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CO-MOVEMENTS BETWEEN ATHENS AND FRANKFURT STOCK EXCHANGES: AN EXAMINATION BY TIME VARYING REGRESSIONS

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ABSTRACT

In this paper we investigate the co-movement between the Greek Stock Exchange and the German Stock Exchange. Possible co-movement could indicate that the two stock markets cannot be used for portfolio diversification purposes. We also examine the effect major political and economic events have on the co-movement of the two stock markets. In that sense we create two subsets of our sample, one from 2000-2008 and the other from 2008-2012. We use time-varying regressions on these stock markets and we regress both the returns from ASE on the returns of DAX and vice versa. In order to provide further robustness for our results, we create two more specifications for the initial models that include lagged returns for these two stock markets. We also extract the smoothed and filtered coefficients from our models and apply dummy variable regression analysis, in order to investigate the effect political and economical events have on the co-movement of the two stock exchanges. We find, in our results, that the two markets show signs of co-movement especially before the financial crisis. Major events also affect the co-movement of the stock markets negatively. However the financial crisis of 2008 disrupts the co-movement. Greek-related major events, political and financial, also have a significant negative impact on the co-movement of the two exchanges.
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1. INTRODUCTION

The co-movement between stock exchanges is a topic that has been a subject of substantial research in the field of Finance. Investors can get information as to how they can diversify their portfolios between stock markets from different countries. This would allow them to not only offset the risk they are taking in investing in one specific market, but it would also give them the ability to yield higher returns on their investments.

The relative literature is rich in studies examining the co-movements between various stock exchanges around the world but also in papers that investigate the reasons that this happens (see e.g. Metin and Muradoglu (2001), Meric et al. (2007), Albuquerque and Vega (2009), and Chow et al. (2011)). However, by reviewing the literature, one can see that there is a discrepancy as to which model can best illustrate the effect of the co-movement between stock markets. This raises the following questions. Is it possible that a model might be more effective at best examining the aforementioned situation, and if there is what can we do to provide further robustness for our results? Also what is the effect that political and economical events have on the co-movement of stock markets?

Motivated by that, we address the first question by examining the co-movement of the German and the Greek stock exchange in a time-varying regression framework, including lagged returns in our analysis to make our results more robust. Afterwards, we examine the effect that political and economical events have on the co-movement between the two stock markets.

Greece and Germany are two totally different countries. Germany is a big open economy, which is a key player in the global financial system. Its growth is based mainly on exports,
investments (principally machinery and equipment) and on industrial output, while factors such as construction and domestic demand affect the GDP to a lesser extent. Greece on the other hand, is a small open economy, which accounts for only a very small percentage of the global GDP. The most important factor for its growth was mainly consumption, whether private or public. Shocks, like the financial crisis, affect these two countries differently. Since Germany is one of the large developed countries shocks are transmitted quite fast, while in Greece shocks seem to have lagged effects. Their respective stock markets also follow the same pattern as the overall economies, in the sense that DAX is one of the largest markets in the world, while ASE’s capitalization is only but a very small fraction of the world’s total capitalization.

In order to examine the effect of major political and economical events have on the co-movement of the two stock markets, we extract the smoothened and filtered time-varying coefficients, and regress them to the effects of those events, by using a dummy variable analysis framework. Our data set consists of 3300 observations, from the years 2000 to 2012. In order to have a clearer view of the pattern of the co-movements in both before and after the financial crisis of 2007, we divide our sample into two subsamples, one from 2000-2008 and the other from 2008-2012. This gives us the opportunity to examine the effects shocks, such as the financial crisis, have upon upon our stock markets.

However, before we examine the results of our time varying regressions and our dummy variable analysis, in detail, we believe it would be useful to present the macroeconomic background of both the world and the two countries, the exchanges of which we research. This is important since, this way, the reader will have a clear view on how the stock exchanges are affected by the rest of the economy and the financial environment in general. Moreover this way it might be possible to shed some light into the reasons that brought us to the sovereign debt
crisis of the Euro-zone. Our analysis starts from the year 2000 and ends up at 2012. This is also the time period during which our paper examines the co-movement between those two stock markets.

Our results indicate that the Greek stock market is positively affected by its German counterpart in times of crisis, however it is the exact opposite for the DAX, where the positive effect from the ASE comes in the years that the Greek economy was booming. Additionally, we examined the effects shocks, from the smaller economy, have on the co-movement of the examined stock markets. What we discovered was consistent with literature. Shocks, in the form of news and events (both political and financial) affect the co-movement of the two stock exchanges to a significant, negative extent.

Moreover, stock markets seem to have high co-movement, while the global economic situation is good, as we can see from their trends in the years 2000-2007. However, when the crisis also reached Greece, in 2008, investors turned to Germany’s stock market, as it was seen as a safer place for them to invest.

The rest of the paper is organized as follows; Section 2 discusses the relevant literature; Section 3 starts with a background analysis on the macroeconomic situation in the major economies of the world, and focuses on the economic situation in Germany and Greece. In that section we also examine our sample and provide the results for our time-varying coefficients, as well as the effect political and economical events have on the co-movement of our stock markets. We offer a discussion of our results in section 3.5 and conclude in section 4.
2. LITERATURE REVIEW

Stock markets co-movements are a topic in Finance that has been heavily researched in the past. In order to have a better understanding of the subject at hand we referred to the relevant literature. The literature in this paper is divided as follows: first we present the literature relative to the co-movement of international stock markets and to the reasons behind it, as well as the factors that influence these co-movements. Then we refer to the research that has been conducted on different stock market regions (Asia, Europe, Africa and US). We conclude with the specific research on which this paper was based.

Early papers (Eun and Shim, 1989) show significant interdependence among major national stock exchange markets. Co-integration in stock exchanges motivates investors to look for alternative investment solutions (Gupta and Guidi, 2012; Friedman and Shachmurove, 1997; Ghosh et al., 1999). Also, as Wong et al. (2004), suggest, it is important to know how stock exchanges' volatilities and returns are related, since this allows for a wider selection of options among the international markets, and thus bigger profit margins. Additionally, Metin and Muradoglu (2001) state that international diversification can have a more positive impact than domestic diversification, in the sense that markets from various countries are less related than markets in the same country. Also Hyughebaert and Wang (2010) claim that co-movements are another factor, which might affect variables such as asset prices and thus the cost of capital. Moreover, according to Meric et al (2012), co-movements in stocks are the key factor that determines the type of choices firms face, when they are to enter a foreign market. This is because co-movements can provide companies with both possibilities for higher returns but also risks.
The degree of integration among different markets, the reasons behind it, as well as the factors that affect it, are still being researched (Zhang et al, 2009). Meric et al. (2008), using principal component analysis (PCA) and Granger causality tests on daily data, report that the type of the market, whether it is bullish or bearish, is related to investor gains. They report that different sectors in bullish markets are correlated to a lesser degree than in bearish ones thus allowing for more international diversification. Chue (2002) attributes the co-movement of markets to the time varying risk aversion of investors. He creates a model using the utility function with a mix of daily and annual data and examines the way shocks move from one international market to the other. Malevergne and Sornette (2004) examine the co-movements of individual stocks with each other and their respective markets. They create to that effect a general formula using daily data that shows the reliance one asset can have on another. This model can be used in addition to any of the well-known models, such as the CAPM or the APT, in order for a manager to find the degree of dependence on any two assets and thus properly diversify his portfolio. Metin and Muradoglu (2001), using Engle-Granger, ECM and VAR models, on weekly data, find that most markets are integrated with some of the world's leading markets (US, Japan). Their results bear significant importance to investors, since they reveal the way by which exchange markets reach equilibrium. Meric et al. (2007) also examine the effect shocks, such as the events of September 11, have on the co-movements of major markets across the globe (US, Japan and EU). For that purpose they use maximum-likelihood tests, PCA and correlation analysis, on weekly data. The results are that the shocking events of September 11, had a great impact on the examined stock markets, as their co-movement increased thus losing diversification gains. Another important research paper is that of Albuquerque and Vega (2009), in which the authors examine the effect news from a large and a small economy (US and
Portugal) have on each other. Using GARCH models, with daily data, they find that US macroeconomic news has no effect on the co-movement of both countries stock markets, whereas Portuguese macro news lowers the co-movement. They stress out that, this is not the result of contagion effects. Regarding the co-movement between stock exchanges, Beine and Candelon (2011), examine the liberalization of the economy and the effect trade has on stock market linkages. The authors of this article use an alternative model, similar to GARCH, with daily returns, and their results suggest that trade and financial liberation allow for more co-movements between stock markets. Akash et al. (2011) examine other possible factors that might affect stock returns in different countries. They use Augmented Dickey-Fuller tests, Philips-Peron tests, Johansen and Juselius co-integration and Granger-causality tests, on monthly data, to identify evidence about possible relation between stock markets and macroeconomic variables. They find that economic policy affects stock markets greatly. Money supply policy has a positive impact on the stock markets, while economic policy on interest rates, exchange rates and inflation has a negative one.

Another factor that might have an effect on market linkages is the exchange rates between various currencies. For that reason, Liu and Wan (2012), examine the effect Yuan/USD exchange rates have on the Shanghai stock market. Using an Engler-Granger test and a non-parametric test, on daily data, since there is a structural break present that was not taken into consideration by previous studies, they find that stock markets are related to the exchange rates after 2008, but not earlier than that.

The reasons as to why different stock markets across the world provide diversification opportunities are various. The dominating perspective is that markets are integrated when the assets in foreign markets bear the same risk with those in the domestic ones (Cheng and
Glascock, 2005). Gupta and Guidi (2012) note that stocks in different countries are affected by different factors and thus they allow foreign investors to find market characteristics that are not present in their domestic markets. Moreover, stock market co-movements seem to be an indication as to how other assets, in a global investor's portfolio, might behave. Bond indices seem to be correlated with stock prices (Ahmed, 2009).

Since the concept of diversification is of great interest to investors and academics, there has been considerable research regarding the co-movements of stocks in different regions of the world. Some events, like the Asian crisis of 1997, provided researchers with unique data to test their hypotheses regarding the integration degree of different markets. There has been considerable research on the Asian markets, especially after the 1997 crisis. Groenewold et al. (2004) examined the correlation between Mainland China stock exchanges and their neighbors, Hong Kong and Taiwan. They used Engle-Granger tests, maximum-likelihood tests and different VAR models on daily data. According to their results, Mainland China (Shanghai and Shenzhen) stock markets are not correlated with the ones in Hong Kong and Taiwan. Before the crisis however the relationship among those exchanges was stronger. Similar results are reported by Hyughebaert and Wang (2010), who applied Sim's likelihood ratio tests and VAR models on daily data. They report that Mainland China stock markets are isolated from those East Asian ones and the rest of the world; however the other East Asian stock markets have a significant correlation to US market. Chow et al. (2011) examine the co-integration of Shanghai and New York stock markets. They use weekly data with time-varying regression and not GARCH models, which are more common in the literature, as those assume stationarity. This method illustrates the co-movements with robust results. The results suggest that the two markets are
getting fairly integrated over time, but the process of integration was interrupted by the recent financial crisis.

Jang and Sul (2002), studied the behavior of stock market integration, for countries that have gone through the Asian crisis as well as the effect the crisis had on their neighbors. They used Granger causality and ADF (Augmented-Dickey Fuller) tests on daily stock market data and came to the conclusion that there was no co-movement before the crisis but there was a significant one after it. These results were contradictory to the results of previous studies. Also Gupta and Guidi (2012), reported that India's stock market had no long run correlation with its developed neighbors (Hong Kong, Japan and Singapore) as well as time varying correlations increase during the crisis but return to prior levels after it. To come to that conclusion they carried out Engle-Granger, Granger and Gregory-Hansen tests, on daily data. They also used a DCC-GARCH model in order to check for the time varying relationship between these markets. Zhu et al. (2004) also explored causal relationships between the three Chinese stock markets (Hong Kong, Shenzhen and Shanghai). For that purpose they used VEC models as well as maximum likelihood estimation on daily returns. They suggest that there is no causal relationship between these three markets and that in case of a crisis, contagion to mainland markets is to be expected. They also comment that the stock index time series are non-stationary and therefore VEC models do not exist. However the results of Goh et al. (2005) are suggesting that, after performing Wald, PP and Granger tests together with VAR model analysis on the 5 ASEAN stock markets (Singapore, Malaysia, Indonesia, Thailand and the Philippines),on daily values, foreign investors would face limited benefits from diversifying between these stock markets, as these markets seems to be correlated. Shanghai and Hong Kong stock market co-movements were also researched by Zhang et al. (2009). They performed MVGARCH and copula approach
to examine the dependencies between those two markets, on daily data. They conclude that there is high tail dependence among them. It would seem that the recent financial crisis also affected the way that Asian markets are co-integrating. Meric et al. (2012) examine the Asian stock markets' movements using PCA and Granger-causality techniques. They report that Asian stock markets are more correlated during the 2001-2011 period than previously. Wong et al. (2004) studied the co-movement of major global stock markets and Asia's emerging markets. They used ADF tests, with weekly returns, to conclude that stock markets in emerging economies are to some degree related to major stock markets around the world but not all of them. Moreover, this phenomena increased after the 1997 crisis.

Another important linkage that came into question was that of Asian markets and the US, since the US is one of the world's largest financial markets and is expected to have an impact on other markets. Ghosh et al. (1999), examined the dependencies between Asian-Pacific stock markets with Japan and Us stock markets. They used ADF and PP together with ECM (Error Correction Models) on daily data. They conclude that Asian-Pacific stock markets are divided into three subgroups. One that is affected by Japan, another one that is affected by US and a last one that relates to neither of the two. However they also came to the conclusion that dominant countries cannot always be used to forecast indices of less dominant ones. Similar research was conducted by Cheng and Glascock (2006). They claim that the three GCEA (Greater China Economic Area), namely Mainland China, Hong Kong and Taiwan stock exchanges are not co-integrated with each other nor with the Japanese and US markets. To prove that they used a bivariate model, with daily data, originally developed by Okunev and Wilson. Moreover, to examine for the efficiency of the markets (weak, semi-strong and strong) they also conducted an innovation accounting analysis. Their results suggest that these three markets are not weak-form
efficient, which means that potential investors can gain from that. Another research that has been
done on the Chinese stock markets was that of Li (2007), which explored the links between the
Mainland China stock markets and those of Hong Kong and US. She used a multivariate
GARCH analysis, with daily data, and found spillover effects from Hong Kong to Shanghai and
Shenzhen but no correlation of those markets with their US equivalent, thus concluding that
foreign investors would benefit from adding Chinese stocks to their portfolios. Similar was the
research of Yusof and Majid (2006), who explored the co-movements of Japanese and US
markets with Malaysian stock exchange. For that, they used VAR models, on daily data, for
three different sub-periods, before during and after the crisis. They came to the conclusion that
the markets co-integrate after the Asian crisis, something that is consistent with the existing
literature. Also Japan seems to affect Malaysian stock market more than US, and thus Japanese
investors would have diminishing returns from trying to diversify in Malaysia. Another
interesting research was conducted by Nissim (2011). He suggests that the largest stock markets
of the world, namely New York, London, Tokyo and Hong Kong are significantly related to each
other. Using Granger causality tests, with daily stock returns, he found that East-Asian markets
are more correlated with New York and London stock markets, but not with other East-Asian
ones. Consistent with the literature Meric et al. (2011) study the co-movements of US and Asian
stock markets before and after the recent financial crisis of 2008. They do a PCA and a time-
varying correlation estimation. Their findings are that there is significant co-movement between
the US and Asian stock markets and that these markets seemed to be unstable before and after
2008.

Other regions were also studied extensively for the existence of correlations between
their stock exchanges, as investors seek non-integrated markets for diversification purposes.
Akoum et al. (2012) examined the co-integration of oil and stock prices in six GCC (Gulf Cooperation Council countries). According to them, oil in this region of the world is both a key characteristic of the economy for those countries but also a risk factor. They find, using wavelet analysis on weekly data, that these markets have a significantly low correlation with the rest of the world. However, their integration increased after 2007. This is important because it distinguishes short and long term and proves that short term dependencies among those countries are low. Graham et al. (2013) explore the integration between US and MENA (Middle East North Africa) region stock markets. They implement a three-dimensional analysis of wavelet squared coherency with simulated confidence bounds on weekly data. They find a modest level of integration between US and MENA countries at the end of their time-series analysis while integration is significantly higher at the beginning. Aksov et al. (2011) also studied the co-movement of various MENA stock markets. Using GARCH, co-integration and correlation analysis they conclude that the co-movements between those markets are not significant and no co-integration is present. Modi et al. (2010), also focus on the relationship between emerging markets (or as they are referred to BRIC countries) and developed markets such as US and UK. They use PCA, Granger causality and ADF tests, with daily data. Among their other conclusions is that Indian investors can achieve high portfolio diversification if they invest in US, UK and the other countries but Russia. This shows, according to them, that the markets are divided and fragmented. Harrison and Moore (2010) examined the co-integration of five Caribbean stock markets. They use PCA and VAR analysis, on monthly data, and conclude that co-movement of these stock markets is periodic and not a significant one. Additionally, Aslanidis et al. (2009) examined the co-integration of US and UK markets. Using STCC GARCH and DCC-GARCH, on monthly data, they discovered high integration between these two markets, and thus
concluded that diversification between those would not create any benefits for investors. Moreover Berument et al (2011) explore the co-integration patterns between US and Turkish stock market. After using VAR models (SVAR), with daily data, they report that Turkish and US stock exchanges are closely related, as shocks from US have an immediate effect on Turkish stock exchange. Mlodokowski and Tastulekova (2012) also examined the correlation and performance of EU and Turkish stock markets. They were mainly concerned with how fast economies recover from shocks. They used SVAR model and a test for similarities and differences between EU and Turkey. They conclude that Turkey recovered faster than EU and despite the fact that these markets seem to be correlated, each country's economy is important. Another question asked was what the effect might be from treaties between countries. The NAFTA agreement, which came into effect in 1994, was also another factor that may have affected co-integration between North-American countries. Ewing et al. (1999) explores the effect a trade agreement, such as NAFTA, has on co-movements between US, Mexico and Canada. For that purpose they use ADF tests and Johansen-Juselius co-integration tests for annual sub-periods with daily data. From the results, the authors, conclude that the North American markets are highly segmented and such treaties do not in reality affect the level of co-integration amongst the participant countries. Ciner (2006) also examined the co-integration between the equity markets of countries bound by the NAFTA agreement. He uses daily data, that he later transforms to weekly, on a Johansen’s co-integration analysis. He concludes that there was co-movement in the equity markets of these countries, but it was limited only in the late 90’s, whereas this co-movement was the result of the blossom of the information technology sector.
The creation of the European Union added another major market to the existing ones. It also provided with the chance to look into the co-movements of both the EU as a whole but also for individual states with each other but with other markets as well. Early literature on this suggest a strong relationship between US and European stock markets. Shoellhammer and Sand (1985) support this argument. They use ARIMA time series analysis on daily data, to examine the correlation of major European markets with Switzerland and the US. According to their results, Benelux countries are highly correlated while there is significant linkage with EU and US. Moreover Bonfiglioli and Favero (2005) attempt to examine the relationship between the German and the US market. They use monthly data and general reduced VAR models followed by VEC models and conclude that there isn't a long run dependence between US and Germany. Additionally they propose a method for future researchers to distinguish interdependence from contagion.

To date, the results from the literature for the European stock markets are fairly consistent. Shoellhammer and Sand (1985) report that Benelux countries are mostly co-integrated. Friedman and Shachmurove (1997) mention, using daily data, that large European stock markets are more correlated than smaller ones within the Euro-zone and larger markets are more affected by innovations than their smaller counterparts. Moore (2007) studies the effect of the Euro on various European stock markets and at what degree these markets are co-integrated due to the common currency. He uses PP, Engle-Granger, ADF and VAR-GARCH models, on daily data, and finds evidence that these markets are having similar co-movement patterns, because of the stabilizing effect Euro has on each market. Another similar study is that of Kenourgios and Samitas (2003), which examines the co-movement of European exchanges, and specifically the "blue chip" sector of the exchanges, but having as its main axis the correlation of
these stocks in the Greek and the foreign stock markets. The authors of that paper use daily data in Engle-Granger two step methodology and Johansen's maximum likelihood test to examine the aforementioned co-integration. They discover efficiency of the markets and no linkage between the Greek stock markets and all the other European markets, save that of UK. This comes to contradiction with the previous literature.

As we can see the topic of the co-movements between stock markets has been heavily researched. The reasons behind it as well as the factors that affect it have been examined thoroughly. This paper contributes to the existing literature by examining the co-integration between the Greek and the German stock market, a linkage that hasn’t been researched yet. Moreover, it also investigates the effect major political and economical events, such as the financial crisis of 2008, have on the co-movement between the two stock markets.
3. DATA ANALYSIS

3.1 Macroeconomic Background Analysis

In the year 2000, the world economy was expanding. Its average growth rate was about 5%. However, although there was high economic expansion in the first half, in the second half of this year the global economy started to slow down. This was the result of the internet bubble bursting in US, an event that made investors more skeptical as to how they evaluate the future earnings of companies and economic sectors. Moreover this year was also characterized by more stable monetary relationships and the rise of oil prices. The consumer prices averaged at about 2.5% in major economies. Another characteristic of this year was that there was a high level of global economic activity, which combined with the uprising of the oil prices and the relatively low inflation, led to declining rates in the capital markets.

US economy was a key-player in the overall growth movements of the global economy. In 2000 US GDP had the highest year-on-year growth at about 5%. This expansion in the GDP was the result of the development in the information technologies. It was also boosted by the high earnings that this sector produced and the positive results it had on the reduction of unemployment. As it was natural, high earnings also attracted investments from abroad. However, in 1999, oil prices started to rise sharply. This led to higher inflation than previous years (3.4%), which made FED respond by raising interest rates up to 1%. This shook the equity market as the investors began to realize the risks this upward trend had on the technology sector and resulted in the burst of the bubble of the IT sector. It is important to note that the NASDAQ index, in which these technology stocks were traded, fell by more than 50%. Both the bubble
and the rise in the energy prices had a great impact on the overall US economy and more importantly on the domestic demand by the second half of this year.

Meanwhile another important economy of the world, that of Japan, remained in uncertainty and recession. The recession started in 1998 and was the aftermath of both the Asian crisis of 1997 and other factors related to Japan. During the first half of 2000 Japan’s economy showed signs of recovery and so the Bank of Japan decided to increase the rate by 0.25%. Moreover the government was trying to boost domestic spending with programs of public spending. However both those moves had no effect on the long run on the economy. Unemployment had an average level of 5% and there was barely non-existent private consumer demand.

In Europe however things were looking better. Exports were boosted due to the fact that economic activity throughout all the European countries was increased. Inflation also seemed to increase but not to very high levels, mostly as a result of the relaxation of the monetary policy in the European Union. However, according to the Bundesbank, countries in accession course to the Euro-zone should try to counter the inflationary pressure in order for their economies to stay competitive and for them to fulfill one of the most basic of the convergence criteria. It is also stressed out that the single monetary policy will probably be difficult to be fair for both mature but also developing economies, in the sense that anti-inflationary policies will stress developing economies within the Euro-zone more.

The monetary union’s growth was also rising in a pretty fast pace. It averaged at 3.5%, which was higher by 1% compared to the previous year. Production was also higher this year, which resulted into higher usage of the factors of productivity and a closure in the output gap.
Domestic demand did not increase as much as the previous year, namely by only 2.75% and the main factor that supported it was private consumption. Exports were also significantly promoted by the depreciation of the Euro against the other major currencies at the astounding level of 11.5%. This was another driving factor of the growth that was noticed in the Euro-zone this year. European Monetary Union (EMU) states seemed to grow at a more similar pace than they had in previous years. The differences that existed between the EMU countries were seen as a by-product of the differences between the developed and the developing countries of the Union.

Unemployment followed a downward trend although this effect seemed to wear off by the end of 2000. Specifically in the EU 9.0% of the work force was unemployed, while this percentage was by 1% higher in 1999. Inflation increased by an average of 1.3%, mainly due to the increase in oil prices and the depreciation of the Euro. However, exports did benefit from the depreciation (and imports became significantly more expensive at an average of 25%) of the Euro and this improved the competitiveness of European products against their rivals.

For the first time in years, Germany had positive results on its balance sheet. Its economy averaged at a 3% growth rate, while its GDP doubled compared to the nineties. For the individual sectors of the economy the best performing was the corporate one, with high investments, that also had a significant positive effect on the labor market. The overall performance of Germany's economy was mainly influenced by factors such as the rise of the oil prices, high exports and the weakening of the Euro compared to other currencies. However the most important factor that drove the high growth in the German economy was foreign demand, which boosted exports by 17.5%. This growth in the demand for German goods, was stimulated by the growth of other countries. The high competitiveness of the German products was dictated by the exchange rates and the reduction in labor costs by 3%. The increase in the demand on
German products was so high that the production could not keep up with the orders. Since the production was pretty high, the need for imports also rose by an astounding 10.25%, despite the fact that the imported goods were more expensive, mainly due to the depreciation of the Euro. Due to the heavy demand on exported goods, GDP rose by 1%.

However, in contrast to the heavy foreign demand, domestic demand remained low, mainly due to the rise in oil prices and the depreciation of the Euro. Only 1.1% of the total growth was distributed in the domestic economy. Domestic demand grew by 2%, which was significantly lower than the previous year. What is striking is the fact that consumer spending remained low, although salaries grew by more than 3.5% and there was an income tax relief during that year.

As for individual sectors in the German economy, the best performing was the corporate one, which owed its success to the heavy investments that averaged at a 9% since the previous year. The worst performing sector was that of housing.

In 2000 there was also a significant increase in the wages, which rose by more than 2%. Also unemployment declined and the employed persons rose to 38.5 million. However low-paid workers represented much of them. Much of that increase should be attributed to the shift of the labor market to a more flexible one. Unemployment in general fell from 8.3% to 7.8%.

Greece in 2000 also had favorable conditions for growth, and this was the result of the overall growth noted both in Europe and the global economy. The high oil prices and the depreciation of Euro against the US dollar caused inflation to rise while this effect was counterbalanced by the rise in European interest rates by the ECB. We have to note at this point
that during 2000 Greece was trying to meet all the convergence criteria, which were the requirement for entering the Euro-zone.

Inflation till mid-2000 remained stable at 2.5%. This changed though after March, as the inflationary pressures from oil prices and exchange rates began to rise. By the end of the year inflation rose to 3.1% and finally to 3.9% by December. However, the easement on monetary policy had a positive effect on consumption and investments demand. This led to increased growth in the economic activity, which for the 5th consequent year surpassed the corresponding European average. GDP growth reached 4.1%, especially with the help of increased domestic demand. On the other hand, though, the balance of goods was negative. There was an expansion in services, manufacturing, energy production and construction sectors. The expansion of investments was mainly fueled by private companies and to a lesser extent by the general government. It is also noteworthy that funds from European organizations, such as the European Structural Fund, contributed highly to the increase in public and private investments. As reported by the European Committee at that time in the Second Report on Economic and Social Cohesion, published a year later, those funds transferred from EU to Greece contributed in the growth of Greece's GDP by 9.9%, which was the highest amongst the so called European-South and Ireland.

Also after a sharp increase, in the year 1999, to 12.4%, unemployment dropped to 11.1%. Moreover unemployment dropped for young people from 31.7% to 29.5%. Additionally the employment rate for people from 45-64 increased by 1%, which was the result of further extending the years till retirement.
During 2000 deficit increased and reached 8.371 million, which was the combined effect of a rise in the trade deficit and the income account deficit. Despite the fact that drachma (Greece's currency at that time) was depreciated to other currencies by 6.2%, the competitiveness of Greek products in other countries did not improve. This was partly due to the value of Greek exports, which was 3 times lower than the imports and thus creating a larger deficit. However deficit in the balance of trade would not affect the economic policy of the government. Here it should be stressed that the easement of access to credit and the improvement of expectations mainly due to the fact that Greece would be a part of the Euro-zone starting from January 1st 2001, was expected to lead to a greater economic expansion, as well as higher private consumption.

In 2001 global economy was sharply declining. Global growth fell from 4.5%, in the previous year, to 2.5%, something that can also be seen from the decline in growth of the world trade from 12.5% to less than 1%. This should be mainly attributed to the increase in the oil prices, the terrorist attacks of 9/11 and the effects the dot-com bubble, of 2000, had on the US economy. Despite the effect all the above had on the global economy, signs of improvement were noted by the end of 2001. Oil prices began to decline at the second half of 2001 and inflationary pressures to major developed countries began to subside. Also equity prices started to get adjusted to their real value after the burst of the so-called "internet bubble".

US economy had lost its momentum and growth came to a halt. US central bank reduced interest rates in order to stimulate the economy in order to create a sense of rapid recovery after the losses of the IT sector bubble. However the negative results of this event extended to a cut-down in employment and thus reduction to the private spending, which in its turn resulted in even further reduction of the economy's output. Also consumer's and investor's confidence took a
great hit by the terrorist attacks of the 11th of September, which resulted in FED reducing even further interest rates, and achieving an all time low at 1.75% which was the lowest since 1961. Moreover US fiscal policy also changed, in the sense that it kept an expansionary stance throughout the year.

Japan's economy continued to perform poorly. This was not only the effect of deflation that it has been into for some years, but also because the Japanese economy is highly correlated to the US economy. Moreover the monetary relaxation, imposed by the Japanese central bank, had an inverse effect on the overall economy. Instead of putting a stop to deflation, it actually accelerated it even further to over 1%. China and other East Asian countries, mainly due to the fact that they were related to the IT sector of US, also experienced a slowdown in their economic growth, although China's economy was affected to a lesser extent.

In EU itself output grew more slowly than ever since 1996. Economic growth within the Euro-zone fell at 1.5%. The growth of GDP also fell to 2.5%. This was, again, the effect of the sharp increase in the oil prices and the sharp drop in equity prices, which in a sense maimed the investment activity. However there were tax reforms in many countries that increased household's income, which in turn increased the private consumption but this effect was counterbalanced by the loss in the purchasing power of the Euro. Another factor that played a key role in the economic situation within the Euro-zone was the terrorist attack in US. The effect on the investor psychology was so heavy, that spending on equipment and buildings fell by 0.25%. This heavily affected the output of the Euro-zone and reduced it by 0.5%. Low domestic demands also affected imports negatively and exports also followed that trend. Growth rates between the various countries within the Euro-zone vary. It is noteworthy, that Greece in 2001 had the highest growth rate at around 4%, while Germany had the lowest at 0.5%. However the
gap between the growth in the various Euro-zone countries seemed to close. Bundesbank attributes the low growth of Germany during that time on foreign influences on the German economy, combined with difficulties in the construction sector. Unemployment rates, which started to get pretty high in the previous years, stopped their upward course and even subsided by 0.5%. Again this was attributed not only to the growth within the Euro-zone but also to the flexibility in the labor market. Finally inflation rates within the EMU (European Monetary Union), fell from 3.4% in May, to 2% in December.

For Germany 2001 was not a good year in terms of trade and industry. GDP grew only by 0.5% and that was 2.5% lower compared to 2000, thus putting Germany amongst the most poor performing countries within the EMU in this year. That led the German government to believe that the country was going through recession and for that reason they should initiate countermeasures. Germany's economy was primarily affected by the world economic climate and especially by the negative effects of the US economy during that time. However the effects were less than those that the government was afraid of. That being said, exports decreased, as well as investments and expansionary plans by German corporations had to be reconsidered. The construction industry, within Germany, also played an important role in the overall situation. German economy seemed to fail to create growth through domestic demand and that can be seen if one examines the flat growth rates during the previous decade.

During that year Germany had undergone through an important tax reform, that had as a main goal to relieve enterprises and thus assisting the economy in dire times. Moreover monetary policy makers lowered interest rates in order to provide cheap money for the various businesses and in an attempt to boost domestic demand. Exports, which was the main way of growth for the German economy, saw a dramatic decline from 13% to 4.75%. However the competitors of
German products saw an even bigger decline in their sales. Imports also had a rapid decline. That affected positively the macroeconomic growth. The employment level also remained steady mainly due to more flexible working conditions.

Greece on the other hand was affected less by the global events. Although industrial output, exports and private investment remained low, private consumption, in the form of residential and construction investment, remained high. The real GDP growth went up to 4.1% and was one of the highest among the rest of the EMU countries. The low lending rates, as well as the competition between Greek banks led to high consumer credit. Greek households were spending more and saving less, however income was growing less than consumer spending and thus leading to lower interest income. However business investment was slowing down, due to the events in the global economy and the uncertainty related to them. Unemployment rate fell yet another year from 11.1% in 2000 to 10.5%, but that rate was still one of the highest within the Euro-zone despite the flexibility measures that were taking effect in the job market.

Inflation in 2001 was at the same rate as the rest of the EMU, although at times it was higher. It started from 3.7% in the beginning of the year and rose to 4.5% in mid-2001. This was mainly attributed to the lagged effects of oil prices and the decline in the exchange rate of the Euro against the USD in the previous year, as well as to the relatively higher unit labor costs in the business sector.

The fall of interest rates, due to Greece being officially part of the Euro-zone, had an expansionary impact upon demand, although this higher demand did not cause higher inflation mainly due to the fact that imported products had immense price competition which kept in check the profit margins and the prices of domestic products.
The Greek deficit during that year also increased, even doubled, mainly due to the drop in interest rates in global markets. There was also surplus in the transfers balance, which was attributed to inflows from European structural funds that were part of the 3rd CSF\(^1\). Moreover, financial transactions from Greece to Europe and vice versa had been made easier due to the monetary union. In 2001 Greece, for the first time after 30 years, had a small, but nonetheless, surplus of 0.1\% and the government debt fell from 102.8\% of the GDP in 2000 to 99.7\%.

![GDP per capita comparison between Greece and Germany from 2000-2012](image)

**Figure 3.1.1**
GDP per capita comparison between Greece and Germany from 2000-2012

Although the year 2002 started off with a promising way, the recovery rate of the global economy was hindered during the second half of 2002. Growth increased by only 0.5\% since the previous year, and this was mainly attributed to the uncertainty that investors from all around the world were experiencing. This uncertainty in the macroeconomic environment made

\(^1\) CSF’s were programs promoted by the European Union that provided the various new members to fund their economic activities in order to become more competitive and on par with the rest of the European states.
investors turn to safer solutions such as secure bonds. This year oil prices began to rise again, mainly due to the events such as the general strike in Venezuela.

US economy showed signs of recovery, which were estimated to be the result of the refinancing of mortgages, low interest rates, and expansionary monetary and fiscal policy. GDP rose by 2.5% from last year. However, during the second half of 2002, another fall in share prices hindered growth, as firms couldn't raise enough capital. Japan also seemed to be making progress in overcoming the problems it faced in the past and its GDP expanded by 0.25%. However Japan still had structural problems, especially in the banking and the public sector. In Latin America the harsh situation of 2001 remained pretty much unchanged, with only Mexico being the exception mainly due to the rise in crude oil prices. Argentina continued to have fiscal and monetary difficulties, while the strike in Venezuela had a negative effect upon the oil prices all around the world.

However the global situation seemed to be improving. Prices were estimated to be stable (letting the oil prices aside), and the global inflation only increased by 1.5%. This allowed central banks all around the world to continue their relaxed monetary policy, and thus improve the conditions for investments.

EU decided to accept more members as of May the 1st in 2004. This was expected to have a positive effect on both the labor market and the trade balances within the EU area. However, 2002 was another difficult year for the EMU. Although there were signs of recovery during the first quarter of 2002, in the second and third quarters this recovery was slowed down. Specifically during 2002 EU’s output grew by merely a 0.75% and thus EU lost its first position amongst the industrialized countries to US. The low output was attributed to the low domestic
demand. Private consumption increased by only 0.5%. This was the result of the rise in inflation following the introduction of the new currency (Euro) within the newly accepted countries. The increase in real income, which was again a byproduct of the Euro, was offset by the decline in stock market prices and the risk of war in the Middle East. In that sense, investors were even more reluctant to further invest in machinery and buildings and enterprises were experiencing difficulties in raising new capital. Imports declined during 2002 but net exports increased up to autumn of 2002, when the Euro appreciated against the USD. Another characteristic of that year was that the growth differences between the various EMU countries began to close in a downward trend, converging to the low growth of Germany during that year. Unemployment also began to rise from 8.0 to 8.3%, with the exception of Italy, which provided special incentives to companies in order for them to hire more workers. Inflation decreased in 2002, from 2.5% to 2.2%, with the exception of luxury products such as tobacco and drink, which were (and always are) subject to higher taxation. However the inflation spreads between the Euro-zone countries remained at the same levels as in previous years, with Finland and Luxembourg being the lowest whereas Ireland had the highest. Exports were also hindered by the overall gloomy economical situation, which rose but still at a pretty low pace (averaging at 2.5%). Imports were even further dampened than in 2001, especially after the appreciation of the Euro against the USD.

2002 was yet again another bad year for the German economy. Weak domestic demand was again the main issue of the sluggishness of the economy, while on the other hand exports continued to be doing fairly well despite the fact that the global economy was performing poorly. GDP increased by merely 0.7%, with growth averaging at 0.2%, which was even lower than the already low growth rate of the previous year (0.6%). Unemployment also increased from 9.5%
the previous year to 10.1%. Household's income rose by 1.25% and was offset by the inflation. However household's, mainly due to the overall pessimistic view on the economy, saved a greater proportion of their money, than they did in previous year, thus further dampening the already low private consumption. As we mentioned above exports rose by 2.5% and German exporters were doing fairly good as compared to those of other major industrialized countries. Exported goods were considered to be fairly competitive in price and quality. The low increase in prices combined with the trivial economic situation in Germany led the policy makers to believe that the risk of deflation was imminent in Germany at that time, but their belief was that low inflation would keep the purchasing power high and the German products competitive. Debt to GDP ratio increased during that year to 60.8%, which was relatively higher than the one dictated by the Maastricht Treaty, and the overall government deficit rose to 3.3% of the GDP.

Greece's GDP growth remained at 4%, which was the same as in the previous year and was considered to be pretty given the weak economic situation. This growth was mainly attributed to 2 reasons: 1) The inflows from EU structural funds and 2) The Olympic Games of 2004, which gave a considerable boost to private and public investments. However, unemployment remained high and only declined with a slow rate by 1%. Inflation rose to 3.6% in 2002, and was 0.2% higher than that of 2001. The account deficit decreased by 0.1% from 6.2% to 6.1% in 2002. Greece is, even now, considered to be a traditionally capital importer, so a higher account deficit should be expected. Competitiveness of Greek products (and economy in general) needed, according to the Greek central bank, structural and fiscal reforms, in order to maintain its position amongst the rest of the European countries.

More importantly, reforms in the labor market were, according to Bank of Greece, needed in the sense that such reforms would decrease both public debt and account deficit and
improve the overall competitiveness of the economy. The government balance changed from surplus to deficit. However the deficit to GDP ratio fell to 1.2%. The government budget deficit averaged at 3.4% of GDP, which was relatively higher than the forecasts of the previous year. However the general government debt declined by 2.1% to 104.9% of GDP. The debt-to GDP ratio was still higher than that of the Euro-zone average.

![Government Debt-to-GDP ratio for Germany and Greece from the year 2000 to 2012](image)

**Figure 3.1.2**

Government Debt-to-GDP ratio for Germany and Greece from the year 2000 to 2012

The first half of 2003 was considered to be full of hardships for the global economy, however the situation seemed to get better after that. Overall growth averaged at 4%, which was somewhat higher than that of the previous year, and its main drivers were US and East Asian economies. Growth was stimulated by the expansionary monetary and fiscal policies followed all around the world, and especially by major industrialized countries.

The overall low interest rates, as well as tax reforms of the US economy provided an annual growth to GDP by 3%. Domestic demand in US was further strengthened by both private and public investments, especially those who were related to the war in Iraq. However this had a
negative effect on the budget deficit, which came up to 5% of the GDP. Japan also had a considerable growth of 2.75% however the structural problems, mainly those associated with its banks, remained up to a certain level.

Within the Euro-zone, growth was still pretty low and rose by only 0.5%. There was a negative output gap, which was estimated to be at around 2%. Exports also started weakly showed no real increase throughout the year. Imports declined as well. In the end real net exports declined by 2.5%. Domestic demand, within the Euro-zone area, increased as a result of both the appreciation of the Euro to the USD and the piling up of oil due to the upcoming war in Iraq. Investment was also affected by the upcoming war and the effects of it on the global economy, which makes investors more reluctant to invest and more prone to reserve money. Consumer spending did not significantly increase however even that 1% was the result of the increase in the oil prices. This year the growth gap between various countries seemed to close even further. Greece was the upper limit in growth, with a 4.2%, mainly due to the upcoming Olympic Games. Following the decline in growth, unemployment also increased by 0.2%, which was lower than that of the previous year (0.5%) and averaged at about 8.8%. Inflation went down by 0.5% down to 2%.

In 2003, Germany had yet again to face another year of economic paralysis, with signs of weakness in its growth. Not only that but also exports during this year failed to give the much wanted stimuli to the German economy. Exports increased by merely 1.2% in 2003, which was almost 3 times lower than the previous year. German exporters lost much of the market share that they owned in previous years, especially outside the Euro-zone area. Not only that, but imports increased at 2.5% and thus causing the balance of trade to decline by 0.5% percent. Inventory turnover however, contributed in somewhat 0.75% to the overall growth. Despite that,
private consumption was again pretty low, with household's withholding even more income (from 10.5% savings increased to 10.75%). Unemployment during that year also increased by 7.75% with the even further deteriorating situation. By the end of the year unemployment had increased to 9.3%. Inflation conditions were good in Germany in 2003, according to the Bundesbank. The rate of price increase was merely 0.8%. The government deficit during that time reached 3.9% of the GDP, and increased to such a level that it reached the Maastricht Treaty's upper limit. This, combined with the low growth increased the government's debt ratio by 3.5% and reached in total 64.2%.

For Greece 2003, seemed as another good year. GDP grew by 0.3% from the previous year to 4.2%, which was estimated to be the highest amongst the European countries. This growth was attributed to the high private and public consumption. During that time exports, and especially those associated with transport services, grew but so did imports. Employment rate did also increase during that time. Yet again the fast pace of growth was attributed to the stability imposed by the monetary union as well as the structural reforms which were being implemented. Construction sector was still growing, mainly due to the Olympic Games, and together with relaxed monetary conditions and the inflow of EU funds, contributed to the overall growth. Public and private consumption was still growing and was influenced by the increase in the disposable household income. Despite the high investments in construction, investments for industry remained extremely low. Business investments were mainly fueled by relaxed monetary policies and increased bank lending and at some part they were also fueled by capital raised in the Stock market. Unemployment rates in Greece continued their downward trend, more as a by-product of continuous growth, but unemployment remained at high levels. Inflation also dropped and was in convergence with the rest of the Euro-zone. Specifically it dropped to 3.4%. Despite
the high growth the fiscal situation of Greece during 2003 worsened. General government deficit averaged at 2.9% of GDP, while the general government's debt fell to 103% of GDP. Even so the debt-to-GDP ratio is still considered very high since it reached a level of 70.4%.

Global economy in 2004 continued the previous year's upward trend. Global output increased by 5% and it was actually the first time after a long time that this happened. World trade increased significantly (up by 9%) and it was the major factor that was driving the growth of the world's economy. Despite, though the high growth, by the end of this year, the major differences in the dynamic of the various economies, became more and more clear. This was stressed out more by the movements of exchange rates, which despite the fact that were measurable, they did not however influence the recovery process of the global economy.

Yet again USA and East Asian countries, with China being the leader among them, were the driving forces of the global economy. The increased demand for imported goods by those two regions provided stimuli for both Europe and Japan, but also for the "energy producer" countries. Moreover growth was also helped by the easement of monetary policies which leded to higher financing options for enterprises, as well as, the share prices and the reduced risk premiums for emerging countries' bonds. However, oil prices remained high, and this acted as a negative factor upon the global growth. These high prices were mainly driven by events such as the hurricane destruction in the US gulf but also by speculators in the commodities market. This affected the pace at which global economy was growing, but not at a very significant level.

US economy grew in 2004, especially in the second half of the year. GDP growth was 4.5% and the main factor for this increase was private consumption, which was primarily fueled by the reduction in savings. Construction sector once more had increased activity and so did
industrial investments. The balance of goods and services was once more, in the negative and the account deficit was estimated at about 5.5% of USA's GDP. The government deficit averaged at high levels this year as well and stayed at around 4.5% of GDP. Inflation grew by 1.8% during that year. Japan's GDP grew by 2.5% in 2004, benefiting from the previous momentum it had acquired in 2003. What is noteworthy is that during this year, Japan's banks and other financial institutions, seemed to be on the right track of overcoming their structural problems.

The EMU also started to show signs of recovery during 2004. GDP grew at about 2%, and the utilization of production potential was even greater, and thus the gap between the other major industrialized areas was even smaller. This expansion was mainly fueled by the increase in exports, especially within the EU, which averaged at about 6%. Imports also rose during that time and thus causing the balance of trade to remain virtually unchanged. However this time domestic demand began to increase, with government consumption leading this increase and private consumption following but only in small steps, especially since there were unresolved problems with the labor market. Unemployment showed signs of rising and reached an average of 8.8% throughout the Euro-zone. Yet again this year inflation rose to 2.1% but remained within the normal boundaries of the stability rules of the Euro-zone (however it was slightly above the upper boundary). This was attributed to some new fiscal measures taken by countries, such as Germany, and the increase in energy prices.

During this year Germany's economy began to recover from the slow growth rate of the previous years. And exports was the main source of its economic growth. However domestic demand still remained at a very low level, and thus, as noted by the Bundesbank: "German economy remained susceptible to disruptive influences and external shocks". Growth by the end of 2004 seemed to slow down from previous year, and this was mainly attributed to a disruption
in the global exports, which happened during the end of the year. GDP however increased by 1.6% and the key factors that affected it were the exports with an overall increase of 1.1% and changes in inventories with 0.7%. Exports increased heavily by an average of 8.6% and was another driving factor of the growth in the German economy.

Imports also increased, however at around 6.4% but the balance of trade remained in a positive sign. Again this year though domestic demand was still low. Private consumption averaged at a negative 0.4%, but the negative effects were offset by the government spending, which was at about 0.4%. Investments for machinery and equipment also increased during this year and together with public spending attributed to the growth of the economy. Unemployment also increased from 10.2% to 10.8%, despite the changes that were taking place in the labor market. Inflationary pressures were also noted during that year, mainly due to the rise in the energy and commodity prices.

Yet another year, government deficit increased and grew to 3.7% of GDP, which was relatively smaller to the deficit of the previous year. However EU Commission wanted to issue a warning against Germany, a decision which was halted by the Ecofin (the council of the finance ministers of all the EU members). Debt did also increase by 2% to 66%, and thus rose for a 3rd consecutive year. This meant that Germany failed to comply with the Maastricht convergence criteria, according to which the debt ceiling is set to 60% of GDP.

The Greek economy yet again displayed signs of strong growth in 2004. GDP continued its upward trend, and grew by 4.2%. Inflation fell to 3.0% during the first 3 quarters of 2004, however climbed back to 3.4% during the last one. The overall boom in global trade affected also Greece's exports positively and contributed to the reduction of its account deficit to 3.9%,
which was 1.7% lower than that of the previous year. Unemployment got up to 10.5%, and thus remained at higher levels than those of the rest of the Euro-zone countries.

Government deficit also increased to 6.1% of GDP and government debt rose by 1.2% at 110.5% of GDP in this year. This was partly attributed to differences between the expected and the actual government revenue and also to the Olympic Games, which took place in Greece in 2004. At that year Ecofin issued a notice to Greece to reduce the deficit to the appropriate levels. During that and the next year a cut down in government spending was decided as a measure of reducing the deficit.

![Graph of Government Spending](image)

**Figure 3.1.3**
Government Spending of Germany and Greece from 2000 to 2012

Growth was still high in 2005, but not as high as the previous year. In particular, world GDP grew by 4.8 (was 5.3% in the previous year). World GDP was mainly affected by: low interest rates and generally expansive monetary policies, an increase in the household's value due to real estate prices going up, emerging markets such as China and India and high profits made
by businesses at the time. USA GDP grew by 3.5% and this was one of the highest among the industrialized countries at that year. Japan also had a minor increase in its growth, compared to the previous year, which averaged at 2.7% up from 2.3%. In the EMU growth decelerated down to 1.3%, which was almost 0.8% down from the previous year. Emerging markets, which accounted for almost half of the world's output, growth was again high, but was somewhat lower than that of the previous year. China and India were the best performing among those markets, and their growth rates averaged at 10% and 8% respectively.

Inflationary pressures were offset by the fact that the wage increase was moderate, and inflation rose by 2.3% in developed and by 5.4% in developing countries. Prices of fuel, oil in specific, and commodities continued to increase for the fourth year in a row. Oil prices in particular rose to 41.3% more than the previous year and 114% by 2002. The rest of the commodities’ prices also increased but only by 10.3%, as compared to 18.5% in the previous year.

FED during that year decided to tighten its monetary policy and many other central banks decided to follow suit. This led to decreased inflation throughout the world. USD began to appreciate compared to other currencies during that year. However the changes had virtually no effect, since the USD exchange rates remained the same as in 2004. Fiscal policy was also tighter during 2005 for the seven largest economies in an attempt to reduce the government deficit.

In the Euro-zone growth seemed to slow down and averaged at 1.3%. This sluggishness in growth was mainly attributed to lagged effect of the appreciation of the Euro in the previous year as well as the increase of the crude oil prices. However the slowdown of growth was considered to be only temporary. Inflation in the Euro area remained over the barrier of 2%, at
2.2% as a result of the high prices of crude oil. Another characteristic of the Euro-zone at that time was that government deficit declined in general to 2.4% of the Euro area's GDP. However there were major differences between countries, and in particular there were those who decreased their deficit (such as Greece and Germany) and those who increased it even further (Italy and Portugal). Moreover the Euro depreciated for the first time after 4 years and that was expected to be one of the main factors of economic growth in the next year, as exports would benefit from the depreciation.

In Germany growth in 2005, averaged at 1.1% and was not higher than that of the previous year. The improvement in the global economy, greatly favored exports, which is one of the driving factors for growth in the German economy. However the positive effects of this improvement were offset by the increase in crude oil prices. This increase mainly hampered private consumption, which was also hit by the difficult conditions in the labor market. However the construction sector showed signs of recovery. Another significant thing was that during 2005 investors’ confidence seemed to slowly be restored.

Exports rose by 6.25%, which was high but still significantly lower than the previous year. Also Germany improved its position within the Euro area in terms of competitiveness, but still exports to non-euro-zone countries accounted for the bigger part of the total exports, with major buyers of the German products being OPEC countries and Russia. However, imports also increased by 5.25% and they were the result of the need to increase the output so that it could keep up with the high demand for German goods in the foreign markets. In that sense investments for machinery and equipment increased rapidly. Construction sector, despite the low output, was showing signs of stabilization. Low private consumption proved to be a significant problem for yet another year, despite the measures that have been taken, mostly in the form of
tax relief. Low private consumption was regarded to be related to the drop in employment rates. Unemployment rate during that year was the highest since the 90's and averaged at about 11.7%.

General government deficit decreased by 0.5% from the previous year and averaged at 3.3% of GDP. Yet again, for the fourth year in a row, the Maastricht criterion for 3% deficit was not achieved. Government debt followed that trend and the debt ratio increased to 67.7%, 2% higher than the previous year. This meant that the 60% ceiling in debt criterion was also not achieved, despite the fact that the government tried to get rid of some of its assets.

Growth rate in Greece was also reduced to 3.7% and lost about 1% compared to the previous year. However this was still considered to be pretty high, given the fact that energy prices increased during that year and that the government was moving on to a more tight fiscal policy. On the other hand, monetary easement and the overall global economic environment contributed to the positive sign on growth. Still Greek economy in 2005 was one of the fastest growing economies within the EU area. Private consumption was somewhat lower than in previous years, however household's expenditure was one of the main contributors to the growth in GDP. The boost in household's expenditure was attributed to the liberalization of the financial system, and the easement on consumer credit that was associated with it. Contrary to the investors in Germany, Greek investors seemed to remain skeptical about the developments in the economy. Even further companies that were originally based in Greece started to move on to neighboring countries, in search of more favorable taxation and lower labor costs. The construction sector, after the rapid increase it faced during the years up to the Olympic Games in 2004, seemed to have lost its force and thus depriving from the GDP some of its growth. However the balance of trade was on a positive note, but exports were declining to 3% from 11.5% during the previous year. Greek products at that time were considered to be losing their
competitiveness. Unemployment in 2005 dropped to 9.9%. Inflation also increased by 0.5% to an average of 3.5% up from 3% during the previous year.

Another important factor, the government deficit increased to 7.9%, up from 6.4%, in 2005. The general government debt also declined to 107.5% of GDP down from 108.5% during the previous year and was far from the ceiling set by the Maastricht Treaty.

Strong growth in the global economy was achieved in 2006. Global GDP increased by 5%. World trade was again the main reason for the increase in the GDP, as it rose by 9%. This expansion was mainly fueled by the increase in growth in the EMU as well as Japan, as growth in the US economy seemed to be slowing down. The factors that appeared to influence global growth were the decline in crude oil prices, the monetary policy of the FED and last but not least the policy measures taken by China that was trying to avoid the overheating of its economy. Inflation in the global economy, and especially in the developed countries, seemed to increase at start by reaching 3% in August, and then declining to 1.4%.

US growth was mainly affected by the rise in the short and long term interest rates. Specifically US economy seemed to benefit by those changes in the sense that they were used to cooling down the rapidly increasing prices of the real estate market, as well as take off the inflationary pressures which started to increase during the previous year. GDP grew by 3.25%. Housing investment declined by 12.5% due to the increase in the interest rates, whereas private consumption remained at low levels. US’s growth major drivers were the increase in industrial investment as well as in exports. The deficit accounted for 6.5% of the GDP.
The Japanese economy was also growing by the end of this year. GDP increased by 2.25. However private consumption was still pretty low. Government spending was also cut down during 2006, mainly due to an effort to improve public finances. Exports and business investments increased and were the driving factors of the growth of the Japanese economy.

Meanwhile the Euro was appreciated against both the Yen and the USD. However this made EU products less competitive against their competitors, but this effect was largely offset by the overall good state of the global economy.

Within the EMU, GDP grew at 2.5%, which was the highest since 2000. Moreover, the differences in growth between the various EU members were diminished even further. Growth was fueled by the increase in domestic demand as well as households' consumption but also due to commercial investment. Exports, including those between the member states, increased by 8.5% which was two times higher than that of the previous year. Unemployment rate also fell by
0.8% from the previous year, to 7.8%. Inflation remained higher than 2%, and this was mainly considered to be the result of the rise in energy prices.

During 2006, the German economy performed very well. GDP increased by 2.7%, with domestic demand, boosting the growth by 1.75%. The German economy was actually providing stimuli to the growth of the Euro-zone. Exports, which rose by 12.5%, were still considered to be the driving factor for economic growth, as it is actually increases the investments within Germany. During this year, even private consumption began to increase, after many years of being a negative factor for the overall economy's growth. Another explanatory factor of this growth, was the FIFA World Cup, which helped in the exports of services. Imports did also increase almost at the same level as exports, namely at 11%. As stated above, domestic demand increased during 2006, especially in the form of machinery and equipment, which grew by 7.25%. Even the construction sector began to expand further and went up by 4.25% during 2006. Moreover private consumption increased, but still at a pretty low pace averaging at 0.75%. Unemployment rate also declined from 11.7% in 2005 to 10.8% in 2006. Even inflation was lower than that of the previous year, with an average price of 1.8%. General government deficit ratio declined to 1.7% and was after five years below the ceiling set by the Maastricht Treaty. However debt-to-GDP ratio remained at the same level as in the previous year and stopped at 68%.

GDP in Greece rose by 4.3%, driven by the increased domestic demand. Monetary and credit conditions of the EMU, allowed for further financing household spending and private investment. Additionally, exports increased mainly due to the favorable global conditions. All the aforementioned factors allowed for the Greek economy to overcome the negative impact the sharp increase in oil prices in the first months of 2006.
Yet again the Greek economy was one of the fastest growing within the EU area. Private consumption increased by 0.5%, from 3.4% during the previous year, to 3.9% during this year. House prices and stocks were also important for the overall growth and continued to rise. Private consumption was affected highly by the deregulation of the financial markets, as well as by the easement in monetary policy, since consumers were given access to more money, which allowed them to spend further than what they could by only their income.

Private investment also increased by 7.6% and business activity followed with an increase from 1.5% to 8.6%. Unemployment also dropped from 9.9% to 8.9%, and that was mainly attributed to the increase in business activity. Inflation fell only a little from 3.3% to 3.5% in 2006, which was higher than the average inflation of the Euro-zone. The deficit of 0.7% of GDP, was turned into a primary surplus of 1.8% in 2006. The general government debt also fell to 104.6% of GDP, which was lower than that of the previous year by 2.9%.

For 2007 growth for the global economy continued its upward trend to an average of 5%. However this year’s growth was slowed down by the end of it, mainly because of the slackening of major economies all around the world, with the most important being USA. Emerging markets maintained their overall high growth and were not affected by the slackening of global growth, or at least not a very high degree. These markets were extremely important for the global economy, as they seemed to be the main driving forces of its growth. China, for instance, accounted for 25% of the overall increase of the global GDP.

The sluggishness of the world economy by the end of 2007, could be attributed to the shock caused by the real estate market in US. Corporate bonds spreads began to rise, which was only natural, since the risks that enterprises have been taking for a couple of years, in the form of
subprime loans, have now been reevaluated and reflected the real risk they had. However at start the effects of this crisis were mostly focused on the US economy and did not spillover to the other large, industrialized countries. Another factor for the drop in the global growth was the increase of the crude oil prices. Moreover world inflation rose at 3.3%, although prices were somewhat offset by the increased energy costs. All in all the prospects for the next year (2008) were deemed as gloomier than in previous years.

US GDP increased by 2.25% in 2007. The burst of the housing bubble was responsible for that, which was created by both the high prices in the real estate market during the previous years and the problems in the subprime mortgage market. However private consumption remained at the same levels as in the previous year (namely 3%). Household spending increased, as savings were declining. Another driving factor of this year's growth for US was the positive sign in the balance of trade, with exports being higher as compared to previous year and imports rising by only a little. Japan's economy also slowed down by 0.25%, with further cuts in government spending in an attempt to reduce the increasing government debt. Japanese exports were contributing the most to the growth in GDP, however their effects were offset by poor private consumption, which was related to the modest wage growth. Further deflation was also noted during that year.

Euro was also appreciated against the other currencies during that year, especially against the USD. During the last quarter of 2007, corporate bond markets as well as interbank money markets, were the ones that took the largest hit of the financial crisis in US's subprime markets. Bonds issued by EMU member states, began to experience high yields. The bond market at that time was characterized by uncertainty and that was reflected upon the ups and downs of the interest rates. Corporate bonds took also a large hit from the loss of confidence. In particular
corporate bonds of BBB had their yields doubled. Of course stock markets could not be unaffected by the above, something that made the financing of corporations even harder.

However indices in major developed countries, such as Germany and US, remained on a positive note by the end of the year, however their gains were relatively smaller. During the first three quarters of 2007 GDP in the Euro-zone grew by 2.75%. However, by the end of the year, the construction sector took a large hit, and private consumption also declined. To that energy prices also played an important role. During that year unemployment in the Euro-zone fell from 8.2% to 7.4%. Inflation also rose to 2.1% in 2007, and it seemed as it would be even more during the next year.

German Economy continued its upward trend. GDP increased by 2.6% and although this wasn't as much as the one in the previous year. The economic reforms that the German economy was going through the previous years, finally seemed to have paid off, with employment being very high. However inflation rose during that year to 2.3%, which was not perceived well by the German government. Exports were one of the basic pillars of the growth of the German economy, and German exporters strengthened their position in the global economy even more. However the appreciation of Euro against all other major currencies was a hindering factor for exports. This is perhaps why German exports were mainly high to the newly accepted EU members. Imports during that year increased by 4.8% thus averaging lower than in the previous year. Investments for machinery and equipment also grew, and construction activity contributed to the increase in GDP. However construction lost its dynamic during the second half of 2007. Private consumption was also negative. Unemployment was further reduced from 10.8% to 9% during that year. This was the first year after a long time (since 1989), that the general
government budget was balanced, with the structural reforms being considered as the driving factor behind this development.

Greece's GDP lost its momentum and averaged at 4% in the second half of 2007. Inflation picked up significantly and averaged at 3%. However the impact of the financial crisis in USA was minor and Greek banks were not affected immensely. The account deficit of Greece in 2007 was 14.1% of the GDP. This was a further sign that Greek economy was losing its competitiveness amongst the other economies in the world. The general government deficit was below 2.8% and the primary surplus of the previous year was reduced to 1.4% of the GDP. The government debt as a percentage of GDP was around 94.5% by the end of this year. Fiscal measures were deemed as necessary, in order to reduce deficit and debt considerably by 2010, as it was dictated by the Stability and Growth Program 2007-2010. Unemployment rates fell from 8.9% to 8.3%, however as noted by the Bank of Greece, the economy had overall a small capacity of creating new jobs, something that was believed that might cause problems in the future.

![Balance of Trade for Germany and Greece between 2000-2012](image)

**Figure 3.1.5**
Balance of Trade for Germany and Greece between 2000-2012
The financial crisis, that started in the mortgage market of US, was raging even more in 2008. The overall global economy was shocked by the crisis, and its effects intensified during the last quarter of 2008, when Lehmann Brothers declared bankruptcy. Various countries around the world, from developed to emerging and developing, started experiencing the effects of the financial crisis. Exports (and subsequently imports) were reduced, and real estate prices began falling rapidly all around the world, and especially in US and UK. The reduction in imports created a chain reaction of loss of income for emerging markets by the loss of propensity to consume from developed countries. Even oil and commodities production countries experienced a severe loss of income. The look of the overall economy was pretty dark during 2008.

Global growth was limited to 3.5%, which was almost 2 points lower than the previous year. Even emerging markets who had high growth during the previous year were losing their momentum. China's production was around 9% during this year, which was 2 points lower than the previous year.

GDP in US grew by only 1%, with exports being the only stimuli for it, and those were stimulated by the depreciation of the USD against other major currencies. The program launched by the US government in the second quarter, which mainly included tax reductions, only provided a short-term boost for household demand, because they used the additional disposable income to service their debts. By the second half of the year private demand began to decline. Investment confidence was at its lowest point. Inflation during that year fell to 3.8% in average. Japan was also hit hard by the crisis and all its economic indicators, such as investment, exports etc. fell, following the downward trend of the global economy.
The USD appreciated a bit during this year in regards, to other currencies. The pound however depreciated by 30% compared to the Euro. However the exchange rates of this year were characterized by increased volatility. Another trend of that year was the switching of investors from risky assets to more secure government bonds. The German bonds (which are commonly known as Bunds) benefited greatly from this situation. The yield in 10-y bonds was almost 100 basis points by the end of the year, and was significantly lower than that of other European countries. Stock markets were also experiencing considerable losses.

Growth for the Euro-zone was small and averaged at 0.75% in that year. The differences in growth between various countries were reduced even further. Housing investments took a serious hit, as the construction sector of major economies such as France, Italy, Spain and Ireland, was experiencing a downturn in its activities. Exports and industrial investments followed a similar trend. Unemployment also increased at that time to 8%. Inflation increased to 4% by June and then declined at 1.6% by the end of the year, averaging at 3.3% in total. ECB decided to further cut the interest rates to 3.75% in an effort to boost the EU economy.

The German economy performed well, given the difficult circumstances. It started off with growth, that was affected by the increase in the construction sector and even when construction slowed down, the industrial sector picked up and continued to boost the growth of the economy. However the economic upswing stopped when parts of the production sector had to cut down on their activities due to the financial crisis. Low exports were to blame for the slackening of the economy on the second quarter of 2008. They were the result of the globalization of the economy, as this promoted the co-movement between the various economies around the world and even more in the monetary union. Imports exceeded exports and thus net exports affected overall growth negatively. Domestic income showed significant
losses mainly due to the rising of the prices of crude oil. Consumer sentiment was also very low due to the overall gloomy situation. Unemployment in Germany during that time was 7.8% and was lower than the previous year by 1.2%. Inflation rate was averaging at 2.8% at that time, and was the highest in Germany since 1994. On a positive note government budget was balanced yet again for another year. General government deficit was at 12 billion Euro, while local and state government had positive balances.

Things did not look good in Greece as GDP fell to 2.9% down from 4% in the previous year, and the decline was attributed to low investments. Private consumption fell to 2.2%, but it still was considered as the main driving force of the GDP. However a sharp decline in investments for machinery and equipment offset the positive effects of private consumption. Moreover the construction sector, which in previous years supported the growth in GDP, lost its growth and fell by 29.1% as compared to the previous year. The sharp decline in domestic demand was counterbalanced by the improvement of the balance of goods and services, with imports falling rapidly and exports being increased at a medium pace. However the prospects of the Greek economy were seemed as dismal for the next year. The unemployment rate fell from 8.3% in the previous year to 7.6% in 2008. Inflation fluctuated a lot during 2008. For the first 7 months it reached an all time-high since 1998, however was then dropped by the fall in oil prices to 2.2% by the end of the year. The account deficit increased by 0.2% to 14.2% of GDP while the government deficit exceeded 3% at a 4% and thus way higher than the 1.6% which was the target for these years. The government surplus also fell from 1.3% of GDP to 0.5%. General government debt rose to 95.4%, up by 0.6%, of GDP. It should be noted that government debt remained high, not only due to annual deficits but also due to specific government transactions that are not accounted for in the deficit, but increase debt.
Figure 3.6
Inflation comparison between Greece and Germany in the years 2000-2012

The global economy showed signs of recovery during 2009, with Asian emerging markets, and especially China, being the pioneers in this development. Major economies all around displayed growth in their GDP. However overall economic growth declined by 0.75% in 2009. The crisis effects seemed to have been suppressed mainly due to efforts by central banks but also government support actions. Industrial output of major economies grew substantially and contributed in the recovery of the global economy. However the high levels of stock from various industrial goods, hindered the output. Inflationary pressures all around the globe, especially in emerging East Asian markets, were attributed to the upward trend in commodity prices.

Chinese government and central bank rushed in and stimulated the economic growth during the times of crisis, with expansionary monetary and fiscal measures.

US economy also displayed signs of recovery with growth in the second half of 2009. However its real GDP fell by 3.75%, but economic activity rose by 2%, but it was still
significantly lower than 2008. Japanese economy, boosted mainly by China's growth, started also to recover. Incentives were introduced in order to boost private consumption, which was further hampered by the rising unemployment.

The euro continued to be appreciated against the USD. Not only that but concerns were expressed about the seemingly high debt of various (mainly South-European countries), with Greece being the most disturbing one. Yields of the bonds within the Euro-zone were at 4%, which was 0.25% higher than the previous year. Yields of the 10-y US treasuries, rose by 1.75%. Even within the Euro-zone bond spreads were having immense differences, mainly due to the rapid increase of the CDS premiums. The difference in yields, between the German Bund and the Greek 10-y bond was over 300 basis points. Stock prices in both EU and US fell by more than 20%.

![Graph showing Bond Yields of Greek and German bonds from 2000-2012](image)

Figure 3.1.7
Bond Yields of Greek and German bonds from 2000-2012

The economy of the Euro-zone showed signs of recovery during the second half of 2009. GDP increased during the second half. Major factors for this increase were the expansionary monetary policy, foreign trade and the inventory cycle. Household spending was still pretty low
and output of the Euro-zone was rather low as well. Major economies of the Euro, namely Germany and Italy helped the overall economy grow, together with the increase in output by France. Greece was having immense problems mainly due to government debt rising to new heights whereas its credibility was hurt due to the inaccurate statistics. The ECB committed to start buying covered bonds from national banks in an effort to reduce the risk premiums and let the banking system breathe.

The GDP of the German economy fell by 5.0%, which was the lowest ever recorded in its history. Industry and exports got seriously hit by the global recession during 2008 and the first half of 2009 but showed clear signs of improvement thanks to the expansionary monetary and fiscal policy followed by many countries throughout the world. Private consumption increased, thanks to the incentives given for buying new cars as well as the premiums for recycling the old ones. Exports where declining for the first quarter, due to the fact that the recession affected the traditional trading partners of Germany, both within but also outside of the EU. As expected business investment took a great hit with the financial crisis and particularly as exports fell so did investment for machinery and equipment. Moreover business activity was hindered further by the difficulty by which enterprises could raise capital, as banks were reluctant in giving loans and thus market was deprived of its liquidity. Investment in housing was not affected by the economic crisis. Consumer confidence was also not affected up to a degree since unemployment prospects were for it to be low. Moreover public construction investment increased with the stimulus programs. Unemployment rose but only by 0.4%, a change which was within the accepted boundaries. Regardless of the increase in construction sector's activity, real estate prices remained low that year and housing's cost was kept at low levels.
Germany's public finance worsened during that year. A deficit in budget of 3.3% was noted during 2009. Government expenditures went up by almost 4% as a result of the fiscal packages that were intended to boost the economy.

Greek economy in 2009 was facing serious problems, mainly caused by high fiscal deficit and debt, while at the same time lost its competitiveness. Structural weaknesses already diagnosed in previous year, played the most decisive part for the situation in the economy. The spread between German and Greek bond yields was widening. Moreover the downturn in the global environment worsened the situation. In 2009, deficit got up to double digit numbers at 12.9% of the GDP, while in the meantime public debt rose to 115.1% of GDP. What followed is pretty much well known. Greece's bonds started to lose credit ratings, which in turn widened the spreads even further. This also increased borrowing and debt service costs. All the above made the already difficult situation even worse. GDP was reduced by 2% compared to the previous year. It is also important to say that Greece, as a small open economy, lagged at receiving the hit of the financial crisis. So when the rest of Europe was already recovering from the effects of the crisis, Greece just started to experience its effects.

The recession was hitting the Greek economy across all its sectors. The banking system, which was doing pretty good before the crisis and even during most of it, started facing liquidity problems, thus reducing the liquidity towards the market. With the stagnation that followed household's income reduced and so did the domestic demand, which for all the previous years was the driving factor of the growth in GDP. Moreover unemployment began to rise and reached 9.5%. In addition to those, national savings were pretty low. That meant that Greek economy was losing its competitiveness.
Global economy was recovering at a very fast pace in 2010. This growth seemed to be mainly connected to the expansionary monetary and fiscal policies, inventory cycles as well as the upswing in the world's financial markets. However this growth was put to the test, mainly due to the uncertainty associated with the high debts that some countries of the Euro-zone were facing. Another factor was yet again the US housing market, which was causing turmoil due to the fact that the incentives set by the government have expired. While industrialized economies began to grow at a good pace, emerging markets on the other hand displayed slackening in their growth during the first quarters of 2010, however their growth picked up again by the end of the year. During the first quarter of this year, industrial output was dropping, however it started increasing again by May. Another characteristic of this period was the increase in commodity prices, which increased by 39%. This was reflected by the all time high that was achieved by the HWWI, which is a commodity index which excludes energy prices. Inflationary pressures where observed in the emerging economies and their growth slowed down a little, which was perceived as a good thing since these countries avoided overheating.
US GDP returned to its levels before 2007 and output rose by 2.75%. Domestic demand was a bit volatile. Exports were picking up pace again and thus contributing the most to the growth of GDP, while at the same time imports also experienced a sharp increase. Private consumption, the basic pillar of US economy, accelerated. However labor market lagged at start and almost crippled the increase in consumption. Unemployment remained nearly at the same levels with a minor decrease of 0.5% and averaged at 9.4%.

Japan also displayed signs of rapid recuperation, and its economy's output grew by 4%. Exports were favored during that time and private consumption increased mainly due to incentives to buy cars and durable goods in general.

With the sovereign debt crisis raging within the Euro-area but also with, the once again, growing US economy USD appreciated against the Euro. Not only that but also the different rates of recovery amongst the various countries led to changes in the whole exchange rate system. During this time EFSF (European Financial Stabilization Mechanism) was established and had as a main purpose to provide financial assistance to the European countries that were hit by the sovereign crisis.

Greek government bonds had a yield of 13%. Ireland, Spain and Portugal were faced with similar problems although Spain and Ireland's problems were mostly due to their banking sector.
Germany was the main pillar of the European growth. Germany's growth had been 3.5 times EMU's growth. This acted as a stimulus for neighboring countries and especially France. The problem with the peripheral EU countries was also another hindering factor to the overall growth. Unemployment rates for the countries in the southern rim of Europe, and Ireland begin to climb at new heights, with Spain averaging at 20.1% and Ireland 13.5%. Inflation was around 1.6% and remained within the limits set by the Stability agreement. This situation was giving out "bad" signals for the future. Liquidity was provided to the European banks, and thus money market rates remained at historically low levels.

German economy, during 2010, was the one growing the most within the EMU. Output increased by 3.6% Once more, the growth in German economy was stimulated by the recovery of world economy and subsequently trade. German corporations took advantage of the opportunities that have been put up by the crisis. But besides exports, imports also increased rapidly. The disposable income of households increased, unemployment fell and there was
liquidity in the market. According to Bundesbank, this has been the best situation Germany had been in since the reunification. The industrial sector, after the disappointing 17% decline during the previous year, finally experienced rapid growth, mainly due to the increase in exports. Investments increased by 11%, which was the result of the high liquidity in the markets. Construction sector did also benefit from the expansive fiscal programs. Private consumption increased by 0.5% and was further strengthened by the optimistic perspectives for the German economy. Unemployment decreased from 8.2% to 7.7% and that strengthened further domestic demand. However, during that time inflation also increased by almost 1%, from 1% up to 2%.

Germany's deficit increased from 3% to 3.3% this year and the debt ratio increased to nearly 80%. Tax relief measures, contributed in the decline of revenues. The deficit in general government budget was also expected to surpass 80 billion Euro.

Meanwhile Greece was striving with high public debts and the need to impose the structural changes, as those were dictated by the Troika (IMF, ECB, EUC) and the memorandum Greece signed with them. On the one hand Greece escaped the default but on the other hand its economic situation worsened. Domestic demand fell as both private and public consumption fell, by 4.5% and 6.5% respectively. According to the Bank of Greece, should the structural reforms take place at a faster pace, recession effects would have been less, since those reforms would lead to an export/investment-oriented model. As it was natural the balance of trade had a positive sign, since imports were reduced (as household's income was shrinking and demand was falling) and exports increased.

Competitiveness of the Greek economy improved, mainly due to the reduction in labor costs. Exports were fueled by the improvement in the world economy. However exports
accounted only for a small fraction of the GDP, namely 21%, and so even if exports improved they still could not influence GDP growth positively. Unemployment climbed to 14.2 and affected the recession in the Greek economy even further, since it reduced private spending even more. We should always have in mind that Greek economy based, traditionally, its growth on domestic consumption. However this model, according to the bank of Greece, has failed and it is no longer sustainable.

The main concern of both the troika and the Greek government was at that point the reduction of fiscal deficit. In this sense, the new policy, produced results and the deficit was reduced by 5% of GDP. However this cut in the deficit was achieved by the cut down of wages, pensions, freeze of hiring in the public sector and by imposing new taxes. Reforms continued but at a slower pace. Current account deficit was decreased from 11% to 10.4% of GDP. The earnings of employees decreased by 5% and at the same time inflation increased to 4.7%. Meanwhile growth was next to zero, and averaged at 0.5%, while national savings averaged to 2.8%.

In 2011, global economy lost its momentum. The rapid increase of oil prices and the natural disasters in Japan and Thailand, as well as the ongoing sovereign debt crisis within the Euro-zone should take the blame for the economic slowdown. Not only in European Union but also in the emerging economies, growth was losing its pace. The only economy that showed signs of robust growth, was the US economy. Global industrial output was higher than the previous year by 4%. Also world trade displayed signs of contraction and expanded by 5.5%. Commodity prices were 12% lower than the previous year if those are calculated by the HWWI Index. However, surge in oil prices made industrial commodities 14.5% more expensive. As expected, inflation grew as well by more than 1%, up to 3.1% by the end of the summer.
The US economy had two major problems. First, household spending was reduced during the previous months, as a result of high inflation (3.2% on average) and the earthquake that hit Japan, which had as a side effect the interrupt of North American production (by the Japanese companies that operated there) of cars. However during the second half of the year US economy overcame the problems that have risen. Household spending increased, investment in machinery and equipment increased and unemployment fell from 9.4% to 8.5%. Thus GDP rose by 1.75% in 2011. Japanese economy faced difficulties, because just as it started to expand, the earthquake of March that year, deprived the economy of growth. Exports and industrial production were highly affected by those events. However Japanese economy showed signs of recovery pretty quickly, only a couple of months later during the third quarter of 2011.

Growing instability within the Euro-zone, resulted in the Euro being depreciated against the USD. The same happened with both the British pound and the Japanese yen. Moreover, the bond market also displayed some more worrying signs. Both the Italian and the Spanish government bond yields rose, as uncertainty about their economic situation increased. That made the EU leaders provide EFSF with emergency powers, as well as approve a second package of financial help for Greece. Another factor that affected the uncertainty levels in the bond markets was the voluntary haircut for the private sector bonds, by Greece (which had 94% participation by private investors).

More specifically, the growth, that was starting to increase during the first months of 2011, now started to slow down. This was attributed to damages in industrial and construction output, which were caused by weather and affected north and central Europe. Energy prices began to rise, and demand was being hampered, mainly due to the consolidation of public finance. GDP growth fell, but it was saved by the fact that there was strong economic activity at
the beginning of 2011. Germany's growth, was for yet another year the driving force of growth in the Euro-zone, and it was about 3 times higher than the overall growth of the EU. Output in Greece fell by 6.75% at the beginning of this year and this sharp fall even reached 15.75%. Overall unemployment grew by 0.8%, to 10.7%. Inflation also picked up and averaged at 2.7%, which was 1.1% higher than the previous year.

German economy's output grew by an average of 3%. Foreign demand was reduced, however domestic demand increased. Corporate investments increased and so did the activity of the construction sector. Household consumption also contributed to the overall growth. However growth was offset by the inflationary pressures, created by the increase in commodity prices. Exports grew by 8.2%, and so did industrial activity, both of which were the basic pillars for the increased economic activity. Business investments increased by 7.2% and housing construction, which was low in the preceding years, grew at about 6.3%. Private consumption rose by 1.5% after many years of stagnation, despite the inflationary pressures. Imports also increased rapidly during 2011. Unemployment was reduced even further to 7.1%. Moreover deficit ratio fell to 1%, which was way below the ceiling of 3%. The debt ratio fell from its previous levels however, it was still over 80%.

According to the Bank of Greece, the long needed structural reforms, that were imposed by the Memorandum should have been implemented swiftly, as the longer it took to the politicians to ratify those reforms, the bigger the adjustment cost would have been and the more the recession would be prolonged. The restructuring of debt and the new loan agreement were seen as absolutely necessary for the economy to overcome its weaknesses. Moreover, it is stressed in the report of 2011, that all the social partners need to be persuaded for the necessity of the reforms and unite, in order for the program to succeed. The restructuring of debt and the loan
agreement would help Greece to serve the debt and thus bring the country faster to growth course.

GDP in Greece in 2011, fell by 6.9%, mainly due to the decline in consumption and investment, with investment going down by more than 20%. Exports increased but at a slower rate, and thus reducing even further the GDP. Output fell also, with construction and the secondary sector taking the biggest hit, with a -17.9% and -12% respectively. The only economic sector that saw growth was the agricultural one, which increased by 2.5%. However this sector's size accounts only for a small part of the GDP so it was offset by the rest of the negative effects. Unemployment also increased at that point at 17.7%. The situation in the financial sector also deteriorated, with the credit expansion turning negative. There was no liquidity whatsoever from banks. On the other hand deficit was reduced by more than 1%, and there was a primary surplus of 0.5% of GDP. The debt was 170.3% of GDP before, and 136.5% after the haircut (the results of which came into effect the next year).

![Graph showing income tax rate comparison between Greece and Germany from 2000-2012](image)

**Figure 3.1.10**
Income Tax rate comparison between Greece and Germany from 2000-2012
Global growth in 2012, remained at low levels, mainly due to the sovereign crisis that still affected the Euro-zone. Most of the major developed economies during that year faced recessionary trends, especially Japan and UK. Increased oil prices were, for yet another year, a negative factor towards the global economic growth. US economy, however, retained its growth despite the ongoing controversies about the country's public finance. The growth of East and Middle Asian economies also slowed down during this year, with many of those countries been at their limits regarding growth. According to IMF's estimations, global economy's growth increased by 2.75% in 2012. The manufacturing sector showed signs of recovery by the end of the year and the global industrial output was increased by 3.5%. Following the manufacturing sector's trend, world trade grew by no more than 2.25%. Commodity prices, excluding energies, fell by more than 15.75%. However inflation seemed to be declining, which meant more disposable income for households.

For US specifically, GDP grew by 2.25%, which was clearly higher than the previous year. The main contributor to the growth was, once again, the increase in private consumption, which was highly related to the increase in income, with inflation falling by more than 1%, from 3.2% in the previous year to 2.1%. Moreover unemployment fell to 7.9% but since this is still a relatively high level, FED was expected to continue stimulating the real economy.

Japan also gained a significant increase in growth, which increased by more than 2% that year. However this was done only due to the great losses to growth in the previous year, mainly due to the earthquake, and the normalization process during 2012, that brought GDP back to its normal levels. Moreover growth was stimulated by the new incentives given by the government for people to buy new cars. However these measures lasted only for half a year, and after that, during the second half of 2012, contraction of GDP started again.
The Euro-USD exchange rate had many fluctuations throughout the year. First the Euro appreciated against the dollar, however regarding the situation within the Euro-zone increased, the Euro depreciated against the USD. However as the discussion about the "fiscal cliff" was being continued in US, the Euro appreciated again, however lost 7.5% of its value since the previous year. This happened, at an even bigger rate, with the yen as well, when in the spring of 2012 the Euro lost significantly against its Japanese equivalent. This situation was even direr after Japan started to show growth. However, by the end of the year the Euro appreciated significantly and overcame even the previous year's increase in the exchange rate, by 13.5%. Capital markets were calmed down by the three-year refinancing program of the Euro-system. This was effective also on the high yield bonds of the countries of the South and Ireland as, this was perceived by the markets as a sign, that those countries would be soon ready to re-enter them. However Greece and Portugal had no gains from that program.

For Greece in particular, investors feared that Greece would not meet the required objectives to receive the second package of financial aid. Moreover, at that time, the Greek government came to an agreement with its private creditors and proceeded to a haircut. Despite the haircut though, investors remained unconvinced as to whether these measures were sufficient to reduce the debt. What made things worse, were the elections that took place in May, and failed to elect a new government. About that time the smooth operation of the Spanish banking system came into question. As a result investors turned to bonds from major industrialized countries, like for example, Germany and USA. That was the reason for the dramatic drop in Bunds’ yields, which reached an all time low of 1%. However, that also caused a widening of the yield spread between the bonds of the various countries. Equity markets, in major developed countries continued their upward trend, especially those in US (SPX) and Japan (Nikkei). Euro Stoxx also
presented significant gains (around 16%). Generally stock markets displayed similar behavior to bond markets.

The sovereign debt crisis affected Euro-zone’s growth negatively, but that was not the only factor. There was a sharp decline in the output of most sectors of the European financial system. Construction fell by 3.5% and so did the output of the service sector. Domestic demand was also low (-2.25%). However the sector of machinery and equipments took the biggest hit. Private consumption was also reduced, as result of the ongoing efforts of consolidating public finance, especially in the countries of the South. Exports, on the other hand, were still on the positive side, although they increased in only half the rate they did the previous year. Unemployment also increased to 11.8%, mainly due to the high unemployment in the countries of the South. Inflation fell by only 0.2% compared to the previous year.

Germany’s GDP grew only by 0.7%, which was a very low growth rate as compared to those of 2010 and 2011 (4.25% and 3% respectively). This was attributed to lagged effects of the financial crisis of 2008 and to the fact that the economy was returning to its normal pace. German industry took a large hit, by the ongoing sovereign crisis, and returned to pre-crisis levels, which were lower than those of 2010 and 2011. Exports grew but at a slower pace, by 3.7%, which is almost 4 points lower than their growth in 2011. Exports within the Euro-zone fell, especially to the countries affected by the debt crisis, but increased outside the Euro-area. Investments in machinery and equipment declined by 4.8%, mainly due to the concerns of investors about the situation in the Euro-zone.

Housing construction, however, increased and this was attributed to the easement in monetary policy. Public construction though decreased mainly due to the ending of the stimulus
packages launched in the previous years. Private consumption increased by 0.6%, while savings dropped by 10.3%. Employment increased, mainly due to the inflow of immigrants, especially from the countries of the European south. Unemployment fell by 6.8%. Household income also rose by 2.5%. Inflation increased by 2.1% in 2012. The general government budget displayed a surplus of 0.2%. Debt also rose from 80.5% to 81.7% by the end of the year. General government deficit also fell, mainly due to an increase in tax revenues of 3%.

According to the Bank of Greece, Greece has taken important steps towards the improvement of its economy. Its progress was far from every expectation. The most important factors towards this improvement of confidence and the fiscal situation have been the formation of a coalition government, which wanted the continuing of Greece’s participation in the Euro-zone, the huge progress in the implementation of the fiscal adjustment program, the restoration of confidence in the Greek banking system, the financial support from the Euro system and the reforms in the European Union and the EMU.

Within Greece uncertainty had been reduced, as implied by the increase in the Economic Sentiment Indicator, which reached a two year high. Another indicator of that was that stock prices in ASE (Athens Stock Exchange), doubled. Savings also increased. Moreover, EU officials kept sending positive messages of support, and so the yield spreads of Greek and German bonds were reduced from 3,000 to 1,000 basis points in less than a year. Deficit was also reduced by 9% and the debt-to-GDP ratio also declined by 10%. The forecast about the reduction of debt is that it will fall below 110% by 2020.

Moreover, borrowing interest rates from national banks within the Euro-zone, were lowered even further, with the prospect of even further reduction, in case Greece achieved a
primary surplus. Growth and exports, in the future, are expected to increase, due to the ongoing structural reforms and the recovery of the lost competitiveness. GDP, however in 2012, was reduced by 6.4%, which if added to the previous years (2008-2012), sums up to a total reduction of 20.1%. Unemployment increased even further and reached 28%.

The aim of the structural reforms was to increase the competitiveness of Greece, and introduce an export-based growth model, instead of the existing domestic demand-driven. The basic idea was to create an economy with efficient public sector, modern infrastructure and more competitive products. Bank of Greece suggests that, should these reforms be successful, then Greece would return to positive signs on all its macroeconomic figures by 2014.

3.2 Indices

The DAX index comprises of the 30 largest companies of the German equities market. These companies are about 70% of the total volume exchanged in the German markets. The index is calculated as a performance index and is unique in the sense that it also includes dividends into the share prices thus providing accurate information on how the companies perform. This index is also highly liquid, and as such is one of the most active indices worldwide, with the trading volume ranging up to almost 9.5 billion Euro in 2011. How much weighting a share will have, is based on the basis of the index, whereas the weighting of each individual share cannot be more than 10%.
The Athens Stock Exchange Composite Index is the most important index of the Athens Stock Exchange. It was originally lost on December 1980 and is a reliable measure of performance of the shares of the companies that are a part of it. This index represents, on average, the 85% of the total capitalization of more than 50 companies that are listed in the Greek Stock Exchange. The index is a composite weighted average mean, that uses weights for every share it includes, according to the value of the shares in relation to the total value of all the shares which are used by the index.
3.3 Data

Daily price index data for Athens Stock Exchange (ASE) and Frankfurt Stock Exchange (DAX) were obtained from the Bloomberg platform. Daily data were used because we wanted to capture the possible co-movement between the two stock exchanges. We used the rate of return (denoted as $r$), which is the rate of change in daily prices, and this is computed as the log differences of price.

Our sample period is from the 3rd of January 2000 till the 31st of December of 2012 (with 3300 observations). As stated above, Greece entered the Euro-zone on the 1st of January 2002. We used the 3rd of January 2000 as our starting date because we also wanted to capture any possible co-movement even before Greece entering the monetary union, since as it is stated in Shoellhamer and Sand (1985) and Moore (2007), financial agreements tend to affect the level of co-movement between markets and the common currency has a stabilizing effect on them. In order to account for the effects the crisis had upon the co-movement of the two stock exchanges, we divided our sample into two sub-samples. One from 2000-2008 and the other from 2008-2012.

Moreover we wanted to examine whether the major political and financial events during the period of the crisis (2008-2012) had an effect on the co-movement of the two stock exchanges, and whether this effect was significant, as stated in Albuquerque and Vega (2009), although we differentiated from their paper in the sense that instead of examining the effect of the events or news of the large market on the small one we examined the effect those events had upon the co-movement of the two stock markets.
The variables we used in our models were:

$r_{ASE}$, which are the rates of return on ASE prices

$r_{DAX}$, which are the rates of return on DAX prices

$r_{ASELAG}$, which are the rates of return with one period lag for ASE

$r_{DAXLAG}$, which are the rates of return with one period lag for DAX

Table 3.3.1 reports the rate of return and the volatility (measured by the standard deviation) of both our sample but also the sub-periods under review.

<table>
<thead>
<tr>
<th>Rate of Return and Volatility of the Full Sample and the Two Sub-samples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ASE rate of return and volatility</strong></td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Variance</td>
</tr>
<tr>
<td>St. Dev</td>
</tr>
<tr>
<td><strong>DAX rate of return and volatility</strong></td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Variance</td>
</tr>
<tr>
<td>St. Dev.</td>
</tr>
</tbody>
</table>

Table 3.3.1
What we notice is that ASE has higher average returns for the full sample, however for the sub-period 2000 - 2008 those are lower than the average returns of DAX. In the second sub-period however, which is the period that the crisis affected the Greek economy, ASE has significantly higher returns than the DAX. Another characteristic of the two stock markets under review is their volatility. Overall, ASE displays higher volatility, which can be attributed to the volatility increase in the second sub-period. We should not forget that at that time the Greek economy started to show signs of deterioration, and the stock market's volatility, reflected that.

Next we examine the correlation between the different variables. Table 3.3.2 displays the correlations for the full sample while tables 3.3.3 and 3.2.4 display the correlations between the different variables of the two different subsets.

<table>
<thead>
<tr>
<th>Correlation of the Whole Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>rASE</td>
</tr>
<tr>
<td>rASELAG</td>
</tr>
<tr>
<td>rDAX</td>
</tr>
<tr>
<td>rDAXLAG</td>
</tr>
</tbody>
</table>

Table 3.3.2

<table>
<thead>
<tr>
<th>Correlations for the Sub-group 2000-2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>rASE</td>
</tr>
<tr>
<td>rASELAG</td>
</tr>
<tr>
<td>rDAX</td>
</tr>
<tr>
<td>rDAXLAG</td>
</tr>
</tbody>
</table>

Table 3.3.3
Correlations for the Sub-group 2008-2012

<table>
<thead>
<tr>
<th></th>
<th>rASE</th>
<th>rASELAG</th>
<th>rDAX</th>
<th>rDAXLAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>rASE</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rASELAG</td>
<td>0.423166</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rDAX</td>
<td>0.377179</td>
<td>0.202748</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>rDAXLAG</td>
<td>0.20627</td>
<td>0.33078</td>
<td>0.507747</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 3.3.4

As we can see there is strong positive correlation between the returns of ASE and DAX and their respective lagged returns, which was something that was expected. In the full sample ASE and DAX have a semi-strong correlation between them, which is also fairly similar to the correlation of their lagged returns. This trend is also displayed in the first sub-sample, as the correlation of the aforementioned pairs (rASE-rDAX, rASELAG-rDAXLAG, rASE-rASELAG and rDAX-rDAXLAG), displayed similar behavior.

What is noticeable however, is that the correlation between ASE and DAX returns increases to 0.377179, up from 0.213974, during the financial crisis period, which is a pattern followed by their respective lagged returns as well, which have a correlation of 0.33078 up from 0.199857. This can be attributed to the timeframe within which we are examining the two stock markets. Greece entered the crisis a bit later than Germany (almost at the end of 2008), however both of those countries experienced its effects during almost the same years. The only difference was that the German economy was much stronger, and allowed them to overcome the crisis earlier than Greece, at the end of 2009, something that is reflected perfectly in the movement of their respective stock markets.

We start our analysis by performing some multiple linear regression regressions. First we regress the returns of one market on its own lag term and on the current and lagged returns of the
other market. We divide our sample into two periods, one before 2008, which was the year during which the financial crisis affected Greece for the first time, and one after that, till the end of 2012. Afterwards, we do the same regression for the full sample and the other subsamples in order to see the differences between the different periods. In the tables 3.2.5 and 3.2.6, that follow, A stands for ASE and D stands for DAX indices, 0 and 1 indicate the lagged return variables.

### Multiple Linear Regressions of rate of return of ASE index

<table>
<thead>
<tr>
<th></th>
<th>Full Sample</th>
<th>Sub-sample 2000-2008</th>
<th>Sub-sample 2008-2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef. /t</td>
<td>Coef. /t</td>
<td>Coef. /t</td>
</tr>
<tr>
<td>A0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A1</td>
<td>0,5285543</td>
<td>0,513028</td>
<td>0,455967</td>
</tr>
<tr>
<td></td>
<td>32,6780132</td>
<td>24,76581</td>
<td>16,63137</td>
</tr>
<tr>
<td>D0</td>
<td>0,32726417</td>
<td>0,184543</td>
<td>0,47508</td>
</tr>
<tr>
<td></td>
<td>17,7191641</td>
<td>9,861999</td>
<td>14,50096</td>
</tr>
<tr>
<td>D1</td>
<td>0,24349665</td>
<td>0,148333</td>
<td>0,275261</td>
</tr>
<tr>
<td></td>
<td>11,6004478</td>
<td>6,737695</td>
<td>7,50588</td>
</tr>
</tbody>
</table>

Table 3.3.5

### Multiple Linear Regressions of rate of return of DAX index

<table>
<thead>
<tr>
<th></th>
<th>Full Sample</th>
<th>Sub-sample 2000-2008</th>
<th>Sub-sample 2008-2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef. /t</td>
<td>Coef. /t</td>
<td>Coef. /t</td>
</tr>
<tr>
<td>A0</td>
<td>0,26560975</td>
<td>0,248099</td>
<td>0,299413</td>
</tr>
<tr>
<td></td>
<td>17,7191641</td>
<td>9,861999</td>
<td>14,50096</td>
</tr>
<tr>
<td>A1</td>
<td>0,15954297</td>
<td>0,150104</td>
<td>0,53795</td>
</tr>
<tr>
<td></td>
<td>9,64956195</td>
<td>5,516612</td>
<td>20,98689</td>
</tr>
<tr>
<td>D0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D1</td>
<td>0,54596</td>
<td>0,556243</td>
<td>0,173193</td>
</tr>
<tr>
<td></td>
<td>32,5230716</td>
<td>24,54569</td>
<td>7,362304</td>
</tr>
</tbody>
</table>

Table 3.3.6
From the multivariate regressions we observe that the Greek Stock market is affected largely by its German equivalent, especially after the financial crisis, while DAX remains relatively unaffected by the ASE. Also both stock markets, before and after the crisis, seem to be affected by their own lagged returns, and both have significant interaction, both with their own lagged returns but also with the ones from the other market.

In the next pages we will regress our returns on their own lagged returns as well as on lagged returns for the “foreign” market. As “native” we set ASE, while as foreign we choose DAX, in the begging. Then we use DAX as native and the ASE as foreign. This allows us to find any possible asymmetric effects. We model our time-varying coefficient as “a random walk process”.

Although those regressions may provide us with a picture as to whether the two indices are co-moving or not through the course of time, we considered as necessary to examine what the effect of the crisis was on the co-movement. In order to have a better view of it we extracted the coefficients on the regressions after 2008, which was the time that the crisis affected Greece. Those coefficients were calculated by both the smoothing method and the filtered method, using the Kalman filter. After that we created a table with the political events in Greece, in order to examine the effect those events had on the co-integration between the two markets. What we did next was to create a new data set of the dates at which a political event had happened, using dummy variables of 0 for the dates with no event and 1 for the dates with an event. Our betas were the dependent variable, while the dummy variables the independent ones.
3.4 Specification of the time-varying coefficient regressions between ASE and DAX

The first model is the simplest one. Our domestic market returns are only regressed on
the foreign market returns with a constant intercept and the aforementioned coefficient.

**Model 1.a:**
\[ r_{ASE} = a + b_t r_{DAX} + e \sim N(0, \sigma_e^2) \]
\[ b = b_{t-1} + u_b \, u_t \sim N(0, \sigma_e^2) \]

**Model 1.b:**
\[ r_{DAX} = a + b_t r_{ASE} + e \sim N(0, \sigma_e^2) \]
\[ b = b_{t-1} + u_b \, u_t \sim N(0, \sigma_e^2) \]

For the second model we add to the first one lagged domestic return with a constant
coefficient to the first specification.

**Model 2.a:**
\[ r_{ASE} = a + b_t r_{DAX} + \gamma r_{t-1} r_{ASELAG} + e \sim N(0, \sigma_e^2) \]
\[ b = b_{t-1} + u_b \, u_t \sim N(0, \sigma_e^2) \]

**Model 2.b:**
\[ r_{DAX} = a + b_t r_{ASE} + \gamma r_{t-1} r_{DAXLAG} + e \sim N(0, \sigma_e^2) \]
\[ b = b_{t-1} + u_b \, u_t \sim N(0, \sigma_e^2) \]

For the third specification we add to our second specification one lagged foreign return as
an extra regressor with time-varying coefficient.
Model 3.a:

\[ rASE = a + b_{1,t} rDAX + \gamma r_{t-1} rASElag + b_{2,t} rDAXlag + e \sim N(0, \sigma^2_e) \]

\[ b_{1,t} = b_{1,t-1} + u_{1t}, u_{1t} \sim N(0, \sigma^2_{u1}) \]

\[ b_{2,t} = b_{2,t-1} + u_{2t}, u_{2t} \sim N(0, \sigma^2_{u2}) \]

Model 3.b:

\[ rDAX = a + b_{1,t} rASE + \gamma r_{t-1} rDAXlag + b_{2,t} rASElag + e \sim N(0, \sigma^2_e) \]

\[ b_{1,t} = b_{1,t-1} + u_{1t}, u_{1t} \sim N(0, \sigma^2_{u1}) \]

\[ b_{2,t} = b_{2,t-1} + u_{2t}, u_{2t} \sim N(0, \sigma^2_{u2}) \]

Our last model is the one that includes the coefficients and the dummy variables. We extracted the time-varying coefficients from the previous regressions, both as smoothened and as filtered, and we used them as our dependant variable in regressions with the political events that happened in Greece during 2009-2012, which were the years that the crisis affected Greece. We created dummy variables for the dates with political events using 0 for the days with no event and 1 for the ones with political events and used these dummy variables as our independent variables. The table of the political events can be found in the Appendix 1.1. For the dates that the stock markets were closed we used the next day assuming that the effect of the previous day’s events remains in the next day as well.
Model 4:

S. Coefficient = a + b * Dummy Variable and

F. Coefficient = a + b * Dummy Variable

3.5 Estimation Results and Analysis

In this part of this paper we present the parameter estimates of each model for both market returns. For the constant coefficients we show the estimates in the equation and present also the t-statistics in the parentheses, while for the time-varying ones we plot the estimated process.

The first models are:

\[ r_{ASE} = 0.00674(3.85) + \beta r_{DAX} + e \]

\[ r_{DAX} = 0.00379(5.16) + \beta r_{ASE} + e \]

3.2.3 ASE and DAX Plot, Model 1

From the first equation and the first plot we notice that the Greek stock market affects the German stock market in a positive way and the German stock market affects the Greek one in a similar
manner. Moreover, as we can see from the plots, the German stock market’s positive impact on the Greek one results in the clear upward trend of the latter especially during the financial crisis (which we denoted that started from observation 2031, or the 1st of January 2008), while the effect of the Greek stock market on the German one seemed to not affect it as much during the crisis but has a strong positive effect on it during the first years of our study.

The second models are:

\[ r_{\text{ASE}} = 0.00030121(2.16) + \beta_t r_{\text{DAX}} + 0.00010374 (40.34)r_{t-1}r_{\text{ASELAG}} + e \]

\[ r_{\text{DAX}} = 0.00060033(3.67) + \beta_t r_{\text{ASE}} + 0.00007809(40.50)r_{t-1}r_{\text{DAXLAG}} + e \]

![ASE Plot](image1)

![DAX Plot](image2)

**Figure 3.2.4 ASE and DAX Plot, Model 2**

We notice that even after we inserted the lagged returns of both the ASE and the DAX on their respective models, the paths of the time varying coefficients resemble the ones from our previous models. The same pattern can be recognized. Specifically for Greece the effect of the DAX before the crisis did not affect the Greek stock market as much as the Greek returns affected the German ones (as seen in the second graph). After the crisis started the German stock market remained unaffected by the Greek one, while its own lagged returns had a smoothening
effect on its trend. The smoothening effect of the Greek lagged returns on the Greek stock market can also be seen, however the clear upward trend remained due to the effects of the German stock exchange returns.

The third models are:

$$r_{ASE} = 0.00017117(2.21) + \beta_{1,t} r_{DAX} + 0.00010373(40.49)r_{t-1}r_{ASELAG} + \beta_{2,t} r_{DAXLAG} + e$$

$$r_{DAX} = 0.00041938(3.86) + \beta_{1,t} r_{ASE} + 0.00007674(40.32)r_{t-1}r_{DAXLAG} + \beta_{2,t} r_{ASELAG} + e$$

3.2.5 ASE and DAX Plot $b_{1,t}$, Model 3
In order for us to examine the robustness of our time-varying coefficient or our current domestic returns on the foreign market, we added one lagged foreign, on top of the domestic foreign return, with a time-varying coefficient. This was also suggested by the statistically significant coefficient we found from our lagged foreign returns on our previous discussion (section 3.2). From the above, one can deduce that our coefficients of the foreign returns on our current returns are still robust, as the path of our coefficients has barely changed.

The effect of the Greek lagged returns on our German returns however, seems to be positive at some point at around 2002 - 2003, which are the years immediately after Greece entered the Euro-zone. If we look back at our initial macroeconomic analysis, we will also see that Greece during those years, and up the Olympics of 2004, was performing extremely well. In that sense, we can easily understand that initially the reaction of the German stock market on the previous "good" years for both the Greek economy and the Greek stock market, could easily
influence the returns of the German one. On the other hand the Greek stock market seems to
remain fairly unaffected by the lagged returns of its German counterpart.

Our last two models are those in which we regress the coefficients for the times of crisis
with:

S. Coefficient = 0.25882(83.31) + (−0.2177)(−9.46) Dummy Variable

F. Coefficient = 0.17515(58.77) + (−0.1424)(−6.45) Dummy Variable

Here we see that the coefficients of the political events have a negative statistical
significant value. This could imply that the political events that happen in Greece have a negative
effect on the co-movement between the two stock markets. This seems to be very significant
during times of economic crisis.
4. CONCLUSIONS

We used time-varying regressions to explore whether there is a co-movement between the two stock exchanges or not. The daily data we used, from January 2000 to December 2012, provided us with a clear picture on the behavior of the two stock markets. Also our time-varying coefficients are fairly robust due to the use of lagged foreign and domestic returns, as proposed by Chow et al. (2011).

![Graph showing co-movement of ASE and DAX stock exchanges over the years 2000-2012](image)

Figure 4.1: Co-movement of ASE and DAX stock exchanges over the years 2000-2012

Our results are consistent with the existing literature. The Greek stock market is highly related to the German stock market. This is the effect of the DAX being one of the world’s leading markets and as such it is expected to have integration with smaller ones, as Metin and Muradoglu (2011) report. Moreover we notice that the process of co-movement between the two markets was interrupted by the recent financial crisis, which was also pointed by Chow et al.
(2011) on the co-movement between Shanghai and New York stock markets during the financial crisis.

Overall, we could conclude that there is co-movement between the ASE and DAX, but only in times where there is no shock in the markets and everything goes smoothly. In times of a crisis, such as the current financial crisis, the two markets seem to move separately and to be more specific in totally opposite directions, as shown in the figure 4.1. This is something that investors should find interesting as these results show that there is a chance for risk hedging, by investing in these two markets in times of crisis.

Also the fact that there are negative, statistically significant, coefficients on our regressions between the coefficients and the major events leads us to the conclusion, that the political events in Greece have a significantly negative impact on the co-movement between the two stock markets. This result was similar to the one by Albuquerque and Vega (2009), who examined how news from a smaller country (Portugal) affect the co-integration between its stock market and a world’s leading market (US). Similar to what they reported, we also see that major news from Greece affect greatly the co-movement between those two markets.

We also notice that the macroeconomic policy that is implemented during the financial crisis (namely the austerity measures) affects the co-movement of the stock markets, something that was also noted by Akash et al. (2011). It seems that this policy makes investors turn from the Greek stock market towards the German one, since they believe that way they will have more safety in their investments.
REFERENCES


Other sources


Appendix

The Appendix table was based on the Greek Wikipedia article on the Greek Debt Crisis. Source: http://el.wikipedia.org/wiki/%CE%95%CE%BB%CE%BB%CE%B7%CE%BD%CE%B9%CE%BA%CE%AE_%CE%BA%CF%81%CE%AF%CF%83%CE%B7_%CF%87%CF%81%CE%AD%CE%BF%CF%85%CF%82_2010-2014, Retrieved at 19th of June 2012

Figures

Figure 3.1.1: GDP per capita comparison between Greece and Germany from 2000-2012, 20th of July 2013, Retrieved from: http://www.tradingeconomics.com

Figure 3.1.2: Government Debt-to-GDP ratio for Germany and Greece from the year 2000 to 2012, 20th of July 2013 Retrieved from: http://www.tradingeconomics.com

Figure 3.1.3: Government Spending of Germany and Greece from 2000 to 2012, 20th of July 2013 Retrieved from: http://www.tradingeconomics.com

Figure 3.1.4: Greek and German unemployment rates from 2000-2012, 20th of July 2013 Retrieved from: http://www.tradingeconomics.com

Figure 3.1.5: Balance of Trade for Germany and Greece between 2000-2012, 20th of July 2013 Retrieved from: http://www.tradingeconomics.com

Figure 3.1.6: Inflation comparison between Greece and Germany in the years 2000-2012, 20th of July 2013 Retrieved from: http://www.tradingeconomics.com

Figure 3.1.7: Bond Yields of Greek and German bonds from 2000-2012, 20th of July 2013 Retrieved from: http://www.tradingeconomics.com

Figure 3.1.8: Comparison between Greek and German exports, 20th of July 2013 Retrieved from: http://www.tradingeconomics.com
Figure 3.1.9: *Greek debt and Euro-zone average*, 20th of July 2013 Retrieved from: http://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm

Figure 3.1.10: *Income Tax rate comparison between Greece and Germany from 2000-2012*, 20th of July 2013 Retrieved from: http://www.tradingeconomics.com

Figure 4.1: *Co-movement of ASE and DAX stock exchanges over the years 2000-2012*, 20th of July 2013 Retrieved from: http://www.tradingeconomics.com
### APPENDIX

#### 1.1 Table of major events in Greece

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd of September 2009</td>
<td>Elections announced by the Prime Minister</td>
</tr>
<tr>
<td>4th of October 2009</td>
<td>Elections are held</td>
</tr>
<tr>
<td>20th of October 2009</td>
<td>The minister for economics and finance announces that the deficit for 2009 will be 12.5% instead of 6%</td>
</tr>
<tr>
<td>22nd of October 2009</td>
<td>Fitch downgrades Greece from A to A-</td>
</tr>
<tr>
<td>20th of November 2009</td>
<td>The public budget was introduced to the parliament for voting</td>
</tr>
<tr>
<td>8th of December 2009</td>
<td>Fitch downgrades Greece from A- to BBB+</td>
</tr>
<tr>
<td>16th of December 2009</td>
<td>Standard and Poors downgrades Greece from A- to BBB+</td>
</tr>
<tr>
<td>23rd of December 2009</td>
<td>Moody’s downgrades Greece from A1 to A2</td>
</tr>
<tr>
<td>24th of December 2009</td>
<td>The public budget is approved by the parliament</td>
</tr>
<tr>
<td>8th of January 2010</td>
<td>European Commission’s report on the Greek debt, according to which data from previous years are also suspected to be inaccurate</td>
</tr>
<tr>
<td>21st of January 2010</td>
<td>10-year bond spreads go over 300 bps</td>
</tr>
<tr>
<td>26th of January 2010</td>
<td>The world economic forum of Davos is the first time where the Greek Prime Minister is getting pushed to take austerity measures</td>
</tr>
<tr>
<td>Date</td>
<td>Event</td>
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<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>3\textsuperscript{rd} of March 2010</td>
<td>The second package of austerity measures is announced</td>
</tr>
<tr>
<td>9\textsuperscript{th} of April 2010</td>
<td>Fitch downgrades Greece to BBB-</td>
</tr>
<tr>
<td>22\textsuperscript{nd} of April 2010</td>
<td>Moody’s downgrades Greece from A2 to A3</td>
</tr>
<tr>
<td>23\textsuperscript{rd} of April 2010</td>
<td>Greece asks for financial support from the ECB, IMF and EU (also known as the troika)</td>
</tr>
<tr>
<td>27\textsuperscript{th} of April 2010</td>
<td>Standard and Poor’s downgrades Greece from BBB+ to BB-</td>
</tr>
<tr>
<td>28\textsuperscript{nd} of April</td>
<td>10 year bond spreads go over 1000 bps</td>
</tr>
<tr>
<td>2\textsuperscript{nd} of May 2010</td>
<td>The austerity measures imposed by the troika are announced</td>
</tr>
<tr>
<td>6\textsuperscript{th} of May 2010</td>
<td>The Greek parliament approves the memorandum signed by the government and the troika, and for the austerity measures</td>
</tr>
<tr>
<td>8\textsuperscript{th} of May 2010</td>
<td>The Greek government signs the loan agreement with EU</td>
</tr>
<tr>
<td>10\textsuperscript{th} of May 2010</td>
<td>The Greek government signs the loan agreement with IMF</td>
</tr>
<tr>
<td>14\textsuperscript{th} of June 2010</td>
<td>Moody’s downgrades Greece by 4 grades from A3 to Ba1</td>
</tr>
<tr>
<td>23\textsuperscript{rd} of December 2010</td>
<td>The public budget for 2011 is approved by the parliament</td>
</tr>
<tr>
<td>Date</td>
<td>Event</td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>14th of January 2011</td>
<td><em>Fitch downgrades Greece from BBB- to BB+</em></td>
</tr>
<tr>
<td>7th of March 2011</td>
<td><em>Moody’s downgrades Greece by 3 grades from Ba1 to B1</em></td>
</tr>
<tr>
<td>12th of March 2011</td>
<td><em>EU decides to extend the time for the repayment of the loan of May 2010 by 7.5 years and reduce the interest rate by 1%</em></td>
</tr>
<tr>
<td>29th of March 2011</td>
<td><em>Standard and Poor’s downgrades Greece from BB+ to BB-</em></td>
</tr>
<tr>
<td>9th of May 2011</td>
<td><em>Standard and Poor's downgrades Greece from BB- to B</em></td>
</tr>
<tr>
<td>20th of May 2011</td>
<td><em>Fitch downgrades Greece from BB+ to B+</em></td>
</tr>
<tr>
<td>1st of June 2011</td>
<td><em>Moody’s downgrades Greece from B1 to Caal</em></td>
</tr>
<tr>
<td>3rd of June 2011</td>
<td><em>Dagong downgrades Greece from BB to CCC</em></td>
</tr>
<tr>
<td>9th of June 2011</td>
<td><em>Mid-term Fiscal Strategy Framework for 2011-2014 is submitted to the parliament</em></td>
</tr>
<tr>
<td>14th of June 2011</td>
<td><em>Standard and Poor’s downgrades Greece from B to CCC</em></td>
</tr>
<tr>
<td>29th of June 2011</td>
<td><em>The Mid-term Fiscal Strategy Framework is approved by the Greek parliament</em></td>
</tr>
<tr>
<td>13th of July 2011</td>
<td><em>Fitch downgrades Greece by 3 grades from B+ to CCC</em></td>
</tr>
<tr>
<td>Date</td>
<td>Event</td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>25&lt;sup&gt;th&lt;/sup&gt; of July 2011</td>
<td>Moody’s downgrades Greece from Caa1 to Ca</td>
</tr>
<tr>
<td>21&lt;sup&gt;st&lt;/sup&gt; of July 2011</td>
<td>EU summit agrees on giving a new loan of 158 billion to Greece</td>
</tr>
<tr>
<td>8&lt;sup&gt;th&lt;/sup&gt; of August 2011</td>
<td>ASE (Athens Stock Exchange) drops below 1000 units for the first time since 1997</td>
</tr>
<tr>
<td>17&lt;sup&gt;th&lt;/sup&gt; of August 2011</td>
<td>Greece signs a bilateral agreement with Finland, in order for the latter to participate in the loan to Greece</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; of September 2011</td>
<td>The minister for Finance and the troika representatives disagree and the representatives leave the country unexpectedly</td>
</tr>
<tr>
<td>27&lt;sup&gt;th&lt;/sup&gt; of October 2011</td>
<td>EU decides to “haircut” Greek debt by 50%</td>
</tr>
<tr>
<td>31&lt;sup&gt;st&lt;/sup&gt; of October 2011</td>
<td>Prime Minister of Greece announces his intention of going on a referendum regarding the new loan</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; of November 2011</td>
<td>The government receives vote of confidence from the Greek parliament</td>
</tr>
<tr>
<td>10&lt;sup&gt;th&lt;/sup&gt; of November 2011</td>
<td>Both political parties of PASOK and ND decide on creating a majority coalition in the parliament</td>
</tr>
<tr>
<td>11&lt;sup&gt;th&lt;/sup&gt; of November 2011</td>
<td>Loukas Papadimos is appointed new Prime Minister of the new government</td>
</tr>
<tr>
<td>Date</td>
<td>Event</td>
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<td>------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>9th of February 2012</td>
<td>The participants of the new government come to an agreement on the new loan, the PSI and the austerity measures that are requested by the troika</td>
</tr>
<tr>
<td>12th of February 2012</td>
<td>The second memorandum is approved by the Greek parliament</td>
</tr>
<tr>
<td>9th of March 2012</td>
<td>PSI was completed with the private sector’s participation being over 95.7%</td>
</tr>
<tr>
<td>11th of April 2012</td>
<td>New elections are announced</td>
</tr>
<tr>
<td>6th of May 2012</td>
<td>The elections have no clear winner</td>
</tr>
<tr>
<td>17th of June 2012</td>
<td>Elections are taking place again and a new coalition is formed between 3 political parties (PASOK, ND and DEMAR)</td>
</tr>
<tr>
<td>21st of June 2012</td>
<td>The new government is being sworn</td>
</tr>
<tr>
<td>5th of November 2012</td>
<td>The Mid-term Fiscal Strategy Framework for 2013-2016 is being brought to the Greek parliament</td>
</tr>
<tr>
<td>7th of November 2012</td>
<td>The Mid-term Fiscal Strategy Framework is approved by the parliament</td>
</tr>
<tr>
<td>22nd of December 2012</td>
<td>The public budget for the fiscal year 2013 is being approved</td>
</tr>
</tbody>
</table>