PATTERNS OF SECTORIAL AND REGIONAL PRODUCTIVITY IN PORTUGAL

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- JUNE 2020 -

In partnership with:

Santander

Acknowledgements

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Abstract: Productivity is one of the main indicators of a country's economic growth. In this study it is exposed how productivity has evolved in Portugal, since 1995, regarding its patterns and dynamics, framing it into a regional and sectorial analysis. This paper proposition is to reflect on how each region was affected by economic impacts from the period of 1995-2018 and understand how the economy adapted to these changes. From the regional perspective, the analysis found that the regions (NUTS III) with higher productivity growth are Lisbon, Porto, Algarve, Cávado and Coimbra. Also, that within these regions, Algarve was the only region to present a higher productivity growth after the financial crisis.

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Introduction

In this work we seek to assess in which regions and which sectors in Portugal have the highest productivity ratios, based on the Gross Value Added (GVA) of workers for each region/sector, and understand the respective productivity dynamics and patterns. With this exposition we hope the reader will be able to have insights about the productivity evolution in Portugal with different regional levels.

Productivity can be measured as the ratio between the GVA and the number of workers/hours worked in a certain sector of the economy. The GVA is responsible for explaining the productivity ratio dynamics, although number of workers also play a part in the dynamics since it is a changing external factor that can influence the productivity.

The productivity per worker has been increasing, although at a progressively lower pace. We should also be aware of the "false positives", as in some cases our productivity ratios increase despite a reduction in both the GVA and the number of workers, if the reduction in latter is higher than in the former. This was the case during the period of the financial crisis.

For this report we mainly based our methodology in the paper "Portugal da Produtividade ao Crescimento Económico", specifically concerning the productivity shift-share analysis method, formulas and productivity concepts as well as the results presentation. This paper was done as an economic study by Santander bank. The authors, Bruno Fernandes and Rui Constantino employ the shift-share analysis which we will further explain in the methodology section, to analyse the drivers of productivity in Portugal from 1999 to 2018 (using GVA per worker as well) and dissect its evolution by economic sector and effect in the context of shift-share analysis. The authors further analyse the main drivers of GDP growth in the same period, namely the contribution of the different productivity effects.

From the paper "Sistema de Indicadores do Crescimento e Produtividade: Plano de Difusão" we retrieved more detailed information on the shift-share analysis productivity components, which we will again explain in the methodology section.

Data

We used data from "Contas Nacionais Regionais", made available by *Instituto Nacional de Estatística*, specifically tables D1.2.1. - referring to the GVA – and table D1.2.5 - referring to number of workers.

However, at the beginning of this project INE only had data up to the most recent period (2016-2018) and not the entire series of 1995-2018. For this reason, Santander retropolated the data in order to provide for the entire data series required for the project. In order to calculate this adjustment, the growth rates were calculated based on the information of the following year to the one we wanted to calculate, from the most recent data, assuring the consistent of the total values already provided.

We study three main sectors: 1- Agriculture, livestock production, hunting, forestry and fishing; 2 - Mining and quarrying; manufacturing; electricity, gas, steam and air conditioning supply; water abstraction, purification and supply; sewerage, waste management and remediation activities; construction; 3 – Services. The regional coverage includes the national levels of Portugal and the regional decomposition according to NUTS II and NUTS III.

For the loans data we used data from PORDATA for the periods of 2000-2001 and 2009-2018.

Methodology

As we have stated before, the GVA per worker reflects the productivity ratio, and we can study its dynamics by decomposing it in two main effects: A Structural and a Competitive effect. This decomposition is known as the Shift-Share analysis. The shift-share analysis is an analytic method developed by Daniel Creamer (1943) and conceptualized by Edgar Dunn (1960) that consists of decomposing the regional economic growth in distinct determinant growth factors. We develop a dynamic shift-share analysis, since we use the growth fluctuations registered within the period we analyse.

The competitive effect can itself be decomposed in two sub effects: the differentiation factors and the specialization factors. The differentiation factors refer to an economy's ability to reallocate the working force from the less productive to the more productive sectors/regions. When it has a positive sign, it means that more workers are moving to more productive working sectors/regions.

The specialization factors signal that the degree of concentration of the working force in an economy depends on the capacity to generate more added value to that region/sector. When it has a positive sign, it means there is an increase in productivity through a higher GVA.

The structural effect assesses the economy's capacity to create new jobs as a response to improvements in regional or sectorial productivity. When it has a positive sign, it means that we verify a placement of workers to sectors or regions with higher productivity ratios.

The sum of both effects explains the total productivity ratios growth.

The effects are calculated in the following way:

Structural Effect: $\frac{\Delta P_{it} * \Delta S_{it}}{P_{0(t-1)}}$

Competitive Effect = Differentiation factor + Specialization factor

Differentiation factor: $\frac{P_{i(t-1)} * \Delta S_i}{P_{0(t-1)}}$ 　　　　　　Specialization factor: $\frac{\Delta P_{it} * S_{i(t-1)}}{P_{0(t-1)}}$

P – Labour Productivity = $\frac{GVA}{Total\ Employment}$

P_i – Labour Productivity in sector/region i

S_i – Employment ratio in sector/region i

P_0 – Labour Productivity in the total Economy

Results

Working Factor – Portuguese Labor Productivity

The GVA per employee indicates the Productivity Ratio – how much is, on average, each employed person producing in a certain period of time in the country analysed.

The Productivity Ratio in Portugal from 1995 to 2018 is depicted on the following graph:

Figure 1 – GVA per worker in Portugal (1995-2018)
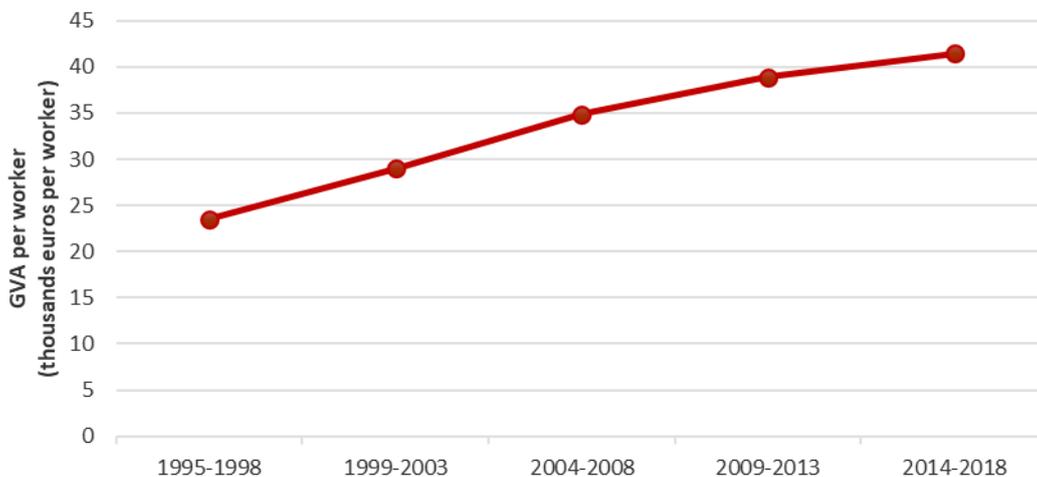
In Portugal, over the analysed period, it is possible to observe a positive growth period after period. However, its marginal value has been decreasing since the period 2009-2013. This might be explained by the financial crisis, which slowed down the Labor Productivity until the last observed value.

It is important to highlight that after 2008 the number of workers decreased significantly, which suppresses some of the harmful impact the crisis had on workers when using GVA per worker as proxy for productivity. Total GVA grew 17.3% from 2004 to 2008 and –5.7% in the following four years, while the number of workers went from a growth of 2.2% to –9.4% in the same periods.

Figure 2 – GVA and number of workers in Portugal, in the four years before and after 2008

Year	GVA (10^6 €)	% change	Number of workers (10^3 people)	% change
2004	133,145	-	4,102	-
2008	156,158	17.3%	4,191	2.2%
2012	147,215	-5.7%	3,795	-9.4%

Shift-Share – Portuguese Productivity Drivers

After computing each of the effects of shift-share analysis, we obtained the graph in figure 2, which illustrastes the contribution of each effect on the Portuguese productivity's dynamic.

In this graph it is possible to observe the evolution of productivity growth in Portugal in the analysed period, and the contribution of each of the studied factors.

From the period of 1995-98 to 1999-03, productivity measured through the GVA per worker increased around 23.3%, mostly due to the competitive specialisation effect – the contribution of each region/sector's evolution in productivity to the overall change in productivity, weighed by the share of total workers in each region/sector. This effect (of 23.5%) is very marginally offset by the structural and competitive differentiation effects, which were negative between those periods (-0.036% and -0.16%, respectively). This suggests the regions with higher productivity were not totally able to keep or increase their share of workers.

Moving to the following period, 2004-08, productivity increased 20.3%, again with the competitive specialisation effect having the largest share of contribution by far (20.5%), and being only marginally but negativelly compensated by the structural and competitive differentiation effects (-0.05% and -0.14%, respectively).

Regarding the post- financial crisis period of 2009-13 productivity growth was naturally severely affected, increasing 11.5%, close to half of the previous growth rates. Specialisation was still the strongest factor in this change (10.45%), but the structural and differentiation factors were positive this time (0.07% and 0.99% respectively), suggesting some positive adaptation of workers to most productive regions after the crisis, and during Portugal's austerity period.

Towards the last period, GVA per worker grew even less, 6.51% in total. The specialisation effect represents an increase in productivity of almost 26%, a value larger than before the crisis, but the other two factors are substantially negative and offset this magnitude. A structural effect of -4% and a differentiation factor of -15.45% indicate there was a far from optimal allocation of workers towards productive regions.

Figure 3 – Productivity growth rate and factor evolution in Portugal
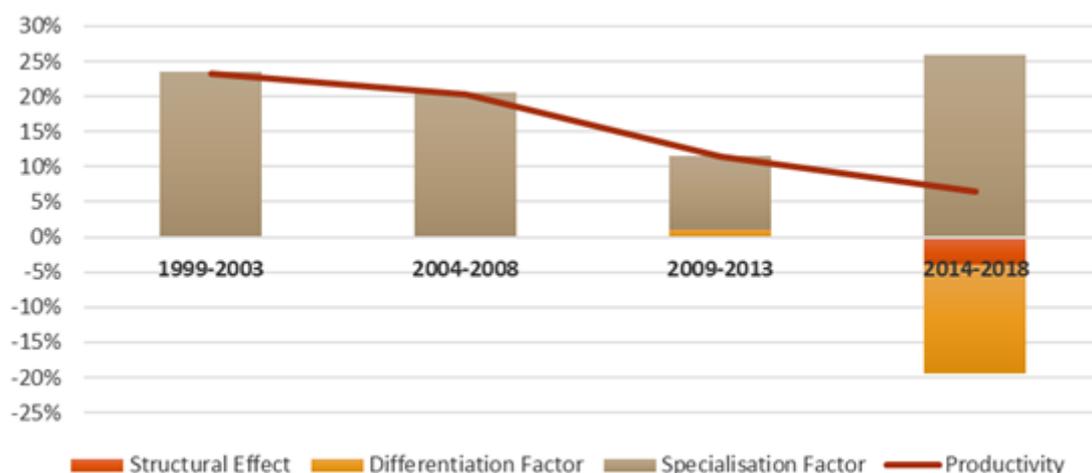

NUTS II Regional Analysis

A more detailed regional analysis could provide interesting insights on how productivity behaved among regions, and, more important in this context, how each effect of the shift-share analysis affected that behaviour.

Figure 4 – Regional contribution to Structural Effect (NUTS II)
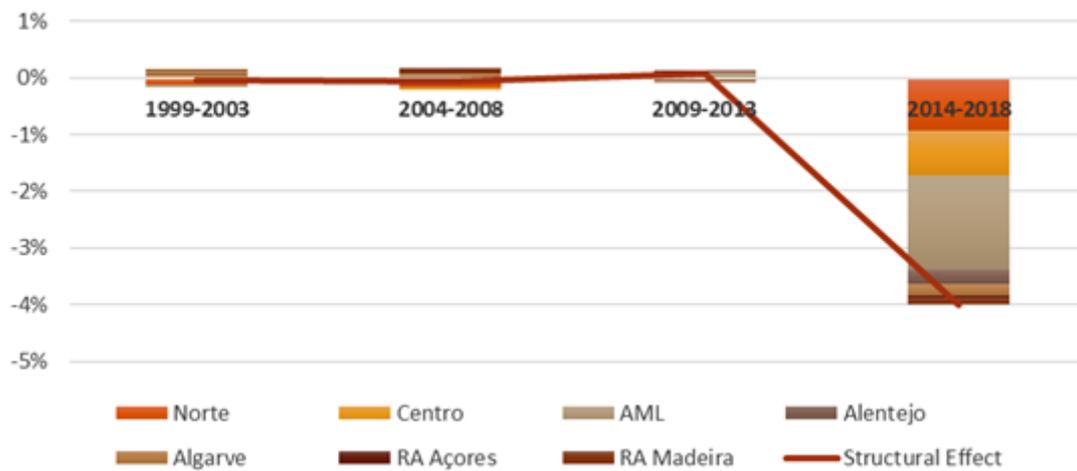
It is possible to see in the graph above that the structural effect by region of the country was marginally insignificant until the last period, where it is possible to observe a considerable negative effect. This means Portugal's productive sector by region has been inefficient in terms of participation of the labour force relatively to gains and losses in productivity.

Figure 5 – Regional contribution to Competitive Effect (NUTS II)
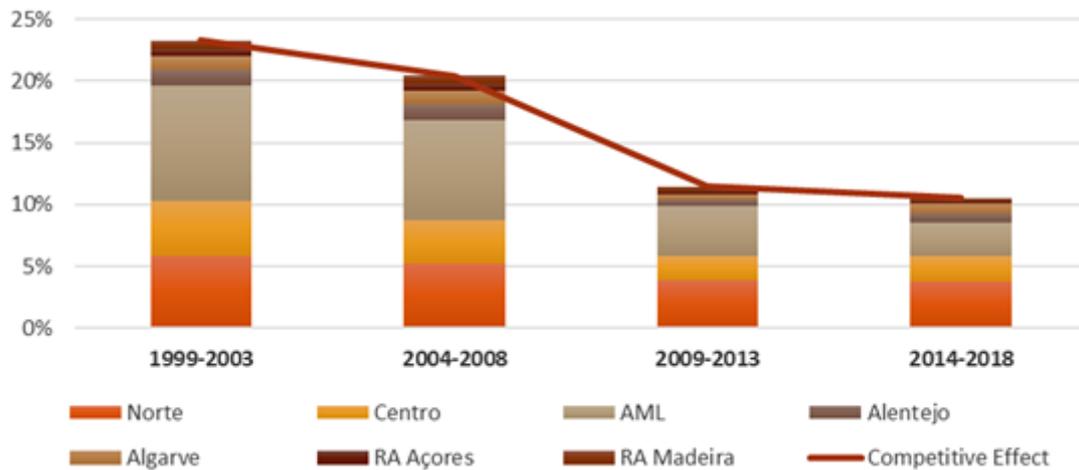
The graph above describes the competitive effect by region in Portugal. As we can see the competitive effect has been decreasing throughout the time. More expressively in the AML and Centro. Despite its decrease in power the competitive effect has been an important contributor to Portugal's productivity.

Figure 6 – Regional contribution to the Differentiation Factor (NUTS II)
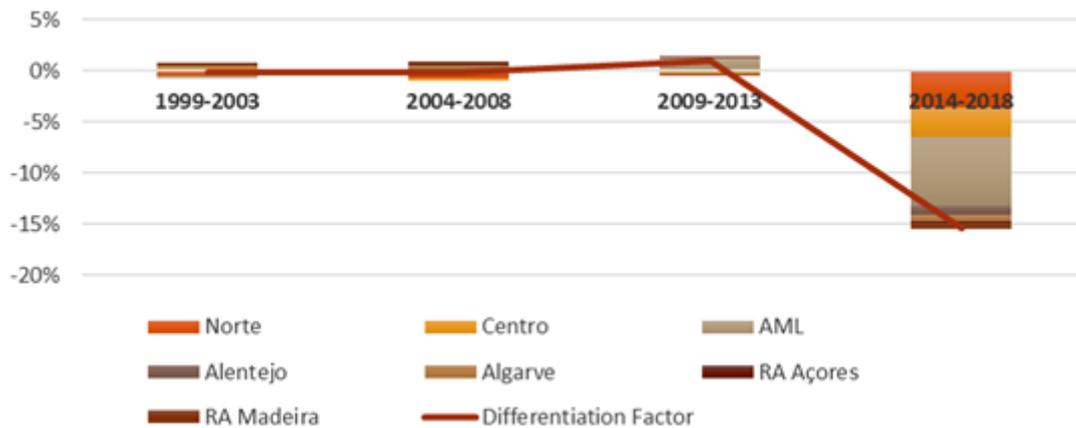
The differentiation factor as we can see was not considerably expressive until the last period considered, where it was negative. All the regions of the country had negative differentiation factor showing a tendency of the whole country and not only a specific region.

Figure 7 – Regional contribution to the Specialisation Factor (NUTS II)
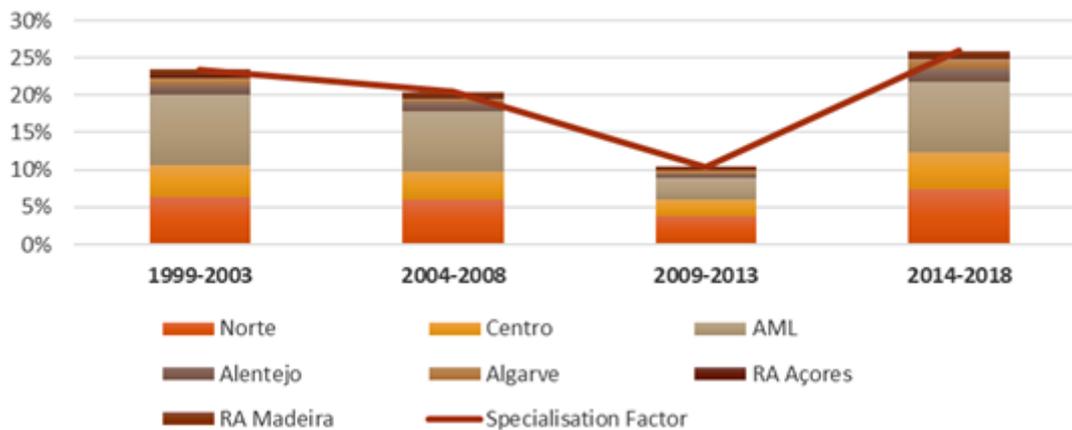
The negative differentiation factor is offset by a positive and increasing specialization factor from period (2009-2013) to period (2014-2018) it is possible to observe a positive trend to levels above previous periods. This shows that Portugal was specializing its labour force to adjust to the decrease in productivity and this was a general trend in the country and not located in one specific region. However, it is worth noticing AML together with North regions are the ones where this effect was more expressive.

NUTS III Regional Analysis

In this map we can have a better understanding of the productivity dynamics by region, taking the results for the annual average sum of the structural and competitive effects for each region in the analyzed period. The regions with highest effects percentage are specifically identified.

These regions are respectively the Metropolitan Area of Lisbon, followed by M.A. Porto, Algarve, Cávado and Coimbra.
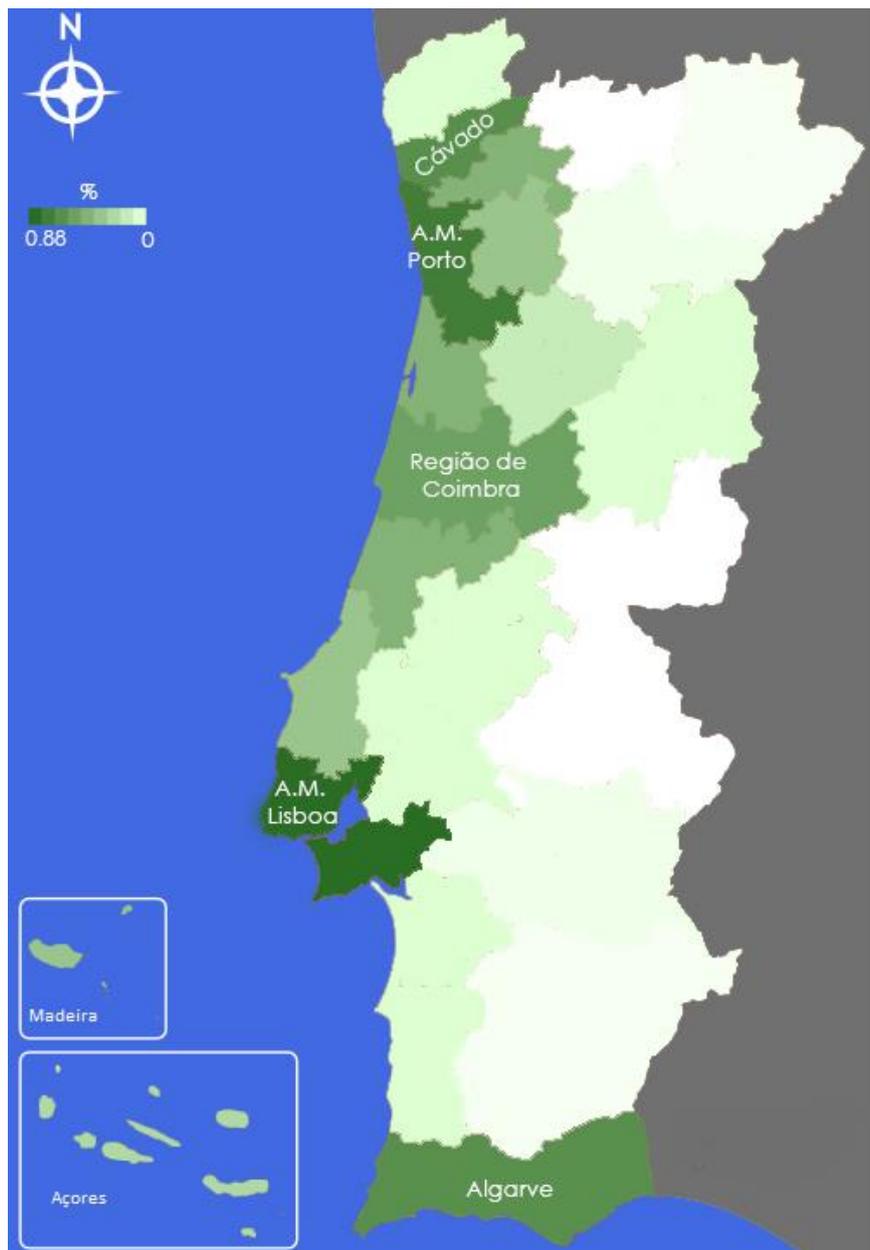

Figure 8 – Average yearly productivity growth as the sum of the effects throughout Portugal, by region (NUTS III)

Sector Analysis of the most productive regions

As seen on the last section, there are five NUTS III regions whose productivity is undoubtly higher in Portugal. Thus, it is important to understand what is the contribution of each sector of activity to the whole productivity growth of these regions. In all these regions, it has been declining, which is in tandem with national values. In none of these five regions the productivity variation was negative. Moreover, the predominant contribution to the productivity is the tertiary sector, which is composed by the services.

The primary sector refers to agriculture, livestock production, hunting, forestry and fishing. The secondary sector corresponds to activities as: mining and quarrying; manufacturing; electricity, gas, steam and air conditioning supply; water abstraction, purification and supply; sewerage, waste management and remediation activities; construction.

In the Lisbon Metropolitan Area, the productivity increment has been reducing, mainly because of the decreasing marginal contribution of the tertiary sector. Furthermore, the contribution of the primary sector is irrelevant and the marginal contribution of the secondary sector has become negative in the last two periods analysed.

Figure 9 – Decomposition of productivity growth by sector in Lisbon Metropolitan Area
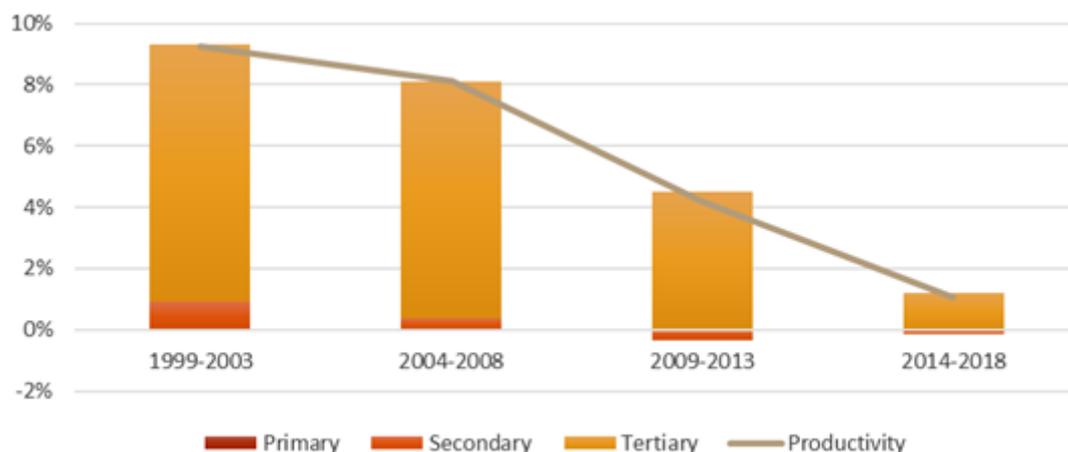
In the Porto Metropolitan Area, it is possible to understand that the secondary sector has a higher importance in this region. Its marginal reduction and its negative value during the financial crisis (2009-2013) contributed to the reduction of the regional marginal growth of productivity until that period. However, on the recovery period from the crisis (2014-2018), the marginal contribution of the secondary sector turned positive (almost at the level before crisis), which contributed to slow down the reduction on the regional

productivity growth, since the tertiary sector has been reducing substantially its marginal contribution.

Figure 10 – Decomposition of productivity growth by sector in Porto Metropolitan Area
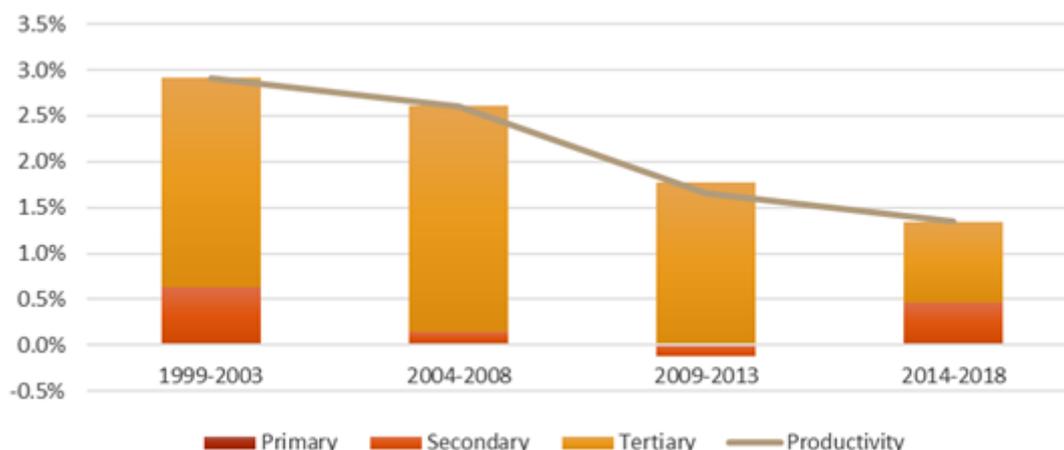
Algarve is the only analysed NUTS III region that increased its regional productivity growth in the post-crisis period. The primary sector has been irrelevant, but, in the period 2004-2008, it slightly contributed to decrease the marginal growth of productivity. The secondary sector had a significative marginal contribution before the financial crisis, but since that period, it has been marginally negative. The tertiary sector is the main contribution – its productivity growth was high in 1999-2003 and in 2004-2008, then it declined in the financial recession (2009-2013), but it increased in the recovery period (2014-2018).
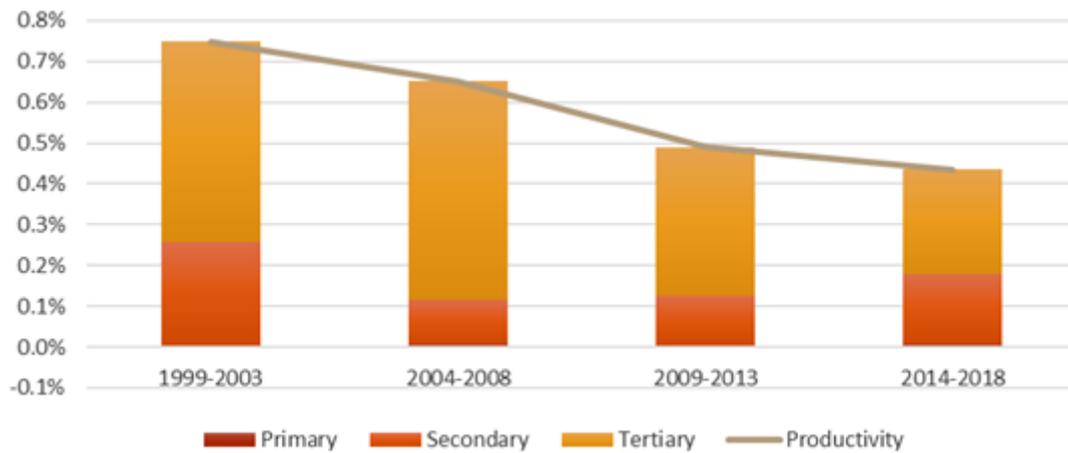
Figure 11 – Decomposition of productivity growth by sector in Algarve
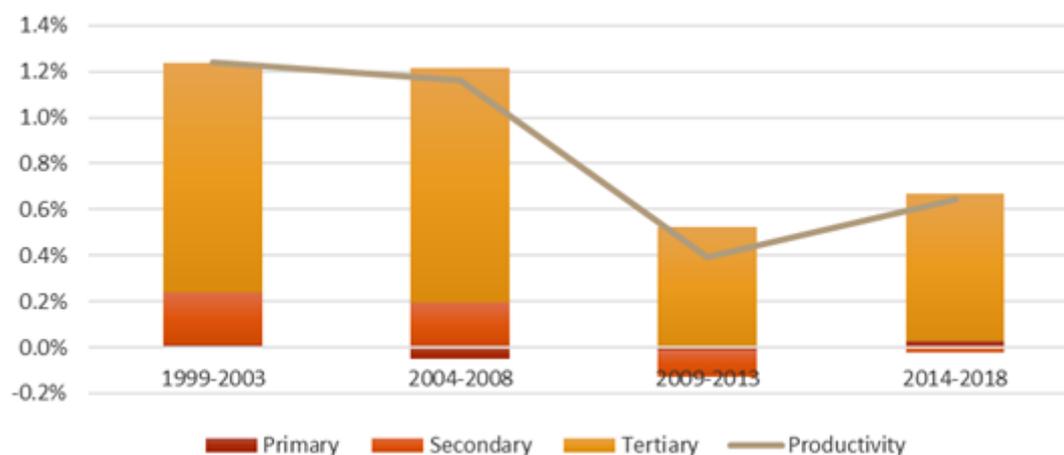
The importance of the secondary sector in Cávado's marginal growth of productivity is high. It slightly decreased before the crisis, remain almost equal during the recession, and

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increased on the recovery period. The marginal contribution of the tertiary sector has been constantly reducing.

Figure 12 – Decomposition of productivity growth by sector in Cávado

Coimbra Region has been linearly decreasing its regional productivity growth, due to the decreasing growth of the tertiary sector.

Figure 13 – Decomposition of productivity growth by sector in Coimbra Region
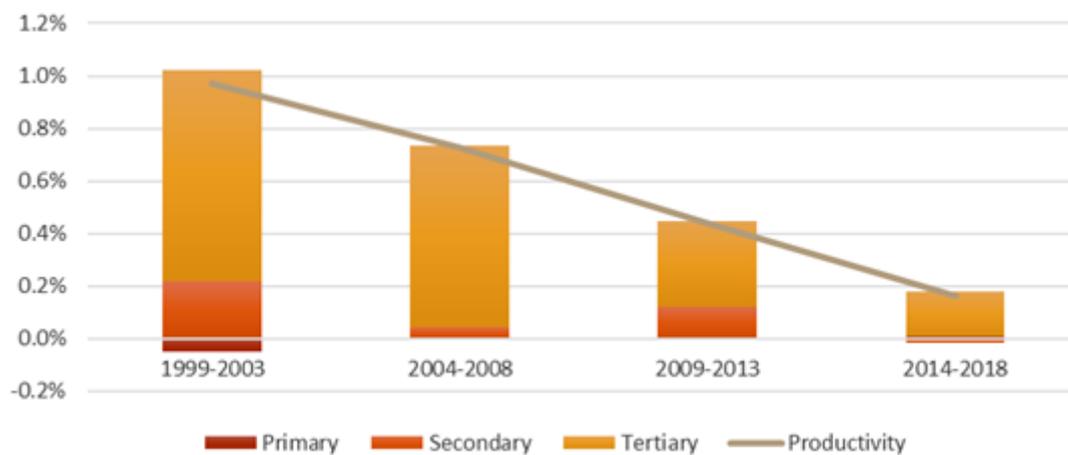
The influence of Productivity on Total Credit

We want to assess how the components that affect productivity can in turn be correlated with other economic variables, such as credit availability. We retrieved data for total loans by region in the NUTS II areas from 2000-2001 and from 2009-2018.

As we can see, there were more loans contracted in the periods of 2009-2011 which correspond to the financial crisis aftermath period. In all periods, the Metropolitan Area of Lisbon represented the majority of loans, followed by the North region. Credit availability has also been higher in the last years than at the beginning of the 2000's.

Comparing with the NUTS II regional analysis of each productivity dynamics component, during the 2009-2013 period it shows the opposite evolution. Before the financial crisis, the competitive effects were higher and decreased during this period. The structural effects were practically null. This suggests that credit availability is higher during distressed economic periods, but at the same time higher for the regions with higher average productivity growth.

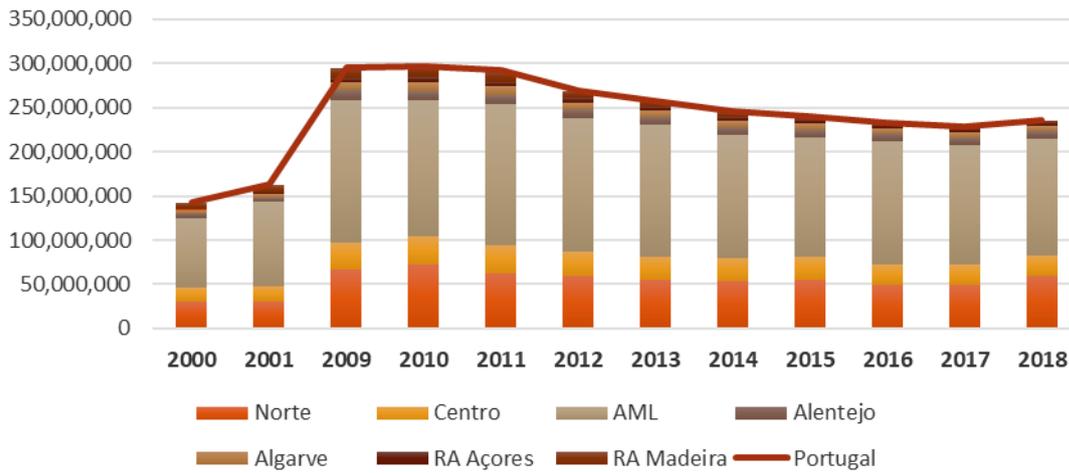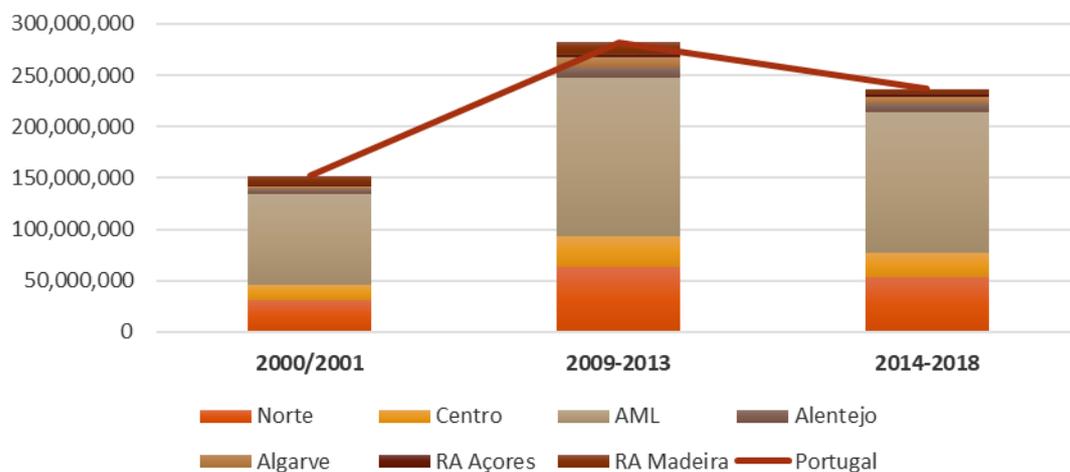Figure 14 – Yearly share of total credit by region (NUTS II)

Figure 15 – Periodic share of total credit by region (NUTS II)

Conclusions

From the regional analysis, we concluded that the regions with highest average productivity growth are the Metropolitan Area of Lisbon and Porto, as well as in Algarve, Coimbra and Cávado, with Lisbon being on the top of the list. The main metropolis, Lisbon, and Porto are undoubtedly the places with higher economic potential. Nevertheless, allocation of workers towards the most productive regions was not optimal. This was most critical after 2014, as shown by the strongly negative structural and competitive differentiation effects. These did not allow Portuguese productivity to return to its pre-crisis growth level, even though the competitive specialisation effect recovered its magnitude.

It is also possible to identify that the effects of the economic crisis of 2008 had a considerably widespread effect throughout the regions of the country, since the decreases in productivity were across all regions. This shared decrease in productivity was on the most part due to a large blow in the specialisation factor growth in the immediate post-crisis period (2009-2013).

The capital still has high economic importance on productivity and thus this is always a safe bet area. However, given that Algarve was the only analysed NUTS III that showed a higher productivity growth in the post-crisis period, we believe this region also has high growth potential if it has access to more resources and credit.

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