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The Validity of the Tourism-led-growth Hypothesis in the Autonomous Region of Madeira

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THE VALIDITY OF THE TOURISM-LED-GROWTH HYPOTHESIS IN THE AUTONOMOUS REGION OF MADEIRA

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ABSTRACT

According to the World Tourism Organization, tourism has become one of the fastest growing economic sectors in the world and a key driver for socio-economic progress in many destinations (OECD et al., 2001). Interestingly, 8 out of the top 10 countries in terms of tourism's contribution to their GDP are small island economies where tourism seems to be the solution found to overcome their lack of resources, small markets and remoteness. The same strategy was applied by the Autonomous Region of Madeira (ARM) however, there is no empirical evidence in the literature to support this claim up until now.

This study investigates whether there is a causal relationship running from tourism exports to economic growth in the ARM, and explores the implications of that relationship. The empirical research is conducted based on the theoretical framework of the augmented Solow Model specified as an Auto-Regressive Distributed Lag (ARDL) model that translates the relationship between the economic growth of ARM and its determinants, over the period 1995-2019.

The estimation results provide empirical evidence of a causal relationship running from tourism expansion to economic growth and, consequently, support the validity of the tourism-led growth hypothesis (TLGH) for the ARM economy. A 1% increase in the ratio of tourism exports to gross value added (XT) causes a 0.65% increase on the ARM's real GDP per capita across the sample period, except for the sub-period 2001-2010, where the impact of XT is slightly below 0.50%. These results give empirical support to the intuition of the region's tourism managers, who believe that encouraging the expansion of the tourism sector leads to the faster growth of the whole economy.

RESUMO

De acordo com a Organização Mundial do Turismo, o turismo é um dos setores económicos com um crescimento mais rápido a nível mundial e um impulsionador para o progresso socioeconómico de muitos destinos (OECD et al., 2001). Curiosamente, 8 dos 10 principais países em termos de contribuição do turismo para o seu PIB são pequenas economias insulares, onde o turismo parece ser a solução encontrada para superar a falta de recursos, o mercado interno reduzido e distância de grandes mercados. Esta mesma estratégia foi aplicada pela Região Autónoma da Madeira, mas até ao momento não existia qualquer evidência empírica que a sustentasse.

Este estudo investiga a existência de uma relação causal proveniente das exportações de turismo para o crescimento económico da RAM e explora as implicações dessa relação. A análise empírica é conduzida com base no enquadramento teórico do *Augmented Solow Model* especificado como um modelo *Auto-Regressive Distributed Lag* (ARDL) que traduz a relação entre o crescimento económico da RAM e seus determinantes, para o período 1995-2019.

Os resultados suportam a existência de uma relação causal direcionada da expansão do turismo para o crescimento económico e, consequentemente, apoiam a validade da *tourism-led growth hypothesis* (TLGH) para a economia da RAM. Um aumento de 1% no rácio das exportações de turismo para o valor acrescentado bruto (XT) causa um aumento de 0,65% no PIB real per capita da RAM, exceto para o período de 2001-2010 em que o impacto de XT é ligeiramente abaixo de 0,50%. Esses resultados apoiam uma maior expansão do setor do turismo da RAM, dado seu papel como impulsionador do crescimento.

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CHAPTER I: INTRODUCTION

According to the World Tourism Organization, tourism has become one of the fastest growing economic sectors in the world and a key driver for socio-economic progress in many destinations (OECD et al., 2001). As a non-standard export, tourism is assumed to share some of the positive economic effects associated with traditional exports. For instances, tourism exports can be an important source of foreign exchange earnings (McKinnon, 1964), create incentives for investments in new infrastructures such as airports and roads, contribute to job creation and foster the development of related industries (Sinclair & Stabler, 1997). In fact, according to the World Travel & Tourism Council, travel and tourism activities (T&T) contributed to 10.4% of worldwide GDP and represented 10% of total employment (WTTC, 2018).

Interestingly, 8 out of the top 10 countries in terms of tourism's contribution to their GDP are small island economies[1] (WTTC, 2018), where the total T&T contributions may exceed 60%. Tourism seems to be the solution found by many small island-economies, including the Autonomous Region of Madeira (ARM), to overcome their economic and geographical constraints, namely the lack of resources, small internal market, and remoteness. However, there is no consensus on whether tourism exports can drive the growth of islands' economies. Although most studies support this point of view, there are some that find no causal relationship from tourism to economic growth, even in tourism dependent country-islands (Katircioglu, 2009(c); Jackman & Lorde, 2010; Lorde, Francis & Drakes, 2011). These studies identify the existence of leakages from imports and the lack of association between economic sectors, as the main reasons constraining the potential of tourism as a driver for growth (Pratt, 2015).

As such, this study aims to contribute to the literature by finding out, for a tourism dependent small island economy such as the ARM, if there is a link between tourism exports and economic growth, and if that link has a causal direction from tourism to growth, as well as

[1] Macau, Seychelles, Maldives, St. Kitts and Nevis, Grenada, Vanuatu, Cape Verde, St. Vincent and the Grenadines, Belize, Antigua, and Barbuda.

the implications of that relationship. Indeed, although the literature has abundant studies on the relationship between exports and economic growth, they tend to focus on goods exports, with some dealing with services exports, whereas those dealing specifically with tourism exports being relatively scarce. Consequently, the literature concerning the importance of tourism in small island economies is not only scarce, but also almost exclusively focused on the tourism-led-growth hypothesis in Small Island Developing States (SIDS), which have considerably different contexts from the settings of the ARM. In addition, to the best of our knowledge, there are only two empirical studies about the relationship between tourism and growth that include Madeira among other destinations. Mazzola et al. (2019) that analyze the role of tourism in the economic resilience of 13 European Island Economies for the period 2000-2015, and Soukiazis and Proença (2008) that use panel data to evaluate the importance of tourism as a source of regional convergence in Portugal. Regardless, there are no studies that test the tourism-led-growth hypothesis for the ARM alone, using a time series approach and considering the possible synergies between goods exports and tourism exports.

The analysis conducted here is also relevant from a management perspective, as its results may allow economic agents to make more informed decisions about their businesses and investments. Moreover, it can also provide a solid empirical basis to guide tourism businesses owners and managers in their demand for government assistance through specific investment and subsidies in infrastructures that can catalyze the region's development and encourage the growth of inbound tourist flows.

This research uses the theoretical framework of the augmented Solow Model, specified as an Auto-Regressive Distributed Lag (ARDL) model that translates the relationship between the economic growth of ARM and its determinants, over the period 1995-2019. Within this sample period, the estimation results uncover the existence of two distinct sub-periods where positive long-run associations between tourism exports and economic growth can be established. Specifically, within the period 2001-2010, a 1% increase in the ratio of tourism exports to gross value added (XT) in the current period, causes an long-run impact slightly below 0.50% on the ARM's growth of its real per capita income. Outside that period, the long-run impact of XT on the growth performance of the region is 0.65%. Additionally, the empirical results also lead to the conclusions that an increase in the ratio of goods exports to total GVA (XG) in period t, leads to negative, although minor, impacts on the region's economic growth, both in the short and the long run. In detail, a 1% increase of XG in the

current period, leads to an income decrease of 0.03% in the same period, and of 0.08% in the long run. These results, which seemingly contradict the mainstream literature on the subject are, nevertheless, not surprising within the context of a small open island economy, highly specialized in one "product", such as the one of the ARM. This negative relationship can be explained by the substantial opportunity costs associated with the reallocation of resources from the region's highly efficient tourism sector to other less efficient sectors. This phenomenon may be associated with the so called "Dutch Disease", which happens when, over a long period of time, resources are drawn from lagging sectors to a booming sector leaving lagging sectors deprived of their resources and, consequently, incapable of being productive or competitive (Capó, Font & Nadal, 2007).

Furthermore, throughout the sample period, there is empirical evidence supporting a causal relationship running from tourism expansion to economic growth and, consequently, that the tourism-led growth hypothesis (TLGH) is valid for the ARM economy.

These results support the further expansion of the tourism sector given its role as an engine of growth. However, there is still the matter on whether this positive relationship is sustainable and whether continued specialization in tourism is beneficial in the long term. Studies such as Pratt (2015), Lee & Chien (2008) and Pablo-Romero & Molina (2013) suggest that it is highly unlikely that a region can achieve sustained long-term growth by developing only one industry of its economy, especially if that industry is tourism, which is particularly vulnerable to many unpredictable exogenous factors.

The remaining of this study is structured in the following way. Chapter two provides a literature review on the relationship between tourism exports and economic growth for island economies; Chapter three presents a brief history of Madeira, as well as an analysis of the different features of the region's demographics and economy for the period 1990 to 2019; Chapter four presents the theoretical framework of the Solow Model, upon which the general ARDL specification is defined and estimated to provide the empirical results that are also interpreted in this chapter; Chapter five concludes the dissertation by summarizing the main empirical results and exploring their economic consequences and implications for policy making and for management in the ARM.

CHAPTER II: LITERATURE REVIEW

The existence of a favorable relationship between trade and economic growth has been acknowledged ever since the eighteenth century when it was first mentioned by Adam Smith. Exports, in particular, have been seen as a driving force for growth, especially after the 1960's growth surge of the four Asian "Tigers" economies: South Korea, Taiwan, Hong-Kong and Singapore; whose unprecedented growth levels, lasting until the beginning of this century, were attributed to their exports' expansion,. The well-known hypothesis of Export-Led Growth Hypothesis (ELG) supported by Balassa (1978; 1985); Michalopoulos and Jay (1973); Feder (1983); Michaely (1977), among others, postulates that exports expansion may be a vital catalyst for economic growth. However, as mentioned by Romero & Molina (2013), empirical literature on the "traditional" ELG concerns mainly the relationship between exports of tradable goods and growth, largely ignoring the exports of services, namely, the exports of tourism.

Only more recently, with the growth of services weight on national GDPs worldwide, researchers have widened their interest to include the study of the impact of service exports on economic growth. According to Brida *et al.* (2016), the tourism-led growth hypothesis (TLGH) was formally introduced by the study of Balaguer and Cantavella-Jordá (2002), who analyze the link between inbound tourism and economic growth considering the case of Spain. Since then, many other empirical papers address the same topic and, although their results are not unanimous, the TLGH is supported by most of them.

The survey of Pablo-Romero and Molina (2013) provides a summary of interesting issues related to the relationship between tourism and economic growth that are also relevant for island economies. Analyzing 87 previous studies, this survey acknowledges that the level of specialization in tourism strengthens the impact of tourism in growth. However, there seems to be a decreasing marginal economic growth as tourism specialization increases. As such, after a certain threshold, tourism can even become an obstacle for growth. This is why these authors defend that those destinations highly specialized in tourism, need to diversify their economies besides tourism. In addition, the study emphasises that the use of foreign

exchange earnings to import capital goods and services and strong inter-industry links are the two most important channels through which tourism can generate growth.

Looking at existing literature on the causal relationship between tourism and economic growth in island economies, 32 relevant studies were found, which are included in three tables separated by type of data, that is, the one study found about cross sections is mentioned in Table 1, studies using time series are cited in Table 2 and studies with panel data are included in Table 3 The first column of all tables lists the authors and year of publication of their works; the second column displays the destinations under analysis; the third column reveals the dependent variable followed by the explanatory variables included and the last column refers the main conclusions related to the causality nexus between tourism (T) and Income (Y).[2]

Table 1: List of studies on the TLG hypothesis for island economies, using cross section

Cross Section			
Authors (date)	Destinations	Variables	Conclusion
Singh (2008)	37 Islands	Tourism Receipts GDP	T → Y

Table 2: List of studies on the TLG hypothesis for island economies, using time series

Time Series			
Authors (date)	Destination	Variables	Conclusion (Long Run)
Ghali (1976)	Hawaii	Personal Income Tourism Growth	T → Y
Narayan (2004)	Fiji	GDP Tourism Receipts	T → Y
Durbarry (2004)	Mauritius	Real GDP Tourism Receipts Physical/Human Capital Sugar /EPZ Exports	T → Y
Kim, Chen & Jang (2006)	Taiwan	Real GDP Tourism Arrivals	T ↔ Y
Louca (2006)	Cyprus	Income from Tourism (Y_T) Investment in Transport and Communication (TC); Hotels and Restaurants (HR); Advertising and Promotion (AP) Tourism Arrivals (TA)	No Relation
Capó, Font & Rosselló (2007)	Balearic and Canary Islands	GDP Growth Rate Specialization in Tourism (compared to other regions)	T → Y

[2] Only studies published in international economics or tourism journals with peer revision are considered.

Lee & Chien (2008)	Taiwan	Real GDP Real Exchange Rate International Tourism Receipts International Tourist Arrivals	T ↔ Y
Katircioglu (2009b)	Cyprus	Real GDP Trade Volume (X+I) Exports Imports International Tourist Arrivals	Y → T
Katircioglu (2009c)	Malta	Real GDP International Tourist Arrivals Real Effective Exchange Rate	T ↔ Y
Jackman & Lorde (2010)	Barbados	Household Expenditure Tourist Arrivals	No Relation
Katircioglu (2010a)	Singapore	Real GDP International Tourist Arrivals Real Effective Exchange Rate	T → Y
Katircioglu (2010b)	North Cyprus	Real GDP International Tourist Arrivals Number of Students enrolled in Higher Education Real Exchange Rate	T → Y
Lee & Hung (2010)	Singapore	GDP per Capita Total Tourist Arrivals Government Expenditure on Health per Capita	T → Y
Schubert, Brida & Risso (2010)	Antigua and Barbuda	Real GDP per Capita Real GDP pc USA (Demand) Real Exchange Rate	Y_{USA}→ T → Y
Lorde, Francis & Drakes (2011)	Barbados	Real GDP / GDP pc Long-Stay International Arrivals Special Drawing Rights (SDR) (proxy for Exchange Rate)	Ambiguous Results due to Leakages (Imports)
Katircioglu (2011)	Singapore	GDP Tourist Arrivals Exchange Rate	T → Y
Jackman (2012)	Barbados	Real GDP Tourist Arrivals from each Source Market Real Effective Exchange Rate	T → Y
Amaghionyeodiwe (2012)	Jamaica	GDP Tourism Receipts	T ↔ Y (T → Y Stronger)
Srinivasan, Kumar & Ganesh (2013)	Sri Lanka	GDP Tourism Receipts	T → Y
Kumar & Kumar (2012)	Fiji	Real GDP pc (Y) Tourism Receipts (% GDP) (T) Number Telecommunications Lines (ICT) Capital per Worker (K)	Y → T
Lee (2012)	Singapore	GDP(Y) International Tourist Arrivals (T) Exports (X) Imports(M)	Y→ T (Short-run)
Ghartey (2013)	Jamaica	GDP Tourist Arrivals	T → Y

		Tourism Receipts Real Exchange Rate Structural Changes Hurricanes	
Bandula Jayathilake (2013)	Sri Lanka	Real GDP International Tourist Arrivals Real Effective Exchange Rate	T → Y
Ridderstaat, Croes & Nijkamp (2014)	Aruba	Real GDP Tourism Receipts Number of Stay-Over Visitors	T ↔ Y (T → Y stronger)
Kumar, Stauvermann, Patel, Kumar & Prasad (2016)	Cook Islands	Real GDP pc Tourist Arrivals pc	T ↔ Y

Table 3: List of studies on the TLG hypothesis for island economies, using panel data

Panel Data			
Authors (date)	Destinations	Variables	Conclusion
Narayan, Narayan, Prasad & Prasad (2010)	4 Pacific Island Countries	GDP Tourism Exports	T → Y
Seetanah (2011)	19 Island Economies	Investment in Physical Capital Human Capital Openness of the Economy (X+M/GDP) Economic Freedom Index Tourist Arrivals Tourism Receipts pc	T ↔ Y
Aspergis & Paine (2012)	9 Caribbean Countries	Real GDP pc Real Effective Exchange Rate International Tourist Arrivals pc	T ↔ Y
Mazzola, Pizzuto & Ruggieri (2019)	13 Mediterranean Island Economies **(RAM)**	Annual Percentage Change in GDP pc Initial GDP pc Physical Capital Population aged 25-64 with higher education (%) Population Density Public Sector Gross Value Added Occupancy (Overnights/Arrivals) Supply (Available Beds / Establishments) Accessibility (Number of Aircraft Movements)	T → Y
Cannonier & Burke (2019)	15 Caribbean Islands	Tourism Receipts Tourist Arrivals Real GDP pc Initial GDP Investment Inflation Trade Volume Government Consumption Life Expectancy	T → Y
Roudi, Arasli & Akadiri (2019)	10 SIDS	GDP Tourism Receipts pc Energy Consumption Foreign Direct Investment	T ↔ Y

Most of the literature on the impact of tourism on island economies focuses on the so called "Small Island Developing States" (SIDS), where tourism traditionally plays a large role, such as Mauritius, Seychelles, Antigua and Barbuda, Barbados, Jamaica, Fiji, Bermuda, Aruba, Singapore or the Cook Islands. These studies have attempted to answer the question: "does tourism expansion positively affect economic growth?" and the causality relations found support one of three hypotheses:

i) Tourism-led Growth Hypothesis: Postulates that tourism export development leads to economic growth, and that, therefore, there is unidirectional causality running from tourism to economic growth (Balanguer & Cantavella-Jordá, 2002);

ii) Growth-led Tourism Hypothesis: Postulates that economic growth leads to the expansion of tourism exports through spillovers, which implies a unidirectional causal relation from economic growth to tourism;

iii) Feedback Hypothesis: Postulates that tourism development and economic growth are mutually reinforcing phenomena and translates into a bidirectional causal relationship.

From all the studies considered, 17 support the TLGH and 11 the Feedback Hypothesis. Two studies (Louca, 2006; Jackman & Lorde, 2010) find no causal relationship between the variables and the remaining 10 either have ambiguous results or support the Growth-led Tourism Hypothesis. In addition, the papers raised some fundamental issues on the impact of tourism in the economic growth for island economies.

Besides the usual independent variables (e.g., prices and income) explaining tourism demand, this variable may also be affected by exogenous factors related to natural disasters, terrorism, economic crisis and political instability (Lee & Chien, 2008), which means that a high dependence of an economy on tourism increases its vulnerability to structural breaks.

In addition, some of the studies mention that tourism growth depends on the exploitation of a destination's natural resources and that, in the long-run, tourism expansion might compromise economic growth and development or negatively impacts the environment, if it results in the overexploitation of those resources.

Furthermore, concerns on the possibility that island economies dependent on tourism might suffer from Dutch Disease also emerged. Dutch Disease occurs when there is a reallocation of resources from lagging sectors to the booming sector, namely tourism, leaving lagging

sectors in a worse situation than before. Capó, Font and Nadal (2007) examined the Balearics and Canary Islands, which are tourism "dependent", and found evidence for the existence of Dutch Disease given that tourism expansion has been leading to a deviation of resources and labor from manufacturing and agricultural sectors to construction and other tourism-related services. While in 1955 agriculture employed almost 60% of the population in the Canary and 40% in the Balearics Islands, in 2005 this percentage was around 1.5% for both regions. In comparison with other Spanish regions, the Balearics and Canary Islands are also found to be the least innovative regions, with the lowest levels of education which may translate into lower long-term growth.

In what concerns the subject of leakages, Pratt (2015) concludes that from every dollar spent on tourism in SIDS, only $0.69, on average, remain in the local economies. The explanation lies on the fact that the continuous specialization in tourism reduced the links between the tourism sector and the other economic sectors leading to an increase in imports needed to provide goods and services for the tourism industry. The same conclusion is reached in Narayan *et al.* (2010) for Pacific Island Economies, especially Fiji, which is heavily dependent on food imports. Leakages from imports are seen as a major problem for many island economies, being associated with the decrease in demand and output of other export sectors such as agriculture and manufacturing. When this is the case, tourism will not generate economic growth, or not as much growth, as if linkages between the sectors were fully developed (Pablo-Romero & Molina, 2013). Singh (2008), considering a sample of 37 island economies, also finds that the impact of tourism was positive but limited because the synergies between the different economic sectors were not sufficiently explored.

The present examination of the existing literature shows the importance of studying the determinants of economic growth. More so, as there is no relevant literature about it, the case of the ARM becomes of utmost urgency. The following chapters of this study take as singular aim to provide evidence about the importance of tourism exports as an engine for economic growth in this region.

CHAPTER III: DATA ANALYSIS

3.1. Introduction

This chapter provides a descriptive statistical analysis of all the data necessary to portrait a clear overview of the issues at hand and the methods used in the estimation of the empirical models. Section 3.2. provides a brief historic characterization of the Autonomous Region of Madeira (ARM). Section 3.3. gives an overview of the region's economy and demographics covering the period from 1990 to the present day, depending on data availability. Section 3.4. focuses on the ARM tourism sector. Section 3.5. provides information on the data collected for the variables that are included in the models estimated in chapter 4. Section 3.6. concludes providing a summary of the chapter.

3.2. Historic contextualization of the ARM

The Autonomous Region of Madeira (ARM) is a part of Portugal's territory, comprising two main islands, Madeira and Porto Santo, and two smaller ones, Desertas and Selvagens, which are qualified as natural reserves since 1971.

The archipelago was discovered in 1419, and colonized by Portuguese citizens, mostly farmers, soldiers and sailors, over the next couple of centuries. Up until the 17th century, the main export of Madeira was sugar. Later, from the 18th century onwards, wine became Madeira's most famous export. By the late 1800, a new industry that would become the single most important source of foreign currency for the island emerged: tourism. Due to Madeira's mild and pleasant climate, unique fauna and flora and "good air", the island became a famous place for tuberculosis treatments, attracting many patients and their families, medical staff and scientists. This good reputation spread across Europe throughout the nineteenth century, drawing rich aristocratic families from all over the world and transforming Madeira into an important healing and relaxing destination.

The increasing number of visitors led to the need for investment in infrastructures such as lodging, hospitals, roads, sewerage, and a channelled water system. As a consequence, the first part of the 20th century saw a surge of public investments in infrastructures such as the multiple expansions of Funchal harbor and the starting of a network of roads that would connect the entire region in the near future. Nevertheless, it is important to note that these roads were, at that time, still underdeveloped and most of the populated areas were still considerably isolated due to the lack of accessibility. Moreover, until the 1960, the majority of households still didn't have access to electricity or channeled water (Rodrigues, 2018).

On the 28th of August 1960, the first airport in the ARM, called *Porto Santo Airport*, was inaugurated, establishing an air connection between the archipelago and Lisbon. Up until this point, the only way to access the ARM was by boat, which of course constrained its development. On the 8th of July 1964, the new Santa Catarina Airport (now *Cristiano Ronaldo*) had its first flight, revolutionizing the region's economy, given the ease and cost effectiveness of the new way to transport tourists and goods from and to the mainland and other countries.

In April 1974, with the democratic revolution, Madeira gained the status of autonomous region with political, administrative, economic, and fiscal autonomy. The archipelago's economy flourished, even more so, after Portugal joined the European Union (EU) in 1986. From then on, the European budgets contemplated improvements to the Portuguese infrastructures and, inevitably, the ARM also benefited from those budget allocations.

The first fast track roads in the ARM started being constructed in 1989 and a crucial network of direct roads and tunnels was finished by 2010. Also, between 1982 and 1986, the Madeira Airport was expanded over the sea to improve its security and ease of landing and takeoff for large aircrafts. These investments allowed the tourism sector to develop faster and attracted millions of tourists to the region every year.

Nowadays, Madeira is referred to as the "*Pearl of the Atlantic*" due to its favorable and unique features and receives worldwide recognition as proven by the awards for "Europe's Leading Island Destination" that Madeira has been receiving every year since 2016 and for "World's Leading Island Destination" every year since 2015.

3.3. The Economy of Madeira

Article no. 349 of the Treaty on the Functioning of the European Union (TFEU)[3], identifies 9 Outermost Regions in the EU territory as having specific characteristics that constrain their economic and social development: "*remoteness, insularity, small size, difficult topography and climate, economic dependence on a few products*" (pp. 195). ARM is one of EU's Outermost Regions.

Being a small archipelago with a total area of 801 km^2 and an average population size not exceeding 255 000 souls, local demand is small, not allowing for scale economies and thus constraining production expansion. The ARM is also distant from major markets centers, meaning that, although being part of the EU free-trade area, the region does not fully benefit from the EU's sizeable internal market. In addition, the rugged terrain, implies that agriculture can only be done in small plots of land limiting production levels and increasing costs. The combination of all these factors leads the region to concentrating resources in a handful of products and industries, especially in the tertiary sector, and to looking for external demand to compensate for the small internal market. As a result, the tourism sector has been groomed as the best solution to overcome the region´s geo-economic constraints.

3.3.1 Demographics

Population

For the last 4 decades, the ARM population has been, with small ups and downs, around a quarter million. In 2019, the resident population of ARM was 254 254, roughly the same size it was in 1995. Figures 1 and 2 show two different aspects of the population variable in the period 1990-2019. Figure 3.1 illustrates the time trend of the variable in levels and Figure 3.2. depicts the time trends of the age groups. The age groups 0-14, 15-24 and 65+ are measured on the left-hand vertical axis, while the age group 25-64 is measured on the right-hand vertical axis.

[3] The TFEU was signed in 1957 in Rome by Belgium, France, Italy, Luxembourg, the Netherlands, and West Germany.

Figure 1, shows that the population level decreases until 1998, increases afterwards until 2010 and decreases again until 2018. These movements are linked with migration flows, due to the economic crises of the early 1990 and the financial crises of 2008. In addition to the recent decreasing trend, the region's population is also ageing like it happens everywhere else in Europe. While at the beginning of the sample period (1990), the younger age groups (under 24) represented around 43% of the population, at the end (2019), its weight was just over 25%. On the other hand, over this period, older population (65+) increased from about 12% to 17%, which represents an average annual growth rate of 1.6%, lower than the average of 2.2% observed for the 28 countries included in the EU (DREM, 2019).

Figure 1: Resident Population in the ARM 1990 - 2019

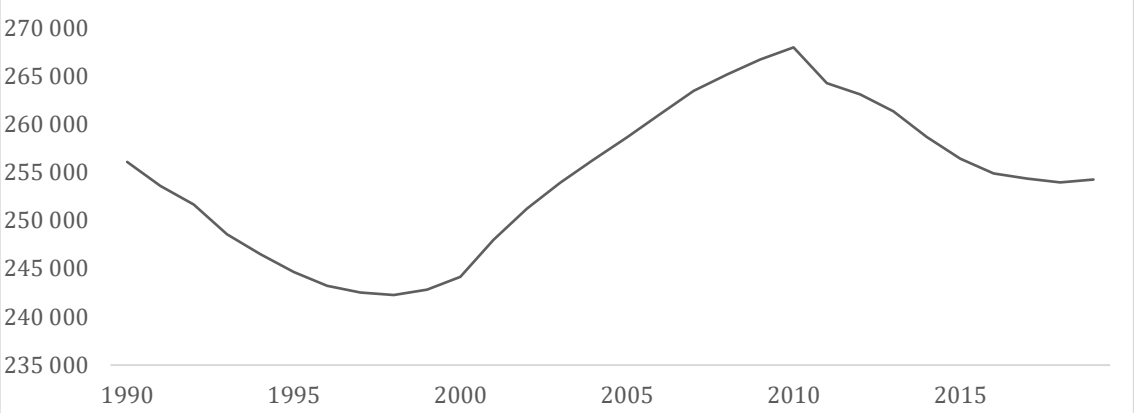
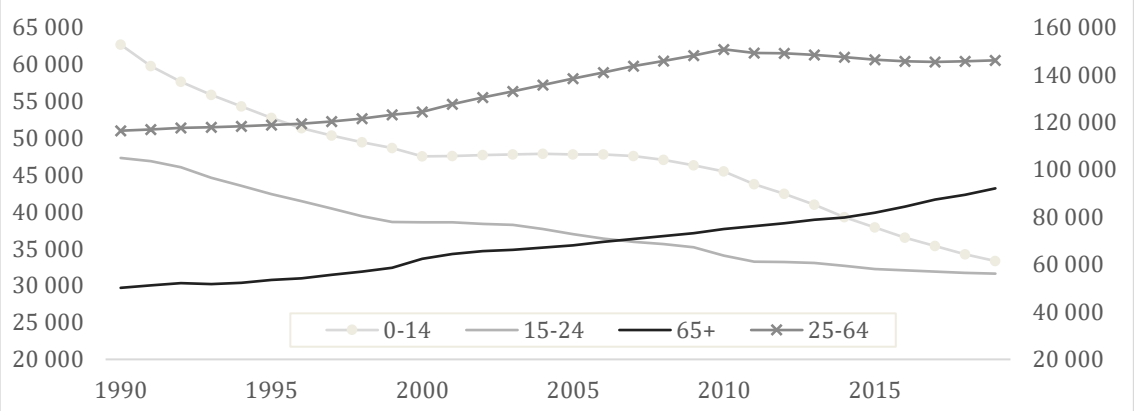


Figure 2: Resident Population in the ARM, by Age Groups, 1990-2019



Labour Force

Figure 3 compares the trends of the unemployment rates of ARM and Portugal, for the period 1998-2019. The two variables show similar behavior with the national unemployment

rate being higher than that of the ARM, up until 2010, and lower from then on. Due to the financial global crises of 2008, both rates attain their maximum level in 2013 (18% for the ARM and 16% for Portugal) steadily decreasing from then on until reaching 7% and 6.5%, respectively, in 2019.

Figure 3: Unemployment Rate in ARM and Portugal, 1998-2019

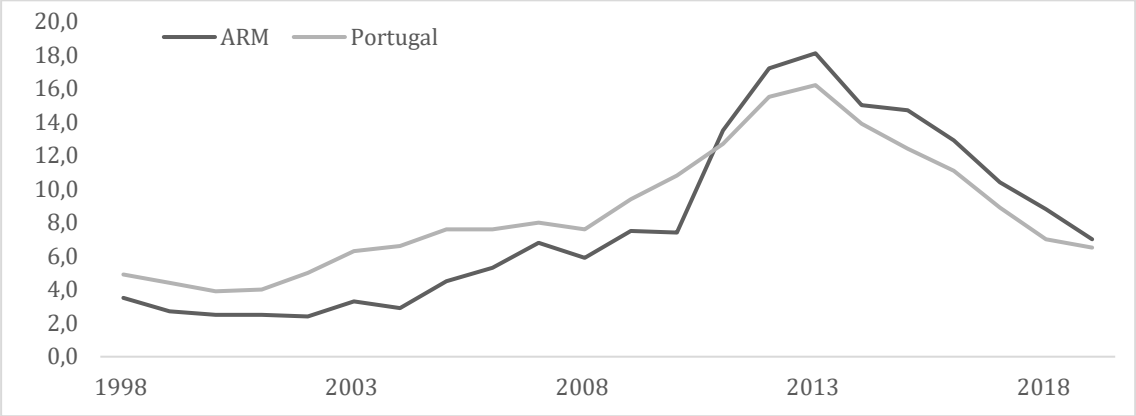
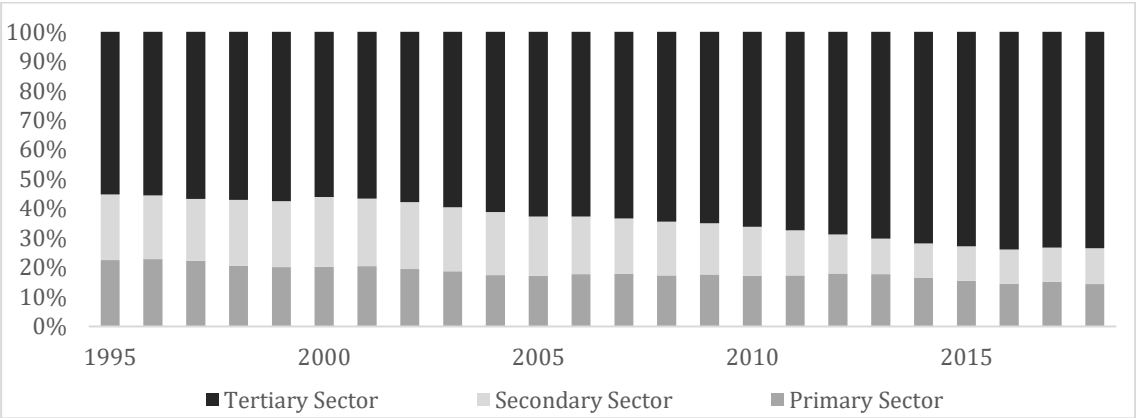


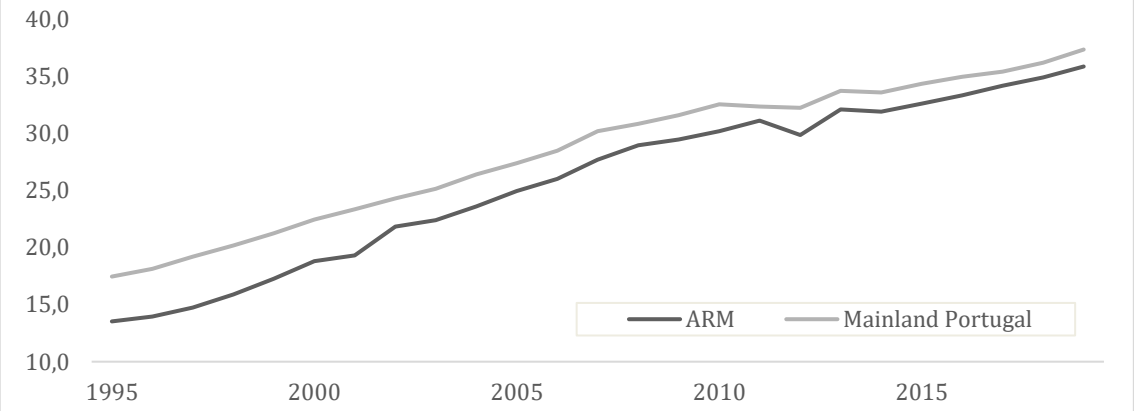
Figure 4 shows the ARM's total employment by economic sector in the period 1995-2018. As expected, the employment share of the primary sector (agriculture, forestry, and fishery), decreases from 23% in 1995 to 14% in 2018. Relatively more surprising is the abrupt decrease of the secondary sector share (industry, construction, energy, and water supply) from 22% to 12% in the same period. On the other hand, the services sector (wholesale, retail, transports, accommodation and food services, public, administrative and support services) appears to be the recipient of the lost jobs in the other two sectors, particularly, the secondary sector, as its employment share grows from 55% in 1995 to 73% in 2018. The data is consistent with the growing importance of tourism as a source of foreign currency, employment, foreign direct investment and, as showed in chapter 4, economic growth.

Figure 4: Employed Population by Sector (%) in ARM, 1995-2018



Another important variable to be considered is labor productivity. Thus, Figure 5 illustrates the trend of a productivity variable, measured as the ratio of gross value added (GVA) to total employment, known as employment apparent productivity (EAP), for the period 1995-2018. It is interesting to note that, in spite of the increasing importance of services relative to the other sectors, and the generaly accepted approach that services are characterized by lower levels of productivity, the EAP of the region's services sector more than doubles during the sample period. In addition, although Mainland Portugal shows a labour productivity higher than that of the ARM, the gap between the two regions has been closing, particularly since 2008.

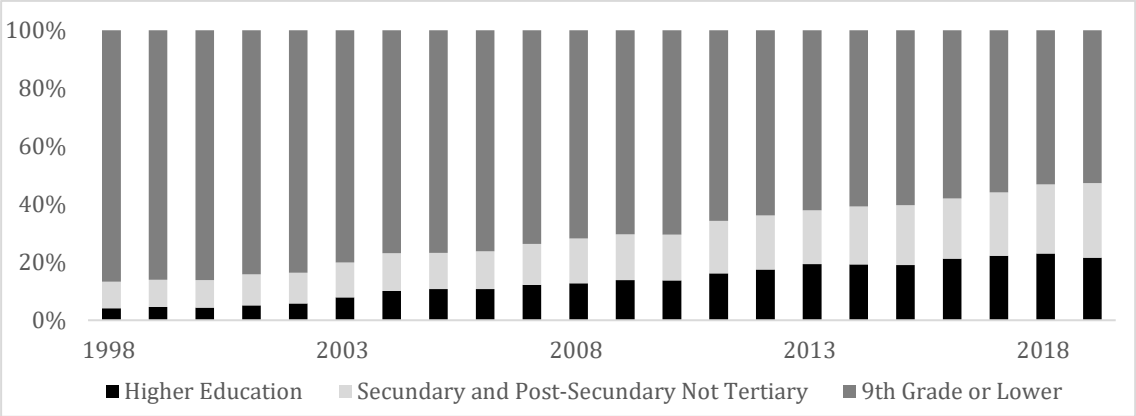
Figure 5: Employment Apparent Productivity, ARM and Mainland Portugal, 1995-2019



Education

The standard determinants of economic growth include human capital, physical capital and technological development. Hence, on the account of human capital, Figure 6 shows the ARM employed population by highest level of education attained between 1998 and 2019. The figure shows that the average level of education has been increasing over the mentioned period. Part of this growth is explained by the 2009 regulations change that extended compulsory education from the 9th to the 12th grade or until 18 years old.

Figure 6: Employed Population by highest level of education attained in the ARM (%)

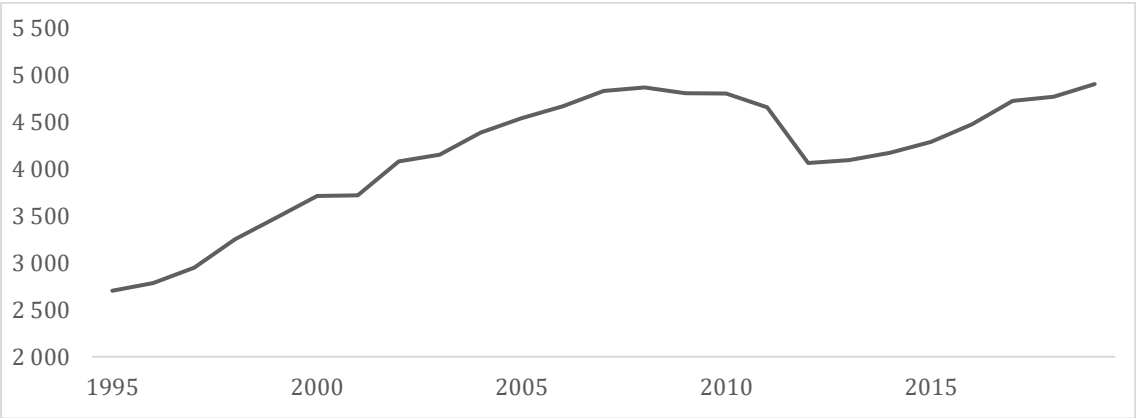


3.3.2. Economic Performance

Growth

The growth rate of real GDP per capita is the most used variable to proxy economic growth and, as such, the dependent variable in the majority of studies about the TLGH. Figure 7 depicts the trend path of the ARM's real GDP per capita over the period 1995-2019. There is a consistent positive trend of the ARM per capita real GDP up until 2008 (annual average of 6.2%), which is resumed after 2012, thought at a significant slower pace (annual average of 3.4%). Between these two paces of growth there is a structural break in the variable's trend, between 2009 and 2012, due to the negative effect of the global financial crisis on the region's economy.

Figure 7: Real GDP in the ARM, Million Euros, 1995-2019



The ARM's real GDP per capita is used as the dependent variable in the econometric models estimated in chapter 4. The series was obtained by deflating the nominal GDP series with the region's consumer price index, both available on DREM's online database under regional accounts and prices.[4]

Physical Capital and Investment

According to the Solow model, which is the theoretical framework of the empirical analysis developed in chapter 4, physical capital is one of the determinants of economic growth. This determinant can be proxied either by investment per worker or by the stock of capital per worker. Figure 8 shows the time-trend of the Growth Fixed Capital Formation (GFCF) per worker, or investment per worker, that is, GFCF divided by the level of employment (GFCF/Employment), for the ARM. In Figure 8, it can be distinguished two main periods of the variable's trend: up until 2005 there is a noticeable growth of the variable from 5.96 in 1995 to 13.57 in 2005 and, after that, a decreasing trend from 13.57 in 2005, to 4.39 in 2013. In the last five years of the sample, the decreasing movement is reversed and the variables picks up a somewhat anemic growth.

In the augmented version of the Solow model represented by equation (4.14), the stock of capital per worker is a theoretical determinant of economic growth. Since this is the model that we selected to our empirical analysis the stock of capital per worker is the appropriate variable to measure the impact of capital accumulation on the growth performance of the ARM. However, data for this variable is not available at the regional level (NUTS I), existing only at the national level. Thus, we assume that the stock of capital per Portuguese worker is a good proxy for the stock of capital per Madeira worker.

Figure 9 shows the time path of the capital stock per national worker, wherever he/she is from, in the period 1995-2019.[5] It can be observed a continuous growth of the variable until 2013, year were there is a clear break in the series, and a decreasing trend since. This abrupt change in the variable's behaviour is explained by the low levels of investment that followed

[4] Data on nominal GDP, resident population, employed population and consumer price index for the ARM were sourced from INE/DREM for the period 1995-2019

[5] Data on capital stock per worker was sourced from the AMECO database which is developed by the European Commission's Directorate General for Economic and Financial Affairs.

the crisis of the sovereign debts in Europe and the increase in total employment commonly seen after periods of crisis.[6]

Figure 8: Gross Fixed Capital Formation per worker in the ARM,1995-2018 (10^3 €)

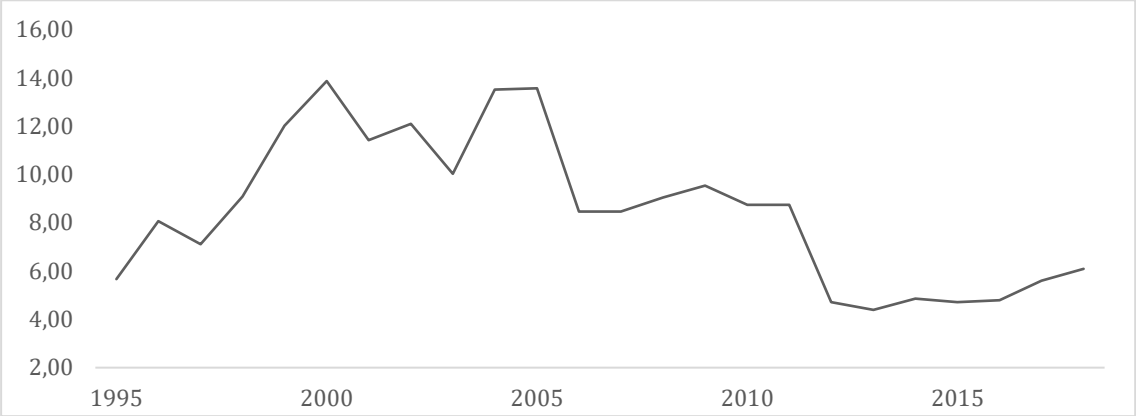
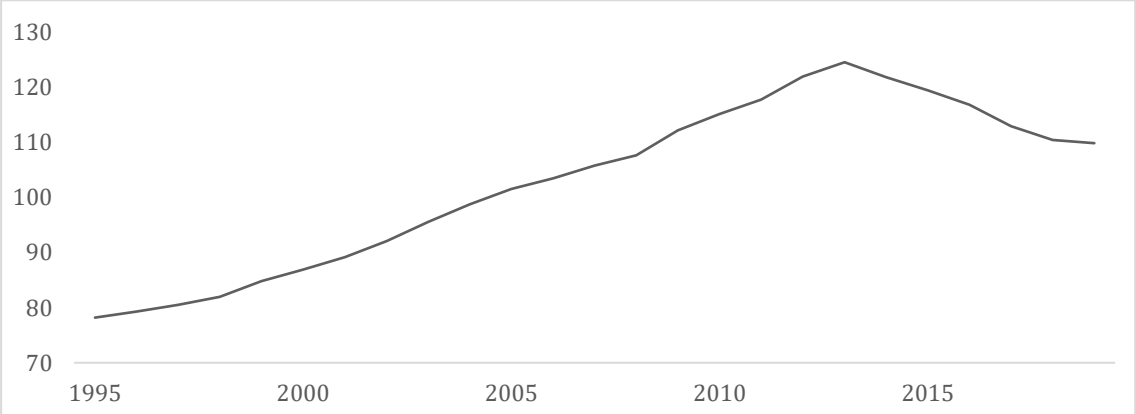


Figure 9: Capital Stock per worker in Portugal, (10^3 €), 1995-2019



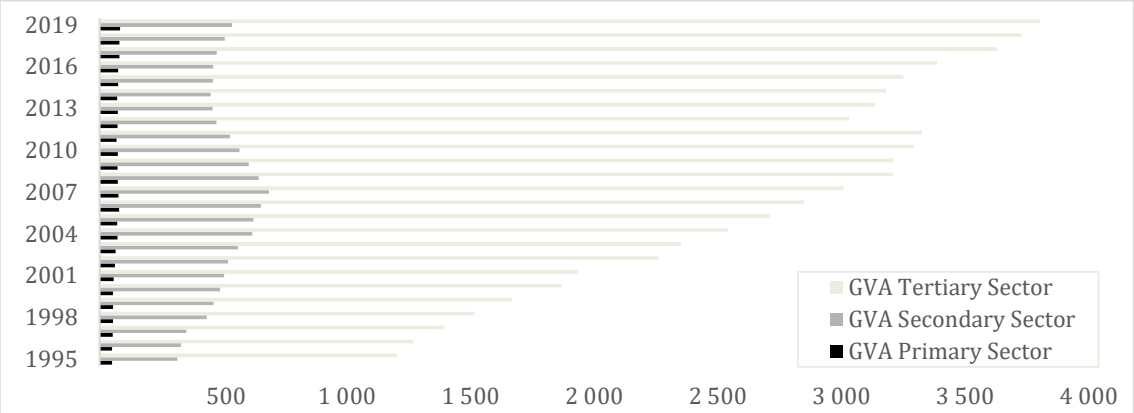
Economic Sectors

Since the 1990s, the ARM services sector has been gaining preponderance relative to the other two sectors of the economy, not only due to its own growth dynamics, but also because of a sustained decreasing weight of the other two sectors that seem to insufflate the labour "migration" from the primary and secondary sectors to the services sector. Figure 10 shows the gross value added by economic sector for the period 1995-2019, where it is possible to observe the increasing prominence of the tertiary sector in contrast to the small and

[6] The existence of a break in the series must be taken into account when performing unit root tests and estimating the model because, if ignored, these estimation results of the model can be invalid and misleading.

decreasing contribution of the primary sector. The secondary sector shows a distinct period of growth until 2007, a decreasing trend up until 2014 and a sluggish but consistent recovery since 2015. Before the crisis, in 2007, the primary sector represented 2% of total GVA, the industry represented 18%, and the services sector 80% but, by the end of the period, the sectors represented, respectively, 2%, 12% and 86% of total GVA. The secondary sector lost importance in total GVA due to the fastest growth of the tertiary sector.

Figure 10: Gross Value Added by Sector (10⁶€)



The theoretical determinants of growth within the augmented Solow model also include the ratios of manufacture and services exports to total exports. However, the only available data on the ARM exports are about exports of goods and nothing else. Thus, there is no available data about the ARM total exports, or even services exports. Nevertheless, given that we are interested in evaluating the impact of tourism exports on the ARM economic growth, we define two variables that are more pertinent for our purposes than the above-mentioned ratios. One, is the ratio of the region's exports of goods to the ARM gross value added (GVA), instead of total exports. The other, is the ratio of the tourism exports (expenditures of non-resident tourists in the region's territory) to the region's GVA.

Also not available is data about the expenditure of non-resident tourists in the ARM. To overcome this difficulty, we estimate the expenditure of foreign tourists per night spent in national territory, by dividing the total tourism exports of Portugal[7], by the number of "foreign" overnights. This gives an estimate of the expenditure per night of international tourists.

[7] This information is available in the Banco de Portugal database, in the "Balance of Payments" domain under the series name "Travel Credit Annual M€".

Assuming that a night spent in national territory, leads to the same amount of expenditure than a night spent in the archipelago of Madeira, we multiply the annual one-night expenditure by the annual amount of nights non-resident tourists spend in the ARM, and obtain an estimate for the total annual expenditure of non-resident tourists in the ARM, that is, an estimate of the region´s tourism exports. This variable divided by the region's GVA gives the ratio that, once included in the augmented Solow model, allows for the estimation of the impact of tourism on the economic growth of ARM. This ratio is denoted by XT.

As a proxy for the ratio of exports of manufactures to total exports we use the ratio of ARM's exports of goods to total GVA. This ratio is denoted XG.

Figures 11 and 12 show the time trends of, respectively, variables XT and XG for the period 1995-2019. The first main feature drawn from the observation of the graphs is the overwhelming weight of tourism exports in total GVA, when compared to the goods exports. Tourism exports ranges from a minimum weight in total GVA of 41% to a maximum of 68%. The goods exports never exceeded 7% over the same period.

Also deserving attention is the structural break in the XT variable between 2000 and 2010, accounting for events that might drive away non-resident tourists such as the joining of Portugal to the European currency in 2000 and the financial global crises of 2008. The growth pace of the variable is also much steeper from 2010 than it was from 1995.

Figure 11: Ratio of Tourism Exports to total GVA (%) in the ARM, 1995-2019

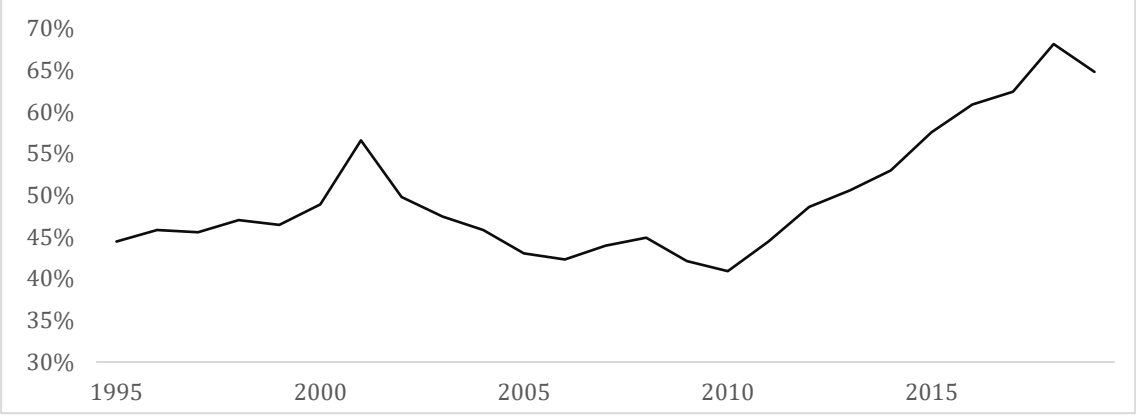
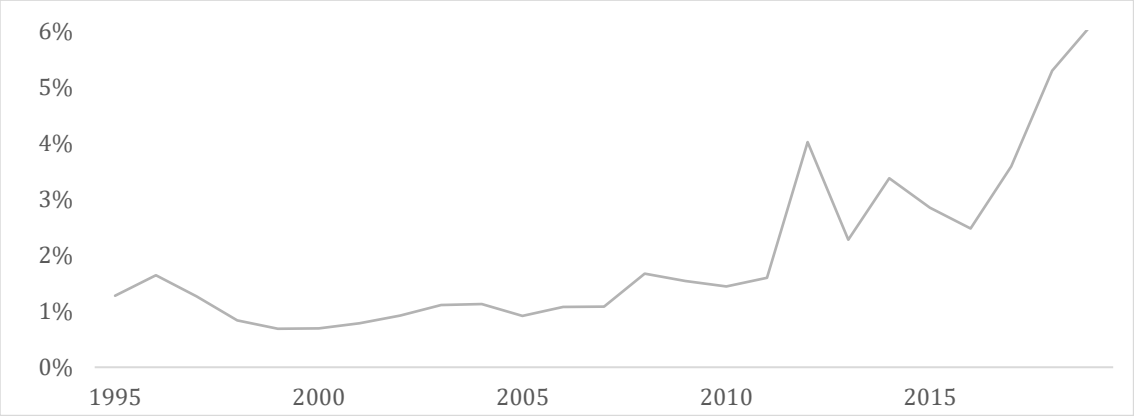


Figure 12: Ratio of Goods Exports to total GVA (%) in the ARM, 1995-2019



3.6. Summary

This chapter provided a brief description of the object of study of this research, the Autonomous Region of Madeira and its economic performance. We concluded that the region has faced considerable economic growth in the last decades, most of which is assumed to come from the development of the tourism sector and related activities in detriment of the primary and secondary sectors. The region has been focusing on developing the tourism sector for decades and it has become a significant share of Madeira's economy however, up until now, there was no significant literature supporting tourism as the main engine of economic growth in the ARM. This study will provide evidence that indeed the policy of nurturing the tourism sector is not only adequate but should be encouraged in the future.

CHAPTER IV: METHODOLOGY, ESTIMATION AND FINDINGS

4.1. Introduction

The aim of this chapter is to present the theoretical framework and econometric models used to test the tourism-led-growth hypothesis (TLGH) for the ARM. The empirical results obtained with the estimated models are also presented and interpreted, as well as their implications for the decision making in management. The rest of the chapter is structured in the following way: Section 4.2. derives the Solow growth model and its augmented version that includes variables representing tourism exports and goods exports. Section 4.3. presents the ARDL model to be used and its dynamic features. Section 4.4. presents the estimated results of the best selected model, as well as all the diagnostic tests that allow to qualify the chosen model as "the best". The section also provides the economic interpretation of the results. Section 4.5. summarizes the chapter.

4.2. The Solow Model

A significant portion of the TLG literature bases its analysis on the growth theoretical model developed by Solow, which uses a conventional Cobb-Douglas production function as a starting point. The traditional Solow (1956) model includes two substitutable inputs to the production process, labour and capital, as well as a measure of technological progress (total factor productivity). This model was criticized by Mankiw et al. (1992) for its assumption that an exogenous rate of technological progress is the only determinant of total factor productivity (TFP). Over the years several studies have tried to overcome this shortcoming by including additional variables as possible determinants of TFP. Knight, Villanueva and Loayza (1993) were the first to develop an augmented Solow model to include trade variables, under the assumption that a higher trade openness would foster more technology transfers and knowledge spill-overs and, consequently, an increased economic growth. The present research follows the same approach by including two trade variables, tourism exports and

goods exports, as possible additional determinants of TFP, causal factor of the economic growth of Madeira.

4.2.1. Derivation of the Solow Model

There are two versions of the Augmented Solow Model. The specification by Mankiw et al. (1992) includes the investment ratio as a proxy for physical capital accumulation, while the specification by Bosworth and Collins (2003) uses capital per worker instead. The derivation of both models is presented next.

Solow Model with Investment Ratio

The conventional Cobb-Douglas production function can be represented as:

$$Y_t = K_t^{\alpha}(A_t L_t)^{1-\alpha} \tag{4.1}$$

where Y_t is output in period t, K_t stands for capital, L_t is labour, and A_t is technological progress. The model assumes that $0 < \alpha < 1$ and $\alpha + (1 - \alpha) = 1$, meaning that there are constant returns to scale.

Expression (4.1) can be rearranged in the following manner:

$$y = k^{\alpha} \tag{4.2}$$

where $y = \frac{Y}{AL}$ denotes the output-technology ratio, and $k = \frac{K}{AL}$ is the capital-technology ratio.

The capital accumulation equation of the Augmented Solow Model is written as:

$$\dot{K}_t = iY_t - \delta K_t \tag{4.3}$$

where $\dot{K}_t$ denotes the derivative of capital stock, i is investment as a share of output, and δ is the depreciation rate of capital. As such, the annual growth rate of capital is given by:

$$\frac{\dot{K}}{K_t} = \frac{iY_t}{K_t} - \delta \tag{4.4}$$

The growth rate of the capital-technology ratio can be written as:

$$\frac{\dot{k}}{k} = \frac{\dot{K}}{K} - g - n \tag{4.5}$$

where the growth rate of technological progress is denoted by g, and the growth rate of the labour force, which is assumed to equal the growth rate of the population, denoted by n. Substituting expression (4.4) in (4.5) gives:

$$\frac{\dot{k}_t}{k_t} = \frac{iY_t}{K_t} - (\delta + g + n) \tag{4.6}$$

To isolate $\dot{k}$ we multiply both sides of the equation by the capital-technology ratio and after rearranging and collecting terms we get the following expression:

$$\dot{k} = iy_t - (\delta + g + n)k_t \tag{4.7}$$

In the long-run equilibrium, $\dot{k} = 0$ and the investment rate (i) equals the savings rate (s). As a result, (4.7) can be rearranged to isolate the steady-state output-technology ratio, k:

$$k^* = \left(\frac{s}{(\delta + g + n)}\right)^{1/(1-\alpha)} \tag{4.8}$$

Substituting equation (4.2) in expression (4.8), and rearranging, we get the long-run output per worker:

$$\left(\frac{Y}{L}\right)_t^* = A_t \left(\frac{s}{(\delta + g + n)}\right)^{\frac{\alpha}{1-\alpha}} \tag{4.9}$$

In the original Solow Model, A was only determined by the initial value the exogenous growth rate of the technological progress, g. However, the present study also includes a measure of goods exports (X_G) and tourism exports(X_T) as determinants of total factor productivity. As such, A can be written as:

$$A = e^{A_0} e^{gt} X_G^{\beta_1} X_T^{\beta_2} \tag{4.10}$$

in which A_0 is a constant, g is the exogeneous growth rate of technology, X_G is the share of goods exports in total gross value added (GVA) and X_T is the share of tourism exports in total GVA.

Substituting A given by (4.10), in (4.9) and taking logarithms, we get equation (4.11):

$$\ln\left(\frac{Y_t}{L_t}\right) = A_0 + gt + \beta_1 \ln X_G + \beta_2 \ln X_T + \frac{\alpha}{1-\alpha}\ln(inv) - \frac{\alpha}{1-\alpha}\ln(\delta + g + n) + \varepsilon_t \tag{4.11}$$

Solow Model with Capital per Worker

In the second specification of the Solow Model technology is assumed to be neutral, affecting in equal manner capital and labour. The model still exhibits constant returns to scale and can be represented by:

$$Y_t = A_t \, K_t^{\alpha} \, L_t^{1-\alpha} \tag{4.12}$$

In per worker terms, equation (4.12) is given by the expression:

$$\frac{Y_t}{L_t} = A_t \left(\frac{K_t}{L_t}\right)^{\alpha} \tag{4.13}$$

Substituting A, as given by (4.10), in (4.13) and taking logarithms we get equation (4.14):

$$ln\left(\frac{Y_t}{L_t}\right) = A_0 + gt + \beta_1 \, lnX_G + \beta_2 \, lnX_T + \alpha \, ln\left(\frac{K_t}{L_t}\right) + \varepsilon_t \tag{4.14}$$

Equation (4.14) is the theoretical framework underlying the specification estimated and interpreted in the empirical analysis done in section 4.4.

4.3. The ARDL version of the augmented Solow Model

To examine the relationship between economic growth and tourism exports described by the theoretical model in the previous section, we use an Autoregressive Distributed Lag (ARDL) model, as developed by Pesaran, Shin and Smith (2001). The choice of an adequate empirical model as the ARDL cannot be underestimated given that it presents three major advantages in relation to the cointegration techniques, such as Engle and Granger (1987) and Johansen (1988), applied to VAR specifications that are adopted in the majority of the TLG literature. First, it can be safely applied to small samples without worrying about inefficiency and bias problems (Pesaran et al., 2001). Second, it can be applied regardless of the variables being I(0), I(1) or a combination of both. However, it is still important to test for the variables' integration order since the ARDL cannot include I(2) variables. In this study, we applied the Augmented Dickey-Fuller (ADF) unit root tests (Dickey & Fuller, 1979) with an intercept and no trend option. Table 1 in Annex 1 summarizes the results of these unit root tests indicating that variables LXT, $LXT \times D0110$ and LXG are nonstationary in levels and

stationery in first differences, implying that they are I(1) and their first differences are I(0). On the other hand, TP is stationary in levels, meaning that it is are already I(0).

The variable LY shows a structural break in the period 2008-2012, reason why the ADF test is made with an intercept and a trend for this variable. The results of the test indicate that LY is $\mathrm{I}(1)$. The variable LP also has structural break in the period 2013-2019, although of a much higher magnitude than the one in LY, which weakens the usual ADF test with an intercept and a trend. Alternatively, the ADF test was applied for the period 1995-2013[8] and the results show that LP is an $\mathrm{I}(1)$ variable. Therefore, it is possible to safely apply the ARDL approach.

Third, the ARDL model, in contrast to the a-theoretical VAR specifications, if cointegrated, confirms a causal relationship from the determinants to the dependent variable, while validly supplying information about both the short-run dynamics and the long-run equilibrium relationship. The long-run relationship is defined through the underlying error-correction model (ECM) and the stability test for the equilibrium error (EQE) that is used to test the existence of cointegration vectors, providing evidence of a stable long-run equilibrium relationship between the variables of the model and, consequently, of a causal relationship from the explanatory variables to the dependent variable. The EQE is the residuals series of the regression estimated with the long run coefficients obtained through the ARDL model.

The ARDL model is specified using the "general to specific" approach (Hendry, 1995) that transforms a general unrestricted ARDL specification, into a parsimonious form that is consistent with the data generating process. Equation (4.15) represents the general ARDL specification of the theoretical relationship defined in equation (4.14).

$$LY_t = \beta_1 + \beta_2 LXT_t + \beta_3 LXT_{t-1} + \beta_4 LXT \times D0110_t + \beta_5 LXT \times D0110_{t-1} + \beta_6 LXG_t + \beta_7 LXG_{t-1} + \beta_8 LP_t + \beta_9 LP_{t-1} + \beta_{10} TP_t + \beta_{11} TP_{t-1} + \beta_{12} D04 + \beta_{13} LY_{t-1} + \mu_t \quad (4.15)$$

where the subscripts of t and $t-1$ denote, respectively, the current period and its one-year lag[9]; the dependent variable LY, is the natural logarithm of ARM's real GDP per capita, representing its economic growth; LXT and LXG denote the natural logarithms of,

[8] The number of observations after 2013 is insufficient to safely apply the ADF test for the period 2013-2019.
[9] The lag length has been defined by the Akaike (1974) and Schwarz (1978) criteria as not exceeding two. Given the exiguity of the sample we decided for a lag of one.

respectively, the ratios of tourism and goods exports to the gross value added; LP is the natural logarithm of Portugal's capital stock per worker, as a proxy for ARM's capital stock per worker, and TP denotes the growth rate of OECD's investment in R&D, as a proxy for technological progress. $D04$ is a dummy variable that assumes value 1 for the year 2004 and zero otherwise, standing for the UEFA Euro Cup in Portugal, which may have had a significant short run effect on the growth rate of the ARM. The dummy variable D0110, assuming value 1 for the period [2001; 2010] and 0 otherwise, stands for the break in the tourism exports data[10], due to the joining of Portugal to the European currency in 2000, the aftermath effects of the EURO 2004 and the financial global crisis of 2008. This variable is multiplied by LXT to account for the break in this variable's trend and included in the model as the slope dummy variables $LXT \times D0110_t$ and its lagged form, $LXT \times D0110_{t-1}$.

4.4. Presentation and Interpretation of the Estimation Results

Presentation of the Results

The estimation results of equation (4.15) are presented in Table 4 that, in its upper part shows the estimation results (p-values in parenthesis) [11] of the unrestricted (general) ARDL – "Regression 1" – and simpler parsimonious (specific) one – "Regression 2". The bottom part of Table 4 shows the diagnostic tests applied to both models. In addition, column 1 shows the variables' names; column 2, entitled "Regression 1", depicts the estimation results of the unrestricted (general) ARDL and column 3, entitled "Regression 2", displays the estimation results of the final parsimonious (specific) model[12] Given that the diagnostic tests of Regression 2 show a theory consistent, statistically robust and reliable specification, we only interpret the estimation results of this last model.

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[10] This structural break can be spotted in figure 9 (chapter 3) showing the time path of tourism exports of ARM.

[11] A p-value higher than 10% (>0.10) implies the non-rejection of the null hypothesis which, in the case of the individual significance test, implies the non-significance of the variable under test and its exclusion from more parsimonious forms of the specification.

[12] The intermediate results of the general-to-specific approach can be seen in Annex 2, where the third and fourth columns of Table 2, entitled "middle Regression 1" and "middle Regression 2" show the estimated results of these intermediate models.

Table 4: Estimation results of the general and specific ARDL models

	Regression 1	**Regression 2**
$Intercept$	0.9473 (0.15)	1.2326 (0.01)
LXT_t	-0.1112 (0.25)	
LXT_{t-1}	0.2854 (0.00)	0.2649 (0.00)
LXT_D0110_t	0.0369 (0.09)	
LXT_D0110_{t-1}	-0.0662 (0.02)	-.0692 (0.00)
LXG_t	-0.0399 (0.01)	-.03179 (0.00)
LXG_{t-1}	-0.0013 (0.92)	
LP_t	-0.6192 (0.18)	
LP_{t-1}	0.7384 (0.06)	0.2376 (0.00)
TP_t	0.5481 (0.12)	0.9846 (0.00)
TP_{t-1}	0.0512 (0.86)	
$D04$	0.0335 (0.06)	0.0299 (0.07)
LY_{t-1}	0.7559 (0.00)	0.5926 (0.00)
R^2	0.9924	0.9893
Adjusted R^2	0.9840	0.9846
F-Statistic	119.08 (0.00)	211.17 (0.00)
Normality (Jarque and Bera, 1980)	3.2922 (0.19)	2.3379 (0.31)
Serial correlation Breusch-Godfrey (Breusch & Gofrey, 1986)	4.1900 (0.12)	1.0898 (0.58)
Heteroscedasticity (White, 1980)	11.2781 (0.51)	7.7904 (0.35)
Functional form Ramsey RESET (Ramsey, 1969)	0.7773 (0.39)	0.0075 (0.93)

The results of Regression 1, show that variables LXT_t, LXT_D0110_t, LXG_{t-1}, LP_{t-1} and TP_{t-1} are not statistically relevant at the 10% level, implying their omission in the estimation of regression 2. The process of elimination of irrelevant variables consists of removing the variable with the lowest level of significance (highest p-value) and continue to do so until all the variables are statistically significant for a significance level of 10% or less (p-value $\leq$ 0.10). Note that, in this process, as one can see from the estimation results of the "middle regression 1" in Annex B (Table 6), variable TP_t, which was insignificant in Regression 1 (p-value = 0.12) became significant at the 1% level with the removal of other variables (p-value

= 0.00). On the other hand, variable LXT_D0110_t, which was significant in Regression 1 (p-value = 0.09) ended up being not significant in the "middle Regression 2", with a p-value of 0.20 and was consequently removed in the final regression.

Figure 13 shows the graph of the actual, fitted and residuals series where the almost overlapping values of the actual and fitted series confirm the regression's goodness of fit, for which the R^2 of 0.99, meaning that the model explains 99% of the dependent variable (LY) variability around its own mean. Regression 2 also shows a higher overall significance, as measured by the F-statistic, when compared to Regression 1.

Figure 14 depicts the output of the CUSUM (Cumulative Sum of Squares) function, showing the recursively estimated residuals well inside the 95% confident interval that supports the stability of the model with 95% confidence.

In addition, the diagnostic tests performed for regression 2 show no evidence of heteroscedasticity or serial correlation in the disturbances, as well as not rejecting normality for their distribution. Furthermore, the model is well specified with an adequate functional form, as supported by the result of the Ramsey test.

Figure 13: Actual, fitted and residual values

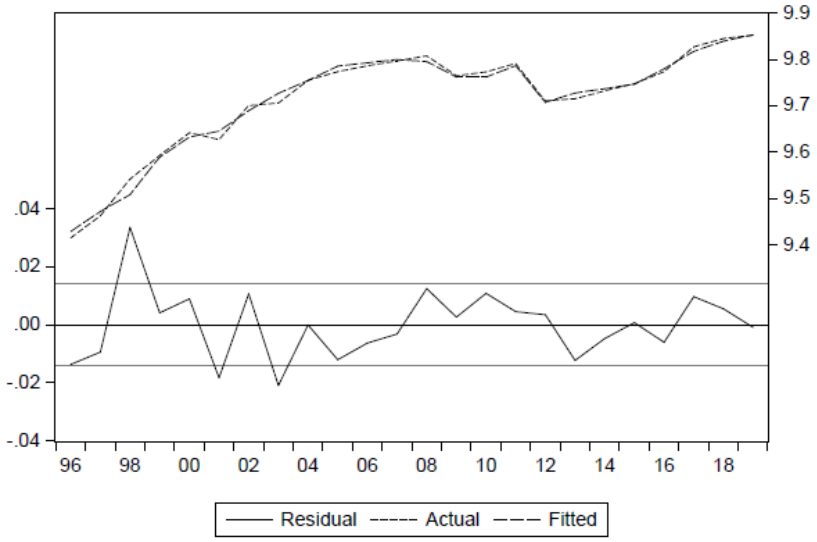
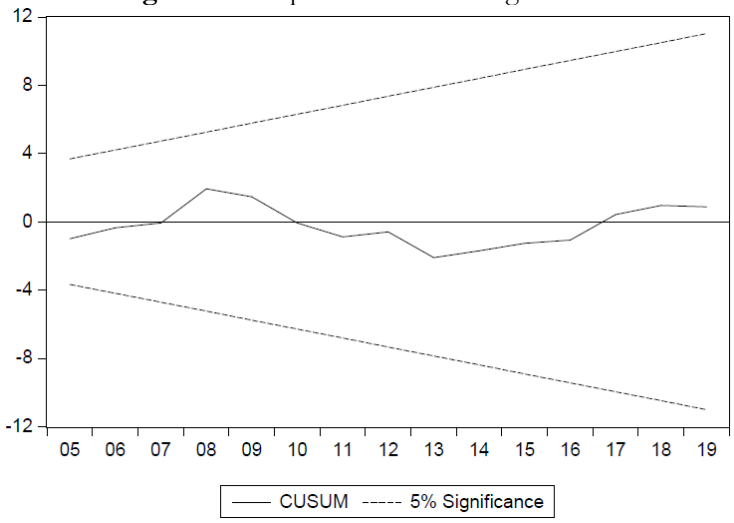


Figure 14: Output of CUSUM diagnostic test



Interpretation of the Coefficients Estimates

The coefficients' estimates of regression 2 are used to derive the short and long-run effects of changes in the determinants, on the dependent variable. Given the estimation results in table 4.1, regression 2 can be written in the following form:

$$\widehat{LY_t} = 1.2326 + \mathbf{zero} \times LXT_t + 0.2649LXT_{t-1} + \mathbf{zero} \times LXT \times D0110_t$$
$$-0.0692LXT \times D0110_{t-1} - 0.0318LXG_t + \mathbf{zero} \times LXG_{t-1} + \mathbf{zero} \times LP_t$$
$$+0.2376LP_{t-1} + 0.9846TP_t + \text{"}\boldsymbol{zero}\text{"} \times TP_{t-1} + 0.0299D04 + 0.5926LY_{t-1} \quad (4.16)$$

The coefficient of the lagged dependent variable, $\hat{\beta}_{13} = 0.5926$, corresponds to the estimate of the declining rate, which is used to compute the estimated velocity of adjustment (VA), such that, $VA = 1 - 0.5926 = 0.4074$.. This means that 41% of the adjustment of the dependent variable to its long run equilibrium path occurs in the current period, and 59% occurs in the following periods.

In equation (4.16), the current values of the variables' coefficients (subscript t) represent their short-run impacts on the dependent variable. The coefficients of variables with subscript t-1, added to the current time variables correspondent coefficients and pondered by the VA, give the long run impact of those regressors on the dependent variable. Variables with "zero" coefficients are the ones statistically insignificant and, therefore, excluded from the final model, having no impact on the dependent variable. We have included them in (4.16) as we believe that it makes it easier to see how the impacts of short and long-run are

computed. The interpretation of the short and long run effects and their respective computations are presented next.

Short-run coefficients

$Intercept$ $\hat{\beta}_1 = 1{,}2326$

LXT: $\hat{\beta}_2 = \text{"}\boldsymbol{zero}\text{"} = 0$ No short-run impact

$LXT \times D0110$: $\hat{\beta}_4 = \text{"}\boldsymbol{zero}\text{"} = 0$ No short-run impact

LXG: $\hat{\beta}_6 = -\,0.0318$

LP: $\hat{\beta}_8 = \text{"}\boldsymbol{zero}\text{"} = \mathbf{0}$ No short-run impact

TP: $\hat{\beta}_{10} = 0.9846$

$D04$: $\hat{\beta}_{12} = 0.0299$

Long-run coefficients

$Intercept$: $\frac{\hat{\beta}_1}{VA} = \frac{1.2326}{0.4074} = 3.02553$

LXT: $\frac{\hat{\beta}_3}{VA} = \frac{0.2649}{0.4074} = 0.65022$

$LXT \times D0110$: $\frac{\hat{\beta}_5}{VA} = \frac{-0.0692}{0.4074} = -0.16986$

LXG: $\frac{\hat{\beta}_6}{VA} = \frac{-0.0316}{0.4074} = -0.07757$

LP: $\frac{\hat{\beta}_9}{VA} = \frac{0.2376}{0.4074} = 0.58321$

TP: $\frac{\hat{\beta}_{10}}{VA} = \frac{0.9846}{0.4074} = 2.41679$

$D04$: $\frac{\hat{\beta}_{12}}{VA} = \frac{0.0299}{0.4074} = 0.07339$

Thus, the estimated long-run equilibrium relationship for the economic growth of ARM can be written as:

$$LY_t = 3.02553 + 0.65022LXT_t - 0.16986LXT \times D0110_t - 0.07757LXG_t + 0.58321LP_t + 2.41679TP_t + 0.07339D04 + \varepsilon_t \quad (4.17)$$

The residuals ε_t in regression (4.17), constitute the equilibrium error series (denoted "EQE"), which is used to construct the Error Correction Model (ECM), associated with the long-run relationship derived from the ARDL model. The EQE series is given by:

$$EQE_t = LY_t - (3.02553 + 0.65022LXT_t - 0.16986LXT \times D0110_t - 0.07757LXG_t + 0.58321LP_t + 2.41679TP_t + 0.07339D04_t) \quad (4.18)$$

To confirm the existence of a valid long run equilibrium relationship between the dependent variable (LY) and its determinants, the next step is to check for the existence of cointegration between the variables included in regression 2 of Table 4. This is done by applying the conventional unit root tests to the series EQE, defined above. If the series is stationary then, the long run equilibrium relationship expressed in (4.17), is meaningful and the variables involved in that relationship are cointegrated. The results of the unit root test for the EQE series, with no intercept and no trend are presented in Table 5:

Table 5: Unit root test for the EQE series

Null Hypothesis: EQE has a unit root			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.677455	0.0097
Test critical values:	1% level	-2.664853	
	5% level	-1.955681	
	10% level	-1.608793	
*MacKinnon (1996) one-sided p-values.			

The results in table 5 indicate cointegration at the 1% level and, consequently, we may conclude for the existence of a meaningful and stable long run relationship between the economic growth of ARM and its determinants. Consequently, we can say that there is a causal link between the variables of the ARDL model runing from the regressores to the dependent variable, which allows the conclusion for a meaningful positive and stable causal connection from tourism exports to growth performance in the archipelago of Madeira.

Pesaran and Shin (1995) have shown that:

"*valid asymptotic inferences on the short-run and long-run parameters can be made, using the least squares estimates of the ARDL model, once the order of the ARDL model is appropriately augmented to allow for possible contemporaneous correlation between the error terms. Therefore, the ARDL method continues to be applicable even if the explanatory variables are endogenous and irrespective of whether they are I(1) or not*", (Pesaran & Pesaran, 1997, pp. 183-4).

Consequently, if the existence of a long-run cointegrated relationship between the dependent variable and its regressors cannot be rejected, the existence of potentially endogenous regressors of the appropriately augmented ARDL model should not affect the validity of the conclusions we take based on its estimation results.

Once the cointegrated relationship has been established and mantaigning everything else constant, we can now interpret the estimates for the short and long run effects of the regressors on the economic growth of ARM. Starting with the short-run effects, that is, starting with changes of the determinants in the current period that impact the dependent variable also in the current period, Madeira's goods exports have a negative and almost irrelevant impact on the region's economic growth. In fact, a 1% increase in XG (ratio of goods exports to total GVA) in the current period, results in a 0.03% decrease in real GDP per capita in the same period. Also, an increase of 1 percentage point (pp) in the growth rate of OECD's investment in R&D in time t, leads to a 98% increase in Madeira's GDP per capita, in the same period. It is important to note that an increase of 1pp in the growth rate of R&D investment would represent, for 2019, an additional spending of over 13000 million US dollars.

The estimated coefficient of the dummy variable $D04$ shows that, in the year 2004, there is an additional increase in real GDP per capita of 0.01%. Indeed, with everything else constant, the estimated annual average growth of the real GDP per capita in the short run, except for the year of 2004, is $e^{1,2326} = 3.43\%$; For the year 2004, the same growth rate, is $e^{1,2326+0.03} = 3.53\%$. Thus, the difference between the two short-run growth rates is 0.01%.

Turning now to the interpretation of the long run impacts, we start with variable LX, which has to be interpreted in two different situations, given the structural break that affects its trend, accounted for by the slope dummy variable D0110. Thus, the impact of the LX variable on the per capita GDP growth must be analysed for distinct periods: when the dummy is 1 (within the period 2001-2010) and when it is zero (outside the period 2001-

2010). For the periods outside [2001-2010] (when D0110 = 0), a 1% increase in the current period value of XT, leads to a 0.65% increase in the long run value of the region's GDP per capita. Within the period 2001-2010 (when D0110 = 1), the impact is relatively smaller, given that the long-run increase in Madeira's GDP per capita is now of only 0.48%.

In what concernes the exports of goods, a 1% increase in the ratio XG results in a 0.08% decrease in the region's GDP per capita, in the long-run. Also, a 1% current increase in variable LP (capital stock per worker) leads to a 0.58% increase in the region's GDP per capita, in the long run. In addition, an increase of 1 percentage point (pp) in the growth rate of OECD's investment in R&D leads to a 242% increase in Madeira's GDP per capita in the long run. Finally, the dummy variable $D04$ shows that there is an additional increase in real GDP per capita in the long-run of 1.57% resulting from the events of 2004 ($e^{3,02553}$ = 20.60% and $e^{3,02553+0.07339}$ = 22.17%, thus the difference between the two long-run growth rates is 1.57%).

4.5. Summary

The chapter presents the theoretical Solow Model and the ARDL econometric model used in the empirical analysis, which shows that the final parsimonious ARDL model selected, denoted as 'Regression 2', is an adequate, theoretically consistent and statistically robust specification . The test for the existence of cointegration between the dependent variable and its determinants shows a stable long-term relationship which implies that there is a causal relationship stemming from the explanatory variables to real GDP per capita.

The results obtained from the estimation of this model show that goods exports have a negative but small effect on the region's GDP per capita, both in the short and long run, which contradicts the mainstream results in the literature, but is consistent with the economic framework of the ARM as a remote and away from the main markets region.

In addition, technological progress, measured by the growth rate of OECD's investment in R&D has a large, significant and positive impact in both short and long run. Capital stock per worker also has a significant positive impact on real GDP per capita in the long run, but none in the short run. Furthermore, the results point to a positive long-run impact of tourism exports on the economic growth of the ARM.

CHAPTER V: CONCLUSION

This Chapter brings together all the work done previously in order to interpret it within the economic context of the ARM. In the light of the empirical evidence supplied along the dissertation, we draw the possible conclusions and suggest some lines of action for local economic agents, in particular, those involved in the daily management of the public and private businesses of trade, tourism and related commercial activities.

The aim of this dissertation is to contribute a study about the growth performance of the Autonomous Region of Madeira (ARM), which is mainly absent from the specialized literature, investigating whether the tourism-led growth hypothesis is applicable to the ARM context, given its high level of specialization in tourism and the particular conditions that entail its economy as a remote small island in the middle of the Atlantic Ocean.

The research uses an augmented Solow Model as the theoretical framework from which is derived the ARDL model that translates the relationship between the ARM economic performance and its determinants, for the period 1995-2019. The model is estimated using Hendry's "general-to-specific" approach, which provides a final parsimonious regression that presents all coefficients' signs and magnitudes consistent with the economic theory; passes all the diagnostic tests proving to be a statistically robust specification; shows cointegration among its variables validating the existence of a meaningful and stable long run equilibrium relationship between the dependent variables and its explanatory regressors, allowing for the manifestation of a causal link from the tourism exports variable to the economic growth performance of the ARM..

The empirical results point to a positive long-run relationship from tourism exports to economic growth, namely that a 1% increase in the tourism exports regressor, leads to a 0.65% increase in GDP per capita. These results support the tourism-led growth hypothesis meaning that there is a causal relation running from tourism expansion to economic growth. Therefore, there is sufficient evidence supporting the claim that increasing investments in the region's tourism sector leads to increasing levels of the region's real GDP per capita. This conclusion gives economic agents the empirical support needed to require additional government assistance to the sector, either through subsidies and incentives to investment

or fiscal policies that encourage the settlement of new businesses, given that its growth can haul along the whole region's economy.

The empirical analysis also shows that the exports of goods have a rather small and negative effect on the region's GDP per capita growth, both in the short and long run. Although this conclusion seams to contradict the mainstream results in the literature, it is not surprising for a small island economy like the ARM, highly dependent on just one "product". This negative impact can be explained by the fact that Madeira is highly specialized in tourism, meaning that there is an opportunity cost of diverting resources from this sector to other less efficient ones. As found by Capó, Font and Nadal (2007), this can be a long-term consequence of the so called "Dutch Disease" which occurs when there is a reallocation of resources from lagging sectors to a booming sector, leaving lagging sectors stripped of their resources and limiting their productivity. In fact, between 1995 and 2019 the secondary sector's share of total employment decreased from 22% to 12% and its share of GVA decreased from 20% to 12% over the same period.

This line of events may be worrisome given that it is highly unlikely that an economy can rely almost exclusively on tourism in the long-term. Existing studies mentioned in chapter 2, conclude that the tourism sector is highly affected by exogenous factors such as natural disasters, economic crisis or the emergence of new competitive destinations (Lee & Chien, 2008), which means that an increasing dependence on this sector may leave the economy weaker and more vulnerable to exogenous shocks.

In addition, the lack of associations among economic sectors has been proved to constrain tourism ability to generate growth, due to the resulting leakages from imports (Pratt, 2015). In fact, food and agricultural products, which are quite important for the tourism industry, accounts for 32% of the 2019total ARM imports. If, as suggested by Pablo-Romero & Molina (2013), the primary and secondary sectors were developed more in connection with the tourism sector, instead of being independently settled or simply neglected, then the region's growth generated by tourism would be higher given that, on the one hand, some products could be sourced from domestic sectors instead of imported and, on the other hand, other goods would benefit from being sold *in situ* to tourists, instead of exported baring higher storage and transportation costs. Good examples of a promising symbiotic relationship in this line of reason would be, the Madeira wine in the primary sector and the traditional embroideries in the manufacturing sector.

The relationship between tourism and economic growth in the ARM deserves further investigation. The hypothesis of a feedback relationship between the variables, with causality running both ways, has not been tested in this dissertation, as it would require different econometric specifications, such as a VAR model, and the application of causality tests, such as Engle & Granger (1987).

Furthermore, there is still the matter of whether the causal relationship between tourism and economic growth is sustainable in the long-term. Some authors find that there is a decreasing marginal economic growth as tourism specialization increases, which implies that destinations such as the ARM should plan, and act upon, the diversification of their economies.

Although the pursuit of these lines of research would be highly interesting and relevant, the constraints to the present dissertation in terms of its extension and deadline do not allow for further research do be done at the present moment.

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ANNEXES

Annex 1

Table 6: ADF unit root test results (1996-2019)

Variable	ADF(0)		Conclusion
	Level	1st Difference	
$LRXT$	-0.2897	-3.9352***	$I(1)$
$LRXT\_D0110$	-1.3633	-4.3548***	$I(1)$
$LRXG$	-0.2679	-5.8400***	$I(1)$
LP	0.8912	-3.5569**	$I(1)$
TP	-3.1884**	-5.2288***	$I(0)$
LY	-2.2424	-3.5653**	$I(1)$
***, ** and * denote significance at the 1%, 5% and 10% levels respectively			

Annex 2

Table 7: Empirical Results of the Models Estimated

	Regression 1	**Middle Regression 1**	**Middle Regression 2**	**Regression 2**
$Intercept$	0.9473 (0.15)	1.0082 (0.06)	1.1935 (0.02)	1.2326 (0.01)
$LRXT_t$	-0.1112 (0.25)	-0.1082 (0.22)		
$LRXT_{t-1}$	0.2854 (0.00)	0.2760 (0.00)	0.2685 (0.00)	0.2649 (0.00)
$LRXT \times D0110_t$	0.0369 (0.09)	0.0368 (0.07)	0.0234 (0.20)	
$LRXT \times D0110_{t-1}$	-0.0662 (0.02)	-0.0646 (0.00)	-0.0822 (0.00)	-0.0692 (0.00)
$LRXG_t$	-0.0399 (0.01)	-0.0400 (0.00)	-0.0353 (0.00)	-0.0318 (0.00)
$LRXG_{t-1}$	-0.0013 (0.92)			
LP_t	-0.6192 (0.18)	-0.6495 (0.11)		
LP_{t-1}	0.7384 (0.06)	0.7519 (0.03)	0.2094 (0.00)	0.2376 (0.00)
TP_t	0.5481 (0.12)	0.5329 (0.09)	0.8638 (0.00)	0.9846 (0.00)
TP_{t-1}	0.0512 (0.86)			
$D04$	0.0335 (0.06)	0.0332 (0.04)	0.0301 (0.06)	0.0299 (0.07)
LY_{t-1}	0.7559 (0.00)	0.7699 (0.00)	0.6297 (0.00)	0.5926 (0.00)
R^2	0.9924	0.9923	0.9904	0.9893
Adjusted R^2	0.9840	0.9864	0.9853	0.9846
F-Statistic	119.08 (0.00)	168.20 (0.00)	193.98 (0.00)	211.17 (0.00)
Normality test (Jarque and Bera)	3.2922 (0.19)	2.6172 (0.27)	2.8609 (0.24)	2.3379 (0.31)
Serial correlation (Breusch-Godfrey)	4.1900 (0.12)	4.3677 (0.11)	2.7288 (0.26)	1.0898 (0.58)
Heteroscedasticity (White)	11.2781 (0.51)	9.6747 (0.47)	6.1886 (0.63)	7.7904 (0.35)
Functional form (Ramsey RESET)	0.7773 (0.39)	0.5692 (0.47)	0.012 (0.91)	0.0075 (0.93)