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Eurozone stock returns co-movement: Some findings for portfolio managers and central bankers

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In this paper we assess the level of country risk vs industry risk for the Eurozone national stock markets and the measure of *dispersion* is used to deliver the desired estimates. We find a significant and permanent increase in the level of country risk since the beginning of the recent global financial crisis. This conclusion may be important both for portfolio managers and monetary policymakers.

JEL Classifications: E50; F30; G11

Keywords: Diversification gains, EMU.

Introduction

Don't put all your eggs in one basket is an old maxim known to all students of finance and economics. In the contemporary reality of financial markets this statement needs to be reconsidered once again. Besides traditional intra-country diversification, liberalization of cross-border capital flows has enabled portfolio managers to exploit also the gains of risk reduction from the international assets allocation. That's why in a practice of global portfolio management the process of stocks selection is a two-stage, where at the one stage an industry has to be selected, in the other the decision on geographic location of investment needs to be made. The question about the relative importance of cross-country and cross-industrial diversification seems to be in this case a natural one.

The problem of diversification priorities may also be appealing not only from the point of view of the portfolio managers. We believe that also monetary policymakers may have an interest in a deeper understanding of stock markets co-movement. That's why we decided to focus on the Eurozone stock markets.

Financial markets are crucial for a successful monetary transmission process and monetary policy in the Eurozone should not induce asymmetric reactions of the local economies to the common monetary shocks. That is the necessary condition due to the Optimum Currency Area (OCA) theory. In the common currency area smooth transmission is possible only when the short- and long-term interest rates are highly cross-country correlated. Many empirical studies confirm that money and bonds markets in the Eurozone exhibit a fair degree of integration (e.g. Baele et al., 2004; Jappelli and Pagano, 2008)

To a lesser extent a high correlation of stock returns across local markets may also be beneficial for European Central Bank (ECB) policy. Besides operating via interest rate channel, stock prices play also some role in a monetary transmission process. Altissimio *et al.* (2005) list four channels through which stock prices can be considered to affect activity: (1) the wealth effect on consumption, (2) the Tobin's Q effect on investment, (3) the balance sheet effect on private spending (via the credit channel) and (4) the confidence effect on private spending. However, in the case of Eurozne, the empirical studies do not find equity channels to be significant in the overall transmission process which is still mostly determined by an interest rate channel (Melbourne and Salomons, 2003; European

Central Bank, 2010). On the other hand, stock market perfomance may also be interesiting from the point of view of ECB, because equity prices may be useful in forecasting output fluctuations (Henry et al., 2003). The identified convergence or divergence of the stock market cycles may deliver additional conclusions for the monetary policymaking process in the Eurozone.

In this paper we would like to investigate the degree of stock markets integration across Euro Area countries by verifying the significance of the international and sector diversification. Following the definition by Jappelli and Pagano (2008), financial markets are integrated if the law of one price holds. In other words, under full integration the assets that represent the same level of common risk (e.g. industry risk) should be priced the same in every country, cause the country-specific risks are diversified away, hence they are not priced. From practical point of view, when stock markets are highly integrated, the sector diversification strategy should dominate the assets allocation decisions giving the opportunity to higher risk reduction than the country diversification paradigm.

The contribution to the existing literature would be twofold. Firstly, we believe that the empirical results in this area needs to be updated due to the recent global financial turbulences. Secondly, we would like to make a deeper insight into the intra-industry country returns co-movement. This part should be useful particularly for portfolio managers because it indicates branches that require (or do not) significant cross-country diversification.

Literature review

As Baele et al. (2004) point out, the literature on stock markets integration can be classified into three broad categories. The first group of papers present the findings that are based on the estimations of some asset pricing models (APM). The second group of studies draw the conclusions that are based on the assessment of the relative importance of country and sector effects in the variation of stock returns. The third group of studies analyses quantity-based indicators instead of price based indicators. In this case the attention is focused on the composition of the mutual funds portfolios to identify the equity *home bias* (i.e. a preference for domestic assets). The process of disappearing the bias may be interpreted as an improvement in market integration. As the data on portfolio composition are relatively difficult to collect, in this study we will discuss the papers representing only the first and second group.

Bekaert and Harvey (1995) propose a model that allows for differing prices of variance risk across countries which depends on country-specific information and a world price of covariance risk which depends on global information. What is especially worth to underline this methodology enables also for the changing degree of market integration through time. The measure of integration is therefore a time-varying weight of the two mentioned components. Bekaert and Harvey (1995) show their model may be then employed to assess the effects of policy shifts (e.g. changes in capital controls) on the level of markets integration. Verifying twelve countries, they do not find a strong evidence that removing restriction led to higher integration in the nineties.

Korajczyk (1996) verifies also a significance of barriers to capital flows in the process of markets integration. He decides to utilize the international arbitrage pricing theory. The advantage of this approach is that the effective not statutory barriers to capital flows, regardless of their source, explain returns deviations from the law of one price. Korajczyk (1996) examines twenty four national stock markets (four developed and twenty emerging markets) and his findings are in line with a theoretical reasoning. Emerging markets were found to be less integrated due to larger capital restrictions. However, the measure tended to decrease over time as these restrictions were gradually relaxed.

Emiris (2002) examines whether the convergence of European economies towards economic and monetary union has lead to integration of European stock market. The Klatent dynamic factor model is used in the study. Under this dynamic approach conditional expected returns vary through time because common factor risk premia are time-varying. The results of the study show the strongest improvement of integration in the case of the smallest markets (Belgium, Spain and Finland).

Heston, Rouwenhorst (1995) and Rouwenhorst (1998) estimate the model with the industry and country effects. They find Western European stock markets returns to be dominated by country effects in every sub-period (1993-1998:8 was the last sub-period). This result is somewhat surprising in the context of economic policies harmonization following the Maastricht Treaty of 1992.

In the later study Brooks and Del Negro (2002) estimate the similar model on a sample of 10,000 companies in 42 countries from 1985 to 2002. Concluding that from the late nineties the industry effects started to dominate the country effects, they confirm the results of Baca et al. (2000) and Cavaglia et al. (2000). Another finding of Brooks and Del Negro (2002) is that country-specific shocks play a smaller role in explaining equities returns of the companies that are diversified internationally, as measured by the international component of their sales, assets and operating income.

Hypotheses

To study the stock markets integration across the Eurozone we decided to verify the following hypotheses:

H1: The diversification potential of cross-country and cross-industry assets allocation varies through time.

H2: The recent financial crisis caused a significant increase of the country risk.

H3: The level of country-risk that is carried by different industries is not equal and it fluctuates through time.

Research method

In this paper we adopt the method proposed by Roulet and Solnik (2000). They measure stock markets co-movement as the *dispersion* of returns on the various markets for any observation period. The dispersion for *t*-moment for N-markets is simply calculated as the standard deviation of national market indices returns:

$$dispersion = \sum_{n=1}^{N} \sqrt{\frac{(x_{nt} - \bar{x}_t)^2}{N}}, \qquad (1)$$

where, x_{nt} is the return for the Eurozone *n*-th country stock market index for the *t*-moment, $\bar{x}_t$ is the cross-country average rate of return for the *t*-moment. It is definitely cross-sectional approach rather than time-series one.

The reasoning for using this method to measure market integration is straightforward: if markets are highly integrated their country indices returns should drift together, cause the relative importance of common vs country-specific factors should increase. Therefore, market integration should be characterized by a low value of market dispersion measure. We should also stress that dispersion is inversely related to global correlation. Lower correlation *ceteris paribus* means higher potential of risk reduction through a diversification process. Hence, the gains from cross-country and cross-industry diversification can be assessed by estimating cross-country and cross-industry dispersion. The higher value of dispersion, the lower correlation and the higher diversification potential. In this way the H1 and H2 will be verified. The findings of this part will be discussed mostly in the context of market integration and ECB monetary policymaking process.

Testing the first two hypotheses we receive only a general outlook on the importance of country and industry diversification. However, it is reasonable to presume that the industries differ in the level of country specific risk. For example, branches that produce tradables should be more resistant to country specific shocks. To identify country diversification potential within a single sector (H3) we will estimate dispersion for the national indices returns for a specified industry. The obtained results should be essentially useful for portfolio managers, indicating branches that require significant cross-country diversification.

To complete the description of the research method we would like also to list the strengths and weaknesses of the *dispersion* measure. Let's start from the advantages.

Dispersion does not require long times series. It only requires sufficient number of cross-section units. In the case of a "traditional" time-series correlation at least 60 observations are needed to receive statistically significant estimates. It means that to estimate robust correlation coefficients one needs time series that are at least 5 years long if the monthly observations are used. It is not recommended to use daily or weekly data because of different time zones across the world.

Using „traditional" correlation it is also difficult to observe changes in the degree of integration. One can always estimate rolling correlations, but in this case the problem of overlapping data emerges. The subsequent measures of correlation are not independent, because they are estimated partly with the same data set. The measure of dispersion, on the other hand, is always calculated with an independent data set and may quickly identify the moment of switching the integration regime, which should be crucially important for portfolio managers.

There are also some strict assumptions that should be fulfilled in a case of time-series correlation. The distribution of returns should be multivariate normal with constant parameters. In the real world where fat tails and volatility clustering are well known phenomena, these assumptions are seriously flawed. As Roulet and Solnik (2000) note these problems may be to some extent overcome by employing multivariate GARCH approach with time-varying covariances, but then the other sever limitations emerge as discussed in Kroner and Ng (1998).

In the end, we should also state that dispersion is not a perfect measure and the drawbacks occur. When interpreting market integration with cross-country variation, the perfectly integrated markets should have zero dispersion. However, this is true only in the case when the examined countries have the same industry mix. Therefore, it is risky to draw precise conclusions that are based on absolute values of dispersion. On the other hand, if we see a quick and significant change in the value of cross-country variation it is hard to believe that this may be due to some abrupt changes in the industrial structure of the examined economies. In such situations a more plausible explanation is the one that is based on the swings of the perceived idiosyncratic risk.

Data

In this research, we investigate data on Datastream Global Equity Indices (DGEI) provided by Thomson Reuters. Monthly rates of return are used for the period 1992:2-2011:1. We examine three types of indices: national stock markets indices, regional (Eurozone) sector indices and intra-industry country indices.

National DGEI indices are calculated on a representative sample of stocks covering a minimum 75 - 80% of total market capitalization. The Eurozone countries covered in this study are: Austria, Belgium, Cyprus, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovenia and Spain.

Regional indices are then created by aggregating the country indices. Stocks are allocated to industrial sectors using the Industry Classification Benchmark (ICB) jointly created by FTSE and Dow Jones. In this study we use Datastream level 3 sector indices[1], where 20 Supersectors are classified: Oil & Gas, Chemicals, Basic Resources, Construction & Materials, Industrial Goods & Services, Automobiles & Parts, Food & Beverage, Personal & Household Goods, Healthcare, Retail, Media, Travel & Leisure, Telecommunications, Utilities, Banks, Insurance, Real Estate, Financial Services, Equity Investment Instruments and Technology.

Due to varying cross-country and time-series industry mix represented on the local stock markets, the number of level 3 sector indices varies for the analyzed countries through the sample period. To calculate a dispersion of the national indices returns for a specified industry we use the following number of country sector indices:

TABLE 1. INTRA-INDUSTRY COUNTRY INDICES

Level 3 - ICB Supersector	Datastream Sector Abbreviation	Number of country sector indices*
Oil & Gas	OILGS	6-14
Chemicals	CHMCL	7-10
Basic Resources	BRESR	9-13
Construction & Materials	CNSTM	10-12
Industrial Goods & Services	INDGS	11-14
Automobiles & Parts	AUTMB	3-5
Food & Beverage	FDBEV	7-14
Personal & Household Goods	PERHH	8-13
Healthcare	HLTHC	10-12
Retail	RTAIL	7-12
Media	MEDIA	6-13
Travel & Leisure	TRLES	5-14
Telecommunications	TELCM	4-12
Utilities	UTILS	5-11
Banks	BANKS	11-14
Insurance	INSUR	10-13
Real Estate	RLEST	7-13
Financial Services	FISV	6-13
Equity Investment Instruments	EQINV	3-9
Technology	TECNO	6-11

Source: Thomson Reuters Datastream Global Equity Indices

Note: *The lower number indicates the minimum number of country indices for a specified sector used to calculate intra-industry dispersion measure in the period 1992:2-2011:1, whereas the higher number indicates the maximum.

Empirical results and findings

Visual inspection of the Figure 1. leads us to the following conclusions.

First of all, the absolute diversification potential of cross-country and cross-industry stocks allocation is definitely time-varying and the national and industry dispersion measures exhibit co-movement in the same direction.

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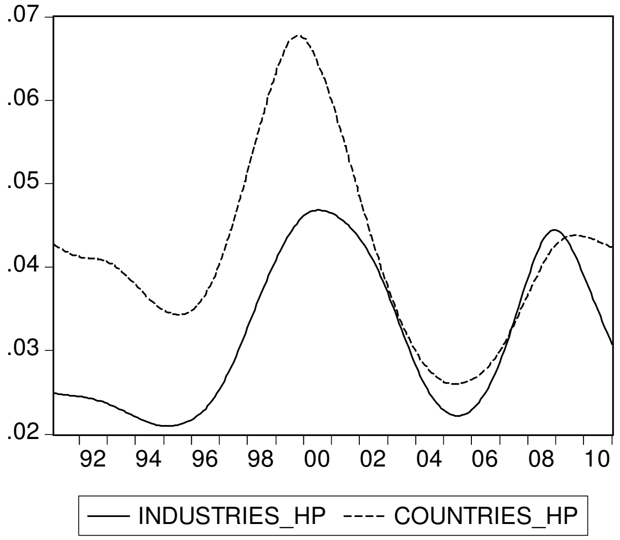
[1] The classification is as follows: Level 1 - Market, Level 2 - ICB Industry, Level 3 - ICB Supersector, Level 4 - ICB Sector, Level 5 - ICB Subsector, Datastream level 6.

Secondly, the relative importance of both patterns varies through time too. In the pre-Eurozone period the risk-reduction gains from country diversification were significantly larger. From 2002 (the moment of Euro adoption by eleven countries) the diversification potential of both types of diversification started to be similar. We see the two main reasons of this phenomenon: exchange rate risk elimination and business cycles synchronization.

FIGURE 1. CROSS-COUNTRY AND CROSS-INDUSTRY DISPERION MEASURES



Source: own calculations based on Thomson Reuters Datastream Global Equity Indices.

Note: To obtain a smooth estimate of long-term trend component the Hodrick-Prescott (HP) filter has been applied to both time series.

Jappelli and Pagano (2008) note that when two countries have different currencies, exchange rate fluctuations create an additional risk and investors require a risk premium to hold a security denominated in a foreign currency. And even if there are no large exchange rate fluctuations, transaction costs for currency conversion still occur inducing a deviation from international arbitrage. Before 2002, Eurozone member countries participated in Exchange Rate Mechanism (ERM) and then in ERM II , which were in fact the semi-pegged systems. These systems limited the exchange rate volatility, but still the transaction costs were present. After Euro adoption by eleven countries in 2002 these barriers for economic integration were eliminated, hence the country risk should decrease. This conclusion is supported by our estimates presented in Figure 1.

The next reason of a significant country risk reduction relative to common risk factors impact (industry risk) is possibly a rising synchronization of local business cycles, which is one of the Optimum Currency Area (OCA) criteria. No matter that some of these criteria were not fulfilled before establishing the Eurozone, the monetary integration should enhance the development of economic linkages between the membership countries. In other words, one might ask a question if the US economy would be the OCA without a single currency. This phenomenon is known as the endogenity of OCA criteria (Frankel and Rose 1998). In the case of business cycle synchronization criterion we can draw the following channel: if monetary policy is a source of shock, in the currency union this type of shock is the same for every country leading to further business cycle synchronization.

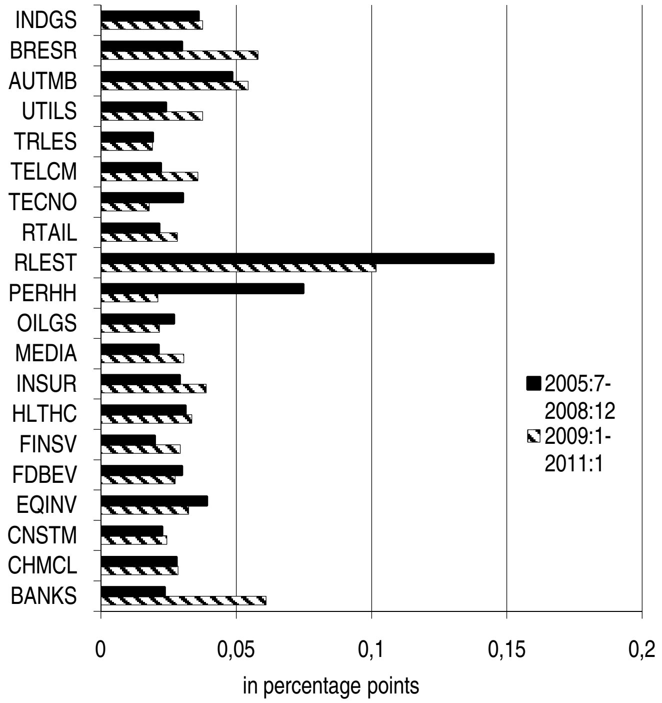
Gonçalves et al. (2009) present the evidence confirming this theoretical considerations. In their study higher business cycle correlation among the Eurozone countries is the result of the common monetary policy *per se*, and not of higher bilateral trade caused by the common currency.

The third comment regarding Figure.1. focuses on the sharp increase of the cross-sector dispersion measure from the mid 2005 reaching its peak in the end 2008. From that moment we may observe the reverse process *i.e.* the convergence of sector rates of return. We decided to find out which industries may be the source of this volatility. Therefore, we calculated for the two subperiods (2005:07-2008:12, 2009:1-2011:1) the *distance* measure, which we define for the *i*-th industry as follows:

$$distance = \sum_{t=1}^{T} \sqrt{\frac{\left(y_{it} - \overline{y}_t\right)^2}{T}}, \qquad (2)$$

where, y_{it} is the return for the Eurozone *i*-th sector index for the *t*-moment, $\overline{y}_t$ is the cross-sector average rate of return of the Eurozone sector indices for the *t*-moment. The results are presented in Figure 2.

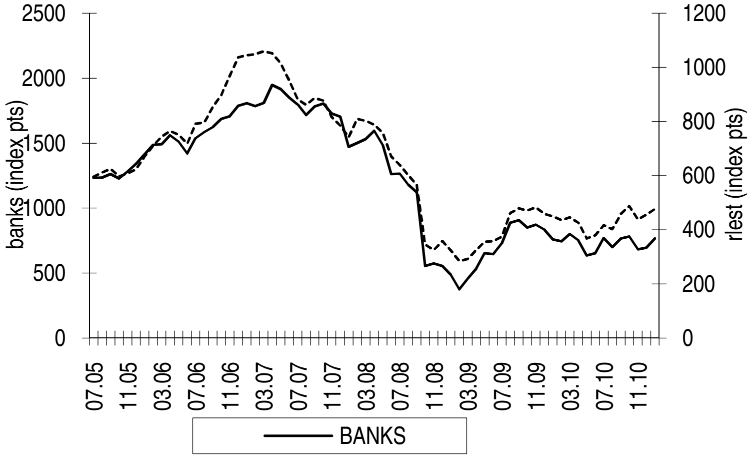
FIGURE 2. THE DISTANCE MEASURE



Source: Own calculations based on Thomson Reuters Datastream Global Equity Indices.

We note that definitely the Real Estate sector differs the most in both subperiods from the cross-industry average. The other interesting finding applies to the Banking sector, where we may observe the highest difference (an increase) in the distance measure comparing the two sub-periods. In case of these two sectors it is worth also to take a quick look on the time series indices values.

FIGURE 3. BANKS AND REAL ESTATE EUROZONE INDICES DEVELOPMENT



Source: Thomson Reuters Datastream Global Equity Indices.

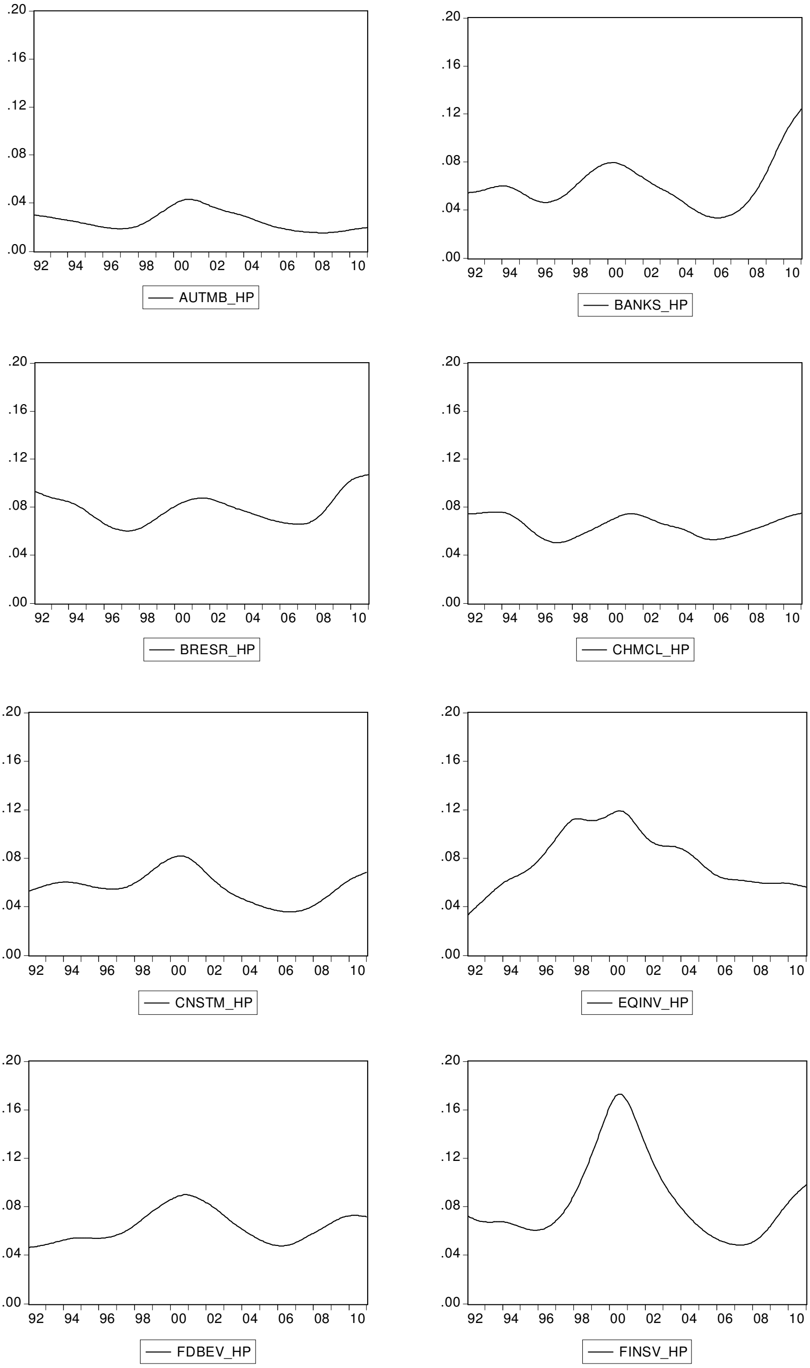
Taking together the results presented in Figure 2 and 3 we see that see that Real estate sector of the Eurozone experienced classical boom and bust cycle, while the banking sector was following it providing financing for real estate investments and collecting the mortgage backed assets.

Last but not least, it is worth to point out that Figure 1. exhibits the divergence of dispersion measures for country and Eurozone sector indices from the 2009. As the global crisis started an initial increase in the perceived country risk was not surprising. Babecký et al. (2010) analyzing the integration of the CEE and Eurozone financial markets in the crisis times observed siginificant divergence of the national stock markets returns, which they interpreted as growth in home bias effect. However, after some time (from the late 2008) Babecký et al. (2010) observed the period of "calm-down," when the CEE and Eurozone local equities markets started to drift closer again. In our study the case is different. The perception of country risk as measured by the dispersion of Eurozone country returns remains high, and it is hard to explain this state only by an increase in home-bias, which is more a psychological phenomenon connected with the nervous reaction to first crisis news. In our opinion higher dispersion of the country rates should be attributed to some more fundamental issues.

The global financial crisis started to be reported in media as the "subprime crisis" and now it is called more often "sovereign debt crisis," which describes the rising problems of the governments of some European countries. At the same time, the popular acronym emerged -"PIIGS" (Portugal, Italy, Ireland, Greece, Spain) becoming the symbol of irresponsible fiscal policy. However, these nicknames do not live only in media world, but they are manifested in hard economic data. Stock prices, generally reflected as good indicators of future economic activity, in our case indicate the economic divergence of Eurozone countries. These finding is crucially important and implausible for the ECB. In the near future it will be harder to run monetary policy that will be appropriate for every membership country. Perhaps further integration of fiscal policies may be needed (see de Grauwe, 2006).

The last part of the presented research focused on the level of country-risk carried by different industries. Therefore, the dispersion measures of country-sector indices returns were calculated separately for every industry. The obtained results are presented in Figure 4.

FIGURE 4. INTRA-INDUSTRY COUNTRY DISPERSION MEASURES



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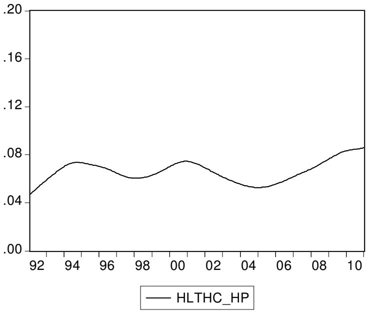
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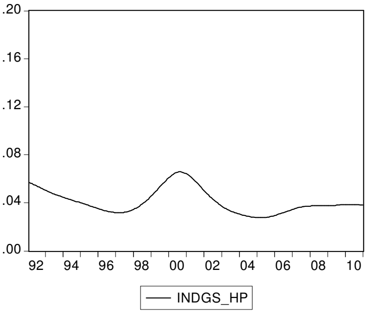
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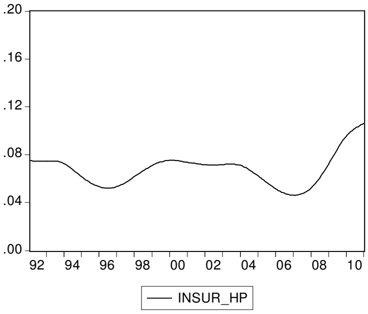
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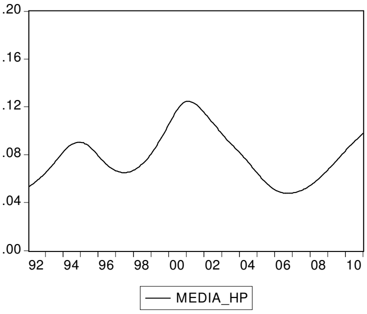
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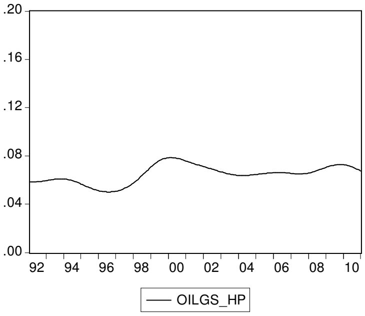
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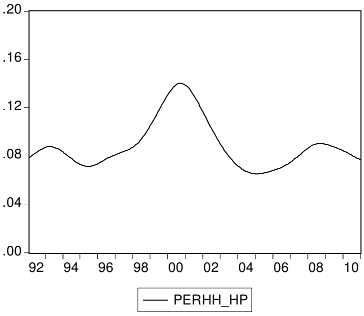
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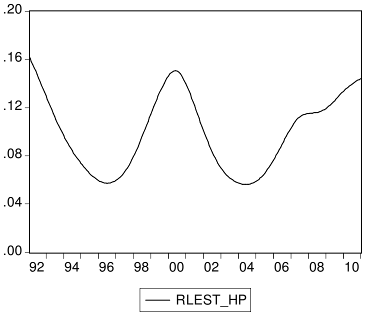
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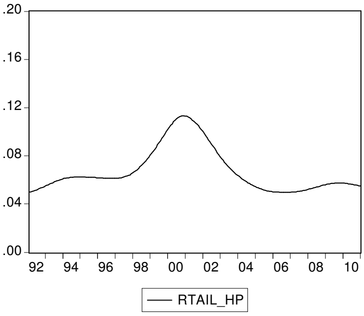
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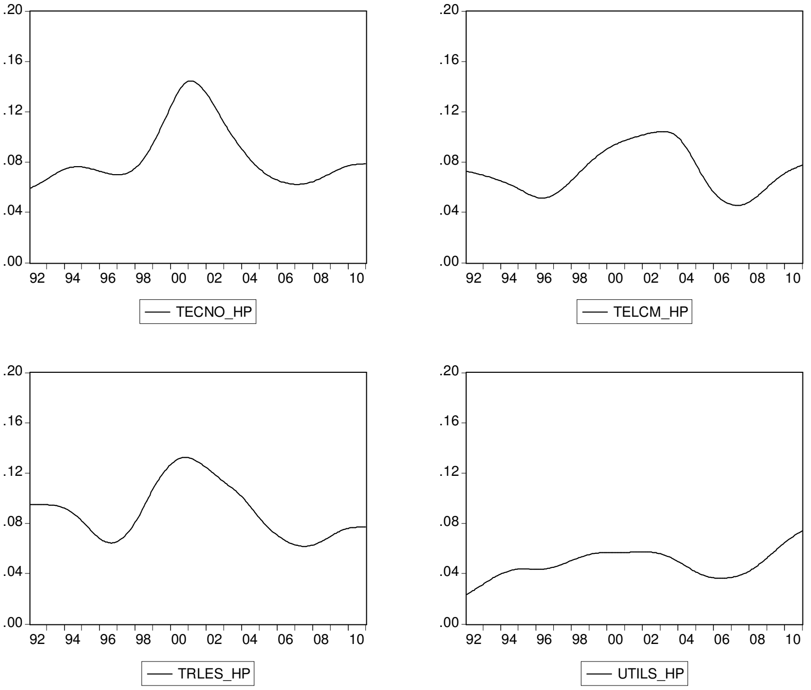

Source: own calculations based on Thomson Reuters Datastream Global Equity Indices.
Note: To obtain a smooth estimate of long-term trend component THE Hodrick-Prescott (HP) filter has been applied to all presented time series.

The general finding that applies to almost all industries states that the level of country risk increased due to global financial crisis. However, there are still industries that are characterized by a low level of country risk (low dispersion), *e.g.* Industrial Goods & Services, Retail and Utilities. On the other hand, we see a sharp rise in the level of country risk in case of Banking and Real estate sectors. This result is complementary to the findings obtained from the Eurozone-sector level. The source of cross-country and cross-sector volatility lays in a few countries that experienced the most the boom and bust cycle on a real estate market or were running highly inappropriate fiscal policy for many years.

To sum up this part, all of the three proposed hypotheses cannot be rejected.

Conclusion

The carried research enables us to formulate two stylized facts: 1) The Euro adoption led to national stock markets integration; 2) The global financial crisis reversed the process of equity market integration.

These findings are important, but have a different meaning for monetary authorities and global portfolio managers.

Nowadays ECB has a really hard task and the integration of fiscal policy is urgently needed. This problem has attracted a lot of attention among economists and the conclusions are very clear. However, it is more of politics nature. Nowadays implementing a system of centralized fiscal transfers neutralizing to some extent the effect of asymmetric shocks may be hard as it is hard to convince taxpayers from one country to pay for the other sins. The case of PIIGS exhibits also that the current system of fiscal policy discipline (Stabilit and Growth Pact) is ineffective. There is no credible way of enforcing the sanctions and it only relies on a peer pressure.

The conclusion for portfolio managers is also apparent – no matter that some sectors are still relatively independent of country risk factors, nowadays the country-diversification paradigm should dominate the portfolio choices. The further studies should investigate if this holds true not only in Eurozone case, but also in worldwide scale.

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