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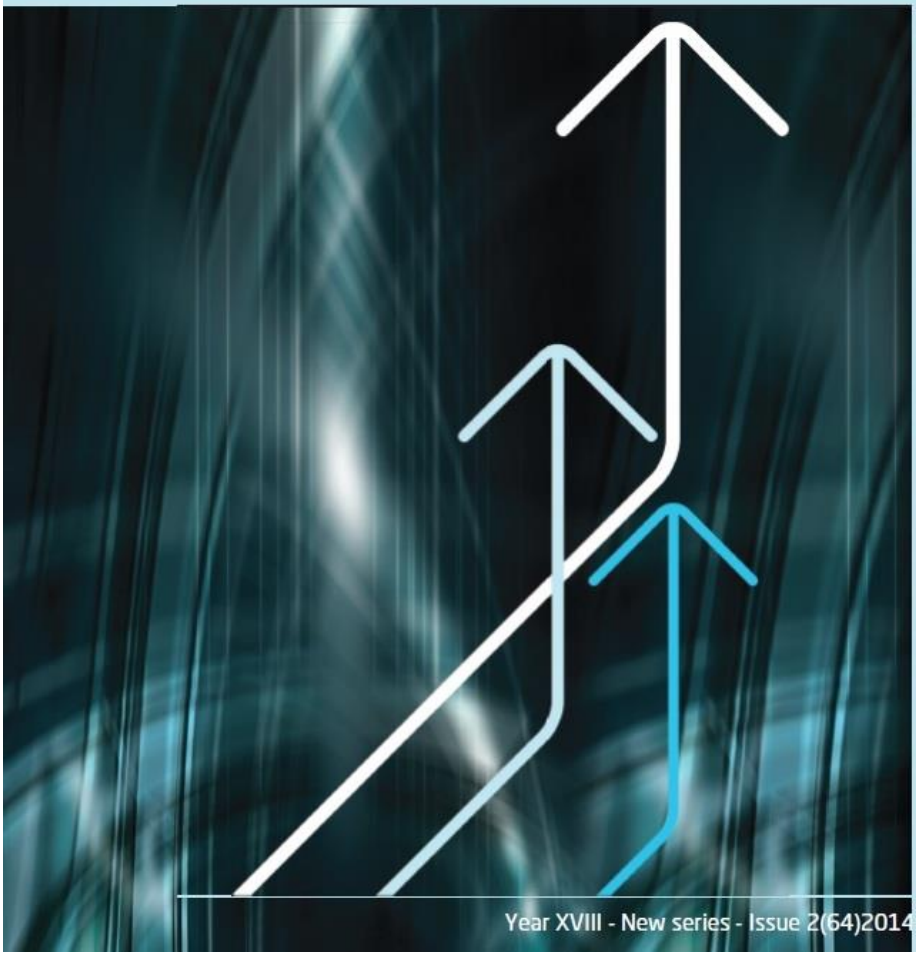

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“VICTOR SLĂVESCU” CENTRE FOR FINANCIAL
AND MONETARY RESEARCH

FINANCIAL STUDIES

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CONTENTS

THE CURRENCY CRISIS TRIGGER OF THE ROMANIAN FINANCIAL CRISIS OF 2008

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Abstract

This paper analyses the ways the financial crisis started to manifest into the Romanian Financial System, through the exchange rate channel. The focus of this Paper is on how the Romanian decision makers contributed in triggering the financial crisis (that would have been triggered anyway). The paper will determine the trigger (the first obvious event) for the Romanian Financial Crisis (the debut) and it will prove that the consequences of this trigger could have been anticipated - it is in line with similar triggers for the debut in other currency crises. Therefore, one of the main conclusions of this paper is that while a global crisis starts to manifest the local economy should limit the exuberance of the decision makers in order to smooth the effects of the crisis.

Keyword: Exchange Rate, financial crisis, currency crisis, balance of payment Crisis.

JEL Classification: E52, E58, G01

1. Premises of the Romanian currency crisis (2008)

By the fall of 2008, the Romanian current account deficit was set to reach 13% of GDP so the question was not if Romania is heading towards a balance of payment crisis, but when. The crisis debuted in Romania, after the fall of The Lehman Brothers but the trigger was not the fall of the investment bank. By the end of 2004, the Q4 dynamics of GDP was -13% comparing with + 9% growth in Q1-Q3.

The main factors for the widening of the current account deficit (exports and imports) are revealed in the Figure 1:

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Figure 1

Source: National Bank of Romania

Romania entered the crisis with a miss match of the foreign debt. According to the National Bank of Romania Governor, Mugur Isărescu, the financing need on the short term at the beginning of the crisis (2008) was up to 16 billion Euros (7.5 billion - 16 billion)[1]

2. Conceptual and theoretical context:

Krugman (1979) and Flood&Garber (1974) explain how the currency crises develop especially after and inadequate economic policy mix - mainly by persistent high fiscal deficits and by trying to maintain a fix exchange rate regime. The inconstancy may be just partially compensated if the Central Bank has enough foreign exchange reserve, but when the reserves become inadequate, the speculators try to force the depreciation of the exchange rate by the selling of the domestic currency[2]. Krugman (1979) states that the speculators will attack a currency as soon as such an action might have a success. In this condition, the false conclusion we might draw is that the currency fall was provoked by the speculators and would not have been justified by fundamentals.

Krugman (1996) defines a model for market manipulation. The scenarios are generated even by rational expectations that eventually

[1] *Isărescu, Mugur - „Finanţarea dezechilbrului extern şi ajustarea macroeconomică în condiţiile crizei financiare. Cazul României'', BNR, Bucureşti, 2009, p.20 - 27*

[2] *Krugman shows that an economy that is subject to persistent and predictable deterioration will face a currency crisis. The logic for a currency crisis is that it will happen before the deterioration of the fundamentals would have driven anyway to a fall in the exchange rate (even in the absence of a speculative attack).*

lead toward self fulfilling crises or by the irrational horde effect. Both of these scenarios leave enough room for profit for the speculators.

The model defined by Krugman takes into consideration that a country is vulnerable by abandoning the deposits in the local currency of the foreign investors. The investors will assume that the local authorities will abandon the peg or the managed floating regime once a speculative attack is triggered or they copy their actions. So, a big investor might register significant gains by shorting on the currency (a bet on the depreciation of the local currency) and by triggering the crisis intentionally. This attitude, according to Krugman might include a mix of public statements and ‘‘show-off’’ selling of the domestic currency (as George Soros did during the attack on the pound in 1992).

Krugman motivates the seldom presence of such attacks, because a self fulfilling crisis scenario is rather limited: most of the currencies tend to be under attack as soon as they are vulnerable to such an action (that what was happening in Romania in 2008). Knowing this, the investors will try to anticipate the fall and to prematurely trigger it, so they will initiate an attack as soon as they see success probabilities. While everybody knows that a certain currency is vulnerable and they can capitalize on this, the investors will short sell the currency anticipating that somehow one of the biggest players will eventually succeed in undermining the exchange rate so they will force the collapse of the exchange rate.

The speculative attack is just the front entrance for a currency crisis. The full scale currency crisis will manifest through the exchange rate channel, by depreciation, that will trigger a huge discomfort in an euroized economy (where the loans are significantly made in a different currency than the local one). The depreciation will put pressure on the borrowers capacity to pay back the loans and we will have a different scale of the crisis.

3. The unofficial debut of the different crisis part of the World Great Recession of 2008

The international economic literature tries to define exactly the moments that different crisis were triggered and the actual trigger of the crisis (that would have come anyway). On Table 1 we describe the triggers of the credit crunch crisis (worldwide), the trigger of the financial crisis in the US, the one for the liquidity crisis and the European sovereign debt crisis. We will also set the date for the debut of the global financial crisis in Romania (through an attack on the currency) on September, 30, 2008.

Table 1

The debut and triggers of the different crisis that were part of the Global Financial Crisis of 2008

The Crisis	Date	Trigger
The US Suprime Debt Crisis an the start of the worldwide Credit Crunch Crisis	August, 9, 2007	BNP Paribas
The US Financial Crisis	March, 5th, 2008	A hedge fund manager in Florida
The World Liquidity Crisis	September, 15th, 2008	Lehman Brothers
The Romanian Crisis Debut	September, 30, 2008	Legislation vote on wages
The start of the European Sovereign Debt Crisis	October, 10th, 2009	Geroge Papandreu

Source: Author's data gathering

Details:

* On August 9 2007, the French bank BNP Paribas announced that it will close three investment funds reasoning that they do not know how to evaluate their assets (Colaterlized Debt Obligations - CDO based on the slice and dice of the US subprime mortgages. It is the official start of the US subprime crisis. In the same day, the FED and the ECB inject 90 billion dollars in the panicked financial markets so we see the debut of the ''credit crunch crisis''[3]

* March, 5th, 2008: A hedge fund manager sends a newsletter to his investors that include the following statement: ''in my books, Bear Stearns is insolvent''[4]. Bear Stearns was ready to announce 115 million dollars profit for the first quarter and a stock of cash reserves of 17.3 billion Euros. Ten days after, Bears Stearns no longer existed. It is the start of the US financial crisis.

[3] *The credit crunch is used for describing a situation when the commercial banks are reluctant to inter-banking lending and this provokes fears for the Central Banks that this signal will be suddenly transmitted towards companies and private persons.*
[4] *Cohen, William - ''House of Cards'', Ed. Doubleday, New York, 2009*

* September, 15th, 2008: Lehman Brothers goes insolvent and triggers a systemic risk for the World Banking System. Merril Lynch, the third investment bank worldwide is bought by Bank of America and the biggest insurer in the world, AIG need a financial bailout of 85 billion dollars. It is the debut of the World liquidity crisis;

* September, 30th, 2008: The Romanian Parliament votes the increase of public wages paid to teachers by 50%, starting next day, October 1st. It is the trigger of the speculative currency attack on the Romanian Leu (RON). On October 27th, S&P downgrades Romania to ''junk'' and on November 10th, 2008, Fitch rating agency does the same thing. On January 16th, 2009, Commerz Bank warns its clients agains the fact the Romania goes through a balance of payments crisis (as it happen to Hungary who avoided the BOP crisis by going to the IMF on October 8th, 2008). In March 2009, Romania signs for a 20 billion Euros loan from IMF, European Comission and the World Bank - through a stand-by arrangement.

* October, 10th, 2009, the new Prime Minister of Greece - George Papandreu says that Greece has a public debt which is 100% bigger than the one previously announced. It is the debut of the sovereign debt crisis;

4. The currency crisis in Romania

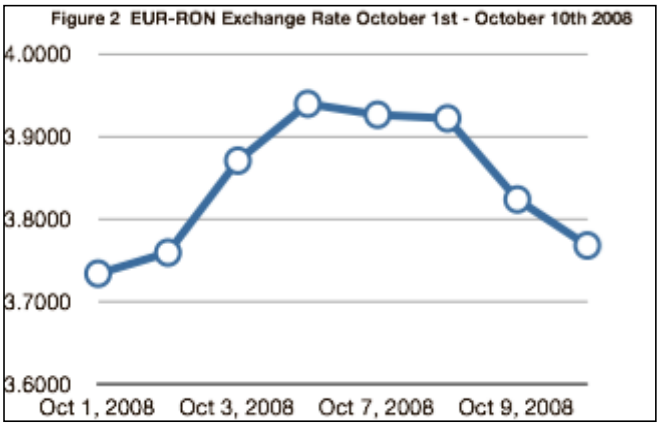
As we stated. the debut of the currency crisis in Romania was triggered by the September 30th, 2008 announcement that Romania is going to increase the teachers wages by 50%.

As a strategy, the attack operated as follows: the speculators assumed the negative effect of the news that during a world financial crisis Romania wants to increase the public wages for the teachers by 50%. They tried to provoke and tot take profit on the RON depreciation. They shorted the RON (they borrowed RONs that were supposed to be paid back later if the depreciation will succeeded). The Central Bank resisted somehow to the depreciation pressures (they sold Euros against the RON so they sterilized the RONs in the market). Croitoru (2012)[5] states that the Central Bank intervened on the market by selling foreign currencies in order to absorb the RONs on the market and the

[5] *Croitoru, Lucian - „Politica monetară. Ipostaze neconvețnionale'', Editura Curtea Veche, Bucureşti, 2012*

NBR found counter parties for the foreign currency from different reasons:

Figure 2



Source: National Bank of Romania, daily exchange rate

* the biggest FOREX players (big banks) watch the fundamentals (huge current account deficit, increased fiscal deficit - that was estimated at that moment at 5% of GDP);

* the fundamentals showed that Romania was speeding towards a Balance of Payment Crisis;

* the only easy exit from a balance of payment crisis it is traditionally the depreciation of the exchange rate

So, following this mechanism, the Euro that was sold by the Central Bank for 3.7 - 3.8 - 3.9 Rons would have been a good profit opportunity for the big banks (not so far away when the RON would have been depreciated anyway). These Euros were treasured in order to sell them at different increased prices (4.2 or 4.3) by the time when the balance of payment crisis would have been fully revealed.

This mechanism succeeded because less than 3 months after, the Eur-Ron exchange rate was floating around 4.3 RONs for 1 Euro.

On the short term, the Central Bank sterilized the RONs on the market so the speculators and toher borrowers were obliged to pay higher interests. As the price of the currency is its interest rate, the RON became more expensive (the interest rate on the money market rose from about 10% to over 50% per annum). At this cost, it was not

rentable for speculators to borrow, so they started to sell back the RONs they bought, marking losses and the exchange rate came back to 3.76 on October 10th (similar to October 2nd RON-EUR exchange rate). Before this, the RON lost 5.5% percent against the Eur in just 3 sessions.

5. Conclusions on the influences of the currency crisis on the Romanian financial system

The speculative attack somehow failed and faded on October 10th. But the tensions were exported through the interest rate channel. Even if the interest rate shown on the money market where ‘‘interest shown’’ not ‘‘effective’’ (not everybody was lending/borrowing at these rates), the money market interest rate used to be references for commercial loans in RON (to companies and households). So, the ‘‘storm’’ on the money market was reflected in a significant increase of the reference interest rate for the loans made in RONs.

The Central Bank tried to limit these distortions by capping the money market interest rate ROBOR to a maximum +25% above the monetary policy interest rate (MPIR). By that time, MPIR was 10.25 so the cap was set to 14.25%, in order to limit the loans in RON to become much more expensive (then they already were).

The appreciation of the RON against the EUR after the speculative attack was temporarily (between October 10th 2008 - January, 20th, 2009 the EUR reached a new historical high against the RON (4,3127 lei on January 20th, 2009 comparing with 3,7690 lei). In 14 weeks, the RON lost 14.4% of its value agains the Euro putting transmitting pressures on other channels (interest rate channel, commercial channel, trust channel, financial channel, wealth channel). These channels would have been activated anyway (by a different trigger and on a different dimension) but the currency crisis accelerated and amplified the tensions and the effects.

As the main lessons of the currency crisis in Romania we identified:

a) when a global crisis in on-going, there is a terrible mistakes for the local authorities to feel and act as the local economy will be isolated;

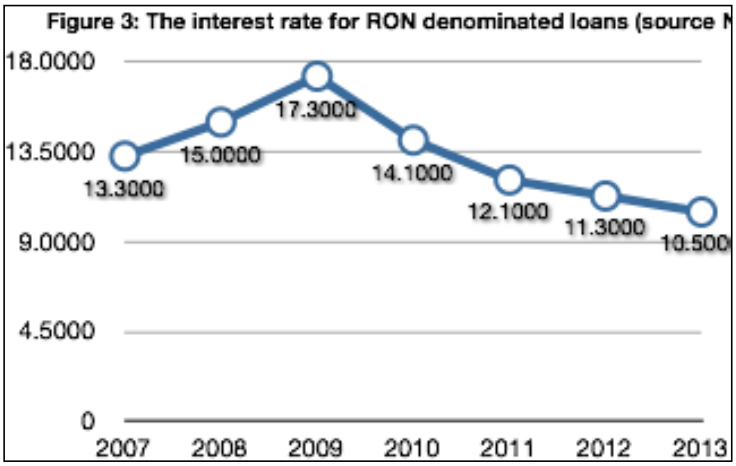
b) there is a strong urge for the policy mix authorities to coordinate their policies in order to assure a ‘‘soft landing’’ (that

means in terms of the exchange rate a smooth depreciation of the national currency˝

c) even if the depreciation of the local currency is a proxy for repairing a balance of payments crisis, in order to assure the smooth landing it is desirable to be pro-active and re-establish strong ties and commitments with the Institutional lenders of last resort (IMF, European Comission, The World Bank). Such an agreement will prevent the appetite of speculators to attack a vulnerable currency;

d) when a balance of payment crisis is unavoidable their is a huge mistake to be addicted to short term borrowings for financing the public debt need. This creates a crowding out effect (the states targets the same limited amount of money that is available on the market as the companies and other private borrowers having as an effect a more expensive price for the loans) (Figure 3);

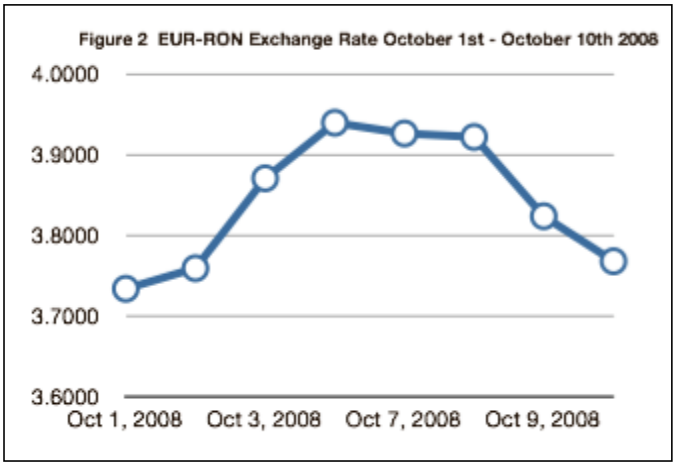
Figure 3



Source: National Bank of Romania

e) an overshooting in terms of depreciation will put additional pressure on the non-performing loans, that might affect the stability of the banking system, especially in an euroized credit enviroment (Figure 4).

Figure 4



Source: National Bank of Romania

f) even if you resist a currency attack, sooner or later the depreciation will be driven by the fundamentals. Knowing this, policy-mix authorities should try to prevent some major disturbances in other sectors (for instance the peg between the ROBOR rate and the actual interest rate perceived for loans in the national currency). Capping the ROBOR has proved to be a ration decision but by the time it came into effect, the disturbance on the money market has been already transmitted in the price of loans (the interest rate for RON denominated loans increased in some cases from 12% per annum to 24% per annum).

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MONETARY POLICY FORCE EFFECT BY MEANS OF BANKS MONEY CREATION

Victoria COCIUG, PhD *
Olga TIMOFEI **

Abstract

In the context of modern economy, banks play an essential role for sustainable growth, by ensuring economy with financial resources and driving impulses of monetary policy to economy. Monetary authorities influence significantly the bank's ability to fulfill this role. Thus, to achieve macroeconomic objectives, there is promoted particular monetary policy and are implemented various practical regulations for banks. In this article, we want to identify the existing relationship between monetary policy followed by the authorities and the ability of banks to create money with its impact on various practical regulations.

Keywords: monetary policy, money creation, bank regulation and supervision survey

JEL Classification: G21, G28

1. Present situation

The international financial crisis triggered by the end of the first decade of the XXI century has imposed monetary authorities together with academia to review the impact of monetary policy on financial stability and its contribution to sustainable economic growth. Successes of recent years in the primary objective of monetary policy, which keeps the price stability, did not bring the expected results for the real sector. In spite of the inflation low rates in the medium term, it is not proving economic recovery expectations.

At the moment, monetary policy changes are undertaken, coming to cheaper financial resources unfocused to the real sector. In this context, as an example can be presented the policies promoted by

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the European Central Bank, which according to the latest statements of its President covers several possible unconventional measures to reduce the risk of installing a low inflation for a long period of negative interest rate for banks liquidity that will redirect to the priority sectors of the economy (ECB, 2014). Thus, different mechanisms of monetary policy attempts to facilitate the process of money creation by commercial banks in such a way that they increase the volume of business funding, in the real sector, in order to achieve real economic growth.

Decisions that are to be taken, were grounded in economic theory by many economists (Fischer, 1986; Friedman, 1969; McCallum, 1987), based on the fact that prevention of disinflation processes in the economy can be made by increasing the money supply in circulation, and create a minimum inflation level required for sustainable economic growth. At the same time, the amount of money supply is not completely directed to the real sector, and a part of it is stored within the financial market.

In this context, a particular interest has the answer to the question related to the effectiveness of liquidity injection measures in the economy, in conditions that commercial banks do not fulfill effectively its function of cash propulsion in the real sector of economy. Especially in condition that any banking lending activity also requires certain costs and limitations that arise from a range of prudential regulations imposed by the authorities, which limit their ability to force the inputs.

2. Tasks and methods

The monetary policy of the central bank, apart from of the objectives and tasks which it proposes, actually seeks indirectly to create conditions for healthy economic growth and development. Conducting a monetary policy focused only on its objectives, do not end with beneficial results for economic growth, if the effectiveness of the used instruments is not monitored. This is because, the central bank can only influence on the economy through commercial banks, which are responsible not only for ensuring the economy with financial resources, but also for the implementation of state monetary policy sending its impulses. When the promoted monetary policy does not lead to expected effects, the causes of failure can be foundnot only in the policy requirements, but also in banking activity, namely in the

performance of its functions, especially in financing function, that is doneby monetary creation.

Commercial banks' ability to create money has a great importance for the economy (Andolfatto&Nosal, 2003). In conditions of bank credit lack, the growth of economic agent's activity becomes impossible or is delayed in time, until thenecessary funds are accumulated from profits or from other sources. Moreover, businesses will be forced to accumulate and save large amounts of money to cover the risks that may arise in their activity. This practice is convictedfrom start, because a large amount of money would have been stored for a long period of time and during thebusiness commencement they could not cover the increased expenses. Economyalways has need of a continuous flow of money, but it should not be very high. The excess of money in circulation, that is much more than the real economy need can generate a harmful inflation for economy. And on the opposite, the deficit of money supply may lead to the stagnation of economic activity which is also opposite to the monetary authority's objectives and goals.

It is important to mention that banking system is relatively independent in its decisions for credits allocation. As to its financing function, banks start with the operations profitability and the assumed risks, in a way that their decisions are influenced more by the level of economy development than the desire to contribute to its growth.It is obvious that the amount of money and the credit worth have different values for an economy. This is because the first depends on monetary policy decisions, taken under the pressure of macroeconomic arguments, based on results indicators. While the second one is caused by anticipated micro-level reasoning, oriented to the most favorable relation between profit and risk that is contributing to the creation of macroeconomic result indicators. Thus, monetary policy decisions are based on indicators that consider the effects of these policies, anticipated by the banking system and therefore you should promote the efficiency of this banking system policy. In this context, it is proposed to follow how the banking system function of money creation is transformed into the financing function, in order to create a *propulsion indicator of money in the economy*, which assesses the relationship between money and the credit amount in the economy.

The efficiency propulsion money to economy indicator shows how the banking system considers the future development of an economy, for the reason that credit is based on the analysis of future

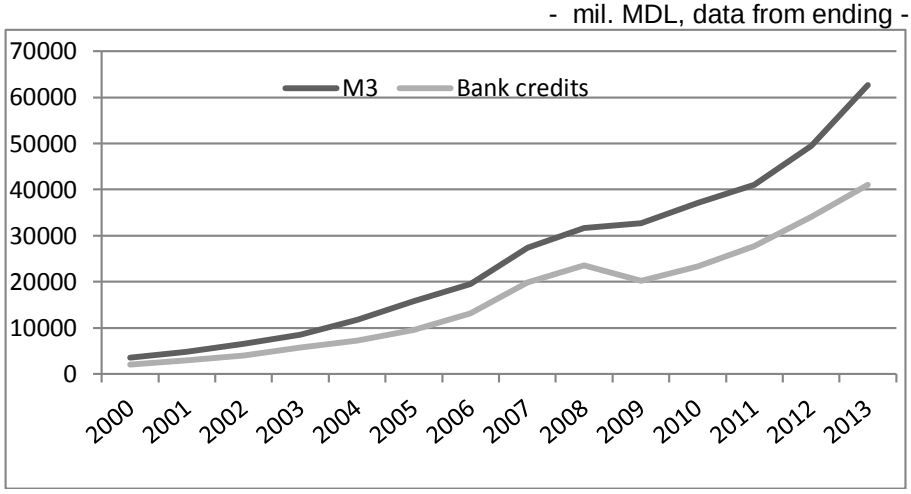
creditworthiness of real sector. By financing real sector, banks do not seek immediate results of monetary policy their decisions are based on the anticipation of future effects.

In order to check theimportance of this indicator, we intend to follow its evolution on the monetary market of Republic of Moldova.

Figure 1

The evolution of money supply M3 and of bank credits within the period of 2000-2013 years, in RM

- mil. MDL, data from ending -

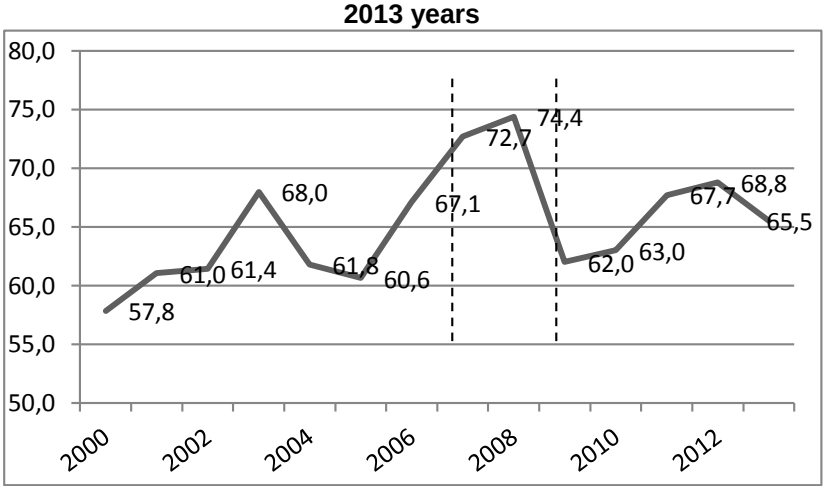


Source:National Bank of Moldova, 2014

It may be noticed a dissimilarsituation during different periods of time, and unusual banks behavior for the monetary policy propulsion taken from money creation into economy point of view. These discrepancies can be noticed much better if the graphic of propulsion indicator evolution is analyzed.

Figure 2

The evolution of propulsion indicator in RM during the period of 2000-2013 years



Source: National Bank of Moldova, 2014

Analyzing the graphics of the propulsion indicator evolution can be noticed that the maximum value it has reached during the analyzed period was of 74% (fig.2). This level may be considered very close to the highest one, as for the prudential requirements obligatory to banks related to maintaining liquidity. According to the second principle of liquidity imposed to banks by NBM, these should have liquidity of 20%from its assets. Thus, in RM, the credits quantity offered to the economymay have a tendency to the maximum of 80%.

Though, it may be noticed that during the reference period there are three specific periods of the propulsion effect development:

- During the 2000-2006 is noted that the ability of banks to create money is quite low, with the exception of 2003, when on the background of a relative stability, the banking system anticipated the mitigation of credit risk in the economy. But this advance was not substantiated by reality, that's why in 2004 the indicator propulsion returned to the level of 2002 year.
- The ability of banks create money during 2007 - 2008 year is improved to maximum, reaching 74.4%.

- From 2009 it is noticed that in spite of the fact that money supply grows, the ability of banks to create money again falls to low levels.

Thus we see that the trend of economy financing by banks is not always equivalent to the quantity of money in the economy trend, which indicates the existence of certain factors influencing the ability of banks to transmit monetary policy impulses to the economy. Identifying these factors and their impact on the ability of banks to create money, in terms of economic growth is a key task of this paper, the formulation of proposals for the correlation of the monetary authorities and banking needs of the real economy.

3. Factors of influence

So, if the central bank, by different means, is trying to stimulate commercial banks to create liquidity for real sector financing. There are a lot of factors that may encourage or block this process at the bank sector level. Most of these factors that may promote or block the commercial banks' money creation process can be distinguished in conditions of an evident sustainability of central banks. Thus:

- *The real economy capacity to absorb a larger quantity of money.*Since the real sector still suffering the consequences of the global financial crisis or in a state of recession, economic agents mostly do not meet all the requirements to get a bank loan, being less creditworthy or having unfavorable credit history. In these conditions, in spite of the facilities provided by central banks, the liquidity insertion into the economy by credits at the commercial banks level is strictly regulated in order to reduce risks andits effects. After an assessment of future solvency of its customers, banks will decide forcash holding, ignoring lending. Thus, with the economy worsening, its capacity to absorb the amounts of money provided by monetary policy will decrease and diminish the effectiveness of monetary policy. So the economy capacity of money absorption and propulsion effect is a contrary relationship, and the level of these indicators depends on the economic situation.

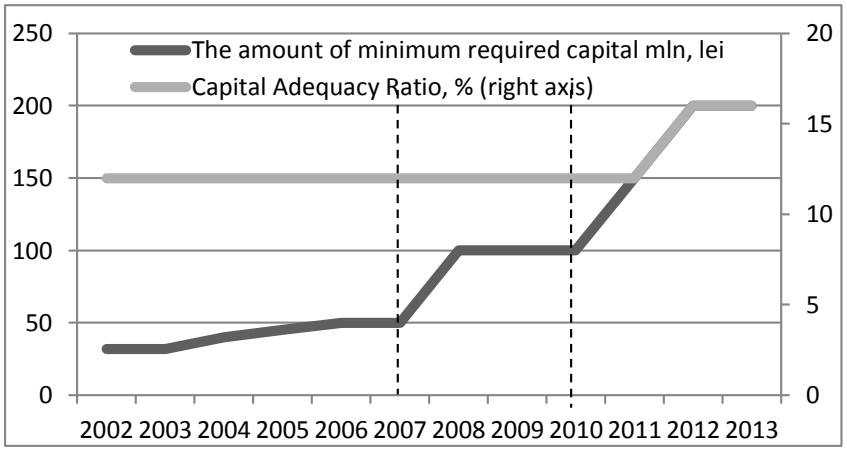
In order to argument this hypothesis we will return to fig.2, where it is shown that from 2009 year (the year when the global financial crisis effects were mostly felt in national economy) the money creation decreased. This effect can be explained by the worsening of economic solvency which influenced their eligibility in the contracting of loans from commercial banks. The verification of borrower's

eligibility is actually a prudential measure of the central bank, which banks cannot avoid.

- *The regulation system of the banking sector.* Themodern banking system is a highly regulated. Although this is very good for stability and economic sustainability it may reduce the propulsion of liquidity in the economy. Even if the banks would like to increase risk perception and provide credits, relying on their own experience and anticipation capacity, they could not do this because of the existing regulatory system.

Figure 3

The evolution of total regulatory capital requirements (million) and risk-weighted capital adequacy ratio (%) in RM



Source:National Bank of Moldova, 2014

For proving this statement, we will follow the influence of prudential norms prudential on banks' ability to create money. In a previous paper (Cociug and Timofei, 2014), we have already managed to prove that the increase of capital requirements for banks in Moldova did not cause credit reduction in the economy and did not negatively affected the ability of banks to create money. What we see now is that increasing the amount of total regulatory capital in 2007-2008, while maintaining risk-weighted capital adequacy ratio favored the growth index propulsion (Fig. 1 and 3). But we have also noted that since 2012, when the central bank raised the risk weighted capital adequacy ratio from 12% to 16%, the ability of banks to create money has decreased.

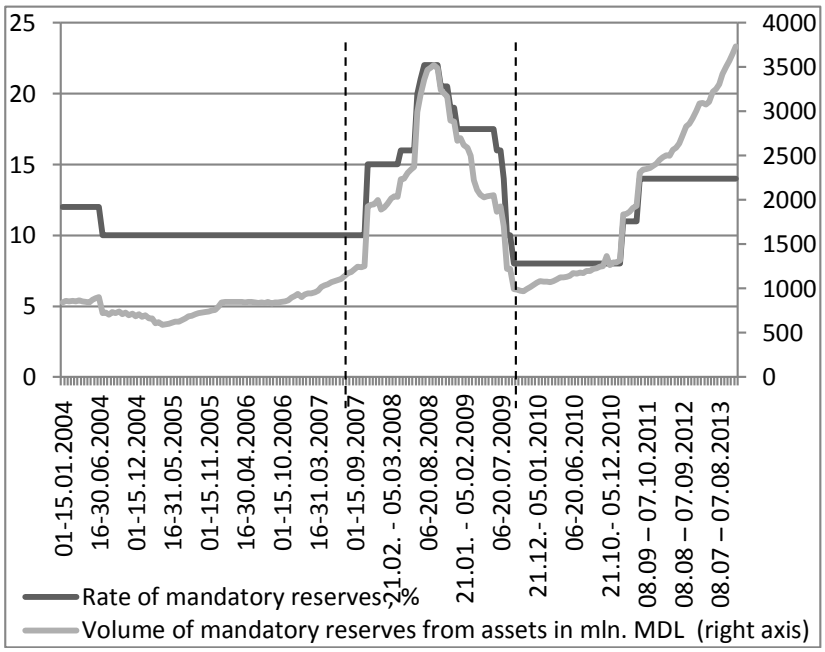
This fact explains the decrease of banks possibilities to finance risk-weighted assets from the equity account.

- *The necessity of risk financing*. Increase in loans assumes extra costs that not all banks may grant. Here again, appears the special banking regulation effect, under which commercial bank is obliged to form reserves for losses on balance sheet assets / engagements subject to credit risk (at least 2% for those classified as standard) (NBM, 2007). Creation of additional funds requires availability of capital for loan maturity period, which increases the cost of credit allocation, so some banks due to the lack of additional funds waive lending. Furthermore, these provisions being components of bank charges increase the cost of credit allocation, and some banks that work at the limit of the projected profitability of shareholders are not ready to accept.
- *Cost effect.* Monetary policy instruments have an effect on interest rates, which represent the base of money flows costs that further are propelled by banks in the economy in the credit form. For example, any increase in required reserves will result in increased costs to the bank for the involved funds, which will eventually create increase of lending rate. In this context, the increase of credit price has a negative influence on their demand limiting the ability of banks to create money (purposes of this instrument), and decrease propulsion indicator.

But if we analyze the minimum reserve volume and coefficient compared with propulsion progress indicator, we observe that minimum necessary reserves do not influence the propulsion effect at the expected extent. Moreover, the effect is converse, the growth of mandatory reserves volume due to the imposition of higher standards by monetary authority's leads to store cash accounts of commercial banks, which diminishes their efforts to remain liquid, and banks are willing to direct available resources for lending. Application of increasing levels of reserves as a rule is, on the background of persistent inflation (for example in RM, in this period inflation reached 10 to 14%), where the banking system predicts growth and is willing to credit, and the economy is able to absorb the financial resources for higher costs.

Figure 4

Evolution of compulsory reserves maintained by banks NBM (mln. lei) and mandatory required reserves imposed by BNM (%)



Source:National Bank of Moldova, 2014

- *Banks internal strategies effects*. As independent economic agents, banks are working to gain profit, which has more effect than purpose the propulsion ofmonetary policy impulses to the economy. In this context, banks may not be willing to credit economic agents, under the influence of internal decisions of shareholders or other internal decision-making bodies and the risk perception of each bank. The risk perception is the risk level that the bank may accept or the existing exposures or exposure face additional risks from existing exposure in its portfolio. The banking system low risk approach will adversely affect any intention of the central bank to raise money supply in circulation through the banking sector.

4. Conclusions and recommendations

Propulsion effect of monetary policy by means of banks money creation can be used as an information indicator for the analysis of the monetary policy effectiveness to stimulate growth.

It was noted that there is some discrepancy between how to promote monetary policy and its effects. This is due to the fact that the monetary authority insists on objectives without their association in one complex of measures for real economic growth. Thus the banking supervisory decisions are in contradiction with the objectives of monetary policy on money creation. The restrictions established for banking activity decrease the efficiency of propulsion for created money in the economy.

Banking system stability in Republic of Moldova andbanks'abilityto create money and monetary policy are seen separately. In some cases, supervisory decisions are in contradiction with the monetary policy set goals being excessive and leading to higher costs of allocated credits resources in the economy. An example in this case is the increase of capital adequacy from 12% to 16% when the banks are sufficiently capitalized and able to assume higher risks for what is hold in the portfolio. But this measure has led to lower banks credit capacity, so that the effectiveness of banks monetary creation is being diminished.

We believe that the actions of monetary authorities should not only focus on maintaining the stability of the banking system but also should act in the interests of economic sustainability using thosemeasures that could bring a maximum propulsion effect of monetary policy.

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A STUDY OF CHINESE YUAN (RMB) APPRECIATION ACCOMPANYING WITH OTHERS FACTORS INCLUDING FOREIGN DIRECT INVESTMENT (FDI) AND THEIR EFFECT ON CHINA ECONOMY

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Abstract

The Chinese Yuan (RMB) has been on the trend of appreciation over the last decade, and such a trend will likely be continuing for some years over the next decade. According to some scholars in their published literatures, the appreciation of RMB, the influx of Foreign Direct Investment (FDI) has been ongoing accompanying the sustained growing economy in mainland China over the past decade. It is believed that the China economy has an implication from some significant factors including appreciation of RMB, interest rate of RMB, inflation and continuous increase of FDI for the next several years. The present study aims to provide an emphasis on investigation into effect on China economy as a result of appreciation of RMB and FDI together with some other factors, and to provide an outlook on the economy in China for the coming decades. First, a review was carried on relevant background information and development history of RMB and FDI. There are many reasons and factors behind leading to the sustained growth in the economy in China in the last decade and such effects were in coverage in the literature review. An overview of the development of RMB exchange mechanism, and other variables including (1) RMB exchange rate, (2) China interest rate, (3) Foreign Direct Investment (FDI), (4) Trade Balance of China, (5) Annual Inflation rate in China, (6) Energy Consumption in China, (7) Foreign Exchange Reserve in China, (8) China wages, (9) China External Debt and (10) China Consumer Price Index, which may have effect on the growth of the economy in China is covered in the literature review conducted in Chapter 2.

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JEL Classification: F3

1. Introduction

1.1. Background of the Research

In early eighty of the last century, China began to remove some of its barriers to encourage the inflow of Foreign Direct Investments (FDI). Following a period of relatively slow growth, the inflow of FDI into China was eventually picked up in early 1990, and it will likely continue to be a key player in the integration of China into the world economy. The future of Chinese state-owned enterprises and the country's economic development are closely related to FDI activities. In particular, coastal regions of China have received the bulk of FDI inflows to the country.

2. Literature review

1.2. Introduction

The continued depreciation of US dollar has progressively developed pressure from the west on the China's currency reform policy. Many developed countries, particularly the US, have urged China to accelerate its pace on removing its hurdle of manipulating RMB exchange rate and allow RMB appreciation. In fact, in 1994 China has already set a reference exchange rate for the RMB against USD, a breakthrough step for the exchange rate regime in China.

2.2. Background of Chinese Yuan Exchange Rate Regime and revaluation

Tung and Baker (2004) argued that the optimal adjustment of 15% for RMB should be made in a one-time against the USD. In addition, China's trade surplus is largely due to slowing imports, rather than growing exports. According to Frankel (2006), Zhang and Pan (2004), Chang and Shao (2004), and Goldstein and Lardy (2003), the RMB was undervalued in as much as 15 to 35%. A few US politicians believed that the undervalued RMB is responsible for much of the U.S trade deficit while other commentators, such as Tung and Baker (2004), and Frankel (2006) argued that a considerable revaluation for RMB is deadly needed in order to serve China's own interest timely. Joseph Stiglitz (2005) also argues that the RMB revaluation will have

little effect on the trade balance for the US and the global economy since the gaps in reduced Chinese imports in the US could be easily filled by increased imports from other developing countries.

According to Guerineau and Guiliamont Jeanneney (2005), China has experienced a prolonged period of falling prices since 1994. Bergsten (2006) criticized that China RMB has been kept undervalued and prevent most other Asian countries from allowing their currencies to rise against the dollar changing competitive position against China. According to K. Bradsher (2007), the China Central Bank has long favoured a stronger RMB. Like most of his Western counterparts, the government is less likely to opt for a one-time revaluation and more likely to choose a faster pace of daily appreciation. According to Bhala (2008), the U.S. government demanded a timely revaluation of the RMB and also was to threaten punitive tariffs against merchandise from China for a change of rules on currency policy.

2.3. The global crisis in 2008 and the rising Chinese Yuan

According to Mengzhi (2009), the US has been widely blamed for the recent financial crisis and China continued to grow during the recession in 2008 and 2009. The US, following the bubble conditions in its subprime mortgage market and in the state of growing deficits, proved more vulnerable than it had been before the financial crisis. According a Pew Research Center (2009) poll, majorities of countries believed that China would replace US as the world's leading superpower. As projected by National Intelligence Council (2008), the U.S. dominance would be ''much diminished'' by 2025. Some analysts believed that China's impressive success in overcoming the financial crisis and its increased holdings of dollars greatly put China in a favourable position in the international stage.

2.4. Chinese Yuan on its path to become a Reserve Currency

According to Carbaugh and Hedrick (2008), the US Treasury Bills provides a highly liquid platform that allows foreign central banks to convert their currencies into interest-bearing and US dollar-denominated assets. The pros of the US included the promise of a good yield, secure political institutions, liquidity and an enormous support of financial expertise. The US faced a dilemma because it cannot run a current-account deficit and a current-account surplus at the same time (Triffin, 1960). The U.S. trade deficits together with the amount of U.S. borrowing had resulted in a depreciation of USD. Since

the US is the prime supplier of both reserve currency and assets for international reserves, it must continue to maintain the issue of monetary liabilities sufficiently attractive enough for acquisition by other nations (Stiglitz, 2006). According to Xiaochuan (2009), the addition of the RMB as a reserve currency is not inconceivable, and officials at the Peoples Bank of China had cited the "Triffin Dilemma" as a main concern USD's present and future role as a reserve currency.

2.5. Influx of Foreign Direct Investment (FDI)

According to China State Statistics Bureau (1994), China had long been one of the most closed economies in terms of policy toward foreign investment and external debt. Among the studies of economic growth, Krugman's (1994) and Collins & Boseworth (1996) contributed in the study on whether China would experience the same problems of other Asian countries in terms of excessive capital and labour input accumulation without rising production efficiency, which were posited as a possible explanation in the case of China's remarkable growth. Until recently, according to other scholars (Wei, 1995; Borensztein, de Gregorio, & Lee, 1998; Wu, 1999; Wei & Liu, 2001; Graham & Wada, 2001; Whalley & Xin, 2006; Tuan & Ng, 2004, 2007; Ng & Tuan, 2006; Yao & Wei, 2007), inward FDI has been considered a critical factor among others contributing to sustained economic growth in China. Yao & Wei (2007) and Tuan & Ng (2007), investigated into the exact mechanism of how FDI has impacted the development process.

From a technical perspective, technological aspects had been considered to relate more to innovation other than R&D, where firm sciences would draw improvements from technology advancements in and technical progress as sources of innovation. FDI is believed to transfer technology and technological know-how to the host countries via channels such as spillovers, demonstration and transfer of management know-how (Teece (1977); Aitken & Harrison (1999); Blomstrom & Kokko (2001); Javorcik (2004)). FDI not only served as a capital injection to the domestic market but also played a key role for technological spillover and advancement of managerial skills. FDI was believed to be embedded with innovative technologies and hence improve efficiency in production. A number of literatures suggested that FDI was a significant source of innovation and technology transfer (Caves, 1974; Findlay, 1978; Mansfield & Romeo, 1980).

In sum, the above evidence suggests that the critical role of FDI in technological transfer and innovative activities are of significant effect. According to Archibugi & Iammarino (2002), multinationals play

a key role in global generation of innovations in the form of R&D and acquisitions of existing R&D laboratories or green-field R&D investment.

2.6. Energy Consumption in China

According to (Galli 1998, Sinton and Fridley 2000), the fall in end-use energy intensity is partially the result of an improvement in energy efficiency and development of new materials. These explanations have also been supported by a recent study involving firm-level data (Fisher-Vanden et al. 2004).

2.7. Inflation Rate in China

There are two ways for RMB to appreciate against the USD through changes in (i) nominal exchange rates and (ii) inflation. China intervenes the RMB exchange rate by selling RMB for USD to keep RMB from rising and piles up massive "reserves" of USD. According to Huang and Gu (2006), the rapid growth of foreign exchange reserve has an implication to an effective monetary policy and results in higher inflation. Also, the RMB appreciation not only results in lower domestic inflation but also has a long term impact on CPI. According to Ihrig, Kamin, Lindner, and Marquez (2007), the phase of low inflation rates can be attributed to China's opening up since the early 1980s. Several papers find no evidence for the hypothesis that the role of import prices in explaining consumer price inflation has increased with growing trade openness.

2.8. Trade Balance in China

Global imbalances have been a controversial financial and economic issue in recent years. China has been blamed to be accountable for the global financial crisis and the subsequent economic recession in the US and European countries. According to the statistics of China Customs (2008), China had a US$298 billion trade surplus in goods. It was only US$5.4 billion in 1994. Decomposing trade into normal and processing trade reveals that, the drastic growth of the trade surplus is mainly due to the rapid expansion of processing trade.

2.9. GDP growth in China

According to the National Bureau of Statistics of China, the major change took place in 1992 when Deng Xiaoping's Southern Tour led foreign direct investment inflows into coastal areas massively and generated a wave of government investment in Shanghai. Record

trade and GDP growth followed. Since 1993 when Zhu Rongji was appointed to rein in the overheating economy at the time, growth rates in China was slowed down gradually in subsequent years, ending with a "soft landing" the financial market in China.

2.10. China Consumer Price Index (CPI)

According to National Bureau of Statistics of China, Consumer Price Index (CPI) as shown in Figure 2.8a China decreased to 101.70 Index Points in October of 2012 from 101.90 Index Points in September of 2012. Consumer Price Index (CPI) in China is reported by the National Bureau of Statistics, China.

2.11. China Population

According to Statistical Bureau of China and World Bank, the total population in China was last recorded at 1347.35 million people in 2011 from 667.1 million in 1960, changing 102 percent during the last 50 years. From 1960 to 2011, China Population as shown in Figure 2.9a averaged 1043.72 Million reaching an all time high of 1347.35 Million in December of 2011 and a record low of 660.33 Million in December of 1961.

2.12. China Wages

According to Statistical Bureau of China, wages in China increased to 42452 RMB in 2011 from 37147 RMB in December of 2010, accounting for a 14.28% significant increase in average wages. The sharp increased in wages in China, particularly in the Guangdong province in recent years, has created a huge impact on the processing industries.

2.13. China Foreign Exchange Reserves

According to the People's Bank of China, Foreign Exchange Reserves in China increased to 328.51 USD Billion in 2012 from 327.29 USD Billion in 2011, accounting for less than 1% change. Foreign Exchange Reserves in China as shown in Figure 2.11a averaged 55.35 USD Billion reaching an all time high of 330.97 USD Billion in February of 2012 and a record low of 2262.0 USD Million in December of 1980.

2.14. China Interest Rate

The benchmark interest rates include lending and deposit interest rate. According to data provided by the People's Bank of China, from 1996 to 2012, China Interest Rate averaged 6.5 Percent reaching an all time high of 11.0 Percent in May of 1996 and a record low of 5.3

Percent in August of 2010. The China Interest Rate is shown in Figure 2.12 for the period of 1996 to 2011. In China, the decision of interest rates is determined by The Peoples' Bank of China Monetary Policy Committee.

3. Methodology

3.1. Introduction

In-depth review on various literatures and relevant materials was conducted in this research paper. Among all, inductive approach on reviewing data including RMB exchange rate, Foreign Direct Investment (FDI) and other factors was carried out. The limitation on using the analytical tool for the multiple regression analysis adopted in the second part of the study was by ANOVA Regression Function built in Microsoft Excel.

3.2 Construction of Analytical Model using Multiple Regression Analysis

Y =	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
GDP in China (Billion USD)	*RMB exchange rate (to USD) RMB/1USD*	*Benchmark Interest Rate (%)*	*FDI (100M USD)*	*Trade Balance of China (100 M USD*	*Annual Inflation rate in China (%)*	*Energy Consumption (Million tons of SCE)*	*Foreign Exchange Reserve (Million USD)*	*China wages (RMB)*	*China External Debt (100M RMB)*	*China Consumer Price Index (CPI)*

The dependent variable is defined as follows

Y = GDP in China (Billion USD)

The independent variables are defined as follows:

X_1 = RMB exchange rate (RMB/1USD)

X_2 = China interest rate (%)

X_3 = Foreign Direct Investment (FDI) (100 Million USD)

X_4 = Trade Balance of China (100 Million USD)

X_5 = Annual Inflation rate in China (%)

X_6 = Energy Consumption (Million tons of SCE),

where SCE= standard coal equivalent

X_7 = Foreign Exchange Reserve in China (Million USD)

X_8 = China wages (RMB)

X_9 = China External Debt (100 Million USD)

X_{10}= China Consumer Price Index (CPI)

The first predicted regression equation involved all variables and was constructed as follows:

$$Y_{req'd} = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$$

3.3. Assumptions and limitations of the linear multiple regression model

3.3.1. Assumptions

It may be noticed a dissimilar situation during different periods of time, and unusual banks behavior for the monetary policy propulsion taken from money creation into economy point of view. These discrepancies can be noticed much better if the graphic of propulsion indicator evolution is analyzed.

- China will maintain its RMB regime and its current state of FDI policy in the coming years.
- RMB exchange mechanism will maintain as it was over the past decade.
- China will carry on its inflation target for the coming decades.

3.3.2. Limitation of the model

The time series of data observed such as interest rate and China trade balance could only be obtained from 1996 to 2011. It is another reason that a minimum number of data sample size for the model is to be maintained as far as possible.

3.3.3. Hypothesis

Null Hypothesis at 5% level of significance was adopted to test the validity of the statement assumption of no change or no effect on China economy due to the RMB appreciation and other variables as discussed in the preceding sections.

3.3.4. Hypothesis

A total of 12 test cases including the lagging effect of some independent variables on China's economy were considered in the multiple regression model as shown below:

Case-1a Model	variables X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}
Case-1b Model **(**X_3, X_5, X_8 lagged by 1 year)	variables X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}
Case-2a Model	variables X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_{10}
Case-2b Model **(**X_3, X_5, X_8 lagged by 1 year)	variables X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_{10}
Case-3a Model	variables X_1, X_2, X_3, X_4, X_7, X_8, X_9, X_{10}
Case-3b Model **(**X_3, X_8 lagged by 1 year)	variables X_1, X_2, X_3, X_4, X_7, X_8, X_9, X_{10}
Case-4a Model	variables X_1, X_2, X_3, X_4, X_7, X_8, X_{10}
Case-4b Model **(**X_3, X_8 lagged by 1 year)	variables X_1, X_2, X_3, X_4, X_7, X_8, X_{10}
Case-5a Model	variables X_1, X_2, X_3, X_4, X_6, X_7, X_{10}
Case-5b Model **(**X_3 lagged by 1 year)	variables X_1, X_2, X_3, X_4, X_6, X_7, X_{10}
Case-6a Model	variables X_1, X_2, X_3
Case-6a Model **(**X_3 lagged by 1 year)	variables X_1, X_2, X_3

3.5 Formulation of Multiple Regression Equations

The multiple regression equation is represented by:

$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$

where: $\sum_{i=0}^{n}(Y_i - Y_i')^2$

X_1 to X_{10} are the independent variables in the regression model:

X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
RMB exchange rate (to USD)	Interest Rate (%)	FDI (100 M USD)	Trade Balance of China (100M USD)	Annual Inflation rate in China (%)	Energy Consumption (Million tons of SCE)	Foreign Exchange Reserve (100M USD)	China wages (RMB)	China External Debt (100M USD)	China Consumer Price Index (CPI)

The equations were formulated in the regression model with 5% level of significance. A total of 12 test cases were considered and carried out in the multiple regression analysis:

Cases	**Multiple Regression Equation**
Case 1a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$
Case 1b (X_3, X_5, X_8 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$
Case 2a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_{10}X_{10} + \varepsilon$
Case 2b (X_3, X_5, X_8 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_{10}X_{10} + \varepsilon$
Case 3a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$
Case 3b (X_3, X_8 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$

Case 4a	$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_7X_7 + \beta_8X_8 + \beta_{10}X_{10} + \varepsilon$
Case 4b (X_3, X_8 lagged by 1 year)	$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_7X_7 + \beta_8X_8 + \beta_{10}X_{10} + \varepsilon$
Case 5a	$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_6X_6 + \beta_7X_7 + \beta_{10}X_{10} + \varepsilon$
Case 5b (X_3 lagged by 1 year)	$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_6X_6 + \beta_7X_7 + \beta_{10}X_{10} + \varepsilon$
Case 6a	$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \varepsilon$
Case 6b (X_3 lagged by 1 year)	$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \varepsilon$

3.6. Test Cases and Variables

The model will be used for Null Hypothesis Test for "RMB appreciation and other variables including FDI has no direct correlation with the economy in China represented by its GDP growth".

4. Data Finding and Analysis

4.1. Introduction

As mentioned in the Chapter 3, variables (1) RMB exchange rate, (2) China interest rate, (3) Foreign Direct Investment (FDI), (4) Trade Balance of China, (5) Annual Inflation rate in China, (6) Energy Consumption in China, (7) Foreign Exchange Reserve in China, (8) China wages, (9) China External Debt and (10) China Consumer Price Index, were considered in the regression model analysis:

Y =	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
GDP in China (Billion USD	RMB exchange rate (to USD)	Interest Rate (%)	FDI (100M USD)	Trade Balance of China (100M USD)	Annual Inflation rate in China (%)	Energy Consumption (Million tons of SCE)	Foreign Exchange Reserve (100M USD)	China wages (RMB)	China External Debt (100M USD)	China Consumer Price Index (CPI)

A total of 12 test cases of different groups of independent variables in the regression model over a period from 1997 to 2011 were analysed using the multiple regression analysis as shown below:

Cases	Multiple Regression Equation
Case 1a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$
Case 1b (X_3, X_5, X_8 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$
Case 2a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_{10}X_{10} + \varepsilon$
Case 2b (X_3, X_5, X_8 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_{10}X_{10} + \varepsilon$
Case 3a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$
Case 3b (X_3, X_8 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$
Case 4a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_7X_7 + \beta_8X_8 + \beta_{10}X_{10} + \varepsilon$
Case 4b (X_3, X_8 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_7X_7 + \beta_8X_8 + \beta_{10}X_{10} + \varepsilon$
Case 5a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_6X_6 + \beta_7X_7 + \beta_{10}X_{10} + \varepsilon$
Case 5b (X_3 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_6X_6 + \beta_7X_7 + \beta_{10}X_{10} + \varepsilon$
Case 6a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \varepsilon$
Case 6b (X_3 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \varepsilon$

The results of the analysis for the above cases are tabulated in Table 4.2a-b to Table 4.7a-b.

4.2. Analysis of Multiple Regression Models

Summary of outputs are all in appendix. The p-values, F-test values, t-statistic value and adjusted R-squares were captured from the output of the analysis as tabulated in Table 4.2a-b to Table 4.7a-b for further interpretation in section 4.2.6. Summary of output for all the 12 different cases is shown in Table 4.8 to Table 4.11. The test of the null hypothesis of "RMB appreciation and other variables have no direct correlation with the economy in China represented by its GDP growth" was carried based on the output from the multiple regression analysis.

4.2.1. Significance of Coefficients of Variables

In each test case, coefficients corresponding to their independent variables of the following equation were computed by means of the multiple regression analysis in the ANOVA of excel 2007.

4.2.2. Significance of p-values in the Regression Model

All the 12 cases were tested under level of significance 5%. A hypothesis will be rejected if the p-value is less than 0.05. From the finding of the analysis as shown in Table 4.2a-b to 4.7a-b, the p-values

of X_1, RMB exchange rate (or RMB appreciation), in all the 12 cases were found less than 0.05 and therefore null hypotheses are rejected. That is, the RMB exchange rate has direct correlation with the economy of China represented by the China GDP growth. Table 4.9 shows a summary of result for p-value of X_1 in all the 12 different cases.

4.2.3. Significance of F-values for overall Regression Model

From the finding of the analysis as shown in Table 4.2a-b to 4.7a-b, the F-values in general are in the range between 205 and 26142, which are greater than the maximum critical value, F(0.05, 10, 4) = 5.96, hence H0: β1 = β2 = β3 = βK = 0 is rejected and it is concluded that at least one coefficient in the model is significant. In other words, the test indicates the usefulness of the variables in the 12 test models. Table 8-11 also show a summary of F test results.

4.2.4. Significance of t-Statistic for Individual Variables

The t statistic (t test) results for the predictors in all 12 cases are in the output in Table 4.2a-b to Table 4.7a-b. A summary of t test results are also shown in Table 8-11.

4.2.5. Significance of R-Square (R2) to overall Regression Model

The interpretation of the results from multiple regression analysis could be complex. The values R-squares were captured from the output of the analysis and are tabulated in Table 4.2a-b to 4.7a-b. The adjusted R-square value was found greater than 0.9776 which indicates a perfect good fit of the data sample. The R-square is generally of secondary importance while the p-value as mentioned earlier indicates how confident that each individual variable has some correlation with the dependent variable.

4.2.6. Interpretation of Results

The output results for different cases are taken for examination. The empirical formulae in associated with the coefficients obtained from the output are as follows:

4.2.6.1. Examination of Case-1a

The empirical regression equation is expressed as:

$$Y = 4504.2495 - 419.2224X_1 + 40.4893X_2 + 0.3794X_3 - 0.1696X_4 - 34.3096X_5 + 0.0631X_6 + 0.0561X_7 + 0.1221X_8 - 0.2890X_9 - 11.5968X_{10}$$

Table 4.2a (case 1a) shows that the independent variable X_1, RMB exchange rate, is significant in the regression model under 5% level of significance with p-value of 0.0304 (< 0.05) and the null hypothesis is rejected. Furthermore, the value of adjusted R^2 is very high (0.999) which implies the about 99.9% variation in GDP growth is explained by RMB exchange rate, interest rate, FDI and all other factors in associated with this case. In other word, the model has a significant fitting effect.

The coefficient of X_1 is -419.2224 which implies that 1% increase in RMB appreciation (denoted by decrease in RMB/USD exchange rate), would result in $4.19X_1$ billion USD increase in GDP of China. Thus, for example in the year end of 2011, the total GDP was 5879 billion USD while the exchange rate of RMB/USD (X_1) was 6.4588, GDP would be increased by 27.06 billion USD per 1% RMB appreciation accounting for about 0.46% increase in GDP growth in the same year. Therefore it is obvious that the driving effect of RMB appreciation on GDP growth is positive and significant.

However, from the regression result under significance level 5%, the p-value of FDI (X_3) was found to be 0.2925 which implies the null hypothesis cannot be rejected. But there is no strong evidence that the FDI has no effect on the China economy growth. It means that the independent variable FDI (X_3) is not significant and cannot explain the GDP correctly.

The F-test is a test to determine the overall significance of the model, and not just of one individual coefficient. Since the F test (F = 4823.756652) on the significance of the whole multiple regression equation is far larger than 5.96 under the 5% level of significance, the model is significant in general. This is also confirmed by the p-value of the entire regression model as a whole. Since the F-test is used to test the following hypotheses:

From the output of the regression analysis, the absolute value of t-statistic for X_1 is 6.4898 which is larger than 2.160 under the 5% level of confidence. Therefore the explanation of RMB exchange rate is significant. The regression coefficient β_1 of X_1 is significance in the multiple linear regression model.

4.2.6.2. Examination of Case-1b (X_3, X_5, X_8 lagged by 1 year)

The empirical regression equation is expressed as:

$Y= 14015.1756 – 922.7765X_1 + 51.0195X_2 – 1.0109X_3 – 0.3151X_4 + 2.6990X_5 + 0.6616X_6 + 0.0395X_7 + 0.0847X_8 – 0.0482X_9 – 67.1828X_{10}$

Table 4.2b (case 1b) shows that the p-value of RMB exchange rate (X_1) is 0.0009372 and the p-value of FDI (X_3) is 0.03744. Thus the null hypotheses for both the RMB appreciation and FDI have no effect on economy in China are rejected. In this case, a 1 % increase in RMB appreciation would result in $9.23X_1$ billion USD increase in GDP while 1% increase in FDI would result in $0.01X_3$ billion USD decrease in GDP. It means that the 1 year lag FDI is in negative proportion with the GDP in China. According to the theory the role of FDI on economy growth is positive in general. Many economists admit that FDI is very important to the development of a country, particularly to the developing countries like China. There are many reasons to explain the conflict such as small data sample size, data corruption or the complexity of the multiple regression model. Examination of the other cases with different combination of variables in the regression models may help to eliminate such errors.

Since the F-value (F = 22348.19823) on the significance of the whole multiple regression equation is far larger than 5.96 under the 5% level of significance, and the p-value (p = 4.80496E-09) is far less than 0.05, the model is significant in general.

The absolute value of t-statistic for X_1 is 8.7572 which is larger than 2.16 under the 5% level of confidence. Therefore the explanation of RMB exchange rate for GDP is significant. The regression coefficient β_1 of X_1 is significance in the multiple linear regression model.

4.2.6.3. Examination of the significance of RMB exchange rate (or RMB appreciation), X_1, from the output of 12 cases

The study of impact of RMB exchange rate or appreciation on the China economy was selected for analysis and discussion. The results were summarized below:

Cases	t-value for X1	P-value for X1	Adjusted R square	F-value
Case 1a	-3.283180451	0.030409682	0.999709794	4823.756652
Case 1b	-8.75722445	0.000937226	0.999937356	22348.19823
Case 2a	-3.174320496	0.024694948	0.999234722	2032.110773
Case 2b	-15.81618222	1.83811E-05	0.999940497	26141.89378
Case 3a	-5.343533123	0.001755373	0.999789882	8327.89169
Case 3b	-6.489835814	0.000636526	0.99959227	4291.310101
Case 4a	-5.911322778	0.000592673	0.999302789	2867.57263
Case 4b	-7.923230124	9.69326E-05	0.999465843	3743.216604
Case 5a	-4.378661235	0.003239737	0.997239686	723.5551798
Case 5b	-11.6221785	7.87882E-06	0.999079427	2171.560663
Case 6a	-3.000582337	0.012067273	0.977634948	204.9922142
Case 6b	-3.603516434	0.004144328	0.986584333	344.1853414

Source: Bank's People of China with authors calculations

From the output of the 12 different cases for RMB exchange rate X_1, the range of the adjusted R-squared was found between 0.999940 and 0.977635 which shows that over 97% variation in GDP growth is explained by the RMB interest rate in all 12 cases. That is, the results above show that the variability of the Y values around the regression line is over 1-0.9776 times of the original variance. Therefore, it has more than 97% of the original variability, and left with less than 3% in residual variability. Therefore, the variability of the determinants around the regression line relative to the overall variability is of strong good fit in all the 12 cases regarding the predictions to the regression equation.

The null hypothesis refers to the case that each independent variable gives absolutely no effect or coefficient of zero. For the model under investigation, the null hypothesis of "RMB appreciation has no direct correlation with the economy in China represented by its GDP growth" was adopted. Since the all P-value were found in the range between $0.00000787882 < P < 0.030409682$ Hence, there is a strong a reason to reject this theory. Hence RMB appreciation has positive effect on the China's GDP growth.

Since the F-values were found in the range between 205 and 26142 on the significance of the whole multiple regression equation in all 12 cases, the minimum value of F-statistic is far larger than the critical $F_{(0.05, 10, 4)}$ value of 5.96 under the 5% level of significance. The model is significant in general.

Moreover, the output t-statistic value for X_1 is in a range between -3.000582337 and -15.81618222 for all 12 different cases 5% level of significance. The minimum absolute value of t-stat is 3.0006 which is greater than the critical $t_{(0.05, 13)}$ value of 2.16. Therefore, the regression coefficient β_1 of X_1 is significance in the multiple linear regression and the explanation of RMB exchange rate for GDP is significant.

In conclusion, it is strongly believed that RMB appreciation (denoted by RMB exchange rate) has a positive effect on the China's GDP growth.

4.2.6.4. Summary of the interpretation results for different cases

- From the 12 different cases, F-values on the significance of the whole regression models are found to be in the range between 204.9922 and 26141.8938 which are far larger than maximum critical F-value of 5.96 under the 5% level of significance, all the 12 regression models are generally significant. Adjusted R-square is in a range of 0.9776 and 0.9999 which implies over 97.76% variation in GDP growth is explained by RMB exchange rate, interest rate, FDI and all other factors in different regression models. In other words, the model has a significant fitting effect.
- 5 out of the 12 cases (cases 1b, 2b, 5b, 6a & 6b shown in Table 4.10-11), FDI (X3) has p-value <0.05 and null hypotheses are rejected. The F-values are between 205 and 26142 which show that the variables are significant on these regression models. The absolute value of t-statistic is greater than 2.16. Therefore, the regression coefficient β3 of X3 is significance in the multiple linear regression model and the explanation of FDI for GDP is significant subject to limitation of the data sample size. In general, it can be explained that FDI has effect on the GDP but the evidence to support its claim is not very strong.
- From the output of Case 5b, all independent variables (X1, X2, X3, X4, X6, X7 and X10) are good fit into the regression equation. All the variables and intercept have p-value <0.05 which imply that null hypotheses are rejected. Since F value is 2171.5607 which is far larger than the critical value of F (5.96) under the 5% level of significance, the regression model is significant. That is, each of these variables is significance in the regression model. The absolute value of t-statistic is also greater than 2.16 for all variables in this case, which implies that the regression coefficient β of the corresponding X is significance in

the multiple linear regression model and the explanation of these independent variables for GDP is significant.

The empirical regression equation for case 5b is expressed as follows:

Y= 21840.3677 – 1515.5835X1 + 74.9726X2 – 2.8828X3 – 0.5957X4 + 1.6519X6 + 0.0572X7 – 97.6442X10

Take 2011 in consideration:

1% increase in RMB exchange rate (X1) gives 15.155835X1 in Y= 97.8885 billion USD = 1.6651% increase in GDP

1% increase in Benchmark Interest Rate (X2) gives 0.749726X2 in Y= 4.7233 billion USD = 0.0803% increase in GDP

1% increase in FDI (X3) gives -0.028828X3 in Y=-30.4813 billion USD = -0.5185% decrease in GDP

1% increase in Trade Balance (X4) gives -0.005957X4 in Y= -9.2463 billion USD = -0.1573% decrease in GDP

1% increase in Energy Consumption (X6) gives 0.016519X6 in Y= 57.4865 billion USD = 0.9778% increase in GDP

1% increase in Foreign Exchange Reserve (X7) gives 0.000572X7 in Y = 18.876 billion USD = 0.3211% increase in GDP

1% increase in CPI (X10) gives -0.976442X10 in Y = 102.9170 billion USD = -1.7506% decrease in GDP

It is obvious that RMB exchange rate (X1), FDI (X3), Energy Consumption (X6) and CPI (X10) contribute greater impacts on GDP in China as per 1% change in these variables. FDI has a negative correlation with GDP which is uncommon as it is normally believed that FDI has important effect on driving China's economic growth.

However, from the summary of results in Table 4.11, the coefficient estimated for FDI (X3) both in case 6a and case 6b are positive. In both cases, FDI accounts for at most 0.807% of the GDP growth in China as per 1% increase in FDI while 1% increase in RMB appreciation accounts for about 1.098% in GDP growth at the same period in 2011.

5. Conclusions

However, from the summary of results in Table 4.11, the coefficient estimated for FDI (X3) both in case 6a and case 6b are positive. In both cases, FDI accounts for at most 0.807% of the GDP growth in China as per 1% increase in FDI while 1% increase in RMB appreciation accounts for about 1.098% in GDP growth at the same period in 2011.

Among the 12 regression models, case-5b model apparently appeared to be the best fit model verified by the results of estimated F-test, t-statistic and p-values from the output of empirical regression model analysis. Taken 2011 as an example, the predictor, RMB appreciation, among all other predictors contributes the most significant positive effect on the GDP in China based on a unit percentage change in value. The CPI has the biggest negative effect on the GDP growth as per unit percentage change in CPI. However, FDI is highly a controversial variable that has negative effect on China's GDP as many experts believe that FDI has a direct correlation with GDP in China. The result in some case of regression model shows there is about half percent drop in GDP growth as per unit percentage increase in FDI. The data sample of the FDI is doubtful and the effect of FDI on economic growth is inconclusive. Expert interviews and literature suggest that this effect is industry dependence, and it might be distorted by the ability of the economy to absorb the benefits of FDI. Research methodology should be refined and the result may prove that a devaluation of currency can induce FDI inflow. Based on the data analysis, energy consumption and CPI, apart from RMB appreciation, also seem to have significant effect on GDP in China. Thus establishing a comprehensive policy of energy consumption and maintaining CPI stability could ensure economic stability and in turn, stimulate GDP.

It is important to recognize that there are some other factors affecting GDP growth that were also included in the model, therefore this study attempts to quantify some merits of FDI and energy consumption in conjunction with the significant positive contribution of RMB appreciation to the GDP in China. Due to some constraints of the regression model, the results are not yet completely satisfactory and there are still more findings be found in the future. Based on the empirical findings of the regression models as shown in Table 4.2a-b to 4.7a-b and summary of Table 4.9 to Table 4.11, the p-values for the predictor RMB exchange rate (or RMB appreciation) were found to be in general very small and suggested that the null hypothesis is to be

rejected. That is, there is strong evidence that the RMB exchange rate has direct correlation with the economy of China represented by the China GDP growth. In other words, the contribution of Yuan appreciation to GDP growth is significant and positive.

Even though the FDI inflow is important for economic growth, the real impact on economic development is not so clear. In this research paper, the results reflect that FDI has less significant effect on the economy in China. In some cases, FDI has a negative effect on economy in China. Some impacts of FDI on GDP in China cannot be measured quantitatively such as professional services, knowledge acquisition and management training, technology transfer and international image, and it may take a considerable time before these variables affect growth. The methodology used for the empirical analysis has problem with low sample size and therefore might not be able to show the effects of these variables on growth. Besides, it is argued that a notable amount of FDI flow to China investing in assets such as real estate just for the purpose of speculating for the RMB appreciation and expected rising property price. Moreover, for instance, repatriated profits gained in China may be transferred by the multinational enterprises to their home countries and are being counted as part of GDP in China for the same period due to different accounting systems between China and the foreign country in concern. Hence the GDP figure may be misleading to the public. That might contribute to the reasons why FDI's contribution to GDP growth is not significant or even negative.

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Table 4.2a

Case1a: Y against X1, X2, X3, X4, X5, X6, X7, X8, X9, X10

	Y	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Year	GDP in China (Billion USD)	RMB exchange rate (to USD) RMB/1 USD	Bench-mark Interest Rate (%)	FDI (100M USD)	Trade Balance of China (100M USD)	Annual Inflation rate in China (%)	Energy Comsumption (Million tons of SCE)	Foreign Exchange Reserve (100M USD)	China wages (RMB)	China External Debt (100M USD)	China Consumer Price Index (CPI)
1997	856	8.2898	9.75	452.57	406.80	2.81	1359.09	1398.90	6500	1163	102.8
1998	953	8.2791	7.50	454.63	433.61	(0.78)	1361.84	1449.59	6875	1310	99.2
1999	1019	8.2783	6.10	403.19	294.11	(1.40)	1405.69	1545.75	8200	1460	98.6
2000	1083	8.2784	5.85	407.15	241.46	0.35	1455.31	1655.70	9000	1518	100.4
2001	1198	8.2770	5.85	468.78	227.93	0.73	1504.06	2121.65	9750	1457	100.7
2002	1325	8.2770	5.40	527.43	300.41	(0.73)	1594.31	2864.07	11250	2033	99.2
2003	1454	8.2770	5.30	535.05	255.16	1.13	1837.92	4032.51	12500	2026	101.2
2004	1641	8.2768	5.40	606.30	320.55	3.84	2134.56	6099.32	14000	2194	103.9
2005	1932	8.1917	5.60	603.25	1019.76	1.78	2359.97	8188.72	16000	2630	101.8
2006	2236	7.9718	5.90	630.21	2003.54	1.65	2586.76	10663.40	18500	2965	101.5
2007	2713	7.6040	6.75	747.68	2623.75	4.82	2805.08	15280.00	21500	3386	104.8
2008	3494	6.9451	6.95	923.95	2976.16	5.97	2914.48	19460.30	25000	3892	105.9
2009	4522	6.8310	5.35	900.33	1963.82	(0.72)	3066.47	20000.00	29500	3902	99.3
2010	4991	6.7695	5.40	1057.35	1830.44	3.17	3249.39	23500.00	33000	4286	103.3
2011	5879	6.4588	6.30	1160.11	1552.17	5.53	3480.02	33000.00	37500	5489	105.4

Summary of Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999958541
R Square	0.999917084
Adjusted R Square	0.999709794
Standard Error	27.69988381
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	37011891.91	3701189.191	4823.75665	1.03103E-07
Residual	4	3069.134252	767.2835631		
Total	14	37014961.04			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	4504.249513	17436.80688	0.258318484	0.8089081	-43908.08761	52916.58664	-43908.0876	52916.58664
X1	-419.222352	127.6878801	-3.28318045	0.03040968	-773.7407414	-64.7039621	-773.740741	-64.7039621
X2	40.48930336	15.1308998	2.675934933	0.05546247	-1.520809339	82.49941605	-1.52080934	82.49941605
X3	0.379380601	0.313253048	1.211099469	0.29251559	-0.490349292	1.249110494	-0.49034929	1.249110494
X4	-0.16959722	0.03747211	-4.5259585	0.01060998	-0.273636474	-0.06555796	-0.27363647	-0.06555796
X5	-34.3095639	173.9866801	-0.1971965	0.85328869	-517.3740301	448.7549022	-517.37403	448.7549022
X6	0.063115618	0.135060792	0.467312661	0.6645976	-0.311873257	0.438104494	-0.31187326	0.438104494
X7	0.056108874	0.015791935	3.553008264	0.02373441	0.012263435	0.099954313	0.012263435	0.099954313
X8	0.122083463	0.016800778	7.266536348	0.00190505	0.075437026	0.168729901	0.075437026	0.168729901
X9	-0.28898467	0.095352768	-3.03068986	0.03875431	-0.553726391	-0.02424294	-0.55372639	-0.02424294
X10	-11.5968058	171.3037148	-0.06769734	0.94927541	-487.2121663	464.0185547	-487.212166	464.0185547

Case 1b:
Y against X1, X2, X3, X4, X5, X6, X7, X8, X9, X10
(Independent variables X3, X5, X8 lagged behind dependent variable Y by 1 year)

	Y	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Year	GDP in China (Billion USD)	RMB exchange rate (to USD) RMB/ 1USD	Bench-mark Interest Rate (%)	FDI (100M USD)	Trade Balance of China (100M USD)	Annual Inflation rate in China (%)	Energy Comsumption (Million tons of SCE)	Foreign Exchange Reserve (100M USD)	China wages (RMB)	China External Debt (100M USD)	China Consumer Price Index (CPI)
1997	856	8.2898	9.75	417.26	406.80	8.33	1359.09	1398.90	6250	1163	102.8
1998	953	8.2791	7.50	452.57	433.61	2.81	1361.84	1449.59	6500	1310	99.2
1999	1019	8.2783	6.10	454.63	294.11	(0.78)	1405.69	1545.75	6875	1460	98.6
2000	1083	8.2784	5.85	403.19	241.46	(1.40)	1455.31	1655.70	8200	1518	100.4
2001	1198	8.2770	5.85	407.15	227.93	0.35	1504.06	2121.65	9000	1457	100.7
2002	1325	8.2770	5.40	468.78	300.41	0.73	1594.31	2864.07	9750	2033	99.2
2003	1454	8.2770	5.30	527.43	255.16	(0.73)	1837.92	4032.51	11250	2026	101.2
2004	1641	8.2768	5.40	535.05	320.55	1.13	2134.56	6099.32	12500	2194	103.9
2005	1932	8.1917	5.60	606.30	1019.76	3.84	2359.97	8188.72	14000	2630	101.8
2006	2236	7.9718	5.90	603.25	2003.54	1.78	2586.76	10663.40	16000	2965	101.5
2007	2713	7.6040	6.75	630.21	2623.75	1.65	2805.08	15280.00	18500	3386	104.8
2008	3494	6.9451	6.95	747.68	2976.16	4.82	2914.48	19460.30	21500	3892	105.9
2009	4522	6.8310	5.35	923.95	1963.82	5.97	3066.47	20000.00	25000	3902	99.3
2010	4991	6.7695	5.40	900.33	1830.44	(0.72)	3249.39	23500.00	29500	4286	103.3
2011	5879	6.4588	6.30	1057.35	1552.17	3.17	3480.02	33000.00	33000	5489	105.4

Summary of Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999991051
R Square	0.999982102
Adjusted R Square	0.999937356
Standard Error	12.86955423
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	37014298.54	3701429.854	22348.19823	4.80496E-09
Residual	4	662.5017044	165.6254261		
Total	14	37014961.04			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	14015.17561	1254.874032	11.16859163	0.000365844	10531.08675	17499.26448	10531.08675	17499.26448
X1	-922.7764888	105.3731686	-8.75722445	0.000937226	-1215.339307	-630.2136705	-1215.339307	-630.2136705
X2	51.01954887	15.65520654	3.258950863	0.031111603	7.553727298	94.48537043	7.553727298	94.48537043
X3	-1.010902195	0.329722385	-3.065919214	0.037441628	-1.926358296	-0.095446094	-1.926358296	-0.095446094
X4	-0.315133859	0.047722	-6.603534207	0.002725236	-0.447631372	-0.182636346	-0.447631372	-0.182636346
X5	2.698985138	3.437292918	0.785206615	0.47623162	-6.844469957	12.24244023	-6.844469957	12.24244023
X6	0.66156778	0.156885024	4.21689569	0.013511185	0.225985124	1.097150435	0.225985124	1.097150435
X7	0.039487746	0.008313185	4.750014074	0.00897081	0.016406644	0.062568848	0.016406644	0.062568848
X8	0.084694776	0.010997998	7.700926562	0.001529924	0.054159438	0.115230114	0.054159438	0.115230114
X9	-0.048177145	0.055655381	-0.865633194	0.435522401	-0.202701256	0.106346965	-0.202701256	0.106346965
X10	-67.18280601	5.987917098	-11.21972882	0.000359389	-83.80792913	-50.5576829	-83.80792913	-50.5576829

Table 4.3a

Case 2a: Y against X1, X2, X3, X4, X5, X6, X7, X8, X10

	Y	X1	X2	X3	X4	X5	X6	X7	X8	X10
Year	GDP in China (Billion USD)	RMB exchange rate (to USD) RMB/1USD	Bench-mark Interest Rate (%)	FDI (100M USD)	Trade Balance of China (100M USD)	Annual Inflation rate in China (%)	Energy Comsumption (Million tons of SCE)	Foreign Exchange Reserve (100M USD)	China wages (RMB)	China Consumer Price Index (CPI)
1997	856	8.2898	9.75	452.57	406.80	2.81	1359.09	1398.90	6500	102.8
1998	953	8.2791	7.50	454.63	433.61	(0.78)	1361.84	1449.59	6875	99.2
1999	1019	8.2783	6.10	403.19	294.11	(1.40)	1405.69	1545.75	8200	98.6
2000	1083	8.2784	5.85	407.15	241.46	0.35	1455.31	1655.70	9000	100.4
2001	1198	8.2770	5.85	468.78	227.93	0.73	1504.06	2121.65	9750	100.7
2002	1325	8.2770	5.40	527.43	300.41	(0.73)	1594.31	2864.07	11250	99.2
2003	1454	8.2770	5.30	535.05	255.16	1.13	1837.92	4032.51	12500	101.2
2004	1641	8.2768	5.40	606.30	320.55	3.84	2134.56	6099.32	14000	103.9
2005	1932	8.1917	5.60	603.25	1019.76	1.78	2359.97	8188.72	16000	101.8
2006	2236	7.9718	5.90	630.21	2003.54	1.65	2586.76	10663.40	18500	101.5
2007	2713	7.6040	6.75	747.68	2623.75	4.82	2805.08	15280.00	21500	104.8
2008	3494	6.9451	6.95	923.95	2976.16	5.97	2914.48	19460.30	25000	105.9
2009	4522	6.8310	5.35	900.33	1963.82	(0.72)	3066.47	20000.00	29500	99.3
2010	4991	6.7695	5.40	1057.35	1830.44	3.17	3249.39	23500.00	33000	103.3
2011	5879	6.4588	6.30	1160.11	1552.17	5.53	3480.02	33000.00	37500	105.4

Summary of Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999863334
R Square	0.999726686
Adjusted R Square	0.999234722
Standard Error	44.9815428
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	9	37004844.35	4111649.372	2032.110773	2.29863E-08
Residual	5	10116.69597	2023.339193		
Total	14	37014961.04			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-13271.50013	26665.48203	-0.497703365	0.639806078	-81817.30385	55274.30359	-81817.30385	55274.30359
X1	-590.3476239	185.9760615	-3.174320496	0.024694948	-1068.414309	-112.2809384	-1068.414309	-112.2809384
X2	68.35363773	19.51462555	3.502687641	0.017234822	18.18969578	118.5175797	18.18969578	118.5175797
X3	0.002097338	0.466794897	0.004493062	0.996588821	-1.197837145	1.202031822	-1.197837145	1.202031822
X4	-0.214290977	0.055940175	-3.830716985	0.012238743	-0.358089774	-0.07049218	-0.358089774	-0.07049218
X5	-219.1954361	264.5983342	-0.828408224	0.445168603	-899.3671076	460.9762354	-899.3671076	460.9762354
X6	0.103879534	0.218233463	0.476001859	0.654144569	-0.457107442	0.66486651	-0.457107442	0.66486651
X7	0.022463	0.018238017	1.231658012	0.272840091	-0.024419315	0.069345315	-0.024419315	0.069345315
X8	0.116676375	0.027128336	4.300904235	0.007708832	0.046940768	0.186411983	0.046940768	0.186411983
X10	176.4835688	259.2822417	0.680661998	0.526321706	-490.0226518	842.9897894	-490.0226518	842.9897894

Table 4.3b
Case 2b: Y against X1, X2, X3, X4, X5, X6, X7, X8, X10
(independent variables X1, X5, X8 lagged behind dependent variable Y by 1 year)

	Y	X1	X2	X3	X4	X5	X6	X7	X8	X10
Year	GDP in China (Billion USD)	RMB exchange rate (to USD) RMB/ USD	Bench-mark Interest Rate (%)	FDI (100M USD)	Trade Balance of China (100M USD)	Annual Inflation rate in China (%)	Energy Comsumption (Million tons of SCE)	Foreign Exchange Reserve (100M USD)	China wages (RMB)	China Consumer Price Index (CPI)
1997	856	8.2898	9.75	417.26	406.80	8.33	1359.09	1398.90	6250	102.8
1998	953	8.2791	7.50	452.57	433.61	2.81	1361.84	1449.59	6500	99.2
1999	1019	8.2783	6.10	454.63	294.11	(0.78)	1405.69	1545.75	6875	98.6
2000	1083	8.2784	5.85	403.19	241.46	(1.40)	1455.31	1655.70	8200	100.4
2001	1198	8.2770	5.85	407.15	227.93	0.35	1504.06	2121.65	9000	100.7
2002	1325	8.2770	5.40	468.78	300.41	0.73	1594.31	2864.07	9750	99.2
2003	1454	8.2770	5.30	527.43	255.16	(0.73)	1837.92	4032.51	11250	101.2
2004	1641	8.2768	5.40	535.05	320.55	1.13	2134.56	6099.32	12500	103.9
2005	1932	8.1917	5.60	606.30	1019.76	3.84	2359.97	8188.72	14000	101.8
2006	2236	7.9718	5.90	603.25	2003.54	1.78	2586.76	10663.40	16000	101.5
2007	2713	7.6040	6.75	630.21	2623.75	1.65	2805.08	15280.00	18500	104.8
2008	3494	6.9451	6.95	747.68	2976.16	4.82	2914.48	19460.30	21500	105.9
2009	4522	6.8310	5.35	923.95	1963.82	5.97	3066.47	20000.00	25000	99.3
2010	4991	6.7695	5.40	900.33	1830.44	(0.72)	3249.39	23500.00	29500	103.3
2011	5879	6.4588	6.30	1057.35	1552.17	3.17	3480.02	33000.00	33000	105.4

Summary of Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999989374
R Square	0.999978749
Adjusted R Square	0.999940497
Standard Error	12.54279303
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	9	37014174.44	4112686.048	26141.89378	3.87741E-11
Residual	5	786.6082854	157.3216571		
Total	14	37014961.04			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	14780.914	867.4536922	17.03942716	1.2739E-05	12551.0533	17010.77471	12551.0533	17010.77471
X1	-994.8787189	62.90258326	-15.81618222	1.83811E-05	-1156.574957	-833.182481	-1156.574957	-833.182481
X2	62.42452175	8.240905371	7.574959175	0.000636129	41.2406001	83.6084434	41.2406001	83.6084434
X3	-1.186364827	0.253455001	-4.680771023	0.005429827	-1.837891649	-0.534838004	-1.837891649	-0.534838004
X4	-0.346870831	0.029772558	-11.65068962	8.18205E-05	-0.423403627	-0.270338034	-0.423403627	-0.270338034
X5	1.010365178	2.758269587	0.366303998	0.729127308	-6.079992517	8.100722874	-6.079992517	8.100722874
X6	0.757614892	0.108096912	7.008663571	0.000911544	0.479742932	1.035486851	0.479742932	1.035486851
X7	0.033218716	0.003978099	8.350399243	0.000402948	0.022992687	0.043444745	0.022992687	0.043444745
X8	0.078684365	0.008312546	9.465735371	0.000222307	0.057316284	0.100052446	0.057316284	0.100052446
X10	-70.26788375	4.689622821	-14.98369622	2.3972E-05	-82.32294298	-58.21282452	-82.32294298	-58.21282452

Table 4.4a
Case 3a: Y against X1, X2, X3, X4, X7, X8, X9, X10

	Y	X1	X2	X3	X4	X7	X8	X9	X10
Year	GDP in China (Billion USD)	RMB exchange rate (to USD) RMB/1 USD	Bench-mark Interest Rate (%)	FDI (100M USD)	Trade Balance of China (100M USD)	Foreign Exchange Reserve (100M USD)	China wages (RMB)	China External Debt (100M USD)	China Consumer Price Index (CPI)
1997	856	8.2898	9.75	452.57	406.80	1398.90	6500	1163	102.8
1998	953	8.2791	7.50	454.63	433.61	1449.59	6875	1310	99.2
1999	1019	8.2783	6.10	403.19	294.11	1545.75	8200	1460	98.6
2000	1083	8.2784	5.85	407.15	241.46	1655.70	9000	1518	100.4
2001	1198	8.2770	5.85	468.78	227.93	2121.65	9750	1457	100.7
2002	1325	8.2770	5.40	527.43	300.41	2864.07	11250	2033	99.2
2003	1454	8.2770	5.30	535.05	255.16	4032.51	12500	2026	101.2
2004	1641	8.2768	5.40	606.30	320.55	6099.32	14000	2194	103.9
2005	1932	8.1917	5.60	603.25	1019.76	8188.72	16000	2630	101.8
2006	2236	7.9718	5.90	630.21	2003.54	10663.40	18500	2965	101.5
2007	2713	7.6040	6.75	747.68	2623.75	15280.00	21500	3386	104.8
2008	3494	6.9451	6.95	923.95	2976.16	19460.30	25000	3892	105.9
2009	4522	6.8310	5.35	900.33	1963.82	20000.00	29500	3902	99.3
2010	4991	6.7695	5.40	1057.35	1830.44	23500.00	33000	4286	103.3
2011	5879	6.4588	6.30	1160.11	1552.17	33000.00	37500	5489	105.4

Summary of Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,999954974
R Square	0,999909949
Adjusted R Square	0,999789882
Standard Error	23,56983626
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	8	37011627,82	4626453,478	8327,89169	1,46017E-11
Residual	6	3333,223089	555,5371815		
Total	14	37014961,04			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	7517,154173	478,1402595	15,72165076	4,19724E-06	6347,187108	8687,121238	6347,187108	8687,121238
X1	-376,66655	70,49016846	-5,343533123	0,001755373	-549,1497783	-204,1833217	-549,1497783	-204,1833217
X2	40,07111108	12,68756997	3,158296756	0,019607312	9,025745812	71,11647635	9,025745812	71,11647635
X3	0,402996368	0,264199574	1,525348288	0,178017325	-0,243476699	1,049469434	-0,243476699	1,049469434
X4	-0,155406829	0,016305347	-9,531034684	7,61183E-05	-0,195304576	-0,115509082	-0,195304576	-0,115509082
X7	0,056477931	0,013017189	4,338719531	0,004882103	0,024626018	0,088329844	0,024626018	0,088329844
X8	0,129763497	0,008775509	14,78700573	6,01382E-06	0,108290601	0,151236393	0,108290601	0,151236393
X9	-0,306925849	0,073947779	-4,150575605	0,006007229	-0,487869546	-0,125982152	-0,487869546	-0,125982152
X10	-44,84893703	6,075613735	-7,381795319	0,000317022	-59,71542825	-29,98244581	-59,71542825	-29,98244581

Table 4.4b
Case 3b: Y against X1, X2, X3, X4, X7, X8, X9, X10
(Independent variables X3, X8 lagged behind dependent varible Y by 1 year)

	Y	X1	X2	X3	X4	X7	X8	X9	X10
Year	GDP in China (Billion USD)	RMB exchange rate (to USD) RMB/1 USD	Bench-mark Interest Rate (%)	FDI (100M USD)	Trade Balance of China (100M USD)	Foreign Exchange Reserve (100M USD)	China wages (RMB)	China External Debt (100M USD)	China Consumer Price Index (CPI)
1997	856	8.2898	9.75	417.26	406.80	1398.90	6250	1163	102.8
1998	953	8.2791	7.50	452.57	433.61	1449.59	6500	1310	99.2
1999	1019	8.2783	6.10	454.63	294.11	1545.75	6875	1460	98.6
2000	1083	8.2784	5.85	403.19	241.46	1655.70	8200	1518	100.4
2001	1198	8.2770	5.85	407.15	227.93	2121.65	9000	1457	100.7
2002	1325	8.2770	5.40	468.78	300.41	2864.07	9750	2033	99.2
2003	1454	8.2770	5.30	527.43	255.16	4032.51	11250	2026	101.2
2004	1641	8.2768	5.40	535.05	320.55	6099.32	12500	2194	103.9
2005	1932	8.1917	5.60	606.30	1019.76	8188.72	14000	2630	101.8
2006	2236	7.9718	5.90	603.25	2003.54	10663.40	16000	2965	101.5
2007	2713	7.6040	6.75	630.21	2623.75	15280.00	18500	3386	104.8
2008	3494	6.9451	6.95	747.68	2976.16	19460.30	21500	3892	105.9
2009	4522	6.8310	5.35	923.95	1963.82	20000.00	25000	3902	99.3
2010	4991	6.7695	5.40	900.33	1830.44	23500.00	29500	4286	103.3
2011	5879	6.4588	6.30	1057.35	1552.17	33000.00	33000	5489	105.4

Summary of Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999912626
R Square	0.999825259
Adjusted R Square	0.99959227
Standard Error	32.83301443
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	8	37008493	4626061.625	4291.310101	1.06671E-10
Residual	6	6468.041018	1078.006836		
Total	14	37014961.04			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	8272.816088	816.5252444	10.1317334	5.37521E-05	6274.850795	10270.78138	6274.850795	10270.78138
X1	-502.7662538	77.46979557	-6.489835814	0.000636526	-692.3280143	-313.2044933	-692.3280143	-313.2044933
X2	20.23319767	16.84021231	1.201481151	0.2748336	-20.97331733	61.43971268	-20.97331733	61.43971268
X3	0.660914298	0.304537675	2.170221789	0.073039601	-0.084262547	1.406091142	-0.084262547	1.406091142
X4	-0.109355687	0.02063247	-5.300174316	0.001829516	-0.159841523	-0.058869852	-0.159841523	-0.058869852
X7	0.044997562	0.016604531	2.70995673	0.035108094	0.004367737	0.085627386	0.004367737	0.085627386
X8	0.124385961	0.010486223	11.86184621	2.1715E-05	0.098727099	0.150044824	0.098727099	0.150044824
X9	-0.172977591	0.09714565	-1.780600472	0.125272475	-0.410684433	0.064729252	-0.410684433	0.064729252
X10	-42.12944879	7.70186374	-5.470032996	0.001557867	-60.97523041	-23.28366716	-60.97523041	-23.28366716

Table 4.5a
Case 4a: Y against X1, X2, X3, X4, X7, X8, X10

	Y	X1	X2	X3	X4	X7	X8	X10
Year	GDP in China (Billion USD)	RMB exchange rate (to USD) RMB/1 USD	Bench-mark Interest Rate (%)	FDI (100M USD)	Trade Balance of China (100M USD)	Foreign Exchange Reserve (100M USD)	China wages (RMB)	China Consumer Price Index (CPI)
1997	856	8.2898	9.75	452.57	406.80	1398.90	6500	102.8
1998	953	8.2791	7.50	454.63	433.61	1449.59	6875	99.2
1999	1019	8.2783	6.10	403.19	294.11	1545.75	8200	98.6
2000	1083	8.2784	5.85	407.15	241.46	1655.70	9000	100.4
2001	1198	8.2770	5.85	468.78	227.93	2121.65	9750	100.7
2002	1325	8.2770	5.40	527.43	300.41	2864.07	11250	99.2
2003	1454	8.2770	5.30	535.05	255.16	4032.51	12500	101.2
2004	1641	8.2768	5.40	606.30	320.55	6099.32	14000	103.9
2005	1932	8.1917	5.60	603.25	1019.76	8188.72	16000	101.8
2006	2236	7.9718	5.90	630.21	2003.54	10663.40	18500	101.5
2007	2713	7.6040	6.75	747.68	2623.75	15280.00	21500	104.8
2008	3494	6.9451	6.95	923.95	2976.16	19460.30	25000	105.9
2009	4522	6.8310	5.35	900.33	1963.82	20000.00	29500	99.3
2010	4991	6.7695	5.40	1057.35	1830.44	23500.00	33000	103.3
2011	5879	6.4588	6.30	1160.11	1552.17	33000.00	37500	105.4

Summary of Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.999825682
R Square	0.999651395
Adjusted R Square	0.999302789
Standard Error	42.93452901
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	37002057.43	5286008.204	2867.57263	1.47227E-11
Residual	7	12903.61647	1843.373782		
Total	14	37014961.04			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	7810.299827	861.4201144	9.066772062	4.06537E-05	5773.364934	9847.23472	5773.364934	9847.23472
X1	-569.9100867	96.40990826	-5.911322778	0.000592673	-797.8832938	-341.9368796	-797.8832938	-341.9368796
X2	72.34375344	18.26287243	3.961247263	0.005452964	29.15892239	115.5285845	29.15892239	115.5285845
X3	-0.039383131	0.440363165	-0.089433301	0.931242619	-1.08067655	1.001910288	-1.08067655	1.001910288
X4	-0.20373048	0.020794311	-9.797414161	2.44806E-05	-0.252901213	-0.154559747	-0.252901213	-0.154559747
X7	0.010376525	0.012364892	0.839192464	0.429085808	-0.0188618	0.039614849	-0.0188618	0.039614849
X8	0.136991416	0.015667455	8.743692842	5.14558E-05	0.099943772	0.174039061	0.099943772	0.174039061
X10	-36.1605777	10.38963526	-3.480447271	0.010260065	-60.7281612	-11.59299419	-60.7281612	-11.59299419

Table 4.5b

Case 4b: Y against X1, X2, X3, X4, X7, X8, X10

(Independent variables X3, X8 lagged behind dependent variable Y by 1 year)

	Y	X1	X2	X3	X4	X7	X8	X10
Year	GDP in China (Billion USD)	RMB exchange rate (to USD) RMB/1 USD	Bench-mark Interest Rate (%)	FDI (100M USD)	Trade Balance of China (100M USD)	Foreign Exchange Reserve (100M USD)	China wages (RMB)	China Consumer Price Index (CPI)
1997	856	8.2898	9.75	417.26	406.80	1398.90	6250	102.8
1998	953	8.2791	7.50	452.57	433.61	1449.59	6500	99.2
1999	1019	8.2783	6.10	454.63	294.11	1545.75	6875	98.6
2000	1083	8.2784	5.85	403.19	241.46	1655.70	8200	100.4
2001	1198	8.2770	5.85	407.15	227.93	2121.65	9000	100.7
2002	1325	8.2770	5.40	468.78	300.41	2864.07	9750	99.2
2003	1454	8.2770	5.30	527.43	255.16	4032.51	11250	101.2
2004	1641	8.2768	5.40	535.05	320.55	6099.32	12500	103.9
2005	1932	8.1917	5.60	606.30	1019.76	8188.72	14000	101.8
2006	2236	7.9718	5.90	603.25	2003.54	10663.40	16000	101.5
2007	2713	7.6040	6.75	630.21	2623.75	15280.00	18500	104.8
2008	3494	6.9451	6.95	747.68	2976.16	19460.30	21500	105.9
2009	4522	6.8310	5.35	923.95	1963.82	20000.00	25000	99.3
2010	4991	6.7695	5.40	900.33	1830.44	23500.00	29500	103.3
2011	5879	6.4588	6.30	1057.35	1552.17	33000.00	33000	105.4

Summary of Output

Regression Statistics	
Multiple R	0.999866452
R Square	0.999732921
Adjusted R Square	0.999465843
Standard Error	37.58020509
Observations	15

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	7	37005075.14	5286439.306	3743.216604	5.79593E-12
Residual	7	9885.902701	1412.271814		
Total	14	37014961.04			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	8690.097514	895.2638546	9.706744519	2.60233E-05	6573.134892	10807.06014	6573.134892	10807.06014
X1	-580.4743362	73.26233457	-7.923230124	9.69326E-05	-753.7122292	-407.2364432	-753.7122292	-407.2364432
X2	39.97470217	14.50833584	2.755292034	0.028287294	5.667939402	74.28146494	5.667939402	74.28146494
X3	0.527429911	0.33784349	1.561166417	0.162453259	-0.271442999	1.326302822	-0.271442999	1.326302822
X4	-0.134262502	0.017359946	-7.734039191	0.00011304	-0.175312251	-0.093212753	-0.175312251	-0.093212753
X7	0.020305856	0.010453706	1.942455297	0.093197425	-0.00441323	0.045024943	-0.00441323	0.045024943
X8	0.126961291	0.01188767	10.68008236	1.3843E-05	0.098851419	0.155071163	0.098851419	0.155071163
X10	-42.85123827	8.803226247	-4.867674313	0.001819092	-63.66756054	-22.034916	-63.66756054	-22.034916

Table 4.6a

Case 5a: Y against X1, X2, X3, X4, X6, X7, X10

	Y	X1	X2	X3	X4	X6	X7	X10
Year	GDP in China (Billion USD)	RMB exchange rate (to USD) RMB/1 USD	Bench-mark Interest Rate (%)	FDI (100M USD)	Trade Balance of China (100M USD)	Energy Comsunption (Million tons of SCE)	Foreign Exchange Reserve (100M USD)	China Consumer Price Index (CPI)
1997	856	8.2898	9.75	452.57	406.80	1359.09	1398.90	102.8
1998	953	8.2791	7.50	454.63	433.61	1361.84	1449.59	99.2
1999	1019	8.2783	6.10	403.19	294.11	1405.69	1545.75	98.6
2000	1083	8.2784	5.85	407.15	241.46	1455.31	1655.70	100.4
2001	1198	8.2770	5.85	468.78	227.93	1504.06	2121.65	100.7
2002	1325	8.2770	5.40	527.43	300.41	1594.31	2864.07	99.2
2003	1454	8.2770	5.30	535.05	255.16	1837.92	4032.51	101.2
2004	1641	8.2768	5.40	606.30	320.55	2134.56	6099.32	103.9
2005	1932	8.1917	5.60	603.25	1019.76	2359.97	8188.72	101.8
2006	2236	7.9718	5.90	630.21	2003.54	2586.76	10663.40	101.5
2007	2713	7.6040	6.75	747.68	2623.75	2805.08	15280.00	104.8
2008	3494	6.9451	6.95	923.95	2976.16	2914.48	19460.30	105.9
2009	4522	6.8310	5.35	900.33	1963.82	3066.47	20000.00	99.3
2010	4991	6.7695	5.40	1057.35	1830.44	3249.39	23500.00	103.3
2011	5879	6.4588	6.30	1160.11	1552.17	3480.02	33000.00	105.4

Summary of Output

Multiple R	0.999309683							
R Square	0.998619843							
Adjusted R Square	0.997239686							
Standard Error	85.42871927							
Observations	15							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	7	36963874.58	5280553.512	723.5551798	1.81424E-09			
Residual	7	51086.46253	7298.066076					
Total	14	37014961.04						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	14178.35644	1589.13816	8.922041395	4.51388E-05	10420.64181	17936.07107	10420.64181	17936.07107
X1	-1075.14245	245.5413636	-4.378661235	0.003239737	-1655.755513	-494.5293873	-1655.755513	-494.5293873
X2	21.11060486	30.67227624	0.688263391	0.513442016	-51.41780337	93.63901309	-51.41780337	93.63901309
X3	0.608423002	0.829389749	0.73357912	0.487041537	-1.352772112	2.569618117	-1.352772112	2.569618117
X4	-0.366651045	0.071528316	-5.125956604	0.001359732	-0.535788637	-0.197513454	-0.535788637	-0.197513454
X6	0.883106855	0.235359878	3.752155484	0.007147938	0.326569181	1.439644529	0.326569181	1.439644529
X7	0.045907002	0.020135221	2.279935268	0.056641672	-0.001705231	0.093519234	-0.001705231	0.093519234
X10	-58.71761977	19.20643408	-3.057184874	0.018396173	-104.1336196	-13.30161996	-104.1336196	-13.30161996

Table 4.6b

Case 5b: Y against X1, X2, X3, X4, X6, X7, X10

(Independent variables X3 lagged behind dependent variable Y by 1 year)

	Y	X1	X2	X3	X4	X6	X7	X10
Year	GDP in China (Billion USD)	RMB exchange rate (to USD) RMB/1 USD	Bench-mark Interest Rate (%)	FDI (100M USD)	Trade Balance of China (100M USD)	Energy Comsunption (Million tons of SCE)	Foreign Exchange Reserve (100M USD)	China Consumer Price Index (CPI)
1997	856	8.2898	9.75	417.26	406.80	1359.09	1398.90	102.8
1998	953	8.2791	7.50	452.57	433.61	1361.84	1449.59	99.2
1999	1019	8.2783	6.10	454.63	294.11	1405.69	1545.75	98.6
2000	1083	8.2784	5.85	403.19	241.46	1455.31	1655.70	100.4
2001	1198	8.2770	5.85	407.15	227.93	1504.06	2121.65	100.7
2002	1325	8.2770	5.40	468.78	300.41	1594.31	2864.07	99.2
2003	1454	8.2770	5.30	527.43	255.16	1837.92	4032.51	101.2
2004	1641	8.2768	5.40	535.05	320.55	2134.56	6099.32	103.9
2005	1932	8.1917	5.60	606.30	1019.76	2359.97	8188.72	101.8
2006	2236	7.9718	5.90	603.25	2003.54	2586.76	10663.40	101.5
2007	2713	7.6040	6.75	630.21	2623.75	2805.08	15280.00	104.8
2008	3494	6.9451	6.95	747.68	2976.16	2914.48	19460.30	105.9
2009	4522	6.8310	5.35	923.95	1963.82	3066.47	20000.00	99.3
2010	4991	6.7695	5.40	900.33	1830.44	3249.39	23500.00	103.3
2011	5879	6.4588	6.30	1057.35	1552.17	3480.02	33000.00	105.4

Summary of Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99976983
R Square	0.999539714
Adjusted R Square	0.999079427
Standard Error	49.33483413
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	7	36997923.56	5285417.652	2171.560663	3.89333E-11
Residual	7	17037.48101	2433.925858		
Total	14	37014961.04			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	21840.36772	2017.098724	10.82761466	1.2637E-05	17070.68716	26610.04828	17070.68716	26610.04828
X1	-1515.583499	130.4044245	-11.6221785	7.87882E-06	-1823.940964	-1207.226035	-1823.940964	-1207.226035
X2	74.97261695	22.55126919	3.324540907	0.012685718	21.64733892	128.297895	21.64733892	128.297895
X3	-2.8828483	0.729825189	-3.950053171	0.005531635	-4.60861064	-1.15708596	-4.60861064	-1.15708596
X4	-0.595694947	0.062000485	-9.607907878	2.78318E-05	-0.742302798	-0.449087097	-0.742302798	-0.449087097
X6	1.651901779	0.207713607	7.952785596	9.46584E-05	1.160737148	2.143066411	1.160737148	2.143066411
X7	0.057193107	0.011912403	4.801139182	0.001963703	0.029024749	0.085361465	0.029024749	0.085361465
X10	-97.64419299	15.0430907	-6.49096618	0.000336986	-133.2154501	-62.07293591	-133.2154501	-62.07293591

Table 4.7a

Case 6a: Y against X1, X2, X3

	Y	X1	X2	X3
Year	GDP in China (Billion USD)	RMB exchange rate (to USD) RMB/1 USD	Bench-mark Interest Rate (%)	FDI (100M USD)
1997	856	8.2898	9.75	452.57
1998	953	8.2791	7.50	454.63
1999	1019	8.2783	6.10	403.19
2000	1083	8.2784	5.85	407.15
2001	1198	8.2770	5.85	468.78
2002	1325	8.2770	5.40	527.43
2003	1454	8.2770	5.30	535.05
2004	1641	8.2768	5.40	606.30
2005	1932	8.1917	5.60	603.25
2006	2236	7.9718	5.90	630.21
2007	2713	7.6040	6.75	747.68
2008	3494	6.9451	6.95	923.95
2009	4522	6.8310	5.35	900.33
2010	4991	6.7695	5.40	1057.35
2011	5879	6.4588	6.30	1160.11

Summary of Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.991174787
R Square	0.982427459
Adjusted R Square	0.977634948
Standard Error	243.16977
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	36364514.14	12121504.71	204.9922142	6.22164E-10
Residual	11	650446.9076	59131.53705		
Total	14	37014961.04			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	9850.511532	3794.282146	2.596146294	0.024864262	1499.35284	18201.67022	1499.35284	18201.67022
X1	-1147.009704	382.2623662	-3.000582337	0.012067273	-1988.363499	-305.6559093	-1988.363499	-305.6559093
X2	-118.5900847	58.37653038	-2.031468536	0.067081283	-247.0759617	9.895792251	-247.0759617	9.895792251
X3	3.322609932	1.085841666	3.059939618	0.010853131	0.932688541	5.712531324	0.932688541	5.712531324

Table 4.7b

Case 6b: Y against X1, X2, X3

(Independent variable X3 lagged behind dependent variable Y by 1 year)

	Y	X1	X2	X3
Year	GDP in China (Billion USD)	RMB exchange rate (to USD) RMB/1 USD	Bench-mark Interest Rate (%)	FDI (100M USD)
1997	856	8.2898	9.75	417.26
1998	953	8.2791	7.50	452.57
1999	1019	8.2783	6.10	454.63
2000	1083	8.2784	5.85	403.19
2001	1198	8.2770	5.85	407.15
2002	1325	8.2770	5.40	468.78
2003	1454	8.2770	5.30	527.43
2004	1641	8.2768	5.40	535.05
2005	1932	8.1917	5.60	606.30
2006	2236	7.9718	5.90	603.25
2007	2713	7.6040	6.75	630.21
2008	3494	6.9451	6.95	747.68
2009	4522	6.8310	5.35	923.95
2010	4991	6.7695	5.40	900.33
2011	5879	6.4588	6.30	1057.35

Summary of Output

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.994715597
R Square	0.989459119
Adjusted R Square	0.986584333
Standard Error	188.3348817
Observations	15

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	36624790.74	12208263.58	344.1853414	3.75358E-11
Residual	11	390170.3042	35470.02766		
Total	14	37014961.04			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	7826.099768	2859.309197	2.737059628	0.019332807	1532.802661	14119.39687	1532.802661	14119.39687
X1	-999.2937467	277.3107227	-3.603516434	0.004144328	-1609.650532	-388.9369616	-1609.650532	-388.9369616
X2	-66.03488178	48.49017017	-1.361819964	0.20049269	-172.7610267	40.6912631	-172.7610267	40.6912631
X3	4.487582012	0.936800865	4.790326504	0.000562009	2.425697212	6.549466812	2.425697212	6.549466812

Table 4.8 - Summary of Multiple Regression Models for 12 Different Cases

Cases	Multiple Regression Equation
Case 1a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$
Case 1b (X_3, X_5, X_8 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$
Case 2a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_{10}X_{10} + \varepsilon$
Case 2b (X_3, X_5, X_8 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_{10}X_{10} + \varepsilon$
Case 3a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$
Case 3b (X_3, X_8 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \varepsilon$
Case 4a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_7X_7 + \beta_8X_8 + \beta_{10}X_{10} + \varepsilon$
Case 4b (X_3, X_8 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_7X_7 + \beta_8X_8 + \beta_{10}X_{10} + \varepsilon$
Case 5a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_6X_6 + \beta_7X_7 + \beta_{10}X_{10} + \varepsilon$
Case 5b (X_3 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_6X_6 + \beta_7X_7 + \beta_{10}X_{10} + \varepsilon$
Case 6a	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \varepsilon$
Case 6b (X_3 lagged by 1 year)	$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \varepsilon$

Table 4.9 - Summary of Output for RMB Exchange Rate (X_1)

Cases	t-value for X1	P-value for X1	Adjusted R square	F-value
Case 1a	-3.283180451	0.030409682	0.999709794	4823.756652
Case 1b	-8.75722445	0.000937226	0.999937356	22348.19823
Case 2a	-3.174320496	0.024694948	0.999234722	2032.110773
Case 2b	-15.81618222	1.83811E-05	0.999940497	26141.89378
Case 3a	-5.343533123	0.001755373	0.999789882	8327.89169
Case 3b	-6.489835814	0.000636526	0.99959227	4291.310101
Case 4a	-5.911322778	0.000592673	0.999302789	2867.57263
Case 4b	-7.923230124	9.69326E-05	0.999465843	3743.216604
Case 5a	-4.378661235	0.003239737	0.997239686	723.5551798
Case 5b	-11.6221785	7.87882E-06	0.999079427	2171.560663
Case 6a	-3.000582337	0.012067273	0.977634948	204.9922142
Case 6b	-3.603516434	0.004144328	0.986584333	344.1853414

Table 4.10 - Summary of Output for Case 1a-b, 2a-b, 3a-b

Model	Output	Intercept	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
			RMB exchange rate (to USD)	Benchmark Interest Rate (%)	FDI (100 Million USD)	Trade Balance of China (100 Million USD)	Annual Inflation rate in China (%)	Energy Comsumption (Million tons of SCE)	Foreign Exchange Reserve (Million USD)	China wages (RMB)	China External Debt (100M USD)	China Consumer Price Index (CPI)
Case 1a	P-value	0.8089081	0.030409682	0.055462468	0.292515586	0.010609982	0.85328869	0.664597604	0.023734405	0.001905048	0.038754311	0.949275414
	t-stat	0.258318484	-3.283180451	2.675934933	1.211099469	-4.525958496	-0.197196498	0.467312661	3.553008264	7.266536348	-3.030689863	-0.06769734
	Coefficient	4504.249513	-419.2223517	40.48930336	0.379380601	-0.169597216	-34.30956394	0.063115618	0.056108874	0.122083463	-0.288984666	-11.59680577
	Adj. R square	0.999709794										
	F-value	4823.756652										
Case 1b	P-value	0.000365844	0.000937226	0.031111603	0.037441628	0.002725236	0.47623162	0.013511185	0.00897081	0.001529924	0.435522401	0.000359389
	t-stat	11.16859163	-8.75722445	3.258950863	-3.06591921	-6.603534207	0.785206615	4.21689569	4.750014074	7.700926562	-0.865633194	-11.21972882
	Coefficient	14015.17561	-922.7764888	51.01954887	-1.01090219	-0.315133859	2.698985138	0.66156778	0.039487746	0.084694776	-0.048177145	-67.18280601
	Adj. R square	0.999937356										
	F-value	22348.19823										
Case 2a	P-value	0.639806078	0.024694948	0.017234822	0.996588821	0.012238743	0.445168603	0.654144569	0.272840091	0.007708832		0.526321706
	t-stat	-0.497703365	-3.174320496	3.502687641	0.004493062	-3.830716985	-0.828408224	0.476001859	1.231658012	4.300904235		0.680661998
	Coefficient	-13271.50013	-590.3476239	68.35363773	0.002097338	-0.214290977	-219.1954361	0.103879534	0.022463	0.116676375		176.4835688
	Adj. R square	0.999234722										
	F-value	2032.110773										
Case 2b	P-value	1.2739E-05	1.83811E-05	0.000636129	0.005429827	8.18205E-05	0.729127308	0.000911544	0.00040294	0.000222307		2.3972E-05
	t-stat	17.03942716	-15.81618222	7.574959175	-4.68077102	-11.65068962	0.366303998	7.008663571	8.350399243	9.465735371		-14.98369622
	Coefficient	14780.914	-994.8787189	62.42452175	-1.18636483	-0.346870831	1.010365178	0.757614892	0.033218716	0.078684365		-70.26788375
	Adj. R square	0.999940497										
	F-value	26141.89378										
Case 3a	P-value	4.19724E-06	0.001755373	0.019607312	0.178017325	7.61183E-05			0.004882103	6.01382E-06	0.006007229	0.000317022
	t-stat	15.72165076	-5.343533123	3.158296756	1.525348288	-9.531034684			4.338719531	14.78700573	-4.150575605	-7.381795319
	Coefficient	7517.154173	-376.66655	40.07111108	0.402996368	-0.155406829			0.056477931	0.129763497	-0.306925849	-44.84893703
	Adj. R square	0.999789882										
	F-value	8327.89169										
Case 3b	P-value	5.37521E-05	0.000636526	0.2748336	0.073039601	0.001829516			0.035108094	2.1715E-05	0.125272475	0.001557867
	t-stat	10.1317334	-6.489835814	1.201481151	2.170221789	-5.300174316			2.70995673	11.86184621	-1.780600472	-5.470032996
	Coefficient	8272.816088	-502.7662538	20.23319767	0.660914298	-0.109355687			0.044997562	0.124385961	-0.172977591	-42.12944879
	Adj. R square	0.99959227										
	F-value	4291.310101										

Table 4.11 - Summary of Output for Case 4a-b, 5a-b, 6a-b

Model	Output	Intercept	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
			RMB exchange rate (to USD)	Benchmark Interest Rate (%)	FDI (100 Million USD)	Trade Balance of China (100 Million USD)	Annual Inflation rate in China (%)	Energy Comsumption (Million tons of SCE)	Foreign Exchange Reserve (Million USD)	China wages (RMB)	China External Debt (100M USD)	China Consumer Price Index (CPI)
Case 4a	P-value	4.06537E-05	0.000592673	0.005453	0.931243	2.44806E-05			0.429086	5.14558E-05		0.01026
	t-stat	9.066772062	-5.911322778	3.961247	-0.089433	-9.797414161			0.839192	8.743692842		-3.480447
	Coefficient	7810.299827	-569.9100867	72.34375	-0.039383	-0.20373048			0.010377	0.136991416		-36.16058
	Adj. R square	0.999302789										
	F-value	2867.57263										
Case 4b	P-value	2.60233E-05	9.69326E-05	0.028287	0.162453	0.00011304			0.093197	1.3843E-05		0.001819
	t-stat	9.706744519	-7.923230124	2.755292	1.561166	-7.734039191			1.942455	10.68008236		-4.867674
	Coefficient	8690.097514	-580.4743362	39.9747	0.52743	-0.134262502			0.020306	0.126961291		-42.85124
	Adj. R square	0.999465843										
	F-value	3743.216604										
Case 5a	P-value	4.51388E-05	0.003239737	0.513442	0.487042	0.001359732		0.007147938	0.056642			0.018396
	t-stat	8.922041395	-4.378661235	0.688263	0.733579	-5.125956604		3.752155484	2.279935			-3.057185
	Coefficient	14178.35644	-1075.14245	21.1106	0.608423	-0.366651045		0.883106855	0.045907			-58.71762
	Adj. R square	0.997239686										
	F-value	723.5551798										
Case 5b	P-value	1.2637E-05	7.87882E-06	0.012686	0.005532	2.78318E-05		9.46584E-05	0.001964			0.000337
	t-stat	10.82761466	-11.6221785	3.324541	-3.950053	-9.607907878		7.952785596	4.801139			-6.490966
	Coefficient	21840.36772	-1515.583499	74.97262	-2.882848	-0.595694947		1.651901779	0.057193			-97.64419
	Adj. R square	0.999079427										
	F-value	2171.560663										
Case 6a	P-value	0.024864262	0.012067273	0.067081	0.010853							
	t-stat	2.596146294	-3.000582337	-2.031469	3.05994							
	Coefficient	9850.511532	-1147.009704	-118.5901	3.32261							
	Adj. R square	0.977634948										
	F-value	204.9922142										
Case 6b	P-value	0.019332807	0.004144328	0.200493	0.000562							
	t-stat	2.737059628	-3.603516434	-1.36182	4.790327							
	Coefficient	7826.099768	-999.2937467	-66.03488	4.487582							
	Adj. R square	0.986584333										
	F-value	344.1853414										

A MIXED FREQUENCY ANALYSIS OF CONNECTIONS BETWEEN MACROECONOMIC VARIABLES AND STOCK MARKETS IN CENTRAL AND EASTERN EUROPE

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Abstract

The importance of connections between macroeconomic growth and financial markets is studied for a long time in the academic research. The special case of the developing countries, which is the case of the Central and Eastern European economies highlights this phenomenon even more, as many of them are still at the verge of reforming their economies. Our paper proposes the use of MIDAS regression in an analysis of the connections between macroeconomic growth and equity markets in this region in order to exhibit the importance of the latter for the reform strategies.

Keywords: MIDAS regression, mixed frequency series, CEE markets

JEL Classification: C51, C53, G17

Introduction

Modeling the relations between macroeconomic variables and parameters that characterize the financial environment has recently become an important research topic. One of the biggest challenges faced when dealing with this type of approach is the fact that economic time series exhibit important differences in terms of the frequency of the data. In general, financial variables have high frequencies that can be studied at a daily or intraday level. On the opposite side of the spectrum, core macroeconomic variables like for example the gross domestic product (GDP) have in general quarterly or annual

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frequencies. This difference in frequency constitutes an important obstacle that needs to be dealt with in applications that focus on the linkages between financial and macroeconomic variables.

An interesting solution derived from the studies of Ghysels, Santa-Clara and Valkanov (2006), Ghysels, Sinko, and Valkanov (2007) or Andreou et al (2013), is the procedure called Mixed Data Sampling (MIDAS) regression.

The main advantage of the nonlinear *autoregressive distributed lag* (ADL) formulation included in the MIDAS procedure is the fact that it permits the use of regressors that have a much higher frequency than that of the regressand.

Since its genesis, the MIDAS methodology has been used in a wide range of macroeconomic forecasting applications like, Hogrefe (2008), Montefort and Moretti (2010), Kuzin et al (2011).

In addition to this, the mixed data sampling regressions were also used in empirical financial studies, key contributions being issued by: Tay (2007), Chen and Ghysels (2010) or Ghysels and Volkanov (2010).

We contribute to this literature by addressing the interconnections between macroeconomic variables and the dynamics of the financial markets in the case of the Eastern European Markets. Therefore, the purpose of this paper is to provide an analysis of the dependences between the economic growth on one hand and the dynamics of the stock market on the other hand. We search for this type of evidence by using the MIDAS regression methodology, which allows for such types of studies.

The remainder of the paper is organized in the following manner. Section II provides a review of the literature, then we present the data and the methodology, the results found and we conclude with some remarks regarding the observed evidences.

Literature review

As stated above, the study of the correspondence between macroeconomic variables and financial markets has received an important amount of academic attention during the last decades.

The scientific literature has shown that stock prices are influenced in some manner by core macroeconomic variables such as inflation or exchange rate. Chen, Roll and Ross (1986) report a correlation between aspects like output and inflation and the evolution

of financial returns. Other key studies in this direction were carried out by Geske and Roll (1983), Chen (1991), Fama (1900), Poon and Taylor (1991) or Lee (1992).

Mukherjee and Naka (1995) build on the Johansen cointergration methodology and report a close relation between the Japanese financial market and a series of macroeconomic variables such as industrial production inflation, money supply or bond rates. In a similar approach Mayasmai and Koh (2000) add a VECM model and observe that the Singapore stock market exhibits cointegration with macroeconomic phenomena. In another cointegration approach, Maghyereh (2002) finds that the evolution of macroeconomic fundamentals has an impact on the stock prices in the Jordanian capital market.

In an investigation on the connections between stock prices and exchange rates on a data series specific to the G-7 countries, Nieh and Lee (2001) report a lack of long-run relationships between the above mentioned values. However, the author observes the presence of certain short run effects for some countries.

Wongbangpo and Sharma (2002) follow the financial markets of five ASEAN countries (Thailand, Philippines, Indonesia, Singapore and Malaysia) searching for the role of significant macroeconomic variables such as GNP, CPI, exchange rate or money supply. They report long and short term relationships between the macroeconomic elements and stock prices. Panetta (2003) focuses on the macroeconomic constituents that have an impact on the Italian financial markets and finds an unstable relation between the two sets of variables.

Another cointegration based research is found in Humpe and Macmillan (2007) which also consider macroeconomic factors such as industrial output, CPI, long term interest rates and the money supply. Using monthly data for a period of over 40 years for the financial markets of Japan and US they observe a single cointegration vector between the financial variables, the industrial output and the long interest rate.

Abugri (2008) conducts an analysis for four Latin American Countries focusing on indicators like: industrial output, money supply, interest rates and exchange rates. Using a VAR approach, the author finds that both global factors and the global values have a significant effect on the dynamics of all the markets considered.

The linkages between financial and macroeconomic variables are also investigated in more modern studies. In a dynamic factor analysis approach, Ludvigson & Ng (2009) examine the connections between the variation in excess bond yields and macroeconomic fundamentals. They observe that inflation is a key parameter in relation to forecasting excess returns.

Alper and Forni (2011) consider the implications of fiscal and macroeconomic variables on long term yields and a possible spillover effects of advanced economies' debt levels on the yields of other markets. They conclude that domestic debt clearly influences long-term yields. In a similar study, Gruber and Kamin (2012) focus on the influence of fiscal positions, level of debt and fiscal balance on the evolution of long-term bond returns in OECD. Using a panel data methodology, they find a strong and significant effect of fiscal performance on long-term bond returns.

Albu et al (2014 a) and Albu et al (2014 b) investigate the influence of quantitative easing initiatives on a series of nine sovereign CDSs belonging to CEE countries, through an ARMA-GARCH based event studies. The studies report a significant and powerful effect of these monetary policies on the returns of the sovereign CDSs. In another analysis on the Eastern European Countries Albu, Lupu and Calin (2014) use a nonlinear model in order to estimate the correlation between stock market capitalization and GDP per capita.

Data and methodology

Our data consists of two types of series for the following Central and Eastern European countries: Poland, Hungary, Bulgaria, Estonia, Latvia, Slovenia and Romania. On one hand, we are using GDP series with quarterly frequency for the period between the first quarter of 1998 and the second quarter of 2014 and on the other hand we use stock market indices with daily frequency from the 1st of January 1998 until the 1st of May 2014.

The mixed frequencies of the data at hand require the use of a methodology that needs to be relevant for such type of connections. We therefore use the so-called ADL-MIDAS (p_Y^Q, q_X^D), as in the work of **Error! Reference source not found.** (2010). Their specification is the following:

$$Y_{T+1}^{Q} = \mu + \sum_{j=0}^{p_Y^Q - 1} \alpha_{j+1} Y_{t-j}^{Q} + \beta \sum_{j=0}^{q_X^D - 1} \sum_{i=0}^{N_D - 1} w_{i+j*N_D}(\theta^D) X_{N_D - i, t-j} + u_{t+1} \quad (1)$$

where the weighting structure, $w(\theta^D)$, is developed according to the Almon lag polynomial, which has the following formulation:

$$w_j(\theta^D) = w_j(\theta_1, \theta_2) = \frac{exp\theta_1 j + \theta_2 j^2)}{\sum_{j=1}^{m} exp(\theta_1 j + \theta_2 j^2)} \quad (2)$$

We will be able to develop an analysis of the relations existing between the changes in GDP series with quarterly frequency, for the above mentioned countries and the corresponding log-returns of the stock market indices with daily frequency. In our notation the dependent variable (changes in GDP) will be denoted by Y_t^Q (equation 1), while the explanatory variable is denoted by X_t^D (the log-returns for each index).

Results

After an analysis for the whole period, the MIDAS regression results are presented in Table 1 and Table 2.

Table 1. Results of MIDAS regression for the whole period – part 1

	Coefficients	Standard Errors	Tstats	R-squared
Poland	0.956	NaN	NaN	0.361
Hungary	-1.290	0.735	-1.755	0.251
Bulgaria	-1.405	1.447	-0.971	0.045
Estonia	-1.167	0.933	-1.252	0.405
Latvia	2.552	1.579	1.616	0.417
Slovenia	1.288	0.275	4.687	0.676
Romania	-1.028	1.986	-0.517	0.080

Source: Reuters-Datastream and authors' calculations

Table 2. Results of MIDAS regression for the whole period – part 2

	LogLikelihood	Akaike Criterium	Bayesian Criterium
Poland	88.115	-353.531	-342.582
Hungary	75.965	-329.231	-318.283
Bulgaria	30.097	-206.278	-196.241
Estonia	85.831	-320.583	-310.457
Latvia	54.810	-264.217	-253.915
Slovenia	111.040	-305.729	-298.246
Romania	-0.065	-171.495	-160.701

Source: Reuters-Datastream and authors' calculations

We notice the fact that, with the exception of the Slovenian economy, there is very little dependence of the economic growth on the stock market dynamics. Latvia shows also a larger significance of the MIDAS regression coefficients, but there is not a particular significant contribution found for the whole sample in the rest of the cases.

We also ran the MIDAS regression for the sample until the end of 2008 and separately for the period after 2008. Table 3 and 4 show the results for the first period, while Table 5 and 6 show the results for the second sample period.

Table 3 – Results of MIDAS regression for the period 1998-2008 - part 1

	Coefficients	Standard Errors	Tstats	R-squared
Poland	-1.881	1.239	-1.517	0.413
Hungary	-2.809	1.267	-2.217	0.328
Bulgaria	0.675	1.260	0.536	0.013
Estonia	-1.657	0.942	-1.759	0.524
Latvia	2.354	1.799	1.309	0.510
Slovenia	1.737	0.625	2.779	0.713
Romania	-2.959	2.415	-1.225	0.099

Source: Reuters-Datastream and authors' calculations

Table 4 – Results of MIDAS regression for the period 1998-2008 - part 2

	LogLikelihood	Akaike Criterium	Bayesian Criterium
Poland	64.776	-244.419	-235.498
Hungary	54.324	-223.515	-214.594
Bulgaria	22.990	-129.630	-122.148
Estonia	57.080	-200.647	-193.015
Latvia	35.870	-163.904	-155.987
Slovenia	36.290	-93.797	-91.808
Romania	2.145	-113.481	-104.792

Source: Reuters-Datastream and authors' calculations

For the first period of our analysis, we observe similar situation as for the whole sample, with the extrapolation of the negative dependence of stock markets on the macroeconomic growth, which suggests that the stock market had a low weight of the economy for most of the countries in our sample. Slovenian is still the only case with significant coefficients.

Table 5 – Results of MIDAS regression for the period 2009-2014 - part 1

	Coefficients	Standard Errors	Tstats	R-squared
Poland	1.688	1.678	1.006	0.360
Hungary	-2.698	4.375	-0.617	0.217
Bulgaria	-2.741	6.868	-0.399	0.086
Estonia	0.790	0.963	0.820	0.607
Latvia	2.673	4.320	0.619	0.360
Slovenia	0.948	0.256	3.701	0.601
Romania	2.512	4.596	0.547	0.153

Source: Reuters-Datastream and authors' calculations

Table 6 – Results of MIDAS regression for the period 2009-2014 - part 2

	LogLikelihood	Akaike Criterium	Bayesian Criterium
Poland	25.448	-100.492	-95.269
Hungary	24.447	-98.490	-93.267
Bulgaria	8.848	-67.291	-62.068
Estonia	37.951	-125.497	-120.275
Latvia	21.767	-93.129	-87.906
Slovenia	83.311	-216.217	-210.995
Romania	2.495	-54.585	-49.363

Source: Reuters-Datastream and authors' calculations

The period after the crisis shows that the negative coefficients become insignificant, which could be interpreted by the fact that the economic growth has shrunk and the stock markets showed similar dynamics in the crisis period.

Conclusions

In this paper we aimed to determine the possible linkages between the evolution of the GDP and the dynamics of stock market indices for a series of CEE countries.

The results indicate a very weak dependence between economic growth and the movements of the stock market. The only conclusive case observed is that of Slovenia, with Latvia displaying also a greater significance but without a notable effect on the entire sample.

We then divided the data in two separate samples in order to investigate the effects of the economic crisis on the analysis. The results were symmetrical to those previously found, with Slovenia being the only significant case.

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ECONOMIC AND FINANCIAL RISK TAKING IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

Iulia LUPU, PhD*

Abstract

The need to ensure competitiveness and access to finance and new opportunities as a support for growth, entails countries to take economic and financial risks. One solution for economic growth is innovation and investment, which is equivalent with risk taking behavior. In this paper we intend to present the current economic and financial challenges for Central and Eastern European Countries, members of the European Union. As countries had to face specific challenges, the whole picture is mixed, but common threats still remain.

Keywords: CEE, economic and financial challenges

JEL Classification: G01, G32

Introduction

In a way or other, the new member states joined the European Union based on a prosperity perspective, a promise for economic growth. The need to ensure competitiveness and access to finance and new opportunities as a support for growth entails countries to take economic and financial risks, risks that are evolving and interblending in more sophisticated ways. In a general approach, risk taking implies decisions with perilous potential, but in the same time bring new opportunities with positive results. For example, innovation is considered to be a risks bearer, by developing new products and services with the capacity to create new markets and contribute to the economic growth.

The central banks may decide to adopt monetary policies to foster considerably spending from consumers and businesses by diminishing the interest rate and thereby making money affordable.

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When growth is slowing, some central banks (starting with Federal Reserve that first announced in September 2012, and continuing with The Bank of Japan that used it also in the early 2000s, and European Central Bank) may decide to use quantitative easing (the policy of assets purchase) to boost the economy. By buying government securities or other types of securities from the market, money is released in the economy with the aim to lower the interest rate and increase the nominal spending and the liquidity. Albeit it has already a history, this form of monetary policy is called unconventional and the debate about its efficiency and objectionable side effects. Previous research has acknowledged the existence of significant impact of quantitative easing news on the dynamics of financial markets (Albu et al. 2014) and particularly on UK gilt yields (Joyce et al., 2010).

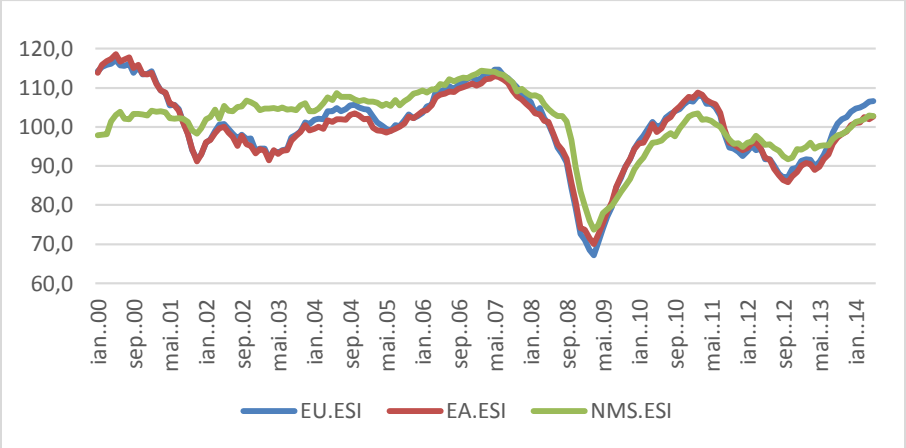
As mentioned in Bank for International Settlements report (2013), after the last crisis "At the same time as central bank measures may have become less effective, accommodative monetary policies have produced various side effects […]. Prolonged low policy rates tend to encourage aggressive risk-taking, the build-up of financial imbalances and distortions in financial market pricing." In different words, the accommodative monetary policy, known also as "easy monetary policy" used mostly for stimulate economic growth has also some side effects and when not supported by structural reforms may be even more dangerous, affecting economically and socially the entire society.

The role of central banks received more attention after the crisis, as many expect solutions for a bunch of key economic and financial issues. The central banks have to find a way to pursue the price stability objective while promoting financial stability (Criste and Lupu, 2014), are setting the framework for exchange rate and are linked with capital fluctuations (Milea, 2013) and liquidity. The lack of symmetry of business cycles in Central and Eastern European countries (Chirilă and Chirilă, 2012) is also a cause for a different matrix of risks.

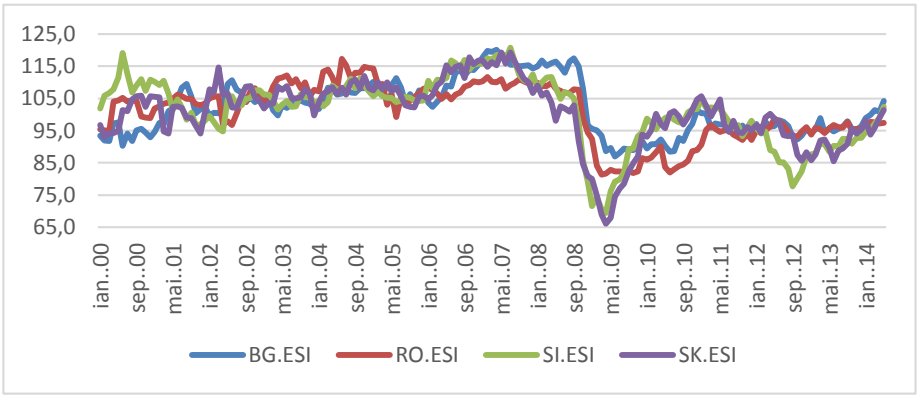
Economic risk taking

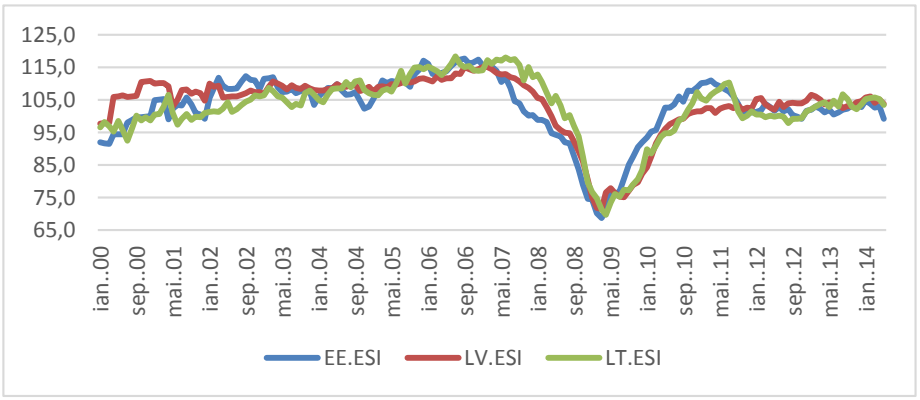
The economic sentiment indicator[1] is a quantified measure of the economic confidence and at a first glance may offer an image that reflects the difference between countries. Looking at a longer trend that starts in the year 2000, can be observed that till the begging of 2008, almost all new member states of the European Union had a smooth evolution, slightly positive. The dramatic drop from 2008 affected all countries, but on average (except Hungary) the new member states were above the level of euro area countries. From the second half of 2012, all new member states started to recover, following the bigger European trend. Hungary is much above the common trend, strengthening its fluctuant evolution.

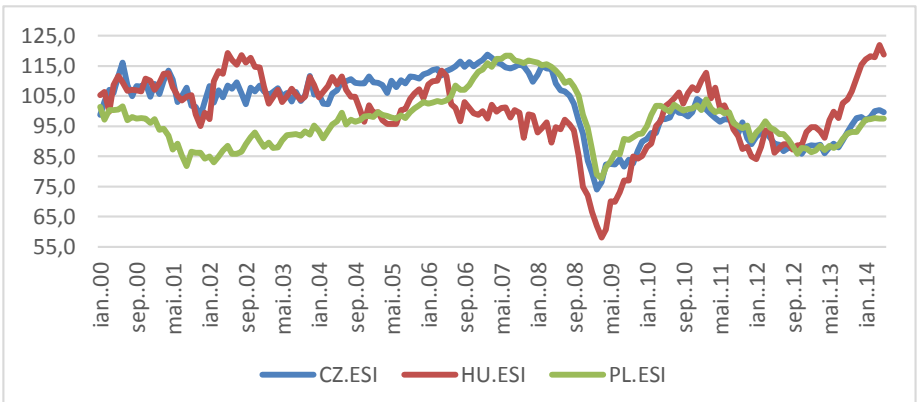
Figure 1 - Economic Sentiment Indicator in the New Member States (January 2000-May 2014)



[1]*A composite indicator designed by the European Commission based on judgments and attitudes of producers and consumers; investors and analysts may see how optimistic or pessimistic the market conditions are. It is a compered with a long term average (=100) and consists in a withed average of 5 indicators representing different components of the economy: industrial confidence indicator (40%), service confidence indicator (30%), consumer confidence indicator (20%), construction confidence indicator (5%), and retail trade confidence indicator (5%).*



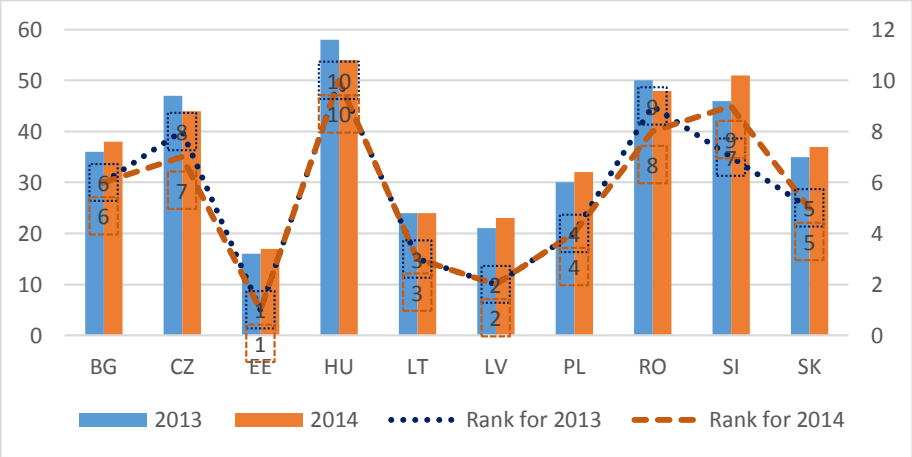




Source: European Commission, AMECO database and author's calculations

Another well-known index for measuring the climate for business is published by World Bank. Even if uses a criticized methodology, the researchers involved in constructing the index are arguing that the improvement of the elements taken into account (starting a business, property rights, protecting investors etc.) may favorable influence the economic growth. Looking at our group of countries for the available data – 2013 and 2014, although the first six positions are kept in 2014 by the same countries, in the same order (Estonia, Latvia, Lithuania, Poland, Slovak Republic and Bulgaria), with the exception of Lithuania that has the same index, the others are losing 1 or 2 points. Slovenia is declining from 7th position to the 9th, allowing Czech Republic and Romania to advance with 1 position, Hungary remaining on the last place, albeit the index is improving with 4 points.

Figure 2 - Ranking for Ease of doing business index

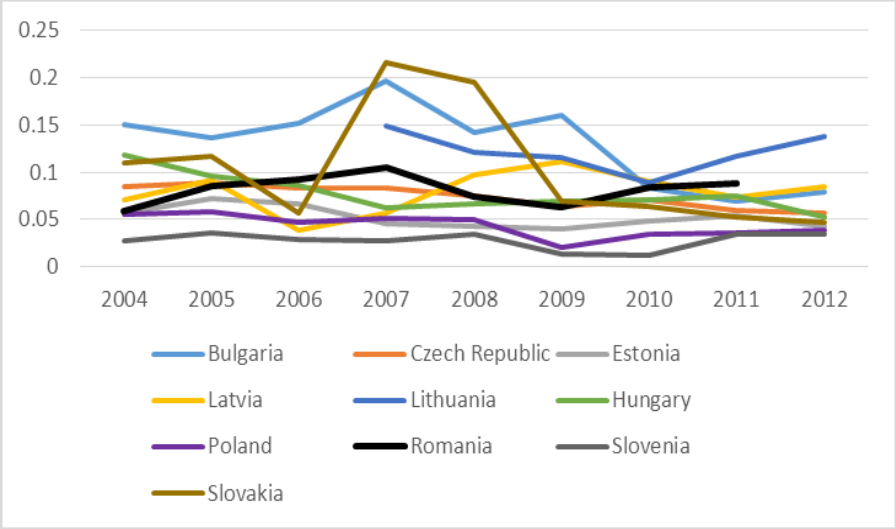


Source: World Bank database, Doing Business and author's calculation Note: 1 = most business-friendly regulations, 189 = worse

The number of SMEs is generous in European Union at large and in Central and Eastern European Countries, but their main challenge is to enlarge and to survive in the next years. Romania and Poland are leading when looking at the number of their new created companies with 10 or more employees, but when scaling with population, Romania is somewhere in the middle of the group and

Poland is the penultimate and Bulgaria is leading till 2010 (excepting Slovakia for a short period in 2007 and 2008 when was recorded an abnormal situation). Starting with 2009 and more obvious after 2010, the number of new created enterprises at 1000 population is converging to a narrow interval between 0.03 and 0.08 (except Lithuania), demonstrating a more risk averse behavior.

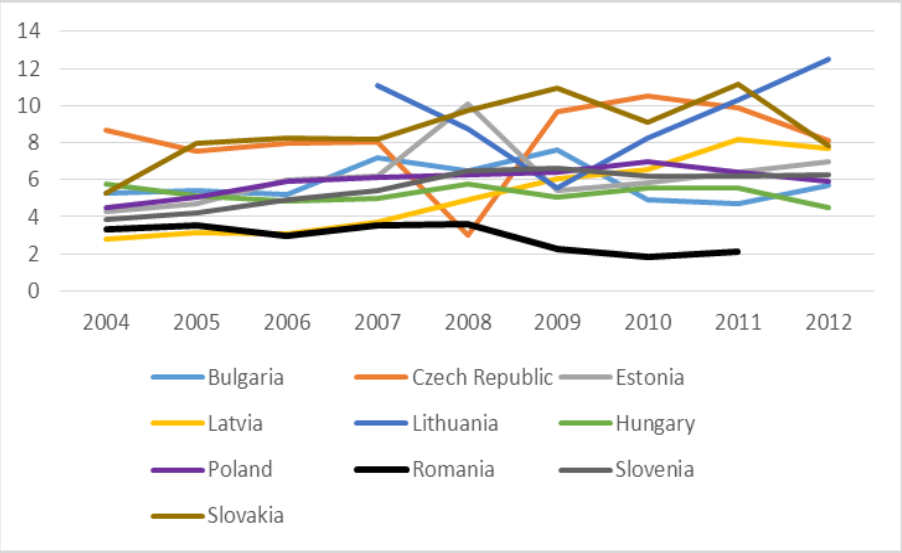
Figure 3 - New enterprises with 10 or more employees at 1000 population in the period 2004-2012 (business economy except activities of holding companies)



Source: Eurostat and author's calculations

As for creation of new smaller enterprises at 1000 population, the places of Romania and Poland are changing, Romania placing last and Poland in the middle of the group. The evolution in the other countries is chaotic, the interval narrowing in 2012, in a range between 4 and 8 (except Romania – at a lower level, and Lithuania, again with a number of new created enterprises much higher than the average – more than 12), the aversion toward risk having a 1-2 years lag comparing with the case of enterprises with 10 or more employees.

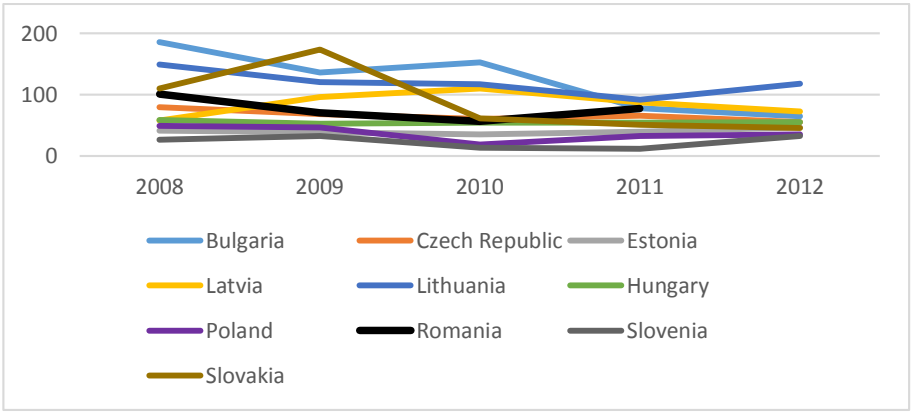
Figure 4 - New enterprises with less than 10 employees at 1000 population in the period 2004-2012 (business economy except activities of holding companies)



Source: Eurostat and author's calculations

Together with the narrowing of interval for the new created enterprises with 10 or more employees at 1000 population, the number of newly born enterprises in t-1 having survived to t with 10 or more employees at 1000000 population, is also converging to values between 30 and 70, except again Lithuania, confirming an unfriendly environment.

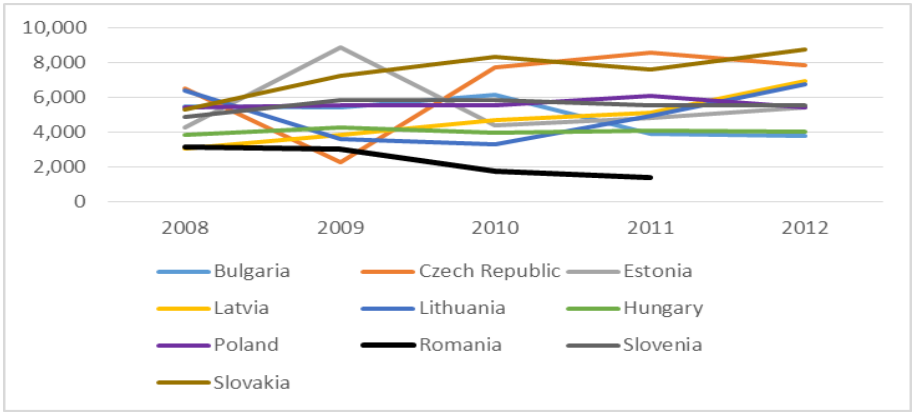
Figure 5 - New enterprises with 10 or more employees at 1000000 population in the period 2004-2012, newly born in t-1 having survived to t(business economy except activities of holding companies)



Source: Eurostat and author's calculations

The number of newly born enterprises with less than 10 employees at 1000000 population in t-1 having survived to t, in an unexpected way, is even increasing after 2010 (except Romania) and these numbers are much higher than in the previous case.

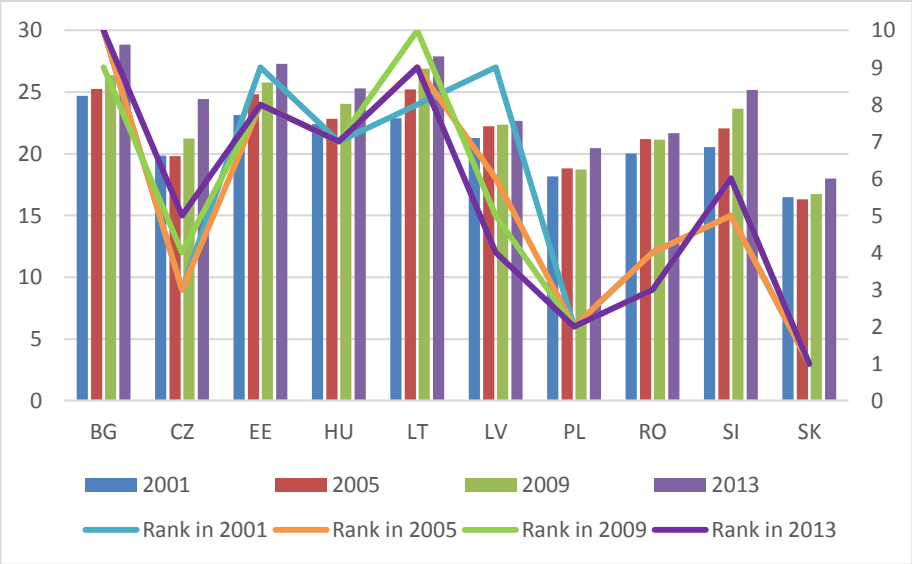
Figure 6 - New enterprises with less than 10 employees at 1000000 population in the period 2004-2012, newly born in t-1 having survived to t (business economy except activities of holding companies)



Source: Eurostat and author's calculations

A real threat for the current moment is the population ageing (Ciumara and Lupu, 2014; Ciumara et al., 2013), more advanced in the Western European economies. In the group of analyzed countries, the bigger problem seems to be in the case of Bulgaria, with highest level of old age dependency ratio, followed by Lithuania and Estonia. The smallest rate is in Slovakia, followed by Poland and Romania, almost all countries registering a slight increase.

Figure 7 - Ranking for Age dependency ratio, old (% of working-age population)



Source: World Bank database and author's calculations

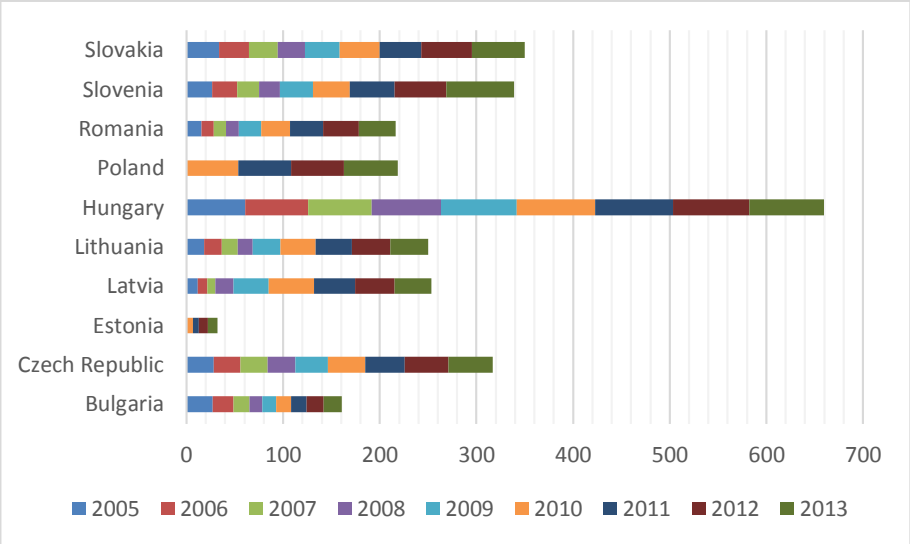
Financial risk taking

Bank for International Settlements (2013) drew the attention on currently used aggressive easy-money policies by many central banks, policies that fostered investors and financial institutions to take more risks - "Abundant liquidity and low volatility fostered an environment favoring risk-taking and carry trade activity".

While confronting the own challenges, the Central and Eastern European countries imported some problems through the banking system that is mostly held by countries from the euro zone (IMF, 2014; EIB, 2013; Ailincă, 2014).

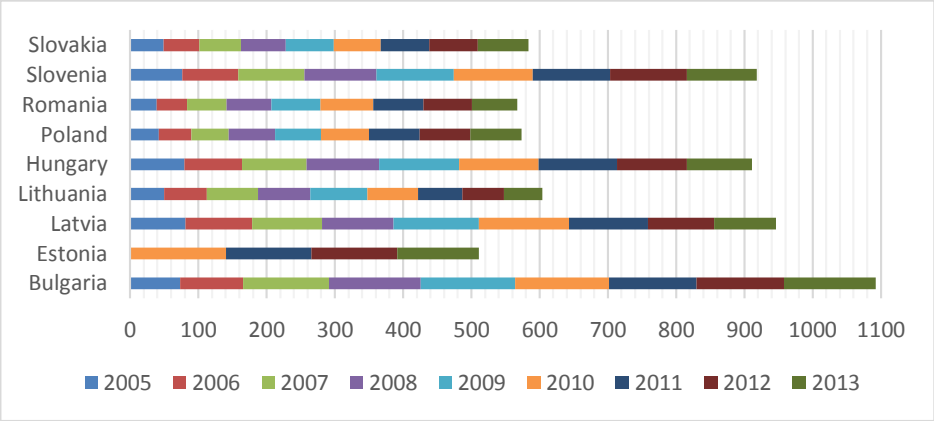
The debt stock (private debt accumulated mostly prior to the crises and public debt that increased after the crises) raised the need for refinancing; this conjuncture (Miclăuş and al., 2010) combined with the dependence on external financing make these countries vulnerable. The currency risk is elevating in some cases their weakness, albeit this risk is differentiating across various sectors of the economy (Horobet and Lupu, 2005).

Figure 8 – General government gross debt, consolidated annual data (%GDP)



Source: Eurostat database
Note: Data not available for Estonia and Poland between 2005 and 2009

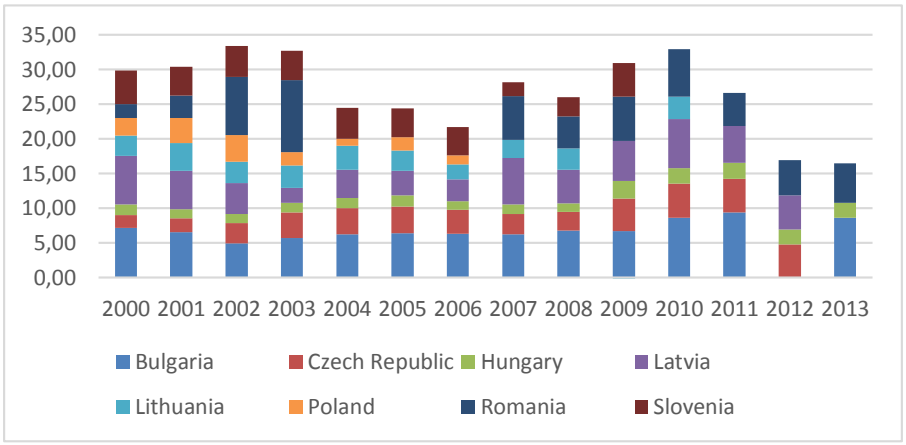
Figure 9 – Private sector debt, consolidated (%GDP)



Source: Eurostat database
Note: Data not available for Czech Republic (entire period), and Estonia between 2005 and 2009

Some countries (Hungary, Lithuania) are keeping relatively low risk premium for lending, while countries like Bulgaria are maintaining a high level, even if the stock of debt (at least for public sector) is one of the smallest. Romania had a huge increase in 2002-2003, and from 2007 the level is slightly floating in the same rage.

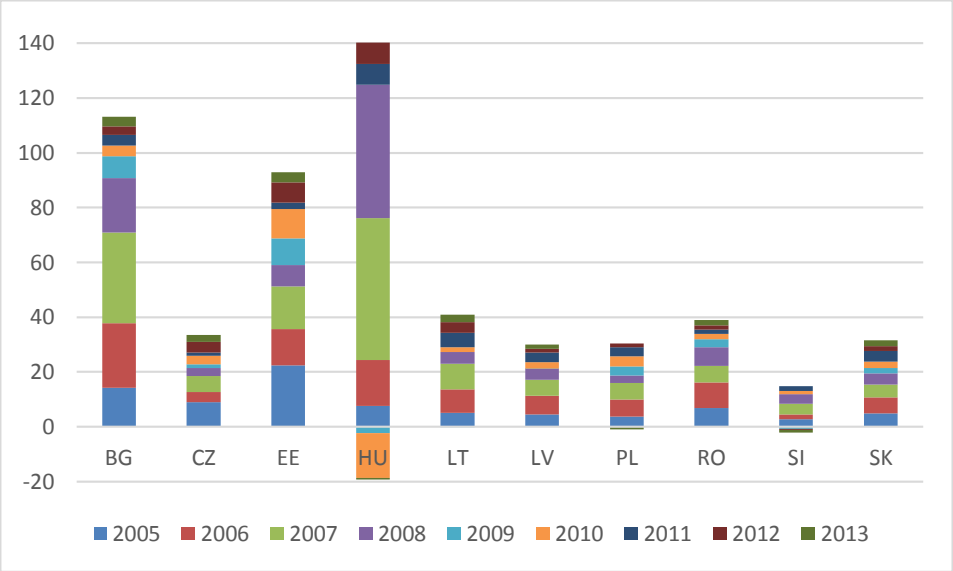
Figure 10 – Risk premium on lending



Source: World Bank database and author's calculations
Note: Lending rate minus treasury bill rate. For the years when some countries are not included in the graphic, data is not available.

Even if Hungary and Bulgaria had not very good positions for economic sentiment indicator calculated by European Commission (Bulgaria is sometime little bit better positioned than Romania, but Hungary had a lower index than other countries) or ease of doing business index published by World Bank (Bulgaria in on 6th place in the group of ten, and Hungary is on the last place), these countries attracted most of the foreign direct investments between 2005 and 2013, being followed by Estonia. Besides the fact that this kind of investments bring good and bad for the host country, depending of the quality of investors, the indexes calculated by different institutions to measure the business climate are not considered in all cases.

Figure 11 – Foreign direct investment, net inflows (% of GDP)



Source: World Bank database and author's calculations

Concluding remarks

The last crisis induced a growing risk adverse behavior in the last years. Complementary, the external financing was more volatile starting with the middle of 2013, the foreign banks reduced the external funding, and the geopolitical situations was in strong distress. The growth perspective in CEE is facing many downside risks in the near future. The tightened conditions of the financial markets due to higher

market volatility are affecting all markets, including CEE that can receive less funding and investments, limiting the market liquidity. Geopolitical risks raised by tensions regarding Russia and Ukraine, very close geographically to CEE countries, currently have a negative influence with a limited impact, especially in the energy and trade sectors, but a sustained conflict may encompass serious prejudice in the entire region, affecting the confidence. As countries had to face specific challenges, the whole picture is mixed, and in the context of an increased private and public debt, they are responsive to internal and external markets' conditions changes. For a better position of banking sector there is a need for strengthening the capital and liquidity levels and for eschewing from riskiest lending's forms.

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