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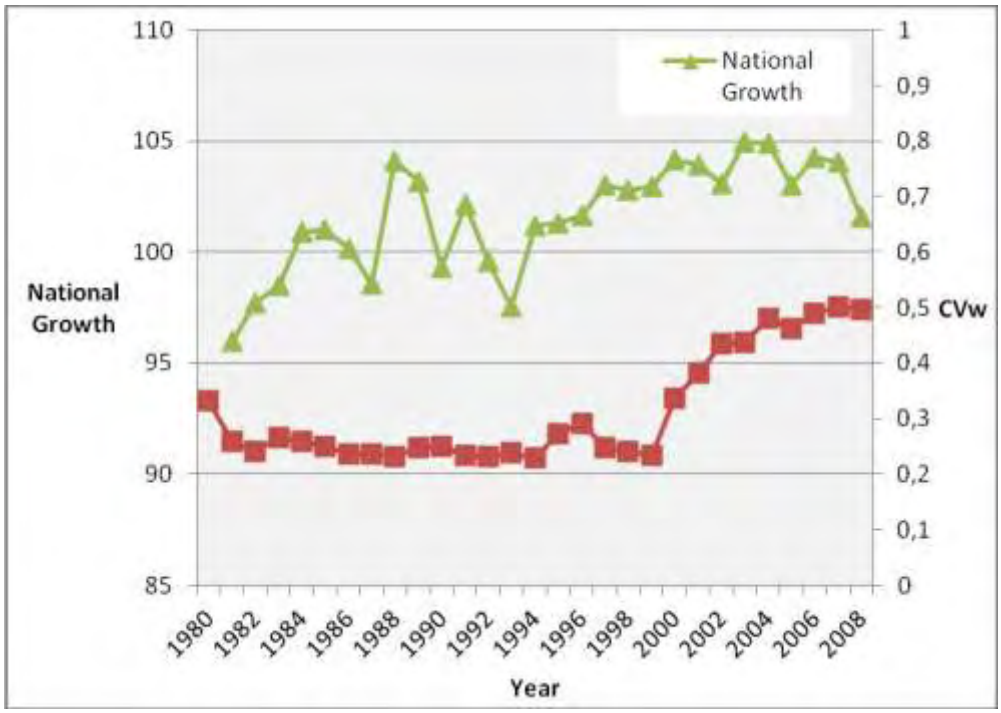

"The relationship between regional inequalities and business cycles: The case of Greece."

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Abstract

The objective of the Master Thesis is to study the relation between per capita GDP growth and regional inequalities in Greece. In other words, it is attempted to give an answer whether the pattern of regional growth in Greece is procyclical or countercyclical. The analysis covers the period 1980-2008 and uses per capita GDP and population data at the national and the regional (NUTSIII) spatial level. Data are derived from Cambridge Econometrics Data Base. The relation between national growth and regional inequalities has been investigated econometrically on a basis of a time-series model. Among the three versions of the model presented, the one with a two years time lag has been selected. The findings of the empirical analysis suggest that the pattern of regional growth in Greece during the period under consideration is non-linear and countercyclical. This indicates that increasing regional inequalities are accompanied by negative national growth, and decreasing regional inequalities are accompanied by positive national growth. The countercyclical pattern detected indicates that when a significant part of the country does not participate equally in the development procedure, the impact on national growth is negative.

Keywords: business cycles, national growth, regional inequalities, procyclical / countercyclical pattern, Greece.

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Acronyms

CV	Coefficient of Variation
CVw	Coefficient of Variation weighted
GDP	Gross Domestic Product
GFC	Global Financial Crisis
NUTS	Nomenclature of Territorial Units for Statistics
WLS	Weighted Least Squares

1. Introduction / The objectives of the Master Thesis

The objective of the Master Thesis is to study the relation between national growth and regional inequalities in Greece. The analysis covers the period 1980-2008 and uses per capita GDP and population data at the national and the regional (NUTSIII) spatial level. Data are derived from Cambridge Econometrics Data Base. There seems to be a controversy in the theoretical and empirical literature whether the relation between national growth and regional inequalities is procyclical or countercyclical. If regional inequalities are getting increased (decreased) and national growth is also getting increased (decreased), there is a procyclical pattern of growth. In contrast, if regional inequalities are getting increased (decreased) and national growth is getting decreased (increased), there is a countercyclical pattern of growth. The relation between national growth and regional inequalities has been investigated econometrically on a basis of a time-series model. The findings of the Master Thesis are expected to provide valuable insight for both theory and policy-making.

The remainder of the Master Thesis is structured as follows: In section 2 definition, history periods and occurrence of business cycles are stated. In section 3, regional growth in Greece is discussed. Section 4 presents the relation between regional inequalities and business cycles. Section 5 presents the literature concerning regional inequalities in Greece. In section 6 the empirical analysis is conducted. Finally, section 7 reports the conclusions.

2. Definition, history, periods and occurrence of business cycles

2.1 Definition

First of all it must be explained what business cycle is. Business cycle is the recurring and fluctuating levels of economic activity that an economy experiences over a long period of time. The five stages of the business cycle are growth (expansion), peak, recession (contraction), trough and recovery. At one time , business cycles were thought to be extremely regular, with predictable durations, but today they are widely believed to be irregular, varying in frequency, magnitude and duration.

The first systematic exposition of periodic economic crises, in opposition to the existing theory of economic equilibrium, was the 1819 “Nouveaux Principes d'économie politique” (New Principles of Political Economy) by Jean Charles Léonard de Sismondi. Prior to that point classical economics had either denied the existence of business cycles, blamed them on external factors, notably war, or only studied the long term. Sismondi found vindication in the Panic of 1825, which was the first unarguably international economic crisis, occurring in peacetime. Sismondi and his contemporary Robert Owen, who expressed similar but less systematic thoughts in 1817 Report to the Committee of the Association for the Relief of the Manufacturing Poor, both identified the cause of economic cycles as overproduction and under consumption, caused in particular by wealth inequality. They advocated government intervention and socialism, respectively, as the solution. This work did not generate interest among classical economists, though under consumption theory developed as a heterodox branch in economics until being systematized in Keynesian economics in the 1930s.

Sismondi's theory of periodic crises was developed into a theory of alternating cycles by Charles Dunoyer, and similar theories, showing signs of influence by Sismondi, were developed by Johann Karl Rodbertus. Periodic crises in capitalism formed the basis of the theory of Karl Marx, formulated in the 1867 “Das Kapital” (The Capital), who further claimed that these crises were increasing in severity and, on the basis of which, he predicted a communist revolution.

There may be a period where economic growth is quite strong. When this happens we might see the number of people being employed rising and the number of

people unemployed falling. This makes sense if you refer back to our definition of economic activity. If there is more buying and selling going on then businesses need to employ people to produce the goods and services that people want to buy.

Business cycles have some characteristics that include:

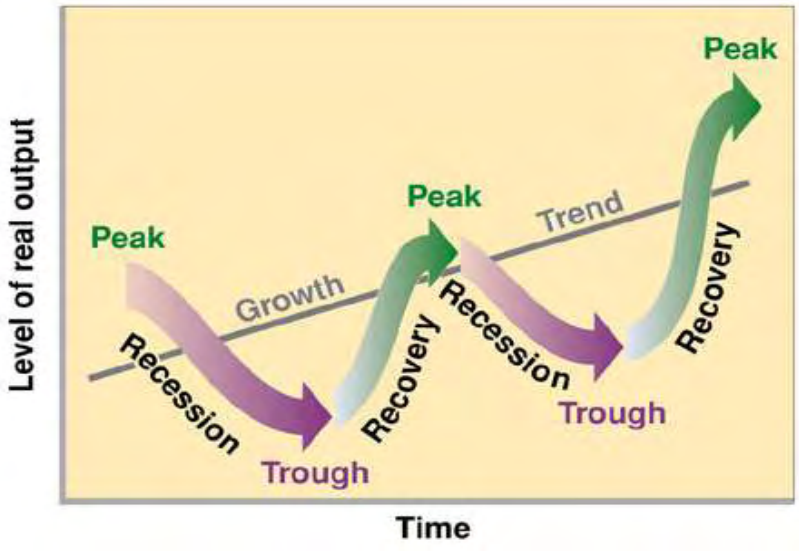
(i) Fluctuations that tend to affect durable manufactured goods more than services.

(ii) Wholesale and industrial prices tend to be affected more than retail prices.

(iii) Short-term interest rates track and amplify the cycles, moving in an exaggerated manner along with the economy.

Also we must not ignore the influences of fortune on the business cycles. Wars, hurricanes, floods and fires can all have powerful effects on the business. Wars in particular have a tendency to affect the entire economy, producing booms in their early years and followed by the dampening effects of inflation and later, recession as the economy cools down.Figure 1 below depicts the phases of a business cycle, from peak to recovery.

Figure 1: Description of business cycles



Source: www.peakwatch.typepad.com

Under the line of the diagram we have average growth which is the level of expected growth of the economy. It can be seen as the overall capacity of the economy. What it is capable of producing given its resources of land, labour and

capital. Actual growth is what actually happens. It can be seen as the level of demand in an economy at any one time.

Above the line and above average growth there is the actual growth. In times like this the level of demand is higher than the ability of the economy to supply goods and services. When this happens, there might be what are called "bottlenecks" in production. Business might be trying to meet the level of demand but might be having difficulties getting hold of the right resources to carry out production. Price might be rising as a result.

As we can see in the diagram above the rate of economic growth might be slowing down and if things get really bad we might slip into recession. At times like this business will be having difficulties selling and stock levels may be rising. They might decide there is no point continuing to produce at the same rate if sales are slow and decide to cut back production. If that happens there is a risk that some people might lose their jobs and suppliers might also notice a slowdown in orders. They then get affected in the same way and so the process continues.

2.2 Classification by periods

In 1860, French economist Clement Juglar identified the presence of economic cycles 8 to 11 years long, although he was cautious not to claim any rigid regularity. Later, Austrian economist Joseph Schumpeter argued that a Juglar cycle has four stages:

(i) expansion (increase in production and prices, low interests rates)
(ii) crisis (stock exchanges crash and multiple bankruptcies of firms occur)
(iii) recession (drops in prices and in output, high interests rates)
(iv) recovery (stocks recover because of the fall in prices and incomes).

In this model, recovery and prosperity are associated with increases in productivity, consumer confidence, aggregate demand, and prices.

In the mid-20th century, Schumpeter (1939), proposed a typology of business cycles according to their periodicity, so that a number of particular cycles were named after their discoverers or proposers.

- **Kitchin inventory cycle** of 3–5 years (after Joseph Kitchin)

Kitchin cycle is a short business cycle of about 40 months discovered in the 1920s by Joseph Kitchin. This cycle is believed to be accounted for by time lags in information movements affecting the decision making of commercial firms. Firms react to the improvement of commercial situation through the increase in output through the full employment of the extent fixed capital assets. As a result, within a certain period of time (ranging between a few months and two years) the market gets 'flooded' with commodities whose quantity becomes gradually excessive. The demand declines, prices drop, the produced commodities get accumulated in inventories, which informs entrepreneurs of the necessity to reduce output. However, this process takes some time. It takes some time for the information that the supply exceeds significantly the demand to get to the businessmen. Further it takes entrepreneurs some time to check this information and to make the decision to reduce production, some time is also necessary to materialize this decision (these are the time lags that generate the Kitchin cycles). Another relevant time lag is the lag between the materialization of the above mentioned decision (causing the capital assets to work well below the level of their full employment) and the decrease of the excessive amounts of commodities accumulated in inventories. Yet, after this decrease takes place one can observe the conditions for a new phase of growth of demand, prices, output, etc.

- **Juglar fixed investment** cycle of 7–11 years (often identified as 'the' business cycle

Fixed investment in economics refers to investment in fixed capital, i.e., tangible capital goods (real means of production or residential buildings), or to the replacement of depreciated capital goods which have been scrapped. Thus, fixed investment is investment in physical assets such as machinery, land, buildings, installations, vehicles, or technology. Normally, a company balance sheet will state both the amount of expenditure on fixed assets during the quarter or year, and the total value of the stock of fixed assets owned.

Fixed investment contrasts with investments in labour, ongoing operating expenses, materials or financial assets. Financial assets may also be held for a fixed term (for

example, bonds) but they are not usually called "fixed investment" because they do not involve the purchase of physical fixed assets. The more usual term for such financial investments is "fixed-term investments". Bank deposits committed for a fixed term such as one or two years in a savings account are similarly called "fixed-term deposits".

Statistical measures of fixed investment, such as provided by the Bureau of Economic Analysis in the United States, Eurostat in Europe, and other national and international statistical offices (e.g., the International Monetary Fund), are often considered by economists to be important indicators of longer-term economic growth (the growth of output and employment) and potential productivity.

The more fixed capital is used per worker, the more productive the worker can be, other things being equal. For example, a worker who tills the soil only with a spade is normally less productive than a worker who uses a tractor-driven plough to do the same work, because with a tractor one can plough more land in less time, and thus produce more in less time, even if a tractor costs more than a spade. Obviously one would not normally use a tractor to plough a small garden, but in large-scale farming the income earned using a tractor by far outweighs the expense of using a tractor. It is not economical to use a spade for large-scale ploughing, unless the labour is extremely cheap, and the supply of labour is plentiful.

The level of fixed investment by businesses also indicates something about the level of confidence that business owners or managers have about the ability to earn more income from sales in the next few years. The reasoning is that they would be unlikely to tie up additional capital in fixed assets for several years or more, unless they thought it would be a commercially viable proposition in the longer term. If there is too much uncertainty about whether their fixed investment will pay off, they are unlikely to engage in it.

In recent decades, the growth rate of fixed investment in the US, Europe and Japan was relatively low, but in China for example it is relatively high. Often the relativities are expressed as a ratio between gross fixed capital formation and GDP, or fixed investment per worker employed or per capita.

- **Kuznets infrastructural investment cycle** of 15–25 years (after Simon Kuznets)

Kuznets swing is a claimed medium-range economic wave with a period of 15–25 years found in 1930 by Simon Kuznets. Kuznets connected these waves with demographic processes, in particular with immigrant inflows/outflows and the changes in construction intensity that they caused, that is why he denoted them as "demographic" or "building" cycles/swings. Kuznets swings have been also interpreted as infrastructural investment cycles.

Kuznet's finding was debunked by Howrey (1968). Howrey claimed that the apparent business cycle found by Kuznets was an artifact of the filter Kuznets used. Howrey suggested that the same cyclical pattern could be found in white noise series when the Kuznets filter was applied. However, a more recent spectrum analysis has confirmed the presence of the Kuznets swings in the world GDP dynamics even without the application of the Kuznets filter.

- **Kondratiev wave** or long technological cycle of 45–60 years (after Nikolai Kondratiev).

Kondratiev waves (also called supercycles, great surges, long waves, K-waves or the long economic cycle) are described as sinusoidal-like cycles in the modern capitalist world economy. Averaging fifty and ranging from approximately forty to sixty years in length, the cycles consist of alternating periods between high sectoral growth and periods of relatively slow growth. Unlike the short-term business cycle, the long wave of this theory is not accepted by current mainstream economics.

Interest in these different typologies of cycles has waned since the development of modern macroeconomics, which gives little support to the idea of regular periodic cycles.

2.3 Occurrence

There were frequent crises in Europe and America in the 19th and first half of the 20th century, specifically the period 1815–1939, starting from the end of the Napoleonic wars in 1815, which was immediately followed by the Post-Napoleonic depression in the United Kingdom (1815–30), and culminating in the Great Depression of 1929–39, which led into World War II.

In 1929 the Wall Street Crash (October 1929), also known as the Great Crash**,** and the Stock Market Crash of 1929, was the most devastating stock market crash in the history of the United States, taking into consideration the full extent and duration of its fallout. A stock market crash is a sudden dramatic decline of stock prices across a significant cross-section of a stock market, resulting in a significant loss of paper wealth. Crashes are driven by panic as much as by underlying economic factors. They often follow speculative stock market bubbles.

Stock market crashes are social phenomena where external economic events combine with crowd behavior and psychology in a positive feedback loop where selling by some market participants drives more market participants to sell. There is no numerically specific definition of a stock market crash but the term commonly applies to steep double-digit percentage losses in a stock market index over a period of several days. Crashes are often distinguished from bear markets by panic selling and abrupt, dramatic price declines. Bear markets are periods of declining stock market prices that are measured in months or years. While crashes are often associated with bear markets, they do not necessarily go hand in hand.

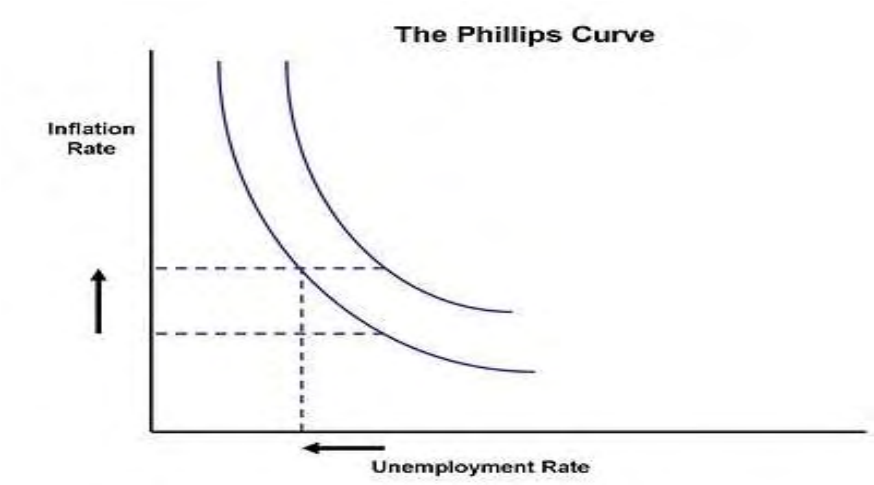
The crash signaled the beginning of the 12-year Great Depression that affected all Western industrialized countries and did not end in the United States until 1947.

Business cycles in the OECD after World War II were generally more restrained than the earlier business cycles, particularly during the Golden Age of Capitalism (1945/50–1970s), and the period 1945–2008 did not experience a global downturn until the Late-2000s recession. Economic stabilization policy using fiscal policy and monetary policy appeared to have dampened the worst excesses of business cycles, and automatic stabilization due to the aspects of the government's

budget also helped mitigate the cycle even without conscious action by policy-makers.

In this period the economic cycle – at least the problem of depressions – was twice declared dead; first in the late 1960s, when Phillips curve was seen as being able to steer the economy. In economics, the Phillips curve is a historical inverse relationship between the rate of unemployment and the rate of inflation in an economy. Stated simply, the lower the unemployment rate in an economy, the higher the rate of inflation (negative relation). While it has been observed that there is a stable short run trade-off between unemployment and inflation, this has not been observed in the long run. Figure 2 depicts an indicative Phillips curve.

Figure 2: An indicative Phillips curve



Source: taylorfrigon.blogspot.com

Phillips Curve was followed by stagflation in the 1970s, which discredited the theory. Stagflation is a situation in which the inflation rate is high and the economic growth rate slows down and unemployment remains steadily high. It raises a dilemma for economic policy since actions designed to lower inflation or reduce unemployment may actually worsen economic growth. Secondly, in the early 2000s, following the stability and growth in the 1980s and 1990s in what came to be known as The Great Moderation – which was followed by the Late-2000s recession. Notably, in 2003, (Robert Lucas), in his presidential address to the American Economic

Association, declared that the "central problem of depression-prevention has been solved, for all practical purposes.

However, in the early 90s many countries from the former Eastern/Soviet bloc have experienced prolonged depressions, following the end of the Soviet Union. These countries, experiencing the processes of transition (from central planning to the free-market economy) and integration (into the European economic space), recorded a major decline in their GDP levels and an, overall, upset in their productive bases (Petrakos and Kallioras 2007, Kallioras and Petrakos 2010).

The financial crisis of 2008, also known as the Global Financial Crisis (GFC), is considered by many economists to be the worst financial crisis since the Great Depression of the 1930s. It resulted in the collapse of large financial institutions, the bailout is an act of loaning or giving capital to an entity (a company, a country, or an individual) that is in danger of failing, in an attempt to save it from bankruptcy of banks by national governments and downturns in stock markets around the world. There is strong evidence that the riskiest, worst performing mortgages were funded through the "shadow banking system" and that competition from the shadow banking system may have pressured more traditional institutions to lower their own underwriting standards and originate riskier loans. In many areas, the housing market also suffered, resulting in numerous evictions, foreclosures and prolonged unemployment. It contributed to the failure of key businesses, declines in consumer wealth estimated in the trillions of U.S. dollars, and a significant decline in economic activity, leading to a severe global economic recession in 2008.

The financial crisis was triggered by a complex interplay of valuation and liquidity problems in the United States banking system in 2008. The bursting of the U.S. housing bubble, which peaked in 2007, caused the values of securities tied to U.S. real estate pricing to plummet, damaging financial institutions globally. Economies worldwide slowed during this period, as credit tightened and international trade declined. Governments and central banks responded with unprecedented fiscal stimulus, monetary policy expansion and institutional bailouts. Although there have been aftershocks, the financial crisis itself ended sometime between late-2008 and mid-2009.

2.4 How to avoid business cycles: Prevention of and recovery from the economic crisis[1].

At this point it can be easily deduced that once banks have initiated a policy of credit expansion, or the money supply has increased in the form of new loans granted without the support of new voluntary saving, processes which eventually provoke a crisis and recession are spontaneously triggered. Thus economic crises and depressions *cannot be avoided* when credit expansion has taken place. The only possible measure is to *prevent* the process from beginning, by precluding the adoption of policies of credit expansion or of growth in the money supply in the shape of new bank loans.

These institutional reforms essentially involve restoring banking to the traditional legal principles which regulate the contract of irregular deposit of fungible goods and which require the continuous maintenance of the *tantundem*; in other words, a 100-percent reserve requirement. This is the only way to guarantee that the system will not independently initiate any credit expansion unbacked by real saving, and that the loans granted will always originate from a prior increase in society's voluntary saving. Thus entrepreneurs will only undertake the lengthening of the productive structure when, barring unusual circumstances, they are able to complete and maintain it in the absence of systematic discoordination between the entrepreneurial decisions of investors and those of the other economic agents with respect to the amount and proportion of their income they wish to consume and save.
Assuming credit expansion has taken place in the past, we know the economic crisis will inevitably hit, regardless of any attempts to postpone its arrival through the injection of new doses of credit expansion at a progressively increasing rate. In any case the eruption of the crisis and recession ultimately constitutes the beginning of the *recovery*. In other words the economic recession is the start of the *recovery* stage, since it is the phase in which the errors committed are revealed, the investment projects launched in error are liquidated, and labor and the rest of the productive resources begin to be transferred toward those sectors and stages where consumers value them most. Just as a hangover is a sign of the body's healthy reaction to the assault of alcohol, an economic recession marks the beginning of the recovery period,

[1] This section draws heavily on De Soto (2006/2009: 432-440).

which is as healthy and necessary as it is painful. This period results in a productive structure more in tune with the true wishes of consumers.

The recession hits when credit expansion slows or stops and as a result, the investment projects launched in error are liquidated, the productive structure narrows and its number of stages declines, and workers and other original means of production employed in the stages furthest from consumption, where they are no longer profitable, are laid off or no longer demanded. Recovery is consolidated when economic agents, in general, and consumers, in particular, decide to reduce their consumption in relative terms and to increase their saving in order to repay their loans and face the new stage of economic uncertainty and recession. The boom and the beginning of the readjustment are naturally followed by a drop in the interest rate. This drop arises from the reduction and even the disappearance of the premium based on the expectation of a decrease in the purchasing power of money, and also from the increased relative saving the recession provokes.

The slowing of the frantic pace at which goods and services from the final stage are consumed, together with the rise in saving and the reorganization of the productive structure at all levels, furthers the recovery. Its effects initially appear in stock markets, which are generally the first to undergo a certain improvement. Moreover the real growth in wages which takes place during the stage of recovery sets the “Ricardo Effect” in motion, thus reviving investment in the stages furthest from consumption, where labor and productive resources are again employed. In this spontaneous manner the recovery concludes. It can be strengthened and maintained indefinitely in the absence of a new stage of credit expansion unbacked by real saving, an event which is usually repeated, giving rise to new recurring crises.

Nevertheless now that we have established that economic crises cannot be avoided once the seeds of them are sown, and that the only alternative is to prevent them, what would be the most appropriate policy to apply once an inevitable crisis and recession have hit? The answer is simple if we remember the origin of the crisis and what the crisis implies: the need to readjust the productive structure and adapt it to consumers’ true desire with regard to saving, to liquidate the investment projects undertaken in error and to massively transfer factors of production toward the stages and companies closest to consumption, where consumers demand they be employed.

Therefore the only possible and advisable policy in the case of a crisis consists of making the economy as flexible as possible, particularly the different factor

markets, and especially the labor market, so the adjustment can take place as quickly and with as little pain as possible. Hence the more rigid and controlled an economy is, the more prolonged and socially painful its readjustment will be. The errors and recession could even persist indefinitely, if it is institutionally impossible for economic agents to liquidate their projects and regroup their capital goods and factors of production more advantageously. Thus rigidity is the chief enemy of recovery and any policy aimed at mitigating the crisis and initiating and consolidating recovery as soon as possible must center on the microeconomic goal of deregulating all factor markets, particularly the labor market, as much as possible, and on making them as flexible as possible.

This is the only measure advisable during the stage of economic crisis and recession, and it is particularly important to avoid any policies which, to a greater or lesser extent, actively hinder or prevent the necessary spontaneous process of readjustment.

Also to be especially avoided are certain measures which always acquire great popularity and political support during crises, in view of the socially painful nature of such phenomena. The following are among the main steps which are normally proposed and should be averted:

(a) The granting of new loans to companies from the capital goods stages to keep them from going through a crisis, suspending payments and having to reorganize. The granting of new loans simply postpones the eruption of the crisis, while making the necessary subsequent readjustment much more severe and difficult. Furthermore, the systematic concession of new loans to repay the old ones delays the painful investment liquidations, postponing, even indefinitely, the arrival of the recovery. Therefore any policy of further credit expansion should be avoided.

(b) Also very harmful are the inappropriately-named policies of “full employment,” which are intended to guarantee jobs to all workers. As Hayek very clearly states, all attempts to create full employment with the existing distribution of labour between industries will come up against the difficulty that with full employment people will want a larger share of the total output in the form of consumers’ goods than is being produced in that form. Thus it is impossible for a government policy of spending and credit expansion to successfully protect all *current* jobs if workers spend their income, originating from credit expansion and artificial demand from the public sector, in a way that requires a different productive structure, i.e., one incapable of keeping them in their current jobs. Any policy of

artificially preserving jobs which is financed with inflation or credit expansion is *self-destructive*, insofar as consumers spend the new money created, once it reaches their pockets, in a way that makes it impossible for those very jobs to be profitable. Hence the only labor policy possible is to facilitate the dismissal and rehiring of workers by making labor markets highly flexible.

(c) Likewise, any policy aimed at restoring the status quo with respect to macroeconomic aggregates should also be avoided. Crises and recessions are by nature microeconomic, not macroeconomic, and thus such a policy is condemned to failure, to the extent it makes it difficult or impossible for entrepreneurs to review their plans, regroup their capital goods, liquidate their investment projects and rehabilitate their companies. As Ludwig M. Lachmann articulately puts it, any policy designed merely to restore the s*tatus quo* in terms of "macro-economic" aggregate magnitudes, such as incomes and employment, is bound to fail. The state prior to the downturn was based on plans which have failed; hence a policy calculated to discourage entrepreneurs from revising their plans, but to make them "go ahead" with the same capital combinations as before, cannot succeed. Even if business men listen to such counsel they would simply repeat their former experience. What is needed is a policy which promotes the necessary readjustments.

Therefore monetary policies intended to maintain at ball costs the economic boom in the face of the early symptoms of an impending crisis (generally, a downturn in the stock market and real estate market), will not prevent the recession, even when they are sufficient to postpone its arrival.

(d) In addition the price of present goods in terms of future goods, which is reflected by the social rate of time preference, or the interest rate, should not be manipulated. Indeed in the recovery phase the interest rate in the credit market will spontaneously tend to decline, given the drop in the price of consumer goods and the increase in saving brought about by the reorganization the recession entails. Nevertheless any manipulation of the market rate of interest is counterproductive and exerts a negative effect on the liquidation process or generates new entrepreneurial errors. In fact we can conclude with Hayek that any policy which tends to maintain interest rates at a fixed level will be highly detrimental to the stability of the economy, since interest rates must evolve spontaneously according to the real preferences of economic agents with respect to saving and consumption.

The tendency to keep the rates of interest stable, and especially to keep them low as long as possible, must appear as the arch-enemy of stability, causing in the end much greater fluctuations, probably even of the rate of interest, than are really necessary. Perhaps it should be repeated that this applies especially to the doctrine, now so widely accepted, that interest rates should be kept low till "full employment" in general is reached.

(e) Finally any policy involving the creation of artificial jobs through public works or other investment projects financed by the government should be avoided. It is evident that if such projects are financed by taxes or via the issuance of public debt, they will simply draw resources away from those areas of the economy where consumers desire them and toward the public works financed by the government, thus creating a new layer of widespread mal investment. Moreover if these works or "investments" are financed through the mere creation of new money, generalized mal investment also takes place, in the sense that, if workers employed through this procedure dedicate most of their income to consumption, the price of consumer goods tends to rise in relative terms, causing the delicate situation of companies from the stages furthest from consumption to deteriorate even further. In any case, in their contracyclical policies of public spending, it is nearly impossible for governments to resist the influence of all kinds of political pressures which tend to render these policies even more inefficient and harmful, as indicated by the conclusions of public choice theory. Furthermore there is no guarantee that by the time governments diagnose the situation and decide to take the supposedly remedial measures, they will not err with respect to the timing or sequence of the different phenomena and tend with their measures to worsen rather than solve the maladjustments.

3. Regional growth in Greece

Greece is an open-market economy of almost 132,000 square kilometers and 11,000,000 inhabitants, located in Europe's southern-most tip. Following the end of the 2nd World War and the Greek Civil War (period 1946-1949), at the beginning of the 1950s, Greece experienced its highest levels of economic growth. Between 1950 and 1973, Greece recorded an average annual growth rate of about 6.5% outperforming all other European countries. After the first oil crisis in 1973 and the second oil crisis in 1979, however, the Greek economy entered a period of recession (Maddison, 1995).

Besides the adverse impact of the oil crises, the Greek governments had to face the increasing demands for income redistribution and expansion of the welfare state, after the fall of the Greek military junta (period 1967-1974) (Oltheten et al, 2003). The expanded role of the State satisfied popular demands; it failed, however, to address the implications of the crises and restore macroeconomic stability (Kazakos, 2001). This is mainly due to the failure of the Greek governments to control the rate of inflation. While most of the European Economic Community (EEC) member-states created and participated in the European Monetary System (EMS), in order to maintain fixed exchange rates ,so-called European "currency snake"), monetary policy in Greece operated (to a great extent) as a tool for the implementation of expansionary fiscal policy (Oltheten et al, 2003).

As for the Greek industrial sector, it had experienced significant growth in the 1960s and the mid-1970s, reaching an average annual growth rate of about 10% (Maddison, 1995). The expansion of the Greek industry – that took place under conditions of protectionism (from external competition) – had as its main elements the high rates of investment, the abundance of (unskilled) labor force, the low production cost, the dominance of labor-intensive sectors, the dominance of small-sized family-owned enterprises and the incentives provided by the Greek State (Oltheten et al, 2003). On the basis of the implementation of the strategy of growth poles (Perroux, 1955), the majority of the industrial sectors in Greece has been concentrated in the metropolitan regions of Attiki-Athens and Thessaloniki, and to a lesser extent, in some dynamic (comparing to the national standards) urban regions (i.e. Achaia-

Patras, Magnesia-Volos, Larissa) that form the, so-called, "S axis of development" (Skayannis, 2009).

In 1981, Greece joined the EU (then EEC) (after a long pre-accession period started in 1959) in conditions of economic recession. The apparent inability of the Greek economy to compete successfully in the common market environment generated skepticism regarding the impact of EU membership. It should be noted here that the EEC membership was a highly-debated political decision, mostly on the part of the socialist and the communist parties, since it determined, to a great extent, the future of the country. Even though this fierce debate is now a distant memory of the past, skepticism concerning the impact of EU membership on the Greek economy remains (Petrakos et al. 2012). It is indubitable that if significant assistance had not been provided to the less advanced Greek regions, in the context of the Community Support Frameworks (CSF), the debate regarding the Greek membership would have been more intense (Petrakos et al, 2008, Petrakos et al. 2012). Indeed, despite membership, Greece continues to suffer from poor macroeconomic performance, recording low (or, even, negative) growth rates, high public debt, industrial decline and unemployment increase (Petrakos et al. 2012). In particular, after EU membership, the Greek economy experienced a phase of de-industrialization (Louri and Pepelasis-Minoglou, 2001) since the gradual removal of protectionism has accentuated the structural deficiencies of the industrial sector.

There is a scarcity of works which attempt to assess the performance of the Greek economy from the post-World War II period until recently. Here, the significant contributions will be presented briefly, along with some comments emphasizing on some crucial issues.

In his study, Mouzelis (1977) argued that the 1960s coincided with a period when investment, especially in the manufacturing sector (chemicals, metallurgy, etc), expanded for the first time to a considerable extent. This was, according to the author, an important step towards the 'industrialization' of the Greek economy (Mouzelis 1977: 91 and 276-277).

Ioakimoglou and Milios (1993), suggested the following periodization for Greece's economic performance: (a) 1960-1973 ("the golden era of Greek capitalism") characterized by economic boom and increasing profit rate supported by the repression of the labor movement.(b) 1974-79 ("the first period of crisis") during

which high inflation rates and decreasing rates of investment persisted and a radical change in the political and social relation of forces benefited the working class. (c) 1980-85 ("aggravation of the crisis") marked by a change in government and the application of 'left-Keynesian economics' destined to fail due to the negative response of both the workers and the employers.(d) 1986-91 ('some recovery of profits') during which an increase in the marginal rate of profit on fixed capital is observed but not enough to ensure a steady increase in the profit rate.

Alogoskoufis (1995) separated the performance of the Greek economy of the post - 1960 period into two distinct phases, and considered the year 1974 (i.e. the end of the military dictatorship) as the turning point. In the pre–1974 period, the Greek economy was characterized by high growth rates in terms of GDP, labor productivity and Total Factor Productivity (TFP). On the contrary, the post–1974 period revealed a dramatic slowdown in most indices and the economy remained in a state of stagflation.

Bosworth and Kollintzas (2001) perceived two distinct phases in the growth patterns of the Greek economy and placed the year 1973 as their demarcation date. They accounted for external shocks occurring in all European countries and compared Greece's performance to EU countries. However, this extension of the analysis does not alter significantly their main conclusions. The decrease in both capital accumulation and TFP rates are found to contribute significantly to the growth slowdown. Regarding TFP they found a large downward break in the early 1980s and claimed that the break in performance occurred in the early 1980s and not in 1973 (Bosworth and Kollintzas 2001, pp. 157, 160). The authors attempted to trace the causes for this fall-off in TFP growth. They argued that this was the result of a large number of negative developments such as "the worsening macroeconomic situation and a highly inefficient structure of the labor market" alongside the unsuccessful trade policy after E.U. accession (*ibid*, p. 168 ff.). The authors focused on the strengthening of labor's bargaining situation and the centralized management of the economy as causes behind the deteriorating performance of the Greek economy in the post–1973 period. Also, regarding labor market structures, they pointed to the "rapid expansion of life-time government jobs in the 1980s, as well as the increase in the public/private relative wages in the 1980s" (*ibid*: 175-176) as examples of growth-hindering processes.

This periodization is consistent, in general terms, with Christodoulakis *et al*. (1996) who reached the same conclusion focusing on the reduction in industry protection following Greece's entry in the E.U. and the impact of uncertainties about the future political situation on investment as the underlying cause for their choice of the inflexion point. This periodization is also consistent with the findings by Michaelides *et al.* (2005) who focused in their study on investment activity and stressed its low levels during the first half of the 1980s.

From all above, it can be concluded that the deterioration of macroeconomic environment resulting in steadily increasing budget deficits and double-digit inflation is considered as another contributing factor to the slowdown.

4. Regional inequalities and Business Cycles

4.1. The convergence/divergence debate

The issue of inequalities (or convergence/divergence issue) of per capita income (or productivity) across any set of regions has attracted considerable research interest, especially during the last couple of decades. Apart from its obvious policy implications, whether economies converge or diverge over time is an issue of theoretical significance (Sala-i-Martin, 1996). Following Solow (1956), proponents of the neoclassical paradigm argue that disparities are bound to diminish with growth (Barro and Sala-i-Martin, 1995). In contrast, other schools of thought, such as the endogenous growth theories (Romer, 1986; Lucas, 1988; Aghion and Howitt, 1998) and the new economic geography (Krugman, 1991; Fujita et al., 1999) tend to agree with the basic claim of Myrdal (1957) that growth is a spatially cumulative process, which is likely to increase inequalities.

The dominant approach in the convergence/divergence literature is derived from the neoclassical paradigm, following the seminal studies of Baumol (1986), Barro and Sala-i-Martin (1992) and Mankiw et al., (1992). Two main concepts of convergence have been developed in this literature: (unconditional or conditional) β-convergence and σ- convergence If economies are homogeneous, convergence can occur in an absolute sense (unconditional β-convergence) since these economies will converge towards the same steady-state. This concept implies that poor economies grow faster than rich ones and, therefore, over a long period of time, they converge to the same level of per capita income. Unconditional β-convergence among countries or regions is observed when a negative and significant relation is found between the growth rate of income per capita and the initial level of income. This negative relation is more likely to apply across regions within countries than across countries (Barro and Sala-i-Martin, 1992). Conversely, if economies are heterogeneous, convergence may occur only in a conditional sense (conditional β-convergence) since these economies will grow toward different steady-state positions. The concept of σ-convergence examines the dispersion of income at a given moment in time. Thus, convergence is accepted if the dispersion (measured by the coefficient of variation) of per capita income among economies falls over time (Barro and Sala-i-Martin, 1995). Quah (1993a, 1993b) stresses the importance of σ-convergence over β- convergence

on the basis that the former also provides an indication whether the distribution of income across economies is becoming more equitable. However, β- convergence analysis has dominated the literature because it is considered to be a necessary (though not sufficient) condition for σ-convergence.

At the regional level, there is ample empirical evidence of this type of research (Magrini, 2004). However, most empirical studies have examined convergence/divergence processes utilising econometric or statistical models of linear specification as suggested by the neoclassical theory (Durlauf, 2001). Rather recently, a few empirical studies have asserted the presence of nonlinearities in the growth process implying multiple steady-states and convergence clubs (Chatterji, 1992; Quah, 1993; Durlauf and Johnson, 1995; Hansen, 2000).

4.2 Procyclical and countercyclical patterns of regional development

There are two kinds of relations between regional inequalities and business cycles: the Pro-cyclical and the Countercyclical.

Pro-cyclical is a term used in economics to describe how an economic quantity is related to economic fluctuations.

In business cycle theory and finance, any economic quantity that is positively correlated with the overall state of the economy is said to be procyclical. That is, any quantity that tends to increase when the overall economy is growing is classified as procyclical. Quantities that tend to increase when the overall economy is slowing down are classified as 'countercyclical'. Gross Domestic Product (GDP) is an example of a procyclical economic indicator. Many stock prices are also procyclical, because they tend to increase when the economy is growing quickly.

But Pro-cyclical has a different meaning in the context of economic policy. In this context, it refers to any aspect of economic policy that could magnify economic or financial fluctuations. An economic policy that is believed to decrease fluctuations is called countercyclical. The accord requires banks to increase their capital ratios when they face greater risks. Unfortunately, this may require them to lend less during a recession or a credit crunch, which could aggravate the downturn. A similar criticism has been directed at fair value accounting rules. The effect of the single

Eurozone interest rate on the relatively high-inflation countries in the Eurozone periphery is also pro-cyclical, leading to very low or even negative real interest rates during an upturn which magnifies the boom.

Countercyclical is also a term used in economics to describe how an economic quantity is related to economic fluctuations and has two meanings.

An economic or financial policy is called 'countercyclical' (or sometimes 'activist') if it works against the cyclical tendencies in the economy. That is, countercyclical policies are ones that cool down the economy when it is in an upswing, and stimulate the economy when it is in a downturn. Keynesian economics advocates the use of automatic and discretionary countercyclical policies to lessen the impact of the business cycle. One example of an automatically countercyclical fiscal policy is progressive taxation. By taxing a larger proportion of income when the economy expands, a progressive tax tends to decrease demand when the economy is booming.

But we have a different meaning in business cycle theory which is more useful. So In business cycle theory, any economic quantity that is negatively correlated with the overall state of the economy is said to be 'countercyclical'. That is, any quantity that tends to increase when the overall economy is growing is classified as procyclical. Quantities that tend to increase when the overall economy is slowing down are classified as 'countercyclical'. Unemployment is an example of a countercyclical variable.

Concerning the relation between regional inequalities and national economic growth, Berry (1988) maintains that regional inequalities expand or contract during the economic cycle, depending on whether the economy is in an expanding or declining phase. This position, which directly links high rates of economic growth with increased inequalities, has some points in common with the growth pole theory (Perroux, 1970) and the cumulative causation theory (Myrdal, 1957). On the other hand, Dunford (1993) presents evidence at the European level indicating that regional disparities tend to increase during periods of recession and decrease during economic expansion, being in that sense a phenomenon with counter-cyclical behaviour. Also, Pekkala (2000) reports evidence of counter-cyclical behavior among Finnish regions. However, some recent evidence highlights that the evolution of regional disparities in

many European states has become pro-cyclical, representing a change with respect to the predominantly anti-cyclical pattern of the 1960s and 1970s (Rodriguez Pose and Fratesi , 2007).

5. Regional Inequalities in Greece

5.1 Regional patterns of growth in Greece

In recent years, it is generally believed that there has been a serious improvement in indicators of prosperity in the Greek periphery. Disposable income has increased, modes and levels of consumption have, in several cases, approached those of the metropolitan regions and internal migration has stopped or been restricted to very few regions. With regard to Greece, where regional inequalities intensified greatly during the first three post-war decades and subsequently diminished (Athanasiou et al., 1995), the empirical investigations concerned with the evolution of the phenomenon and its relation to the geographical features of the regions, the changes in their productive structure, the spatial policies under implementation, and the new international economic environment, are relatively few. Recent studies refer to a slight tendency towards a reduction in inequalities at a prefecture level during the period 1981–1991 (Michelis et al., 1996), combined, however, with a simultaneous divergence from the European Union (Lyberaki, 1996; Petrakos and Pitelis, 1999). In addition, evidence at the city level, shows a tendency towards the maintenance or strengthening of the dynamism of the two major metropolitan centres (Athens and Thessaloniki) during that same period (Petrakos and Tsoukalas, 1999; Petrakos et al., 2000).

Petrakos and Tsoukalas (1999) have shown that economic cycles have significantly influenced the concentration level of population in Athens and that periods of rapid growth have been associated with an increase in spatial imbalance of population distribution. A negative influence of European integration on the productive system of Greece, which has become apparent in regions with a serious concentration of large-scale industrial capital. The cases of Achaia, Boeotia, Magnesia and other prefectures, which have suffered intensive de-industrialisation in recent years including the closure of a significant number of large enterprises, indicate that the process of economic integration exerts pressures selectively hitting the most significant (and most exposed) clusters of economic activity. Although similar tendencies are also apparent in Attica (Lavrion, Shipyard Zone) and to some extent in Thessaloniki, the rapid tertiarisation of these two metropolitan areas offers employment alternatives which are not available in the remaining areas and which are comparable with the productive profile of European metropolitan regions.

Petrakos and Saratsis (2000), in their empirical study concerning regional inequalities in Greece, support that regional inequality depends on economic cycles. Although this finding explains at least part of the regional convergence tendencies during the ten years plus industrial recession in the Greek economy, its main interest lies in the consequences of an (already apparent) economic recovery. This implies that economic recovery begins mainly in the centres of development and does not diffuse automatically. This generates a policy problem that is hard to solve, as the attempts for national convergence towards the average levels of the EU are likely to be accompanied by internal divergence tendencies with an increase in disparities among the regions of the country.

5.2 Business cycle Synchronisation in Greek Regions

The gradual deepening of integration has intensified the interaction and the interdependency between different areas and economies. At the same time the integration process has put border areas in a state of flux and has led to the aggravation of disparities between the less and the more developed regions. Regions with an inferior technologically productive system and a lower competitive position, such as Greece, have to tackle the pressure of global competition and exposure to international market forces (Panteladis and Tsiapa, 2011).

Greece is characterised by an unequal spatial distribution of income, and an intensification of the regional disparities over time. Regional inequalities are based on the dominance of a metropolitan urban system, where the metropolitan region grows more rapidly than the national average. As a result, it has reaped pertinent advantages in terms of external economies, productive restructuring and extensive infrastructure improvement (Petrakos, 2009).

The study on the influence of integration on economic growth is traditionally related to classical business cycles defined by absolute expansions and contractions of economic activity (Burns and Mitchell 1946). However, this relationship does not provide information on the tendency of economic fluctuations to become synchronised. Business cycle synchronisation is the co-movement of business cycles expressed in terms of deviations around an estimated trend (Lucas, 1977). The degree of synchronisation of business cycle fluctuations among regions is conditioned upon

some common structural characteristics, making the shocks and -cum- the fluctuations more symmetric. Consequently, the growth rate movements of some regions might be more or less synchronised, which is revealed by studying their synchronisation cycles. This new aspect on the influence of integration on business cycle synchronisation has lately been the focus of considerable research. The vital role of production systems in the economy and the unprecedented changes they experience during integration require study of the evolution, transformation and determinants of synchronisation cycles. The systemically intensified influence of integration affects the backwardness, low levels of competitiveness and the inertia in structural changes that characterise the Greek regions, indicating the importance of studying the patterns and the potential determinants of synchronisation cycles in Greece (Panteladis and Tsiapa, 2011). The literature on Greek business synchronisation cycles is limited and is focused mostly in the association of cycles with the European Union (EU), also study the extent to which business cycles of the Greek regions are correlated and to investigate econometrically the determinants of the co-movement of output. The analysis outcomes are based on three salient points. First, the prefectures (NUTSIII regions) are more synchronised with the NUTSII regions than the national level, highlighting a regional (NUTSII) border. Second, there is a two-stage integration of Greek regions influencing on a differentiated way the synchronisation cycles, first by reinforcing urbanization economies and secondly by reinforcing localization economies. Third, the metropolitan region, apart from its prominent position of economic growth, displays a confined level of business synchronisation with the other regions, stressing the pattern of economic and structural dualism in Greece.

6. Empirical Analysis

6.1 Data source

The empirical analysis covers the period 1980-2008 and uses national and regional GDP and population data derived from European Regional Database (Cambridge Econometrics 2011). The period of analysis is extremely significant since it includes not only the shocks of the early post-accession (to the EU) period but also more recent trends. Regional data are disaggregated at the Nomenclature of Territorial Units for Statistics (NUTS) III spatial level (i.e. 51 prefectures).

6.2 Estimation of regional inequalities in Greece

The most well-known indicator for estimating regional inequalities is the Coefficient of Variation (CV). CV is expressed under the formula:

$$CV_{c,t} = \sqrt{\sum_{r} (Y_r - Y_c^{avr})^2} \; / \; Y_c^{avr}$$

,and it takes values in the interval [0, 1]. CV estimates the dispersion of the variable under consideration from its mean. Higher values indicate higher regional inequalities, lower values indicate lower regional inequalities, increasing values over time indicate increasing regional inequalities and decreasing values over time indicate decreasing regional inequalities.

In the Master Thesis, it is preferred to compute the weighted coefficient of variation (CVw) and not CV view to balancing the spatial data and, based on population of each region. Thus, the weighting variable is the relative population (i.e. the ratio between regional and national population) of each region. With this way the observations refer to regions with relatively large populations have greater weight (influence) in the Index, and, by extension, in the estimation of the regional disparities in the country.

The level and the evolution of regional inequalities in the Greece are evaluated, for the period 1980-2008,in per capita GDP terms as it was mentioned above, with the use of the coefficient of variation (also known as σ-convergence analysis) (Friedman, 1992; Quah, 1993b; Sala-i-Martin, 1996). In contrast to the vast

majority of studies, this study employs the weighted rather than the unweighted coefficient of variation since regions vary widely in terms of population (Williamson, 1965). This coefficient (CVw) is expressed under the formula:

$$CVw_{c,t} = \sqrt{\sum_{r} (Y_r - Y_c^{avr})^2 * (W_{r/c})} / Y_c^{avr}$$

where *t* denotes the year under consideration, *c* denotes the country under consideration, *r* (*c*) denotes the region under consideration, *Y* is the variable under consideration (i.e. per capita GDP), *Yavr* is the average figure of the variable under consideration, and *Wr/c* the weighting variable (i.e. relative population). CVw takes values greater than (or equal to) 0, ranging from lower to higher levels of inequality.

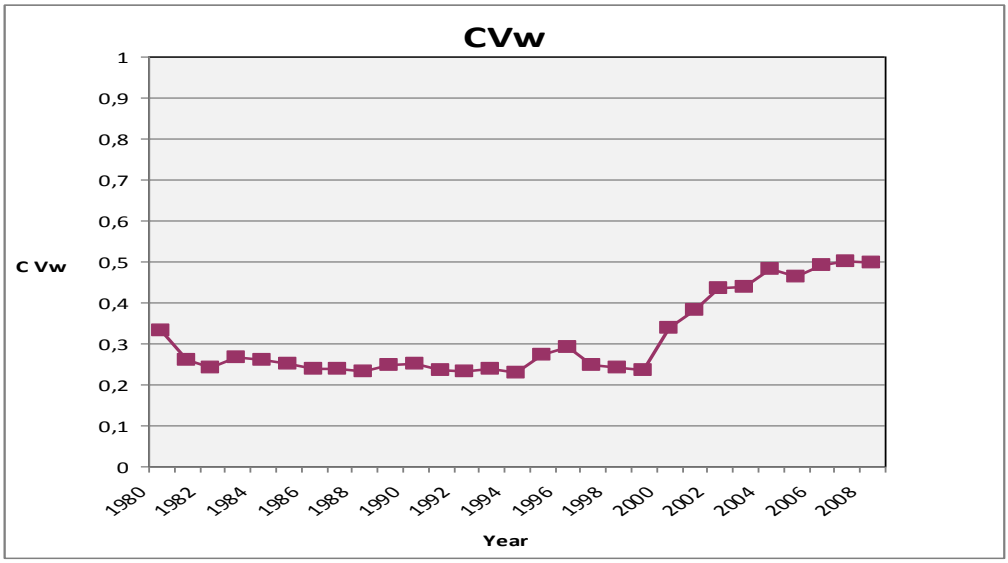
Table 1: Regional inequalities in Greece for the period 1980-2008 with the use of the CVw.

Year	CVw	Year	CVw	Year	CVw
1980	0.332	1990	0.251	2000	0.336
1981	0.260	1991	0.233	2001	0.382
1982	0.242	1992	0.231	2002	0.435
1983	0.265	1993	0.238	2003	0.437
1984	0.259	1994	0.229	2004	0.481
1985	0.251	1995	0.273	2005	0.463
1986	0.236	1996	0.291	2006	0.490
1987	0.237	1997	0.247	2007	0.501
1988	0.232	1998	0.242	2008	0.497
1989	0.248	1999	0.235	----------	----------

Source: Cambridge Econometrics data / Own elaboration

The Table above describes the level of inequalities (CVw) among NUTS III regions in Greece in the period 1980-2008. In 1980 the figure of CVw is 0.332 and from this year and after, until 1999, the rate of CVw remains in stable levels from 0.231 to 0.265. So from 1981 until 1999, regional inequalities remain rather stable and in low levels. But from year 2000, the CVw displays an increase from 0.235 to 0.336 which states an increase of regional inequalities. This increase continues until 2008.The highest figure (0.501) of CVw in all these years from 1980-2008 is observed in 2007 just before the beginning of the economic crisis.

Figure 3: Regional inequalities in Greece for the period 1980-2008



Source: Cambridge Econometrics data / Own elaboration

6.3 National growth in Greece

Growth is estimated annually at the national level as a simple division of the per capita GDP of a reference year with the corresponding per capita GDP of the previous year, using the formula: (PCGDPt2/PCGDPt1)*100. Considering that the per capita GDP figure of a reference year is equal to 100, figures higher than 100 indicate positive growth (comparing to the previous year) and figures lower than 100 indicate negative growth (comparing to the previous year). It should be noted here that per capita GDP data are expressed at constant prices of the year 2000. So, growth is expressed at real (deflated) values.

Table 2: National growth of Greece for the period 1980-2008

Year	National growth	Year	National growth	Year	National growth
1980	----------	1990	99.282	2000	104.146
1981	95.977	1991	102.129	2001	103.903
1982	97.718	1992	99.608	2002	103.090
1983	98.476	1993	97.536	2003	104.965
1984	100.900	1994	101.209	2004	104.907
1985	101.043	1995	101.299	2005	103.018
1986	100.167	1996	101.663	2006	104.250
1987	98.539	1997	102.989	2007	104.058
1988	104.118	1998	102.801	2008	101.613
1989	103.198	1999	102.953	----------	----------

Source: Cambridge Econometrics data / Own elaboration

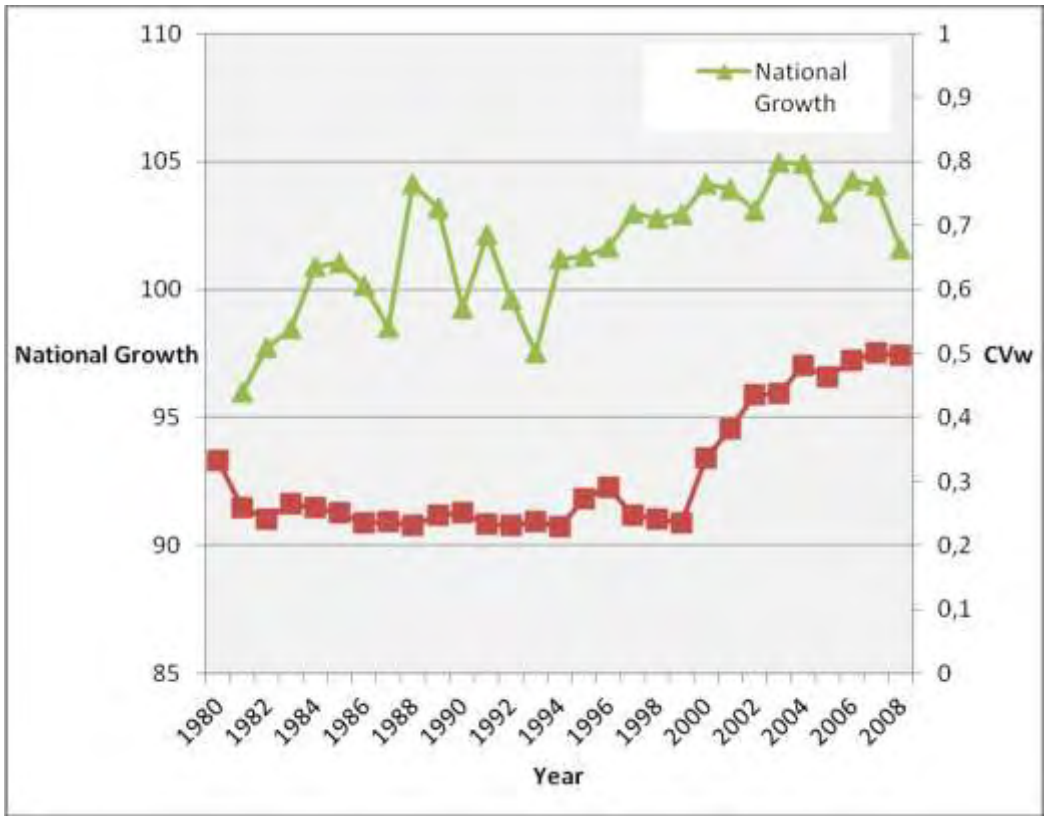
As it is mentioned above considering that the per capita GDP figure of a reference year is equal to 100, figures higher than 100 indicate positive growth (comparing to the previous year) and figures lower than 100 indicate negative growth (comparing to the previous year). During the first three years under consideration, from 1981 to 1983, the figure of national growth ranges from 95.977 to 98.476 which indicates negative growth. The next three years, from 1984 to 1986, the figure of national growth ranges from 100.900 to 100.167 which indicates positive growth. During the years from 1987 to 1993 there are mixed results (i.e. positive and negative growth). After 1994, the figures of national growth range from 101.209 to 104.907 which indicates stable positive growth.

Figure 4: National Growth for the period 1980-2008

Source: Cambridge Econometrics data / Own elaboration

6.4 Relation between national growth and regional inequalities

Figure 5: Relation between national growth and regional inequalities



Source: Cambridge Econometrics data / Own elaboration

From the figure above it can be observed that from 1994 onwards there seems to be a direct relation between national growth and regional inequalities since positive national growth rates are combined with increasing regional inequalities. In contrast, during the period from 1980 to 1993 there seems to be no clear relation between national growth and regional inequalities. Regional inequalities remain rather stable and are combined with mixed national growth trends.

6.5 Econometric investigation

This section investigates econometrically the relation between national growth and regional inequalities in Greece. The dependent variable of the model is the level of national growth, estimated annually, in per capita GDP terms, and expressed in real values. The independent variable of the model is the level of regional inequalities, at the NUTS III spatial level, in per capita GDP terms, assessed by the use of the

weighted coefficient of variation (CVw). The model is expressed in logarithmic terms (logarithmic model). The novelty of the econometric approach followed here is that the model allows for a non-linear relation between national growth and regional inequalities to be found. Thus, the independent variable of the model (i.e. regional inequalities) takes powers further (greater) than the first.

Tables 3, 4, and 5 present three versions of the econometric model. In the first version of the model, the independent variable concerns the current year (without time lag). In the second and the third version of the model, the independent variable is expressed with a one year-time lag and two years-time lag, respectively. So, in all models the logarithm of annual national real growth is the dependent variable (LOG(GROWTH)). The independent variable in the first version of the model is the logarithm of the level of regional inequalities (LOG(CVW)). The independent variable in the second version of the model is the logarithm of the level of regional inequalities expressed with a one year hysteresis (LOG(CVW(-1))). The independent variable in the third version of the model is the logarithm of the level of regional inequalities expressed with a two years hysteresis (LOG(CVW(-2))). In all models, the independent variables take the first, the second, and the third powers. Thus, a non-linear relation between national growth and regional inequalities in Greece can be detected. For the first version of the model the period of analysis covers the years between 1981 and 2008. The corresponding periods for the other two versions of the model cover the years between 1982 and 2008, and 1983 and 2008, respectively. Thus, the models estimated are time-series models.

Table 3: The relation between national growth and regional inequalities, econometric model 1
Dependent Variable: LOG(GROWTH)

Method: Least Squares

Sample: 1981 2008

Included observations: 28

White Heteroskedasticity-Consistent Standard Errors & Covariance

	Coefficient	Std. Error	t-Statistic	Prob.
C	3.844299	0.359977	10.67928	0.0000
LOG(CVW)	-2.403157	1.076292	-2.232811	0.0352
(LOG(CVW))^2	-2.307299	1.038322	-2.222142	0.0360
(LOG(CVW))^3	-0.700717	0.323478	-2.166195	0.0405

R-squared	0.386552	Mean dependent var	4.621029
Adjusted R-squared	0.309871	S.D. dependent var	0.024171
S.E. of regression	0.020080	Akaike info criterion	-4.846670
Sum squared resid	0.009676	Schwarz criterion	-4.656355
Log likelihood	71.85338	Hannan-Quinn criter.	-4.788489
F-statistic	5.041046	Durbin-Watson stat	1.121288
Prob(F-statistic)	0.007528		

Source: Cambridge Econometrics data / Own elaboration

Table 4: The relation between national growth and regional inequalities, econometric model 2
Dependent Variable: LOG(GROWTH)

Method: Least Squares

Sample (adjusted): 1982 2008

Included observations: 27 after adjustments

White Heteroskedasticity-Consistent Standard Errors & Covariance

	Coefficient	Std. Error	t-Statistic	Prob.
C	3.888065	0.341646	11.38038	0.0000
LOG(CVW(-1))	-2.181812	1.018073	-2.143081	0.0429
(LOG(CVW(-1)))^2	-2.009495	0.981019	-2.048375	0.0521
(LOG(CVW(-1)))^3	-0.586601	0.306373	-1.914660	0.0681

R-squared	0.363616	Mean dependent var	4.623137
Adjusted R-squared	0.280610	S.D. dependent var	0.021851
S.E. of regression	0.018533	Akaike info criterion	-5.002544
Sum squared resid	0.007900	Schwarz criterion	-4.810568
Log likelihood	71.53434	Hannan-Quinn criter.	-4.945459
F-statistic	4.380574	Durbin-Watson stat	1.388610
Prob(F-statistic)	0.014043		

Source: Cambridge Econometrics data / Own elaboration

Table 5: The relation between national growth and regional inequalities, econometric model 3
Dependent Variable: LOG(GROWTH)

Method: Least Squares

Sample (adjusted): 1983 2008

Included observations: 26 after adjustments

White Heteroskedasticity-Consistent Standard Errors & Covariance

	Coefficient	Std. Error	t-Statistic	Prob.
C	3.798082	0.377052	10.07311	0.0000
LOG(CVW(-2))	-2.422226	1.109910	-2.182363	0.0400
(LOG(CVW(-2)))^2	-2.224517	1.059417	-2.099756	0.0474
(LOG(CVW(-2)))^3	-0.651425	0.327895	-1.986688	0.0596

R-squared	0.299639	Mean dependent var	4.624716
Adjusted R-squared	0.204135	S.D. dependent var	0.020653
S.E. of regression	0.018425	Akaike info criterion	-5.009564
Sum squared resid	0.007469	Schwarz criterion	-4.816010
Log likelihood	69.12433	Hannan-Quinn criter.	-4.953827
F-statistic	3.137454	Durbin-Watson stat	1.533387
Prob(F-statistic)	0.045908		

Source: Cambridge Econometrics data / Own elaboration

From all the versions above we choose to study the third one. First of all because it has the figure of the Akaike information criterion (AIC) is the lowest one. AIC is a measure of the relative goodness of fit of a statistical model. It was developed by Hirotsugu Akaike (1974), under the name of "an information criterion" (**AIC**). It is grounded in the concept of information entropy, in effect offering a relative measure of the information lost when a given model is used to describe reality. It can be said to describe the trade-off between bias and variance in model construction, or loosely speaking between accuracy and complexity of the model. AIC values provide a means for model selection. AIC does not provide a test of a model in the sense of testing a null hypothesis (i.e. AIC can tell nothing about how well a model fits the data in an absolute sense). However, at this point it has to be noted that if all candidate models fit poorly, AIC will not give any warning of that.

The second reason for the selection of the third version of the model is the Durbin-Watson (DW) figure. The DW statistic is a test statistic used to detect the presence of autocorrelation (i.e. a relationship between values separated from each other by a given time lag) in the residuals from a regression analysis. It is named after James Durbin and Geoffrey Watson. Durbin and Watson (1950, 1951) applied this statistic to the residuals from least squares regressions, and developed bounds tests for the null hypothesis that the errors are serially independent (not autocorrelated) against the alternative that they follow a first order autoregressive process. In the third version of the model, the figure of the DW statistic is close enough to the critical value of 2. Thus, it can be supported that this version of the model probably has no autocorrelation problem. At this point, it has to be mentioned that there was an attempt to detect and correct the problem of autocorrelation with the use of the Lagrange multiplier (LM) autocorrelation test. LM autocorrelation test reports the multivariate LM test statistics for residual serial correlation up to the specified order (Johansen, 1995).

Concerning heteroskedasticity, even though the model is a time-series one, there was a small problem. This problem has been detected and corrected with the use of the White test (White, 1980). In statistics, the White test is a statistical test that establishes whether the residual variance of a variable in a regression model is constant: that is for homoscedasticity.

From the specification of the model above, it is obvious that the relation between regional inequalities and national growth in Greece is non-linear. In order to estimate the intervals where the relation is positive (procyclical pattern) and where the relation is negative (anticyclical), we first estimate the first derivative of the specified econometric equation.

Setting $LOG(GROWTH) = Y$ and $LOG(CVw(-2)) = X$, the specified econometric equation takes the form: $Y = -0{,}651425x^3 - 2{,}224517x^2 - 2{,}422226x + 3{,}798082$.

The first derivative of the equation above takes the form:

$$\frac{\partial y}{\partial x} = -1{,}954283x^2 - 4{,}449034x - 2{,}422226 .$$

Solving the second-degree equation: $\frac{\partial y}{\partial x} = \mathbf{0}$, we find that the solutions are:

$X = -1{,}375$ and $X = -0{,}902$. Thus, $\forall x \in [-1{,}375, -0{,}902]$, $\frac{\partial y}{\partial x} > \mathbf{0}$. This means that: $\forall CVw(-2) \in [0{,}042, 0{,}125]$, $\frac{\partial y}{\partial x} > \mathbf{0}$. Thus, the findings of the econometric investigation suggest that: $\forall CVw(-2) \in [0{,}042, 0{,}125]$, the relation between national growth and regional inequalities in Greece is procyclical. When CVw(-2) takes values that are not included in this interval, then the relation between national growth and regional inequalities in Greece is countercyclical.

Looking at the actual figures of national growth and regional inequalities it can be concluded that the pattern of regional inequalities in Greece is non-linear and countercyclical. This indicates that increasing regional inequalities are accompanied by negative national growth, and decreasing regional inequalities are accompanied by positive national growth. The countercyclical pattern detected indicates that when a significant part of the country does not participate equally in the development procedure, the impact on national growth is negative. This suggests that the Greek State should pay attention to regional policy interventions towards the decrease of regional inequalities. The rather high values of the CVw suggest that in Greece there is a regional problem, even though the Greek State diachronically tries to underestimate it.

7. Conclusions

The aim of this study was to examine the relation between per capita GDP growth and regional inequalities in Greece. In other words, it was attempted to give an answer if this relation is procyclical or countercyclical. In the empirical analysis of this master thesis three versions of the econometric model were run. From these versions the one with the two years-time lag was chosen on a basis of statistical and econometric criteria such the AIC and the DW figures.

The findings of the empirical analysis suggest that the pattern of regional growth in Greece during the period under consideration is non-linear and countercyclical. This indicates that increasing regional inequalities are accompanied by negative national growth, and decreasing regional inequalities are accompanied by positive national growth. The countercyclical pattern detected indicates that when a significant part of the country does not participate equally in the development procedure, the impact on national growth is negative. This suggests that the Greek State should pay more attention to regional policy interventions towards the decrease of regional inequalities (indeed, the rather high values of the CVw suggest that in Greece there is a regional problem).

The findings of the Master Thesis are expected to provide valuable insight for both theory and policy-making. In any case, they provide the basis for future research on the issue. Indeed, it is important to be mentioned that further research must be conducted in the future by extending the time series in order to incorporate more years from 2008 onwards, by studying the inverse causality between regional inequalities and national growth (i.e. regional inequalities as dependent variable), by duplicating this study in terms of a composite indicator.

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