Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies

MASTER THESIS

Scoreboard Indicators as a Measure of Macroeconomic Imbalances

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Academic Year: **2012/2013**

Declaration of Authorship

The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

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Prague, May 15, 2013

Signature

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I would like to thank my thesis supervisor, prof. Ing. Oldřich Dědek CSc. for his suggestions and valuable comments. My gratitude belongs to PhDr. Michael Princ as well, who gave me an idea of how I should conduct my empirical analysis.

Abstract

This thesis examined an ability of the scoreboard indicators created by the European Commission to capture macroeconomic imbalances expressed as the changes of GDP. We conducted an empirical analysis for panel data of 27 EU countries in the 1997-2011 period. We adopted three different dynamic panel data models based on the three estimators: the Arrelano-Bond, the Arrelano-Bover and the corrected LSDV estimator. Our results suggest that despite some bad characteristics of our dataset we can conclude that some of the indicators such as 3-year average of current account balance or percentage change in export market shares seem to be inadequate for measuring the imbalances. Moreover, the indicators were proved not to be able to predict an occurrence of imbalances.

Bibliographic record

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Abstrakt

Tato práce zkoumá schopnost hodnotící tabulky ukazatelů vytvořených Evropskou komisí zachycovat makroekonomické nerovnováhy vyjádřené pomocí změn v HDP. Byla provedena empirická analýza panelových dat pro 27 zemí EU v letech 1997-2011, která zahrnovala tři různé dynamické modely panelových dat založené na třech různých odhadech: Arrelanův-Bondův, Arrelanův-Boverův a upravený LSDV odhad. Naše výsledky naznačují, že navzdory některým nepříznivým vlastnostem použitých dat můžeme prohlásit, že některé indikátory, například tříletý průměr salda běžného účtu nebo procentuální změna podílů na vývozu, se nezdají být vhodnými prostředky pro měření nerovnovah. Kromě toho se také ukázalo, že indikátory nejsou schopny předpovídat výskyt těchto nerovnovah.

Bibliografická evidence

Toušková, D. (2013): Hodnotící tabulka jako nástroj pro měření makroekonomických nerovnovah. Diplomová práce, Univerzita Karlova v Praze, Fakulta sociálních věd, Institut ekonomických studií. Vedoucí práce: prof. Ing. Oldřich Dědek CSc.

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List of Acronyms

ADF test	Augmented Dickey-Fuller test
AMR	Alert Mechanism Report
AR	Autoregressive process
CA	Current account
CAP	Corrective Action Plan
CEE	Central and East European countries
EC	European Commission
ECB	European Central Bank
EDP	Excessive deficit procedure
EERP	European Economic Recovery Plan
EIP	Excessive Imbalance Procedure
EMU	Economic and Monetary Union
ESFS	European System of Financial Supervisors
ESRC	European Systemic Risk Council
EU12	New Member countries of the European Union
EU15	Old Member countries of the European Union
GDP	Gross Domestic Product
GLS	Generalized Least Squares
GMM	Generalized method of moments

HICP	Harmonised index of consumer prices
IPS	Im, Pesaran and Shin test
IV	Instrumental variables
KPSS test	Kwiatkowski–Phillips–Schmidt–Shin test
LLC test	Levin, Lin and Chu test
LSDV	Least Squares Dummy Variable
MIP	Macroeconomic Imbalance Procedure
NIIP	Net International Investment Position
PIGS	Portugal, Ireland, Greece, Spain
PP test	Phillips and Perron test
REER	Real Effective Exchange Rate
RQMV	Reverse qualified majority voting
SGP	Stability and Growth Pact
ULC	Unit labour costs

Master Thesis Proposal

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Proposed Topic:

Specifics of measuring scoreboard indicators in case of the Czech Republic

Topic Characteristics:

In my thesis I will focus on a scoreboard of indicators published in Alert Mechanism Report (AMR) by the European Commission in February 2012. AMR is considered the first step in dealing with large and persistent macroeconomic imbalances which have accumulated over the past few years and were among the causes of the current economic crisis. The system of scoreboard indicators consists of five external imbalances indicators and five external imbalances indicators. Although they have been set at levels which should prevent both false alarms and late detection problems, 12 out of 27 member states were indicated as states which need a further risk assessment of macroeconomic imbalances. According to AMR, the Czech Republic does not belong to the countries which need an increased attention. In spite of it, there are some problems mentioned in AMR such as large current account deficit or losses in price competition. I will try to focus on these problematic aspects of Czech economy and suggest several hypotheses related to it.

Hypotheses:

1. As current development implies, Czech Republic is supposed to further comply with the indicative thresholds of indicators measuring external imbalances.
2. Some of the indicators could be excluded from the table since there are some interdependencies between them.
3. According to AMR, the Czech Republic has one of the best results of New Member States.
4. Similarly to other New Member States, there is a need for a specific approach towards measuring and interpreting scoreboards indicators in case of the Czech Republic.

Methodology:

In the first part of my thesis I will focus on describing the design of scoreboard indicators and on the way of measuring them. As far as the available literature is concerned, the main sources of information are reports and occasional papers provided by the European Commission. Then, I will describe some specifics which are needed to be taken into consideration when applying indicators to Czech conditions. Next, in the empirical part of my thesis, some regression models related to suggested hypotheses will be introduced. Data available at the Eurostat databases will be used during calculations of these models.

Outline:

1. Introduction of Alert Mechanism Report
   a. Design of Scoreboard Indicators
   b. Macroeconomic Imbalance Procedure
2. Specifics of the Czech Republic
   a. Problematic Indicators and Their Economic Interpretation
   b. Suggested Solutions
3. Empirical Part
   a. Description of the Data
   b. Regression Models
   c. Discussion of the Results

Core Bibliography:

1. European Commission (2012): Report from the Commission: Alert Mechanism Report
2. European Commission (2012): Quarterly Report on the Euro Area, Volume 11 No.1 (2012)
3. European Commission (2011): Quarterly Report on the Euro Area, Volume 10 No.4 (2011)
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Author

Supervisor

1 Introduction

The global economic crisis starting in 2008 has revealed certain weaknesses in the governance framework which underlies functioning of EMU. Moreover, concealed weaknesses of some of unwillingly participating countries were brought to light as well. As a response, EU institutions adopted a new legislative framework which should lead to enhanced economic governance in the whole Union.

So, the surveillance mechanism for correcting and preventing macroeconomic imbalances called Macroeconomic Imbalance Procedure (MIP) has been set up in December 2011 as a part of so-called six-pack of legislation on economic governance.

In a nutshell, MIP consists of two parts – a preventive arm, which serves to an early detection of potential imbalances, and a corrective arm, which establishes a procedure in which a Member state must put in a place a detailed policy plan in order to achieve correction of imbalances. Moreover, MIP is implemented as a two-step approach. In the first step, an alert mechanism which should function as a filter was adopted. Member countries which do not manage to pass through this filter have to proceed to the second step consisting of an in-depth analysis leading to assessing threats of imbalances and suggestions of some policy recommendations.

Until now, 13 Member States have been suggested to proceeding to in-depth analysis. Countries in question are Belgium, Bulgaria, Denmark, Finland, France, Italy, Hungary, Malta, the Netherlands, Slovenia, Spain, Sweden and the United Kingdom. This decision was made as lately as on 28 November 2012 and the analysis was completed and evaluated on 4 April 2013.In the reviews, origins, nature, severity and threats of potential macroeconomic imbalances are described together with policy challenges and final recommendations for further process. So, we must wait to see if the recommendations will be successful and those countries will manage to overcome prevailing imbalances.

However, our analysis presented in this thesis will focus on slightly different, yet not less important topics: are the scoreboard indicators useful in measuring macroeconomic imbalances? Are there differences between Old and New Member countries in the way how these imbalances can be captured?

In order to find answers to such questions, we adopted a dynamic panel data approach employing annual data from 1997-2011 for all 27 countries. We chose growth of GDP per capita as a proxy of macroeconomic stability and we conducted dynamic panel regressions of indicators´ values as explanatory variables. Because we adopted three different basic models and three different estimators, we arrived at nine final models. Given that our dataset appeared to be quite problematic in terms of its quality, our results must be treated with caution.

Nevertheless, we can conclude that it really does matter on which group of countries we employ our estimation. Results are different in case of Old and New Member countries and they suggest, inter alia, that while in case of the EU 15 group the most significant indicators for GDP growth seem to be nominal labour cost and private debt, in the EU 12 group it is the rate of unemployment and average current account balance. Such results are robust regardless of which estimator we use. On the other hand, such indicators such as export market shares or government debt seem to be inappropriate in preventing macroeconomic imbalances.

The structure of the thesis can be described as follows: in the second chapter, we described the development in the Eurozone from its establishing in 1999 together with the causes and nature of imbalances which started to occur in individual countries.

Then, we will introduce some of the most important initiatives and measures that have been adopted by EU authorities in order to achieve macroeconomic stability and enhance the surveillance of the competent authorities. In the fourth chapter, focus is given to Macroeconomic Imbalance Procedure as it provides essentials for our analysis.

In the following section, we provide descriptive statistics of individual indicators together with theoretical background of their creation and description of values and indicative thresholds for different countries. Chapter 6 introduces the empirical framework of the thesis. We will describe the data, construct the models and introduce three estimators and their techniques which we used in our analysis. Next, the seventh chapter introduces dynamic panel data use we will employ in our analysis.

Finally, Chapter 8 summarizes our findings along with their overall assessment.

2 Development of macroeconomic imbalances in the Eurozone

In 1999, eleven European countries (twelve including Greece, which was admitted in 2001) stopped using their traditional, centuries old currencies in order to adopt one common currency – the euro.[1] At the same time, an institution with a mandate to maintain price stability while implementing the common monetary policy was established – European Central Bank (ECB). Also, the Stability and Growth Pact (SGP) was implemented in order to set binding constraints on each Member Country´s fiscal policy.

The unprecedented step of establishing a common currency was cautiously monitored by the rest of the world. Many important questions arose. Will it work? Is it possible to create a monetary union from such different countries? What if it will bring imbalance into until then functioning economies?

However, as the time went by, it turned out that sceptical worries did not come true. The euro started to be widely used to denominate all kind of bonds shortly after its debut. All over Europe, the rapid integration of money and government bond markets as well as equity markets could be observed (Chinn and Frankel, 2007).

Moreover, Detken and Hartmann (2000) proved in their study that in the first year of euro being in operation, there was a sharp increase in the issuance of international debt securities denominated in euros outside Europe, too. Then, during the next five years, international use of euro continued to grow until half of Eurozone trade with non-euro area residents was invoiced in euros. In 2007, the euro was holding the second position in the most important international currencies ahead of the yen and gained a wide acceptance (Chinn and Frankel, 2007).

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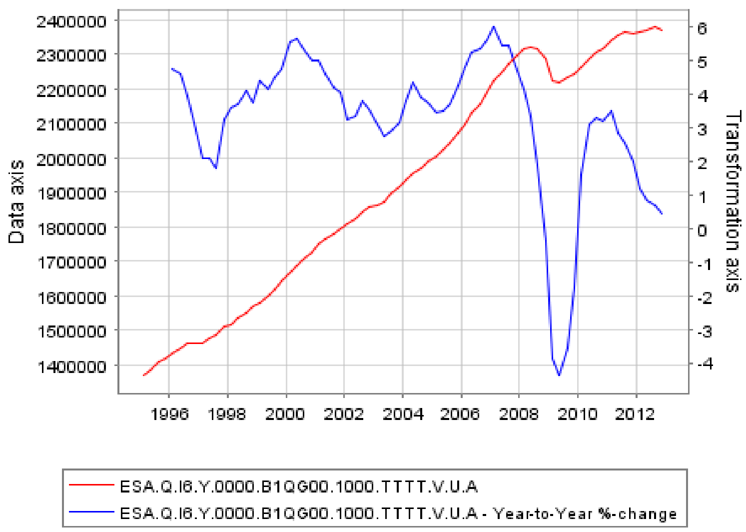
[1] In 1999, euro was adopted by Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain.

Also, when we look at some financial indicators in first years of the Euro area, everything seemed to develop plausibly. In Figure 1, we can see development of GDP level in current prices in 17 Euro area countries. We can see that until 2008, there were not many significant changes in GDP growth – it was positive and about 5% in average.

Also, when we look at inflation measured by HICP index with 2005=100 in Figure 2, we can observe a following pattern: year-to-year percentage change was more or less stable since 2000 until the crisis occurrence in 2007 – so it is obvious that ECB was successful in fulfilling its goal to keep inflation low and stable.

However, although we could find many more indicators proving that overall economic conditions of the Eurozone were developing very plausibly in the first years of EMU, a detailed examination of the economic conditions in individual countries in detail provides a slightly different picture.

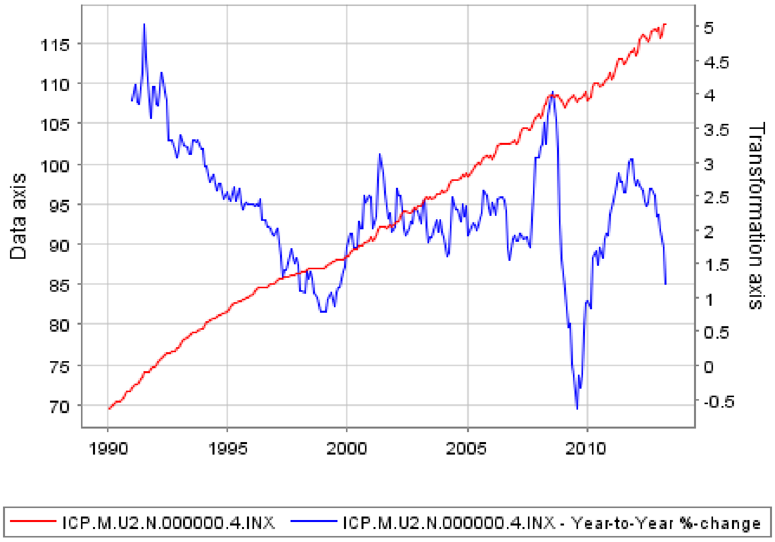
Figure 1: GDP at market prices, current prices, Euro Area



Source: ECB, Statistical Data Warehouse

First of all, growing current account imbalances between southern and northern countries could be observed since the very beginning of monetary union. The gap between countries with large and persistent current account surpluses such as Germany, Austria, Finland or the Netherlands and countries with large deficit – mainly PIGS countries – has started to widen.

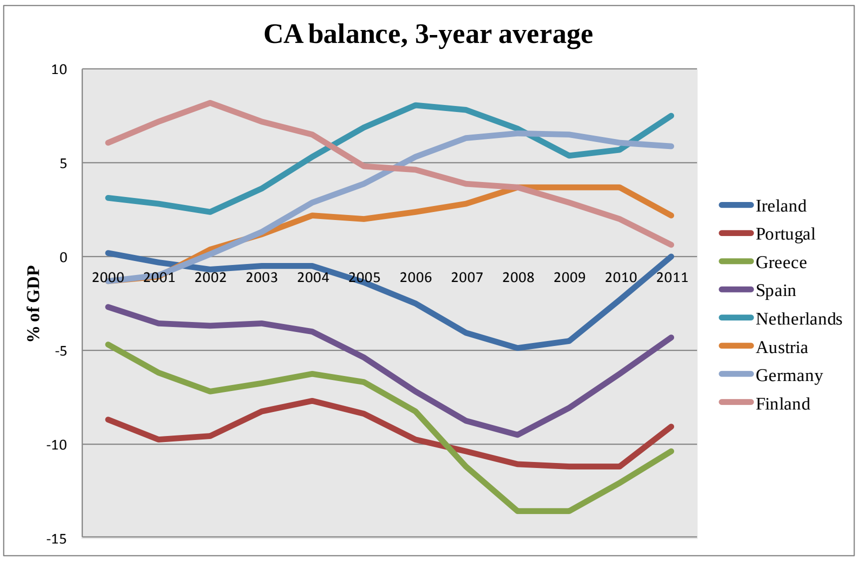
Figure 2: HICP, overall index, Euro Area



Source: ECB, Statistical Data Warehouse

This diverging pattern is shown in Figure 3. However, governments of the Euro area countries did not seem to be aware of potential threats which such imbalances can bring (Holinski, Kool and Muysken, 2012).

Figure 3: Current Account Balance



Source: Eurostat, author´s computations

Naturally, already in 2007 when the global financial crisis hit, large current account deficit in some European countries appeared to be very problematic. The unprecedented credit boom that most countries, especially the southern ones, experienced during the first decade after the establishment of the EMU, had to stop abruptly when the private capital flows started to dry up. Market financing was no longer at pre-crisis level and the governments of PIGS countries were no longer able to fund themselves at any sustainable price (Gros, 2012).

Another source of macroeconomic imbalances was in development of housing prices. To a certain extent, their fluctuations are natural as they belong to defining features of the business cycle. However, during the 1998-2006 period, real house prices in the euro area have not followed the usual path and they rose on average by 4% a year, in cumulative numbers it was over 45%. It is not surprising that the largest boom experienced mainly countries with large credit financing such as Ireland, Spain or France. Subsequently, in those countries house prices declines were the most painful in the third quarter of 2009: Ireland -37%, Spain -18% and France -15%.

In the first column in As we have just shown, various macroeconomic imbalances have occurred during the existence of monetary union. While in the years preceding the global economic crisis which were characterized by boom in many sectors the imbalances seemed to be harmless, everything changed with the occurrence of the crisis. So, several key questions have emerged: how to correct such imbalances, how to prevent them in the future and what the role of ECB should be in the process.

Table 1, differences between actual and equilibrium house prices in 2008Q4 as computed by Quarterly report (2010) are shown. Results indicate that, apart from Germany and the Netherlands, house prices were overvalued in all Eurozone countries. When we compare changes in prices in 2009 with estimates of equilibrium prices for the end of 2008, we can again observe diverging phenomenon between the two groups of countries. Countries in the first group, which is a majority of countries concerned, seem to successfully reduce price misalignments. France and Italy, for example, probably reached approximately balanced level in the third quarter of 2009. On the other side, some Member countries such as Finland, Germany or the Netherlands tend to diverge from the equilibrium prices (European Commission, 2010c).

As we have just shown, various macroeconomic imbalances have occurred during the existence of monetary union. While in the years preceding the global economic crisis which were characterized by boom in many sectors the imbalances seemed to be harmless, everything changed with the occurrence of the crisis. So, several key questions have emerged: how to correct such imbalances, how to prevent them in the future and what the role of ECB should be in the process.

Table 1: House price imbalance and adjustment in %

Country	Price misalignments	Real price changes betw. 2008Q4 and 2009Q4
Finland	15	9
France	9	-5
Germany	-4	-2
Ireland	3	-19
Italy	8	-3
Netherlands	-1	-5
Spain	24	-7
Euro area(median)	8	-5

Source: European Commission (2010)

Before we will describe the methodology suggested by the European Commission for solving and preventing such imbalances which we have focused on, we will shortly describe some remedies which the Commission had previously adopted in order to examine them.

3 Measures adopted by the EU against macroeconomic imbalances

Since 2008 when the whole Union had to deal with consequences of the crisis for the first time, the EU legal authorities have came with many measures, remedies and suggestions for assessment of macroeconomic stability. Describing all of them would be far beyond the framework of this thesis. Thus, we will mention only the most important ones.

- **European Economic Recovery Plan (EERP)** was approved by the European Council on 11-12 December 2008 and was meant to set out how the Union could coordinate its policies with Member States. EERP consists of two pillars – first one is represented by injection of purchasing power into economy represented by € 200 billion. It was believed that such incentive should increase demand and overall confidence. Second pillar was connected with the need of stimulating European competitiveness in a long-term period. For this purpose, EERP suggested new kind of "smart" investments which should have a positive impact on future needs, such as investing in energy efficiency, which helps create jobs and save energy; investing in clean technologies in order to boost construction sector and development of low-carbon cars or investing in infrastructure and inter-connection to ensure increasing efficiency and reach new innovations (European Commission, 2008)

- **"Driving European recovery„** was the Communication issued by the European Commission on 4 March 2009.This document was focused mainly on establishing new framework for both macro-prudential and micro-prudential financial supervision and highlight problems and their causes as well as supervision objectives. The whole framework was based on two pillars: European System of Financial Supervisors (ESFS), which represents the micro-prudential part of supervision and thus is focused on individual financial institutions; and European Systemic Risk Council (ESRC), which supervises the economy as a whole and issue warnings and recommendations if they are necessary.

Also, the Communication focused on setting out various measures which could trigger a recovery in Europe needed for dealing with consequences of the global economic crisis. So, suggested programmes aim at four main areas:

- Reforming the financial sector regarding that its stability is necessary for recovery to be durable
- Sustaining demand
- Boosting investment
- Retaining or creating jobs including various measures for ensuring reintegration into labour market, supporting the most vulnerable by increasing minimum wages etc. and strengthen social protection (European Commission, 2009)

- **Europe 2020** is a EU´ s proposed growth strategy accepted on 3 March 2010 and it reflects the Commission´s view where the Union should be in 2020. It is based on three priorities which reinforce each other: to ensure smart (based on knowledge and innovation), sustainable (greener and more resource-efficient) and inclusive (high employment, social and territorial cohesion) growth of economy.

These newly defined growth requirements should be fulfilled by achieving five key targets, which cover employment, education, research and development, social inclusion and poverty reduction and climate/energy.

All of these targets can be expressed numerically as it is shown in the following summary:

1. In the age of 20-64, 75% of population should be employed
2. 3% of EU´s GDP should be reinvested in R&D

3. Targets for climate and energy called "20/20/20[2]" should be met, including 30% increase of emissions reductions if the conditions are right

4. The share of people who leave school prematurely should not exceed 10% and at least 40% of the younger generation should have a tertiary degree

5. Number of Europeans living under the national poverty line should be reduced by 25% which should lift over 20 million people out of poverty.

However, these targets can differ in individual Member States – the countries are welcomed to tailor them to their particular situation.

For purpose of our analysis we are interested in topic of macroeconomic imbalances mentioned in this document. There is emphasized need to control the imbalances by carefully considered and approved methods or instruments. Moreover, control measures have to take into account current situations in individual countries – it is obvious that some adjustments need to be done at countries' level (European Commission, 2010b)

- **Six-pack of legislation on economic governance** came into force on 13 December 2011. Six-pack consists of five Regulations and one Directive and it is applied to all Member States with some adjustments regarding especially financial sanctions for Eurozone countries. The package is supposed to have two main objectives:

    1. Stronger preventive and corrective actions to ensure financial sustainability – Member States must regard their fiscal policies not individually but from the view of all Union and must avoid excessive deficit. This system requires changes in three key areas:

        - **Stronger preventive arm –** this includes stricter rules for fiscal behaviour and better enforcement in case when the given rules were broken including setting a penalty.

[2] The „20/20/20" rule includes three targets: greenhouse gas emissions should be reduced of at least 20% below 1990 level, 20% of energy should come from renewable resources and primary energy use should be reduced by 20% due to improving energy efficiency (European Commission, Climate Action, 2013)

- **Excessive Deficit Procedure (EDP) –** defines two requirements regarding deficit, which should not exceed 3% of GDP and government debt, which should be kept below 60% of GDP or should be declining towards this threshold. EDP was novelized in the six-pack by implementing stricter rules and more effective enforcement by setting a punishment of establishing a non-interest bearing deposit of 0.2% of GDP in case the country is under EDP

- **National budgetary frameworks –** there was a need to set some minimal requirements on fiscal decisions on Member States regarding their quality and consistency with a common framework.

2. Reducing macro-economic imbalances and promoting competitiveness through preventive and corrective action – until recently, Member States made their economic choices on their own, which often has had negative consequences for other countries too due to their economic interconnection and has led to imbalances (European Commission, 2013a). So, the new system called Macroeconomic Imbalance Procedure (MIP) was established. We will describe it in detail in the following chapter.

- **Regulation on the prevention and correction of macro-economic imbalances** was published on 16 November 2011 and states that coordination of economic policies of Member States should be developed in a broad economic policy and employment guidelines. Also, the role of the European parliament and national governments should be strengthened as well as the role of the European Commission in the surveillance procedure. For implementing this procedure, the alert mechanism for early detection and monitoring of imbalances including the scoreboard of indicators needs to be established, as will be described in the following chapters (European Union, 2011).

4 Macroeconomic Imbalance Procedure

Macroeconomic Imbalance Procedure (MIP) is a surveillance mechanism for correcting and preventing macroeconomic imbalances built on the Article 121.6 of the Maastricht Treaty. As far as the legal basis is concerned, MIP is based on two pieces of legislation, one of them mentioned previously: regulation No 1176/2011 on the prevention and correction of macroeconomic imbalances and regulation No 1174/2011 on enforcement measures to correct excessive macroeconomic imbalances in the euro area, both published on 16 November 2011.

The first one specifies details of the new surveillance procedure and encompasses all Member States while the latter one is focused only on the euro area and establishes the enforcement mechanism with description of sanctions. The overall logic of both of them follows the same way as the Stability and Growth Pact and can be described as a two-arms system: the preventive arm, which should serve as a protection against possible occurrence of imbalances and the corrective arm, which becomes important if the imbalances exist and are not easily removable.

MIP relies on three main elements (European Commission, Economic and Financial Affairs, 2013b):

- **An early warning system:** the alert system is based on the economic reading and evaluation of the scoreboard of ten indicators. The indicators should cover the most problematic areas which create potential sources of macroeconomic imbalances.
- **Preventive and corrective actions:** based on article 121.6 of the Treaty, the EC and the European Council are allowed to release preventive recommendations at an early stage of potential macroeconomic imbalances. As far as the corrective actions are concerned, a country can be put under excessive imbalance procedure if necessary. In this case, a Member State is

obliged to submit a corrective action plan (CAP) together with supposed deadlines of implementing it and specific policy actions. Then, surveillance of the Commission is implemented by controlling regular report the Member State has to submit under EIP.

- **Rigorous enforcement:** for the euro area countries, the new regime of enforcement was established. It consists of the following the two-step approach:
  - after first failure of complying with the recommended corrective action, an interest-bearing deposit can be imposed
  - after second failure of complying with the recommended corrective action, this interest-bearing deposit can be converted into a fine up to 0,1% of GDP

If the country fails twice in submitting the sufficient corrective action plan, some sanctions can be imposed too. There is also a new system of voting introduced: unlike most of decisions, reverse qualified majority voting (RQMV) is required in all decisions regarding possible sanctions. As a consequence, it is very difficult to block majority for Member States.

On 14 February 2012, Alert Mechanism Report (AMR) was published by the European Commission after consultations with the Council, the European Parliament and the European Systemic Risk Board (ESRB) and was considered to be the first step in implementing the MIP. The Report contains final design of the scoreboard of indicators as we will describe it later. The alert mechanism should work as the initial screening device, which establishes when and under which circumstances should be the Member States put under further in-depth analysis. The Commission can suggest policy recommendation regarding either preventive or corrective arm of the procedure only on the basis of such in depth-analysis. (European Commission, 2012a)

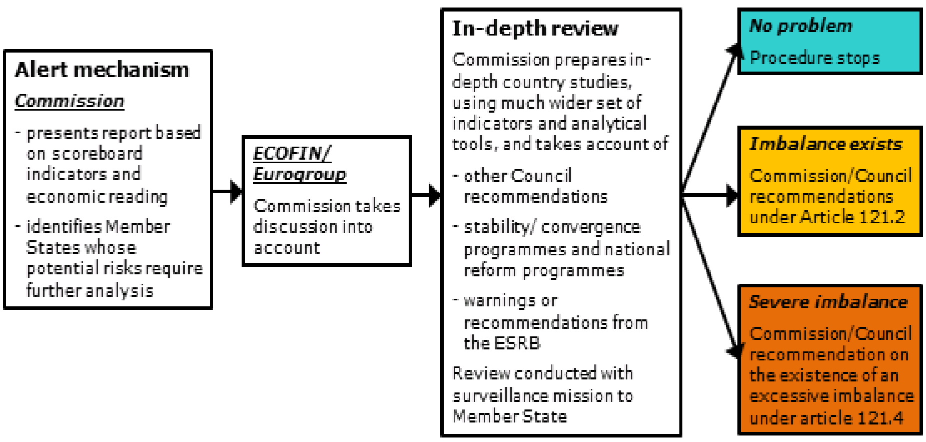
Functioning of the alert mechanism procedure and distinguished preventive and corrective arm is shown in the two pictures below.

Picture **1** shows the whole procedure starting with applying the alert mechanism and ending with three possible outcomes. If the imbalances are persisting, the excessive imbalance procedure which is described in the next picture would be used.

In Picture 2 we can see two different ways of implementing the procedure depending on if the Council evaluates the corrective action plan (CAP) of a given country being sufficient and taken in a timely manner or not. Shaded boxes depict Council decisions that are taken under RQMV. Thus, this can have two possible outcomes:

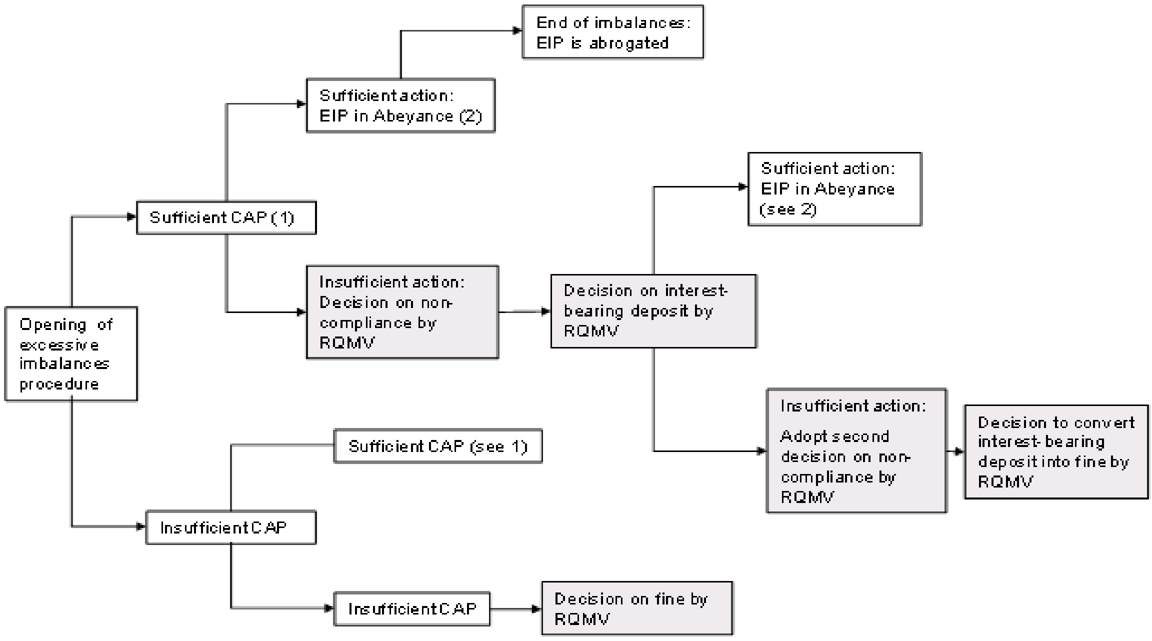
- If the Council finds out that recommended corrective actions were not taken by the considered Member State, it has to set new deadlines for implementing them and the enforcement arm of the regulation comes into play as described earlier.
- If the Council finds out that the Member state has satisfied the recommended correction actions but there are still some imbalances left, the procedure is temporarily deferred and the Member State is obliged to continue in periodic reporting. On the other side, if imbalances are corrected sufficiently enough, EIP can be finally closed. (European Commission, Economic and Financial Affairs, 2013b).

Picture 1: Functioning of the alert mechanism



Source: European Commission, Economic and Financial Affairs (2013b)

Picture 2: Functioning of the EIP



Notes: CAP – corrective action plan; EIP – excessive imbalances procedure; RQMV – reverse qualified majority voting

Source: European Commission, Economic and Financial Affairs (2013b)

5 Summary of Scoreboard Indicators

5.1 Theoretical Background

In the previous chapter, we described the reasons and ideas leading to creation of the scoreboard for the surveillance of macroeconomic imbalances. The scoreboard consist of ten indicators: two are focused on monitoring external positions, three try to comprehend the development of competitiveness and five are measuring internal imbalances. All indicators together with their indicative thresholds are shown in Table 2.

Apart from the main indicators there are also another eighteen additional indicators, which should complement the main ten and provide a better picture of economic conditions of a given country. List of the additional indicators is shown in the Appendix.

The European Parliament recommends paying attention to them due to a possibility of spill over effects. Moreover, they can reflect a propensity to macroeconomic imbalances as well as a country´s ability to make quick adjustments (European Commission, 2012a).

In the following section we will introduce each of the indicators separately. By reading its results we have to bear in mind that the European Commission (2012 (e)) warns against evaluation of indicators on strictly mechanic basis. In fact, they should be considered with broader economic context. Moreover, AMR (2012) states that selected indicators have to meet several criteria, such as being relevant, practical, simple, measurable and available.

Furthermore, there are four main principles which should not be forgotten when interpreting the results of the indicators:

1. The chosen indicators are focused on the most important features of macroeconomic imbalances and losses of competitiveness.
2. Results which the indicators provide can be considered to be a warning signal for potentially dangerous imbalances or losses of competitiveness, which should be recognized as early as possible. This is administered by

Table 2: Summary of the scoreboard indicators

Indicator	Data source	Indicative threshold	Period for calculating thresholds
3 year average of **current account balance as a % of GDP**	Balance of payment statistics, EUROSTAT	6%/-4%	1970 - 2007
Net International Investment Position as a % of GDP	Balance of payment statistics, EUROSTAT	-35% Lower quantile	First available year (mid-1990s) - 2007
% change (3 years) of **Real Effective Exchange Rate**, HICP deflators relative to 35 industrial countries	DG ECFIN indicator data base on Price and Cost competitive-ness	+/-5% for EA +/- 11% nonEA Lower and Upper Quartiles of EA -/+ s.d. of EA	1995-2007
% change (5 years) in **export market shares**	Balance of payment statistics, EUROSTAT	-6% Lower quartile	1995-2007
% change (3 years) in **nominal unit labour cost**	EUROSTAT	+9% EA +12% nonEA Upper Quartile EA 3 p.p.	1995-2007
y-o-y % change in **deflated house prices**	Harmonised house price index by EUROSTAT, completed with ECB, OECD and BIS data	+6% Upper quartile	
private sector credit flow as % of GDP	EUROSTAT for annual data and QSA, ECB for quarterly data	+15% Upper quartile	1995-2007
private sector debt as % of GDP	EUROSTAT for annual data and QSA, ECB for quarterly data	160% Upper quartile	1994-2007
general government debt as % of GDP	EUROSTAT (EDP - treaty definition).	+60%	
3 year average of **unemployment rate**	EUROSTAT	+10%	1994-2007

Source: European Commission (2012b)

two factors: a combination of stock and flow indicators on one side, which allows to capture short-term deflections and the long-term trends in macroeconomic imbalances as well, and also the fact that the thresholds are set at levels which should both prevent false alarms and help recognize real problems once they are entrenched.

3. In order to preserve intelligibility, the number of indicators is limited and the computations are as easy as possible. The summary of those computations can be seen in the Appendix.
4. There is a strong emphasis on the quality of data used – all data are available at EUROSTAT or ESS databases.

As far as the technical features of indicators are considered, threshold values are the same for all countries with two exceptions – change of Real Effective Exchange Rate and Nominal Unit Labour Costs, which differ between Eurozone and non-Eurozone countries. This division has certain reasons which are explained in detail in the respective chapters.

In the following section, we will describe individual characteristics of all indicators and show their values for two groups of states: EU 15, the Old Member states which were mostly among the first members of the European Community[3]; and EU 12, which denotes the New Members – all countries which joined the EU after 2004[4]. Such division will be substantiated in our empirical analysis.

5.2 A 3 year average of Current Account Balance as a percentage of GDP

5.2.1 Definition and setting

Current account should cover all transactions involving economic values between resident and non-resident units. It consists of a balance of trade, which mean a difference between earnings from exports and payments from exports, net factor income (earnings on payments on or to foreign investors) and net transfer payments, such as foreign aid. Its importance lies in providing important information about economic relations between country and the rest of the world. (European Commission, Eurostat, 2012).

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[3] Belgium, Denmark, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden, United Kingdom

[4] Bulgaria, Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Romania, Slovenia, Slovakia

Basically, the current account balance is understood as a difference between a country´s savings and investments. In the scoreboard, average of current account balance in past three years is used, expressed as a percentage of GDP. This should help control short-term fluctuations in annual data and provide better indications of potential imbalances.

Based on Eurostat data from Balance of payments statistics, the indicative thresholds were set at +6% and -4%. A lower indicative threshold was set based on the statistical distribution analysis of data starting in 1970 (1990s for New Member States, respectively) and ending in 2007. This number is also consistent with a research based on the existing literature on the sustainability of current account imbalances (European Commission, 2012b).

One could maybe wonder why these thresholds aren´t symmetric – the upper quantile of distribution of three-year backward average of current account balances should be +2%. This "intelligent symmetry" is explained by giving more weight to current account deficit. However, after consultations this topic at the Czech Ministry of Finance, we inferred that the upper threshold of 6% was probably set as a compromise given by the European Commission to the German government due to their restrictive export policies.

The fact that under MIP both deficit and surpluses are measured, brings naturally two different policy challenges. Large current account surpluses are evidently much less risky in the measure of external imbalances than large deficit. Thus, a greater degree of urgency is given to Member States which show large current account deficit or losses of competitiveness (European Commission, 2012b).

5.2.2 Economic background

Why is the current account balance considered to be an important indicator? Frankel and Saravelos (2010) conducted a research of the existing literature related to this topic and on the basis of 83 papers they came to a conclusion that current account balance is one of the most important indicators, which are often mentioned as the drivers of the crisis pulling the strings of crisis.

Generally, if a country exhibits current account imbalance, it does not necessarily mean bad news. Deficit or surpluses can be a natural reaction to changes of the underlying structural characteristics and a consecutive saving behaviour of economic agents. For example, some transition countries may run current account deficit in order to subsidise massive investments as they try to ensure brighter future through temporary increase of indebtedness.

But on the other hand, high current account deficit can also be a warning sign of non-favourable economic conditions. Namely, it can detect an extensive volume of borrowing that can lead to an unsustainable debt position. An external imbalance can also reflect several other types of imbalances. Thus, the importance of the current account balance indicator lies in the possibility of detecting these imbalances (European Commission, 2012b).

5.2.3 Indicator values

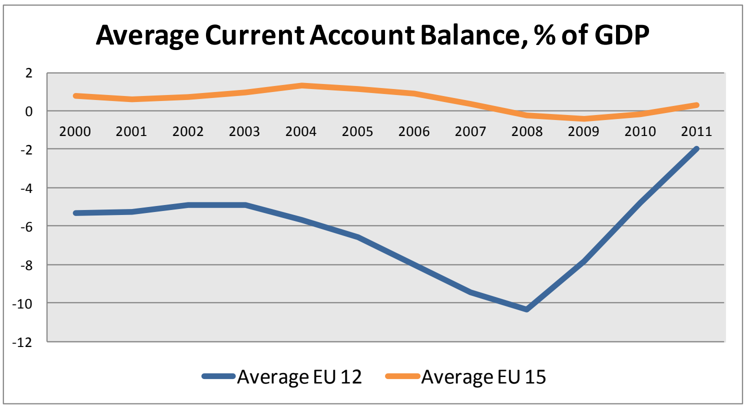
In Figure 4 we can see the average of given indicator in Member States in the first decade of the new century. There are two things stated clearly in this figure. First, there had been a sharp impairment of the current account balance in the years immediately preceding the 2008 crisis in both subgroups. However, the indicator reached again its pre-crisis level in the following years.

There are values of the CA balance indicator for both subgroups, throughout four years, shown in Figure 5. As we can see, the CA balance for most of the New Member States remains negative. On the other side, results for the Old Member States are not convincing as there are quite large differences between economic conditions of the countries.

Also, the current account provides a bright picture of changes in NIIP. So, each deficit or surplus should be assessed together with the level of outstanding foreign debt or credit of the respective country.

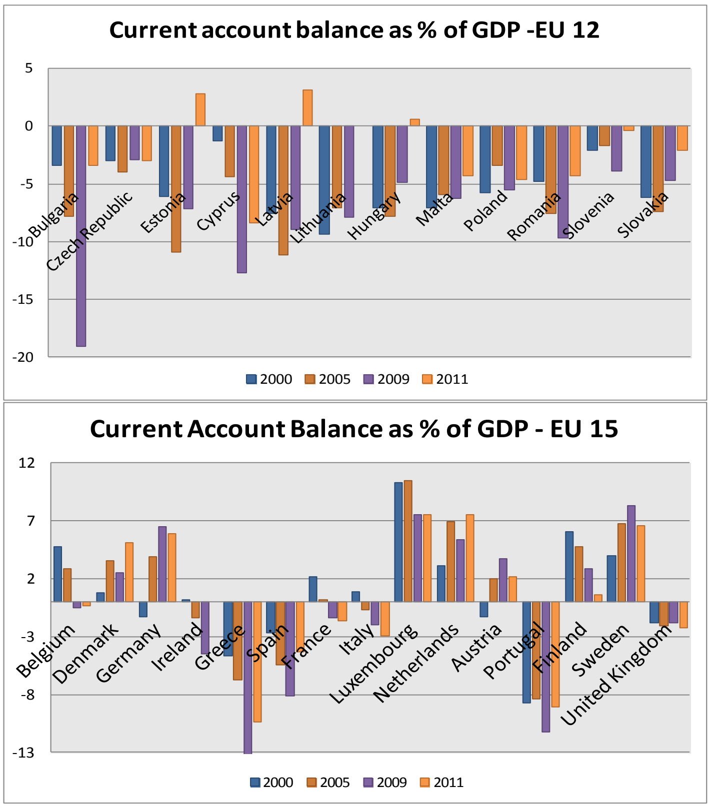
The European Commission also agreed with the European Council that in case of catching up economies, there will place higher relevance upon some additional information.

Figure 4: Comparison of CA Averages in %



Source: author´s computations

Figure 5: CA Balance in Member States



Source: author´s computations

5.3 Net International Investment Position as % of GDP

5.3.1 Definition and setting

International Investment Position can be simply explained as the balance of financial assets and liabilities of a given country considering non-residents (Czech National Bank, 2012).

The NIIP scoreboard indicator is expressed as a total net international investment position in the end of the year through the percentage of GDP (Eurostat). As this is a stock indicator, data from the previous year were used. An indicative threshold was set at -35%. Setting it was not simple as there is very little existing literature on issue of riskiness of the net external assets. However, large positive positions are not considered to pose a threat for Member States or for functioning of EMU. That is why the indicative threshold is set only for negative values of NIIP (European Commission, 2012b).

Data used for this indicator are the same as in the case of the current account balance indicator – they are derived from the statistics of Balance of Payment and are provided by the EUROSTAT database. The data cover stocks of direct and portfolio investments, reserve assets, financial derivatives and other investment (European Commission, Eurostat, 2012).

5.3.2 Economic background

Beyond incorporating the NIIP indicator in the scoreboard there is a simple reasoning: if there is a current account balance indicator – which is a flow indicator-, there should also be a corresponding stock indicator, which is NIIP. This indicator provides a clear picture of the net asset position of domestic economy vis-à-vis rest of the world. Due to that, it also focuses on the external vulnerability or the risk of crises (Frankel & Saravelos, 2010).

Generally, there are two possibilities of interpreting the sign of NIIP:

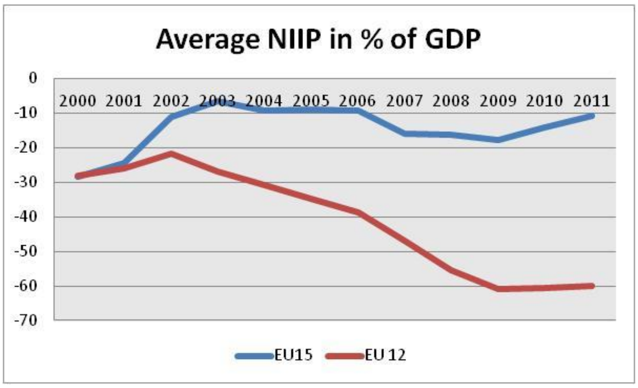
- If NIIP < 0, then the given country is indebted to the rest of the world. This usually coincides with high current account deficiencies.

- If NIIP > 0, then the rest of the world in indebted to the given country. This usually coincides with high current account surpluses.

5.3.3 Indicator values

Figure 6 shows the average values of NIIP indicator for all Member States divided into two subgroups while Figure 7 shows the real values in Member States in four years. The time series begins in 2000. We can see that although the overall average value of indicator in EU 15 countries moved around -10%, there were some countries, usually the southern ones, which exceeded the threshold of -35% by far.

Figure 6: Average NIIP

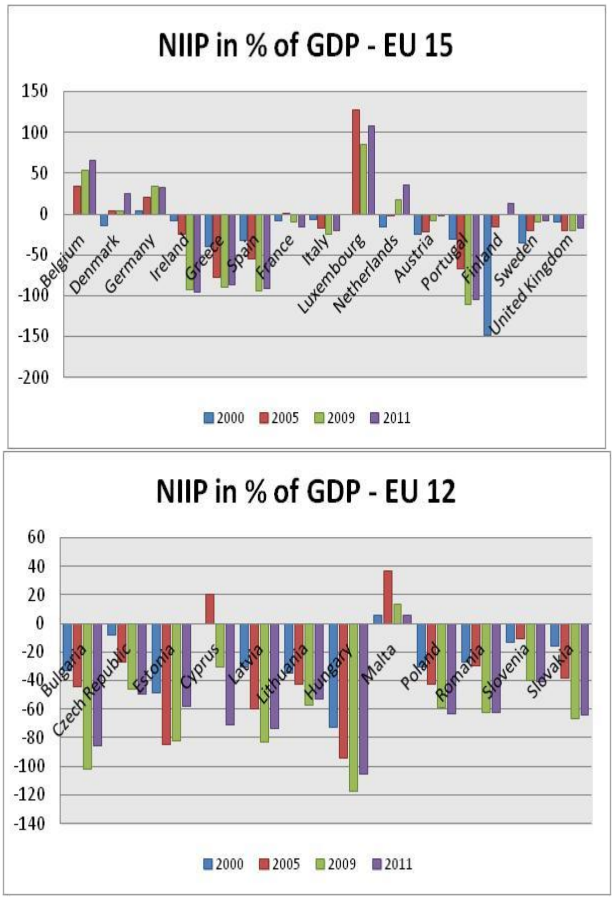


Source: author´s computations

In case of the New Member states, the displayed chart is more convenient – apart from Malta and Cyprus most countries exceeded the threshold in all four years.

By interpreting results of this indicator we must bear in mind that they should be evaluated from a broader economic sense. For instance, we should distinguish between two kinds of liabilities: those which require the repayment of principal or interest and those which don´t. With a growing share of the first-kind liabilities, the overall risk grows too. Therefore, there should be attention paid to additional indicators as well, namely NED (Net External Debt), which can provide a broader picture of an economic background of the given country. For example, NED is very low in the New Member States which is caused by the high levels of FDI stocks (European Commission, 2012b).

Figure 7: NIIP indicator in member states



Source: author´s computations.

5.4 Percentage Change of Real Effective Exchange Rate

5.4.1 Definition and setting

Real effective exchange rate (REER) serves to assess the competitiveness of a given country relative to its principal competitors in international markets (European Commission, Eurostat, 2012).

Then, the REER scoreboard indicator, which is a percentage change of REER over the last three years, is based on the consumer price index deflators, namely a harmonised index of consumer prices (HICP), if available. If the indicator is positive, there is a loss of competitiveness detected. It takes into account movements of the exchange rate and consumer prices of the given country against a panel of other 35 countries[5]. REER can be computed by deflating the nominal exchange effective rate (NEER) by HICP deflator. NEER serves to measure global depreciation/appreciation of currency based on weighing currency´s exchange rates with foreign currencies (European Commission, Eurostat, 2012).

For a calculation, the exports are weighted twice so that the competition not only in home markets, but also everywhere else can be captured. The indicative threshold of REER indicator is set at +/-5% for Eurozone countries and +/-11% for non-Eurozone countries. This division has an economic rationale: many of New Member States (which are mostly also those not participating in the Eurozone) have experienced large trade liberalizations since 1990´s as a consequence of the transition from the communist era (European Commission, 2012a).

5.4.2 Economic background

This indicator is included in the scoreboard due to its ability to capture the reasons of persistent changes of price and cost competitiveness. These changes are captured on the level of each country relative to its biggest trading partners. Moreover, this indicator provides a picture of how attractive imports are over the domestic production. Deviation from the threshold can imply that prices have grown with different proportion than productivity and there has been no compensation of this fact via the nominal exchange rate. In other words, country has lost or gained labour cost competitiveness with respect to its trading partners (European Commission, 2012a).

As far as the related economic literature is concerned, many studies agree on one point – REER belongs to statistically significant predictors of a crisis. For instance, Frankel and Saravelos (2010) state that REER is one of the most important leading indicators in 48 out of 83 crises which occurred before 2008. Authors also came to a conclusion that REER played an important role also in case of Great Recession.

On the other hand, there is a considerable amount of literature proving that impacts of the REER appreciations are not always harmful. So, in case of catching-up Member

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[5] EU27 plus Australia, Canada, United States, Japan, Norway, New Zealand, Mexico, Switzerland and Turkey

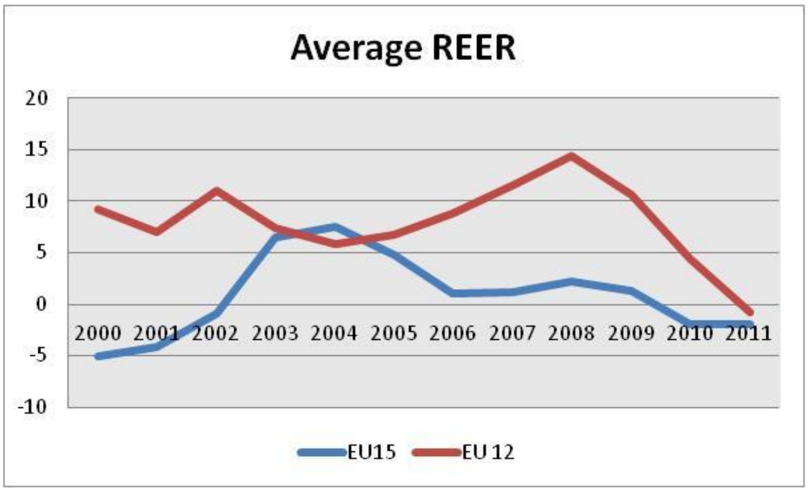
states it can point to some economic imbalances partially caused by inappropriate reaction of wages to productivity in key sectors.

Finally, REER is focused only on the changes of exchange rates and prices. But the competitiveness can be assessed by many other measures, such as product quality, overhead costs or market efficiency, so it would help to have another indicator dealing with competitiveness in the scoreboard and luckily, there is one – export market shares indicator (European Commission, 2012b).

5.4.3 Indicator values

Figure 8 provides an interesting picture of average REER as it has developed in Old and New Member States in eleven years. We can see that despite the two lines started at very different levels in 2000, they converged until 2003 when both averages started to move around 5%. Then, we can observe a pattern of an increasing divergence in the data. This fact can have several reasons: overheating, structural rigidities in product or labour markets or an inappropriate response of wages to some shocks. But, in some countries it can simply signalize the catching-up process. . The crisis apparently stopped the diverging tendencies and led to a bigger convergence (European Commission, 2012b)

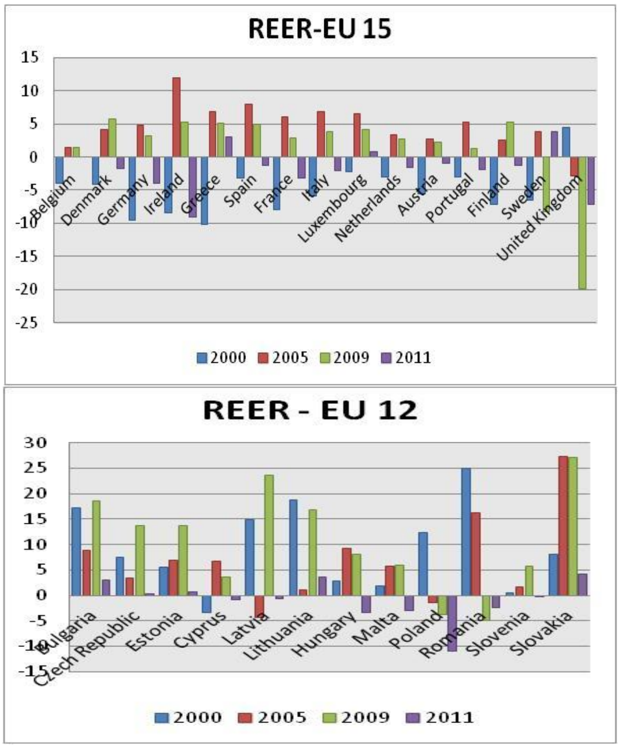
Figure 8: Average REER in %



Source: author´s computations

From Figure 9 we can see that almost all EU 15 countries reached positive values of REER in 2005 and 2009 and negative values in 2000 and 2011. Only two exceptions from this rule are Sweden and United Kingdom.

Figure 9: Actual values of REER



Source: author´s computations

As far as EU 12 countries are concerned, the positive values of REER are strongly prevailing with few exceptions. The indicative threshold of 5% (11% respectively) was exceeded mainly in 2000 and 2009. In 2011, all countries reached the lowest values.

5.5 Percentage Change in Export Market Shares

5.5.1 Definition and setting

Basically, export market shares mean the share of world exports. So, this measure simply compares the value of all domestic exports of goods and services with exports of all other countries.

The indicator is expressed as the percentage change over five years. Used data are based on the Balance of Payments and comes from the Eurostat and International Monetary Fund databases. The lower indicative threshold was set at - 6%. An upper indicative threshold is not necessary since no potentially harmful imbalance should develop in this direction (European Commission, Eurostat, 2012).

5.5.2 Economic background

This indicator belongs to those which measure the non-price factors. The overall importance of such measures was definitely proved in the current economic crisis, when EU as a whole lost many positions in the global export market, while some countries lost more of these positions than the others. Therefore, export shares have lowered not only in individual countries, but in the EU as a whole as well. (European Commission, 2012a).

So, what is monitoring of the export shares development good for? Apparently, it tries to capture structural loss of competitiveness. Lowering of the export share can have two reasons: first, domestic exports have lowered (the so-called "numerator effect"). Second, exports continue to grow, but not as fast as in the rest of the world (the so-called "denominator effect"). Given the fact that world exports have risen by 83 % between 1994 and 2007, the second possibility is much more probable (European Commission, 2012b).

As Carlin et al. (2001) states, apart from the relative costs there are many other factors which can influence export shares – for example the relative investment shares or technological improvements.[6] The authors also proved that in the long run, proportionate changes on relative ULC components, such as exchange rate, wages or labour productivity, are in a direct relationship with changes in the export market shares and have approximately the same effect on them.

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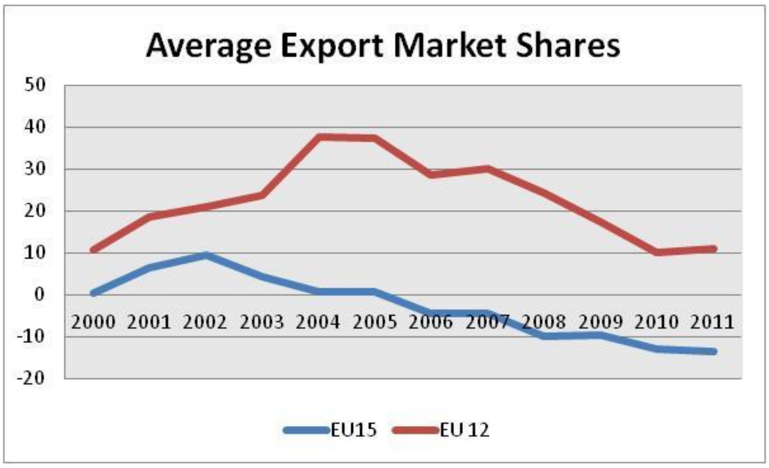
[6] Carlin came with an interesting observation: countries which are the most sceptical about the monetary integration (UK, Norway or Sweden) seem to be more sensitive to relative costs and also exhibit negative export shares trends. So, since the devaluation of their currencies is a possibility gaining back the lost competitiveness, one can understand why they are so hesitant in the question of monetary integration.

5.5.3 Indicator values

Figure 10: Average Export market shares in %

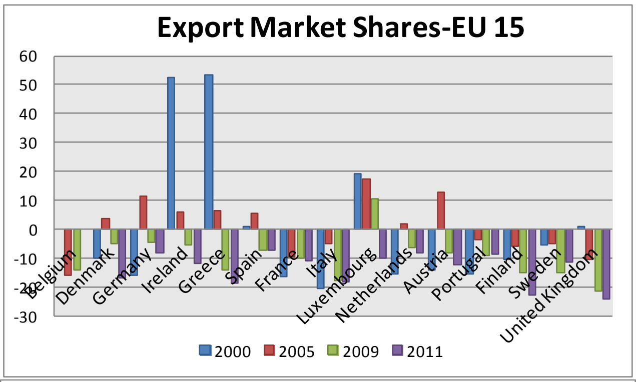


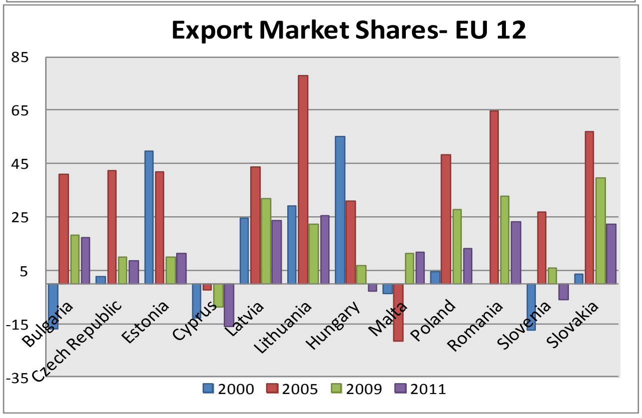
Source: author´s computations

Figure 10 shows that both EU 15 and EU 12 countries have been following a similar trend: while their average export market shares were increasing in the first half of the new decade, in the second half a slow-decreasing trend was prevailing which has slowed down in 2011. Since the indicative threshold was set at -6%, it looks like that in average the Old Member states have been achieving worse results than the New Member states, especially since 2008, when the average values exceeded the threshold of -10%.

Moreover, Figure 11 shows that the global recession has had a negative impact on export market shares due to the fact their values in 2009 and 2011 are significantly lower than in previous years in all member states. Once again, it is the EU 15 group which has problems with respecting the indicative threshold of -6%, whereas New Member States move mostly in positive values.

Figure 11: Actual values of Export Market Shares





Source: author´s computations

5.6 Percentage change in Nominal Unit Labour Costs

5.6.1 Definition and setting

Nominal unit labour cost (nominal ULC) is one of the indicators measuring competitiveness. It compares remuneration (in other words, financial compensation per employee, which covers not only wages and salaries, but also social contributions) with productivity expressed by the GDP per employee. The ULC thus measures how these two things are related based on the computations from national accounts data (European Commission, Eurostat, 2012)

The scoreboard indicator of nominal ULC is set as a percentage change over three years. Indicative thresholds are +9% for Eurozone countries and +12% for Non-Eurozone countries. The three-year period is used for two reasons: first, it is long enough to capture medium and long term trends in ULC developments and second, it is short enough to absorb the cyclical impacts and recognize built-up losses of competitiveness. Establishing a softer threshold for non-Eurozone countries is not caused by statistical differences of observed values, but by the fact that most of these countries have experiences large trade liberalizations since 1995 when the data started to be collected. Naturally, liberalizations have led to an increase of labour price (and price of other factors too) when the countries have tried to get on the same level with their new trade partners (European Commission, 2012b).

5.6.2 Economic background

Why is it useful to pay attention to nominal ULC? When it rises, it means that in the given country, labour costs have grown faster than labour productivity measured by GDP per employment. If this growth is not compensated for by other phenomena than labour costs, it can pose a potential threat of losing the economy´s cost competitiveness (European Commission, 2012b).

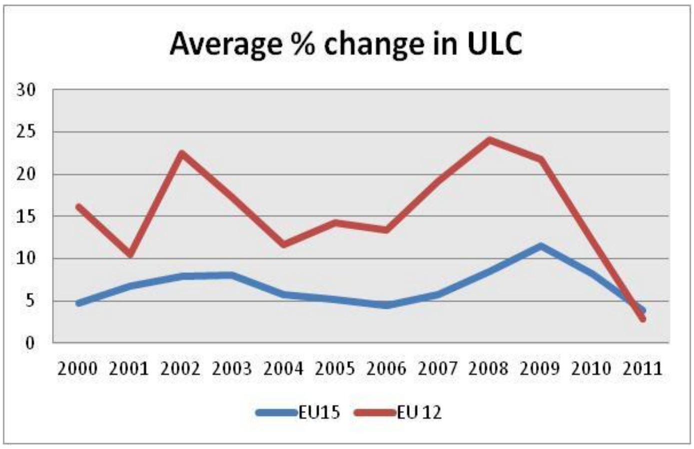
In the empirical models, nominal ULC is sometimes used as a proxy for productivity-adjusted wages, whose changes are believed to correlate with inflation in the long run. This hypothesis was confirmed for example by Mehra (1993), although it depends on how we measure the prices –when using consumer price index, data are consistent with the hypothesis. But by using more broadly defined GDP deflator, hypothesis was not confirmed. Moreover, Mehra showed that short run movements in ULC can´t be used to predict a future price level.

Also, Sbordone (2008) confirmed that by introducing some degree of price stickiness, aggregate prices are predictably driven by the anticipated behaviour of ULC.

5.6.3 Indicator values

As we can see in Figure 12, there are two directly observed trends in the average ULC. First, values in the EU 12 group were permanently higher by 5-10% than in the EU 15 group. Second, whereas the trend of the changes of the ULC can be evaluated as increasing in the long term, in 2008 it changed with a sharp slowdown in both subgroups and it converged to values slightly under 5% in 2011. This was probably caused by the fact that competitiveness divergences between countries are led by a different set of policies dealing with productivity and labour market issues. When the crisis hit, it influenced all countries to a certain extent. The policy measures in productivity and employment fields tended to have a similar form across all countries and thus nominal ULC started to converge (European Commission, 2012b).

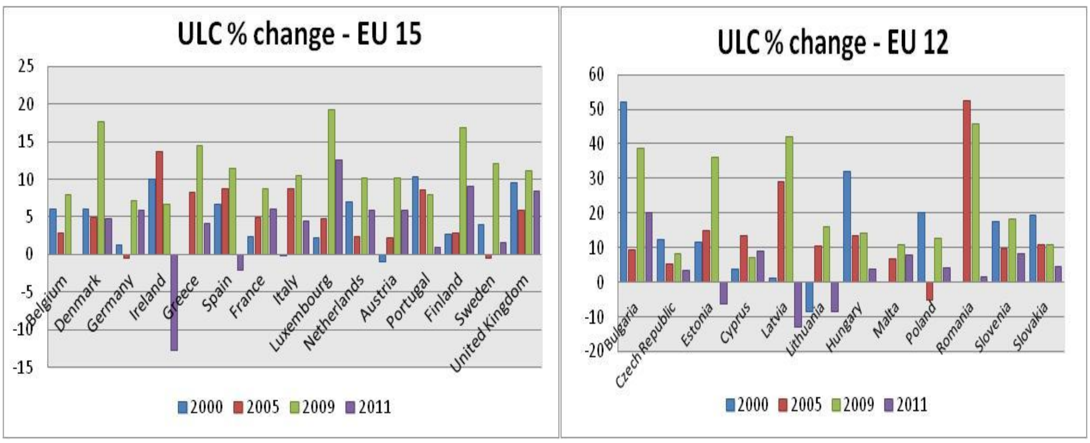
Figure 12: Average % change in ULC



Source: author´s computations

Figure 13 shows that in both observed groups, the highest values were reached in 2005 and 2009, when most countries exceeded the indicative thresholds of 9% (12%, respectively). In 2011, the ULC decreased to values below the ones in 2000.

Figure 13: Actual values of ULC% change



Source: author´s computations

5.7 Y-o-y % change in deflated house prices

5.7.1 Definition and setting

The indicator is set as a year on year change of the deflated house price index (HPI), which captures all residential properties and the households one can possibly buy – flats and all kinds of houses, even distinguishing between new and previously owned and their purpose. The HPI index takes only market prices (i.e. no self-made improvements) into an account. Since the measurement of house pricing development appears to be very difficult to conduct properly throughout the EU, the HPI is considered to be the best achievable proxy of such development. If the value of the indicator is positive, it means that house prices grow faster than consumer spending (European Commission, 2012b).

Because it is not simple to obtain housing prices data of all Member States, it was difficult to derive an indicative threshold based on the statistical distribution. So, the OECD data set for years 1970 -2007 has to be used in order to finally set a threshold value of +6%.

5.7.2 Economic background

House price indices are believed to be important for a swath of reasons. In many countries, housing exceeds 50% of households´ wealth (Bourassa et al., 2004).

Furthermore, it is generally believed that large movements in a housing market were among the causes of many economic recessions and have played an important role in the emergence of the current financial crisis as well. This has a simple reason: the development of asset prices affects the real economy through many channels and thus can become a source of macroeconomic imbalances (European Commission, 2012b). Moreover, some studies suggest that a significant fall in real estate prices can have even a bigger impact than a corresponding fall of stock prices (Case et al., 2001)

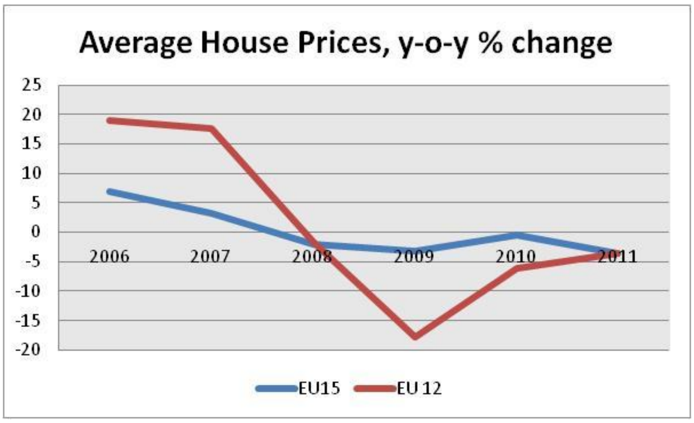
Also, a possibility remains that if HPI indices had been available to wide public in the USA, where the housing bubble started, the number of inappropriate housing loans would have been significantly lower and the bubble would hence have been immediately visible, which could have alerted the agents in the housing market to concede that the house price inflation rates were not longer sustainable (Diewert & Shimizu, 2011).

5.7.3 Indicator values

Unfortunately, data for house prices are not available in Member States until 2006 and in case of some countries even as late as 2008. Yet, from the comparison of two subgroups in Figure 14 we can see that the average house prices inflation was at much higher levels in Old Member States in 2006-2008. That is one of the reasons why their fall was much sharper and why it took them three years to get at the same level with the EU 12 group again.

Figure 15 shows pre-crisis values of the indicator in 2006, when it reached high positive values in all countries for which the data were available (except for Portugal). Then, in 2009, the level of house prices decreased in comparison with 2008 (again, excluding Portugal). In 2011 we can see an improvement and a return to a zero or slightly positive growth with some exceptions (PIGS states). So it seems that housing markets started to recover.

Figure 14: Average House Prices



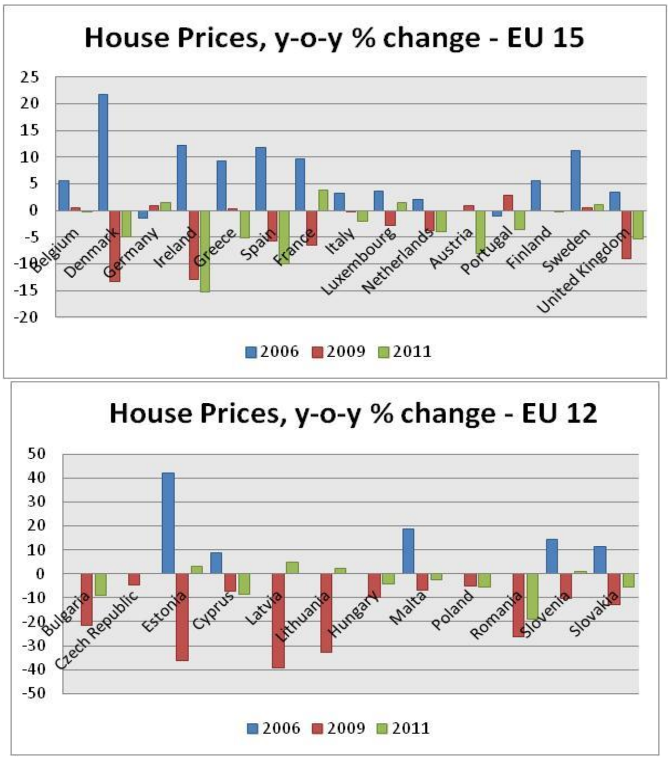
Source: author´s computations

5.8 Private debt as % of GDP

5.8.1 Definition and setting

This indicator expresses the stock of private sector debt as a percentage of GDP. Private sector is then defined as non financial corporations, which can be public or private; households and non-profit institutions serving households (European Commission, 2012b). Other forms of liabilities than shares and loans are not considered to be a part of the private sector debt (European Commission, Eurostat, 2012).

Figure 15: Deflated House Prices, actual values



Source: author´s computations

The indicator is integrated into the scoreboard in a non-consolidated form – in other words, it also includes intra-sector liabilities, for example intra-company loans. This has three reasons: within Member States, only non-consolidated data are available and thus such data are the only possible ones when drawing a comparison. Second, ECB has been providing non-consolidated data quarterly and these are used for annual data complementation. Finally, non-consolidated data provides relevant information about the total indebtedness of private sector. (European Commission, 2012b)

On the other side, using non-consolidated data has one main disadvantage – one does not know in what extent intra-sector liabilities dominate intra-group transactions. There can be a legitimate reason for keeping a high amount of intra-enterprise loans – fiscal and accounting practices of the given enterprise.

The threshold for private sector debt indicator was set at 160%, which is derived from the upper quartile of its statistical distribution. For setting the threshold, annual data in the period 1995-2007 were used. (European Commission, 2012b)

Furthermore, the consolidated data are reflected in the scoreboard too– in the form of an additional indicator. If those two indicators significantly differ from each other, the Commission services will examine the underlying causes.

5.8.2 Economic background

As we could make sure in the current financial crisis, high private sector debt overhang increases a probability of an occurrence of higher risks for growth and financial stability of the country and also makes the country more vulnerable to economic shocks. So, an observation of private debt developments can be useful for assessing country´s vulnerability to changes in business cycles, inflation or interest rate.

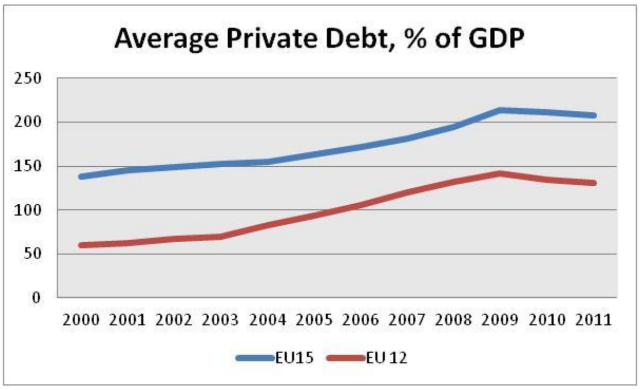
Basically, there are three subcategories which private debt can be divided in: loans, credits and special accounting subcategory called other accounts: payable. In this subcategory, two main groups of debt can be distinguished: other payables excluding trade credits and advances, which comprise mainly financial claims arising due to time discrepancies between conducted transactions and corresponding payments such as taxes or dividends; and trade credits (European Commission, 2012b).

5.8.3 Indicator values

As we can see from Figure 16, there are two well observable trends. First, both EU 15 and EU 12 countries exhibit similar trend in their average private debt development. The percentage of debt was slightly increasing until 2009, when it turned down and continued falling until 2011. Yet, the difference between average debts of the two subgroups remains more or less constant. Old Member States show higher average values than the new ones which is not surprising regarding their more debauched behaviour in terms of inhabitants´ indebtedness, especially in southern countries.

Figure 17 confirms the conclusions we came to after assessing the average values of private debt – in 2009, there were the highest debt ratio in ten years. In contrast, 2011´s values were slightly lower. This indicates the lowering willingness of people to buy on credit and become further indebted – they behave more responsibly pertaining mortgages and other long-term loans. But private debt values still remain at much higher levels than ten years ago.

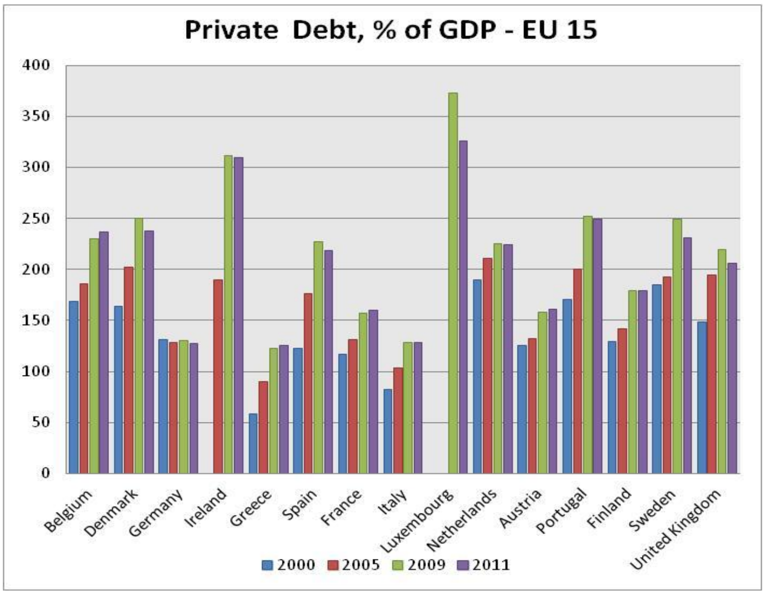
Figure 16: Average Private Debt

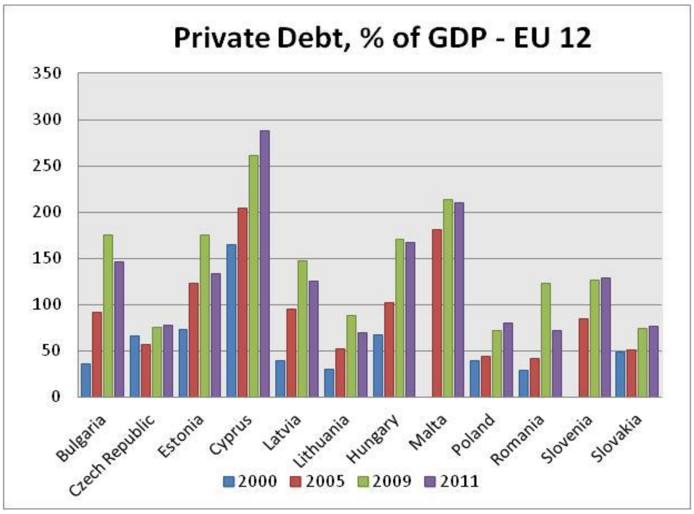


Source: Eurostat (2013), author´s computations

Three countries with the highest private debt ratio are Luxembourg, Ireland and Cyprus – the last one has even enhanced its indebtedness in 2011.

Figure 17: Private Debt in % of GDP, actual values





Source: author´s computations.

5.9 Private sector credit flow as % of GDP

5.9.1 Definition and setting

The private sector credit flow indicator is expressed as the net amount of liabilities that have incurred the private sector during the corresponding year. The definition of public sector still remains the same as in the case of private sector debt indicator – it includes non-financial corporations, households and non-profit institutions serving households, whereas liabilities encompass loans and other securities than shares.

Again, this indicator uses non-consolidated data and is the flow counterpart of private debt indicator, which is a stock indicator.

The indicative threshold for private sector credit flow was set at 15% of GDP, which is again derived from the upper quartile of its historical distribution. Data from the 1995-2007 period were used for the computation.

5.9.2 Economic background

There are many studies which suggest that the expansion of credit is in a direct connection with a higher probability of crisis occurrence. So, Sachs et al. (1996) claim that credit growth[7] can be considered a proxy of banking system vulnerability. Moreover,

[7]Here, credit growth is understood as an outstanding credit growth, i.e. the growth of stock variable which represents the flow plus valuation effects (European Commission, 2012b)

Frankel and Saravelos (2010) proved empirically that a high credit flow is connected with higher crisis incidence.

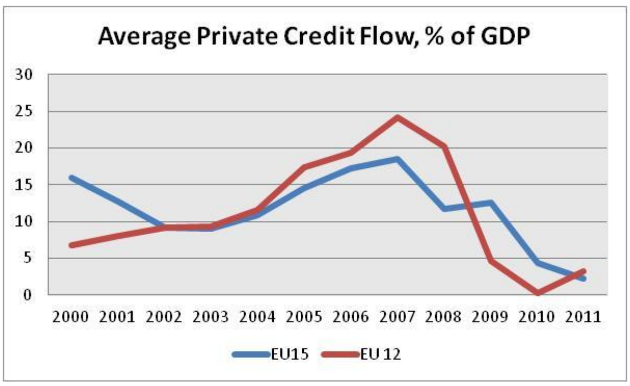
Studies also proved that there is a connection between asset prices and credit growth – in the past, boost and boom cycles of asset markets were associated with the developments of credit aggregates (Adalid & Detken, 2007).

Last but not least, it is possible to find a potentially important link between credit growth and external imbalances. There is a simple logic behind it: stronger relative demand pressures increase the demand for import and capital inflows while widening the current account deficit. The credit dynamics develops in the same way as demand pressures, which leads to a rise in household and corporate debt (European Commission, 2012b)

5.9.3 Indicator values

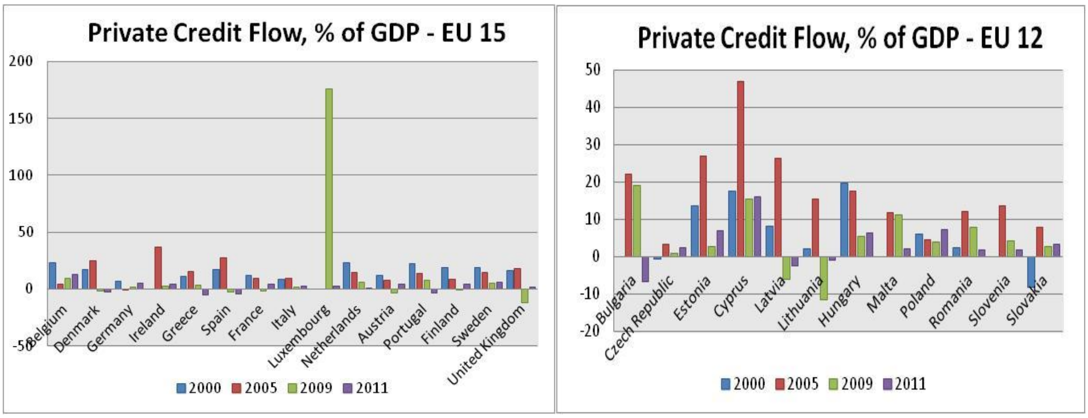
Figure 18 provides a picture of an average credit flow development. Same as many other indicators, this one exhibited a boom until 2007, when the global recession converted the trend downwards. Once again, since the average percentage of a private credit flow in GDP had risen faster in EU 12 group, its consequent fall had to be faster too. In 2011, average flows in both groups converged at pleasurable levels around 4% of GDP, which is much lower that the threshold established at 15%.

Figure 18: average Private Credit Flow



Source: author´s computations

Figure 19: Private Credit Flow in % of GDP, actual values



Source: author´s computations

As far as actual values of private credit flows are concerned, there is one outlier reaching the highest values in the EU 15 group – Luxembourg. As can be seen in Figure 19, in 2009 its credit flow was over 176% of GDP while the overall average was approximately 12.6%. However, this can be explained by lending and borrowing operations inside international non-financial corporations, rather than excessive indebtedness of their private sector (European Commission, 2012a). Among the other countries, the highest values were achieved in 2000. In the EU 12 group the largest credit flow was observed in 2005, with Cyprus standing out and reaching values of 46% of GDP.

5.10 General government debt as a percentage of GDP

5.10.1 Definition and setting

A definition of public debt is included in the Maastricht Treaty and is used both for the purpose of the Stability and Growth Pact (SGP) and Excessive Default Procedure (EDP). So, the public debt is then defined as a form of consolidated government gross debt at nominal value, standing out at the end of the year (European Commission, Eurostat, 2012). Other accounts payable or other financial derivatives could possibly fit in the definition as well, but their implementation would not be easy due to difficult measurements (European Commission, 2012b).

Under the term general government sector we understand a central government, state government, local government and social security funds.

Then, the scoreboard general government sector debt indicator is expressed as a percentage of GDP and the data used are consolidated between and within the sub-sectors at the national level (European Commission, 2012b).

Indicative threshold was set according to the values mentioned in the Treaty at 60% of GDP. Setting a different level would probably be too confusing and unreasonable.

5.10.2 Economic background

As the lingering global crisis has shown, the overall country's indebtedness is strongly linked to private sector debt – large governmental liabilities affect the debt levels directly or indirectly through lowering the perceived creditworthiness.

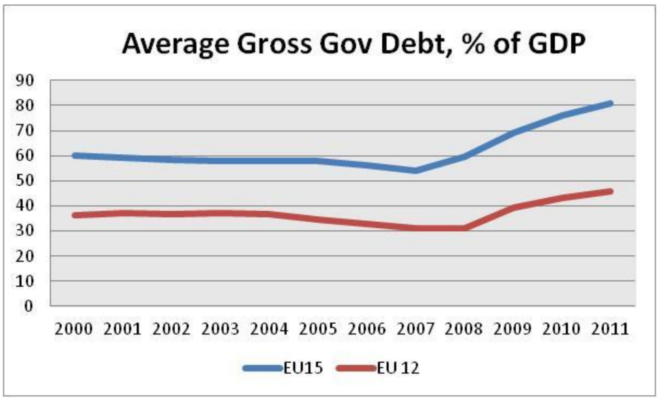
The main reason for implementation of this indicator into scoreboard was not its ability to monitor risks of public financing, which are sufficiently covered by SGP, but to complement the private debt indicator and thus provide a broader picture of the overall country´s indebtedness. So, we should pay more attention to high public sector debt especially if it is accompanied by large private sector debt. On the other side, large public debt represents higher vulnerability *per se* without a possibility of compensating by lowering private sector debt (European Commission, 2012b).

5.10.3 Indicator values

Figure 20 shows that unlike private debt, the average share of gross governmental debt in GDP has been rising since 2007, when the recession hit for the first time. This can be explained by the efforts of individual governments to pump additional money into stagnating economies. Again, both subgroups exhibit a similar trend, although in case of EU 15 countries, values of their gross government debt are on average 20% higher than in the case of EU 12.

When we compare the actual values of the general government debt indicator in the EU 15 and EU 12 groups in Figure 21, we can see that in both cases the highest values were mainly achieved in 2011, which is consistent with the findings in the average values. The threshold of 60% is exceeded by the PIGS countries in EU 15 and Hungary, Malta and Cyprus on EU 12 group.

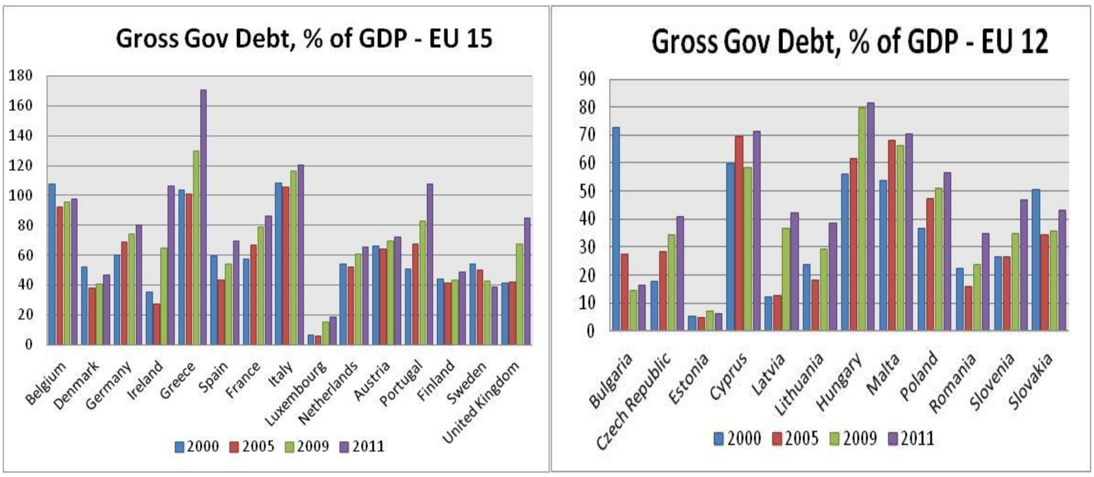
Figure 20: Average Gross Government Debt



Source: author´s computations

This is indeed an implicit message as the PIGS states fight with constant difficulties to sustain their economies severely crippled by the recession. All in all, these four countries struggle with the latest recession to a much greater extent than other European countries.

Figure 21: Gross Government Debt in % of GDP, actual values



Source: author´s computations.

5.11 3 Year Average of Unemployment Rate

5.11.1 Definition and setting

The unemployment rate can be defined as a number of unemployed people expressed as a percentage of the labour force, which is based on the definition provided by International Labour Office (ILO): labour force is the total number of unemployed and employed people. Unemployed people are those who are older than 15 and younger than 74 and meet three conditions: they have no job during the reference week, they are available to start working within the next two weeks and for the past four years, they have been actively looking for a job or have already found a job to start within the next three months

The unemployment rate scoreboard indicator is computed as an average of the unemployment rate in the past three years. Because the labour force methodology has changed several times in different countries or there were gaps in available data, Eurostat had to amend the time series in order to ensure their consistency (European Commission, Eurostat, 2012). The three year average is favoured over the yearly approach since yearly figures are heavily influenced by short term volatility.

The indicative threshold was set at 10%. This value is based on the upper quartile of indicator's statistical distribution.

5.11.2 Economic background

According to European Commission (2012b), the unemployment rate indicator was added to the scoreboard due to its ability to monitor and timely recognize high and persistent rates of unemployment. Also, as the Commission recommends, this indicator should be taken into consideration together with forward-looking scoreboard indicators. Its importance lies in provision of better understanding the occurrence and consequences of prospective macroeconomic imbalances.

This indicator can hence be seen as a proxy of the structural unemployment rate, which is otherwise unobservable and its estimates are not reliable. Also, indicator is set to pose as a stock one rather than to reflect changes since they would highly correlate with the changes of GDP.

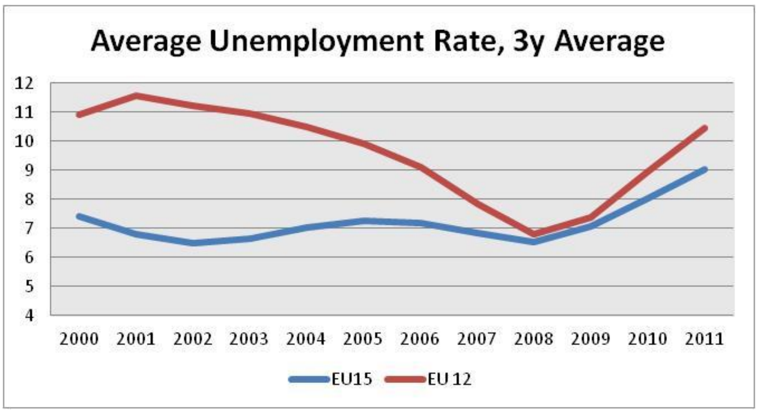
5.11.3 Indicator values

It is not surprising that throughout the first years of the new decade, the three year average of the unemployment rate was significantly lower in the Old Member states than in the New ones due to their higher living standards and more prosperous economies overall, as can be seen in Figure 22. The unemployment rate was first decreasing in both groups, but not to the same degree. As EU 12 countries experienced increasing prosperity and new opportunities to expand, their unemployment rates decreased faster.

On the other side, labour market in the Old Member States has been somehow saturated so the decline was only moderate and in 2004, it even converted to temperate growth. Moreover, the average unemployment started to increase in the EU 15 group. However, after the average unemployment rates converged to around 7% in 2008, with the start of the recession they began increasing again, with the EU 12 rate growing faster.

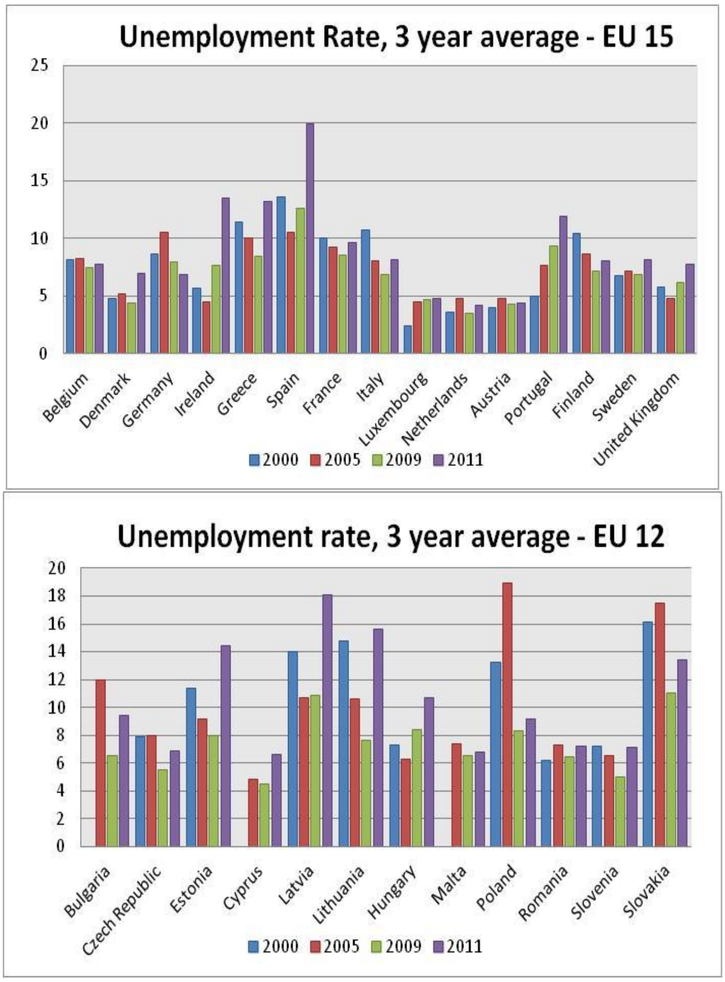
By focusing on the real values of unemployment rates in Figure 23 we can see that it is difficult to observe some unambiguous trends. What can be clearly stated is that in the EU 12 group, the 2000´s unemployment rate was high and in it decreased in following years until 2011 (with the exceptions of Bulgaria, Poland and Slovakia), when it reached the highest levels due to consequences of the unfolding crisis. On the other side, the trend in the EU 15 group was opposite and in most countries the unemployment rate was slightly increasing in all observed periods.

Figure 22: Average Unemployment Rate



Source: author´s computations

Figure 23: Unemployment rate - 3 year average, actual values



Source: author´s computations

6 Empirical Framework

In the empirical part of our study, we will deal with the issue of how good the scoreboard indicators are in capturing potential macroeconomic imbalances. The key outstanding question is how to measure their ability to do so. With the development of current economic theories, it started to be generally understood that macroeconomic stability can comprise following factors: sustainable growth, low inflation or stable growth of employment together with low levels of unemployment or balanced public finance.

This list can be confirmed also by the related literature; however, a choice of the best proxy of macroeconomic stability differs according to the intended methodology and hypotheses. Satyanath and Subramanian (2004), for instance, suggest inflation to be a good proxy of nominal macroeconomic instability mainly for one core reason: any price distortions influence consumer and producer behaviour which leads to instability. Barro (2000) on the other hand focuses on growth rate of GDP per capita and ratio of real investment to GDP. Finally, Ceccetti and Krause (2001) built their analysis on analysing real GDP growth and inflation and came to the conclusion that in terms of those two variables, the world is much more stable now than it was in the 1980s.

As will be shown below, we chose the annual growth of GDP per capita as the proxy of macroeconomic stability of the given country. This decision was made mainly due to the availability reasons since the data for such variable are available at most databases such as Eurostat or OECD, but it is also supported by an extensive amount of related literature. For example, Barro (2001) examined GDP growth as a core measure of macroeconomic performance which is strongly connected with financial crisis and he came to conclusion that combination of currency and banking crisis usually reduces economic growth by 2% per year (over a five-year period), whilst during the Asian crisis in 1997-8 it was even 3%.

From now on, we will use exclusively the Stata software for all our computations. In the following section, we will introduce our dataset and describe its basic characteristics.

6.1 Data Description

Our dataset consists of the annual data panel from the period 1997-2011 for 27 EU Member countries and for 9 scoreboard indicators. All data comes from the Eurostat database. When choosing variables, we were forced to make a compromise between their number and availability of data both in panel and cross-sectional units; so we excluded the indicator measuring the change in deflated house prices from the set of variables since its measurement began in all countries no sooner than in 2006, which would left only 7 years for every country and such number of observations would be too low for our analysis.

In the empirical part we will continue in the division of countries into two subgroups, as we did also in the previous chapters. So, we examined data of the EU 15 and EU 12 group and computed all their characteristics separately from the very beginning. Just to remind to our readers, in the first group there are the so-called Old Member States, which we refer further as EU 15, while in the second group there are the New Member States – all countries which joined the EU in 2004 and later. Thus, our panel has T= 15 and N=12 or N=15, respectively.

However, we cannot declare our dataset to be balanced. Some data are missing, especially in the case of CEE countries, which don´t have as long tradition of measuring macroeconomic indicators as the Old Member States. So, in the case of EU 15 group, we obtained 180 complete observations out of 225 available, while in EU 12 group only 131 complete observations out of 180 were obtainable.

Tables 3 and 4 summarize variables description.

As we can see, there are missing data mainly in cases of *exshares* and *govdebt* variables in both subgroups. Surprisingly, while values of unemployment rate are available in the whole EU15 panel, it belongs to the least available variables in the case of EU12. Next, as far as mean values and standard deviations are concerned, their values in two groups differ a lot. In case of *ca* and *exshares* their mean values have even opposite signs.

Table 3: Basic characteristics of EU 15 data

Variable	Variable name	Observations	Mean	Std. Dev.	Min	Max
y-o-y change **in GDP per capita**	gdpgrowth	225	1.644444	2.762888	-9	10.4
3 year average of current account balance as a % of GDP	ca	225	0.645333	5.535945	-14.9	13.2
Net International Investment Position as a % of GDP	niip	214	-15.1051	45.58971	-175.4	140.3
% change (3 years) of **Real Effective Exchange Rate**	reer	225	0.303556	5.9614	-19.9	22.3
% change (5 years) in **export market shares**	exshares	188	-2.18298	16.91673	-24.3	72.5
% change (3 years) in **nominal unit labour cost**	ulc	215	6.17907	4.53026	-12.8	19.3
private sector credit flow as % of GDP	prcf	211	11.36066	14.57902	-37.6	176.3
private sector debt as % of GDP	prdebt	212	164.7396	55.70774	39.3	373.2
general government debt as % of GDP	govdebt	180	62.29833	29.37311	6.1	170.6
3 year average of **unemployment rate**	unemp	225	7.502667	3.028273	2.2	19.9

Source: author´s computations

Table 4: Basic characteristics of EU 12 data

Variable	Variable name	Observations	Mean	Std. Dev.	Min	Max
y-o-y change **in GDP per capita**	gdpgrowth	176	3.688068	4.571742	-16.4	13.3
3 year average of current account balance as a % of GDP	ca	180	-5.79222	4.961364	-25.2	8.6
Net International Investment Position as a % of GDP	niip	172	-37.8174	33.03383	-117.2	39
% change (3 years) of **Real Effective Exchange Rate**	reer	180	9.922778	12.0265	-16.2	78.4
% change (5 years) in **export market shares**	exshares	152	23.03421	23.71154	-21.6	115.9
% change (3 years) in **nominal unit labour cost**	ulc	163	41.50491	229.9914	-17	2648.3
private sector credit flow as % of GDP	prcf	162	10.81358	11.0157	-21.6	46.7
private sector debt as % of GDP	prdebt	165	94.39939	57.26379	19.5	287.5
general government debt as % of GDP	govdebt	144	36.77986	20.8018	3.7	81.8
3 year average of **unemployment rate**	unemp	149	9.55302	4.068909	4	19.6

Source: author´s computations

Generally, based on our previous analysis of indicator values and also on amount of related literature, most countries from EU12 group seem to be dealing better with consequences of the global crisis than EU 15 group, which could indicate that old and more developed countries were hit by the recession to a greater extent than the new member countries. Such idea is supported for example by Aslund (2012), who states that the CEE countries overcame the crisis with successful reforms while some countries in the Southern Europe region were hit by subsequent severe fiscal crises. One of the reasons is probably the different matter of the crisis in the CEE and Southern countries – while the CEE countries suffered mainly from a current account crisis, Southern region went through a deterioration of a public finance sector.

6.2 The Basic Model

The main hypothesis of our thesis is testing if the scoreboard indicators are able to explain or predict the macroeconomic imbalances expressed as changes of growth of GDP per capita. Reasons behind choosing such a dependent variable were explained previously. As explanatory variables we used all scoreboard indicators except HPI. We did not make any transformations to the data and used the original EC set similarly as Knedlik (2012) who examined if the thresholds of the indicators were set correctly by using signal approach and had found out that they are probably set too low and are resulting in more alarm signals.

However, the analysis of the thresholds will not be part of our thesis although there is a large potential for further research. So, what we would like to examine is if some of the indicators are redundant and thus can be excluded from the scoreboard table when proving to be insignificant. This hypothesis will be tested by several methods and estimators as described further.

In our analysis, we will estimate three different models. First two differs only in the dataset used – data for EU 15/EU12 – and all estimations are made separately for these two groups in order to examine if the significance of indicators differs according to division to Old/New Member countries, which would be our next hypothesis.

Thus, our basic model will take the following form:

$$\Delta GDP_{it} = \beta_0 + \beta_1 CA_{it} + \beta_2 NIIP_{it} + \beta_3 REER_{it} + \beta_4 ExShares_{it} + \beta_5 ULC_{it} + \beta_6 PrCF_{it} + \beta_7 PrDebt_{it} + \beta_8 GovDebt_{it} + \beta_9 Unemp_{it} + u_{it}$$

where i= $1, \dots ,15$ $(1, \dots ,12$ respectively) denotes Member Country and

t=1979, ... , 2011stands for the year. This notation will hold for all equations from now on.

Finally, for testing if the scoreboard indicators can predict changes in a country´s macroeconomic stability measured by changes in GDP growth, we applied the third model which uses $\Delta GDP_{i,t+0,5}$ as a dependent variable – in other words, dependent variable is half a year delayed compared to the explanatory variables. That should be long enough for reaction to some significant changes in indicators' values and short enough to avoid business cycle fluctuations.

So, our third and last basic model will take the form

$$\Delta GDP_{i,t+0,5} = \beta_0 + \beta_1 CA_{it} + \beta_2 NIIP_{it} + \beta_3 REER_{it} + \beta_4 ExShares_{it} + \beta_5 ULC_{it} + \beta_6 PrCF_{it} + \beta_7 PrDebt_{it} + \beta_8 GovDebt_{it} + \beta_9 Unemp_{it} + u_{it}$$

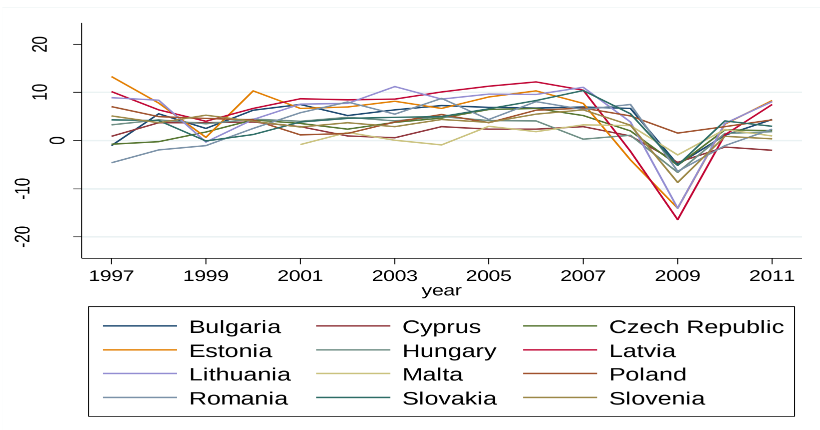
This model will be applied on the dataset containing variables from 20 countries, since quarterly data of GDP growth were not available for the whole EU.

6.3 Variables description

As far as the explanatory variables from our models are concerned, we described them previously in a sufficient detail as they are non-transformed values of the indicators. So, in this section we will describe only the dependent variable, which is growth of GDP per capita. In Figure 24 and Figure 25 we can see the development of this variable in both observed groups during 1997-2011.

It is obvious that GDP growth in both groups follows the similar pattern. From the sluggish growth (EU12) and more or less constant development (EU15) it came to the sudden drop starting in 2007 and reaching its peak in 2009.

Figure 24: Growth of GDP per capita, EU 12

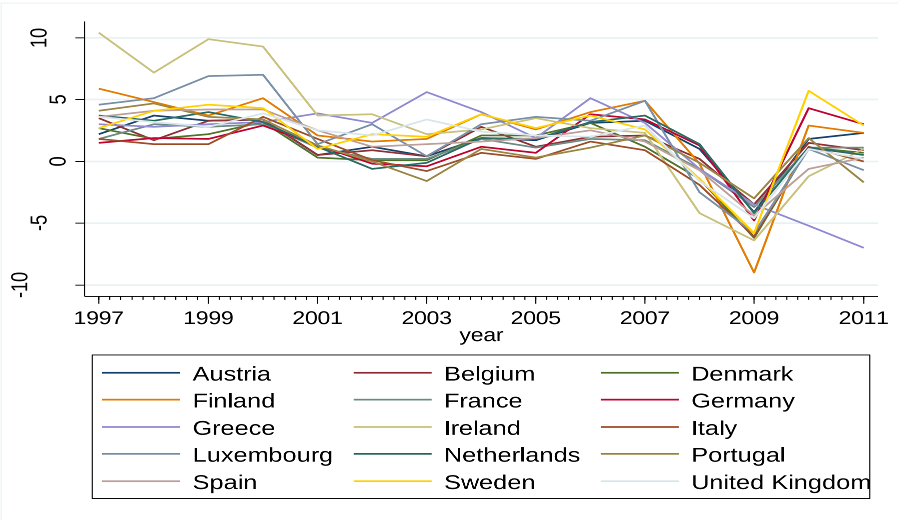


Source: author´s computations

However, we can conclude that in the case of EU12 countries, the GDP growth has both larger variance and higher mean with the minimal value reaching -16.4% and maximal 13.3%, while corresponding values in EU 15 are -9% and 10.4%.

Moreover, in 2006-2007, growth in the EU15 countries converged to very close levels between 2 and 4 percents while values in the EU 12 fluctuated in the 10% range.

Figure 25: Growth of GDP per capita, EU15



Source: author´s computations

6.4 Data testing

Before we introduce our estimation results, we have to analyse quality of our panel data from several points of view. There are three things we have to worry about when dealing with the panel data: non-stationarity, spurious regression and cointegration.

Tests will be applied on EU 12 and EU 15 group separately. Dataset of 20 countries which we have applied in the third model will not be examined since it is assumed that its characteristics will be very similar to those of the two subgroups.

6.4.1 Stationarity

There are many tests of non-stationarity. In case of the time series, the augmented Dickey-Fuller (AFF), Phillips-Perron(PP) or KPSS test belong to the most widely used tests of unit roots. However, when we work with the panel data, such tests might not be appropriate due to their lower statistical power of rejecting the null hypothesis of non-stationarity (Constantini and Martini, 2010). So, the three unit root tests constructed especially for the panel data were applied: Levin, Lin and Chu test; Im, Pesaran and Shan test and Fisher tests. Below we will shortly describe their characteristics and test statistics.

6.4.1.1 The Levin-Lin-Chu (LLC) test

The LLC test was firstly described by Levin, Lin and Chu in their (2001) paper which enlarged the original Levin and Lin paper from 1992. LLC test was introduced as a reaction to the need of creating a unit root test suitable for panel data, which would allow for individual-specific intercepts and time trends. Also, the error variance and pattern of serial correlation were made to vary freely across individuals – in other words, different lags are allowed across different cross sections.

The LLC model can be described by the following equation:

$$\Delta y_{it} = \gamma_i y_{it-1} + \sum_{L=1}^{p_i} \beta_{iL} \Delta y_{it-L} + X_{it}' r_{it} d_{mt} + \varepsilon_{it.}$$

The null hypothesis in LLC test is that the each individual time series contains a unit root, while the logical alternative is that all series are stationary – we can rewrite this as

$$H_0: \gamma = 1 \text{ and } H_1: \gamma < 1.$$

The LLC test is emphasized to use if the data sample consists of N (number of panels)between 10 and 250 and T (number of time periods) between 25 and 250. Since our panel dimension is T=15 and N=12/15, we can say this test is still applicable to our data. However, it cannot be reliable if the cross-sectional correlation is present. Also, the assumption that all cross-sections have or don´t have a unit root can be sometimes too restrictive. (Baltagi, 2008)

Moreover, this test requires strongly balanced data, thus it can be done only for some of our variables.

6.4.1.2 The Im, Pesaran and Shin (IPS) test

The IPS test is considered to be an alternative to LLC test. The model used is the same, but the mechanics of its implementation differs. The main difference is that while LLC test requires a common unit root process, IPS allows individual unit root processes by making averages of all individual ADF tests statistics

So, the null hypothesis is formulated as a requirement that each series should contain a unit root for all *i* cross sections. Moreover, the alternative hypothesis is also formulated less strictly than in case of the LLC – here, at least one of the cross section is required to be stationary, not necessarily all of them (Im, Pesaran and Shin, 2003).

Formally speaking, we can express it as

$$H_0: \gamma_i = 1 \text{ and } H_1: \gamma_i < 1.$$

Again, this test requires strongly balanced data, thus it can be done only for some of our variables (Baltagi, 2008).

6.4.1.3 Fisher test

Fisher test was firstly published in Maddala and Wu (1999). It belongs to the class of tests with combining p-values and it is based on the summation of logarithmic p-values from individual tests of unit roots. In other words, Fisher-type tests conduct unit root tests for each panel individually and then combine their p-values in order to produce an overall test.

Fisher test uses the following test statistics:

$$P = -2 \sum_{i=1}^{N} \ln p_i,$$

where p_i is an asymptotic p-value of a unit root test for cross-section *i*.

P has the χ^2 distribution with 2 degrees of freedom as $T_i \to \infty$ for finite N. The null hypothesis and the alternative are the same as in case of the IPS test –non-stationarity, while the alternative is that at least one panel is stationary. (Baltagi, 2008)

Stata allows us to use two types of Fisher test for each panel: the Dickey-Fuller, which conducts ADF test on every panel, or the Phillips-Perron test, which conducts PP test. Both of them are allowed also in case of unbalanced data and gaps in every panel.

6.4.2 Results of the unit root testing

In Table 5 and Table 6 we summarized results of the unit root testing including values of t-statistics of individual tests and corresponding p-values. For the LLC test, we chose the option including the mean of the series across panels being computed first for each time period and then subtracted from the series. Levin, Lin and Chu (2001) emphasize this procedure in order to mitigate possible impacts of cross-sectional dependence.

The same option was used also for the IPS test and for the Fisher test based on the ADF and Phillips-Perron test. Finally, the inverse chi-squared version of t-statistic was used, which is suitable for finite number of panels.

As we consider the 95% confidence level being sufficient in all our computations, we can see that the results are ambiguous both in the EU 15 and EU 12 case. Some of the variables can be considered to be stationary, some of them cannot. However, we can say that variables *GDPgrowth*, *REER* and *ULC* can be considered to have no unit roots. As far as other variables are concerned, we tested stationarity also on their first differences. LLC and IPS test could not be computed for some of them since number of observations became too small after differencing the data, but two types of Fisher test confirmed that the variables are integrated of order 1. What is important, our dependent variable is stationary, which should eliminate a chance of spurious regression as will be tested in the following chapter.

The usual way how to achieve stationarity is to transform variables into the first differences (or even differences of higher order). However, such transformation would probably disable us to interpret such variables properly, as most of them are currently set as differences or long-term averages. Moreover, as our dataset is not balanced, we would lose even more observations if we dropped differenced observation computed from missing values. Another usual transformation, making logarithms of variables, is not viable either since many of them take negative values. This problem will definitely influence the choice of the estimator as it will be dealt with in the following section.

Table 5: Unit root testing – EU 15

Stationarity testing - unit root tests

	Common AR parameter		**Panel-specific AR parameter**	
	LLC	IPS	Fisher-ADF	Fisher-PP
GDP growth	0.05	0.00	0.41	0.00
CA balance	0.01	0.56	0.99	0.68
NIIP	unbalanced	0.98	0.71	0.99
REER	0.00	0.09	0.00	0.50
Export market shares	unbalanced	unbalanced	1.00	0.22
Unit Labour Cost	unbalanced	unbalanced	0.00	0.98
Private Cash Flow	unbalanced	unbalanced	0.65	0.00
Private Debt	unbalanced	unbalanced	0.27	0.04
Government Debt	0.99	1.00	1.00	0.99
Unemployment	0.09	1.00	0.00	0.98

Source: author´s computations

Table 6: Unit roots testing – EU 12

Stationarity testing - unit root tests

	Common AR parameter		**Panel-specific AR parameter**	
	LLC	IPS	Fisher-ADF	Fisher-PP
GDP growth	unbalanced	0.00	0.94	0.00
CA balance	0.00	0.10	0.00	0.19
NIIP	unbalanced	0.74	0.73	0.84
REER	0.00	0.00	0.00	0.00
Export market shares	unbalanced	0.00	1.00	0.00
Unit Labour Cost	unbalanced	N/A	0.00	0.00
Private Cash Flow	unbalanced	N/A	0.11	0.00
Private Debt	unbalanced	N/A	0.00	0.86
Government Debt	0.00	0.73	1.00	0.00
Unemployment	unbalanced	0.99	0.00	0.84

Source: author´s computations

6.4.3 Cointegration

Another assumption which we have to examine is the assumption of no cointegration between variables. Two non-stationary time series are considered to be cointegrated if they tend to move together through time. However, such series are said to be integrated of order one (I(1)) – in other words, they must be non-stationary. Thus, in the panel data analysis there is an apparent need to examine if there are some long-run relationships among variables both in a time-series dimension, T, and a cross-sectional dimension N.

For testing the null hypothesis of no cointegration we used four statistical tests developed by Westerlund (2007), which are implemented in the Stata software. These tests have several advantages: they are general enough to accommodate unit-specific short-run dynamics, unit-specific trend, slope parameters and cross-sectional dependence. Further, the results of Westerlund´s simulation suggest that they are suitable for small sample panel data in comparison with classical tests by Pedroni (2004), which make them especially suitable for our small dataset.

The basic idea behind these tests is testing whether there is an error correction for individual panel members or for the panel as a whole (whether the error correction term in a conditional error correction model is equal to zero). Thus, if the null hypothesis of no error correction is rejected, we can reject also the hypothesis of no cointegration.

However, since we have small sample of observations, for some variables Westerlund test can´t be computed. Moreover, as we assessed *REER* and *ULC* as being stationary, cointegration test will be applied only on the remaining seven variables.

Table 7: Cointegration tests, EU15

Cointegration with GDP growth	Test statistic			
	Gt	Ga	Pt	Pa
CA balance	0.00	0.13	0.00	0.00
NIIP	0.00	0.07	0.00	0.00
Export market shares	x	x	x	x
Private Cash Flow	x	x	x	x
Private Debt	x	x	x	x
Government Debt	0.00	0.41	0.00	0.00
Unemployment	0.00	0.01	0.00	0.00

Source: author´s computations

Ga and *Gt* statistic test the null hypothesis of no cointegration against the alternative that at least one of the cross-sectional units is cointegrated with another one. On the other side, *Pt* and *Pa* statistics compute with the alternative of cointegration of panel as a whole, null hypothesis being the same (Persyn & Westerlund, 2008).

Table 8: Cointegration tests EU12

Cointegration with GDP growth	Test statistic			
	Gt	Ga	Pt	Pa
CA balance	0,02	0,196	0,00	0,00
NIIP	0,027	0,710	0,013	0,005
Export market shares	0,00	0,169	0,00	0,00
Private Cash Flow	x	x	x	x
Private Debt	0,453	0,742	0,034	0,008
Government Debt	0,00	0,808	0,00	0,058
Unemployment	0,00	0,352	0,001	0,001

Source: author´s computations

The results shown in Table 7 and Table 8 suggest that for all variables in both subgroups, we can reject the null of no cointegration at 95% confidence level and thus we can conclude that there is a long run relationship between GDP growth and explanatory variables (Dritsakis, 2004).

6.4.4 Spurious regression

Finally, we need to check if the relationship between dependent and explanatory variables is not based on a spurious regression, which is an often problem of regressions based on non-stationary series. The spurious regression was firstly defined by Granger and Newbold (1974) as a situation with high degree of measure of fit (R squared or adjusted R squared), but with extremely low Durbin-Watson statistic. This can arise especially if the series of residuals is strongly autocorrelated; R squared is then no longer reliable. In other words, we could asses our regression estimation results inaccurately.

For testing a null hypothesis of no spurious regression we used new test created by Shehata(2012). This test uses simple OLS regression and resulting R squared is compared with corresponding Durbin-Watson statistic with $(N+1,n)$ degrees of freedom, where *N* is a number of cross-sectional panels and *n* number of complete observations. Hence, the null hypothesis is that R squared is lower than D-W statistic, thus there is no spurious regression. This null is tested against the alternative of R squared being higher than D-W, which would indicate the presence of the spurious regression.

Table 9: Spurious regression testing, EU 12

Spurious regression testing

Ho: No Spurious Regression: R2 < DW			
Ha: Spurious Regression: R2 > DW			
* Rho Value	= 0.13366		
* R-squared	= 0.59868		
* Durbin-Watson Test	= 1.53625	df:	(10,31)
No Spurious Regression: R2 (0.5987) < DW (-1.5362)			

Source: author´s computations

According to the results presented in Table 9 and Table 10, there is no spurious regression relationship between GDP growth and explanatory variables. So, based on evaluation of previous tests, we can proceed to estimation of our data in the way which will be described in the following part with no need to transform the data, as it is supported for example by Seetaram(2010).

Table 10: Spurious regression testing, EU15

Spurious regression testing

Ho: No Spurious Regression: R2 < DW		
Ha: Spurious Regression: R2 > DW		
* Rho Value	= 0.14412	
* R-squared	= 0.43457	
* Durbin-Watson Test	= 1.52017	df: (10 , 164)
No Spurious Regression: R2 (0.4346) < DW (1.5202)		

Source: author´s computations

7 Dynamic panel data models

For our analysis we decided to use the linear dynamic panel-data models, which include *p* lags of the dependent variable as covariates and contain unobserved panel-level effects, which can be fixed or random. Their important feature is that the unobserved panel-level effects are correlated with the lagged dependent variables, which causes standard estimators to be inconsistent.

Advantages of using dynamic panel data models is that they allow to better understand the dynamic of an adjustment of given variable when being in an economic relationship which is dynamic in nature. Also, it can be reasonable for our models since regressing GDP per capita growth on its past levels (and other variables) was used for example by Levine and Renelt (1992). Dynamics of real GDP per capita in its logarithmic transformation was examined also by Huang et al.(2008).

As we mentioned above, dynamics of the economic relationships is captured by including a lagged dependent variable between explanatory variables into a general model:

$$y_{it} = \delta y_{i,t-1} + x_{it}^{'}\beta + u_{it}, \qquad i = 1, \dots, N; t = 1, \dots, T,$$

where δ is a scalar, $x_{it}^{'}$ is $1 \times K$ and β is $K \times 1$. Moreover, u_{it} is assumed to follow a one-way error component model$u_{it} = \mu_i + \vartheta_{it}$, where $\mu_i \sim IID\left(0, \sigma_\mu^2\right)$are individual effects and $\vartheta_i \sim IID\left(0, \sigma_\vartheta^2\right)$are usually error terms, which are independent of each other and among themselves (Baltagi, 2008).

This dynamic panel data regression is persistent over time from two reasons: first, there is an autocorrelation among the regressors due to including the lagged dependent variable. The reasoning is simple: since y_{it} is a function of μ_i, $y_{i,t-1}$ must be also function of μ_i. Therefore, $y_{i,t-1}$ is correlated with the error term. As a result, using OLS estimator on such regression would be inappropriate since the estimator would be biased. However, using lagged dependent variable has following reasoning: such variable can be considered to be a proxy of speed of adjustment, which is measured by the dynamic model (Judson & Owen, 1996).

Second, there are individual effects which characterize the heterogeneity among the individuals. Thus, the big issue here is if the individual effects should be taken as fixed or as random. If we would like to take them as random ones, they would have to be uncorrelated with the exogenous variables included in the model. In our case, such estimators would not be optimal since it is exactly the correlation which helps us to decide which estimator to use. (Islam, 1995).

Also, we would run into problems if we would want to use the standard fixed-effects or random-effects GLS estimators on the dynamic panel data model – such estimators would not be consistent. Therefore, we will introduce three versions of estimators created especially for dynamic panel data: Arellano-Bond estimator, Arellano-Bover estimator and corrected LSDV estimator. In the next section we will describe all of them in detail.

The dynamic panel data models are estimated using the General Method of Moments (GMM) technique.GMM was firstly introduced in a seminal paper by Hansen (1982). This method chooses the estimators of parameters in order to achieve as close satisfaction of the theoretical model as possible – estimators should minimise the weighted distance between the theoretical and actual values. This approach has several advantages – it can be applied on both linear and nonlinear models, single equations and system of equations and to models encompassing time series, panel or cross section data. That is one of the reasons why GMM is used quite abundantly in macroeconomic field (Baltagi, 2008).

GMM used on dynamic panel data requires $N \leq T$, so we have to make a compromise between the number of observations available and ideal number of instruments as will be described further. Moreover, parameters of model must satisfy orthogonality conditions – in other words, sample correlations between explanatory variables and instruments must be as close to zero as possible.

In the next section, we will describe basic characteristics of all three estimators individually.

7.1 The Arrelano - Bond estimator

Arrelano and Bond (1991) introduced the dynamic model of employment in their work. For the parameters of such model they derived a consistent generalized method of moments (GMM) estimator.

So, the authors claim that we can obtain additional instruments in a dynamic panel data model, if we utilize the orthogonality conditions existing between lagged dependent variable y_{it} and disturbances ϑ_{it}. The final estimator can be derived as follows:

Let us assume a simple autoregressive model with no regressors:

$$y_{it} = \delta y_{i,t-1} + u_{it} \qquad i = 1, \dots, N; \quad t = 1, \dots, \mathrm{T},$$

where $u_{it} = \mu_i + \vartheta_{it}$ with $\mu_i \sim IID(0, \sigma_\mu^2)$ and $\vartheta_i \sim IID(0, \sigma_\vartheta^2)$ are independent among each other and themselves. To get a consistent estimate of δ for $N \to \infty$ and T being fixed and eliminate the individual effects, we transform the previous equation into the first differences:

$$y_{it} - y_{i,t-1} = \delta(\mathrm{y}_{i,t-1} - \mathrm{y}_{i,t-2}) + (\vartheta_{it} - \vartheta_{i,t-1}).$$

Obviously, $\vartheta_{it} - \vartheta_{i,t-1}$ is MA (1) with a unit root. If we would continue in the same way and would add an extra instrument for each forward period, we would get a set of instruments $(y_{i1}, y_{i2}, \dots, y_{i,T-2})$. For the differenced error term $(\vartheta_{it} - \vartheta_{i,t-1})$ holds:

variance-covariance matrix of the errors can be described as $E(\Delta\vartheta_i \Delta\vartheta_i^{'}) = \sigma_\vartheta^2 (I_N \otimes G)$, where $\Delta\vartheta_i^{'} = (\vartheta_{i3} - \vartheta_{i2}, \dots, \vartheta_{iT} - \vartheta_{i,T-1})$ and

$$G = \begin{pmatrix} 2 & -1 & 0 & \cdots & 0 & 0 & 0 \\ -1 & 2 & -1 & \cdots & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \vdots & \vdots \\ 0 & 0 & 0 & \cdots & -1 & 2 & -1 \\ 0 & 0 & 0 & \cdots & 0 & -1 & 2 \end{pmatrix}$$

is $(T-2)\times(T-2)$, $\Delta\vartheta_i$ being MA(1) with unit root. Next, define

$$W_i = \begin{bmatrix} [y_{i1}] & \cdots & 0 \\ 0 & [y_{i1}, y_{i2}] & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & [y_{i1}, \dots, y_{i,T-2}] \end{bmatrix}.$$

Matrix $W = [W_1', \dots, W_N']'$ is the matrix of instruments. Thus, if we premultiply the differenced equation in vector form by W', we get

$$W'\Delta y = W'(\Delta y_{-1})\delta + W'\Delta\vartheta.$$

When running GLS on the previous equation, we finally arrive at one-step Arrelano Bond estimator:

$$\widehat{\delta_1} = \left[(\Delta y_{-1})'W\left(W'(I_N \otimes G)W\right)^{-1}W'(\Delta y_{-1})\right]^{-1} \times$$

$$\left[(\Delta y_{-1})'W\left(W'(I_N \otimes G)W\right)^{-1}W'(\Delta y)\right]$$

For simplification we can rewrite the above expression into

$$W'(I_N \otimes G)W = \sum_{i=1}^{N} W_i' G W_i = V_N = \sum_{i=1}^{N} W_i' (\Delta\vartheta_i)(\Delta\vartheta_i)' W_i,$$

as stated in Hansen (1982). Then, by replacing $\Delta\vartheta$ by differenced residuals obtained from the one-step estimator $\widehat{\delta_1}$, we get the final two-step Arrelano-Bond GMM estimator as derived in Baltagi (2008):

$$\widehat{\delta_2} = \left[(\Delta y_{-1})'W\widehat{V_N}^{-1}W'(\Delta y_{-1})\right]^{-1}\left[(\Delta y_{-1})'W\widehat{V_N}^{-1}\left(W'(\Delta y)\right)\right]$$

This estimator is constructed for datasets with many panels and few periods and it has a strict assumption that the idiosyncratic errors are not autocorrelated. Arrelano-Bond estimator is sometimes called “difference GMM”. (Roodman, 2006)

7.2 The Arrelano-Bover estimator

In their paper, Arrelano and Bover (1995) introduced a new GMM framework for working with instrumental variables estimators for dynamic panel data models, which was fully developed in Blundell and Bond (1998). They improve the Arrelano-Bond estimator by implementing an additional assumption that the first differences of instrument variables have to be uncorrelated with the fixed effects. As a consequence, more instrument variables can be used in the model and thus the efficiency can significantly increase. Moreover, Arrelano-Bover estimator is considered to be more appropriate to use if we have small sample and non-stationary data (Roodman, 2009).

While Arrelano-Bond estimator is sometimes called “difference GMM”, Arrelano-Bover is in the literature referred as “system GMM”.

So, Arrelano and Bover´s approach is considered to be another strategy against the dynamic panel bias – that $y_{i,t-1}$ is correlated with the fixed effects in the error term (Nickell, 1981).

In a nutshell, Arrelano and Bover did not transform the regressors to avoid the fixed effects as Arrelano and Bond. Instead of it, they transformed - differenced – the instruments, which caused them to be exogenous to the fixed effects. This is valid given the assumption that any changes in instrument variables, w, are uncorrelated with fixed effects:

$$E(\Delta w_{it}\mu_i) = 0 \ \ \forall i, t$$

In other words, $E(\Delta w_{it}\mu_i)$ is required to be time-invariant. If this assumption is fulfilled, than $\Delta w_{i,t-1}$is a valid instrument for the variables in levels:

$$E(\Delta w_{i,t-1}\varepsilon_{it}) = E(\Delta w_{i,t-1}\mu_i) + E(w_{i,t-1}\vartheta_{it}) - E(w_{i,t-2}\vartheta_{it}) = 0 + 0 - 0.$$

We will again shortly describe derivation of the Arrelano-Bover estimator here, as it is described in Baltagi(2008).

Arrelano and Bover built their estimation on the Hausman and Taylor (1981) model:

$$y_{it} = x_{it}'\beta + Z_i'\gamma + u_{it},$$

where β is $K \times 1$, γ is $g \times 1$, $Z_i$are time-invariant variables and x_{it} vary over individuals and time. In a vector form, this can be written as

$$y_i = W_i\eta + u_i, \text{ where}$$

$y_i = (y_{i1}, \dots, y_{iT})', u_i = (u_{i1}, \dots, u_{iT})', \eta' = (\beta', \gamma'), W_i = [X_i, \iota_T Z_i'], X_i =$
$(x_{i1}, \dots, x_{iT})'$

and ι_T is the vector of ones of dimension T. Then, Arrelano and Bover transformed this equation, which is the system of T equations using the non-singular transformation:

$$H = \begin{bmatrix} C \\ \iota_T'/T \end{bmatrix},$$

where C is any $(T-1) \times T$ matrix of rank $(T-1)$such that $C_{\iota T} = 0.$

What is important, disturbances transformed into form

$$u_i^{+} = Hu_i = \begin{bmatrix} Cu_i \\ \bar{u}_i \end{bmatrix}$$

have the first $(T-1)$transformed errors free of μ_i - individual effects. That is reason why for these first $(T-1)$ equations are all exogenous variables valid instruments. Then, valid instrument variable matrix for the complete transformed system can be written as

$$\mathrm{M_i} = \begin{bmatrix} \mathrm{w_i'} & & & 0 \\ & \ddots & \mathrm{w_i'} & \vdots \\ 0 & & & \mathrm{m_i'} \end{bmatrix},$$

where m_i denotes the subset of instrument variables w_i, which are assumed to be uncorrelated with μ_i in levels and their dimension have to be greater than or equal to the dimension of η.

Moment conditions are given by $E(M_i^{'}Hu_i) = 0$. If we define

$W = (W_1^{'}, \dots, W_N^{'})^{'}, y = (y_1^{'}, \dots, y_1^{'})^{'}, M = (M_1^{'}, \dots, M_N^{'})^{'}, \bar{H} = I_N \otimes$ H and

$\bar{\Omega} = \mathrm{I_N} \otimes \Omega$ and premultiply the vector form equation by $M^{'}\bar{H}$, we get

$$M^{'}\bar{H}y = M^{'}\bar{H}W\eta + M^{'}\bar{H}u.$$

Finally, when we perform GLS estimation on the previous equation, we arrive at the Arrelano-Bover estimator:

$$\hat{\eta} = \left[W^{'}\bar{H}^{'}M\left(M^{'}\bar{H}\bar{\Omega}\bar{H}^{'}M\right)^{-1}M^{'}\bar{H}W\right]^{-1}W^{'}\bar{H}^{'}M\left(M^{'}\bar{H}\bar{\Omega}\bar{H}^{'}M\right)^{-1}M^{'}\bar{H}y$$

7.3 The Corrected LSDV estimator

The corrected Least Square Dummy Variable (LSDVC) estimator was firstly introduced by Kiviet (1995) when he proves that when we eliminate the bias from classical LSDV estimator, we arrive at the very efficient estimation procedure also in case of the small sample data.

The reason behind developing such an estimator is simple: the classical LSDV estimator becomes inconsistent dealing with large N and finite T. If this inconsistency was firstly proved in Nickell (1981) for $N \to \infty$ being bounded of order T^{-1}, many suggestions on more consistent instrumental variable estimators were made including GMM estimator of first-differenced model(Arrelano-Bond) or first-differenced instrumental variables (Arrelano-Bover).

However, as Bruno (2005) suggests, problem of all of those indicators is that their properties are fulfilled mainly when using large N data – with small sample of cross-sectional units they can become biased.

Let us consider the standard LSDV estimator in a matrix form given by

$$\delta_{\mathrm{LSDV}} = \left(\mathrm{W}'\mathrm{A_S}\mathrm{W}\right)^{-1}\mathrm{W}'\mathrm{A_S}\mathrm{y},$$

where $A_S = S\left(I - D\left(D'SD\right)^{-1}D'\right)S$ is the symmetric and idempotent $(NT \times NT)$ matrix wiping out individual means and also selecting usable observations and $D = I_N \otimes \iota_T$ is the $(NT \times N)$ matrix of individual dummies, with ι_T being the $(T \times 1)$ vector of all unity elements.

Kiviet(1995) firstly derived the formula for the bias of LSDV estimator for the small sample data and order of $N^{-1}T^{-1}$, which has a $O(N^{-1}T^{-\frac{3}{2}})$ approximation error. This error is considered to be not large, so if the bias could be removed, LSDV would remain a very efficient estimator due to its other plausible characteristics such as low variance.

Then, Kiviet (1999) derived the more accurate bias approximation with terms of even higher order than T^{-1} as it is described in Bruno (2005):

$$E(\delta_{LSDV} - \delta) = E\left[(W'AW)^{-1}W'A\varepsilon\right] =$$

$$= QE(W'A\epsilon) - QE(W'AWQW'A\varepsilon) + QE(W'AWQW'AW)QE(W'A\varepsilon) + o(N^{-1}T^{-1}) =$$

$$= c_1(T^{-1}) + c_2(N^{-1}T^{-1}) + c_3(N^{-1}T^{-2}) + o(N^{-1}T^{-1}),$$

where $A = I_{NT} - D(D'D)^{-1}D'$ is the within operator and $Q = [E(W'AW)]^{-1}$.

So, Kiviet (1999) proved that by subtracting the LSDV bias from estimated LSDV coefficients, we obtain much more efficient estimator. This conformed also Judson and Owen (1999) who ran a Monte Carlo simulation on a dynamic fixed effects model and they came to conclusion that LSDVC outperforms Anderson-Hsiao and other GMM-IV estimators in case of small sample data.

8 Results

In this chapter, we will present econometric results of our models and comment on estimated coefficients and their signs. Then, we will describe the decision process of choosing the right model and compare the results of the three estimators mentioned above – Arrelano-Bond, Arrelano-Bover and corrected LSDV.

Since we introduced three kinds of models – the same model for EU 15 and EU 12 and a different one with a shifted dependent variable for 20 selected countries, we will follow this division in the following section as well and will divide it into three parts.

Because the estimation procedure will be the same in all three models, we will describe its techniques in detail only in the estimation of the first model. Subsequently, the description of latter two models will be correspondingly shorter.

8.1 EU 15 results

Before we start evaluating results of our estimations, we should check the correlation matrix of explanatory variables in order to examine if there are some significant correlations between them. The matrix is shown in Table 11.

As we can see, the highest correlation was observed between *ca* and *niip,* high coefficients were also found between *unemp* and *govdebt* or *reer* and *exshares*. So, we must be careful when including these variables into models together.

Table 11: Correlation matrix of explanatory variables, EU 15

	ca	niip	reer	exshares	ulc	prcf	prdebt	govdebt	unemp
ca	1.00								
niip	0.65	1.00							
reer	-0.14	-0.02	1.00						
exshares	0.10	0.09	0.41	1.00					
ulc	-0.24	0.08	0.30	0.02	1.00				
prcf	-0.06	0.07	0.14	0.16	0.25	1.00			
prdebt	0.13	0.11	-0.07	-0.15	0.21	0.26	1.00		
govdebt	-0.43	-0.33	-0.06	-0.29	-0.18	-0.29	-0.39	1.00	
unemp	-0.33	-0.42	-0.05	-0.11	-0.32	-0.18	-0.21	0.42	1.00

Source: author´s computations

8.1.1 Arrelano-Bond estimator

For our purposes we used the two-step robust version of Arrelano-Bond estimator. The two step variant tends to be asymptotically more efficient and the standard covariance matrix is also robust (which means it is consistent despite a possible presence of autocorrelation or heteroskedasticity among panels). However, such a matrix usually yields standard errors which can then lead to being downwardly biased. (Arrelano & Bond, 1991). That is why the finite-sample correction of the two-step covariance matrix developed by Windmeijer (2005) was applied. After such adjustments, the two-step robust estimation should be definitely more efficient than the original one-step robust.

Next, we only used the second lags of endogenous variables as instruments. Using only the first lags would probably yield wrong results because they would be correlated with the current error term. So, one should use at least a second lag. If the number of our panel variables would be higher, we could use any of the available lags as instruments.

However, since N, which denotes number of our panel variables, is not large (as we have 15 countries only), we must avoid using too many instruments because it causes many diagnostic tests, such as the Sargan or Hansen test to be inconclusive. So, the ordinary rule of thumb is to use fewer instruments than the number of panels. We managed to fulfil these criteria in most of our models (Roodman, 2009).

Table 12 summarizes the results of the Arrelano and Bond estimator.

We can see that in the first estimated model, all regressors seem to be highly insignificant. This can occur from a variety of reasons, the correlation between the explanatory variables being one of them.

As a measure of fit we used the same one as for example Bloom, Bond and Van Reenen (2007) – the squared correlation coefficient between actual and predicted values of the dependent variables. The value of 0.07 is very low giving the idea that our model is not estimated well.

Table 12: Arrelano-Bond, EU 15

Group variable	country
Time variable	year
No.of instruments	11
F(10, 15)	7.00
Prob > F	0.00

Variable	Coef.	Std. Err.	t	P>|t|
gdp growth L1.	-0.17	0.21	-0.81	0.43
ca	1.18	2.06	0.58	0.57
niip	-0.17	0.30	-0.55	0.59
reer	-0.14	0.23	-0.58	0.57
exshares	-0.09	0.09	-0.99	0.34
ulc	-0.09	1.64	-0.05	0.96
prcf	-0.10	0.11	-0.93	0.37
prdebt	-0.03	0.12	-0.27	0.79
govdebt	-0.44	0.97	-0.46	0.66
unemp	2.44	8.96	0.27	0.79
Arellano-Bond test for AR(1)	z = 0.14	Pr > z = 0.891		
Arellano-Bond test for AR(2)	z = 0.65	Pr > z = 0.516		
Sargan test of overid. restrictions:	chi2(1) = 0.04	Prob > chi2 = 0.841		
Hansen test of overid. restrictions:	chi2(1) = 0.27	Prob > chi2 = 0.600		
Measure of fit	0.07			

Source: author´s computations

We coped with it by estimating a restricted model, as will be described in the following section. We gradually dropped the insignificant variables until all variables in the model were significant at 95% confidence level and checked by F-test if their ommission is reasonable. This was made carefully after checking whether some regressors should be reincorporated into the model after dropping the other ones until we made our way to the, hopefully, best model possible.

Moreover, we should keep in mind that we have no theoretical background to think that some variables should be more significant than the others and thus they should be preserved in the model – conversely, we try to figure out if they are significant for the GDP growth at all. Naturally, one of the reasons of the insignificance of regressors can be the wrong specification of the model. That is why we applied several diagnostic tests as described in the following section.

8.1.1.1 <u>The Arrelano-Bond test</u>

The Arrelano-Bond test checks for the presence of AR (1) and AR (2) process in the first differences of residuals. Basically, it tests whether there is an autocorrelation in the idiosyncratic disturbance term, v_{it} , which would mean that some lags cannot be used as instruments (since lags of the dependent variable are in fact endogenous and are thus very bad instruments). However, a full disturbance ε_{it} is assumed to be autocorrelated due to the inclusion of fixed effects (Wawro, 2002).

The null hypothesis is zero autocorrelation. There are two types of tests in our output – for AR(1) and AR(2) processes. It is expected that null hypothesis of no autocorrelation in the AR(1) process in first differences will be rejected, because $\Delta e_{it} = e_{it} - e_{i,t-1}$ and $\Delta e_{i,t-1} = e_{it,-1} - e_{i,t-2}$ both contain $e_{i,t-1}$. Such rejection has thus no informational value. On the other side, the testing of AR (2) is more important since rejecting the null would indicate a presence of autocorrelation in levels. (Roodman, 2009).

As far as our data are concerned, we can state that the null of no autocorrelation is not rejected not only for the AR(2) process, but even for the AR(1) at 95% confidence level.

8.1.1.2 <u>Tests of over-identifying restrictions</u>

These types of test were constructed for checking if the instruments are exogenous as a group, which is the null hypothesis of such tests and also it is a crucial assumption of the validity of GMM. We will introduce two of them and one must carefully access results of both, because each of them has its own problems: the Sargan statistic is not robust to heteroskedasticity or autocorrelation, but its values are not weakened by many instruments. On the other side, the Hansen J statistic can be weakened by higher number of instruments, but it is robust (Wawro, 2002).

Again, in our case both of these tests exhibit the same phenomenon: the null hypothesis is not rejected which indicates a correct identification of instruments. Moreover, a number of instruments is lower or equal to the number of panels so all available post-estimation tests should not be weakened and should therefore give correct results(Roodman, 2009).

8.1.1.3 <u>Final model</u>

So, after assessing our instruments as being properly established, we estimated the restricted model in order to achieve significant regressors with prevailing good post-estimation statistics. The results of the most optimal model are shown in Table 13.

Table 13: Arrelano-Bond, EU 15, optimal model

Group variable	country1
Time variable	year
No. of instruments	11.00
F(5, 15)	24.10
Prob > F	0.00

Variable	Coef.	Std.Error	t	P>|t|
gdpgrowthL1.	-0.27	0.11	-2.56	0.02
prdebt	-0.07	0.04	-1.78	0.10
reer	-0.10	0.06	-1.74	0.10
ulc	-0.77	0.22	-3.46	0.00
unemp	-1.06	0.54	-1.97	0.07
Arellano-Bond test for AR(1)	z = -0.74	Pr > z = 0.46		
Arellano-Bond test for AR(2)	z = -1.57	Pr > z = 0.12		
Sargan test of overid. restrictions:	chi2(6) = 21.87	Prob > chi2 = 0.01		
Hansen test of overid. restrictions:	chi2(6) = 12.85	Prob > chi2 = 0.12		
Measure of fit	0.1701			

Source: author´s computations

As we can see, there are five explanatory variables left in the restricted model, which leads to the following form:

$$\Delta GDP_{it} = -0{,}27\ \Delta GDP_{i,t-1} - 0{,}07\ PrDebt_{it} - 0{,}10\ REER_{it} - 0{,}77\ ULC_{it} - 1{,}06 Unemp_{it} + u_{jt}$$

Thus, we can conclude that all explanatory variables exhibit negative signs. *PrDebt* and *REER* are significant only at 90% confidence level, but the high F statistic with very low p-value precludes us from omitting them in the model. Also, standard errors of all variables are considerably lower.

Moreover, specification tests have reasonable p-values as well – very high values would also be suspicious. The measure of fit is at 17%, which is significantly higher than in the case of unrestricted model.

Then, if we check our correlation matrix again, we can see that the only considerable correlation, 30%, is between *ULC* and *REER,* but we still keep both variables in the model regarding its best post-estimation tests. Also, the abovementioned correlation coefficient is not high enough for us to worry about.

8.1.2 The Arrelano-Bover estimator

Using the Arrelano-Bover estimator, which is sometimes called the system GMM, with no adjustments seemed to be inappropriate in our case, because the system GMM uses more instruments than the Arrelano-Bond estimator and thus our specification tests would be dramatically weakened in our small dataset. Moreover, this estimator adopts a new assumption: the first-difference instruments used for the variables in levels must not be correlated with the unobserved country effects (Judson & Owen, 1999). So, we decided that instruments will be used only in level equation, not in a first-difference equation. As further analysis of the model shown, this assumption was correct.

Moreover, we chose a model with no constant in the Arrelano-Bover estimator, because including the equation in levels does not alter the constant either.

Table 14: Arrelano-Bover, EU 15

Group variable	country1
Time variable	year
No.of instruments	12
F(10, 15)	2.84
Prob > F	0.03

Variable	Coef.	Std.Error	t	P>|t|
gdpgrowthL1.	-0.20	0.27	-0.75	0.46
ca	-0.24	0.36	-0.66	0.52
niip	0.01	0.10	0.13	0.90
reer	-0.10	0.56	-0.18	0.86
exshares	0.28	0.39	0.72	0.49
ulc	-0.41	0.60	-0.69	0.50
prcf	-0.01	0.07	-0.08	0.94
prdebt	0.01	0.02	0.56	0.58
govdebt	0.00	0.11	0.02	0.99
unemp	0.50	0.64	0.78	0.45
Arellano-Bond test for AR(1):	z = -0.89	Pr > z = 0.37		
Arellano-Bond test for AR(2):	z = -0.23	Pr > z = 0.82		
Sargan test of overid. restrictions:	chi2(2) = 0.31	Prob > chi2 = 0.86		
Hansen test of overid. restrictions:	chi2(2) = 0.37	Prob > chi2 = 0.83		
Measure of fit	0.08			

Source: author´s computations

As we can see in Table 14, the pattern in results is similar to the case of the Arrelano-Bond estimator – most variables are highly insignificant. Post estimation tests show plausible results, yet F test suggests at 99% confidence level that some variables are insignificant and should be excluded from the model. Moreover, the measure of fit is at a very low level.

Repeating the same procedure as described earlier, we managed to work out, by the gradual elimination of variables, into a best-fitting model as described in Table 15:

Table 15: Arrelano-Bover, EU 15, final model

Group variable	country1
Time variable	year
No.of instruments	12
F(5, 15)	10.35
Prob > F	0.00

Variable	Coef.	Std.Error	t	P>|t|
gdpgrowthL1.	-0.15	0.14	-1.11	0.28
reer	0.11	0.06	1.96	0.07
exshares	0.07	0.03	2.57	0.02
ulc	-0.51	0.15	-3.43	0.00
prdebt	0.03	0.01	4.35	0.00
Arellano-Bond test for AR(1):	z = -1.56	Pr > z = 0.12		
Arellano-Bond test for AR(2):	z = -1.33	Pr > z = 0.18		
Sargan test of overid. restrictions:	chi2(7) = 6.83	Prob > chi2 = 0.45		
Hansen test of overid. restrictions:	chi2(7) = 5.36	Prob > chi2 = 0.62		
Measure of fit	0.045			

Source: author´s computations

The post-estimation tests as well as the F test suggest that our model is estimated correctly. All variables are significant at least at the 90% confidence level. Thus, our final model estimated by Arrelano-Bover estimator can be written as

$$\Delta GDP_{it} = -0.15\ \Delta GDP_{i,t-1} + 0.07\ ExShares_{it} + 0.11\ REER_{it} - 0.51\ ULC_{it} \\ + 0.03\ PrDebt_{it} + u_{it}.$$

We can see that while the signs of coefficients of lagged ΔGDP and *ULC* are the same as in the case of the Arrelano-Bond estimator, the sign of *REER* coefficient differs. Moreover, *exshares* and *prdebt* variables were not included in the previous model due to their high correlation coefficients and the overall insignificance. Here, there is a correlation of 41% between *REER* and *exshares*. Again, results are more convincing when both variables are included in the model despite their correlation. However, the measure of fit remains at very low levels – lower than in the case of the unrestricted model, but this minor reduction can be caused by omission of our variables.

8.1.3 Corrected LSDV (LSDVC) estimator

As Bruno (2004) states, Arrelano-Bond, Arrelano-Bover and Anderson-Hsiao are all suitable and consistent estimators for the initialization of bias approximations. However, we decided to use the AH estimator as it was recommended by Judson and Oven (1999). Next, the bootstrapped variance-covariance matrix for the corrected estimator was used with number of bootstrap repetitions equal to 50. Why did we use this bootstrapping? Bun and Kiviet (2001) derived the asymptotic variance for large N. However, if the data sample is small, the estimated asymptotic standard errors can yield poor approximations, t-statistics and confidence intervals are no longer credible.

Thus, the approximations to the sampling distributions of a statistic provided by bootstrapping can be considered to be at least as accurate as the approximations based upon the first-order asymptotic theory (Bruno, 2004). Given this and supported by Bun and Kiviet, we bootstrapped the variance-covariance matrix of LSDVC to yield standard errors, t-statistic and confidence intervals. The bias correction was done up to order 1/T.

The results of the original LSDVC model for the EU 15 group are shown in Table 16.

Table 16: LSDVC, EU 15

Variable	Coef.	Std.Error	z	P>|z|
gdpgrowthL1.	-0.17	0.08	-2.10	0.04
ca	-0.06	0.10	-0.61	0.54
niip	0.01	0.01	1.25	0.21
reer	-0.09	0.04	-2.02	0.04
exshares	0.00	0.02	0.18	0.86
ulc	-0.32	0.06	-5.08	0.00
prcf	0.02	0.01	1.50	0.13
prdebt	-0.03	0.01	-4.75	0.00
govdebt	-0.09	0.02	-4.29	0.00
unemp	0.08	0.21	0.36	0.72
Measure of fit	0.37			

Source: author´s computations

We can see that unlike previous two estimators, in this case there are much more significant regressors. Also, the measure of fit remains considerably higher. Nevertheless, in order to achieve as good fit as possible, we again followed the procedure of dropping insignificant variables.

So, having considered the correlations between variables and the noticeable lowering of standard errors, we assessed the following model as being the most reasonable one:

Table 17: LSDVC, EU 15, final model

Variable	Coef.	Std.Error	z	P>|z|
gdpgrowthL1.	-0.16	0.07	-2.34	0.02
reer	-0.09	0.03	-2.93	0.00
ulc	-0.31	0.05	-6.49	0.00
prdebt	-0.04	0.01	-5.31	0.00
govdebt	-0.11	0.02	-6.62	0.00
Measure of fit	0.34			

Source: author´s computations

Again, we can see that the signs of all coefficients are negative and the measure of fit had lowered only fractionally. Thus, our optimal model can be written as

$$\Delta GDP_{it} = -0.16\, \Delta GDP_{i,t-1} - 0.11\, GovDebt_{it} - 0.09\, REER_{it} - 0.31\, ULC_{it} - 0.04\, PrDebt_{it} + u_{it}.$$

In the next section, we will introduce the results of two remaining groups of countries. Since we described the post-estimation tests and other specifics of already used estimators and illustrated our estimation techniques earlier, the following results will be described a bit more concisely.

8.2 EU 12 results

First of all, we need to check the correlation matrix of explanatory variables as shown in Table 18.

We can see that the correlation coefficient of -78% between *PrCF* and *CA* could cause serious problems and also high negative correlations between *PrDebt* and *Exshares* or *PrDebt* and *Unemp*. Thus, we should avoid including them together in the final model.

Table 18: Correlation matrix, EU 12

	ca	niip	reer	exshares	ulc	prcf	prdebt	govdebt	unemp
ca	1.00								
niip	0.09	1.00							
reer	-0.11	-0.11	1.00						
exshares	-0.27	-0.29	0.30	1.00					
ulc	-0.24	-0.15	0.21	0.25	1.00				
prcf	-0.78	-0.04	0.03	0.12	0.22	1.00			
prdebt	-0.11	0.02	-0.20	-0.60	0.02	0.30	1.00		
govdebt	0.27	0.17	-0.17	-0.43	-0.25	-0.17	0.38	1.00	
unemp	0.14	-0.06	0.13	0.30	-0.36	-0.32	-0.51	-0.10	1.00

Source: author´s computations

8.2.1 The Arrelano-Bond estimator

The main difference compared to the previous models is the lower number of panels (12). Still, the number of instruments remains low enough since we have 10 explanatory variables, so our results should not be weakened. In order not to overwhelm the readers by including many tables and given the fact that the procedure and estimation techniques are exactly the same as were described in the estimation of the EU 15 group, we will simply present the final results of each model. All tables with the results of the original models can be found in Appendix.

As we can see in Table 19, we arrived at the final model employing three explanatory variables only. All post-estimation tests suggest that our model is specified correctly and the measure of fit remains at 0.27 which is significantly higher than 0.11 in the unrestricted model.

Thus, our final model can be written as

$$\Delta GDP_{it} = -0.26\ \Delta GDP_{i,t-1} - 1.32\ CA_{it} + 1.97\ Unemp_{it} + u_{it}.$$

Such a result differs from the one we got in the EU 15 group. To be more specific, the sign and size of the *Unemp* coefficient is opposite. Despite its higher significance, its standard error remains still the highest of all variables.

Table 19: Arrelano-Bond, EU 12

Group variable	country1
Time variable	year
No. of instruments	11
F(3, 12)	23.96
Prob > F	0.00

Variable	Coef.	Std.Error	t	P>|t|
gdpgrowthL1.	-0.26	0.09	-2.89	0.01
ca	-1.32	0.21	-6.21	0.00
unemp	1.97	0.53	3.75	0.00
Arellano-Bond test for AR(1):	z = 1.23	Pr > z = 0.22		
Arellano-Bond test for AR(2):	z = -0.45	Pr > z = 0.65		
Sargan test of overid.restrictions:	chi2(10) = 11.62	Prob > chi2 = 0.31		
Hansen test of overid. restrictions:	chi2(10) = 10.94	Prob > chi2 = 0.36		
Measure of fit	0.27			

Source: own estimations

8.2.2 The Arrelano-Bover estimator

After the estimation of the model, the results were again very similar to those in the EU 15 group – insignificant variables with high p-values of all tests. Thus, we estimated an optimal model regarding correlations between residuals and specification tests in the following way, as can be seen in Table 20:

Table 20: Arrelano-Bover, EU 12, final model

Group variable	country1
Time variable	year
No.of instruments	12
F(5, 12)	97.51
Prob > F	0.00

Variable	Coef.	Std.Error	t	P>|t|
gdpgrowthL1.	0.06	0.09	0.64	0.54
ca	-0.38	0.22	-1.73	0.11
govdebt	0.04	0.02	-1.87	0.09
unemp	0.37	0.11	3.25	0.01
Arellano-Bond test for AR(1):	z = -2.01	Pr > z = 0.045		
Arellano-Bond test for AR(2):	z = -1.96	Pr > z = 0.050		
Sargan test of overid. restrictions:	chi2(7) = 12.01	Prob > chi2 = 0.151		
Hansen test of overid. restrictions:	chi2(7) = 7.88	Prob > chi2 = 0.446		
Measure of fit	0.39			

Source: author´s computations

The final model takes the following form:

$$\Delta GDP_{it} = 0.06\ \Delta GDP_{i,t-1} - \ 0.38\ CA_{it} + 0.04\ GovDebt_{it} + 0.37\ Unemp_{it} + u_{it}.$$

As we can see, this model is not as convincing as the previous ones were. First of all, the hypothesis of no second-order autocorrelation in residuals tested by the Arellano-Bond test in not rejected very closely at the 95% confidence level. Moreover, variables *Ca* and *GovDebt* are not significant at 95% and *gdpgrowth* not even at the 90% confidence level. However, this model still remains the best of all variants we examined, but its results should be treated with caution.

8.2.3 The Corrected LSDV estimator

Again, after having carefully eliminated the insignificant variables we succeeded in creating a final model presented in Table 21:

Table 21: LSDVC, EU 12, final model

Variable	Coef.	Std.Error	z	P>|z|
gdpgrowthL1.	0.05	0.07	0.66	0.51
ca	-0.53	0.07	-7.88	0.00
reer	-0.11	0.04	-2.78	0.01
prdebt	-0.05	0.01	-3.59	0.00
unemp	0.43	0.14	3.02	0.00
Measure of fit	0.47			

Source: author´s computations

The *PrCf* variable appeared to be significant too, but we dropped it because its high correlation with *CA*. Thus, the final model should be embedded in the following form:

$$\Delta GDP_{it} = 0.05\ \Delta GDP_{i,t-1} - \ 0.53\ CA_{it} - 0.11\ REER_{it} + 0.43\ Unemp_{it} - 0.05\ PrDebt_{it} + u_{it}.$$

Despite the insignificance of the lagged dependent variable, the measure of fit remains very high. In comparison with the original model, it was reduced by 3% only which is probably due to us dropping some of the insignificant variables.

8.3 EU 20 results

Finally, we arrived to our third and last model. This model will differ from our previous estimations – as we mentioned previously, we use a different form of the dependent variable – the change of the GDP growth shifted half a year forward in order to capture whether our explanatory variables are able to predict changes of GDP levels.

Moreover, our dataset now contains data from 20 European countries.

First of all, we will again take a look at the correlation matrix in Table 22. We can find a higher number of significant correlation coefficients than in our previous models – especially in the cases of *CA* and *REER*..

Table 22: Correlation matrix, EU 20

	ca	niip	reer	exshares	ulc	prcf	prdebt	govdebt	unemp
ca	1.00								
niip	0.63	1.00							
reer	-0.32	-0.17	1.00						
exshares	-0.34	-0.23	0.59	1.00					
ulc	-0.34	-0.12	0.39	0.27	1.00				
prcf	-0.11	0.04	0.05	0.08	0.17	1.00			
prdebt	0.34	0.22	-0.38	-0.58	-0.10	0.24	1.00		
govdebt	-0.09	-0.13	-0.25	-0.44	-0.28	-0.23	0.06	1.00	
unemp	-0.33	-0.32	0.20	0.34	-0.18	-0.19	-0.43	0.07	1.00

Source: author´s computations

8.3.1 The Arrelano-Bond estimator

When estimating our model by the Arrelano and Bond estimator, we discovered a similar pattern to our previous models. However, the p-value of the F test is high enough to give us a reason to omit insignificant variables.

So, after we had dropped them and compared with the F test, we arrived to the following optimal model with coefficients showed in Table 23:

$$\Delta GDP_{i,t+0,5} = 0.26\ \Delta GDP_{i,t-0,5} - 0.38\ NIIP_{it} + 1.14\ ULC_{it} + 0.27\ PrCF_{it} + 0.33\ PrDebt_{it} + 12.21\ Unemp_{it} + u_{it}.$$

Table 23: Arrelano-Bond, EU 20, final model

Group variable	country1
Time variable	year
No. of instruments	13
F(2, 21)	10.24
Prob > F	0.00

Variable	Coef.	Std.Error	t	P>|t|
gdpgrowthL1.	0.26	0.28	0.74	0.35
niip	-0.38	0.26	-1.45	0.16
ulc	1.14	0.53	2.14	0.04
prcf	0.27	0.20	1.38	0.18
prdebt	0.33	0.19	1.75	0.10
unemp	12.21	2.85	4.28	0.00
Arellano-Bond test for AR(1):	z = 1.12	Pr > z = 0.264		
Arellano-Bond test for AR(2):	z = 2.34	Pr > z = 0.019		
Sargan test of overid. restrictions:	chi2(11) = 1.87	Prob > chi2 = 0.967		
Hansen test of overid. restrictions:	chi2(11) = 3.33	Prob > chi2 = 0.853		
Measure of fit	0.01			

Source: author´s computations

As we can see, this model has almost zero measure of fit, which poses a hindrance for us to attribute high information value to our results. Moreover, the Arrelano-Bond test did not reject the hypothesis of the AR(2) process in the residuals.

8.3.2 The Arrelano-Bover estimator

When we tried to estimate the same model with the Arrelano and Bover estimator, we received very similar results as it is shown in Table 24. The measure of fit still remains at very low level, yet standard errors and the significance of regressors is a bit more favorable than in the previous model.

8.3.3 Corrected LSDV estimator

Finally, we estimated the EU 20 model based on the corrected LSDV estimator.

The results shown in Table 25 confirm the findings from our previous models: the corrected LSDV estimator seemed to be the best choice for our model with its measure fit being the highest of all three indicators. Still, the value of 0.13 gives us an idea that the overall accuracy of this model may be questioned.

Table 24: Arrelano-Bover, EU 20, final model

Group variable	country1
Time variable	year
No. of instruments	26
F(4, 21)	11.61
Prob > F	0.00

Variable	Coef.	Std.Error	t	P>|t|
gdpgrowthL1.	-0.13	0.12	-1.14	0.27
prcf	0.17	0.04	4.38	0.00
prdebt	-0.03	0.01	-3.51	0.00
unemp	0.65	0.16	3.99	0.00
Arellano-Bond test for AR(1):	z = -2.37	Pr > z = 0.02		
Arellano-Bond test for AR(2):	z = -1.41	Pr > z = 0.16		
Sargan test of overid. restrictions:	chi2(22) = 107.06	Prob > chi2 = 0.00		
Hansen test of overid. restrictions:	chi2(22) = 18.86	Prob > chi2 = 0.65		
Measure of fit	0.05			

Source: author´s estimations

Table 25: Corrected LSDV, EU 20, final model

Variable	Coef.	Std.Error	z	P>|z|
gdpgrowthL1.	-0.04	0.06	-0.60	0.55
ulc	-0.10	0.04	-2.55	0.01
prcf	0.05	0.02	2.19	0.03
prdebt	-0.06	0.01	-6.37	0.00
Measure of fit	0.13			

Source: author´s estimations

9 Summary

In this study we present the analysis of scoreboard indicators for measuring macroeconomic imbalances created by the European Commission in February 2012. Our main aim was to examine if they are able to catch or predict such imbalances and thus be an effective tool for enhancing economic governance the of ECB within the EU. To our best knowledge, such analysis has not been conducted yet since the indicators belong to the newest measures adopted by the Commission and thus no analyses regarding this topic on the aggregate level have been introduced so far. In fact, the only analysis of the indicators was made by Knedlik (2012) who examined if the threshold levels were set at reasonable levels.

For the purposes of our analysis, we used data from the Eurostat database for nine out of ten indicators (the indicator measuring house prices was dropped due to its low number of observations). In order to examine if the indicators are an appropriate tool for assessing a country's macroeconomic stability, we used the real GDP growth per capita as a proxy for such stability. This idea was also supported by the literature pertaining this phenomenon.

Our dataset consists of annual data from the 1997-2011 period. It would certainly be worth performing the analysis on a longer time interval, but this was unfortunately not possible due to the unavailability of a longer period. Then, we obtained data regarding 27 EU countries and divided them into three groups in order to run three different basic models:

- model with level dependent variable and data from EU 15 countries
- model with level dependent variable and data from EU 12 countries
- model with shifted dependent variable and data from EU 20 countries

The first two models were adopted to see if there is a significant difference in indicators´ ability to catch macroeconomic imbalances in Old Member countries and in New Member countries, as those two groups differ in many characteristics due to their divergent economic conditions, as we shown in our description analysis.

The third model was applied in order to see if the indicators can explain the GDP growth shifted half a year forward, in other words, if they are able to predict changes in a country's macroeconomic stability. We used only a limited number of 20 countries due to the lack of data regarding other countries. Otherwise it would be possible to conduct a research on all European countries.

In our analysis we applied a dynamic panel data approach. This approach was chosen for several reasons – firstly, as we assume the GDP growth being a dynamic process, the classical panel data estimators would be inconsistent. Secondly, our dataset suffers from many problems which made the use of classical estimators problematic – unbalancedness, non-stationarity and small sample problems since we have a maximum of 20 panels and 15 time periods.

Fortunately, most of those problems can be solved by using dynamic panel data estimators. So, we adopted three of them: the Arrelano-Bond estimator, the Arrelano-Bover estimator and the LSDV estimator with corrected bias. Thus, together with our three basic models we came to the final number of nine models. The obtained results were relatively ambiguous both in terms of estimator and dataset used, but we can still derive several conclusions common for all of them.

But, first of all we would like to highlight the possible limitations which are necessary to be taken into account when interpreting the results of our analysis.

First, the third model's estimation provides the poorest results of all of our models. The highest measure of fit which it reached was 0.13 in the case of the corrected LSDV estimator. So, this could suggest that the scoreboard indicators are not suitable for predicting changes of the GDP growth. Or, poor results can also be caused by a wrong specification of the model. A further analysis of the shifted dependent variable may provide better results given that six-month shift can be too short or too long to capture the changes of GDP properly.

Second, the corrected LSDV estimator proved to be the most suitable one for all small-sample unbalanced data. Thus, we can assess its results as being the most trustworthy.

Next, in all of our models we found a very large amount of insignificant variables. A naive conclusion from that would be that some indicators are redundant and thus their inclusion in the scoreboard would be a subject of further consideration. However, regarding the problems from which our data suffers and poor results of some estimators we do not feel entitled to make such strong conclusions. Still, we realize that since there was no such analysis conducted regarding the indicators data, we can hope that our conclusions will be perceived as inspiring at least and we believe that they can serve as a basis for further analysing.

So, bearing the aforementioned limitations in mind, we can observe following common conclusions:

- 3-year average of current account balance, percentage change in export market shares and general government debt are the least significant variables in our models suggesting they do not explain or predict the GDP growth well
- on the other hand, 3-year average rate of unemployment and a percentage change of unit labour costs play an important role in six (five, respectively) out of our nine models
- But the most significant indicator seems to be the private sector credit flow, which is presented in seven out of nine models
- Generally, the most convincing results were achieved in the EU 12 group, in which the corrected LSDV estimator reached 47% measure of fit. In this group, the the most significant variables appeared to be the 3-year average of current account balance and unemployment rate

We would like to mention that the most important conclusion in our opinion is that it indeed does matter, which dataset we choose. The results are significantly different for EU 15 and EU 12 group suggesting that while in Old Member countries, the growth of GDP is influenced mainly by the nominal unit labour cost and private debt, in New Member countries the unemployment rate and current account balance are those which matter.

These results are robust regardless which estimator we chose. That complies with the descriptive analysis described in the previous section of our study: In the EU 12 group, the average unemployment rate reaches on average much higher values than in EU 15 and its levels diverge in much larger scale between individual countries which can contribute to overall macroeconomic imbalances. Similarly, the Old Member countries experienced much higher levels of private debt and its sharp decline with the outbreak of the crisis that contributed to the overall enlargement of imbalances and led to subsequent fiscal crises in several southern countries, as mentioned previously.

However, when interpreting the results we must not forget that our analysis was made on panel data involving many countries with different economic conditions and policies. It is more than likely that similar analysis performed on the level of individual states would provide different results. However, the thresholds for the indicators were set at the same level for all countries with one exception – the difference in some thresholds for Eurozone and non-Eurozone countries. Therefore, we believe that our analysis is comprehensible when it comes to the aggregate level as well.

Finally, we have to mention a possible lower explanatory power of our conclusions due to the coherence of macroeconomic imbalances throughout the whole economy. Even though the scoreboard indicators were created to measure them, reality has proved that in some cases, it is exactly the presence of imbalances which boosts the economic growth. China can be considered to be a shining example, a showcase of such a situation – despite its large expenditure and external imbalances, it employed several liberalizing measures to boost the purchasing power of its population and continued to grow on average by about 10% per year in pre-crisis years (Knight & Wang, 2011).

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Appendix

A. Summary of Formulas for Computing the Indicators

Picture 3: Scoreboard indicator formulas

Indicators	Formulas for data transformation
3 year backward moving average of CURRENT ACCOUNT BALANCE as a % of GDP	$\frac{\left(\frac{CA}{GDP}\right)_t + \left(\frac{CA}{GDP}\right)_{t-1} + \left(\frac{CA}{GDP}\right)_{t-2}}{3} * 100$
NET INTERNATIONAL INVESTMENT POSITION as a % of GDP	$\frac{NIIP_t}{GDP_t} * 100$
% change (3 years) of REAL EFFECTIVE EXCHANGE RATE with HICP deflators relative to 35 other industrial countries (a)	$\frac{(REER\_HICP\_35)_t - (REER\_HICP\_35)_{t-3}}{(REER\_HICP\_35)_{t-3}} * 100$
% change (5 years) in EXPORT MARKET SHARES	$\frac{\left(\frac{EXP_c}{EXP_{world}}\right)_t - \left(\frac{EXP_c}{EXP_{world}}\right)_{t-5}}{\left(\frac{EXP_c}{EXP_{world}}\right)_{t-5}} * 100$
% change (3 years) in NOMINAL UNIT LABOUR COST (b)	$\frac{(ULC)_t - (ULC)_{t-3}}{(ULC)_{t-3}} * 100$
y-o-y % change in DEFLATED HOUSE PRICES (c)	$\left(\frac{\frac{HPI_t}{DEFL_t} - \frac{HPI_{t-1}}{DEFL_{t-1}}}{\frac{HPI_{t-1}}{DEFL_{t-1}}}\right) * 100$
PRIVATE SECTOR CREDIT FLOW as % of GDP (d), (e)	$\frac{PSCF_t}{GDP_t} * 100$
PRIVATE SECTOR DEBT as % of GDP (d), (e)	$\frac{PSD_t}{GDP_t} * 100$
GENERAL GOVERNMENT DEBT as % of GDP	$\frac{GGD_t}{GDP_t} * 100$
3 year backward moving average of UNEMPLOYMENT RATE	$\frac{(UR)_t + (UR)_{t-1} + (UR)_{t-2}}{3}$

Source: European Commission (2011b)

B. Summary of Additional Indicators

Table 26: Summary of additional indicators

Gross domestic expenditure on R and D as % GDP	Net lending / borrowing vs. ROW as % GDP,	FDI Inflows as % GDP
% Change (3 years) in REER vs. EA (17)	% y-o-y growth of Labour Productivity	% change (10 years) in Nominal ULC
% change (3 years) in Nominal House Prices	Private Sector Debt as % GDP, consolidated data	% Change in Deposits over total financial liabilities, NCO data
Current Account balance as % of GDP, BoP data	Net external debt as % GDP	Net Trade Balance of energy products as % GDP
% y-o-y change in Export Market Shares, volumes	% y-o-y growth of Employment	% change (10 years) in Effective ULC vs. EA (17)
Residential Construction as % GDP	% y-o-y change in Financial Liabilities of the whole financial sector, NCO data	Current account, % GDP NA
	% y-o-y change in Private Sector Debt as % GDP	

Source: European Commission (2012a)

C. Results of the Basic Models for EU 15 and EU 20

Table 27: Arrelano-Bond, EU 12, basic model

Group variable	country1
Time variable	year
No. of instruments	11
F(10, 12)	19.43
Prob > F	0.00

Variable	Coef.	Std. Err.	t	P>|t|
gdp growth L1.	-0.36	0.83	-0.43	0.67
ca	-0.80	1.81	-0.44	0.67
niip	-1.00	1.06	-0.94	0.36
reer	0.18	0.49	0.38	0.71
exshares	-0.01	0.18	-0.08	0.94
ulc	0.15	0.79	0.19	0.86
prcf	0.13	0.95	0.14	0.89
prdebt	-0.43	0.65	-0.65	0.53
govdebt	-0.74	2.58	-0.29	0.78
unemp	4.32	13.13	0.33	0.75
Arellano-Bond test for AR(1)	z = 0.42	Pr > z = 0.673		
Arellano-Bond test for AR(2)	z = -1.01	Pr > z = 0.310		
Sargan test of overid. restrictions:	chi2(1) = 0.36	Prob > chi2 = 0.546		
Hansen test of overid. restrictions:	chi2(1) = 0.38	Prob > chi2 = 0.540		
Measure of fit	0.11			

Source: author's computations

Table 28: Arrelano-Bover, EU 12, basic model

Group variable	country1
Time variable	year
No. of instruments	12
F(9, 12)	180.46
Prob > F	0.00

Variable	Coef.	Std.Error	t	P>|t|
gdpgrowthL1.	-0.30	0.56	-0.53	0.60
ca	-0.75	0.99	-0.76	0.46
niip	0.04	0.09	0.41	0.69
reer	-0.27	0.67	-0.40	0.69
exshares	0.04	0.22	0.20	0.85
prcf	0.18	0.90	0.21	0.84
prdebt	-0.04	0.05	-0.83	0.42
govdebt	0.07	0.18	0.40	0.69
unemp	0.50	0.46	1.10	0.29
Arellano-Bond test for AR(1):	z = -0.39	Pr > z = 0.70		
Arellano-Bond test for AR(2):	z = -0.52	Pr > z = 0.60		
Sargan test of overid. restrictions	chi2(3) = 2.88	Prob > chi2 = 0.41		
Hansen test of overid. restrictions	chi2(3) = 2.05	Prob > chi2 = 0.56		
Measure of fit	0.41			

Source: author's computations

Table 29: Corrected LSDV estimator, EU 12, basic model

Variable	Coef.	Std.Error	z	P>|z|
gdpgrowthL1.	-0.09	0.09	-0.94	0.35
ca	-0.29	0.15	-1.96	0.05
niip	0.00	0.05	-0.10	0.92
reer	-0.14	0.04	-3.23	0.00
exshares	0.02	0.03	0.75	0.45
ulc	-0.03	0.03	-0.85	0.39
prcf	0.13	0.07	1.77	0.08
prdebt	-0.06	0.03	-2.13	0.03
govdebt	-0.07	0.07	-1.02	0.31
unemp	0.36	0.26	1.39	0.17
Measure of fit	0.50			

Source: author's computations

Table 30: Arrelano-Bond, EU 20, basic model

Group variable	country1
Time variable	year
No. of instruments	11
F(10, 21)	0.55
Prob > F	0.83

Variable	Coef.	Std.Error	t	P>|t|
gdpgrowthL1.	0.55	1.38	0.40	0.69
ca	7.95	12.42	0.64	0.53
niip	-0.03	1.53	-0.02	0.99
reer	0.10	0.65	0.15	0.88
exshares	-0.12	0.34	-0.34	0.74
ulc	-1.13	4.77	-0.24	0.82
prcf	0.83	1.93	0.43	0.67
prdebt	-0.21	1.21	-0.17	0.86
govdebt	0.72	3.90	0.18	0.86
unemp	-10.69	51.23	-0.21	0.84
Arellano-Bond test for AR(1):	z = -0.61	Pr > z = 0.54		
Arellano-Bond test for AR(2):	z = 0.39	Pr > z = 0.69		
Sargan test of overid. restrictions:	chi2(1) = 0.08	Prob > chi2 = 0.78		
Hansen test of overid. restrictions:	chi2(1) = 0.20	Prob > chi2 = 0.66		
Measure of fit	0.03			

Source: author's computations

Table 31: Arrelano-Bover, EU 20, basic model

Group variable	country1
Time variable	year
No. of instruments	23
F(10, 21)	4.62
Prob > F	0.00

Variable	Coef.	Std.Error	t	P>|t|
gdpgrowthL1.	-0.03	0.25	-0.10	0.92
ca	0.76	0.47	1.59	0.13
niip	-0.03	0.03	-0.81	0.43
reer	-0.01	0.18	-0.06	0.95
exshares	0.03	0.08	0.34	0.74
ulc	0.03	0.16	0.20	0.85
prcf	0.22	0.10	2.21	0.04
prdebt	-0.03	0.01	-2.20	0.04
govdebt	-0.01	0.07	-0.12	0.90
unemp	0.56	0.62	0.90	0.38
Arellano-Bond test for AR(1):	z = -1.61	Pr > z = 0.11		
Arellano-Bond test for AR(2):	z = -0.18	Pr > z = 0.85		
Sargan test of overid. restrictions:	chi2(13) = 43.66	Prob > chi2 = 0.00		
Hansen test of overid. restrictions:	chi2(13) = 15.08	Prob > chi2 = 0.30		
Measure of fit	0.01			

Source: author's computations

Table 32: Corrected LSDV, EU 20, basic model

Variable	Coef.	Std.Error	z	P>|z|
gdpgrowthL1.	-0.06	0.08	-0.72	0.47
ca	0.03	0.13	0.23	0.82
niip	0.02	0.02	1.38	0.17
reer	-0.01	0.06	-0.24	0.81
exshares	0.04	0.03	1.68	0.09
ulc	-0.10	0.07	-1.40	0.16
prcf	0.05	0.02	1.87	0.06
prdebt	-0.04	0.01	-2.74	0.01
govdebt	0.01	0.03	0.37	0.71
unemp	0.12	0.19	0.67	0.50
Measure of fit	0.17			

Source: author's computations