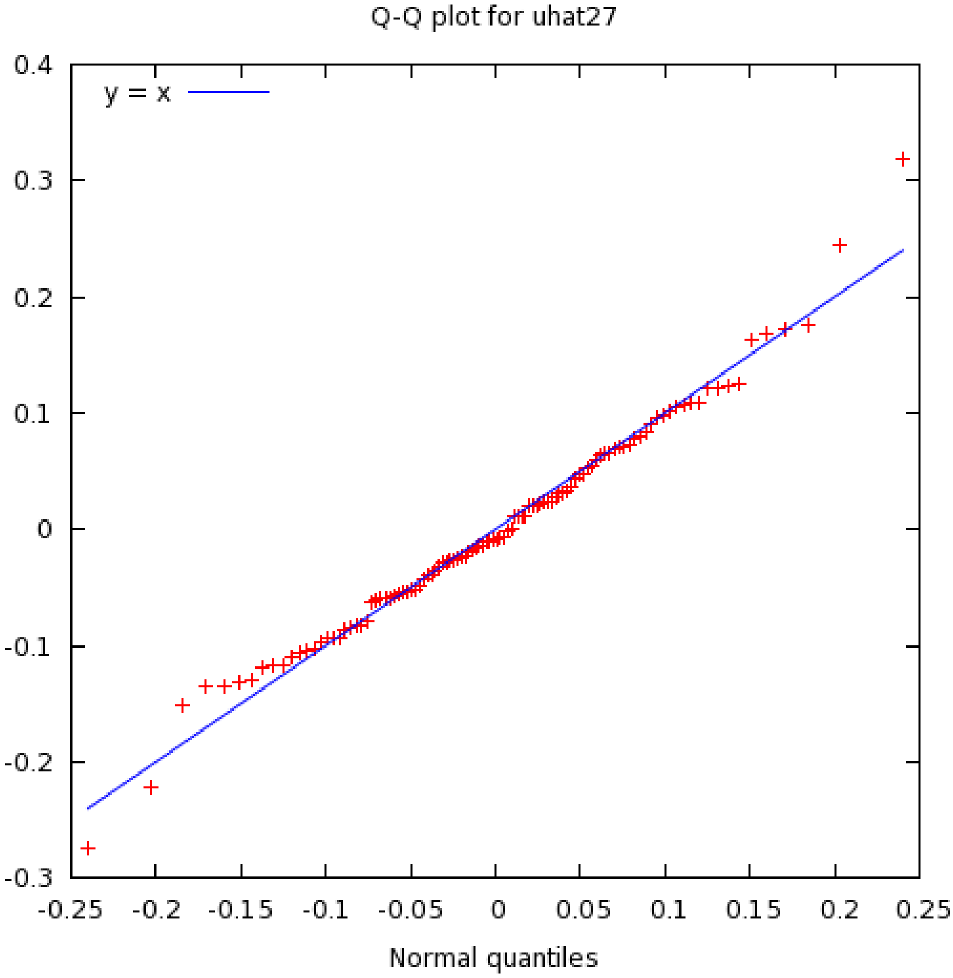
Appendix 10

Impact of total debt on capital stock growth

	OLS	FE	DIFF-GMM	GMM-SYS
Constant	0.2042	-0.5355	0.000386458	0.0752669
	(0.2496)	(0.3719)	(0.0157864)	(0.305375)
Gross savings	-0.005774	-0.001593	0.00147303	−0.00449313
	(0.004368)	(0.003826)	(0.00414245)	(0.00449295)
Population growth	-0.004038*	-0.006316**	−0.00691608**	−0.00509519**
	(0.002166)	(0.002905)	(0.00287930)	(0.00223636)
Schooling	0.005944	-0.04361	−0.0361593	0.00944523
	(0.01006)	(0.03320)	(0.0506330)	(0.0142918)
Trade openness	6.235e-05	0.009001***	0.00951821***	0.00127628
	(0.0008219)	(0.002299)	(0.00329170)	(0.00116232)
Fiscal balance	0.02383***	0.02101***	0.0207539***	0.0255663***
	(0.008669)	(0.006965)	(0.00598531)	(0.00856827)
Dependency ratio	-0.008362	0.03865**	0.0421602**	−0.00807141
	(0.006922)	(0.01761)	(0.0210754)	(0.00832111)
Investment	0.009030**	0.02048***	0.0237616***	0.00983539**
	(0.003624)	(0.002703)	(0.00294258)	(0.00394354)
Total non-financial debt	-0.0008774***	-0.004198***	−0.00480875***	−0.00135651***
	(0.0002721)	(0.0004820)	(0.000985872)	(0.000316829)
Capital stock growth (-1)	-0.05975	-0.2900***	−0.344252***	−0.0813058
	(0.08041)	(0.04782)	(0.0629799)	(0.0798315)
Observations	110	110	100	110
Adjusted R-Square	0.3759	0.6543		
Log-likelihood	76.09	106.8		
P-value for Sargan test			0.0074	0.000
AR (2)			0.0277	0.0203

Standard errors in parentheses: * significant at 10 %; ** significant at 5%; *** significant at 1%.

Note. Author’s calculations.



Appendix 11. Normality of residuals for capital stock growth in FE model.

Note. Author's calculations.

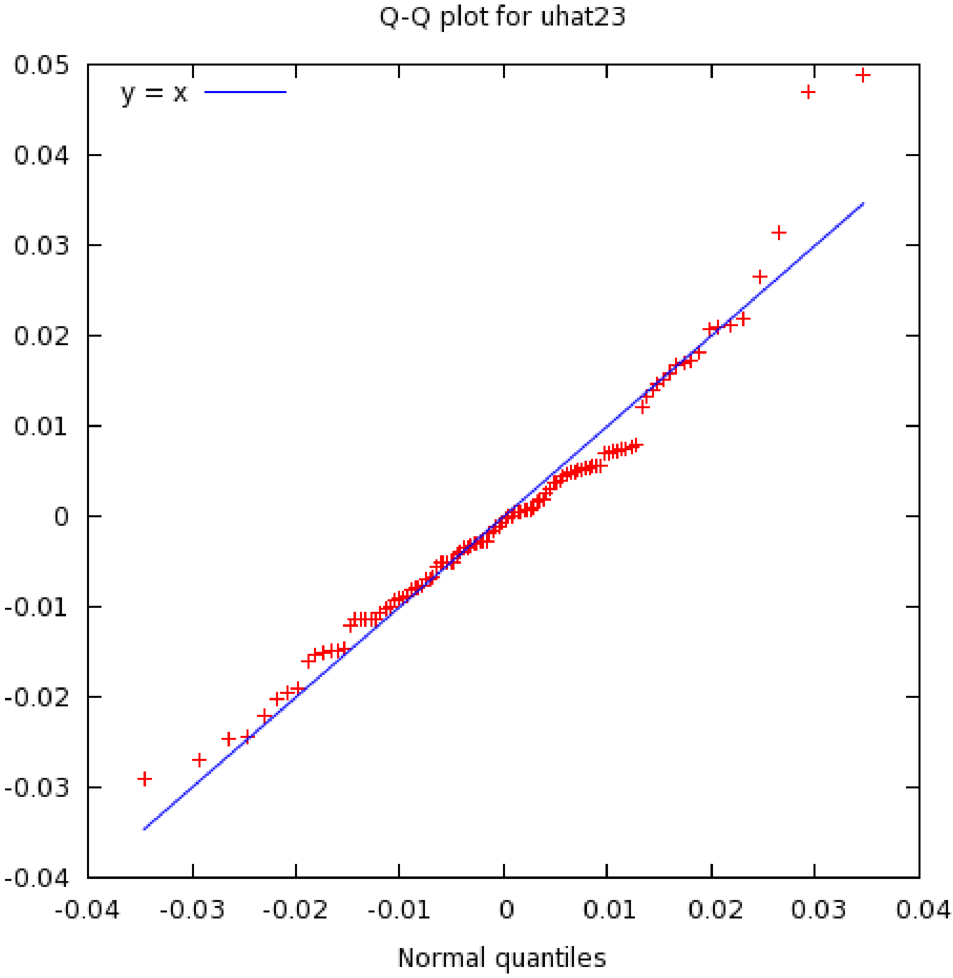
Appendix 12

Impact of total debt on Human capital growth

	OLS	FE	DIFF-GMM	GMM-SYS
Constant	0.04015**	-0.06458	−0.00584053***	0.0351635
	(0.02016)	(0.06644)	(0.00169449)	(0.0323298)
Gross savings	-0.0003666	6.533e-05	0.000949090	−9.27561e-05
	(0.0004581)	(0.0006394)	(0.000617784)	(0.000556075)
Population growth	-0.0001193	-0.0006821	−0.000442519	−0.000352895
	(0.0002706)	(0.0005760)	(0.000660524)	(0.000407619)
Schooling	0.0005990	0.01700**	0.0355668***	0.00221876
	(0.001672)	(0.008548)	(0.00576204)	(0.00248673)
Trade openness	0.0001479*	0.0001461	0.000558420**	0.000169764*
	(8.389e-05)	(0.0002612)	(0.000242863)	(0.000100213)
Fiscal balance	0.0001422	-0.0001832	−0.000975466	0.000301792
	(0.0004766)	(0.0008566)	(0.00124140)	(0.000486944)
Dependency ratio	0.0003960	-0.005352	−0.00151719	4.22210e-05
	(0.0006804)	(0.003223)	(0.00403577)	(0.000916816)
Investment	-0.0009487***	-0.001968***	−0.00277597***	−0.00125008***
	(0.0003356)	(0.0006670)	(0.000668329)	(0.000429429)
Total non-financial debt	-0.0002418***	-0.0005129***	−0.000388524*	−0.000351629***
	(5.403e-05)	(0.0001032)	(0.000203836)	(9.28805e-05)
Human capital growth (-1)	-0.07306	-0.3644**	−0.433989***	−0.251268
	(0.1398)	(0.1663)	(0.132435)	(0.185122)
Observations	110	110	100	110
Adjusted R-Square	0.1253	0.4408		
Log-likelihood	298.3	319.9		
P-value for Sargan test			0.0001	0.0000
AR (2)			0.2801	0.0875

Standard errors in parentheses: * significant at 10 %; ** significant at 5%; *** significant at 1%.

Note. Author’s calculations.



Appendix 13. Normality of residuals for human capital growth in FE model.

Note. Author's calculations.

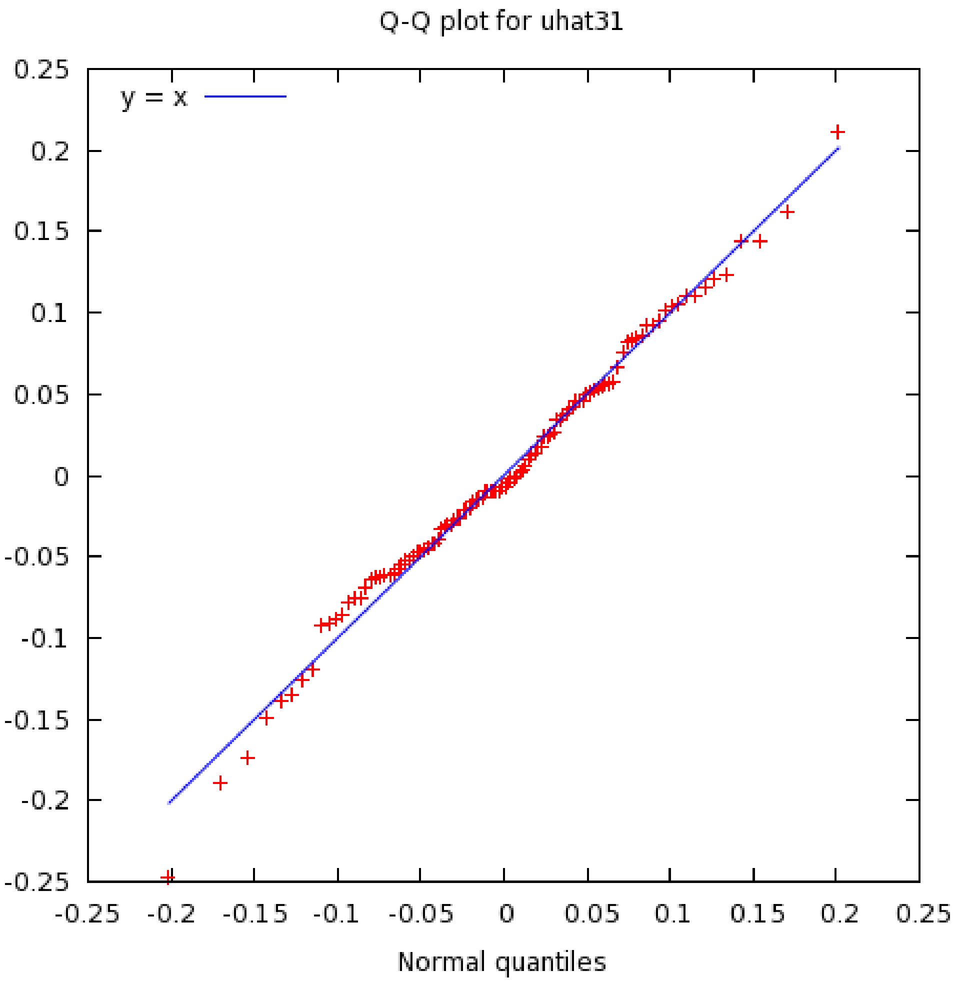
Appendix 14

Impact of total debt on TFP growth

	OLS	FE	DIFF-GMM	GMM-SYS
Constant	0.1906	-0.06528	−0.000161396	0.121464
	(0.2226)	(0.3924)	(0.0125060)	(0.247489)
Gross savings	-0.004739	-0.003489	−0.00113845	−0.00419528
	(0.003498)	(0.004933)	(0.00518152)	(0.00376496)
Population growth	-0.004207***	-0.006577***	−0.00758254***	−0.00465764**
	(0.001587)	(0.002433)	(0.00278172)	(0.00184260)
Schooling	0.001258	-0.05277**	−0.0310548	0.00303582
	(0.007983)	(0.02548)	(0.0326859)	(0.00997812)
Trade openness	-0.0001007	0.004835***	0.00502924**	0.000538204
	(0.0005213)	(0.001400)	(0.00207448)	(0.000699882)
Fiscal balance	0.01532**	0.01531***	0.0141457***	0.0172303***
	(0.006792)	(0.005802)	(0.00401208)	(0.00667931)
Dependency ratio	-0.005499	0.03601**	0.0373345*	−0.00513401
	(0.004958)	(0.01599)	(0.0201289)	(0.00583266)
Investment	0.009186***	0.01582***	0.0173648***	0.0103281***
	(0.002636)	(0.002781)	(0.00205551)	(0.00254526)
Total non-financial debt	-0.0006500***	-0.002716***	−0.00319429***	−0.000979220***
	(0.0001915)	(0.0006142)	(0.000966763)	(0.000241105)
TFP growth (-1)	-0.1413**	-0.2801***	−0.304072***	−0.196176***
	(0.06027)	(0.04571)	(0.0565073)	(0.0603209)
Observations	110	110	100	110
Adjusted R-Square	0.3685	0.5693		
Log-likelihood	105.4	126.2		
P-value for Sargan test			0.0065	0.0000
AR (2)			0.0295	0.0196

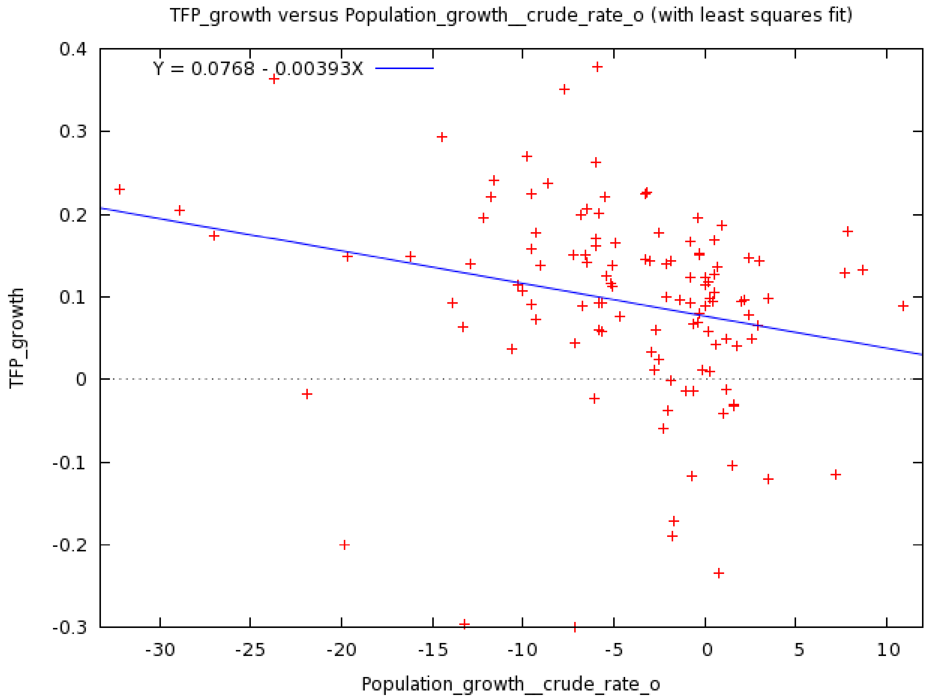
Standard errors in parentheses: * significant at 10 %; ** significant at 5%; *** significant at 1%.

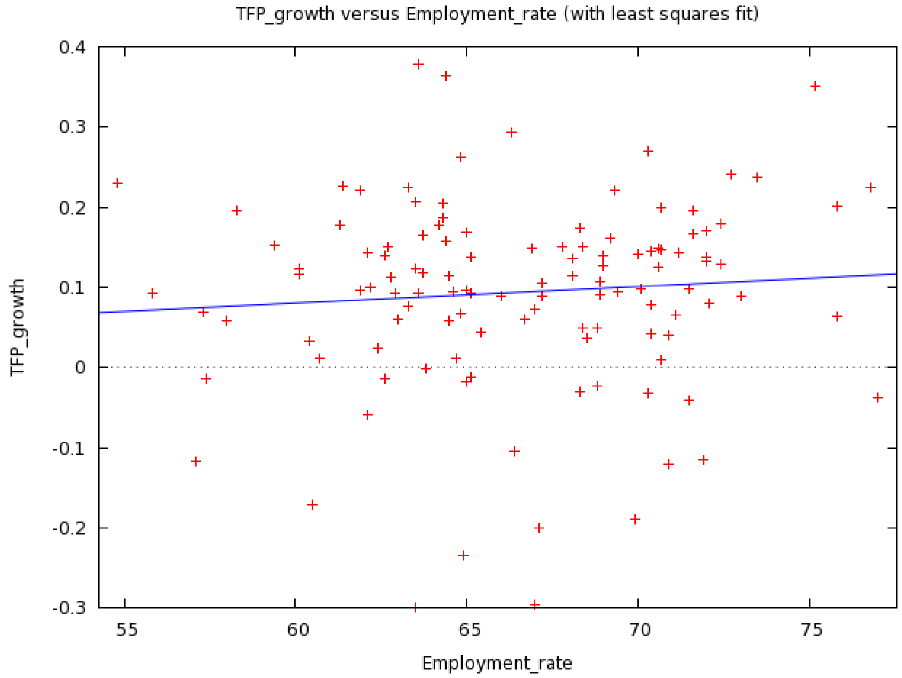
Note. Author's calculations.



Appendix 15. Normality of residuals for TFP growth in FE model.

Note. Author’s calculations.





a) correlation between TFP growth and population growth rate.

b) correlation between TFP growth and employment ratio.

Appendix 16. Correlation between TFP growth, population and employment in CEE, (2001 – 2012). Author's calculations.

Appendix 17

Fixed effect model for growth regression (I)

	(1)	(2)	(3)	(4)	(5)	(6)
Gross savings	-0.04386	-0.03078	-0.04348	-0.03374	-0.005355	-0.08070
	(0.1610)	(0.1321)	(0.1559)	(0.1533)	(0.1580)	(0.1552)
Population growth	-0.07930	-0.1078***	-0.08985	-0.05448	-0.03775	-0.09216**
	(0.05327)	(0.01657)	(0.05570)	(0.03973)	(0.04247)	(0.04073)
Schooling	0.3029	0.05237	0.2463	0.3472	-0.1680	1.079
	(0.6678)	(0.6949)	(0.6877)	(0.7804)	(0.7181)	(1.061)
Trade openness	0.2950***	0.3164***	0.2978***	0.3011***	0.3302***	0.2552***
	(0.08247)	(0.04943)	(0.08776)	(0.04316)	(0.04373)	(0.07140)
Fiscal balance	0.6274**	0.5319***	0.6310**	0.5228**	0.4967**	0.6165**
	(0.3146)	(0.1875)	(0.3077)	(0.2082)	(0.1996)	(0.2738)
Dependency ratio	-2.200***	-0.1567	-2.138***	-0.6349	-1.009**	-0.9162**
	(0.3652)	(0.5045)	(0.3299)	(0.3852)	(0.3980)	(0.3879)
Investment	0.3244*	0.3362***	0.2970**	0.4671***	0.4760***	0.3784***
	(0.1647)	(0.07496)	(0.1142)	(0.08254)	(0.08579)	(0.1288)
Total non-financial debt		-0.1085***				
		(0.01206)				
Government debt			-0.02053			
			(0.05377)			
Private debt				-0.09903***		
				(0.01669)		
Corporate debt					-0.1308***	
					(0.02674)	
Household debt						-0.1916***
						(0.06255)
Constant	24.60***	-7.011	25.28***	-7.545	6.535	-11.14
	(6.913)	(7.112)	(7.111)	(8.795)	(7.203)	(12.77)
Observations	120	120	120	120	120	120
Adjusted R-Squared	0.5858	0.7086	0.5866	0.6942	0.6893	0.6439
Log-likelihood	-305.8	-284.7	-305.7	-287.6	-288.6	-296.8

Standard errors in parentheses: * significant at 10 %; ** significant at 5%; *** significant at 1%.

Note. Author’s calculations.

Appendix 18

Fixed effect model for growth regression (II)

	(7)	(8)	(9)	(10)	(11)
Gross savings	-0.03096	0.003359	-0.08043	-0.01010	-0.02529
	(0.1339)	(0.1429)	(0.1478)	(0.1393)	(0.1515)
Population growth	-0.09984***	-0.09056***	-0.1066***	-0.09455***	-0.04910
	(0.01915)	(0.02019)	(0.03951)	(0.01801)	(0.04400)
Schooling	0.09437	-0.5699	1.007	-0.3070	0.1986
	(0.7528)	(0.6817)	(1.078)	(0.8717)	(1.015)
Trade openness	0.3144***	0.3520***	0.2588***	0.3373***	0.3096***
	(0.04779)	(0.04469)	(0.07793)	(0.04842)	(0.04763)
Fiscal balance	0.5283***	0.4949***	0.6214**	0.5056***	0.5130**
	(0.1901)	(0.1685)	(0.2714)	(0.1726)	(0.2019)
Dependency ratio	-0.1875	-0.4521	-0.8232*	-0.2942	-0.7106***
	(0.5387)	(0.4877)	(0.4511)	(0.4305)	(0.2446)
Investment	0.3577***	0.3465***	0.3416***	0.3526***	0.4727***
	(0.08560)	(0.09352)	(0.09943)	(0.08847)	(0.08343)
Total non-financial debt					
Government debt	-0.09338***	-0.1166***	-0.02790	-0.1092***	
	(0.02828)	(0.03062)	(0.05238)	(0.03755)	
Private debt	-0.1094***				
	(0.01232)				
Corporate debt		-0.1531***		-0.1384***	-0.1103***
		(0.01666)		(0.03018)	(0.03327)
Household debt			-0.1929***	-0.04686	-0.07237
			(0.05894)	(0.05317)	(0.06225)
Constant	-7.818	7.319	-10.44	0.3602	-4.135
	(7.545)	(7.022)	(12.15)	(8.633)	(12.90)
Observations	120	120	120	120	120
Adjusted R-Squared	0.7091	0.7114	0.6453	**0.7137**	0.6951
Log-likelihood	-284.6	-284.2	-296.5	**-283.7**	-287.5
P- value (F)	0.000	0.000	0.000	0.000	0.000

Standard errors in parentheses: * significant at 10 %; ** significant at 5%; *** significant at 1%.

Note. Author’s calculations.