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Portuguese regional economic growth disparities and productive specialisation

Joana Rita Soares dos Santos

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PORTUGUESE REGIONAL EONOMIC GROWTH DISPARITIES AND PRODUCTIVE SPECIALISATION

Joana Rita Soares dos Santos

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Maria Manuel Pinho

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Abstract

Specialisation occurs when the concentration of economic activities of a region is focussed mainly in a few sectors or when a region has a higher share of a sector in comparison to the benchmark territory. Several studies have identified specialisation as a determinant of regional economic growth even though it is still uncertain the role it plays. This research aims at analysing the economic disparities among Portuguese regions and relating the observed different economic growths with the regional productive composition structure. By using absolute and relative specialisation indices, we first described the evolution of the specialisation of the Portuguese regions in the 2000-2015 period and then, by resorting to three different shift-share approaches – the classic shift-share analysis formulated by Dunn (1960), an extension of the classic shift-share proposed by Esteban-Marquillas (1972) and a modern shift-share method proposed by Artige and Neuss (2014) – we were able to decompose the levels of economic growth observed in each region against the growth observed in the nation into different components. Our findings suggested that, in general, the degree of specialisation did not play a positive role in the growth of the Portuguese regions and were less significant in explaining regional economic disparities in comparison to the role played by the competitive effect. Moreover, the values from Dunn (1960) and Esteban-Marquillas (1972) models in general overvalue the role of the industry-mix effect in comparison to the results from the Artige and Neuss' (2014) approach. Also, Dunn's (1960) approach seemed to undervalue the effect of the competitive component.

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Keywords: productive specialisation, economic growth, regional disparities, shift-share analysis

Resumo

A especialização ocorre quando a concentração das atividades económicas de uma região está focada somente em alguns setores ou quando a região tem um setor com uma importância maior do que o território de referência. Muitos estudos identificaram a especialização como determinante do crescimento económico regional embora seja incerto o seu papel. Este estudo visa analisar as disparidades regionais portuguesas relacionando os diferentes crescimentos económicos com a estrutura produtiva. Recorrendo a índices de especialização absolutos e relativos, descreve-se em primeiro lugar a evolução da especialização das regiões portuguesas no período de 2000 a 2015 e, em seguida, através de três diferentes abordagens da análise de shift-share – a análise clássica de shift-share formulada por Dunn (1960), uma extensão da análise clássica de shift-share proposta por Esteban-Marquillas (1972) e um método moderno de shift-share proposto por Artige e Neuss (2014) – decompôs-se o crescimento económico observado em cada região com o que foi observado em todo o pais em várias componentes explicativas. Os resultados sugerem que, em geral, o grau de especialização desempenhou um papel negativo no crescimento das regiões portuguesas e, em comparação com o efeito competitivo, mostrou-se pouco importante na explicação das disparidades do crescimento económico das regiões portuguesas. Além disso, os valores dos modelos de Dunn (1960) e Esteban-Marquillas (1972), em geral, sobrevalorizam o efeito do componente estrutural em comparação com os resultados da abordagem de Artige e Neuss (2014). Adicionalmente, a abordagem de Dunn (1960) subestima o efeito da componente competitiva.

Códigos JEL: O40 O47 P25 R12

Palavras-chave: especialização produtiva, crescimento económico, disparidades regionais, análise de shift-share

Table of contents

List of tables

List of figures

Introduction

The European Union's (EU) integration process has as basic principle to drive growth on member countries and to rise economic and social cohesion. In other words, one of the aims of the EU's policy is to consider the spatial dimension of the economic and social balance between member countries as well as within them (Marelli, 2007).

Esteban (1994) has argued that territorial inequalities in productivity are the main factor of regional disparities in gross value added (GVA) *per capita* in the EU. Therefore, intrinsic characteristics of countries or regions such as the degree of specialisation are important factors in order to study economic growth. Such analysis for public policies purposes may help diminish the existing spatial imbalances and help regions to take advantage of each one's capacity.

Sector specialisation is defined by the European Commission as the concentration of production activity in a few sectors (European Commission, 1999). Thus, a region will have a productive structure profile extremely specialised when the regional production is distributed mainly in a few number of sectors.

The literature regarding the impact of productive specialisation in regional economic growth is still not clear. Some authors argue that specialisation is the path to growth since firms can benefit from intra-sectoral spillovers externalities, also known by specialisation externalities, and subsequently firms from the same industry will tend to concentrate in the same location (Glaeser *et al.*, 1992). On the other hand, several studies evidenced that specialisation has a negative impact on economic growth which can be due to urbanization externalities as firms will seek diversified regions because of the gains from intersectoral spillovers and these externalities lead to a more innovative and productive economy (Jacobs, 1969).

Therefore, this research aims at contributing to the discussion of this topic by finding evidence on the impact of the specialisation profile in Portuguese regions' economic growth and a better insight on the determinants of differences between regions. This analysis comes as an essential step to mitigate regional disparities, leading to a better success of public policies and in turn will lead as well to a more spatially balanced economic progress.

We will focus on the existence of Portuguese regions' disparities observed in the gross value added (GVA) at annual current prices and its relation with the region's productive

specialisation profile in order to analyse the contribution of the degree of productive specialisation to regional growth.

This research is structured with three more sections. Section 1 is related to the literature review on the contributions of specialisation to economic growth, both in terms of theoretical models and empirical evidence. The empirical strategy, data and results are described and discussed in section 2. Finally, section 3 presents the main conclusions of this research as well as recommendations for future research.

1. The literature on regional specialisation and economic growth

In this section, we will review the existing literature on regional specialisation and economic growth, dividing the section in three subsections. The first subsection (1.1) constitutes the framework to understand the main concepts in which this research is focussed on, and the second subsection (1.2) studies the determinants of sectoral specialisation in a region in order to understand why a region can be more or less specialised. The impact of regional specialisation on economic growth is reviewed in section (1.3). Finally, in the last subsection (1.4), the studies relating regional specialisation and regional disparities are discussed.

1.1. The relevant conceptual framework

Using the formal concept, a region can be defined as being an extensive territory that "shares homogeneous characteristics on the basis of selected criteria such as physical condition, economic structure and agricultural resources" (Raheem *et al.*, 2014: 165). As regions exploit differently their natural resources and capacities and there are different governmental policies applied to each region, regional disparities can arise with regions attaining different levels of economic and social development (Raheem *et al.*, 2014).

Economic growth is defined by Metcalfe *et al.* (2006) as the result of changes over time on the structural configuration of an economy. According to Escóssia (2009), economic growth is evidenced by the increase of the productive capacity of a region which is expressed as the production of goods and services that can be measured, for example, by the GVA *per capita*. The catching-up of a region is not only dependent on increases in productivity and variations of the inputs and outputs in the existing sectors. As Kuznets (Lankauskienė and Tvaronavičienė, 2013: 357) has argued, "it is impossible to attain high rates of growth *per capita* or per worker without commensurate the substantial shifts in the shares of various sectors". Therefore, economic growth can be reflected in the performance of the economic sectors of an economy and can encourage structural change that happens when the labour is reallocated across the economics sectors changing in this way the sectoral composition of a region (Lankauskienė and Tvaronavičienė, 2013). Marelli (2004) has found significant results on how the role of national and regional specialisation is important to determine economic growth even though the degree of specialisation itself is influenced by the region development level, suggesting the existence of endogeneity.

Benito and Ezcurra (2005) studied the distribution of territorial productivity in the EU and they showed that the territorial and sector profile are important determinants in explaining disparities in productivity among the countries under analysis. The evaluation of the spatial behaviour of the activity sectors permits measuring the degree of specialisation or diversification of the activities within a region (Kemeny and Storper, 2014).

According to Aiginger and Davies (2004), specialisation can be either absolute or relative. A region is specialised in absolute terms when a few number of industries have higher shares in the whole region's employment. This means that the increase in absolute specialisation in a region happens when a sector grows in a specific location independently of the sectors growth in other locations (Kemeny and Storper, 2014). On the other hand, relative specialisation occurs when a region possesses a higher share of an industry than the spatial reference chosen. According to Constantin *et al.* (2009: 100), "regional specialisation depicts the distribution of the sectoral shares in one region, usually compared to the rest of the country". A region which has a more specialised profile in absolute terms is not necessarily relatively more specialised in that industry (Min-rong and Yan-hua, 2013).

In relation to the flipside of the specialisation concept, a diversified region is a region comprising a wide array of sectors that are distinct and unrelated, where no specific sector is dominating (Kemeny and Storper, 2014). As claimed by Marshall (1975: 38), "It seems both simpler and more realistic to regard specialisation and diversification as the two ends of a single dimension... a city is said to be diversified if it resembles the weighted national profile, and specialised if it does not".

1.2. Determinants of specialisation

In relation to the factors that encourage specialisation of a region, the concentration of population may be one of them. Krugman (1991) reflects that transportation costs are decisive for industrial location and industries will locate in densely populated regions so that transportation costs will be lower, which may lead to the agglomeration of certain industries. Moreover, people and firms can learn from each other, incentivising firms to locate where there is a high density of population (Glaeser *et al.*, 1992). On the other hand, excessive agglomeration can also lead to congestion costs such as traffic, immobile labour and wages that increase endogenously with agglomeration which may counter-effect the benefits from agglomeration and influence industries on reformulating their location decision (Ezcurra *et al.*, 2004).

Additionally, regional size may also be a determinant of specialisation. A more heterogenous population and variety of physical factors that tend to be a characteristic of larger regions will lead to a less specialised profile comparing to smaller regions (Ezcurra *et al.*, 2004). The "new economy geography" suggests that industries will move to larger regions due to agglomeration economies. Larger regions will then have a less specialised structural composition profile but, on the other hand, specialisation may increase as certain type of concentration of industries may arise due to a specific agglomeration economy (Ezcurra *et al.*, 2004). Therefore, it is still inconsistent whether specialisation in a region increases or decreases with the agglomeration of economies that may be a result from density of population or the size of the region.

The international trade model suggests that it may be beneficial for an economy to be specialised in a specific sector whenever there is an external demand for that sector growing faster in comparison to the regional demand (Kemeny and Storper, 2014). Therefore, regions do not have any incentive of becoming self-sufficient and will focus their production according to their factor endowment. But then again, as suggested by Duranton and Puga (2000), if an economy has consumers with a taste for diversity, it may be favourable to open new sectors in the region instead of importing them at a higher cost inducing the economy to diversify. Krugman (1991) compared the United States of America with four European countries in relation to the degree of specialisation, and the results confirmed a higher specialisation in the American regions, which was due to the existence of commercial barriers in the European countries. The creation of the Single Market and the European Monetary Union would lead to the elimination of the commercial barriers and would decrease the costs associated to trade which would allow each country to specialise in the goods that present more productivity and lower opportunity cost, stimulating interindustry trade and economic growth. In the end, participating countries would have a more specialise productive profile and disparities in productive structures among countries would also be higher.

1.3. Regional economic growth theories

Going back to the approach of neoclassic growth theories, Solow's model was an important contribution in order to study regional growth. In his model, there are two economies with similar structures and perfect mobility of goods and capital. The equilibrium between these two economies is reached by the adjustment of capital and labour which is explained by the decreasing returns to scale of these two variables (Solow, 1956). Capital will

move to the less developed region which is characterized by the lowest wages and scarce capital, what in turn will lead to increases on the levels of growth, and convergence in income between the two economies will be reached. The only determinant of economic growth is the technological progress while the productive structure is viewed as a constant which plays no role in reaching the equilibrium between the two economies. Therefore, structural composition does not change (Echevarria, 1997). Moreover, the neoclassic authors believed that the government has no role in the economy, leaving it to automatic mechanisms to reach equilibrium between supply and demand.

However, there is a possibility that if the market is left to run freely, it will lead to more disparities. The free transportation of goods and movement of people lead to losses which decrease the possibility of peripheral regions to grow (Silva and Ribeiro, 2013). Developed regions with a higher developed infrastructure and with more qualified human capital, will be the ones at advantage, increasing the disparities between urban areas (more developed) and rural areas (less developed) (Gurgul and Lach, 2011). Changes in the sectoral structure can be caused by changes in the demand side where products that are more diversified and complex are favoured and will impact the growth of the economy of a region. Industries which possess higher levels of productivity growth, which is a characteristic of high tech industries, will be the ones to contribute more to economic growth (Silva and Ribeiro, 2013).

Perroux (1955) also addressed the issue of territorial unbalanced growth by creating the concept of growth poles where the appearance of agglomeration economies explains the observed disequilibria. Therefore, economic growth is not observed in all parts of an economic space but only in some specific locations which is manifested in growth poles with different intensities and will be expanded by diverse channels affecting the whole economy. Economic growth is then not equally distributed in the economic space which results in a spatially unbalanced growth process by nature in contrast to the classic and neoclassic models (Perroux, 1955).

A growth pole is defined by Richardson (1978: 127-128) as a "group of industries, strongly interrelated through the input-output links around a leading industry (propulsive industry or *industrie motrice*), capable of generating a dynamic growth of the economy".

Innovation will generate an accelerated growth in a leading industry which in turn will transmit to the other industries through external economies. This will lead to a more spatial concentration of industries which consecutively causes an even more intensified economic activity within the growth pole deepening the asymmetries between regions. Activities that

are more dynamic will be pulled by market forces to developed areas for the advantages that they can obtain from it (Perroux, 1955).

The growth pole model was viewed firstly in an economic space rather than geographic area even though Perroux (1955) did not exclude geographical agglomeration. For Hirshman (1958), in line with the growth poles model, an economy must have one or more economic centre to attain higher levels of growth. Boudeville (1966) associated a growth pole to a city or town where there is a set of industries that are complex and propulsive. McCann and Van Oort (2009) have related economic growth through the growth pole model by Perroux (1955) and embedded it in geographical space by Boudeville (1966) as a process based on innovation and knowledge that is generated in a specific central location and is expected to spread to nearby localities.

According to Souza (2005), economic growth has different levels for each region depending on its productive structure and internal resources availability. For that reason, economic growth occurs in a concentration form in poles, with effects that can be expansive or as of drainage of resources from near areas. The polarized growth model has as its objective to find why some industries and regions grow more than the average creating imbalances among regions that are not explained by neoclassic theories.

The growth pole model was important in the decades of 1960 and 1970 where it was used as a tool to diminish regional asymmetries. It has influenced development policies in several countries like USA, Russia, France, Italy and Brazil to concentrate investments in the growth centres, but they were not successful in its majority as the expected results were not achieved due to further growth in the centre regions without effects being diffused (Almeida, 2013). Nevertheless, this model is a starting point to study economic growth disparities between regions that are indeed related to its economic structure even though it does not specify if the existence of agglomeration economies and growth poles was the result of specialisation or diversification of sectoral composition.

Geographic proximity can help transmit ideas and knowledge and these spillovers are positive externalities as people and firms learn from each others either by interacting on their own or with other sectors. Cities will then tend to have higher levels of growth than rural areas as externalities are larger and more important in cities because people interact more (Glaeser *et al.*, 1992).

The Marshall-Arrow-Romer (MAR) model, formalized by Glaeser *et al.* (1992), refer to these knowledge spillovers as externalities within the industry. Firms from the same

industry will take advantage of the others accumulated knowledge and will improve their technologies without compensation. Concentration of similar or same industries in a region helps flow this free information and ideas of products and processes through imitations and business interactions. The industries that will grow faster are the ones that are in specialised regions where they can benefit from spillovers externalities within the industry, and the cities where these kinds of industries are located will also grow faster.

On the other hand, Jacobs (1969) argues that regions that have more diversified productive structures will be expected to grow more because there is more transmission of different ideas. The author uses the example of Manchester as a city specialised in textile that failed in contrast to the success of Birmingham that was structurally diversified. Jacobs (1969) argues that the diversification of industries within a location will promote externalities concerning knowledge and will lead to innovation and economic growth.

Glaeser *et al.* (1992: 1126) in an attempt of discovering which of the MAR or Jacobs approaches are correct, analysed the "growth of large industries in 170 U.S. cities between 1956 and 1987" using location quotients and relative specialisation indicators and cross-region regressions. They find that regional diversification was an important determinant of employment growth in firms suggesting that firms from different industries benefit from spillovers externalities from knowledge sharing which is consistent with Jacobs' view.

Kemeny and Storper (2014) have addressed three explanations for the advantages of diversification. The first explanation is that diversification spreads the risk from economic fluctuations and economic shocks and as such, it will be more beneficial for an economy to have a more diversified portfolio. Furthermore, following this idea and by assuming that similar workers can easily shift to different industries, the degree of regional specialisation is correlated to the level of regional unemployment. Regions with a wide range of economic sectors may experience a lower number of unemployed workers than specialised regions since in the event of a demand shock affecting one economic sector, a diversified region shall have other economic sectors to compensate the losses from the other affected sector (Puga and Duranton, 2000). Therefore, through a portfolio motive, this perspective addresses diversification as a process to economic growth even though it is only associated to counterbalance negative shocks and does not consider opportunity costs from diversification and the benefits from specialisation since a region can benefit from producing the goods that are relatively more efficient and which present the lower cost of opportunity in comparison to other countries (law of comparative advantage of production) and then supply them to

consumers with higher production costs of those goods. Moreover, a specialised region may be willing to pay higher wages than the national average as firms exhibit higher productivity than firms located in diversified regions (Traistaru *et al.*, 2002).

Another explanation, as stated by Kemeny and Storper (2014: 3), is that "a modern economy is a vast and very complex social division of labour. For an economy to move into, or capture, new activities, it needs to be able to draw quickly and easily from a shifting set of inputs and factors. A diversified economy might be able to do this better than a highly specialised one" as it exhibits diversity in local inputs and services which leads to more availability of job opportunities reducing unemployment levels. But in contrast, specialised regions offer more locally specialised inputs and skilled labour (Drucker, 2013).

Lastly, urbanization economies may be able to provide interindustry or intersectoral relationships where an output from an industry or sector can be the input for another. This idea suggests that diversification is an output of the economy being big and complex but, as mentioned by Myrdal (1957), it may have gone that way by starting in a first stage as being successfully specialised and getting bigger and diversified through its economies of scope, which explains how a firm or a city can take advantage in the production of a variety of goods rather than producing them on its own, by sharing its resources which lowers the average total cost of production. "Such economies can come from businesses sharing centralised functions, such as finance or marketing. Or they can come from interrelationships elsewhere in the business process, such as cross-selling one product alongside another, or using the outputs of one business as the inputs of another" (Hindle, 2008: 72).

In Table 1 we can observe the main advantages and disadvantages reviewed in this subsection 1.3.

Table 1 – Advantages and disadvantages of productive specialisation

Advantages	Disadvantages
Higher productivity due to the existence of firms that benefit from economies of scale	Rising costs if labour or inputs have to be drawn from other regions
More innovation due to knowledge spillovers within firms from the same industry	Less transmission of different ideas that may happen from firms of different industries
More efficiency due to specialisation in goods that have comparative advantages which stimulates interindustry trade with other regions and economic growth	More volatility as a result of economic fluctuations and shocks
Higher wages than the national average as firms exhibit higher productivity due to comparative advantages	Higher unemployment level and less job opportunities
More local supplies of specialised inputs and skilled labour	Less diversity of local inputs and services

1.4. Empirical evidence on specialisation and regional disparities

There are several studies (summarized in Table 2) that aimed to analyse the specialisation effect on economic growth both at the national and the regional level.

At a national level, Alhowaish and Al-shihri (2015) studied the relationship between structural change and economic growth in Saudi Arabia between 1970 and 2012. Resorting to an econometric analysis, the authors concluded that economic growth was mainly dependent on the services and industrial sectors even though these two depended as well on the incomes of the oil and gas sectors. This suggests that there "exists bidirectional causality among the sectoral output of Saudi Arabian economy at least in the short run" (Alhowaish and Al-shihri, 2015: 411).

Pérez and Villareal (2017) have shown that even though Mexico has shifted to more complex industries during the period from 1990 to 2014, this was not followed by an increase in innovation. This illustrates that although Mexico has diversified its production complexity, productive growth did not reach significant results comparing to its main trader partner, the USA.

In relation to the analysis done for the OECD countries, Silva and Teixeira (2011) have found a significant relation between changes in the sectoral composition of the economy and productivity growth (in terms of labour) for the 9 less developed OECD countries in the late 1970s (Austria, Finland, Greece, Ireland, Italy, Japan, South Korea, Portugal, Spain) plus Taiwan and, at the beginning of the period analysed, these countries all shared similar structural characteristics. They observed that an economic activity can be more successful when it is constituted of strategic branches such as information technology related industries, and different growth patterns experienced by countries might be due to the different capacities of conducting economic structure towards more skilled and innovative activities. Dietrich (2012) also found results, in his application on OECD countries, of structural change – a shift of the sectoral distribution from primary and secondary sectors to the tertiary sector (tertiarization) – leading to positive aggregate economic growth even though economic growth leads to a greater change in structural change than the other way around. Dalum *et al.* (1999: 281), through a regression analysis, found significant results indicating that "specialisation in activities offering high levels of technological opportunity and/or in areas with high income elasticities" in OECD countries lead to economic growth.

At the regional level, Longhi *et al.* (2005) studied the EU regions at a NUTS 1 and NUTS 2 level, from 1979 to 2001, and by using the Herfindahl index and regression analysis, the authors were able to relate regional unemployment rate to the degree of sectoral specialisation of a region and found positive correlation between these two variables which indicates that the more specialised a region is, the higher is the rate of unemployment. Ezcurra *et al.* (2004) and Marelli (2007) have analysed inequalities in regional *per capita* income in the EU at a NUTS 2 level using as tool various specialisation indices. Ezcurra *et al.* (2004) were able to conclude that productive specialisation in aggregate terms decreased for EU regions between 1977 and 1999 even though an increase of specialisation occurred in the nineties. The decrease in aggregate specialisation was due to the high specialised countries from the beginning of the period analysed, shifting towards the EU's average specialisation. Results evidenced by the authors suggested that the increase in regional specialisation in the nineties "may have helped to explain the absence of convergence in regional development levels and the maintenance of the degree of polarization of regional *per capita* income observed over this period" (Ezcurra *et al.*, 2004: 24). Marelli (2007) also found results on the increasing of homogeneity of the sectoral composition within the EU between 1980 and 2005, where overall specialisation across countries and regions decreased in the period analysed. Marelli's analysis results suggested that the high levels of specialisation in the beginning of the period contributed to regional growth in *per capita* income over the observed period; on the other hand, the increase of specialisation observed over the period in some countries generally led to lower growths, while if it is looked at individual sectors impact, specialisation in agriculture expressed negative relation to productivity growth and services exhibited a positive role in it. Thus, there is still uncertainty in the role played by specialisation in regional growth. Esteban (2000) studied interregional productivity disparities between European countries on a NUTS 3 level using a shift-share analysis as methodology. The author was able to show that regional specialisation had a very small role in explaining inequalities within the EU, and this was essentially explained by uniform productivity gaps across sectors. Traistaru *et al.* (2002) studied, through the Krugman index, the patterns of regional relative specialisation in five EU countries (Bulgaria, Estonia, Hungary, Romania and Slovenia) and concluded that countries that presented high specialisation levels performed better in terms of GDP *per capita*, wages and unemployment, than the ones that had low specialisation levels in the period 1990 to 1999.

There are also several studies focusing on the analysis of regional specialisation in a specific country. Šipilova (2015) evidenced, for the case of the Latvian regions, that the increase of specialisation in high-tech sectors only conducts to regional economic growth if it is followed by labour productivity progresses. Constantin *et al.* (2009), using specialisation and concentration indices such as the Herfindahl index (as an absolute measure) and Krugman dissimilarity index (as a relative measure), have found evidence, in the period from 1995 to 2005, that Romanian regions had to reallocate employment to adapt to the changing of economic environment from the integration in the EU. The reallocation of employment across sectors led to a decrease of regional specialisation both in absolute and relative terms, even though industries became geographically more concentrated (measured by the GVA and the number of employed workers). Southern Italian regions have, according to the analysis by Paci and Pigliaru (1997) using cross-region regressions, over the period between 1970 and 1992, gone through structural change as a result of regional policy to foster industrialization, inducing higher growth rates (measured by *per capita* output). The regions were at the beginning of the period mainly driven by the agriculture sector, and over the period there were shifts of labour shares into high productivity sectors. Combes (2000) tested how the economic structure in local areas from France affected employment growth in the period from 1984 to 1993. The author was able to confirm, through the use of the Herfindahl index and the generalized Tobit model, that the impact of local economic structure on growth depended on the sector, if industry or services. In the industrial sectors, sectoral specialisation reduced growth even though there was as well an increase in growth in a few sectors. In relation to service sectors, specialisation always revealed a negative impact on growth, and diversity and density favoured local employment growth of the sector, suggesting the possibility of the existence of intersectoral knowledge spillovers. Service sectors in France, unlike industrial sectors, are then characterized by urbanization economies in local areas in the analysed period. García-Milá and Marimon (1999) analysed the employment patterns and GVA in Spanish regions and related the regional sectoral composition in determining the growth of the regions in the period of 1980 to 1995. Through a shift-share analysis, the authors were able to verify that sectoral composition was a crucial determinant in explaining regional productivity differences, the evolution of employment and average wages. In case of differences in the GVA, the regional component (for example, comparative advantages) came across to be more important in explaining them than sectoral component.

Looking at researches that focussed on regional asymmetries in Portugal and the corresponding productive structures (three sectors analysis), Matos (2015), using a shift-share methodology, studied the asymmetries in GVA growth rates in the Portuguese NUTS 3 level regions, and the impact of productive structures and specific regional component on regional growth. In the 1995 to 2010 period, even with improvements in the infrastructure and living conditions of the population, regional asymmetries increased. Subregions, not only from the inner mainland territory but also from the coastal area, had difficulties in reaching positive economic performance. Only Grande Lisboa, Madeira, Grande Porto and Algarve had a sectoral structure favourable to economic growth even though the profile of the productive structures of these regions is not mentioned. According to Carvalho and Diniz (2014) in their research over the evaluation of specialisation in the productive structure (data from 10 sectors) of Portuguese regions at a NUTS 3 level, there were no significant changes on the pattern of regional specialisation for the period from 1996 to 2010. The authors also studied the impact of relative specialisation (measure either in GVA and employment) on GDP *per capita* through a cohesion index, and results showed a negative relationship between relative specialisation in the primary sector and GDP *per capita* but there was a positive impact on this variable for regions highly specialised in the services sector. Souza and Cabral (2001) sought to reflect on the dynamics of the productive structure of the NUTS 3 of Northern Portugal in the 1986 to 1998 period. The regional component (for example, possession of locational advantages) was the one that most stood out as a determinant of regional growth (measured by labour). Thus, the structural component has little effect on regional growth which is consistent with the one found by García-Milá and Marimon (1999) for the Spanish regions.

Viegas *et al.* (2013) focussed their research on the Algarve region which was considered the second most specialised region of Portugal, being highly specialised in the tourism sector with linked branches such as accommodation and catering, fishing, commerce and construction to be the ones to contribute the most to regional growth.

Table 2 – Overview of empirical studies

Author	Sample	Time frame	Methodology	Conclusions
Alhowaish and Al-shihri (2015)	Saudi Arabia	1970-2012	Granger causality test, Philips Perron panel	Bidirectional causality within the sectoral output economy; Co-dependency between the growth of the industrial and services sectors

Author	Sample	Time frame	Methodology	Conclusions
Pérez and Villareal (2017)	Mexico	1990-2014	Shift-share, Sectoral production functions	Diversification was not followed by growth
Glaeser *et al.* (1992)	USA	1956- 1987	Specialisation and location quotients	Diversity and local competitiveness promoted labour urbanization growth while specialisation hurts employment growth
Silva and Teixeira (2011)	10 less developed OECD + Taiwan	1979-2003	Nickell and Lilien indices	Economic activity can be more successful when it is constituted of strategic branches such as information technology related industries
Dietrich (2012)	OECD	1960-2004	Granger causality test	Changes in economic structure of a region are positive correlated to economic growth
Dalum *et al.* (1999)	OECD	1965-1988	Regression analysis	Specialisation in sectors which present high levels of income and technologic opportunities matters for economic growth
Longhi *et al.* (2005)	EU NUTS 1 and NUTS 2	1979-2001	Herfindahl index Regression analysis	Sectoral specialisation of a region is positive correlated to the unemployment rate
Ezcurra *et al.* (2004)	EU NUTS 2	1977-1999	Krugman index Gini index	In the nineties, there was an intensification of the specialisation degree of regions that is connected to the lack of convergence of regional economic growth under the analysed period
Marelli (2007)	EU NUTS 2	1980-2005	Various specialisation indices Convergence beta	The role of specialisation in regional growth is still uncertain depending on the sector analysed: specialisation in agriculture expressed negative relation to productivity growth and services exhibited a positive role in it
Esteban (2000)	EU NUTS 3	1986-1989	Shift-share	Regional specialisation had a very small role in explaining inequalities within the EU, because of the uniform productivity gaps across sectors
Traistaru *et al.* (2002)	EU NUTS 3	1990-1999	Krugman index	Countries that presented high specialisation levels performed better in terms of GDP *per capita*, wages and unemployment
Šipilova (2015)	Latvian regions	1995-2005	Shift-share	The increase of specialisation in high-tech sectors only conducts to regional economic growth if it is followed by labour productivity progresses
Constantin *et al.* (2009)	Romania regions	1996-2005	Herfindahl index Krugman index Dissimilarity index	Romanian regions had to reallocate employment to adapt to the changing of economic environment from the integration in the EU

Author	Sample	Time frame	Methodology	Conclusions
Paci and Pigliaru (1997)	Italian regions	1970-1992	Cross-region regressions	Shifts of labour shares from the primary sector to higher productivity sectors induced higher levels of growth
Combes (2000)	French regions	1984-1993	Herfindahl index Tobit model	The impact of local economic structure on growth depends on the sector, if industry or services
García-Milá and Marimon (1999)	Spanish regions	1980-1995	Shift-share	Sectoral composition was a crucial determinant in explaining regional productivity differences, evolution of employment and average wages but not for GVA growth
Matos (2015)	Portugal (NUTS 3)	1995-2010	Shift-share	Only Grande Lisboa, Madeira, Grande Porto and Algarve had a sectoral structure favourable to economic growth
Carvalho and Diniz (2014)	Portugal (NUTS 3)	1996-2010	Localisation, specialisation indices and regression analysis	Negative relationship between relative specialisation in the primary sector and GDP *per capita* but there was a positive impact on the variable for regions highly specialised in the services sector
Souza and Cabral (2001)	Portugal - North Region (NUTS 3)	1986-1998	Localisation, specialisation and diversification indices Shift-share	The high concentration of employment in a productive sector such as the textiles, clothing and leather industries, at NUTS Ave, Tâmega and Vouga, explains the high values in their specialisation index
Viegas *et al.* (2013)	Portugal - Algarve	1995-2002	Economic base model	Algarve region where it was considered the second most specialised region of Portugal, highly specialised in the Tourism sector with linked branches such as accommodation and catering, fishing, commerce and construction to be the ones to contribute the most to regional growth

Overall, the empirical evidences analysed in this section do not provide consistent results. For Marelli (2007), Combes (2000), Silva and Teixeira (2011), Dalum *et al.* (1999) and Carvalho and Diniz (2014), more important than the degree of specialisation when accounting economic growth, is the regional sectoral distribution. However, Souza and Cabral (2001) and García-Milá and Marimom (1999) found the structural component to have little effect on growth and Esteban (2000) results suggest regional specialisation to play a not significant role when explaining regional economic disparities. The results of Longhi *et al.* (2005) in relation to specialisation contributing to unemployment are in accordance with the view of Kemeny and Storper (2014) but not with Traistaru *et al.* (2012) that found a negative relation between these two variables.

2. An empirical analysis of the Portuguese regional economic disparities and productive specialisation

In this section, an empirical analysis is applied to the Portuguese regions in order to give an additional insight of whether and how the regional productive composition contributes to regional growth. In subsection 2.1, the empirical strategy is identified and described as well as the data that will be used; subsection 2.2 presents the specialisation indices used followed by the discussion of the results and lastly, in subsection 2.3, a shift-share analysis is applied to explain regional growth rates of Portuguese NUTS 2 regions.

2.1. Empirical strategy and data

The empirical strategy is divided in two stages. In the first stage, we will use specialisation indices for the analysis of the regional economy of the Portuguese NUTS 2 regions using Portugal as the territorial reference unit. The aim of this analysis is to characterize and describe the economic structure (sectoral distribution) of the regions in the period of 2000 to 2015 (2016 has been excluded as it is still a provisional value) which is the time series available from Statistics Portugal and to identify which sectors are more predominant in comparison to the national structure. In the second stage, we will apply a shift-share analysis to Portuguese regions in order to decompose each regional economic growth rate into national and local effects. We will apply three approaches of the shift-share analysis and will confront the results obtained from each application. The first is the classic shift-share approach proposed by Dunn (1960), the other is an extension of the previous mentioned one proposed by Esteban-Marquillas (1972) and the last one is a modern shift-share method proposed by Artige and Neuss (2014), all described in more detail in subsection 2.3. This analysis will help to identify if the growth of each region in the observed period was due to local competitive advantages or/and specialisation in more dynamic economic activities.

As for similar analysis also applied to Portugal in the recent years (see Table 3), the most recent one was done by Statistics Portugal in 2017 which applied Esteban-Marquillas (1972) shift-share as methodology for Portuguese NUTS 3 regions and used data from 10 economic activities.

In order to add value to the existing literature, we will also apply the Artige and Neuss (2014) approach as it aims to correct the flaws pointed by critiques to the Esteban-Marquillas

(1972) and Dunn's (1960) approaches and, as such, we may be able to reach more accurate results in comparison to previous researches. Nevertheless, it is the first time that the Artige and Neuss (2014) shift-share is applied to Portugal's regions and as we will use indices of specialisation to support it, our empirical strategy is then unique and will be able to characterize the specialisation profile of Portuguese regions and relate it to the growth of the region.

Table 3 – Recent similar analysis applied to Portugal

Author	Sample	Time frame	Methodology	Variables/ Number of sectors
Matos (2015)	Portugal (NUTS 3)	1995-2010	Classic shift-share analysis	GVA 3 sectors
Carvalho and Diniz (2014)	Portugal (NUTS 3)	1996-2010	Quotient of localization Coefficient of specialisation Entropy index Regression analysis	GVA and employment 10 sectors
Statistics Portugal (2017)	Portugal (NUTS 3)	2000-2015	Gini Index Theil Index Coefficient of variation Esteban-Marquillas shift-share analysis	GVA 10 sectors

The variable which will be used to characterize each economic activity and regional growth is the annual gross value added at current prices (GVA) which was retrieved from the Statistics Portugal database for Portuguese NUTS 2 regions (see Appendix 1) – North, Centre, Lisbon Metropolitan Area (Lisbon M. A.), Alentejo, Algarve, Autonomous Region of Azores (A. R. of Azores) and Autonomous Region of Madeira (A. R. of Madeira). The Extra region constitutes the parcel that cannot be assigned to a single region and consequently is excluded from our analysis. Data of NUTS 2 level is available for 10 branches of activity (Table 4) and at NUTS 3 level is only available for general use for 3 branches of activity. Hence, we are limited by the trade-off between the number of regions and the number of branches of activity and that is why the analysis is done for NUTS 2 as we will be able to reach results with a wider range of sector activities and bring added value to the Statistics Portugal analysis in terms of the territorial units under analysis.

Table 4 – List of economic activities and corresponding codes

A. Agriculture, livestock production, hunting, forestry and fishing
B. Mining and quarrying; manufacturing; electricity, gas, steam and air conditioning supply; water abstraction, purification and supply; sewerage, waste management and remediation activities
C. Construction
D. Wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storages; accommodation and food activities
E. Information and communication activities
F. Financial and insurance activities
G. Real estate activities
H. Professional, scientific technical and similar activities, administrative and support service activities
I. Public administration and defence, compulsory social security; education; human health and social work activities
J. Arts, entertainment and recreation, repair of household goods and other services

Source: Statistics Portugal.

We next describe the notation used in the following sections. There are j=1…J industries (in our case J=10) in region i=1…I (in our case I=7) located in country n (Portugal) and:

X_j^i — is the value of GVA of the activity j in region i;

$\sum_{j=1}^{J} X_j^i$ — is the total value of GVA of all activities in region i;

X_j^n — is the value of GVA of the activity j in country n;

$\sum_{j=1}^{J} X_j^n$ — is the total value of GVA of all activities in country n;

$s_j^i = \frac{X_j^i}{\sum_{j=1}^{J} X_j^i}$ — is the share of GVA in the activity j of the region i in the total GVA of region i;

$s_j^n = \frac{X_j^n}{\sum_{j=1}^{J} X_j^n}$ — is the share of GVA of the activity j of the country n in the total national GVA.

2.2. A descriptive approach: specialisation indices

Sectoral composition of a region can be evaluated regarding the degree of specialisation and diversification through absolute and relative specialisation indices. Absolute and relative analyses differ from each other as the first one relates to the

distribution of the sectoral weights within a single region and the other depicts the distribution of the sectoral weights of a region in comparison with a global one (national, for example) (Min-rong and Yan-hua, 2013). The two can exhibit different ranks for regions in relation to its degree of specialisation as the existence of high absolute specialisation for a region does not necessarily result in the region being as well relatively more specialised in relation to the reference selected. For example, if a region is specialised in sectors in which other regions are as well, it will present high specialisation for the absolute index while it will exhibit a lower degree of relative specialisation (Palan, 2010).

According to Palan (2010), there are some characteristics, as described in Table 5, that indices must possess in order to be considered suitable for analysing regional specialisation.

Table 5 – The ideal characteristics of indices

Characteristic	Definition
Axiom of anonymity	When measuring specialisation, changing the sequential order of the sectors' indicator (the variable chosen) shares should not result in different outcomes for the degree of specialisation.
Axiom of progressive transfers	If there is a transfer of the variable share from a sector in which a region is more (less) specialised into a lower (stronger) specialised sector but the sectoral specialisation ranking is not changed, then the region should reflect a lower (higher) level of absolute specialisation.
Bounds	Indices should present both upper and lower bounds in order to easy the interpretation of the respective outcomes of calculation of the degree of specialisation.
Decomposability	An index should be able to decompose inequality into within and between subgroups; for example, being able to split inequality into intersectoral heterogeneity and intra-regional differences.
Classification of industries	When an industry is divided into two smaller industries, this will result in proportional decrease of specialisation and the merge of industries will lead to the contrary effect as smaller industries are given less weight.
Number of industries	If there is an industry with values for the variable used of approximately zero, its impact on the absolute specialisation of a region should be none or insignificant. Also, the introduction of a sector with low or zero shares in the reference region should not be reflected in different values for the relative specialisation index.

Source: Palan, 2010.

In the following subsections, absolute and relative indices are used for our analysis of the Portuguese regions and the corresponding results are discussed.

2.2.1. An absolute analysis

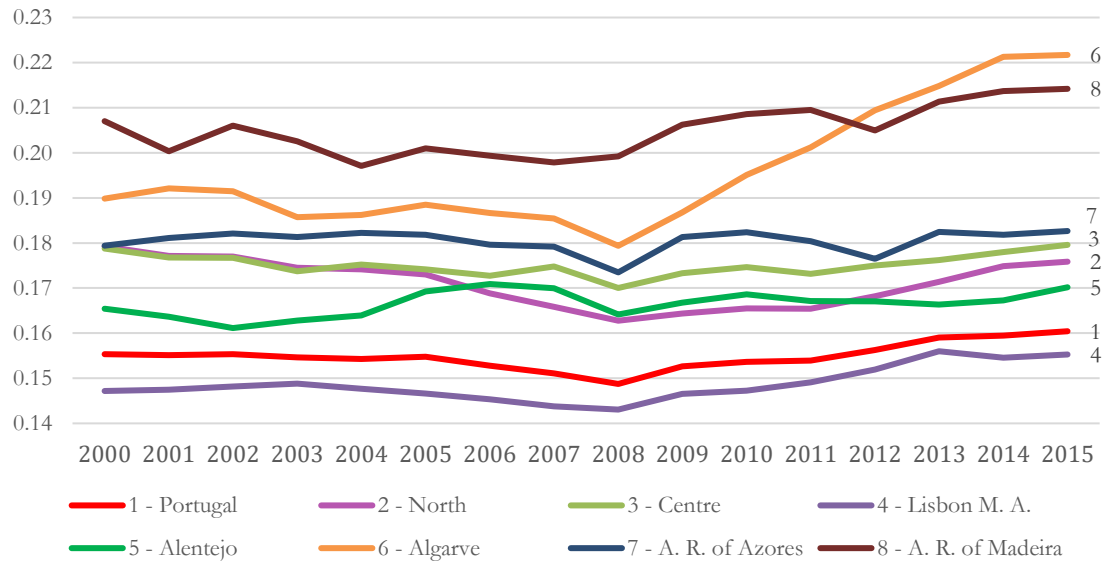
The Hirschman-Herfindahl index (HHI), in contrast to other indices such as the Shannon entropy index, the Ogive index, the diversification index and the absolute Gini index, fulfils all of the characteristics described in Table 5 and is suitable when comparing regions regarding their most relevant industries (Palan, 2010). Moreover, the index is easily computable and as such, we will use it to characterize the sectoral distribution for each Portuguese region. The reference point for this absolute measure is the uniform distribution of the GVA of a region, in accordance to the requirement that "absolute specialisation indices give evidence on how the economic structure (the degree of specialisation) of one specific country changes over time, regardless of the development of other countries" (Palan, 2010: 3).

$$HHI_i = \sum_{j=1}^{J} (s_j^i)^2, \qquad 1/J < HHI < 1$$

This index increases as specialisation of a region increases. The outcome of this index can take values from 1/J, which means the economic sectors exhibit equal GVA shares in the region i, to 1 which means the region is fully specialised in one sector. As J equals to the number of sectors, in this research the lower bound of the HHI is 0.1 (1/10).

Figure 1 shows the evolution of the specialisation level for Portuguese NUTS 2 regions calculated through the HHI index (which values are presented in the Appendix 2).

Figure 1 – HHI results for the Portuguese NUTS 2 regions in the 2000-2015 period



Source: Author's calculation considering information of Statistics Portugal.

By observing Figure 1, we can see that throughout the analysed period, until 2011, the A. R. of Madeira was the most absolute specialised region being surpassed by Algarve which became increasingly more specialised since 2008 and by looking at the distribution of shares of the sectors within the region (Appendix 3), we can observe that the sudden increase of specialisation between 2008 and 2015 was due to sectors B, D and G (which includes tourism-related activities) becoming more pronounced in the region to the detriment of sectors C, E, F and I which had their share significantly diminished in the region. Lisbon M. A. is the less absolute specialised region in the whole period under analysis and thus, being the one that possessed a GVA more equally distributed within sectors even though it slightly became more specialised by the end of the period. With the exception of Lisbon M. A., all regions were more specialised than the nation. A. R. of Azores, Centre and the North regions had a similar path and values of specialisation throughout the period under analysis.

Table 6 – Regional rankings of the HHI for Portuguese NUTS 2 regions in 2000 and 2015

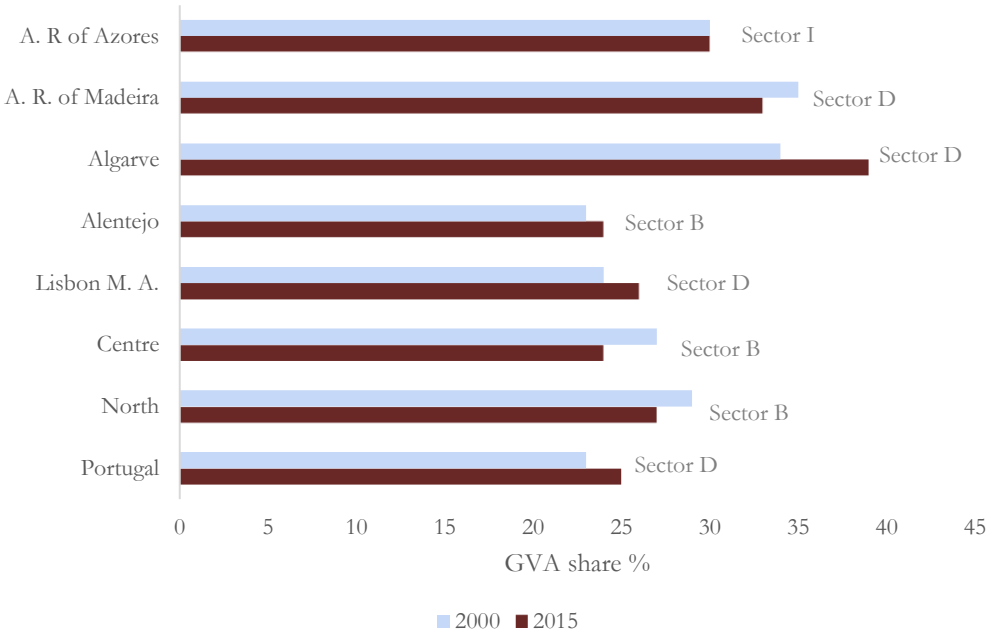
2000		2015	
Region	**HHI Index**	**Region**	**HHI Index**
A. R. of Madeira	0.207	Algarve	0.222
Algarve	0.190	A. R. of Madeira	0.214
A. R. of Azores	0.179	A. R. of Azores	0.183
Centre	0.179	Centre	0.181
North	0.179	North	0.176
Alentejo	0.165	Alentejo	0.170
Portugal	0.155	Portugal	0.160
Lisbon M. A.	0.147	Lisbon M. A.	0.155

Source: Author's calculation considering information of Statistics Portugal.

By analysing Table 6, which computes the region rank for the HHI index starting with the region with highest HHI value to the region with the lowest HHI result in both 2000 and 2015, it is easily visible that the only region that became less specialised at the end of the period in comparison to the beginning was the North region by 3 centesimal points.

Figure 2 describes the sector which possesses the highest share of GVA for each Portuguese NUTS 2 region in 2000 and in 2015. We can easily notice that most regions either concentrate their activities in sector D (A. R. of Madeira, Algarve and Lisbon M. A.) or in sector B (Alentejo, Centre and North) except for the A. R. of Azores which focuses its production in sector I (public services) with an average of GVA share of 30%. Portugal is characterized by having sector D with the highest share in the whole period and its value is higher at the end of the period.

Figure 2 – Sector with the highest GVA share per Portuguese NUTS 2 region in 2000 and 2015



Source: Author's calculation considering information of Statistics Portugal.

In the period under analysis, North, Centre and Alentejo regions were characterized by having a specialisation profile more secondary orientated constituted by manufacturing industries. The rest of the regions as well as the whole country are considered more tertiary having sector D as the most represented sector except for the A. R. of Azores which is more specialised in public services.

2.2.2. A relative analysis

Relative specialisation indices provide insights into the economic structure of a given region in comparison to the selected benchmark (Palan, 2010). There are several indices proposed in the existing literature such as the Krugman specialisation index, the Theil index, the index of inequality in productive structure, the relative Gini index, with all of them exhibiting advantages and disadvantages. According to Palan (2010), within the indices mentioned before, the Krugman index and the Theil index seem to be the most efficient ones. The Theil index is the only one that possesses the criteria of decomposability which is useful when one wants to study interregional and international specialisation differences as it can split inequality within and between regions. However, if the focus is to study the behaviour of economic structures in a given period, then the Krugman specialisation index

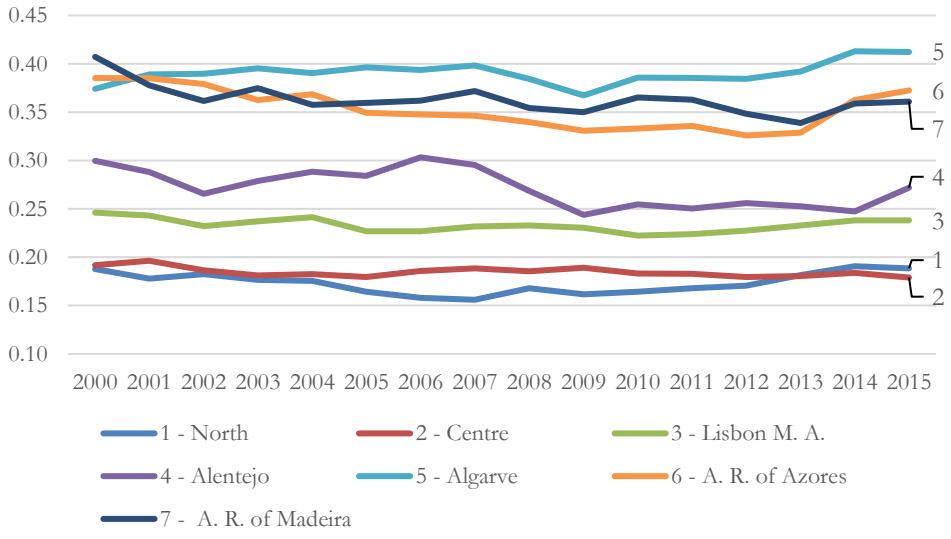
is more suitable as it is the only index that has the classification of industries property which is important when one wants to have an accurate estimation of the degree of specialisation.

Accordingly, in order to determine whether a region is more specialised than the whole nation, this research will use the Krugman specialisation index (KSI):

$$KSI_i = \sum_{J=1}^{J} \left| s_j^i - s_j^n \right| , \qquad 0 < K_i < \frac{2\times(J-1)}{J}$$

The minimum value of this index is zero, which means that the economic structure of the region i and the reference's are exactly the same, and the maximum value is $\frac{2\times(J-1)}{J}$, which in our case is 1.8, and implies perfect relative specialisation where the region i is specialised in solely one sector assuming that the reference is not specialised in one sector. The higher the index, the higher is the disparity between the regional economic structure and the reference benchmark (Palan, 2010). Another possibility is that a region which "is specialised in the same industries as the reference group will obtain a lower KSI value in comparison to a country[1] with a rather homogeneous structure but one that is different from that of the reference group" (Mongelli *et al.*, 2016: 29).

Figure 3 – KSI results for Portuguese NUTS 2 regions in the 2000-2015 period



Source: Author's calculations considering information of Statistics Portugal.

Figure 3 describes the evolution of the KSI for the Portuguese NUTS 2 regions in the period under analysis (see Appendix 4) and the following (Table 7) ranks the regions with a higher to a lower value of the KSI both in 2000 and 2015.

[1] In our analysis, country should be replaced by region as we are comparing regions and not countries.

Table 7 – Regional rankings of the KSI for Portuguese NUTS 2 regions in 2000 and 2015

2000		2015	
Region	**Krugman index**	**Region**	**Krugman Index**
A. R. of Madeira	0.41	Algarve	0.41
A. R. of Azores	0.39	A. R. of Azores	0.37
Algarve	0.37	A. R. of Madeira	0.36
Alentejo	0.30	Alentejo	0.27
Lisbon M. A.	0.25	Lisbon M. A.	0.24
Centre	0.19	North	0.19
North	0.19	Centre	0.18

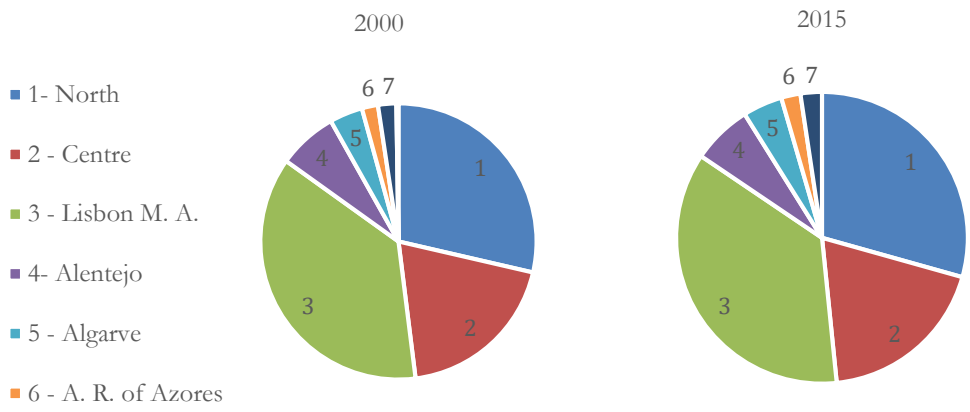
Source: Author's calculations considering information of Statistics Portugal.

By analysing Figure 3 and Table 7, we can observe that in 2000, the A. R. of Madeira was the most specialised region in comparison to the nation having a value of the KSI of 0.41 and ended in 2015 with a decrease of 5 decimal points of the value of specialisation and being the third most specialised region in comparison to the nation. Algarve, which was the third most relatively specialised region in 2000, ended in 2015 as being the most specialised region with an increase of 4 decimal points followed by the A. R. of Azores which until 2013 became continuously less specialised but since then became more specialised and surpassed the A. R. of Madeira; however, ended 2015 with a KSI below the one of 2000. Similar to A. R. of Azores, Alentejo became less specialised throughout the period ending in 2015 with a decrease of 3 decimal points respectively in comparison to the beginning of the period. Algarve is then the most specialised region in 2015 both in relative and absolute terms. This is not the case when looking at the lowest values.

Looking back at the absolute analysis, Lisbon M. A. was the less specialised region in the whole period; however, in this analysis both Centre and North regions were the less relatively specialised regions in 2000 and Centre region ended in 2015 as being the less specialised one with a slight decrease while the North ended with the same value as in the beginning of the period.

A relative analysis cannot be finished without an analysis of the GVA shares of the selected data in the GVA of the benchmark. As such, Figure 4 describe the regional share in the total GVA for the Portuguese NUTS 2 regions in the year of 2000 and 2015.

Figure 4 – Portuguese NUTS 2 regional share of total GVA in 2000 and 2015



Source: Author's calculations considering information of Statistics Portugal.

It is clear by looking at Figure 4 that Lisbon M. A., North and Centre regions are the main regions that have the majority of the GVA share of the total economy influencing in this way the low values of the KSI for these regions which results in the economic structure of these regions being alike to the national economic structure.

In summary, Algarve, A. R. of Azores and A. R. of Madeira, as they do not have a big influence in the total GVA of the economy, they were the ones with the highest KSI values throughout the period, displaying a specialisation profile more distant from the nation and North, Centre and Lisbon M. A. which play an important share in the national GVA, having a more similar specialisation profile to the national one. The economic structure of the Portuguese regions slightly converged to the national one in the period under analysis with the exception of Algarve which had its specialisation profile diverging from the national one.

The Krugman specialisation index only compares the productive specialisation profile of the region with the benchmark and does not mention which sectors are the source of the specialisation. By using the location quotient, we can study internally each region in order to identify which sectors are over-represented or under-represented in the region in comparison to the nation. The location quotient (LQ) is given by:

$$LQ_{i,j} = \frac{s_j^i}{s_j^n}, \qquad LQ > 0$$

If this index is higher than 1, then region i is more specialised in sector j than the benchmark[2] and, the higher the index, the more the sector is important to the regional

[2] Then $s_j^i > s_j^n$, which means that the share of GVA in the activity j of the region i is higher than the GVA share of sector j in the whole nation.

economy. If the index is 1, then sector j plays an identical role in the region and in the national economy. If the index is lower than 1, then the benchmark is more specialised in sector j than the region (Diniz and Sequeira, 2009). The sectors that possess the highest location quotient (LQ) are not necessarily the ones having the higher shares of GVA within the region.

Table 8 – Over-represented sectors in the Portuguese NUTS 2 regions in 2000 and 2015

Location quotients in 2000 and then in 2015 where LQ ≥ 1.1							
Sector/Region	North	Centre	Lisbon M. A.	Alentejo	Algarve	A. R of Azores	A. R. of Madeira
Sector A		1.6 → 2.1		4.3 → 4.2	1.6 → 1.3	3.2 → 4.0	
Sector B	1.4 → 1.5	1.4 → 1.3		1.1 → 1.3			
Sector C	1.1 → 1.2				1.1 → 1.0		1.6 → 1.4
Sector D					1.5 → 1.6		1.5 → 1.3
Sector E			1.8 →1.8				
Sector F			1.6 → 1.7				
Sector G					1.5 → 1.4	1.1 → 1.1	
Sector H			1.6 → 1.6				
Sector I						1.5 → 1.5	1.2 → 1.4
Sector J			1.2 → 1.1				1.1 → 1.0

Source: Author's calculations considering information of Statistics Portugal.

According to the information from Table 8 – which describes the sectors over-represented in the regions with location quotient higher[3] than 1.1 in 2000 and 2015 (see Appendix 5) – Centre, Alentejo, Algarve and A. R. of Azores are considered specialised in sector A and it is the most over-represented sector in these regions in the whole period under analysis except for Algarve. Alentejo had the highest location quotient of 4.3 in 2000 and 4.2 in 2015 for sector A followed by A. R. of Azores with a location quotient of 3.2 and 4.0 for sector A in 2000 and 2015 respectively. This means that, in 2000, sector A was 4.3 and 3.2 times more important in these regions respectively than in the nation, and in 2015, it was 4.2 and 4.0 times more important in these regions than in the nation. The highest value of this index for other regions does not exceed 2.1 and thus, we can observe a high discrepancy between Alentejo and A. R. of Azores and the other regions. Algarve also had sector A as the most over-represented sector in 2000 but in 2015, sector A lost its ranking position to sector D and G placing third.

[3] A location quotient lower than 1.1 is considered too close to 1 which gives almost the same importance of the sector for the region and the nation.

Madeira, in 2000 was more specialised in sector C but ended 2015 with sector I as the most important sector to the region in comparison to the nation. In the whole period, in comparison to the nation, North had sector B as the most specialised sector and Lisbon M. A. had sector E. We can observe that, except for North and Algarve regions, the sectors that possessed higher GVA shares within the regions that can be seen in Figure 2, do not match with the ones with a higher LQ in the period under analysis.

In general, there were no significant changes in the specialisation profile for Portuguese NUTS 2 regions in the 16 years of our analysis. Only Algarve had over the period sector D (which includes tourism-related activities) overpassing sector A as the most important sector when comparing to the nation. In the period under analysis, sectors E, F and H are only important in Lisbon M. A. which is the only region exhibiting a LQ higher than 1.1 for these sectors.

2.3. An explanatory approach: shift-share analysis

In this section, three different shift-share methods that will be applied to the Portuguese NUTS 2 regions are reviewed in the first subsection. In subsection 2.3.2, a descriptive analysis is applied to the evolution of the Portuguese NUTS 2 regions economic growth rates in the period from 2000 to 2015. Finally, the results of the application of the shift-share approaches are presented and analysed in subsection 2.3.3.

2.3.1. A review of the shift-share analysis

The shift-share methodology is generally used in regional analysis and was initially developed by Daniel Creamer in 1943 and later conceptualized by Dunn in 1960 to decompose regional economic growth. This method can be applied when one wants to know the extent to which differences in growth between regions result from the local economic structure (the sectoral distribution of employment/GVA shares) or are due to the average performance of all sectors, as in the event of outperforming the national one, which can be due to advantages in location (Cerejeira, 2011). We are then able to reach the conclusion on whether a region has a favourable specialisation profile in comparison to the national one and identify the competitive industries of the region.

The classic shift-share proposed by Dunn can then decompose regional growth (in our case measured by GVA) into three factors:

1. the national-share (or growth effect) reflects the GVA that the region would have considering it had grown the same as the benchmark in the period under analysis;
2. the industry-mix effect (or structural effect) reflects the growth that is the result of the region being specialised in more or less dynamic sectors than the benchmark and permits to identify which of these two specialisation profiles is more favourable. If this component is positive, then the local economic structure of the region results in more growth than the national one (Cerejeira, 2011);
3. the competitive effect compares the regional growth rate in a sector relatively to the growth rate of the same sector but at the national level. In summary, the competition effect measures the sectoral growth performances comparing the regional with the national level. A positive value of this effect represents a region with sectors performing better at a regional level than in the benchmark which can be due to local advantages that reflect a better performing sector. A region can then grow differently than the national average by having specific characteristics such as a lower or higher transportation costs or endogenous resources (Oguz and Knight, 2010).

For a specific region i, the classic shift-share analysis is decomposed so that the variation in absolute terms of GVA of region i is the sum of the three components mentioned above and is defined as:

$$\sum_{j=1}^{J} (X^{i}_{j,t+1}-X^{i}_{j,t}) = \sum_{j=1}^{J} X^{i}_{j,t} n_{t+1} + \sum_{j=1}^{J} X^{i}_{j,t} (n_{j,t+1}-n_{t+1}) + \sum_{j=1}^{J} X^{i}_{j,t} (r^{i}_{j,t+1}-n_{j,t+1}) \quad (2.1)$$

Where $X^{i}_{j,t+1}$ and $X^{i}_{j,t}$ is the GVA in sector j of region i at time t+1 and t, respectively, and n_{t+1} and $n_{j,t+1}$ is the national GVA growth rate for the total economy and sector j, respectively, between t and t+1. The growth rate of GVA between time t and t+1 in sector j of region i is represented by $r^{i}_{j,t+1}$.

The first component of the right-hand side is the national-share, $\sum_{j=1}^{J} (X^{i}_{j,t} n_{t+1})$, which quantifies the change in the regional variable that would have occurred if it had increased at the same rate as in the nation. The second component of the right side of the equation, $\sum_{j=1}^{J} X^{i}_{j,t} (n_{j,t+1}-n_{t+1})$, characterises the industry-mix effect which quantifies the effect of the sectoral distribution of region i in the GVA growth differential between national GVA in sector j and the total national GVA growth in the analysed period. If this effect is zero, it means that this component is not important in explaining GVA growth as the regional economic structure contributes to the same growth as the national one. The competitive

effect that corresponds to $\sum_{j=1}^{J} X_{j,t}^{i}(r_{j,t+1}^{i}-n_{j,t+1})$ quantifies the performance of the sectors in the region i in the analysed period for the observed GVA growth in comparison with the national performance of that sector. When the sectoral GVA growth rate is identical in the region and in the nation, the competitive effect is zero.

If we transfer the national effect component to the left-hand side in equation (2.1), then Dunn's (1960) shift-share approach compares the regional growth observed in the period with a hypothetical growth that would be observed if it had grown the same as the selected reference. This difference between the actual GVA regional growth and the expected growth based with the national share is called the net-shift which is represented by the sum of the industry-mix effect and competitive effect. We have then:

$$\sum_{j=1}^{J}(X_{j,t+1}^{i}-X_{j,t}^{i}) - \sum_{j=1}^{J} X_{j,t}^{i} n_{t+1} = \sum_{j=1}^{J} X_{j,t}^{i}(n_{j,t+1}-n_{t+1}) + \sum_{j=1}^{J} X_{j,t}^{i}(r_{j,t+1}^{i}-n_{j,t+1}) \quad (2.2)$$

If one wants to account growth in percentage terms, then by dividing equation (2.2) by the total GVA of region i at time t, $\sum_{j=1}^{J} X_{j,t}^{i}$ we have:

$$r_{t+1}^{i}{}^{4} - n_{t+1} = \frac{\sum_{j=1}^{J} X_{j,t}^{i}(n_{j,t+1}-n_{t+1})}{\sum_{j=1}^{J} X_{j,t}^{i}} + \frac{\sum_{j=1}^{J} X_{j,t}^{i}(r_{j,t+1}^{i}-n_{j,t+1})}{\sum_{j=1}^{J} X_{j,t}^{i}} \quad (2.3)$$

Rosenfeld (1959) criticized the shift-share approach proposed by Dunn (1960) as the model fails in properly separating the competitive effect from the industry-mix effect since it considers the regional economic structure ($\sum_{j=1}^{J} X_{j,t}^{i}$) when measuring the competitive effect and not only the dynamic performance of the sector ($r_{j,t+1}^{i}-n_{j,t+1}$). In this way, if there are two regions with the same sectoral growth rates but different sectoral distribution, it will result in different values for the competitive effect of both regions which in turn should be identical. Also, if the region and the nation have the same growth rates and distribution of shares and both are specialised in the highest performing sector, both the industry-mix effect and the competitive effect of the region would be null. However, if the highest performing sector in the region is different than the national one, having each one specialising in different sectors, both the industry-mix effect and competitive effect will have values different from zero when applying Dunn's approach, as it considers the national growth rates when accounting for the industry-mix effect and consequently assumes that the national specialisation is better than the regional one (Artige and Neuss, 2014).

[4] $r_{t+1}^{i} = \frac{\sum_{j=1}^{J}(X_{j,t+1}^{i}-X_{j,t}^{i})}{\sum_{j=1}^{J} X_{j,t}^{i}}$ which is the growth rate of GVA for the total economy between time t and t+1 of region i.

Esteban-Marquillas (1972), in order to isolate the competitive effect from the industry-mix effect, introduced a new concept, "homothetic change", and re-defined the competitive effect and added a new component called the allocation effect to account for the change that cannot be explained by the industry-mix effect and the competitive effect, so that equation (2.2) is now reformulated as:

$$\sum_{j=1}^{J}(X^{i}_{j,t+1}-X^{i}_{j,t}) - \sum_{j=1}^{J}(X^{i}_{j,t}\times n_{t+1}) = \sum_{j=1}^{J} X^{i}_{j,t}\,(n_{j,t+1}-n_{t+1}) +$$

$$\sum_{j=1}^{J} H^{i}_{j,t}\,(r^{i}_{j,t+1}-n_{j,t+1}) + \sum_{j=1}^{J}(X^{i}_{j,t}-H^{i}_{j,t})(r^{i}_{j,t+1}-n_{j,t+1}) \qquad (2.4)$$

Where $H^{i}_{j,t} = \sum_{j=1}^{J} X^{i}_{j}\, s^{n}_{j}$ is the "homothetic change" which is the GVA that region i would possess in relation to sector j, if the regional economic structure was the same as the national one.

The competitive effect, the second component in the right-hand side of equation (2.4), and according to Esteban-Marquillas (1972) is then the difference between the regional and national growth rates multiplied by the "homothetic GVA" and not by the regional economic structure.

The new component, the allocation effect, is then defined as the difference between the economic structure of region i and the national one observed in period t for sector j weighted by the difference of the regional and national GVA growth rate in sector j. A positive allocation effect is viewed as a region being specialised in sectors which are more dynamic and a negative value as a region being specialised in the less dynamic sectors. The higher the value for the allocation effect, the better is the regional specialisation profile. For Cunningham (1969) the allocation effect refers to the existence of convergence (if positive value) between the regional and the national economic structures or divergence (if negative value) of these last two. But, as we can observe in Table 9 which identifies all possible effects of the allocation component, this component does not give a direct and simple interpretation based only on its sign.

Table 9 – Possible effects of the shift-share allocation component

Allocation effect	Value
• Region i is specialised in sector j ($X^i_{j,t} - H^i_{j,t} > 0$) which possesses a competitive advantage ($r^i_{j,t+1} - n_{j,t+1} > 0$) • Region i is not specialised in sector j ($X^i_{j,t} - H^i_{j,t} < 0$) and does not have a competitive advantage ($r^i_{j,t+1} - n_{j,t+1} < 0$)	Positive
• Region i is not specialised in sector j ($X^i_{j,t} - H^i_{j,t} < 0$) which exhibits a competitive advantage ($r^i_{j,t+1} - n_{j,t+1} > 0$) • Region i is specialised in sector j ($X^i_{j,t} - H^i_{j,t} > 0$) which does not have a competitive advantage ($r^i_{j,t+1} - n_{j,t+1} < 0$)	Negative
• Region i has the same growth rate as the national ($r^i_{j,t+1} - n_{j,t+1} = 0$)	Zero

Source: Herzog and Olsen (1977).

Equation (2.4) can be rewritten in terms of percentage growth:

$$r^i_{t+1} - n_{t+1} = \frac{\sum_{j=1}^{J} X^i_{j,t}(n_{j,t+1} - n_{t+1})}{\sum_{j=1}^{J} X^i_{j,t}} + \frac{\sum_{j=1}^{J} H^i_{j,t}(r^i_{j,t+1} - n_{j,t+1})}{\sum_{j=1}^{J} X^i_{j,t}} + \frac{\sum_{j=1}^{J} (X^i_{j,t} - H^i_{j,t})(r^i_{j,t+1} - n_{j,t+1})}{\sum_{j=1}^{J} X^i_{j,t}} \quad (2.5)$$

Esteban-Marquillas' (1972) model was soon criticized for not solving the issue of the correlation between the industry-mix and competitive effect as the industry-mix effect is still the same one as in Dunn's (1960) model and both the competitive effect and the industry-mix effect present values different from zero in the case of the region and the nation having the same growth rates and distribution shares but are specialised in different sectors which are the highest performing ones in each region. Moreover, the addition of the allocation effect does not have a clear theoretical definition and interpretation being associated to an effect of the economic structure that should only be connected to the industry-mix effect (Artige and Neuss, 2014).

The application of the previously discussed shift-share approaches, as they are faulty, can then lead to incorrect results and improper advice for future decision making and policies.

Artige and Neuss (2014) proposed a new shift-hare approach where the authors attempted to isolate the industry-mix effect from the competitive effect, using weights in order to account for the sectoral shares of each region. In order to isolate the two effects, the authors associated a uniform distribution of sectors when accounting for the growth of the sectors.

The competitive effect is then defined by:

$$\sum_{j=1}^{J} \frac{1}{J} (r^{i}_{j,t+1} - n_{j,t+1}), \tag{2.6}$$

where $\frac{1}{J}$ is the GVA assumed uniform share of each sector.

Equation (2.6) is the arithmetic average of the difference between the regional growth rates and the national ones. If the outcome is positive, this means that on average the economic activities contribute to more growth in the region than in the nation.

We can now calculate the industry-mix effect as the residual, such as:

$$\sum_{j=1}^{J} (s^{i}_{j,t} - \frac{1}{J})\, r^{i}_{j,t+1} - \sum_{j=1}^{J} (s^{n}_{j,t} - \frac{1}{J})\, n_{j,t+1} \tag{2.7}$$

The first component from equation (2.7), $\sum_{j=1}^{J} (s^{i}_{j,t} - \frac{1}{J})$, represents the regional specialisation and $\sum_{j=1}^{J} (s^{n}_{j,t} - \frac{1}{J})$ represents the national specialisation. And as such, the difference between these two components can not specify which of the specialisations, if the regional or national, is better. However, if it is associated with their respective growth rates, which results in equation (2.7), the outcome will measure the GVA growth due to specialisation. If the industry-mix effect is positive, it means that the regional specialisation profile leads to more growth than the national one which can be the result of the region being specialised in more dynamic sectors than the benchmark. If it is negative, it is the other way around.

The shift-share can then be decomposed as being the sum of the competition effect (equation 2.6), and the industry-mix effect (equation 2.7):

$$r^{i}_{j,t+1} - n_{j,t+1} = \left[\sum_{j=1}^{J} (s^{i}_{j,t} - \frac{1}{J})\, r^{i}_{j,t+1} - \sum_{j=1}^{J} (s^{n}_{j,t} - \frac{1}{J})\, n_{j,t+1}\right] + \sum_{j=1}^{J} \frac{1}{J} (r^{i}_{j,t+1} - n_{j,t+1}) \tag{2.8}$$

Equation (2.8) refers to the difference between the regional and national GVA growth which is explained unambiguously by the industry-mix and competitive effects.

The growth rate of the nation and the region can be decomposed as:

$$n_{j,t+1} = \sum_{j=1}^{J} (s^{n}_{j,t} - \frac{1}{J})\, n_{j,t+1} + \sum_{j=1}^{J} \frac{1}{J} n_{j,t+1} \tag{2.9}$$

$$r^{i}_{j,t+1} = \sum_{j=1}^{J} (s^{i}_{j,t} - \frac{1}{J})\, r^{i}_{j,t+1} + \sum_{j=1}^{J} \frac{1}{J} r^{i}_{j,t+1} \tag{2.10}$$

Equation (2.9) and (2.10) are independent of each other which can generate ordinal variables for the regional and national economic structures. With this shift-share decomposition method, we can then compare two growth effects of any region with another without having to define a reference benchmark based on the results from equation (2.10).

Table 10 describes the possible outcomes for the industry-mix and competitive effect of the shift-share approach proposed by Artige and Neuss (2014).

Table 10 – Possible shift-share component effects

Industry-mix effect	Competition effect	Value
Regional specialisation profile is more favourable than the national $(\sum_{j=1}^{J} (s_{j,t}^{i} - \frac{1}{J})\, r_{j,t+1}^{i} - \sum_{j=1}^{J} (s_{j,t}^{n} - \frac{1}{J})\, n_{j,t+1} > 0)$	Region i has, on average, a higher sectoral growth rate than the nation, $(\sum_{j=1}^{J} (r_{j,t+1}^{i} - n_{j,t+1}) > 0)$	Positive
Regional specialisation profile is less favourable than the national $(\sum_{j=1}^{J} (s_{j,t}^{i} - \frac{1}{J})\, r_{j,t+1}^{i} - \sum_{j=1}^{J} (s_{j,t}^{n} - \frac{1}{J})\, n_{j,t+1} < 0)$	Region i is constituted with sectors that on average are growing less than the national ones $(\sum_{j=1}^{J} (r_{j,t+1}^{i} - n_{j,t+1}) < 0)$	Negative

Source: Artige and Neuss (2014).

In summary, in contrast to Dunn (1960) and Esteban-Marquillas (1972) who use hypothetical regional growth rates that consist of assuming the same regional growth as the national ones, Artige and Neuss (2014) use actual data and real growth rates of the region and the benchmark and compare them, capturing the growth effect from the economic structure and from the competitive effect.

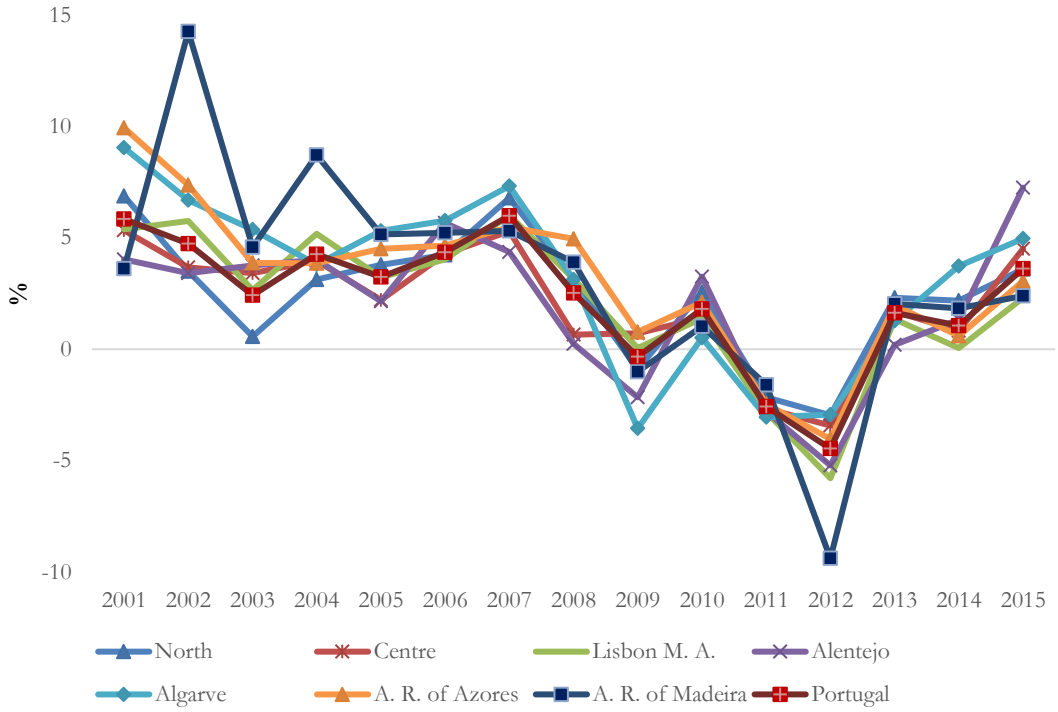
One of the main limitations of the shift-share analysis which is common to the three approaches discussed previously is that it does not take into account the annual changes of the economic structure and regional GVA variations along the period under analysis (Knudsen, 2000). Barff and Knight (1988) introduced the "dynamic shift-share" method which uses a static shift-share approach but instead of using only the values of the initial and final year, it calculates the values for each year and sums them annually in order to correct the annual changes. By using this methodological strategy, we can obtain results for the shift-share by calculating annually the effects and then summarizing the obtained results under the analysed period. This will give the possibility to annually adjust changes in the industry-mix and to update regional GVA by using annual growth rates.

2.3.2. Evolution of the economic growth rates in the Portuguese regions

Prior to the shift-share analysis, a study of the economic growth observed in the Portuguese NUTS 2 regions in the period 2000 to 2015 is carried out to support the subsequent analysis.

Through Figure 5 we are able to observe the evolution of the GVA annual growth of the Portuguese NUTS 2 region from the year 2000 to 2015 (see Appendix 6 for the annual growth rates per region).

Figure 5 – Annual GVA growth rate evolution for the Portuguese NUTS 2 regions in the 2000-2015 period



Source: Author's calculation considering information of Statistics Portugal.

The A. R. of Madeira, Alentejo and Centre regions started the period growing less than Portugal where Madeira was the region with the lowest growth and A. R. of Azores was the region which highest growth. At the end of the period, the A. R. of Madeira, the Lisbon M. A. and the A. R. of Azores performed worse than Portugal with Lisbon M. A. being the region which grew less and Alentejo as the region which performed better.

Figure 6 – Compound annual GVA growth rate[5] for the Portuguese NUTS 2 regions in the 2000-2008, 2008-2012 and 2012-2015 period

Source: Author's calculation considering information of Statistics Portugal.

Figure 6 presents a static analysis for the Portuguese NUTS 2 regions regarding the evolution of the economic growth in three different periods 2000 to 2008 in which all the regions exhibited a higher growth; 2008 to 2012 where the world economic and financial crisis which started in the USA reached Portugal and regions started to have negative growth levels; and 2012 to 2015 where the regions started to recover from the negative growth rates from the period before.

In the first eight years, Alentejo, Centre and North did poorly in comparison to the nation, but we can observe that Centre and North regions along with the A. R. of Azores were the only ones performing better than the nation in the recession period (from 2008 to 2012). The regions which performed better in this initial period setting them by a descending order were the A. R. of Madeira, Algarve and the A. R of Azores.

In the period from 2008 to 2012, the A. R. of Madeira was the region with the worst performance followed by Algarve and the A. R. of Azores, Centre and North were the only regions which performed better than the whole nation. The A. R. of Madeira exhibited a more volatile performance compared to others since the region grew more on average in the

[5] The formula of the compound annual GVA growth rate is: $\left(\frac{\sum_{j=1}^{J} X_{j,t+1}^{i}}{\sum_{j=1}^{J} X_{j,t}^{i}}\right)^{1/\text{number of years}} - 1$.

economic expansion period (2000 to 2008) than the others and declined more in recession times (2008 to 2012) and had a hard time to recover after it. Centre, the A. R. of Azores and the Lisbon M. A. were the only ones that in 2009 grew more than the year before where all the others exhibited a negative performance.

The last period showed in Figure 6 (from 2012 to 2015) is characterized by a recovery from regions after the negative growth values from the previous period, and it is possible to observe that Algarve had the best performance in this period and Lisbon was the region with the lowest growth levels.

In summary, the regions which performed worse in the first half of the period, Centre, North and Alentejo, were the regions with a secondary specialisation profile as analysed in subsection 2.2.1. The regions that have an economic structure less similar to the national one, the A. R. of Madeira and Algarve, were the regions with the highest growth levels in the first half of the period, even though they were also the ones with the lowest growth levels in the recession years. The A. R. of Azores was the region which performed better in the recession time and is the only region with sector I (essentially, public and social services) as the highest GVA share in the whole region.

2.3.3. Results of the shift-share analysis

In order to decompose the growth performance of a region in comparison to the national average, a shift-share analysis is applied to the Portuguese NUTS 2 regions which aims to assess whether the region grew more or less than the nation due to its economic structure or/and to the overall performance of its sectors.

Table 11 displays the results of the three methods of shift-share described in the previous subsection applied to the NUTS 2 Portuguese regions over the period between 2000 and 2015.

Table 11 – Shift-share analysis of the Portuguese NUTS 2 regions in the 2000-2015 period

Regions	Growth rate differential (%)	Dunn (1960)		Esteban-Marquillas (1972)			Artige and Neuss (2014)	
		Industry-mix effect (%)	Competition effect (%)	Industry-mix effect (%)	Competition effect (%)	Allocation effect (%)	Industry-mix effect (%)	Competition effect (%)
North	2.5	-1.1	3.6	-1.1	3.7	-0.1	-3.2	5.7
Centre	-2.2	-1.9	-0.4	-1.9	0.4	-0.8	-2.6	0.3
Lisbon M. A.	-2.2	2.4	-4.6	2.4	-4.7	0.2	1.8	-4.0
Alentejo	-4.6	-5.0	0.4	-5.0	2.3	-1.8	-7.1	2.5
Algarve	13.3	3.6	9.6	3.6	7.8	1.9	6.9	6.3
A. R. of Azores	12.5	-1.0	13.6	-1.0	14.9	-1.4	-1.5	14.0
A. R. of Madeira	12.0	-0.4	12.3	-0.4	15.7	-3.4	-3.7	15.6

Note: The growth rate differential is the difference of the sum of the regional annual GVA rates and the national annual GVA rates. The sum of the industry-mix effect and the competitive effect equals to this growth rate differential (Barff and Knight, 1988).

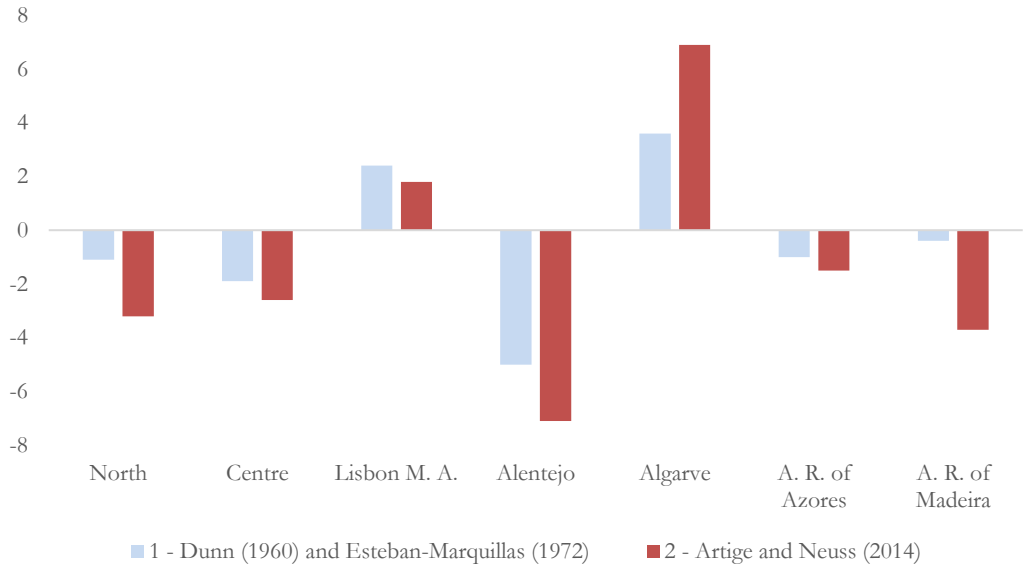
Source: Author's calculations considering information of Statistics Portugal.

In the period from 2000 to 2015, the regions that had a positive growth rate differential which characterizes the region performing better than the national were the North, Algarve, the A. R. of Azores and the A. R. of Madeira. The regions of Algarve, the A. R. of Azores and the Madeira had similar growth rate differentials and much higher than the North region. The others, Centre, the Lisbon M. A. and Alentejo exhibited a poor performance since the growth rate differential was negative for these regions and Alentejo was the region with the worst performance.

The most evident difference in the results from the three shift-share approaches estimation is the case of the Centre region in which according to Dunn's (1960) approach the industry-mix effect was -1.9% and the competitive effect was -0.4% against -1.9% and 0.4% (with an allocation effect of -0.8) from Esteban-Marquillas (1972) and a -2.6% and 0.3% from Artige and Neuss's (2014) approach. As such, Centre is considered to have possessed in the period under analysis a competitive disadvantage following Dunn's (1960) method however, the two other models identified Centre region as having a competitive advantage.

Figure 7 provides an easy comparison of the industry-mix results for the three shift-share approaches applied to the Portuguese NUTS 2 regions.

Figure 7 – Industry-mix effect per shift-share approach



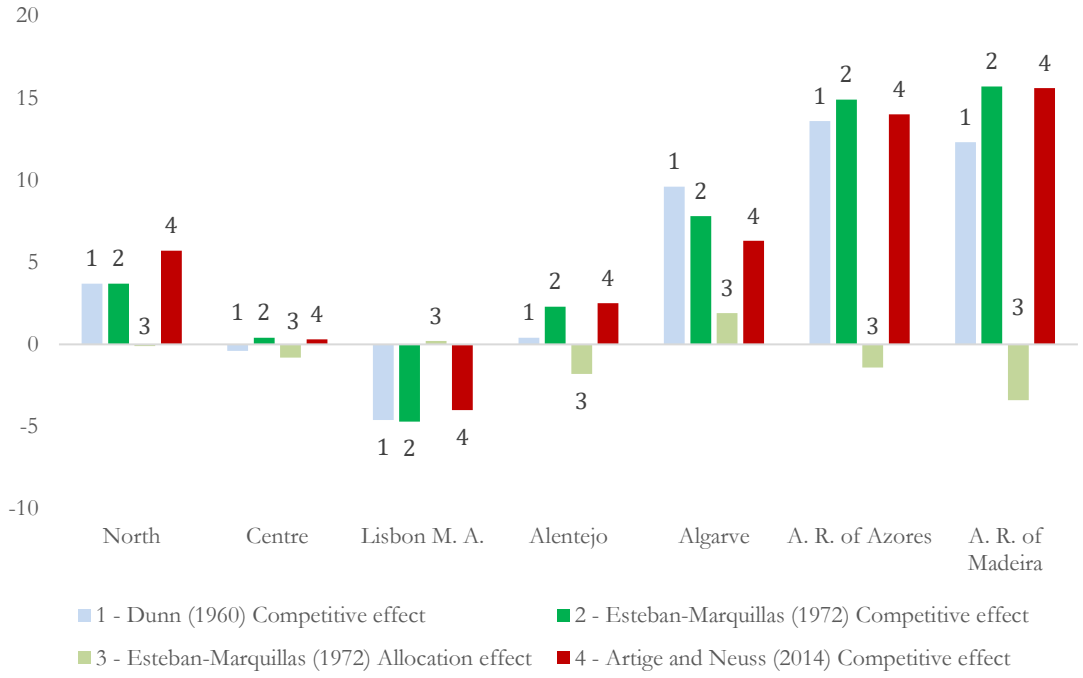
Source: Author's calculations considering information of Statistics Portugal.

According to Dunn's (1960) and Esteban-Marquillas' (1972) approach results, the industry-mix effect of the A. R. of Madeira is approximately zero, only -0.4, which means that the specialisation profile of the region was practically insignificant to explain economic growth of the region and as such, the higher levels of growth of this region in comparison to the national is then explained solely by having a strong competitive component. Yet, according to Artige and Neuss (2014) approach, the economic structure of the region plays an important negative role in the growth of the region being then significantly less favourable than the nation specialisation profile. Dunn's (1960) and Esteban-Marquillas' (1972) [6] approach also exhibited higher values for the industry-mix effect in comparison to the Artige and Neuss (2014) application for the North, Centre, Lisbon M. A., Alentejo and the A. R. of Azores. Nonetheless, the signal of the industry-mix for the Portuguese regions do not differ in all used shift-share approaches.

Figure 8 compares the competitive effect from the three shift-share applied to the Portuguese NUTS 2 regions along with the allocation effect from Esteban-Marquillas (1972).

[6] Both Dunn (1960) and Esteban-Marquillas' (1972) approaches assume the same values for the industry-mix effect.

Figure 8 – Competitive effect per shift-share approach



Source: Author's calculations considering information of Statistics Portugal.

The competitive effect is lower by Dunn's (1960) approach in comparison to Esteban-Marquillas (1972) and Artige and Neuss (2014) for all regions except for the Lisbon M. A. and Algarve. This suggests that Dunn (1960) and Esteban-Marquillas (1972) models tend to overvalue the effect of the industry-mix component and Dunn's (1960) approach may undervalue the effect of the competitive component.

We summarized the results displayed in Table 11 that can be seen in Table 12 in order to identify the effect that contributed more to growth in each Portuguese NUTS 2 region. The regions that are underlined grew less than the nation in the period under analysis.

Table 12 – Brief summary of the shift-share results for the Portuguese NUTS 2 regions

			Dunn (1960)		Esteban-Marquillas (1974)		Artige and Neuss (2014)	
			Competitive effect		Competitive effect		Competitive effect	
			+	-	+	-	+	-
Industry-mix > competitive Effect	**Industry -mix**	+		Lisbon M. A.		Lisbon M. A.	Algarve	Lisbon M. A.
		-						
Industry-mix < competitive effect	**Industry -mix**	+	Algarve		Algarve			
		-	North Centre Alentejo A. R. of Azores A. R. of Madeira	Centre	North Centre Alentejo A. R. of Azores A. R. of Madeira		North Centre Alentejo A. R. of Azores A. R. of Madeira	

Source: Author's calculations considering information of Statistics Portugal.

Within the regions that performed worse than the nation, only in Lisbon it was due to losses from the competitive component that outperformed the favourable economic structure that was characterized in subsection 2.2 by being a tertiary region with the lowest specialisation level in absolute terms and a low level of relative specialisation which means that Lisbon's economic structure is similar to the national one.

The negative performance of the Centre and Alentejo was due to structural factors, which for Centre were intensified by competitive factors according to Dunn (1960); however, according to Esteban-Marquillas (1974) and Artige and Neuss (2014) the competitive effect was actually a positive factor. For Alentejo, the competitive effect was positive according to all approaches, but it was not enough to outperform the negative industry-mix effect.

Algarve possessed a competitive advantage according to the tree models; yet only Artige and Neuss (2014) results give the economic structure of Algarve a superior role to the growth of the region than the one played by regional specific characteristics (competitive effect is lower than the industry-mix effect). Recalling the analysis of the characterization of the specialisation profile of Algarve, this region was in the end of 2015 the most specialised region within the Portuguese regions, and as such, this may have contributed to the region having grown much more than the nation.

Table 13 – Characterization of the economic growth for the Portuguese NUTS 2 regions

Industry-mix		Competitive			
Favourable specialisation	**Unfavourable specialisation**	**Advantage**		**Disadvantage**	
Common to all approaches		**Dunn (1960)**	**Esteban-Marquillas (1974) and Artige and Neuss (2014)**	**Dunn (1960)**	**Esteban-Marquillas (1974) and Artige and Neuss (2014)**
Lisbon M. A. Algarve	North Centre Alentejo A. R. of Azores A. R. of Madeira	North Alentejo Algarve A. R. of Azores A. R. of Madeira	North Centre Alentejo Algarve A. R. of Azores A. R. of Madeira	Centre Lisbon M. A.	Lisbon M. A.

Source: Author's calculations considering information of Statistics Portugal.

In conclusion, as it is summarized in Table 13, the regions that possessed a more favourable specialisation profile than the national one were Lisbon M. A. and Algarve. The others, North, Centre, Alentejo, Algarve, the A. R. of Azores and the A. R. of Madeira all had in the period under analysis an economic structure unfavourable to growth. The industry-mix effect displayed the same signal in all shift-share approaches applied to the Portuguese NUTS 2 regions though with different magnitude. Dunn (1960) and Esteban-Marquillas (1972) models seem to overvalue the effect of the industry-mix component and Dunn's (1960) approach may undervalue the effect of the competitive component.

In relation to the competitive effect, all regions exhibited a competitive advantage with the exception of Centre and the Lisbon M. A. according to Dunn (1960), and only Lisbon according to Esteban-Marquillas (1972) and Artige and Neuss (2014). Solely Centre presented a signal for this component which is not common for all the shift-share approaches, as the region is considered to have possessed in the period under analysis a competitive disadvantage following Dunn's (1960) method; however; the two other models identified Centre region as having a competitive advantage.

All regions, with the exception of Centre and Alentejo, had the competitive effect playing a more important role in explaining regional economic growth in comparison to the role played by the industry-mix effect since this component exhibited higher absolute values than the industry-mix effect when accounting for the shift-share component. It is worth stressing that the interest of this dissertation is in the industry-mix effect and the competition/allocation effects are only complements.

3. Conclusions

This research aims at analysing the productive specialisation profile of the Portuguese NUTS 2 regions and to relate it to the disparities in regional growth rates in the period from 2000 to 2015.

We started by characterizing the specialisation profile of the Portuguese regions by resorting to absolute and relative specialisation indices. In the period under analysis, North, Centre and Alentejo regions were characterized by having a specialisation profile more secondary orientated, constituted by manufacturing industries. The rest of the regions as well as the whole country are considered more tertiary having trade, transport and food activities as the most represented sector except for the A. R. of Azores that is also tertiary and is more specialised in public and social services. Except for Algarve that had over the period trade, transport and food activities overpassing agriculture, livestock production, hunting, forestry and fishing activities as the most important sector when comparing to the nation, there were no significant changes in the specialisation profile of Portuguese NUTS 2 regions in the 16 years of our analysis.

In the second stage of our empirical analysis, a shift-share analysis was applied to our sample of Portuguese regions in order to decompose the regional growth rates into two factors, industry-mix effect and the competitive effect. Along with Dunn (1960) and Esteban-Marquillas (1972) which are two common shift-share approaches frequently used in the literature, a recent one from Artige and Neuss (2014), that was never applied to Portuguese regions, was employed in order to have more accurate results.

The regions that possessed a more favourable specialisation profile than the national one were Lisbon M. A. and Algarve. The others, North, centre, Alentejo, Algarve, A. R. of Azores and A. R. of Madeira all had in the period under analysis an economic structure unfavourable to growth.

Most regions exhibited a competitive advantage with the exception of Centre and Lisbon M. A. according to Dunn (1960) and only Lisbon according to Esteban-Marquillas (1972) and Artige and Neuss (2014).

The values from Dunn (1960) and Esteban-Marquillas (1972) model in general overvalued the role of the industry-mix effect and Dunn's (1960) approach seemed to undervalue the effect of the competitive component.

Our findings suggest that, in general, the economic structure of the regions did not play a positive role in the growth of the regions and were less important in explaining the disparities in growth within the Portuguese regions in comparison to the role played by the competitive effect. Only Centre and Alentejo had an industry-mix effect with higher magnitude than the competitive effect when accounting regional growth.

As our data is limited to the one provided by the Statistics Portugal, for future researches it would be advantageable if this analysis would be done with a more desegregated data, either by counties and/or with a wider range of activity sectors. To understand better the disparities between regions, a further look into the determinants that lead to the convergence or divergence of the economic structures between regions may help understanding the different growth levels observed in each region.

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Appendices

Appendix 1 – Aggregate annual GVA in millions of euros at current prices of Portuguese NUTS 2 regions per activity sector

- Portugal

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J	Total
2000	3 992	22 809	8 600	25 503	4 046	6 546	8 595	7 103	22 746	2 627	112 568
2001	4 015	23 555	9 224	26 935	4 422	7 627	8 798	7 289	24 590	2 691	119 145
2002	3 881	24 017	9 476	28 293	4 769	7 789	9 680	7 574	26 337	2 978	124 793
2003	3 872	23 897	9 154	28 689	4 894	8 239	10 457	7 907	27 573	3 138	127 819
2004	3 956	24 390	9 461	29 937	5 163	8 827	10 941	8 323	28 983	3 289	133 270
2005	3 642	24 366	9 534	30 704	5 341	9 036	11 922	8 863	30 785	3 405	137 599
2006	3 737	25 478	9 678	32 009	5 587	10 703	12 484	9 214	31 122	3 568	143 579
2007	3 502	26 829	10 286	34 074	5 799	11 712	13 958	10 338	31 826	3 859	152 183
2008	3 507	26 033	10 523	34 499	5 977	12 640	14 672	11 125	32 822	4 219	156 016
2009	3 409	25 065	9 763	35 494	5 985	10 992	15 244	11 086	34 131	4 338	155 506
2010	3 463	26 594	9 226	36 095	5 739	10 424	16 795	11 244	34 254	4 491	158 326
2011	3 209	25 588	8 465	36 245	5 723	10 808	16 597	10 744	32 411	4 455	154 243
2012	3 212	24 991	7 171	36 017	5 416	9 268	17 424	9 997	29 528	4 338	147 362
2013	3 542	25 399	6 751	36 713	5 217	8 255	18 573	10 119	30 910	4 288	149 768
2014	3 511	26 488	6 278	37 274	5 192	8 089	18 891	10 856	30 391	4 395	151 365
2015	3 687	28 753	6 370	38 786	5 321	8 242	19 233	11 027	30 862	4 558	156 839

- North

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J	Total
2000	768	9 299	2 709	6 601	731	1 483	2 327	1 509	6 083	693	32 202
2001	834	9 699	2 828	7 103	831	1 734	2 417	1 604	6 627	741	34 417
2002	770	9 918	2 893	7 232	875	1 680	2 678	1 680	7 128	768	35 623
2003	775	9 702	2 727	7 197	864	1 754	2 919	1 795	7 339	754	35 826
2004	801	9 846	2 767	7 443	898	1 702	3 044	1 866	7 738	841	36 946
2005	765	9 746	2 849	8 065	926	1 744	3 291	1 913	8 152	893	38 343
2006	779	9 998	2 943	8 286	961	2 328	3 442	2 019	8 281	927	39 964
2007	740	10 597	3 141	8 808	1 004	2 677	3 905	2 278	8 496	1 034	42 679
2008	742	10 700	3 307	8 989	1 028	2 868	4 115	2 493	8 640	1 117	44 001
2009	716	10 104	3 132	9 307	1 026	2 311	4 327	2 540	8 976	1 165	43 607
2010	735	10 707	3 088	9 429	1 045	2 140	4 718	2 655	9 005	1 206	44 729
2011	686	10 480	2 845	9 515	1 133	2 212	4 720	2 515	8 466	1 194	43 767
2012	651	10 409	2 486	9 494	1 108	1 937	4 965	2 364	7 855	1 202	42 471
2013	721	10 860	2 409	9 671	1 005	1 695	5 338	2 434	8 130	1 188	43 451
2014	710	11 589	2 255	9 819	1 015	1 568	5 393	2 645	8 207	1 197	44 399
2015	749	12 314	2 322	10 149	1 048	1 715	5 475	2 676	8 286	1 263	45 997

- Centre

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J	Total
2000	1 262	5 978	1 726	4 652	369	714	1 640	674	4 411	426	21 853
2001	1 210	6 061	2 007	4 864	384	815	1 683	712	4 841	442	23 019
2002	1 092	6 196	2 066	5 140	406	832	1 868	769	5 019	476	23 865
2003	1 119	6 158	2 084	5 286	428	933	2 025	825	5 316	505	24 679
2004	1 141	6 228	2 122	5 645	410	904	2 128	875	5 689	519	25 660
2005	1 082	6 146	2 101	5 716	432	985	2 301	906	6 017	540	26 225
2006	1 169	6 453	2 083	5 957	438	1 207	2 407	936	6 140	556	27 346
2007	1 035	7 031	2 126	6 395	439	1 275	2 644	1 029	6 228	593	28 794
2008	1 027	6 566	2 125	6 410	444	1 420	2 808	1 101	6 428	654	28 983
2009	1 006	6 636	2 050	6 594	429	1 129	2 959	1 147	6 554	687	29 191
2010	1 013	6 961	1 895	6 654	413	1 042	3 246	1 182	6 483	713	29 603
2011	925	6 664	1 835	6 668	473	1 084	3 250	1 137	6 078	703	28 816
2012	952	6 526	1 536	6 630	431	998	3 456	1 051	5 571	678	27 830
2013	1 087	6 583	1 420	6 631	414	879	3 674	1 046	5 883	683	28 299
2014	1 036	6 751	1 318	6 720	435	811	3 756	1 114	5 891	701	28 534
2015	1 089	7 278	1 319	7 040	456	871	3 816	1 162	6 071	719	29 822

- Lisbon Metropolitan Area

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J	Total
2000	207	5 108	2 752	9 974	2 682	3 853	3 257	4 263	8 268	1 150	41 513
2001	245	5 345	2 799	10 417	2 914	4 487	3 291	4 299	8 837	1 115	43 750
2002	218	5 531	2 873	10 937	3 163	4 672	3 544	4 362	9 671	1 298	46 270
2003	215	5 470	2 615	11 179	3 273	4 891	3 795	4 501	10 129	1 429	47 496
2004	210	5 638	2 750	11 600	3 511	5 534	3 959	4 745	10 548	1 461	49 956
2005	201	5 618	2 836	11 406	3 623	5 574	4 354	5 159	11 321	1 476	51 568
2006	229	5 770	2 865	11 951	3 808	6 285	4 545	5 305	11 344	1 545	53 647
2007	236	5 798	3 059	12 675	3 979	6 824	5 071	6 001	11 597	1 633	56 873
2008	237	5 646	3 071	12 736	4 123	7 278	5 263	6 424	12 113	1 777	58 669
2009	224	5 466	2 845	13 170	4 170	6 645	5 384	6 356	12 621	1 822	58 703
2010	235	5 746	2 702	13 470	3 930	6 413	5 978	6 370	12 777	1 896	59 517
2011	210	5 379	2 379	13 561	3 738	6 667	5 787	6 082	12 155	1 882	57 839
2012	198	5 126	1 985	13 650	3 534	5 571	6 018	5 686	10 924	1 800	54 491
2013	207	5 090	1 899	14 122	3 483	5 024	6 387	5 729	11 518	1 767	55 224
2014	220	5 275	1 704	14 161	3 427	5 070	6 498	6 120	10 959	1 825	55 258
2015	212	5 724	1 712	14 704	3 489	4 977	6 642	6 167	11 029	1 878	56 535

- Alentejo

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J	Total
2000	1 203	1 776	580	1 453	76	207	529	229	1 644	136	7 833
2001	1 154	1 770	670	1 536	84	235	540	236	1 780	146	8 149
2002	1 213	1 650	675	1 652	91	242	598	264	1 883	159	8 428
2003	1 166	1 805	660	1 674	96	264	642	266	2 000	171	8 745
2004	1 220	1 871	664	1 738	104	254	675	287	2 116	169	9 097
2005	1 023	2 055	582	1 838	106	266	729	299	2 212	183	9 293
2006	997	2 395	578	1 904	107	334	763	316	2 224	202	9 819
2007	959	2 491	649	2 057	102	342	848	342	2 251	208	10 248
2008	947	2 201	700	2 127	105	394	896	342	2 330	232	10 273
2009	924	1 927	619	2 205	101	333	938	353	2 421	230	10 052
2010	920	2 259	547	2 226	110	313	1 049	359	2 359	238	10 380
2011	855	2 178	530	2 207	125	318	1 048	358	2 233	237	10 090
2012	848	2 068	450	2 094	116	292	1 107	304	2 055	229	9 564
2013	946	1 970	410	2 052	110	256	1 174	314	2 124	227	9 582
2014	941	1 990	404	2 118	111	241	1 207	328	2 143	227	9 710
2015	1 033	2 458	411	2 219	120	257	1 213	338	2 127	237	10 414

- Algarve

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J	Total
2000	252	292	371	1 496	94	146	500	244	859	109	4 362
2001	268	299	418	1 652	104	167	517	252	946	132	4 757
2002	263	313	453	1 753	112	171	581	278	1 003	146	5 075
2003	268	332	533	1 782	107	194	635	290	1 054	154	5 347
2004	239	353	563	1 840	111	194	668	299	1 112	172	5 550
2005	226	322	585	1 943	121	212	744	325	1 191	176	5 845
2006	215	344	614	2 052	128	264	792	356	1 227	191	6 183
2007	208	369	661	2 203	128	292	888	397	1 264	226	6 636
2008	208	373	698	2 191	123	335	927	441	1 299	249	6 844
2009	196	389	557	2 161	114	276	956	387	1 326	238	6 600
2010	205	371	472	2 251	106	246	1 050	374	1 321	238	6 634
2011	183	356	397	2 264	113	247	1 038	355	1 245	233	6 432
2012	186	354	308	2 276	103	224	1 091	326	1 149	227	6 243
2013	200	347	269	2 322	91	193	1 163	332	1 187	219	6 323
2014	211	351	262	2 504	92	179	1 183	368	1 176	233	6 559
2015	206	415	275	2 660	97	197	1 217	388	1 185	245	6 885

- A. R. Azores

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J	Total
2000	240	155	166	496	49	80	181	72	638	50	2 127
2001	241	162	205	551	57	96	187	78	710	52	2 338
2002	254	179	213	598	57	92	208	84	763	61	2 510
2003	256	191	203	631	60	104	226	92	784	61	2 608
2004	265	201	216	661	59	100	237	97	812	60	2 708
2005	266	213	211	695	63	110	259	105	846	64	2 830
2006	261	229	216	732	68	133	271	108	872	71	2 962
2007	239	254	239	762	71	140	293	117	927	83	3 125
2008	264	258	252	785	74	160	324	123	943	96	3 279
2009	262	262	225	804	66	139	342	115	991	99	3 305
2010	273	281	204	830	61	126	373	121	1 005	101	3 374
2011	275	273	190	802	67	118	374	118	971	105	3 292
2012	298	271	155	779	60	110	393	109	880	104	3 159
2013	300	291	132	782	55	88	420	111	938	106	3 222
2014	318	277	123	763	54	97	430	114	955	110	3 241
2015	316	289	125	788	53	103	437	119	993	118	3 340

- A. R. Madeira

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J	Total
2000	61	201	296	831	45	62	161	113	568	63	2 402
2001	63	219	296	812	49	93	164	107	623	64	2 489
2002	70	229	301	981	64	99	202	137	691	69	2 844
2003	73	240	333	940	65	99	215	139	807	65	2 974
2004	81	254	378	1 009	70	138	230	154	850	68	3 233
2005	78	265	372	1 043	70	146	245	156	951	73	3 400
2006	87	288	380	1 127	77	150	264	173	956	76	3 578
2007	85	291	410	1 174	75	162	310	175	1 003	83	3 768
2008	83	288	370	1 260	79	185	339	200	1 017	94	3 915
2009	80	281	336	1 252	78	157	338	188	1 069	96	3 875
2010	82	269	317	1 235	74	145	381	182	1 131	100	3 915
2011	75	258	289	1 228	75	161	379	179	1 108	101	3 853
2012	79	238	252	1 093	62	135	395	157	982	98	3 491
2013	81	259	213	1 133	58	120	418	153	1 026	99	3 562
2014	76	254	211	1 189	57	122	425	168	1 023	102	3 628
2015	82	275	205	1 226	59	122	433	177	1 040	97	3 715

Appendix 2 – Hirschman-Herfindahl index of Portuguese NUTS 2 regions

Year/ Region	Portugal	North	Centre	Lisbon M. A.	Alentejo	Algarve	A. R. of Azores	A. R. of Madeira
2000	0.155	0.179	0.179	0.147	0.165	0.190	0.179	0.207
2001	0.155	0.177	0.177	0.147	0.164	0.192	0.181	0.200
2002	0.155	0.177	0.177	0.148	0.161	0.191	0.182	0.206
2003	0.155	0.174	0.174	0.149	0.163	0.186	0.181	0.203
2004	0.154	0.174	0.176	0.148	0.164	0.186	0.182	0.197
2005	0.155	0.173	0.175	0.147	0.169	0.188	0.182	0.201
2006	0.153	0.169	0.174	0.145	0.171	0.187	0.180	0.199
2007	0.151	0.166	0.176	0.144	0.170	0.185	0.179	0.198
2008	0.149	0.163	0.171	0.143	0.164	0.179	0.173	0.199
2009	0.153	0.164	0.174	0.147	0.167	0.187	0.181	0.206
2010	0.154	0.166	0.176	0.147	0.169	0.195	0.182	0.209
2011	0.154	0.165	0.174	0.149	0.167	0.201	0.180	0.209
2012	0.156	0.168	0.176	0.152	0.167	0.209	0.176	0.205
2013	0.159	0.171	0.177	0.156	0.166	0.215	0.182	0.211
2014	0.159	0.175	0.179	0.155	0.167	0.221	0.182	0.214
2015	0.160	0.176	0.181	0.155	0.170	0.222	0.183	0.214

Appendix 3 – GVA Shares % of Portuguese NUTS 2 regions per activity sector

- Portugal

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	3.55	20.26	7.64	22.66	3.59	5.81	7.64	6.31	20.21	2.33
2001	3.37	19.77	7.74	22.61	3.71	6.40	7.38	6.12	20.64	2.26
2002	3.11	19.25	7.59	22.67	3.82	6.24	7.76	6.07	21.10	2.39
2003	3.03	18.70	7.16	22.44	3.83	6.45	8.18	6.19	21.57	2.45
2004	2.97	18.30	7.10	22.46	3.87	6.62	8.21	6.24	21.75	2.47
2005	2.65	17.71	6.93	22.31	3.88	6.57	8.66	6.44	22.37	2.47
2006	2.60	17.74	6.74	22.29	3.89	7.45	8.70	6.42	21.68	2.49
2007	2.30	17.63	6.76	22.39	3.81	7.70	9.17	6.79	20.91	2.54
2008	2.25	16.69	6.75	22.11	3.83	8.10	9.40	7.13	21.04	2.70
2009	2.19	16.12	6.28	22.82	3.85	7.07	9.80	7.13	21.95	2.79
2010	2.19	16.80	5.83	22.80	3.62	6.58	10.61	7.10	21.63	2.84
2011	2.08	16.59	5.49	23.50	3.71	7.01	10.76	6.97	21.01	2.89
2012	2.18	16.96	4.87	24.44	3.68	6.29	11.82	6.78	20.04	2.94
2013	2.37	16.96	4.51	24.51	3.48	5.51	12.40	6.76	20.64	2.86
2014	2.32	17.50	4.15	24.63	3.43	5.34	12.48	7.17	20.08	2.90
2015	2.35	18.33	4.06	24.73	3.39	5.26	12.26	7.03	19.68	2.91

- North

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	2.38	28.88	8.41	20.50	2.27	4.61	7.23	4.69	18.89	2.15
2001	2.42	28.18	8.22	20.64	2.41	5.04	7.02	4.66	19.26	2.15
2002	2.16	27.84	8.12	20.30	2.46	4.72	7.52	4.72	20.01	2.16
2003	2.16	27.08	7.61	20.09	2.41	4.89	8.15	5.01	20.49	2.10
2004	2.17	26.65	7.49	20.15	2.43	4.61	8.24	5.05	20.94	2.28
2005	2.00	25.42	7.43	21.03	2.41	4.55	8.58	4.99	21.26	2.33
2006	1.95	25.02	7.36	20.73	2.40	5.83	8.61	5.05	20.72	2.32
2007	1.73	24.83	7.36	20.64	2.35	6.27	9.15	5.34	19.91	2.42
2008	1.69	24.32	7.52	20.43	2.34	6.52	9.35	5.67	19.64	2.54
2009	1.64	23.17	7.18	21.34	2.35	5.30	9.92	5.83	20.58	2.67
2010	1.64	23.94	6.90	21.08	2.34	4.78	10.55	5.94	20.13	2.70
2011	1.57	23.95	6.50	21.74	2.59	5.05	10.78	5.75	19.34	2.73
2012	1.53	24.51	5.85	22.35	2.61	4.56	11.69	5.57	18.49	2.83
2013	1.66	24.99	5.54	22.26	2.31	3.90	12.29	5.60	18.71	2.73
2014	1.60	26.10	5.08	22.12	2.29	3.53	12.15	5.96	18.49	2.70
2015	1.63	26.77	5.05	22.07	2.28	3.73	11.90	5.82	18.01	2.75

- Centre

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	5.78	27.36	7.90	21.29	1.69	3.27	7.50	3.08	20.18	1.95
2001	5.54	26.33	8.72	21.13	1.67	3.54	7.31	3.09	21.03	1.92
2002	5.00	25.96	8.66	21.54	1.70	3.49	7.83	3.22	21.03	1.99
2003	5.12	24.95	8.44	21.42	1.74	3.78	8.20	3.34	21.54	2.04
2004	5.22	24.27	8.27	22.00	1.60	3.52	8.29	3.41	22.17	2.02
2005	4.95	23.43	8.01	21.79	1.65	3.75	8.77	3.45	22.94	2.06
2006	5.35	23.60	7.62	21.78	1.60	4.41	8.80	3.42	22.45	2.03
2007	4.74	24.42	7.38	22.21	1.53	4.43	9.18	3.57	21.63	2.06
2008	4.70	22.65	7.33	22.12	1.53	4.90	9.69	3.80	22.18	2.26
2009	4.60	22.73	7.02	22.59	1.47	3.87	10.14	3.93	22.45	2.35
2010	4.64	23.51	6.40	22.48	1.40	3.52	10.97	3.99	21.90	2.41
2011	4.23	23.12	6.37	23.14	1.64	3.76	11.28	3.94	21.09	2.44
2012	4.36	23.45	5.52	23.82	1.55	3.59	12.42	3.78	20.02	2.44
2013	4.97	23.26	5.02	23.43	1.46	3.11	12.98	3.70	20.79	2.41
2014	4.74	23.66	4.62	23.55	1.53	2.84	13.16	3.90	20.64	2.46
2015	4.98	24.41	4.42	23.61	1.53	2.92	12.80	3.90	20.36	2.41

- Lisbon Metropolitan Area

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	0.50	12.30	6.63	24.02	6.46	9.28	7.85	10.27	19.92	2.77
2001	0.56	12.22	6.40	23.81	6.66	10.26	7.52	9.83	20.20	2.55
2002	0.47	11.95	6.21	23.64	6.84	10.10	7.66	9.43	20.90	2.80
2003	0.45	11.52	5.51	23.54	6.89	10.30	7.99	9.48	21.33	3.01
2004	0.42	11.29	5.50	23.22	7.03	11.08	7.93	9.50	21.11	2.92
2005	0.39	10.89	5.50	22.12	7.03	10.81	8.44	10.00	21.95	2.86
2006	0.43	10.76	5.34	22.28	7.10	11.72	8.47	9.89	21.15	2.88
2007	0.42	10.19	5.38	22.29	7.00	12.00	8.92	10.55	20.39	2.87
2008	0.40	9.62	5.23	21.71	7.03	12.41	8.97	10.95	20.65	3.03
2009	0.38	9.31	4.85	22.44	7.10	11.32	9.17	10.83	21.50	3.10
2010	0.40	9.65	4.54	22.63	6.60	10.78	10.04	10.70	21.47	3.18
2011	0.36	9.30	4.11	23.45	6.46	11.53	10.00	10.52	21.02	3.25
2012	0.36	9.41	3.64	25.05	6.49	10.22	11.04	10.44	20.05	3.30
2013	0.37	9.22	3.44	25.57	6.31	9.10	11.56	10.37	20.86	3.20
2014	0.40	9.55	3.08	25.63	6.20	9.18	11.76	11.07	19.83	3.30
2015	0.37	10.13	3.03	26.01	6.17	8.80	11.75	10.91	19.51	3.32

- Alentejo

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	15.35	22.67	7.41	18.55	0.97	2.64	6.75	2.92	20.98	1.74
2001	14.16	21.71	8.22	18.85	1.03	2.88	6.63	2.90	21.84	1.79
2002	14.40	19.58	8.01	19.60	1.09	2.87	7.10	3.13	22.34	1.88
2003	13.33	20.64	7.55	19.15	1.10	3.02	7.34	3.04	22.87	1.95
2004	13.41	20.57	7.30	19.11	1.14	2.79	7.42	3.16	23.26	1.85
2005	11.01	22.12	6.26	19.78	1.14	2.86	7.85	3.22	23.81	1.97
2006	10.15	24.39	5.88	19.39	1.09	3.40	7.77	3.22	22.65	2.06
2007	9.35	24.30	6.33	20.07	1.00	3.34	8.28	3.34	21.96	2.03
2008	9.21	21.43	6.82	20.70	1.02	3.83	8.72	3.33	22.68	2.26
2009	9.20	19.17	6.16	21.94	1.01	3.32	9.33	3.51	24.09	2.29
2010	8.86	21.76	5.27	21.44	1.06	3.02	10.11	3.46	22.73	2.29
2011	8.47	21.59	5.25	21.87	1.24	3.16	10.39	3.55	22.13	2.35
2012	8.87	21.63	4.70	21.90	1.22	3.06	11.57	3.18	21.49	2.39
2013	9.87	20.56	4.28	21.42	1.15	2.67	12.25	3.27	22.16	2.37
2014	9.69	20.49	4.16	21.82	1.14	2.49	12.43	3.38	22.07	2.34
2015	9.92	23.61	3.95	21.31	1.15	2.47	11.65	3.24	20.43	2.28

- Algarve

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	5.77	6.70	8.49	34.29	2.14	3.35	11.46	5.59	19.69	2.50
2001	5.64	6.29	8.79	34.72	2.20	3.51	10.87	5.31	19.89	2.78
2002	5.18	6.18	8.94	34.55	2.20	3.38	11.45	5.48	19.76	2.88
2003	5.00	6.20	9.97	33.32	1.99	3.62	11.87	5.43	19.72	2.88
2004	4.30	6.36	10.15	33.16	2.00	3.50	12.03	5.38	20.04	3.10
2005	3.87	5.50	10.01	33.24	2.07	3.63	12.72	5.56	20.38	3.01
2006	3.47	5.56	9.92	33.20	2.07	4.26	12.81	5.76	19.84	3.09
2007	3.14	5.56	9.97	33.20	1.94	4.39	13.38	5.98	19.05	3.40
2008	3.04	5.45	10.20	32.02	1.80	4.89	13.54	6.44	18.98	3.64
2009	2.97	5.89	8.44	32.74	1.72	4.19	14.49	5.86	20.08	3.61
2010	3.09	5.59	7.11	33.93	1.60	3.70	15.83	5.65	19.92	3.58
2011	2.85	5.53	6.18	35.19	1.75	3.85	16.14	5.52	19.36	3.63
2012	2.97	5.66	4.93	36.46	1.65	3.59	17.47	5.23	18.40	3.64
2013	3.16	5.48	4.25	36.72	1.44	3.05	18.39	5.26	18.78	3.47
2014	3.22	5.35	3.99	38.18	1.41	2.72	18.04	5.61	17.94	3.55
2015	2.99	6.03	3.99	38.63	1.41	2.86	17.68	5.64	17.21	3.56

- A. R. of Azores

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	11.28	7.28	7.83	23.31	2.31	3.74	8.50	3.38	30.00	2.36
2001	10.30	6.92	8.77	23.57	2.43	4.10	7.99	3.35	30.37	2.21
2002	10.13	7.14	8.50	23.82	2.28	3.66	8.30	3.34	30.38	2.43
2003	9.83	7.31	7.79	24.18	2.31	3.99	8.66	3.52	30.06	2.34
2004	9.77	7.40	7.98	24.41	2.20	3.71	8.75	3.57	30.00	2.20
2005	9.39	7.54	7.44	24.56	2.24	3.87	9.14	3.70	29.88	2.26
2006	8.80	7.74	7.28	24.71	2.31	4.51	9.15	3.66	29.43	2.40
2007	7.65	8.12	7.66	24.39	2.27	4.48	9.37	3.74	29.67	2.65
2008	8.05	7.86	7.69	23.94	2.27	4.88	9.88	3.76	28.75	2.92
2009	7.92	7.94	6.79	24.32	1.99	4.22	10.35	3.48	30.00	2.99
2010	8.09	8.32	6.06	24.60	1.82	3.72	11.04	3.58	29.77	2.99
2011	8.36	8.29	5.76	24.36	2.03	3.59	11.36	3.58	29.49	3.19
2012	9.43	8.58	4.89	24.66	1.91	3.48	12.44	3.45	27.87	3.29
2013	9.30	9.03	4.08	24.28	1.70	2.73	13.02	3.46	29.11	3.28
2014	9.81	8.55	3.79	23.55	1.67	3.00	13.25	3.52	29.47	3.38
2015	9.47	8.65	3.73	23.58	1.58	3.09	13.07	3.55	29.73	3.54

- A. R. of Madeira

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	2.55	8.38	12.33	34.61	1.87	2.58	6.72	4.71	23.65	2.60
2001	2.54	8.79	11.89	32.64	1.95	3.74	6.57	4.28	25.04	2.56
2002	2.47	8.04	10.60	34.50	2.24	3.50	7.10	4.81	24.30	2.44
2003	2.44	8.05	11.18	31.59	2.20	3.32	7.23	4.66	27.14	2.18
2004	2.49	7.86	11.70	31.22	2.16	4.28	7.13	4.77	26.28	2.11
2005	2.30	7.79	10.94	30.67	2.06	4.30	7.21	4.59	27.98	2.15
2006	2.44	8.06	10.61	31.50	2.14	4.20	7.39	4.83	26.71	2.12
2007	2.27	7.71	10.89	31.15	1.98	4.30	8.24	4.64	26.63	2.19
2008	2.11	7.36	9.44	32.20	2.02	4.73	8.65	5.11	25.98	2.40
2009	2.07	7.26	8.66	32.30	2.02	4.05	8.72	4.84	27.59	2.49
2010	2.09	6.88	8.11	31.53	1.88	3.69	9.73	4.66	28.88	2.55
2011	1.95	6.69	7.50	31.88	1.94	4.18	9.83	4.63	28.76	2.62
2012	2.27	6.81	7.22	31.32	1.78	3.87	11.30	4.49	28.13	2.81
2013	2.28	7.28	5.99	31.82	1.64	3.38	11.75	4.31	28.79	2.78
2014	2.10	7.01	5.82	32.77	1.58	3.36	11.71	4.62	28.20	2.82
2015	2.19	7.39	5.52	33.01	1.59	3.28	11.67	4.76	27.99	2.60

Appendix 4 – Krugman specialisation index of Portuguese NUTS 2 regions

Year/ Region	North	Centre	Lisbon M. A.	Alentejo	Algarve	A. R. of Azores	A. R. of Madeira
2000	0.188	0.192	0.246	0.300	0.374	0.385	0.407
2001	0.178	0.196	0.243	0.288	0.389	0.385	0.378
2002	0.182	0.186	0.232	0.266	0.390	0.379	0.361
2003	0.177	0.181	0.237	0.279	0.395	0.363	0.375
2004	0.175	0.182	0.241	0.288	0.390	0.369	0.358
2005	0.164	0.179	0.227	0.284	0.396	0.349	0.360
2006	0.158	0.186	0.227	0.303	0.394	0.348	0.362
2007	0.156	0.189	0.232	0.295	0.398	0.346	0.372
2008	0.168	0.186	0.233	0.268	0.384	0.340	0.354
2009	0.162	0.189	0.230	0.244	0.367	0.331	0.350
2010	0.164	0.183	0.222	0.255	0.386	0.333	0.365
2011	0.168	0.183	0.224	0.250	0.386	0.336	0.363
2012	0.171	0.180	0.227	0.256	0.384	0.326	0.348
2013	0.181	0.180	0.233	0.253	0.392	0.329	0.339
2014	0.191	0.184	0.238	0.247	0.413	0.363	0.359
2015	0.189	0.179	0.238	0.272	0.412	0.372	0.361

Appendix 5 – Location quotient of Portuguese NUTS 2 regions

- North

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	0.67	1.43	1.10	0.90	0.63	0.79	0.95	0.74	0.93	0.92
2001	0.72	1.43	1.06	0.91	0.65	0.79	0.95	0.76	0.93	0.95
2002	0.70	1.45	1.07	0.90	0.64	0.76	0.97	0.78	0.95	0.90
2003	0.71	1.45	1.06	0.90	0.63	0.76	1.00	0.81	0.95	0.86
2004	0.73	1.46	1.06	0.90	0.63	0.70	1.00	0.81	0.96	0.92
2005	0.75	1.44	1.07	0.94	0.62	0.69	0.99	0.77	0.95	0.94
2006	0.75	1.41	1.09	0.93	0.62	0.78	0.99	0.79	0.96	0.93
2007	0.75	1.41	1.09	0.92	0.62	0.81	1.00	0.79	0.95	0.96
2008	0.75	1.46	1.11	0.92	0.61	0.80	0.99	0.79	0.93	0.94
2009	0.75	1.44	1.14	0.94	0.61	0.75	1.01	0.82	0.94	0.96
2010	0.75	1.43	1.18	0.92	0.64	0.73	0.99	0.84	0.93	0.95
2011	0.75	1.44	1.18	0.93	0.70	0.72	1.00	0.83	0.92	0.94
2012	0.70	1.45	1.20	0.91	0.71	0.73	0.99	0.82	0.92	0.96
2013	0.70	1.47	1.23	0.91	0.66	0.71	0.99	0.83	0.91	0.95
2014	0.69	1.49	1.22	0.90	0.67	0.66	0.97	0.83	0.92	0.93
2015	0.69	1.46	1.24	0.89	0.67	0.71	0.97	0.83	0.92	0.94

- Centre

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	1.63	1.35	1.03	0.94	0.47	0.56	0.98	0.49	1.00	0.84
2001	1.64	1.33	1.13	0.93	0.45	0.55	0.99	0.51	1.02	0.85
2002	1.61	1.35	1.14	0.95	0.45	0.56	1.01	0.53	1.00	0.84
2003	1.69	1.33	1.18	0.95	0.45	0.59	1.00	0.54	1.00	0.83
2004	1.76	1.33	1.17	0.98	0.41	0.53	1.01	0.55	1.02	0.82
2005	1.87	1.32	1.16	0.98	0.42	0.57	1.01	0.54	1.03	0.83
2006	2.05	1.33	1.13	0.98	0.41	0.59	1.01	0.53	1.04	0.82
2007	2.06	1.38	1.09	0.99	0.40	0.58	1.00	0.53	1.03	0.81
2008	2.09	1.36	1.09	1.00	0.40	0.60	1.03	0.53	1.05	0.83
2009	2.10	1.41	1.12	0.99	0.38	0.55	1.03	0.55	1.02	0.84
2010	2.12	1.40	1.10	0.99	0.39	0.53	1.03	0.56	1.01	0.85
2011	2.03	1.39	1.16	0.98	0.44	0.54	1.05	0.57	1.00	0.84
2012	2.00	1.38	1.13	0.97	0.42	0.57	1.05	0.56	1.00	0.83
2013	2.10	1.37	1.11	0.96	0.42	0.56	1.05	0.55	1.01	0.84
2014	2.04	1.35	1.11	0.96	0.44	0.53	1.05	0.54	1.03	0.85
2015	2.12	1.33	1.09	0.95	0.45	0.56	1.04	0.55	1.03	0.83

- Lisbon Metropolitan Area

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	0.14	0.61	0.87	1.06	1.80	1.60	1.03	1.63	0.99	1.19
2001	0.17	0.62	0.83	1.05	1.79	1.60	1.02	1.61	0.98	1.13
2002	0.15	0.62	0.82	1.04	1.79	1.62	0.99	1.55	0.99	1.18
2003	0.15	0.62	0.77	1.05	1.80	1.60	0.98	1.53	0.99	1.23
2004	0.14	0.62	0.78	1.03	1.81	1.67	0.97	1.52	0.97	1.18
2005	0.15	0.62	0.79	0.99	1.81	1.65	0.97	1.55	0.98	1.16
2006	0.16	0.61	0.79	1.00	1.82	1.57	0.97	1.54	0.98	1.16
2007	0.18	0.58	0.80	1.00	1.84	1.56	0.97	1.55	0.98	1.13
2008	0.18	0.58	0.78	0.98	1.83	1.53	0.95	1.54	0.98	1.12
2009	0.17	0.58	0.77	0.98	1.85	1.60	0.94	1.52	0.98	1.11
2010	0.18	0.57	0.78	0.99	1.82	1.64	0.95	1.51	0.99	1.12
2011	0.17	0.56	0.75	1.00	1.74	1.65	0.93	1.51	1.00	1.13
2012	0.17	0.55	0.75	1.02	1.76	1.63	0.93	1.54	1.00	1.12
2013	0.16	0.54	0.76	1.04	1.81	1.65	0.93	1.54	1.01	1.12
2014	0.17	0.55	0.74	1.04	1.81	1.72	0.94	1.54	0.99	1.14
2015	0.16	0.55	0.75	1.05	1.82	1.68	0.96	1.55	0.99	1.14

- Alentejo

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	4.33	1.12	0.97	0.82	0.27	0.45	0.88	0.46	1.04	0.75
2001	4.20	1.10	1.06	0.83	0.28	0.45	0.90	0.47	1.06	0.79
2002	4.63	1.02	1.06	0.86	0.28	0.46	0.92	0.52	1.06	0.79
2003	4.40	1.10	1.05	0.85	0.29	0.47	0.90	0.49	1.06	0.80
2004	4.52	1.12	1.03	0.85	0.29	0.42	0.90	0.51	1.07	0.75
2005	4.16	1.25	0.90	0.89	0.29	0.44	0.91	0.50	1.06	0.80
2006	3.90	1.37	0.87	0.87	0.28	0.46	0.89	0.50	1.04	0.83
2007	4.06	1.38	0.94	0.90	0.26	0.43	0.90	0.49	1.05	0.80
2008	4.10	1.28	1.01	0.94	0.27	0.47	0.93	0.47	1.08	0.83
2009	4.20	1.19	0.98	0.96	0.26	0.47	0.95	0.49	1.10	0.82
2010	4.05	1.30	0.90	0.94	0.29	0.46	0.95	0.49	1.05	0.81
2011	4.07	1.30	0.96	0.93	0.33	0.45	0.97	0.51	1.05	0.81
2012	4.07	1.28	0.97	0.90	0.33	0.49	0.98	0.47	1.07	0.81
2013	4.17	1.21	0.95	0.87	0.33	0.49	0.99	0.48	1.07	0.83
2014	4.18	1.17	1.00	0.89	0.33	0.47	1.00	0.47	1.10	0.81
2015	4.22	1.29	0.97	0.86	0.34	0.47	0.95	0.46	1.04	0.78

- Algarve

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	1.63	0.33	1.11	1.51	0.60	0.58	1.50	0.89	0.97	1.07
2001	1.68	0.32	1.14	1.54	0.59	0.55	1.47	0.87	0.96	1.23
2002	1.67	0.32	1.18	1.52	0.58	0.54	1.48	0.90	0.94	1.21
2003	1.65	0.33	1.39	1.48	0.52	0.56	1.45	0.88	0.91	1.17
2004	1.45	0.35	1.43	1.48	0.52	0.53	1.47	0.86	0.92	1.26
2005	1.46	0.31	1.44	1.49	0.53	0.55	1.47	0.86	0.91	1.22
2006	1.33	0.31	1.47	1.49	0.53	0.57	1.47	0.90	0.92	1.24
2007	1.36	0.32	1.47	1.48	0.51	0.57	1.46	0.88	0.91	1.34
2008	1.35	0.33	1.51	1.45	0.47	0.60	1.44	0.90	0.90	1.34
2009	1.36	0.37	1.34	1.43	0.45	0.59	1.48	0.82	0.92	1.29
2010	1.41	0.33	1.22	1.49	0.44	0.56	1.49	0.79	0.92	1.26
2011	1.37	0.33	1.13	1.50	0.47	0.55	1.50	0.79	0.92	1.26
2012	1.36	0.33	1.01	1.49	0.45	0.57	1.48	0.77	0.92	1.24
2013	1.34	0.32	0.94	1.50	0.41	0.55	1.48	0.78	0.91	1.21
2014	1.39	0.31	0.96	1.55	0.41	0.51	1.45	0.78	0.89	1.22
2015	1.27	0.33	0.98	1.56	0.41	0.54	1.44	0.80	0.87	1.23

- Autonomous region of Azores

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	3.18	0.36	1.02	1.03	0.64	0.64	1.11	0.54	1.48	1.01
2001	3.06	0.35	1.13	1.04	0.65	0.64	1.08	0.55	1.47	0.98
2002	3.26	0.37	1.12	1.05	0.60	0.59	1.07	0.55	1.44	1.02
2003	3.24	0.39	1.09	1.08	0.60	0.62	1.06	0.57	1.39	0.95
2004	3.29	0.40	1.12	1.09	0.57	0.56	1.07	0.57	1.38	0.89
2005	3.55	0.43	1.07	1.10	0.58	0.59	1.05	0.57	1.34	0.91
2006	3.38	0.44	1.08	1.11	0.59	0.60	1.05	0.57	1.36	0.97
2007	3.32	0.46	1.13	1.09	0.60	0.58	1.02	0.55	1.42	1.04
2008	3.58	0.47	1.14	1.08	0.59	0.60	1.05	0.53	1.37	1.08
2009	3.61	0.49	1.08	1.07	0.52	0.60	1.06	0.49	1.37	1.07
2010	3.70	0.50	1.04	1.08	0.50	0.57	1.04	0.50	1.38	1.06
2011	4.02	0.50	1.05	1.04	0.55	0.51	1.06	0.51	1.40	1.10
2012	4.33	0.51	1.01	1.01	0.52	0.55	1.05	0.51	1.39	1.12
2013	3.93	0.53	0.91	0.99	0.49	0.49	1.05	0.51	1.41	1.14
2014	4.23	0.49	0.91	0.96	0.49	0.56	1.06	0.49	1.47	1.17
2015	4.03	0.47	0.92	0.95	0.47	0.59	1.07	0.51	1.51	1.22

- Autonomous region of Madeira

Year/ Sector	Sector A	Sector B	Sector C	Sector D	Sector E	Sector F	Sector G	Sector H	Sector I	Sector J
2000	0.72	0.41	1.61	1.53	0.52	0.44	0.88	0.75	1.17	1.11
2001	0.75	0.44	1.54	1.44	0.53	0.58	0.89	0.70	1.21	1.13
2002	0.80	0.42	1.40	1.52	0.59	0.56	0.92	0.79	1.15	1.02
2003	0.81	0.43	1.56	1.41	0.58	0.51	0.88	0.75	1.26	0.89
2004	0.84	0.43	1.65	1.39	0.56	0.65	0.87	0.76	1.21	0.86
2005	0.87	0.44	1.58	1.37	0.53	0.65	0.83	0.71	1.25	0.87
2006	0.94	0.45	1.57	1.41	0.55	0.56	0.85	0.75	1.23	0.85
2007	0.99	0.44	1.61	1.39	0.52	0.56	0.90	0.68	1.27	0.86
2008	0.94	0.44	1.40	1.46	0.53	0.58	0.92	0.72	1.23	0.89
2009	0.95	0.45	1.38	1.42	0.53	0.57	0.89	0.68	1.26	0.89
2010	0.96	0.41	1.39	1.38	0.52	0.56	0.92	0.66	1.33	0.90
2011	0.94	0.40	1.37	1.36	0.52	0.60	0.91	0.67	1.37	0.91
2012	1.04	0.40	1.48	1.28	0.48	0.62	0.96	0.66	1.40	0.95
2013	0.96	0.43	1.33	1.30	0.47	0.61	0.95	0.64	1.39	0.97
2014	0.90	0.40	1.40	1.33	0.46	0.63	0.94	0.64	1.40	0.97
2015	0.93	0.40	1.36	1.33	0.47	0.62	0.95	0.68	1.42	0.90

Appendix 6 – GVA growth rates for the Portuguese NUTS 2 regions (%)

Region/ Year	North	Centre	Lisbon M. A.	Alentejo	Algarve	A. R. of Azores	A. R. of Madeira	Portugal
2001	6,88	5,34	5,39	4,03	9,04	9,93	3,61	5,84
2002	3,50	3,67	5,76	3,42	6,69	7,37	14,26	4,74
2003	0,57	3,41	2,65	3,76	5,37	3,88	4,58	2,42
2004	3,12	3,98	5,18	4,02	3,80	3,86	8,72	4,26
2005	3,78	2,20	3,23	2,15	5,31	4,51	5,15	3,25
2006	4,23	4,28	4,03	5,67	5,78	4,66	5,23	4,35
2007	6,79	5,29	6,01	4,37	7,33	5,48	5,32	5,99
2008	3,10	0,66	3,16	0,25	3,13	4,95	3,90	2,52
2009	-0,90	0,72	0,06	-2,15	-3,56	0,77	-1,01	-0,33
2010	2,57	1,41	1,39	3,26	0,51	2,11	1,03	1,81
2011	-2,15	-2,66	-2,82	-2,79	-3,05	-2,45	-1,60	-2,58
2012	-2,96	-3,42	-5,79	-5,21	-2,93	-4,03	-9,38	-4,46
2013	2,31	1,69	1,35	0,19	1,27	1,98	2,03	1,63
2014	2,18	0,83	0,06	1,33	3,73	0,59	1,84	1,07
2015	3,60	4,51	2,31	7,25	4,97	3,06	2,40	3,62

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