

BANKING SECTORS IN EMU - CLUSTER ANALYSIS

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Abstract

European monetary union (EMU) has been already in the second decade of its existence. We observe that the euro area is heterogeneous and few imbalances occurred during previous years. The most discussed imbalances are connected with different macroeconomic development of member countries and divergent participation in trade and capital flows. The different economic development should be reflected also in banking sectors of individual member countries. Gradual adopting of euro led to creation of one big European bank market which uses in transactions one currency euro, but still we can find a lot of differences between individual banking systems of member countries which are also results of previous development. A lot of new regulation has been prepared and implemented for all banks in euro area after 2008, moreover in connection with banking union project. The main aim of this paper is to deal with individual banking sectors across euro area - find out if banking sectors are similar and to find possible clusters among them.

Keywords: Banks, banking sector, euro, imbalances, cluster analysis

Introduction

Set of European countries has been using euro as its own currency more than fifteen years and volume of discussions about advantages and possible threats of adopting single European currency and EMU as whole is really huge. Adoption of single European currency represents for a country one of the most important steps in integration. Creation and gradual adoption of euro we can evaluate as successful. Euro eliminated exchange rate risk and transactional costs, what is positive. This advantage helped to boost trade and capital flows between countries in following years. We did not observe any serious problems until 2008, when financial crisis spread through world financial markets with all negative aspects and debate about future existence of euro area started. Economic data which included period

2002-2007 showed divergent development of countries using euro as currency in various areas. Firstly it was difference in performance of main macroeconomic indicators, although previous assumption, that fulfilling Maastricht nominal convergence criteria⁸² will automatically ensure next convergence of macro variables (e.g. rate of inflation, nominal interest rates, etc.).

If we assume macroeconomic development influences banks in an individual country of euro area and previous development was asymmetric, it should be also reflected in individual banking sector and its indicators. The main aim of this paper is to find out if banking sectors in euro area are similar and try to find clusters among them. We will also try to prove hypothesis banking sector clusters copy previous imbalances in Europe, it means we observe two groups of countries (core and periphery). Statistical method of cluster analysis will be used to fulfil all mentioned aims in this paper.

Literature overview

However opposite scenario become truth and economists gradually pointed out on significant differences in main macroeconomic variables. Dullien and Fritsche (2006) compared relative unit labor cost developments in the countries of euro area and emphasized that few countries (namely Germany, Spain, Portugal, Italy) experienced unusual development. Mentioned countries except Germany suffered from the most serious economic problems after 2008. Authors also with reference to Lane (2006) saw possible reasons of divergences in absence of national monetary policy, which can amplify the national business cycle and overvalue national real exchange rate. Complementary reason could be slow reaction of single country to changes in aggregate or labor demand.

Mathieu and Sterdyniak (2007) dealt with other disparities in EMU (unemployment, inflation, external position, etc.) and discuss possible ways how to solve them. Estrada, GalínadLópez-Salido (2012) conclude that period 1999-2008 was associated with a strong convergence in unemployment rates across EMU but uncovered persistent inflation differentials at least until 2007. Cuestas, Monfort and Ordóñez (2012) examined real convergence in GDP per worker in the EU member states with using cluster analysis. These authors found strong disparities within the EU (also inside euro area) and found two possible “clubs” of countries and advised deep structural reforms to increase the level of convergence. Cluster analysis focused on current account and other macroeconomic disparities

⁸²Which are based on Article 140 (ex Article 121.1) of the Treaty on the functioning of the European Union.

was used in Pivonka and Loster (2013) and authors see inside EMU five clusters.

New dimension of imbalance was fully uncovered by German economists few years ago. Sinn and Wollmershaeuser (2011) showed disparities (huge volume of cumulated debt and claims of selected EMU central banks) in TARGET2, which is payment system used in euro area. In simplified point of view, they see two groups of countries – creditor (e.g. Germany, Netherlands and Finland) and debtor countries (e.g. PIGS⁸³ countries, France, Austria). However first considerations about problems associated with TARGET we can find in Garber (1999).

Banking sectors in EMU

Banks play significant role in every economy and their good performance is important for future financial stability and growth. In this article we will assume previous economic development and transactions influence banking sector indicators and their results. However it can be also in opposite way. Activity of banks can also significantly influence economy itself (for example increased lending in times of low interest rates should lead to higher GDP growth). That's way banking sector is deeply regulated and serves as one of transmission mechanism of European central bank (ECB) monetary policy.

Research is also dealing with bank issues in euro area, mainly after financial crisis. Final report of expert group chaired by Liikanen (2012) analyzed widely banking sectors in EU and proposed set of regulatory rules to lower future probability of problems in banks. De Santis and Surico (2013) dealt with transmission mechanism of monetary policy in EMU and discovered different impact of change in monetary policy of ECB on banks which depended on individual country and type of a bank.

Banking sectors and individual banks, in EMU are heterogeneous. We can state continental Europe is using mostly model of universal banking, which main business model is to accept deposits and provide credits. There are many possible channels how macroeconomic development can influence performance of banks. Theoretically, if macro conditions are different in individual countries, banks should have different characteristics and we should observe groups of banking sectors.

Let's try to briefly discuss and describe how macro environment and imbalances connected with balance of payments can affect banks and their business. In period of fast real GDP growth which is connected with decreasing unemployment rate, risk premium and interest rates (IR) fall which support demand for credits. Banks provide more credits but they have

⁸³Here stands for Portugal, Italy, Greece and Spain.

to find new sources for its financing and that's way they issue debt securities and take credit from other banks. This dependence can be written down as follows:

$$\uparrow GDP + \downarrow unemployment \rightarrow \downarrow IR + \uparrow credits + \uparrow debt securities issued + \downarrow client deposits share$$

On the other hand, in time of rising unemployment and recession, when risk and premium for it is rising (e.g. measured on ten years government bond yield) we should see contraction or stagnation of bank's balance sheets. The process results in decrease of new provided credits into real economy and increase of non-performing loans (NPL), which makes pressure on bank's capital (measured e.g. by Tier1 ratio) and profitability (measured e.g. by ROE ratio). This dependence can be written down as follows:

$$\uparrow unempl. + \downarrow GDP + \uparrow 10Yield \rightarrow \downarrow balance sheets + \downarrow credits + \uparrow NPL + \downarrow Tier1 + \downarrow ROE$$

If we turn attention to disparities associated with balance of payment, we see in EMU countries with permanent current account (CA) deficits and negative position to payment system TARGET2. At this situation a country is transferring money abroad as a payment for imported goods and services. Banks are facing outflow of deposits which can deteriorate their liquidity position and solution can be credit from central bank. This dependence can be written down as follows:

$$\downarrow TARGET position + \downarrow CA balance \rightarrow \downarrow deposits + \downarrow liquidity + \uparrow liability to central banks$$

All above mentioned dependences have impact on banks position and indicators. We can find two reasons at least why to seriously observe development and aggregate indicators of banking sectors in EMU member countries. The first is connected with monetary policy and its effects. In practice assumed effects of rising interest rates by ECB should be different between banks which lent significant volume of its assets financed by funding on interbank market and banks which rely primarily on client's deposits and their credit policy is moderate.

The second moment, why to look at banking sectors and perceive differences among them is regulation, mainly regulation which is prepared and implemented, currently CRD IV and CRR (as result of BASEL III concept). The new sets of regulatory rules consists also of capital, liquidity and leverage areas and will be compulsory for all banks. However we can see big differences in level of capital and liquidity reserves across banks in euro area what can cause problems in future to maintain new regulatory rules.

Inputs to cluster analysis

We analyze EMU banking sectors in three years. The first year is 2002 which is year, when euro started to be used also for cash transactions inside euro area. As ECB in annual report stated, year 2002 was full of uncertainties and weak economic conditions. At this time EMU had twelve⁸⁴ members and they will be subject of next calculations and analysis. The second observed year is 2007, when EMU adopted Slovenia as new member country and which is period before spread of financial crisis. Due to ECB, year 2007 can be characterized as period of sound economic growth with monetary and credit expansion. These characteristics are also valid for previous years. The third and last year for our cluster analysis is year 2012 which makes period of ten years and we will try to find out how various disparities changed clusters. Period before 2012 represents probably the most difficult stage of European integration, when countries solved problems connected with financial and debt crisis.

We will use set of various indicators for clustering banking sectors in EMU and in general we can divide them into two categories:

Macroeconomic variables

By using basic macroeconomic indicators as inputs, we are consistent with previously stated hypothesis, that banking sectors are sensitive to economic development. Surroundings, in which banks do their business, can be characterized by indicators connected with balance of payments, economic output or price level growth. In our analysis we work with these macroeconomic variables:

Current account balance/GDP ratio ($v1^{85}$), TARGET2 balance/GDP ratio ($v2$), GDP real growth ($v3$), inflation rate ($v4$), unemployment rate ($v5$), ten year government bond yields ($v6$).

All mentioned variables of individual countries are expressed as ratio or percentage.

Banking indicators

Use of indicators describing position of banks in given countries, is essential for construction of banking clusters. We will use more inputs, which describe banks and the whole market, than inputs connected with macroeconomic surroundings. All variables are calculated to ends of observed years.

Bank balance sheet amount per capita in mil. EUR ($v7$), amount of credits to non-financial institutions/nominal GDP ratio ($v8$), lending interest

⁸⁴Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain.

⁸⁵ Number of variable (designation).

rates for house purchase (v9), non-performing loans/gross loans ratio (v10), amount of purchased shares and other equities/total assets ratio (v11), amount of deposits/total assets ratio (v12), amount of debt securities issued/total assets ratio (v13). If not mentioned, all variables above are expressed as ratio or percentage. Variable average annual credit growth in previous five years (v14) is used for years 2007 and 2012. Following variables are in addition used for cluster analysis only in 2012 year: Tier 1 capital ratio (v16), bank liquid reserves/total assets ratio (v18) and number of supervisory and regulatory bodies (v19). Data sources for mentioned variables are statistics published by ECB, European commission, Federal Reserve System (Fed) and Bank for international settlements (BIS).

We use software IBM SPSS for our analysis, especially hierarchical cluster analysis. Chosen cluster method is Ward's method using square Euclian distance. Very simply, Ward's method is based on minimization of variance, especially within cluster variance. More about cluster analysis in e.g. Murtagh and Legendre (2011).

Results of cluster analysis

Firstly let's discuss number of clusters which we can find inside EMU. After using above mentioned method of cluster analysis, two main clusters are offered by our software in each year as optimal solution. Euro area can be divided into two blocs. Distribution of banking sectors of EMU members to clusters in 2002 is illustrated in Tab. 1. Majority of countries is in Cluster 1, which is dominating, and Cluster 2 is small and formed only by three countries from south wing of euro area. Cluster 1 member countries are characterized by better macroeconomic indicators, we can state they are reaching internal and external stability (current account surpluses, lower inflation plus unemployment rate and government bond yields). Banking sectors from this cluster were more important (measured by bank assets per capita), had higher level of provided credits into real economy and lower volume of purchased securities in comparison to banking sectors from countries, which belong to Cluster 2.

Table 1: Banking sector clusters in 2002

	Cluster 1	Cluster 2
Members	France, Germany, Italy; Austria, Netherlands; Ireland; Belgium, Finland; Luxembourg	Greece, Spain, Portugal

Source: own calculations

For 2007, the distribution of countries and their banking sectors remains unchanged to situation from 2002. Macroeconomic parameters of countries in Cluster 1 remain unchanged with one big exception. Countries from Cluster 2 have significant current account deficits (more than 10 % of GDP) and negative positions to payment system TARGET2. Data about

credit growth (used as input v14) show significant general credit expansion across EMU in previous five years (except Germany) with the highest intensity in countries such as Greece, Spain and Ireland. As result, outstanding amount of credits in banks from Cluster 2 countries increased (credit expansion). However nonperforming loans ratio remained on low levels across observed countries.

Table 2: Banking sector clusters in 2007

	Cluster 1	Cluster 2
Members	France, Germany, Italy; Austria, Netherlands; Ireland; Belgium, Finland; Luxembourg	Greece, Spain, Portugal

Source: own calculations

In 2012 (Tab 3.), after ten years functioning of euro zone with cash money, we can see inside EMU banking sectors two clusters again. Cluster 1 is bigger and consists of “core” countries which did not experienced any economic difficulties after 2008 (e.g. Germany, Finland) or solved problems in banking sector without important external help (e.g. without IMF help or EFSF⁸⁶). Cluster 2 is created by the same countries as in 2002 in addition with Ireland and Italy. Better economic performance of countries from Cluster 1 obviously influenced also their banking sectors, which differed from those from Cluster 2. Banks from countries belonging to Cluster 1 had significantly lower share of nonperforming loans. These banks had also higher level of capital and liquid assets. It is obvious that macroeconomic and balance of payment disparities divided also banking sectors across euro area.

All of countries in Cluster 2 faced serious problems after 2008 in their financial sectors but causes are different. Ireland and Spain passed through great credit growth until 2007 (average annual credit growth above 15 %) followed by high GDP growth. After bursting bubble on their real estate markets, banks needed external help. Reason of Greek problems is in public finance and it are excessive deficits which supported economic growth in 2002-2007. Italy and Portugal got under pressure of financial markets mainly because of high public debt and problems with competitiveness which has evidence in current account deficits. Mentioned problems resulted in sharp increase of government bond yields. Portugal accepted emergency funds from EFSF in 2011.

Tab. 3: Banking sector clusters in 2012

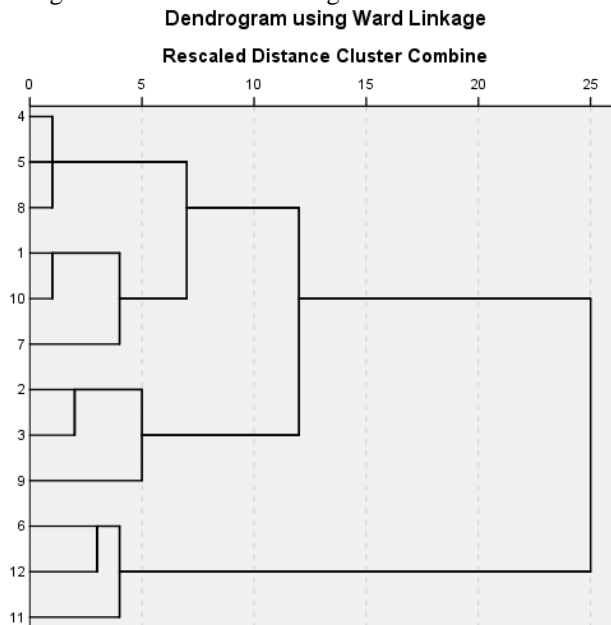
	Cluster 1	Cluster 2
Members	Belgium, France, Austria; Germany, Netherlands, Luxembourg; Finland	Italy, Portugal, Ireland, Spain, Greece

Source: own calculations

⁸⁶IMF = International monetary fund, EFSF = European Financial Stability Facility.

By using dendrogram we can examine individual clusters in more detail and try to find “subclusters” or very similar banking sectors inside them. The biggest countries of EMU (by characteristics of banking sectors) as Germany, France and Italy formed one “subcluster” in 2002. It means they were similar to each other from macroeconomic point of view and also values of banking parameters were close.

Figure 1: Clusters of banking sectors in EMU in 2002



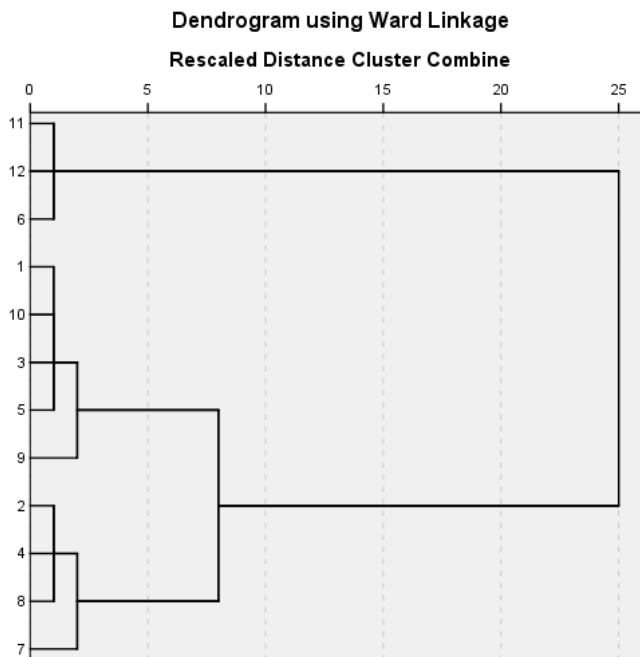
Number for countries (vertical axis): 1- Austria, 2 - Belgium, 3 - Finland, 4 - France, 5 - Germany, 6 - Greece, 7 - Ireland, 8 - Italy, 9 - Luxembourg, 10 - Netherlands, 11 - Portugal, 12 - Spain

Source: own calculations in SPSS

Note: Vertical axis represents individual countries and clusters, horizontal axis shows distance between them.

In dendrogram for 2007 year, we see obvious change in structure of Cluster 1. Whereas in 2002 was Cluster 1 more fragmented and formed by few “subclusters”, in 2007 is Cluster 1 more concentrated with two formations. One consists of banking sectors from countries, which belonged to core countries of EMU and were not significantly hit by problems connected with financial and debt crisis (Germany, Netherlands, Finland, Austria and Luxembourg). Second formation inside Cluster 1 consists of Belgium, France, Italy and Ireland, which were weaker parts of EMU from macroeconomic and situation in banking sector perspectives.

Figure 2: Clusters of banking sectors in EMU in 2007



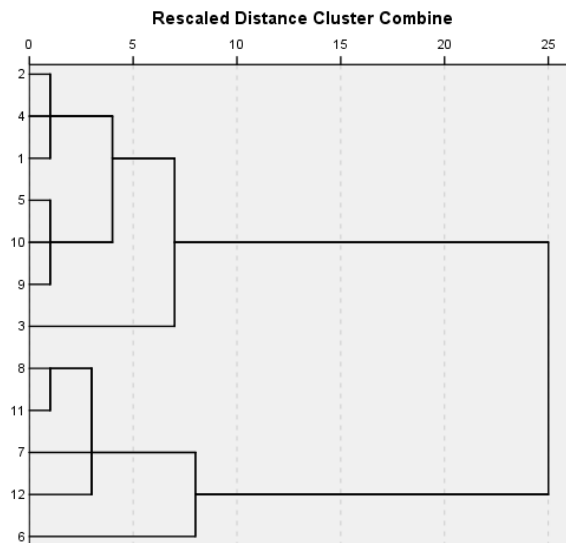
Number for countries (vertical axis): 1- Austria, 2 - Belgium, 3 - Finland, 4 - France, 5 - Germany, 6 - Greece, 7 - Ireland, 8 - Italy, 9 - Luxembourg, 10 - Netherlands, 11 - Portugal, 12 - Spain

Source: own calculations in SPSS

Note: Vertical axis represents individual countries and clusters, horizontal axis shows distance between them.

The number of members in clusters was almost the same in 2012. In dendrogram for year 2007, we observed visible split of few countries from Cluster 1 (“subcluster” formed by Ireland, Italy, Belgium and France). However finally, only two countries and their banking sectors from Cluster 1 moved to Cluster 2 (Ireland, Italy) in 2012. German’s banking sector was in last observed year similar to banks in Netherlands and Luxembourg. In the same year we see inside of each from two main clusters one outlying member. It means that banking sectors in Finland (Cluster 1) and Greece (Cluster 2) had significantly different banking indicators than rest of individual cluster.

Figure 3: Clusters of banking sectors in EMU in 2012
 Dendrogram using Ward Linkage



Number for countries (vertical axis): 1- Austria, 2 - Belgium, 3 - Finland, 4 - France, 5 - Germany, 6 - Greece, 7 - Ireland, 8 - Italy, 9 - Luxembourg, 10 - Netherlands, 11 - Portugal, 12 - Spain

Source: own calculations in SPSS

Note: Vertical axis represents individual countries and clusters, horizontal axis shows distance between them.

As for used variables and their variance, in 2002 we could observe the biggest differences across euro area in level of current account balance, non-performing loans ratio and basic macroeconomic indicators (unemployment, inflation rates, GDP growth). As for 2012 year we can state that imbalances connected with current accounts weakened but some differences deepened and new rose up. Spread in unemployment rates are wider due to unprecedented high unemployment mainly in Greece and Spain and general economic slowdown of some EMU countries. Recession and general economic slowdown caused rise of credit defaults which is reflected in rising non-performing loans ratio. Investors on financial markets reacted on all mentioned problems inside euro area and required significantly higher yield to invest into government bonds of problem countries. This caused great government bond yield variability after 2008 and especially in 2012.

Consolidated banking data from ECB in 2012 shows important discrepancies in key banking sector indicators connected with capital level and liquidity (v16 and v18). Euro area south countries (mainly Greece and Spain) had low levels of this indicators. However banking sectors of Germany, Finland and Luxembourg were well equipped by capital and liquidity assets what emphasizes their financial stability. There were more

variables describing bank markets in countries which could be used as inputs for clustering in 2012, e.g. return on equity (ROE) in a given banking sector (v15) or number of active credit institutions on a given bank market (v17). However they were not used due to their high volatility, which could have negative impact on clustering.

Conclusion

We proved with cluster analysis, that we can divide banking sectors of individual EMU countries. There are two blocks in examined years. Most of countries was in Cluster 1 in 2002. Banking sectors of Germany, France and Italy were similar to each other, measured by used macroeconomic and banking variables. Only a small group of three countries from south of euro area (Greece, Portugal, Spain) was more different and belonged to Cluster 2. Similar situation was in 2007.

After ten years, composition of clusters changed in 2012. Cluster 2 increased number of members by Ireland and Italy, so Cluster 2 consists only of countries and their banking sectors, which suffered from serious problems after 2008 and mostly had to use external financial help. Banking sector of Germany was especially similar to sectors in Netherlands and Luxembourg. Special positions inside it's clusters have Finland and Greece, which were outside any "subclusters". We can conclude that in 2002 banking sectors across EMU were comparatively more homogenous than 2012, when number of members in Cluster 2 increased. Banking sectors copy imbalances during period 2002-2012 and we can divide them also on two groups, as those from "core countries" and "periphery countries", which is used also in speaking about European monetary union disparities.

Examining mentioned variables, in 2002 the biggest variance was in current account balances and macro indicators such as unemployment rate, GDP growth and non-performing loans ratio in banking sectors. Disparity in current account was comparatively better, but some variances got worsen in 2012. In addition difference in amount of capital and liquid assets was significant across banks in euro area.

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