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THE INFLUENCE OF SOCIO-ECONOMIC AND GEOGRAPHICAL CONDITIONS ON AIR PASSENGER TRANSPORT AND ITS IMPLICATIONS FOR THE TOURISM INDUSTRY

Rodrigo Vieira Ventura

Tese de Doutorado apresentada ao Programa de Pós-graduação em Engenharia de Produção, COPPE, da Universidade Federal do Rio de Janeiro, como parte dos requisitos necessários à obtenção do título de Doutor em Engenharia de Produção.

Orientador: Elton Fernandes

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Orientador: Elton Fernandes

Aprovada por: Prof. Elton Fernandes
Prof. Lino Guimarães Marujo
Prof. Nelson Francisco Favilla Ebecken
Prof. Eduardo Lima Campos
Prof. José André de Moura Brito
Prof. Manoela Gonçalves Cabo

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THE INFLUENCE OF SOCIO-ECONOMIC AND GEOGRAPHICAL CONDITIONS ON AIR PASSENGER TRANSPORT AND ITS IMPLICATIONS FOR THE TOURISM INDUSTRY

Rodrigo Vieira Ventura

Abril/2023

Orientador: Elton Fernandes

Programa: Engenharia de Produção

A indústria do turismo possui uma relação intrínseca com o setor de aviação civil. Da mesma forma que turismo e aviação civil têm impacto positivo sobre a economia, ambos são fortemente influenciados pela sua evolução. O escopo da tese é a investigação da influência das condições socioeconômicas e geográficas no transporte aéreo de passageiros e seus impactos sobre a indústria do turismo. Através de análise de dados em painel considerando efeitos individuais do período e da *cross-section*, a primeira etapa da pesquisa fornece evidências de que fatores macroeconômicos, geográficos e espaciais são determinantes de como a demanda por passagens aéreas no Brasil responde a variações de renda e preço. Trata-se de um resultado de relevância estratégica para um país de dimensões continentais, contribuindo para o processo decisório e a formulação de políticas, programas e projetos públicos e privados para esta indústria. O valor estratégico torna-se ainda mais evidente no caso das conexões aéreas que ligam cidades localizadas em regiões remotas. Disparidades socioeconômicas e geográficas podem resultar em desigualdade no acesso ao transporte aéreo, o que pode afetar negativamente a indústria do turismo em regiões mais desavantajadas. Por outro lado, a oferta de voos regulares tem o potencial de estimular o turismo, gerando empregos locais e dando suporte às economias regionais. Neste sentido, a segunda etapa da pesquisa investiga os determinantes do turismo internacional, propondo um modelo teórico ancorado em três *drivers*.

Abstract of Thesis presented to COPPE/UFRJ as a partial fulfillment of the requirements for the degree of Doctor of Science (D.Sc.)

THE INFLUENCE OF SOCIO-ECONOMIC AND GEOGRAPHICAL CONDITIONS ON AIR PASSENGER TRANSPORT AND ITS IMPLICATIONS FOR THE TOURISM INDUSTRY

Rodrigo Vieira Ventura

April/2023

Advisor: Elton Fernandes

Department: Production Engineering

The tourism industry has an intrinsic relationship with the civil aviation sector. The same way tourism and civil aviation have a positive impact on the economy, they are both strongly influenced by its evolution. The scope of the thesis is the investigation of the influence of socioeconomic and geographic conditions on passenger air transport and its impacts on the tourism industry. Through panel data analysis considering period and cross-section individual effects, the first stage of the research provides evidence that macroeconomic, geographic, and spatial factors are determinants of how the air tickets demand in Brazil responds to income and price variations. This is a finding of considerable strategic relevance in a continent-sized country, which contributes to the decision-making process and the formulation of public and private policies, programs and projects for this industry. This strategic aspect becomes even greater in the case of air connections linking cities located in remote regions. Socio-economic and geographical disparities can lead to unequal access to air transport, which may adversely affect the tourism industry in more disadvantaged regions. On the other hand, the supply of regular flights could stimulate tourism, generating local jobs and supporting the regional economy. In this sense, the second stage of the research investigates the determinants of the international tourism proposing a theoretical model anchored on three drivers.

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1 INTRODUCTION

Tourism will play a strategic role in the economic development, the promotion of social welfare, and the environmental sustainability of countries and regions throughout the 21st century. This is why the industry is currently recognised as a key component for the national economies, bringing cultures closer together and promoting people-to-people exchanges that benefit countries and companies.

In the tourism industry, air transport is an integral part of enabling national and international travels. Tourism has an intrinsic relationship with the civil aviation sector, as it is the most widely used mode of transport covering long distances.

The same way tourism and civil aviation have a positive impact on the economy, they are both strongly influenced by its evolution. Given this context, the scope of the present thesis is the investigation of the influence of socioeconomic and geographic conditions on passenger air transport and its impacts on the tourism industry.

The research, as consolidated in this thesis, is anchored in four core papers published in scientific journals and/or presented at international conferences. These are:

i. VENTURA, Rodrigo V.; Fernandes, Elton; Aprigliano Fernandes, Vicente; Cabo, Manoela; Cesar Fadel, Augusto; Caixeta, Rafael. **Consumer behaviour analysis based on income and price elasticities: the case of the air transportation in Brazil**. Case Studies on Transport Policy, v. 10, p. 1262-1272, 2022.

ii. VENTURA, Rodrigo V.; Fernandes, Elton; Cabo, Manoela; Aprigliano Fernandes, Vicente; Caixeta, Rafael. **Air Transportation Income and Price Elasticities in Remote Areas: The Case of the Brazilian Amazon Region**. Sustainability, v. 12, p. 6039, 2020.

iii. VENTURA, Rodrigo V.; Fernandes, Elton; Cabo, Manoela; Aprigliano Fernandes, Vicente; Carvalho; Carla F. de Mello. **Drivers of the world tourism: a regional view**. In: The 2nd BRICS Research Conference, 2023, Kota. BRICS Research Conference, University of Kota, India, 2023.

iv. VENTURA, Rodrigo V.; Fernandes, Elton; Tshikovhi, Ndivhuho; Sharma, Anukreetii Jai. **BRICS and G7 countries tourism: a comparison**. In: XIV Russian International Studies Association (RISA) Convention, 2022, Moscow. World Beyond Convention, MGIMO University, Russia, 2022.

The first two papers are part of Stage 1 of the research. They examine the income-price elasticities of air passenger transport demand and its dynamics regarding geographical and economic factors. The study investigates the variability of the elasticity in a single market, the Brazilian airline market, given all the regional heterogeneity that particularises the country, as well as in the face of the distinct macroeconomic scenarios that shaped the national economy in the recent period. The elasticity in remote cities of the Brazilian Amazon is also examined, with a comparison with the elasticity obtained for the so-called trunk links, which connect the state capital cities of the country.

The last two papers comprise the Stage 2. They investigate the drivers of international tourism, analyzing the particularities of the different touristic regions of the planet. Besides the geographical view, illustrated by the grouping of the investigated countries according to the five touristic macro-regions (as classified by the World Bank), a geopolitical approach is also performed, focusing on the comparison between emerging *versus* developed economies. Beyond the influence of the macroeconomic conditions, the civil aviation market dynamics, and the socioeconomic structure of the countries (their relative weight in the world economy), the effects of the economy on the industry are also analysed through an examination of the globalisation phenomenon.

1.1 Stage 1 | Elasticity of air passenger transport demand dynamics

1.1.1 Overview

Aviation provides the only rapid worldwide transport network, which makes it essential for global business and tourism. Air transport is the main way to easily and safely move cargo and people over long distances and in a short period of time. This is why the industry has been the subject of increasing interest from public and private organisations over the last decades. A growing interest that is reflected in almost every part of the world and covers both domestic and international air routes.

The civil aviation plays a vital role in facilitating economic growth, particularly in developing countries. Airlines transported over 4.5 billion passengers in 2019, with Revenue Passenger Kilometres – RPK (the distance flown by all passengers) totalling nearly 8.7 trillion. Air transport facilitates world trade. It helps countries contribute to the global economy by increasing access to international markets and allowing the globalisation of production (ATAG, 2020).

Aviation is indispensable for tourism, a major engine of economic growth, especially in emerging economies. Globally, 58% of international tourists travel by air. Connectivity contributes to improved productivity by encouraging investment and innovation, improving business operations and efficiency, and allowing companies to attract high-quality employees (ATAG, 2020).

Aviation's global economic impact (direct, indirect, induced and tourism catalytic)[1] was estimated at USD 3.5 trillion (Figure 1), equivalent to 4.1% of world Gross Domestic Product (GDP) (Oxford Economic, 2020)[2]. Around 1,478 airlines operate a total fleet of over 33,299 aircraft. They serve almost 3,800 commercial airports through a route network of several million kilometres managed by 170 air navigation service providers.

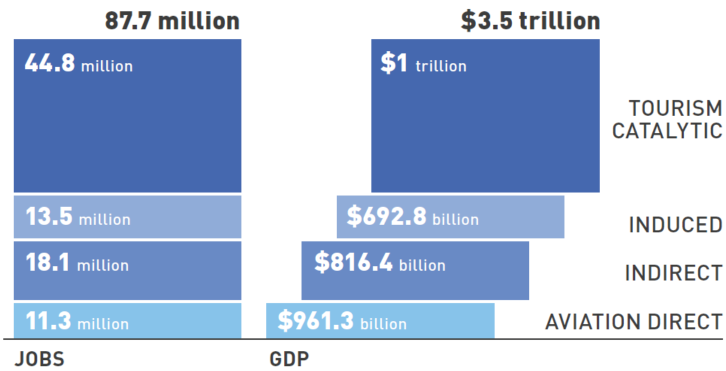

Figure 1 – Aviation's global employment and GDP impact, 2018. Source: Air Transport Action Group (ATAG).

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[1] According to ATAG, direct impacts are subdivided into aviation direct impacts and tourism catalytic, these being direct travel expenses such as accommodation, food, transport, etc. Indirect impacts refer to public and private investments in tourism infrastructure, as well as the impact on the supply chain. Finally, the induced impacts refer to the effects on industries that indirectly benefit from tourism flows, particularly the sectors of food and beverages, clothing, recreation and leisure, and non-durable consumer goods.

[2] These figures do not include other economic benefits of aviation, such as the jobs or economic activity that occur when companies or industries exist because air travel makes them possible, the intrinsic value that the speed and connectivity of air travel provides, or domestic tourism and trade. Including these would increase the employment and global economic impact numbers several-fold.

Brazil has continental dimensions, ranked as the fifth largest country in the world in geographical extension and the seventh in population size (IBGE, 2018b; IBGE, 2019a; CIA, 2020). A country of this magnitude requires an air passenger transport system that makes possible the effective integration of the national territory and the efficient movement of people between the various regions. Therefore, air transport is a strategic sector and a catalyst of direct and indirect impacts on the Brazilian economy.

According to the National Civil Aviation Agency (ANAC), Brazil's aviation infrastructure has about 4,000 airports and aerodromes. Of this total, 721 have paved runways, including landing areas. This aspect positions Brazil as the second largest country in the world in number of airports, behind only the United States.

According to the Air Transport Yearbook 2019 produced by ANAC (ANAC, 2020), in the year 2019 the number of passengers transported in the Brazilian air market reached 119.4 million domestic and international travellers. Of this total, the domestic market accounts for 95.3 million passengers. Figure 2 shows that, until the year 2014, the volume of passengers transported grew, followed by a certain stability in the year 2015 and a drop in 2016. After that, there was a gradual recovery in the number of passengers carried in the domestic market.

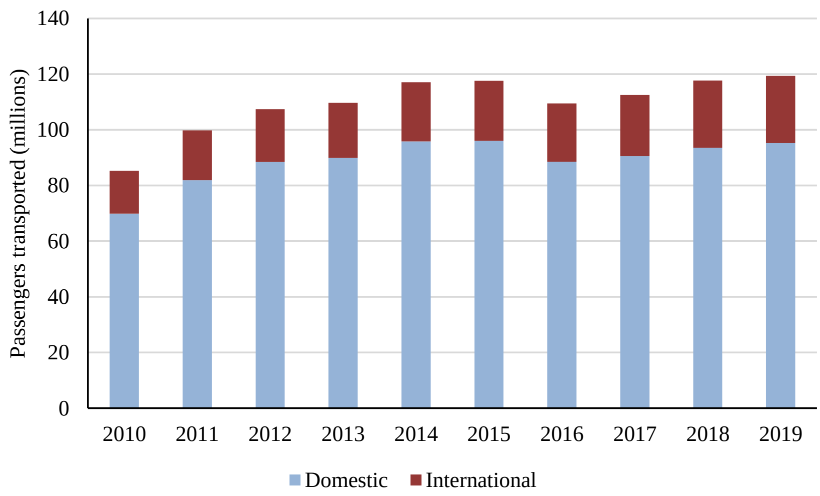

Figure 2 – Number of transported passengers in Brazil – domestic and international markets, 2010 to 2019. Source: National Civil Aviation Agency (ANAC).

The trends in demand for air passenger transport in the Brazilian market can also be measured by using RPK, the sum of the product between the number of passengers carried and the distance of the stages. The accumulated growth of RPK in the Brazilian air market in the period from 2010 to 2019 was 50%. In the domestic market this increase was 38%, while in the international market there was growth of 59% in the period considered (ANAC, 2020). Figure 3 shows, in a similar way to that presented in Figure 2, the growth in RPK until 2014, followed by, respectively, stability and drop in the two following years and, in sequence, smooth recovery from 2017. The importance of the domestic market is also evidenced through the share of the main modals in the regular interstate passengers transport (Figure 4) (ANAC, 2020)[3].

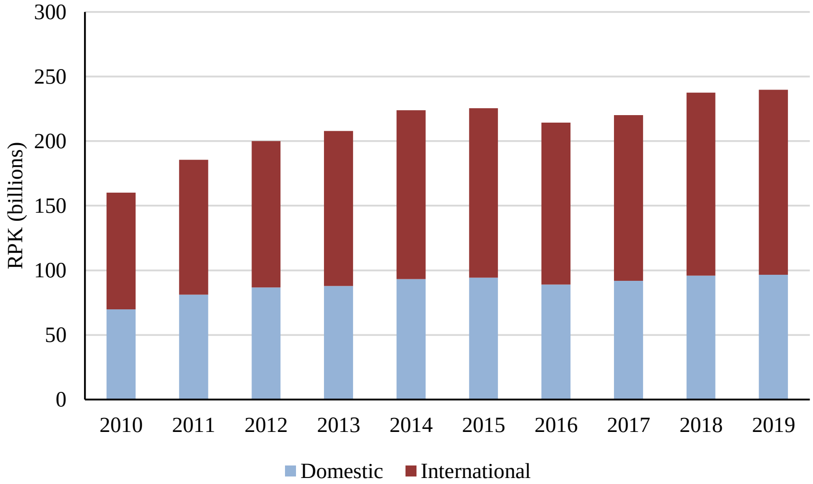

Figure 3 – RPK in Brazil – domestic and international markets, 2010 to 2019. Source: National Civil Aviation Agency (ANAC).

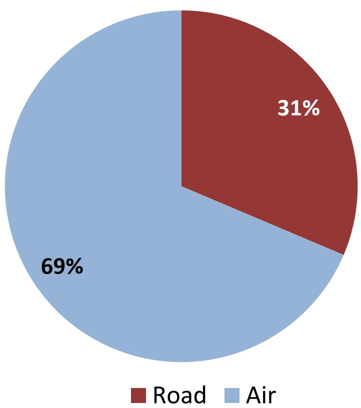

Figure 4 – Shares of air and road modes in Brazilian interstate passenger transport, 2019. Source: National Civil Aviation Agency (ANAC).

[3] The information regarding the road modal is provided by the National Agency of Land Transport (ANTT) and reflects passengers who used the regular service of interstate collective road transport, as defined in Resolution ANTT No. 4,770 of 25 July 2015. The information about the air modal, collected from the ANAC statistical database of air transport, considers the passengers carried on domestic flights with origin and destination in different Federation Units (interstate air connections).

In this sense, the Brazilian Consumer Expenditure Survey (POF), conducted by the Brazilian Institute of Geography and Statistics (IBGE), reveals an increase in the participation of air passenger transport in the Brazilian households' budget. In the most recent survey, which was conducted between the years 2017 and 2018, it was shown that the share of airline ticket expenses (domestic) in the total household monetary expenditure was 0.57%, compared to 0.32% in the previous edition of the survey, which was carried out between the years 2008 and 2009 (IBGE, 2019c).

From a regional perspective, Figure 5 shows that the demand for air passenger transport in Brazil is concentrated in the Southeast Region. Of the 95.3 million boarded passengers in the domestic market in 2019, about half departed from this region. On the other hand, the North Region, the territorially most extensive in the country, participated with only 5% of total boarded passengers (ANAC, 2020).

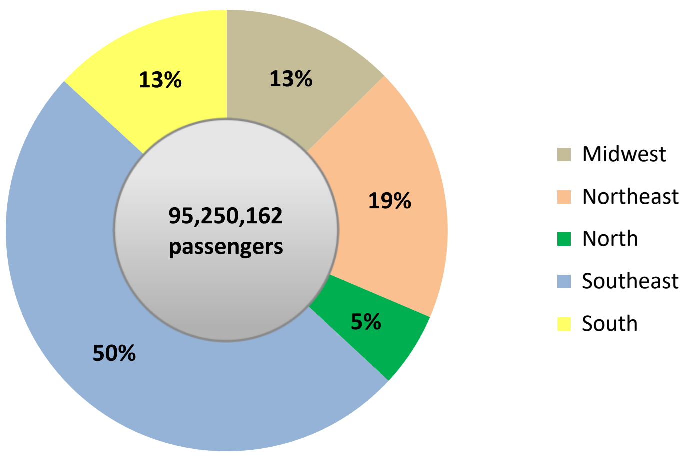

Figure 5 – Distribution of boarding passengers by Brazilian region - domestic market, 2019. Source: National Civil Aviation Agency (ANAC).

From a geographical viewpoint, the air passenger transport demand in Brazil is concentrated in the Federation Units (UF) capital cities. Among the country's 20 largest airports, in terms of domestic operations, only two are not located in capital cities: Campinas and Foz do Iguaçu. Figure 6 shows that the 20 main airports of the domestic market concentrate around 85% of the country's departures (ANAC, 2020).

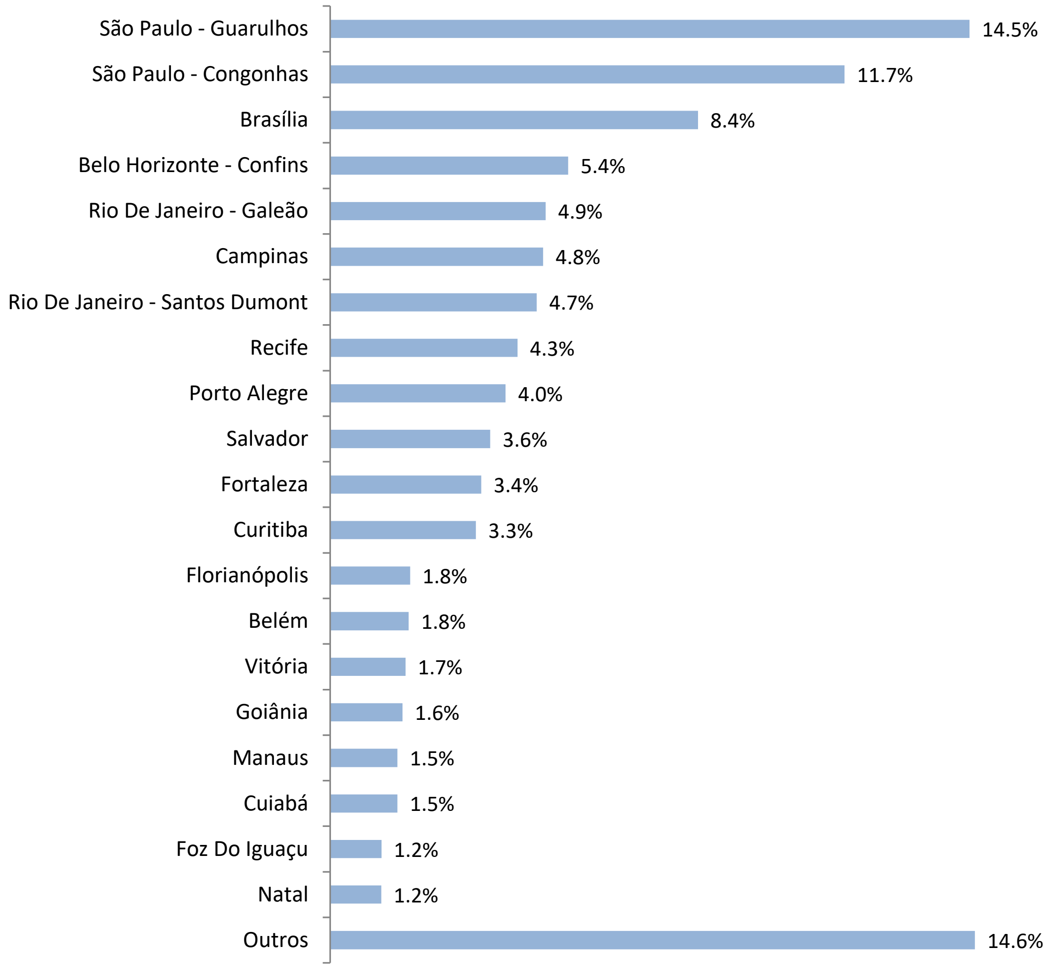

Figure 6 – Departures distribution at the 20 Brazilian largest airports: share in total passengers, domestic market, 2019. Source: National Civil Aviation Agency (ANAC).

The retrospective and situational analysis of air passenger transport globally and in Brazil is based on data produced and made available until the year 2019. It does not include, therefore, the unfoldings of the COVID-19 pandemic that ravaged the world from 2020 onwards. Although data is available after that, ending the analysis in 2019 was intentional, with the central objective being to portray the magnitude and behaviour of the industry in "normal times".

The impact of the COVID-19 crisis on all aspects of the economy and society is well known. Aviation has been particularly acutely impacted, accumulating the effects of previous shocks (9/11, SARS, the global financial crisis and Eyjafjallajökull eruption airspace closure) into one ‘black swan’ event which will have far reaching implications on the industry for many years (ATAG, 2020).

There have been reductions in passenger traffic caused by shocks in the past, but never a near total shutdown of the global system. At the peak of the stoppage in mid-April 2020, the number of flights operating globally was a quarter the number operating just six weeks earlier. This has had a devastating impact on travel and tourism and on the frontline companies operating the aviation system and the rest of the supply chain (ATAG, 2020).

1.1.2 Background and motivation

Investigating economic relationships contributes to understand why some strategies are appropriate for a particular set of conditions, but not for another. The application of economic principles to an organisation's circumstances can enhance the prospects of formulating and implementing a successful business strategy (Besanko et al., 2017).

Elasticity is one of the fundamental information of Economics when the aim is to study the demand, and its investigation has been the subject of substantial research efforts for the analysis of the air transport market (Morlotti et al., 2017). Understanding the relationship involving the binomial passenger demand income-price elasticities is strategic for decision-making regarding establishing airline connections by companies and public policies.

Most air passenger studies focus on a static perspective of demand elasticity of each market, disregarding its variability in different dimensions (Morlotti et al., 2017; Petricek et al., 2020). The literature presents constant elasticity estimates for the individual markets studied, not considering its evolution over time or its diversity throughout the territory. However, the elasticity non-rigidity must be considered by airline industry decision makers, otherwise their demand prospects may not be realised.

Since the 1990s, studies have suggested that the price elasticity of air passenger demand may vary according to the nature of the trip (Brons et al., 2002; Oum et al., 1992) and the presence of substitute transport modes (Brons et al., 2002). The same issue appears regarding income elasticity. Gallet and Doucouliagos (2014) present evidence that the income elasticity of demand in the civil aviation sector is particularly sensitive to a set of factors found in the literature, most notably how it is higher, i.e. more elastic, on international routes. This general example illustrates the importance of economic conditions on the sensitivity of demand to fluctuations in the factors that determine it.

Such non-rigidity of elasticities derives mostly from the consumers' psychological conditions - particularly their future expectations - and the households' financial situation (Smeral and Song, 2015). This way, the use of constant elasticities approaches for demand studies can influence negatively the forecasting performance (Smeral, 2017). Peng et al. (2015) argue that when faced with fluctuations in economic activity or changes in consumers' expectations regarding their income or employment, the assumption of constant income elasticities of demand is likely to lead to larger forecast errors than the application of approaches with varying elasticities.

Studies regarding the elasticity in remote cities are also rare, especially in developing countries, where the air transport assumes an even more strategic character in virtue of the long-distance travel necessary to ensure connectivity with the rest of the world. This is the case of the interior cities of Brazil's North region. Almost the total area of Amazon is located in this region. Besides concentrating the biggest biodiversity of the planet, having a central role in the global warming control and in any policy agendas related to the promotion of the sustainable development (Garda et al., 2010), the Amazon is also individualized by its logistic void. Interior cities in this region are difficult to access through other means of transport than the airplane. In the North region, which is larger than India in territorial extent (it would be the seventh largest in the world if it were a country), passenger regular domestic air traffic between its interior cities has complex characteristics within the intra- and inter-regional scope, which requires a greater understanding between these passenger flows and the local economy.

1.1.3 Assumptions and objectives

The investigation of the elasticity of air fares demand behaviour is justified by the fact that the different values obtained have management and planning implications for the diverse *stakeholders*, namely all the public of interest (Freeman, 1984), of the civil aviation industry activities - airlines, passengers, suppliers, governments, regulatory agencies, tourism professionals, etc. With this motivation, the first stage of the thesis analyses the income-price elasticities of passenger demand for domestic air connections in Brazil – an emerging country with continental dimensions and of great importance to the world economy –, considering its behaviour in different economic situations and internally stratified in distinct areas.

Regarding this thematic, the assumptions that are to be tested by this thesis are:

- Particularly in Brazilian case, the calculation of income-price elasticities of air passenger transport demand results in significantly different estimates across the territory, depending on the macro-region and the typology of the cities involved in the air connections; and
- In addition to their spatial non-rigidity, the income-price elasticities of demand in the Brazil's civil aviation sector also vary over time, influenced by economic activity fluctuations and the stage of the national economy's business cycle.

By shedding light on the demand elasticity dynamics in the country's civil aviation sector, this thesis discusses its explanatory factors and strategic implications. The research singular nature consists in measuring and comparing the demand elasticities of a single market (scheduled domestic flights) in different scenarios of the recent Brazilian economic history – which has experienced periods of growth, stagnation, and economic recession – and also considering all the diversity of the country's five geographic macro-regions.

Giving that consumer sensitivity to changes in income and fares is not geographically uniform in Brazil and the air transport accessibility (link characteristics) can play an important role on building robust regional economies (Chacon-Hurtado et al., 2020), the analysis covers the country, each of its macro-regions, and the remote cities of Brazilian Amazon. Based on the assumptions that economic growth is a key driver of air travel demand (Oum et al., 2010; Zhang and Graham, 2020) and that there is a strong correlation between air passenger transport and economic development (Baker et al., 2015; Tong and Yu, 2018; Tolcha et al., 2020), particularly in Brazil (Fernandes and Pacheco, 2010; Fernandes et al., 2010; Cabo et al., 2018; Aprigliano Fernandes et al., 2021), the period of investigation unfolds into two sub-periods with quite different macroeconomic conditions: one of economic growth and another of stagnation and recession of the national economy. Besides estimating and discussing the factors that affect the air passenger transport demand sensitivity to price and income variations, this thesis also discusses what market conditions would have more influence on the airlines' decision in operating in isolated areas under a liberalising scenario.

1.2 Stage 2 | Drivers of international tourism

1.2.1 Overview

The World Tourism Organization (UNWTO) defines tourism as the set of activities that people carry out during their travels and visits to places other than their usual environment, for a time period of less than a year, for leisure, business and other reasons not associated with the practice of a remunerative activity in the place being visited. Tourism, as an economic activity, is defined from the demand perspective, i.e. as the result of visitors' consumption. Differences in tourists' profile and motivation and in the natural and economic conditions of the place visited mean that different sets of products will be consumed. (IBGE, 2012).

Tourism represents a significant contribution to the worldwide economy, providing employment and boosting global economic activity. In 2018, tourism supported 319 million jobs and made up 10.4% of world GDP, a total of USD 8.8 trillion (ATAG, 2020).

Between 2009 and 2019, international tourism receipts presented a real growth higher than that of world GDP: 54% versus 44% (Figure 7). In 2019, international tourist arrivals numbered 1.460 million people, and international tourism receipts amounted to USD 1.481 billion. Tourism has seen continued expansion over time (Figure 8), despite occasional shocks, underlining the sector’s strength and resilience (UNWTO, 2020).

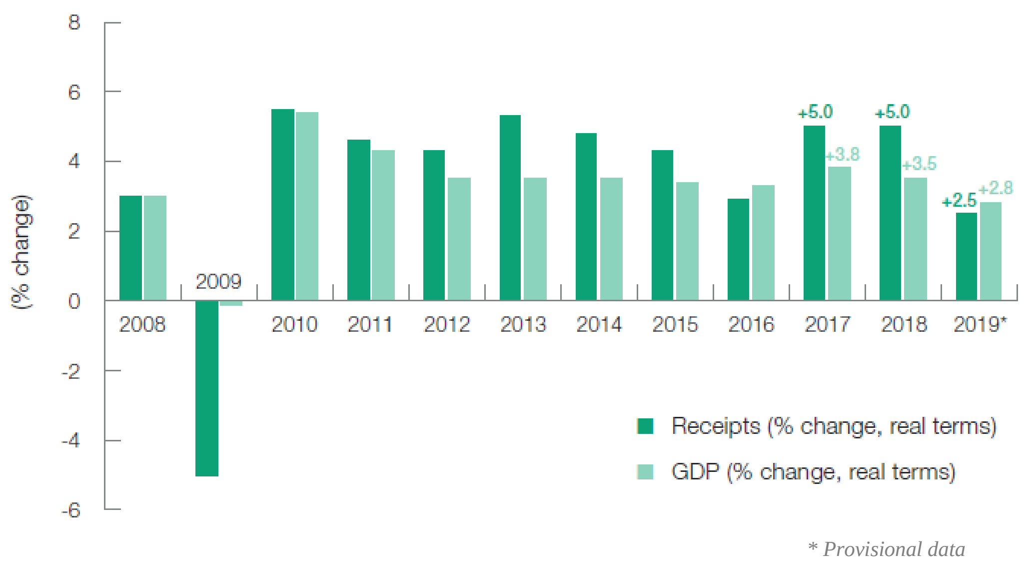

Figure 7 – International tourism receipts and world GDP (real change, %). Source: World Tourism Organization (UNWTO) and International Monetary Fund (IMF).

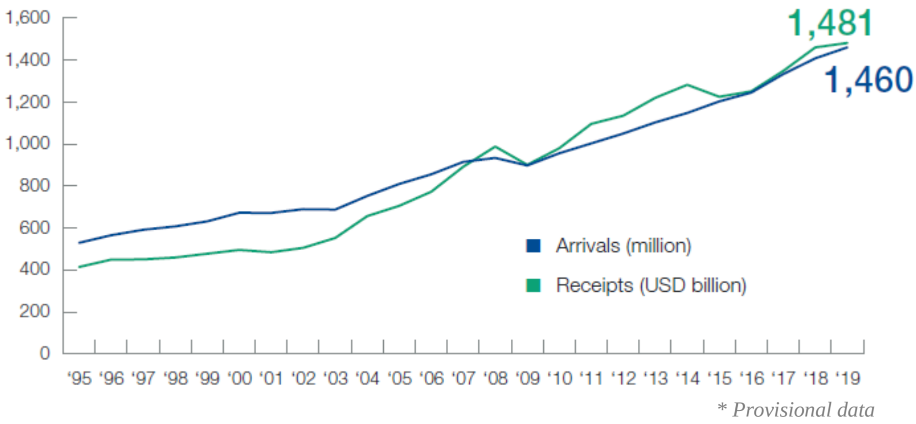

Figure 8 – International tourist arrivals and tourism receipts (% change). Source: World Tourism Organization (UNWTO).

Export earnings from international tourism (travel and passenger transport) are an important source of foreign revenues for many destinations around the world, helping to create jobs, promote entrepreneurship and develop local economies. That is why tourism is a key component of export diversification both for emerging and advanced economies, with a strong capacity to reduce trade deficits and to compensate for weaker export revenues from other goods and services. As a consequence, tourism, consisting of both international and domestic tourism, represents a major part of gross domestic product for many economies around the world. Tourism also generates millions of direct and indirect jobs, with a high share of women and young people. For many small developing countries, including most small island developing states, tourism is a major source of foreign-currency income (UNWTO, 2020).

According to UNWTO data, in the year 2019 tourism figured as the third largest export category in the world, behind only fuels and chemicals, and ahead of important segments such as automotive products and food (Figure 9). In this way, almost every year since 2010 export revenues from international tourism have grown faster than merchandise exports (Figure 10).

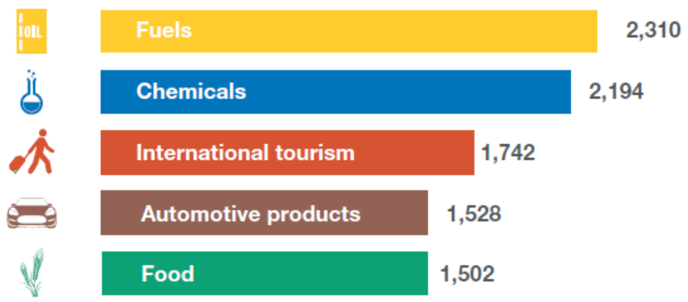

Figure 9 – Export earnings by product category, 2019 (USD billion). Source: World Tourism Organization (UNWTO) and World Trade Organization (WTO).

Figure 10 – Export revenues from international tourism and merchandise exports (% change). Source: World Tourism Organization (UNWTO) and World Trade Organization (WTO).

Over the past decades, tourism has experienced continued expansion and diversification to become one of the largest and fastest-growing economic sectors in the world. Growth in tourism was driven by a relatively strong global economy, growing middle classes and rapid urbanization in emerging economies, affordable travel and visa facilitation, as well as technological advances and new business models (UNWTO, 2020).

Nevertheless, the distribution of tourism as well as its socioeconomic benefits is not uniform around the world. When considering the international tourism from the perspective of advanced economies *vis-à-vis* emerging economies, there is a certain balance in terms of tourist arrivals, but a notorious discrepancy among countries in terms of tourism receipts (Table 1).

Table 1 – International tourist arrivals and tourism receipts, 2019 (million, USD billion and % share). Data source: World Tourism Organization (UNWTO).

	Tourist arrivals		Tourism receipts	
	Million	*Share*	*USD billion*	*Share*
World	1,460	100	1,481	100
Advanced economies*	776	53.2	946	63.8
Emerging economies*	684	46.8	536	36.2

** Classification based on the International Monetary Fund (IMF)*

Brazil's presence in international tourism is quite modest, despite its world renowned cultural heritage and natural beauties. Data for the year 2018 shows that, having USD 5.92 billion in tourism receipts, the country accounts for only 0.41% of the world market share (UNWTO, 2019). In the same year 2018, for example, Brazil's contribution to global GDP was 2.5%. It is, therefore, a situation that still does not represent Brazil's full potential in the global inbound tourism business. As shown in Table 2, among the main outbound countries of the world tourism, except for Italy (0.84%) and France (0.55%), all the others send less than 0.5% of their expenditures to Brazil. The Brazilian participation in the world inbound tourism and as destination of the main outbound countries worldwide is tiny, varying from 0.04% in the case of China to 0.84% for Italy and reaching a world average of 0.41% (Rabahy, 2019).

Table 2 – Brazil's participation as a destination in the main world tourism markets, 2018. Data sources: World Tourism Organization (UNWTO), Ministry of Tourism of Brazil, and Brazilian Central Bank.

	Expenditure (USD billions)		Share of Brazil in origin
	Total	*In Brazil*	
China	277.3	0.110	0.04%
USA	144.2	0.625	0.43%
Germany	94.2	0.211	0.22%
United Kingdom	75.8	0.175	0.23%
France	47.9	0.262	0.55%
Australia	36.8	0.058	0.16%
Russia	34.5	0.023	0.07%
Canada	33.3	0.072	0.22%
Korea	32.0	0.025	0.08%
Italy	30.1	0.254	0.84%
Sub-total	806.1	1.818	0.23%
Other countries	641.9	4.099	0.64%
TOTAL	1,448.0	5.917	0.41%

1.2.2 Background and motivation

Society's evolution is increasingly promoting accelerated global changes. One industry that is becoming more prominent in the countries worldwide is the tourism, both international and domestic (WEF, 2019; Assaf and Dwyer, 2013).

The literature indicates a robust interrelationship between economics and tourism (Wu et al., 2022; Risso, 2018; Gwenhure and Odhiambo, 2017). Just as the economic conditions and the size of the national economies shape the touristic flows, these also consist in an important explanatory element of the recent transformations of the world society, in particular the globalisation (Song et al., 2018). Furthermore, the existing literature on the relationship between tourism and air passenger transport is vast (Aprigliano Fernandes et al., 2022; Papatheodorou, 2021; Spasojevic et al., 2018; Duval, 2013).

1.2.3 Assumptions and objectives

Tourism depends on several factors. This study explores the relation of tourism with the socioeconomic dynamics of a country (including the civil aviation market performance), the globalisation trend in the world, and the countries' socioeconomic structural indicators (Mishra, Rout, & Sahoo, 2021).

With regard to this subject, the main assumption that this thesis is intended to test is:

- The globalisation process, the civil aviation sector, the macroeconomic dynamism and the socioeconomic and demographic structure of the countries shape the tourism vocation of each of them in the current configuration of the global economy.

There is however limited existing literature integrating all these dimensions and providing a systemic view of the tourism industry. With the motivation to propose a framework for analysing the drivers of the tourism sector, the second stage of the thesis investigates the behaviour of inbound and outbound tourism in a group of countries around the world over the last few decades.

There are significant differences in the flow of tourists between the BRICS[4] countries. How to overcome bottlenecks to expand tourism across BRICS countries? What these countries may do to improve their tourism position in the world? How do socioeconomic indicators and globalisation relate to tourism in emerging countries and developed ones? It is necessary a look at the tourism market with fresh eyes and find out how inbound and outbound tourism happens in the countries.

Making some comparisons between BRICS and G7 countries[5], this thesis shed light on potential Global South relationships tourism development opportunities, starting with the idea of people-to-people exchange and cultural integration through air transport and tourism, which is within BRICS' international cooperation framework. To analyse these matters, the second stage of the thesis selected a group of variables available by the World Bank and the United Nations World Tourism Organization. There are other variables that could be selected for this kind of analysis, but the present research would like to stress three points of the assumptions, which are: country socioeconomic dynamics, globalisation, and socioeconomic structure.

1.3 Structure

This thesis is structured as follows:

Chapter 01: an introductory chapter, which introduces readers to the theme of the influence of socioeconomic and geographic conditions on passenger air transport and its implications for the tourism industry. Following some initial considerations and an overview of the investigated matter, are described the research motivation, the assumptions and hypotheses that are assumed, and the general and specific objectives that guide the research.

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[4] BRICS is an acronym formed by the initials of the countries Brazil, Russia, India, China and South Africa. In 2001, this expression was created by the economist Jim O'Neill in the form of BRIC (without South Africa) to designate those emerging countries with great investment capacity and that would become economic potencies by 2050. In 2006, BRIC stopped being just a term and became an international agreement between the countries, but without the configuration of an economic group. Since 2011, the South Africans have joined this interregional agreement, with the addition of a capital S at the end of the acronym.

[5] The Group of Seven (G7) is the group of the world's most industrialized countries, consisting of: Germany, Canada, United States, France, Italy, Japan, and United Kingdom, although the European Union is also represented. These countries are the seven most advanced economies in the world, according to the International Monetary Fund (IMF).

Chapter 02: theoretical framework of the research, the chapter comprises a targeted literature review comprised in this particular area of investigation, where the most pertinent studies to be considered were identified. The literature review was divided between those publications used to analyse the elasticity of air passenger transport demand and those on the drivers of international tourism.

Chapter 03: the research methodology chapter, where the quantitative approach that will support the case study on the elasticity of air fares demand in Brazil is explained, as well as the methodological framework employed in the study of the determinants of international tourism.

Chapter 04: chapter in which the case studies are presented, through which it is developed the investigation of the problems introduced by the two stages of the research.

Chapter 05: this chapter summarizes, discusses, and provides an overview of the main findings of the research in its two stages of analysis: the elasticity of demand for air travels as well as the drivers of international tourism.

Chapter 06: chapter that consolidates and integrates the main conclusions of the research, pointing to eventual further studies, additions, and other possibilities for future research related to the matter.

At the end, all references that were used for the development of the thesis are cited.

2 LITERATURE REVIEW

The literature review is organized in this chapter following the research stages: firstly, the literature of interest related to the theme of the elasticity of air passenger transport demand will be presented; next, the investigated literature will focus on the analysis of the international tourism drivers subject.

2.1 Elasticity of air passenger demand

Since the 1990s, studies have suggested that the elasticity of demand for air passenger transport may vary according to different dimensions (Morlotti et al., 2017), such as the nature of the travel (Oum et al., 1992; Brons et al., 2002; Mumbower et al., 2014) or the presence of substitute modals (Brons et al., 2002; Kopsch, 2012; Granados et al., 2012). Two types of determinants of air travel demand elasticity have been identified in the literature: those that are outside and those inside the scope of airline control (Valdes, 2015). Jorge-Calderón (1997) calls the former geoeconomic drivers and the latter service-related drivers.

Geoeconomic drivers encompass demographic, economic, and locational characteristics of the region in which the service is provided. In this line, the most frequent factors found in the literature are population (Bafail et al., 2000; Abed et al., 2001; Sivrikaya and Tunç, 2013), distance (Brons et al. 2002; Grosche et al., 2007; Morlotti et al., 2017), and economic activity – in the form of GDP (Vedantham and Oppenheimer, 1998; Chèeze et al., 2012; Gillen, 2013), GDP per capita (Cline et al., 1998; Valdes and Ramirez, 2011) or consumption expenditure (Bafail et al., 2000; Abed et al., 2001). Some studies investigate locational factors by considering countries in different parts of the world (Brons et al. 2002; Chèeze et al., 2012; Gillen, 2013). The fundamental assumption in various air transport forecasting studies is that economic growth boosts air traffic (Zhang and Graham, 2020).

Service-related drivers, on the other hand, depend on the airline, such as price and quality. Most studies include a price-related variable or a *proxy* to analyse its effect (Brons et al. 2002; Granados et al., 2012; Mumbower et al., 2014; Morlotti et al., 2017). Furthermore, complexities due to exchange rate fluctuations would potentially make the measured elasticity of air travel notably time dependent, as shown in Athanasopoulos et al. (2014).

Regarding aviation and remote locations, studies in general are interwoven with regional aviation studies, focusing on the question of subsidies. Then, the following government programs are highlighted: Public Service Obligation (PSO); Social services provided by state-owned airlines; and Essential Air Service (EAS). Such studies are concentrated in specific regions of Asia, Australia, Europe and North America, locations with a transport network more developed and more integrated than the one found in remote regions of Latin America countries (Bråthen, 2011; Bråthen and Halpern, 2012; Fageda et al., 2019).

The studies identified for the literature review will contribute to the definition of this research's methodology. In this sense, regarding the analytical methodology of the studies, it is observed that the panel data regression analysis has become adequate.

In general, the existing approaches examine the air passenger market using the aggregate demand function for the service as a reference (Oum et al., 1992). The literature related to the theme of this investigation is focused on the examination of geographical, socioeconomic and market factors, which explain a higher (or lower) income–price elasticity of demand regarding passenger air transport, as well as the formation of prices related to this service under a microeconomic perspective.

Among the studies reviewed, some examined below, in chronological order of publication, are more relevant as a theoretical reference for this research purpose:

- Brons et al. (2002) investigate the determinants regarding the price elasticity of demand on the passenger air transport sector, aiming to identify the common factors supporting the different estimations found in the literature for the elasticity. The investigation is based on the meta-analysis in which 37 studies were considered, where one or more estimations for the price elasticity of demand regarding passenger air transport were calculated, leading to a total of 204 observations concentrated in North America, Europe and Australia air markets. In the analysis, Brons et al. consider the elasticity estimations as the dependent variable to be explained by geographical, economic and demographic variables, which information is obtained in each original study investigated. The authors conclude that, in fact, the price elasticity of demand may vary according to the nature of the travel, the existence or not of other substitute transport modes, the geographical location for which the elasticity is calculated, and cultural differences. Brons et al. also point out that the omission of the income variable in the models analysed introduce a bias in the estimations of price elasticity of demand, suggesting that it must be systematically maintained in these types of studies.

- Bråthen (2011) map and analyse seven strategic questions related to the air transport in remote regions: the need of government support; economies of scale and ticket price process; airport costs and operational costs of airlines; the subsidies level, barriers to entrance and competitiveness in the market environment; bidding process and risk sharing; and remote areas and regional development. The analysis is limited to remote areas within the scope of USA (Essential Air Service) and Canada (Public Service Obligation) government subsidy programs. The author concludes that the quality of the business environment for the promotion of investments in the air transport system is as relevant as the subsidy policy for the economic development of isolated regions.
- Granados et al. (2012) study the variation of the price elasticity of demand regarding passenger air transport due to the different forms of commercialization (online *versus* traditional) and due to the different purposes of the travel (leisure *versus* business). Using a database containing 2.21 million of flight tickets commercialized in USA between September, 2003 and August, 2004 for 47 different routes among North American cities, the empirical analysis uses an estimation of Ordinary Least Squares (OLS) from which it was concluded that, in general, consumers are more sensitive to price variations in markets where research costs are lower, once they have a greater access to the offer of substitute services. The greater access to information causes an increase in the competition through the internet, which enables the offer of alternative services inside and outside the airway mode. The authors conclude that the online demand is more elastic than the offline, for passenger air transport with either the purpose of leisure or business. In addition to this, Granados et al. report that passengers travelling

for leisure present a more elastic demand in relation to the variation in prices than the ones travelling for business.

- Bråthen and Halpern (2012) analyse the air transport in remote regions with the purpose of mapping the critical questions and bottlenecks that must be surpassed so that the sector contributes to the regional economic development in a more efficient form. The authors perform a literature review on the theme and investigate the experience of government programs in Europe and North America. The discussion is limited to situations in which the offer of regional air transport is only feasible by means of subsidies. Bråthen and Halpern highlight that, in addition to the subsidies, the public policies must be capable of impacting the market environment and operational costs of airlines as an integral part of a regional development strategy sustained by the air transport system.
- Kopsch (2012) shows that the air travel demand elasticity changes over time in the Swedish aviation market – a developed country more homogeneous than Brazil. The results suggest that demand is inelastic in the short run and elastic in the long run due to the possibility of using alternative transport modes. Furthermore, the author suggests that leisure travellers are more sensitive to price changes than business travellers.
- Ssamula (2012) analyses the African airline system, a dispersed market where routes are typically characterized by low-frequency and high-cost services – similar to that observed in Brazil. The author advises that different price elasticities of demand on routes between capital cities and those involving remote areas must be considered by air transport sector planners, otherwise their demand expectations will be thwarted.
- Mumbower et al. (2014) investigate how the price elasticity of demand for air passenger transport varies as a function of flights route and seasonal factors. The authors reveal that demand in the United States civil aviation market is elastic overall but becomes inelastic for bookings made within two days of the travel date. Mumbower et al. highlight the importance that the variations in price elasticity of demand are considered in the pricing strategy of airlines, as well as by governments and regulatory agencies for the

definition of public policies (taxation, subsidies, control of greenhouse gas emissions, for example) to deal with the externalities of the industry.

- Gallet and Doucouliagos (2014) demonstrate that the air travel demand income elasticity, with a focus on the United States, Europea, Asia, and Oceania markets, is sensitive to several characteristics. The results found by the authors indicate that the income elasticity is higher on routes abroad, suggesting that in periods of economic growth, the demand tends to move from the domestic market to the international market, with the opposite occurring during periods of recession.
- Valdes (2015) studies the determinants of the air travel demand elasticity in emerging countries. Using panel data models, the author concluded that the income elasticity of demand is the main factor explaining the growth of air ticket consumption in these markets. The results found by Valdes suggest that economic growth has a particular influence on the demand for air passenger transport in developing countries.
- You and Xiong (2017) empirically analyse the sensitiveness of the demand regarding passenger air transport in China and fluctuations in the income level of the resident population. Considering that there is a strong correlation between the passenger air transport and economic development, the authors sought to estimate the income elasticity of demand for the Chinese aviation market. They analyse annual data aggregated for China from the total number of passengers transported by the airlines departing from the country and the available income per capita regarding the resident population between 1995 and 2015. You and Xiong obtained evidence that the demand concerning passenger air transport in China is elastic in relation to the income for the greater part of the period considered by the research. From the results obtained, the authors conclude that, with the accelerated economic growth experienced by China in the last years, the passenger air transport is becoming, gradually, more popular inside the country.
- Wang et al. (2018) sought to analyse the determinants of the price formation process and the demand regarding passenger air transport in the two most populous and fastest-growing economies in the last decades: China and India. Although both countries present many similarities in several areas,

there are substantial differences among their air transport industries. Private and low-cost airlines dominate the Indian aviation market, while government-controlled airlines are the main operators of the Chinese market. The authors analyse data regarding the main domestic routes inside each country. The sample for India includes the routes connecting the 20 most populous cities of the country, while for China, routes connecting the 20 largest domestic airports were selected. 4,387 observations were considered for the Indian market and 7,865 for the Chinese, which were collected on a monthly basis for the period of January, 2012 to December, 2015. Wang et al. use an approach of two-stage least squares, from which the price elasticities of the demand, based on a function of structural demand, were estimated. The results reported that the price elasticity of demand in the Indian passenger air sector (estimated in 2.6) is approximately double that of the one recorded in China (1.2). The authors conclude that the greater intra-modal competition in the Indian market, with a higher ingress of low-cost airlines, is a key-factor to explain the higher sensitivity of demand to price variations when compared to the most concentrated Chinese market.

- Fageda et al. (2019) investigate the influence of prices and frequencies of different public policies regarding the aerial connectivity in remote regions. Authors highlight that the potential positive impacts of such policies must be considered in relation to their costs, once the volume of public subsidies may be very elevated. Fageda et al. reinforces that the public policies must play a strategic role on supporting the connectivity in remote areas.
- Zhang and Graham (2020) examine the validity of applying income elasticities to the air travel demand forecasting in different economic conditions. The study concluded that its use is largely justified given the causal effect between economic growth and air transport. The nature of the feedback effect, though, can differ across economies and is likely to change over time. The findings reveal that the two-way causality relationship is more prevalent in less developed economies.

The literature indicates that the income-price elasticity of demand is considered an essential element for understanding consumer behaviour (Besanko el al., 2017). However, in the context of civil aviation, most published studies focus on a static view of the demand elasticity (Petricek et al., 2020), and those that consider its variability do not examine it in the context of the same market.

The literature shows that the sensitiveness of demand for air transport and the oscillations in prices and income may vary according to the characteristics of travel and economic, demographic and geographic factors, which defines its context. In general, studies on the fluctuation of income-price elasticity of demand throughout the time and their determinants have as a study objective the passenger air transport as a whole and focus on international links or air traffic related to the busiest passenger lines.

Furthermore, the economic scenario's influence on the airline ticket consumer's sensitivity to income and price changes is not sufficiently investigated in the literature. In this sense, Morlotti et al. (2017) underline that the study of the behaviour of air travel demand elasticity is still insufficiently explored when considering its variability in temporal and spatial dimensions, particularly for the same object of study. The lack of studies in this field is explained by the scarcity of databases with information on the values of airfares actually sold, considering true origin and destination, and the number of seats sold (Brons et al., 2002). This is a constraint that limits the calculation of estimates for the elasticity other than the average value of the airline industry in general, as well as a better understanding of the various drivers influencing it (Oum et al., 1992).

Despite the importance of air transport as one of the main items in the basket of goods and services consumed by South American households (Gandelman et al., 2019), it is observed that the regional air market, in which Brazil is included, is little explored in studies related to this matter. Despite being scarce, it has relevance in different aspects, the most prominent of which are the reduction of inequalities related to consumer access to the air transport system and the territorially integrated economic development sustained by civil aviation.

The importance of the sector is even higher when it comes to the remote regions, where the air transport is strategic due to the long-distance travels necessary to connect them to the rest of the world. In this line, the Brazilian Amazon stands out. Located in the macro-region of the North of Brazil, it is a region of international interest by its role in the planet and relevance for the sustainable development. Fenley et al. (2007) discuss the development models in the region, evidencing that the air transport may play an important role for the sustainability of the Amazon development. The lack of studies regarding elasticity in remote regions raises the question: how would this relation be in these locations in which the civil aviation is a key element of the transport system?

2.2 Drivers of international tourism

The tourism contribution to economic development is the study object of a vast literature collected both in scientific journals and in sectoral analyses produced by industry-related organizations. The discussion focuses on the causal relationship between tourism and the economic growth of countries and regions (Gökovali and Bahar, 2006; Benkraiem et al., 2021), extending towards the study of the tourism activity's impact on the passenger transport sector (Dubois et al, 2011), on globalisation (Song et al., 2018), and on the systemic competitiveness of economies, environmental sustainability, income distribution and people's quality of life (Seguí-Amortegui et al., 2019; Prideaux et al., 2020; Rodríguez-Díaz and Pulido-Fernández, 2020; Jeyacheya and Hampton, 2020).

Given the palpable economic value of the global tourism industry, this sector has thus far been propagated as a catalyst for both the economic development and rapid global value-chain integration of most emerging and developing countries (Garidzirai & Matiza, 2020). More so, the role of tourism as a vector of poverty alleviation/reduction has emerged as a critical debate within the tourism economics discourse. Tourism is a highly integrative economic activity – contributing to the socioeconomic development of host economies through employment creation, tax base expansion, infrastructure, and public resource development, as well as export earnings. In this sense, regional and multi-country studies have significantly contributed to the tourism *versus* poverty alleviation debate (Rasool, Maqbool, & Tarique, 2021).

The travel and tourism industry can play a leading role in poverty reduction in developing countries (Henama, 2013). The benefits of tourism will, however, not flow automatically to poor and vulnerable groups of people at a destination; concerted steps must be taken to ensure that tourism is pro-poor. Economic growth can happen in the presence of widespread poverty, and hence pro-poor tourism is imperative. In addition, the tourism industry relies on the natural resources that already exist, which can be regarded as 'free' resources, such as wildlife, scenery, and culture. Tourism contributes to environmental protection, conservation and restoration of genuine heritages, biological diversity, and sustainable use of natural resources. Tourism protects and creates economic value for resources which otherwise have no perceived value to residents or are regarded as a cost rather than a benefit (Pop, 2014).

The rapid economic growth experienced by the BRICS countries is associated with rising incomes, a growing middle-class and improved standards of living (Pop, Kanovici, Ghic, & Andrei, 2016). However, the majority of BRICS countries possess two characteristics: namely, that they are long haul destination and secondly, they represent a small market with huge potential for future growth. In this sense, a strong tourism and travel sector contributes in many ways to the economic growth and development. The potential economic benefits of tourism are a major attraction for developing countries for many reasons. Many developing countries are choosing or being encouraged to develop tourism over some of the more traditional industry alternatives, such as agriculture and manufacturing (Mishra et al., 2021).

Tourism is associated with the movement of people to consume a tourism product offered at a destination area. This means that tourists must undertake a trip or element of journey from the tourist producing area pass through a transit area to get to the tourism destination area. Aviation is indispensable for tourism, which means that the liberalisation of air services can help in the growth of the economy of a country, by allowing the free movement of goods and people.

Among the reviews, some studies detailed below in chronological order were considered more relevant as a theoretical reference for the analytical model proposed in this stage of the research, such as identifying driving forces (Moriarty, 2012). The review examines articles published in tourism-related journals and reports produced and disseminated by organisations dedicated to the analysis of the sector, addressing the study of the drivers of tourism performance and its relationship with the socio-economic environment in which it operates.

- Gökovali and Bahar (2006) demonstrate that tourism development may be able to promote economic progress both directly, by stimulating other sectors' growth, and indirectly, by stimulating the expansion of domestic income and aggregate demand. The authors use a panel data approach, and the coefficient estimates are obtained through fixed and random effect models. The findings suggest that, in addition to the traditional production factors (capital and labour), the tourism-related factor applied in the model also contributes to the economic performance of the studied countries.

- Dubois et al. (2011) investigate the relationship between tourism and the passenger transport sector in the context of CO_2 emissions and its impact on climate change. The obtained results suggest that tourism activity accounts for about 5% of total CO_2 emissions (of which ¾ of this volume would be directly associated with passenger transport), highlighting the important role that tourism has to play in the global climate agenda.
- Moriarty (2012) suggest the use of the prospective scenarios tool for a structural analysis of tourism, given the complexity and relevance of the industry to the world economy. Among the variety of existing prospective analysis approaches, the author highlights the use of driving forces for strategic analysis and the construction of future scenarios for tourism.
- Song et al. (2018) highlight that tourism consists of an essential driving force of the globalisation process that characterizes the economic, social, political, and cultural spheres of the contemporary world in recent decades. According to the authors, tourism developments are influenced by the increasing interdependence of countries: as globalisation deepens, tourist destinations become susceptible not only to local events, but also to global phenomena. Based on a systematic literature review approach, the study identifies the driving forces shaping globalisation and maps their strategic implications on both the supply and demand side of the tourism sector.
- Seguí-Amortegui et al. (2019) conduct bibliometric research oriented to understand the relationship between tourism, sustainability, and competitiveness, emphasizing the tourism destinations analysis. The study demonstrates a significant and exponential growth of the research in this field in recent years. The authors point out that understanding the drivers of global tourism flows, from a socioeconomic viewpoint, still configures a gap in the literature and a vast field of future work.
- Prideaux et al. (2020) examine the strategies of the global tourism industry to face the socioeconomic transformations arising from the low carbon economy emergence. The research approach seeks to understand the strategic implications of such transformations for the tourism industry

through the mapping of the major trends and future driving forces of the world economy, particularly the lessons brought by the crisis triggered by the COVID-19 pandemic.

- Rodríguez-Díaz and Pulido-Fernández (2020) analyse the correlation between sustainability and tourism economic competitiveness, focusing on the estimated parameters' potential differences among the geographic regions. Through the construction of a multicriteria synthesis indicator at global and regional levels, the authors demonstrate a positive relationship between sustainability and tourism competitiveness in all the geographic clusters analysed, notwithstanding significant differences between regions are identified.
- Jeyacheya and Hampton (2020) indicate that tourism has the potential to catalyse economic growth in developing countries, by generating employment, income and government revenue. The authors note that although the relationship between economy and tourism is widely explored in the literature, little is discussed about the socially inclusive nature of the economic growth. In this sense, the paper examines the distributive role of income generation in tourism-related economies, considering as its study object the emerging economies with vibrant and growing international tourism activity (inbound and outbound). Jeyacheya and Hampton raise the fundamental question of how socially inclusive tourism-led economic growth can be in the short and medium term in these countries. The study concludes that while tourism has the potential to generate income overall, public policies for the sector are essential for the creation of well-paid quality jobs and, consequently, the reduction of poverty and social inequalities in the tourist destinations.
- Benkraiem et al. (2021) employ a quantile autoregressive distributed lag model to study the relationship between tourism and economic growth in the world' s main tourist destinations. The analysis results point to a non-linear cointegrating relationship between tourism development and general economic growth, also evidencing a contemporary non-linear and lagged influence of the sector's performance on income generation. The authors attribute the heterogeneity of the obtained results to differences in the

relative weight of tourism in the total economy of each country, as well as to negative externalities caused by tourism growth.

The literature indicates that the economy is considered an essential element to understand the tourism flow among countries. Its influence on international tourism arises not only from the macroeconomic scenario, but also from the size of the national economies and their global relevance (Bianchi, 2018; Scheyvens and Biddulph, 2018; Holden, 2013; Scheyvens, 2011). Complementarily, international tourism contributes to portraying the economic transformations that characterise the present day, in particular globalisation and the increasing integration between countries and people (Cohen, 2012; Nowak et al., 2010; Fayed and Fletcher, 2002; Balaguer and Cantavella-Jorda, 2002). Last but not least, several studies present the relationship between touristic flows and passenger transport, notably the civil aviation sector (Aprigliano Fernandes et al., 2022; Papatheodorou, 2021; Spasojevic et al., 2018; Zhang and Graham, 2020). The literature gap that the review identifies is an integrated study bringing together all these dimensions and proposing a framework for analysing the international tourism determinants, discussing the particularities of each global region regarding the driving forces of inbound and outbound tourism.

Furthermore, despite the economic significance of BRICS nations to tourism, there is a distinct dearth of studies exploring the tourism-poverty alleviation nexus within the combined BRICS nation context. Scant studies related to BRICS nations have typically been country-based, with a significant gap emerging in empirical evidence of the tourism-poverty alleviation nexus explicitly based on the group of nations. The contradictions within the contemporary literature seem to perpetuate the lack of consensus with regard to the effects of tourism on poverty alleviation and point to the potential heterogeneity in the effects of tourism on poverty within BRICS nations. It also appears as though there is no readily available empirical evidence of the tourism-poverty alleviation nexus in the cases of Russia and India, thus pointing to noteworthy gaps in the literature.

Empirical studies have pronouncedly focused on the literature that tourism promotes economic growth. To further substantiate the nexus, the second stage of the research also examines the plausible linkages between economic growth and BRICS tourism while considering the relative importance of financial development in the context of this group of nations. The inclusion of financial development in the examination of air transport and tourism-growth nexus is a unique feature of this study, which has an influencing role in economic growth as financial development has been theoretically and empirically recognized as a source of comparative advantage.

3 METHODOLOGY

This chapter details the quantitative approach that supports the case study regarding the elasticity of air passenger demand in Brazil, as well as the investigation of the international tourism determinants. The proposed methodology is based on the literature review gathered from books, scientific papers, technical reports, and industry studies. Resulting from this analysis, the statistical models designed for the research processing were built.

3.1 Panel data models

The analytical model proposed investigates the relationship between air passenger transport, tourism, and the economy. The assumption is that the passenger movement or the touristic flow on a given route in a particular year can be determined by its economic characteristics.

In the first phase of the survey, the prices and income patterns observed over the last decades, with several fluctuations and some sudden changes, make the use of time series appropriate for estimating the income-price elasticities of demand for air passenger transport (Brons et al., 2002). In addition to the time dependency, the price analysis considers the airline connections (or, in the case of remote areas study, the real origin–destination, O-D, of air links connecting isolated cities). Due to the time dependence of the explanatory variables, price and income, and considering that information is available for a range of units (airline connections or O-Ds) in cross-sectional data format, the panel data technique was applied.

The same approach applies for the second phase of the research, focused on investigating the relationship between global tourism and the economy. In this case, variable's data are collected over the analysed period for the same element (here, tourism indicators).

Also referred as longitudinal data, this is an approach that deals with a time series of cross-sectional observations on a certain group of units. The panel thus reports cross-section data for the same units over time. In this approach, the variables are all collected at different points in time, usually over the entire analysed period, for the same element.

In longitudinal studies, an individual's observations are correlated over time, requiring statistical techniques that consider this dependence (Twisk, 2013). Advantages of panel data analysis include the potential in studying dynamic relationships over time and modelling in individuals' differences (Frees, 2004).

3.1.1 General model

The standard linear model used for panel data can be denoted by:

$$Y = X\mathrm{B} + \mathrm{E}\,. \tag{1}$$

Where:

$$Y_{NTx1} = \begin{bmatrix} Y_1 \\ \vdots \\ Y_N \end{bmatrix},\ X_{NTxk} = \begin{bmatrix} X_1 \\ \vdots \\ X_N \end{bmatrix},\ \mathrm{E}_{NTx1} = \begin{bmatrix} \mathrm{E}_1 \\ \vdots \\ \mathrm{E}_N \end{bmatrix},\ \mathrm{B}_{kx1} = \begin{bmatrix} \beta_1 \\ \vdots \\ \beta_N \end{bmatrix}. \tag{2}$$

And:

$$Y_i = \begin{bmatrix} Y_{j1} \\ \vdots \\ Y_{jT} \end{bmatrix},\ X_i = \begin{bmatrix} X_{j11} & \dots & X_{jk1} \\ \vdots & \ddots & \vdots \\ X_{j1T} & \dots & X_{jkT} \end{bmatrix},\ \mathrm{E}_i = \begin{bmatrix} \mathrm{E}_{j1} \\ \vdots \\ \mathrm{E}_{jN} \end{bmatrix},\quad \begin{matrix} i = 1, \dots, N, \\ j = 1, \dots, n. \end{matrix} \tag{3}$$

The model's assumptions follow those established by the classical multiple linear regression model, except that the latter does not use panel data structure. Thus, the errors should be independent and identically distributed (*iid*), as well as homoscedastic - that is, for a particular individual, the observations are uncorrelated and, between individuals and time, the error variance is constant.

Nevertheless, the benefit of employing the panel data frame is to analyse the individuals' pattern over time, revealing any differences they may have (Frees, 2004). Such differences between individuals arise from the similarities observed for the data compiled for a particular unit. The non-inclusion of this factor in the model could result in biased estimators.

So, an upgraded model is introduced in which there is a structure to the error term, assuming that differences between units can be absorbed through differences in the constant term:

$$Y_{it} = X_{it}\mathrm{B} + \varepsilon_{it}, \tag{4}$$

$$\varepsilon_{it} = \alpha_i + \mathrm{N}_{it}, \qquad \mathrm{N}_{it} \sim iid(0, \sigma^2).$$

Equation 4 is summarised as:

$$Y_{it} = \alpha_i + X_{it}\mathrm{B} + \mathrm{N}_{it}. \tag{5}$$

Where, in Equations 1 to 5, Y_{it} is the dependent variable for each individual i at period t, B is the angular coefficient of the j-th explanatory variable X_{it} for j =1,...,n and ε_{it} is the idiosyncratic error, since it varies with the cross-section (that is, the individual) and also over time.

Within this mathematical expression, α_i denotes the individual effect (with variation across individuals and constancy over time), and N_{it} varies independently of individual or time. With this new model the heterogeneity between the panel individuals can be better reflected (Johnston, 1988).

The model can still be decomposed into others based on the individual effect assumptions that are made. The first consists of the random-effects model, where the individual effect is uncorrelated with the explanatory variables, implying its randomness – that is, it is not influenced by the model's covariates. The second is the fixed-effects model, which considers the existence of correlation between the individual effect and the model's explanatory variables. In it, the effect does not occur at random, but according to the covariates, making it fixed. The models considering the individual effect have great flexibility because they consider the differences between airline connections.

To select the appropriate model, the null hypotheses of a fixed or a random effect have to be tested. Given the panel data approach, it is necessary to assume the possibility of such effects both for the cross-section and for the period. In this sense, the following tests are carried: redundant fixed effects (Chow test), omitted random effects (Breusch-Pagan test) and correlated random effects (Hausman test) (Hsiao, 2014).

3.1.2 Fixed-effects model

A fixed-effect model considers the effects of variables that are omitted from the individual and that remain constant over time (Johnston, 1988). Regressors are presumed to be correlated with the effects of the individual's level. Thus, a robust parameters estimation requires that such effects must be eliminated or controlled for.

The model considers that the intercept may change from one individual to another, but remains constant over time. Therefore, the relationship of the dependent variable with the regressors remains constant for all individuals and/or in all periods. So, it is assumed that the intercept may be correlated with one or more regressors, preserving the homogeneity of observations hypothesis.

Choosing fixed-effects model is more indicated when the data is aggregated (by regions, countries or groups, for example) and the objective is not the prediction of an individual's behaviour (Wooldridge, 2019). Equation 6 illustrates the fixed-effects model:

$$y_{it} = \beta_{0i} + \beta_1 x_{1it} + \cdots + \beta_k x_{kit} + u_{it} \ , \tag{6}$$

Where β_{0i} are the intercepts to be estimated for the individual, which can be interpreted as the effect of the variables that are omitted in the model. Note that the model established in Equation 6 assumes that the regressors' angular coefficients do not vary between individuals and over time.

In order to eliminate the fixed effects of β_{0it} in Equation 6, a transformation *within*, variation over time or for a given individual, is performed by differentiating means.

$$y_{it} - \overline{y_i} = \beta(x_{it} - \overline{x_i}) + (\mu_i - \overline{\mu_i}) + (v_{it} - \overline{v_i}) \quad e \quad v_{it} = (\beta_{0i} + u_{it}) \tag{7}$$

The method centres all data by applying a differentiation around the mean, which eliminates the effects of β_{0it}. An OLS estimator is used in this method, which provides consistent estimates of β_{it}, even if β_{0it} is correlated with x_{it}. The coefficient of a low *within* variance regressor will not have an accurate estimator and thus cannot be identified if there is no internal variance (Wooldridge, 2019). Therefore, the fixed-effects model is given by:

$$y_{it} = \beta_1 x_{1it} + \cdots + \beta_k x_{kit} + v_{it} \tag{8}$$

It is assumed for fixed effects models that the disturbance terms are independent of the explanatory variables, not auto-correlated and homoscedastic, as described below:

$$E(u_{it} | y_{it-1}, x_{it}) = 0 \tag{9}$$

$$Var(u_{it} | y_{it-1}, x_{it}) = \sigma_u^2, \quad \forall\, i = 1, \dots, k \ e \ j = 1, \dots, T$$

$$Cov(u_{it}, e_{js} | y_{it-1,} x_{it}) = 0, i \neq j \ e \ t \neq \mathrm{s}$$

3.1.3 Random-effects model

The random-effect model, in contrast to the fixed-effect, assumes that the intercept is random and not correlated with the explanatory variables (Wooldridge, 2019). Starting the detailing with Equation 10, there is:

$$y_{it} = \beta_{0i} + \beta_1 x_{1it} + \cdots + \beta_k x_{kit} + u_{it} \tag{10}$$

In this model, β_{0i} is not assumed to be fixed. It is presumed to be a random variable with mean value of β_0. The intercept can be expressed by:

$$\beta_{0i} = \beta_0 + e_i \tag{11}$$

Where e_i denotes an error term with null mean and variance σ_e^2. This is representative that all individuals in the data set belong to a larger universe and have a common mean value for the intercept, β_0. However, the characteristics of each individual are captured in the error term e_i. Replacing Equation 11 in Equation 10, gives:

$$y_{it} = \beta_0 + \beta_1 x_{1it} + \cdots + \beta_k x_{kit} + w_{it} \quad e \quad w_{it} = u_{it} + e_i \tag{12}$$

Where w_{it} represents the error term formed with the *i* components, belonging to the *i*-th individual or cross-section, and u_{it} is the combined error element of the time series and cross-section, also known as idiosyncratic error.

When the error term comprises two or more errors, it is called an error-components model (ECM). The assumptions for this model are:

$$\begin{aligned} &\varepsilon_i \sim N(0, \sigma_\epsilon^2) \\ &u_{it} \sim N(0, \sigma_u^2) \\ &E(\varepsilon_i u_{it}) = 0; \quad E(\varepsilon_i \varepsilon_i) = 0 \quad (i \neq j) \\ &E(u_{it} u_{is}) = E\big(u_{ij} u_{ij}\big) = E(u_{it} u_{is}) = 0 \quad (i \neq j; t \neq s) \end{aligned} \tag{13}$$

It can be seen that the error components ε_i and u_{it} are not correlated with each other and consequently w_{it} will not be correlated with any of the variables included in the model. Otherwise, the ECM will result in an inconsistent estimate. This being so:

$$\begin{aligned} &E(w_{it}) = 0 \\ &Var(w_{it}) = \sigma_\epsilon^2 + \sigma_u^2 \\ &cov(w_{it}, w_{is}) = \sigma_u^2 \end{aligned} \tag{14}$$

It is worth noting that if $\sigma_\epsilon^2 = 0$, there will be no differences between the OLS and random-effects models. This occurs because, in this case, there are no specific effects of individuals or, alternatively, all were considered in the explanatory variables. Another observation is that the error term w_{it} is homoscedastic and that the errors of the same individuals at different time points are correlated.

The OLS estimation method is not the most appropriate for that due to the correlation of the errors of the same individuals in different time periods. Thus, the method that best fits is the Generalized Least Squares (GLS). This model is used when the main focus is on variables that are constant over time, or when it is desirable to infer variability between cases and/or low intra-case variability.

3.1.4 Homoscedasticity (Breusch-Pagan test)

For the model choice, the first step is the Breusch-Pagan test (1979). This method seeks to test for homoscedasticity, that is, constant variance of the errors. The following assumptions are made:

$$H_0: \sigma_u^2 = 0 \tag{15}$$

$$H_1: \sigma_u^2 \neq 0$$

The test statistic is defined as:

$$LM = \frac{kT}{2(T-1)} \left[\frac{\sum_{i=1}^{k} [\sum_{t=1}^{T} \hat{e}_{it}]^2}{\sum_{i=1}^{k} \sum_{t=1}^{T} \hat{e}_{it}} - 1 \right]^2 \tag{16}$$

Under the null hypothesis, the test statistic, LM (Lagrange Multiplier), follows chi-square distribution with one degree of freedom and $\hat{e}_{it}$ is the OLS regression residual for stacked data. The parameter k denotes the number of individuals and the parameter T the number of periods. The null hypothesis assumes that the errors variances are equal (homoscedasticity), while the alternative hypothesis is that the errors variances are a multiplicative function of one or more variables. This test is appropriate for large samples and for when the assumption of errors normality is assumed. In other words, this test is useful when you want to choose between the models for stacked data and the random effects model, since in the first is assumed heterogeneity of the errors variance and in the second homoscedasticity. Thus, when the null hypothesis is not rejected, the model for stacked data is preferable.

3.1.5 Correlated random effects (Hausman Test)

For deciding between a fixed-effects model and a random-effects model, the main determinant, according to Wooldrigde (2019), is the unobserved effect β_{0i}. The appropriate method for this decision is the Hausman test (1978). To perform it, the central assumption is that:

$$H_0: \widehat{\beta_{0\iota}} - \widehat{\beta_0} = 0 \tag{17}$$

$$H_1: \widehat{\beta_{0\iota}} - \widehat{\beta_0} \neq 0$$

The test statistic is defined by:

$$H = [\widehat{\beta_{0\iota}} - \widehat{\beta_0}]' \left[Var(\widehat{\beta_{0\iota}}) - Var(\widehat{\beta_0})\right]^{-1} [\widehat{\beta_{0\iota}} - \widehat{\beta_0}] \tag{18}$$

The null hypothesis is that the estimators of the fixed-effect model, $\widehat{\beta_{0\iota}}$, and those of the random-effects model, $\widehat{\beta_0}$, do not differ substantially. This grants the validity of the random-effects model. When the equality of estimates hypothesis is rejected, it concludes that the ECM is not appropriate, i.e., possibly the random-effects are correlated with one or more regressors. Therefore, the fixed-effects model is preferable.

3.1.6 Likelihood ratio (Chow's Test)

Regarding the choice between the stacked data model and the fixed effects model, the most appropriate method is the Chow test (1960). Here, the test checks on the equality of intercepts and slopes, that is, it examines whether the parameters of one data set are equal to the other sets. In summary, the method examines whether the data can be grouped. Considering the groups, the sample interval is divided into two parts and then the parameters in each subsample are re-estimated. The following equations are given:

$$y_{it} = \beta_0 + \beta x + u \tag{19}$$

$$y_{it} = \beta_{01} + \beta_1 x + u_1 \tag{20}$$

$$y_{it} = \beta_{02} + \beta_2 x + u_2 \tag{21}$$

Equation 19 contains all k observations, Equation 20 has n_1 observations and Equation 21 numbers n_2 observations. The Chow Test is based on the following assumptions:

$$H_0: \beta_0 1 = \beta_{02} \ e \ \ \beta_1 = \beta_2 \tag{22}$$

$$H_1 : \beta_0 1 \neq \beta_{02} \ e \ \ \beta_1 = \beta_2$$

The test statistic is defined by:

$$F = \frac{\frac{\sum_{i=1}^{k}\left[\sum_{t=1}^{T} u_{it}\right]^2 - \left(\sum_{i=1}^{n_1}\left[\sum_{t=1}^{T} u_{1it}\right]^2 - \sum_{i=1}^{n_2}\left[\sum_{t=1}^{T} u_{2it}\right]^2\right)}{k}}{\frac{\sum_{i=1}^{n_1}\left[\sum_{t=1}^{T} u_{1it}\right]^2 - \sum_{i=1}^{n_2}\left[\sum_{t=1}^{T} u_{2it}\right]^2}{n_1+n_2-2k}} \quad (23)$$

Where $\sum_{i=1}^{k}[\sum_{t=1}^{T} u_{it}]^2$ is the squared sum of the model residuals for stacked data. Under the stability hypothesis, if the residuals are independent and normally distributed, the F distribution is verified, and if only the intercepts are different, then it is a fixed-effects model. In other words, when the null hypothesis is rejected, it is assumed that the most appropriate method is the fixed-effects model.

3.2 Analytical methodology of the elasticity of air passenger transport demand

3.2.1 Elasticity: basic concepts

In studying the demand curve of a given good or service based on consumers' essential preferences, it is useful to know how sensitive the demand is to price or income changes. In order to estimate an adimensional measure of sensitivity, that is, independently of the units used for measuring quantity demanded, price, or income, the idea of elasticity is commonly applied in the field of Microeconomics (Varian, 2009).

The price elasticity of demand, ε, is defined as the percentage change in quantity, q, divided by the percentage change in price, p. In mathematical terms, the definition of price elasticity of demand is given by:

$$\varepsilon = \frac{\frac{\Delta q}{q}}{\frac{\Delta p}{p}} \quad (24)$$

From where, rearranging Equation 24, the most commonly used expression for elasticity is obtained:

$$\varepsilon = \frac{p}{q}\frac{\Delta q}{\Delta p} \quad (25)$$

The elasticity may thus be described in Equation 25 as the ratio between price and quantity multiplied by the slope of the demand function for a given good or service. The price elasticity of demand is usually negative, since the demand curves have, in the vast majority of cases, a negative slope, i.e., the relationship between the quantity demanded for a good or service and its price is inversely proportional (Pindyck and Rubinfeld, 2017).

If a good or service presents elasticity of demand above 1 (in modulus) in absolute value, this means that its demand is elastic. The elastic demand curve is that in which the demanded quantity is very sensitive to price changes. Analogously, if the elasticity is below 1 in absolute value, the demand is inelastic. And if demand has elasticity exactly equal to 1, it is a unitary elastic demand.

Similarly, the income elasticity of demand, μ, is utilised to express how the quantity demanded for a good or service responds to a variation in consumer income, m. Mathematically, it can be represented as follows:

$$\mu = \frac{\frac{\Delta q}{q}}{\frac{\Delta m}{m}} \tag{26}$$

From where, rearranging Equation 26, the following expression is obtained:

$$\mu = \frac{m}{q} \frac{\Delta q}{\Delta m} \tag{27}$$

For the named normal goods, an increase in income results in an increase in demand, which is represented by a positive income elasticity of demand. The inferior good is the one whose income elasticity of demand is negative, which means that an increase in the income leads to a decrease in the demand. The luxury goods, on the other hand, are those whose income elasticity of demand is greater than 1, that is, a percentage increase in income leads to a proportionally greater increase in the quantity demanded (Varian, 2009).

The demand curve shape can strongly influence a corporation's successful pricing strategy. The concept of price elasticity of demand captures this effect by measuring the sensitivity of the quantity demanded to their price. The same occurs in relation to the economic scenario in which the corporation operates, that is affected by the growth and retraction cycles of the economy - known as business cycle - and their impact on the available income for household consumption. By measuring the sensitivity of the quantity demanded to variations in income, the concept of income elasticity of demand summarizes this effect.

The investigation of the income-price elasticity of demand is widely recognized and is usually considered in tactical business analysis, especially in the corporate financial management field. For instance, in organizations whose strategic positioning is typified by cost leadership, the analysis of the price-elasticity of demand might lead the executive to seek a reduction in costs, which would enable him to earn greater profit or pass on a lower price to the customer.

According to Besanko et al. (2017), in strict financial terms, the relationship between demand elasticity and business strategy can be established as follows:

- The more elastic the demand, the higher the impact on the company of a market strategy favourable to the customer (a reduction in price or an increase in the quality of the product supplied, for example); and
- The more vertical the demand curve, that is, more inelastic the demand, the better the corporate results from market strategies favourable to the company and which do not fully please the client (such as, for example, the increase in the price of the product).

The elasticity research in the corporate strategy field shows the importance of distinguishing between tactical and strategic choices. Decisions regarding occasional price increases or reductions are tactical choices, whereas the market positioning of cost differentiation is a strategic choice (Porter, 1998). Although the variable income is exogenous to the organization, the variable price is quickly adjustable and can also be rapidly re-established, if necessary, whereas the other strategic factors for the organization involve medium- and long-term movements. In other words, it is somewhat easier to change prices than to modify the quality of a product (as this involves more time and investment), and it is difficult to quickly return to a previous scenario when such a change proves to be wrong.

If the demand for a given good or service is very sensitive to its price, this may suggest a relatively lower degree of differentiation in other aspects, such as product quality or the customer relationship, for instance. For Porter (1998), when the prices change does not significantly influence the organization (that is, when its customers are less sensitive to price), it is clear evidence that the organization has achieved a form of differentiation other than the best cost. On this issue, Besanko et al. (2017) points out that an excessive price increase could lead customers to forego the benefit of differentiation in favour of the large price difference of less qualified competitors.

3.2.2 Data

a) Geographical approach: Brazil and its macro-regions

The domestic air travel information utilised in this stage of the research is collected from the ANAC microdata base[6], which contains the effectively commercialised airfare value and the number of seats sold per connection and per fare level, monthly, between 2011 and 2019. An annualization of the passenger traffic data between the cities involved in each air link and the calculation of the weighted average fares, per route, was performed for each year. According to ANAC, this accounts for about 50% of the total passenger movement by year once the tickets acquired via frequent flyer programmes and specific agreements between customers and airlines are not part of the database. The use of a database comprising the airfares actually commercialised and the number of seats sold, per air route, is a factor of methodological robustness in research works oriented to estimating elasticities of demand, as highlighted by Valdes (2015).

The economic statistics employed are from the Brazilian Institute of Geography and Statistics (IBGE). These are the GDP of the municipalities covered by the routes included in the sample and the price deflators. The Brazilian official consumer price index (IPCA) was applied to deflate the airfares values, while the national GDP deflator was adopted for the deflation of the GDP of the municipalities in the sample. All monetary data are therefore worked in 2019 constant prices.

The database comprises 186 airports with 6874 validated air connections for analysis over the period 2011-2019. Only links with more than 52 seats sold are considered, meaning an average of more than 26 seats in each direction.

The analytical model examines the interrelationship of three variables, two of which representing the regular domestic aviation and the remaining one illustrating the economy. The first is the natural logarithm of the number of seats sold (*PAX*), representing the air transport demand, and the second is the natural logarithm of the weighted average airfare applied on the sampled routes (*PRICE*). The variable price is

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[6] Available at: www.anac.gov.br/assuntos/dados-e-estatisticas/microdados-de-tarifas-aereas-comercializadas.

weighted by the incidence of airline ticket purchases, that is, the weight used is the number of airline ticket purchases at each price level for each route. The other variable reflects the macroeconomic scenario using the natural logarithms of the GDPs of the cities involved in the flight connections (*GDP*).

According to this approach, the volume of seats sold was used as a *proxy* for the number of passengers transported and the economic growth measured by the GDP as a *proxy* for the income. Thus, the quantity of seats sold – the dependent variable of the applied model – is estimated, with the average air fare and the aggregated GDP of the two cities involved in the air link being used as explanatory variables. As it is a panel data approach, the link and period characteristics will be expressed by *dummy* variables in the model. Table 3 presents the descriptive statistics of the model's variables, compiled for Brazil and its regions.

Table 3 – Demand elasticities model's descriptive statistics – Brazil and macro-regions.

	ln(PAX)	*ln(PRICE)*	*ln(GDP)*
Brazil			
Mean	7.09	7.16	17.72
Maximum	14.60	8.45	20.92
Minimum	3.97	1.05	12.42
Std. Dev.	2.19	0.42	1.17
Observations	23197	23197	23197
North Region			
Mean	6.72	7.38	17.50
Maximum	12.88	8.43	20.64
Minimum	3.97	4.20	12.94
Std. Dev.	1.88	0.36	1.12
Observations	7326	7326	7326
Northeast Region			
Mean	7.06	7.24	17.61
Maximum	14.05	8.45	20.62
Minimum	3.97	5.56	12.42
Std. Dev.	2.17	0.34	1.06
Observations	9230	9230	9230
Southeast Region			
Mean	7.27	7.08	17.93
Maximum	14.60	8.43	20.91
Minimum	3.97	1.05	12.42
Std. Dev.	2.32	0.42	1.33
Observations	11837	11837	11837
South Region			
Mean	6.99	7.14	17.66
Maximum	13.62	8.45	20.66
Minimum	3.97	4.59	13.23
Std. Dev.	2.08	0.37	1.00
Observations	7961	7961	7961
Midwest Region			
Mean	7.18	7.18	17.85
Maximum	13.72	8.39	20.80
Minimum	3.97	1.05	14.26
Std. Dev.	2.28	0.39	1.17
Observations	4891	4891	4891

The *ln(PRICE)* variable mean reveals that North and Northeast are the regions where airfares are higher. The low standard deviation of *ln(PRICE)* indicates a certain homogeneity in the ticket prices within each geographical area. *ln(PAX)* mean and standard deviation indicate a notable variability in terms of transported passenger flow on the connections included in the sample. The passengers' movement is higher in the Southeast and Northeast regions. Once this geographical approach of the study is concerned with analysing the two cities involved in each air connection, without splitting the routes according to the originating or destination city of each flight on the link[7], their GDPs are analysed conjointly, represented by the *ln(GDP)* variable. Its standard deviation reflects the varying size of the cities within each region. Some of the selected cities are economic hubs, tourist cities, or cities of strategic interest for the country. On the other hand, some cities are economically smaller, or have low tourism attractiveness or are in remote areas, for instance, thus evidencing the country's inter- and intra-regional geographic diversity.

b) Geographical approach: Brazilian Amazon (remote cities)

As in the previous geographic framework, also in this approach the air transport data is obtained from ANAC microdata base. But now, from 2011 to 2016 – period of more political, economic and financial stability in the recent Brazilian scenario. Here, the first step in the sample preparation is the identification of the isolated cities and the annualization of the movement data among O-Ds and the calculation of the weighted average fare in each link per year. The analysis of the Brazilian territory indicates the North region as the one presenting the largest number of cities located in isolated and remote regions, concentrated in the named Legal Amazon.

Although a category can always be divided into subcategories, it is considered that the Amazon is a homogeneous region in relation to air transport in its remote cities, whose differences between localities are explained by the *dummy* variables of each route. This procedure was also adopted in relation to the movement between capital cities.

Here, the database is directional, i.e., it considers the one-way ticket from the interior (remote) city of the North region to intra- and inter-regional destinations. The data refers to the 33 airports with 1372 O-Ds validated for the analysis in the period. Annexes 1 and 2 present the map of Brazilian North Region, with the location of airports considered in the remote areas' investigation, as well as the International Civil Aviation

[7] For the investigation of the elasticity of demand considering remote areas as the geographical approach, a segmentation of air connections by origin and destination (O-D) is used.

Organization (ICAO) acronym of airports, the cities related to each one of them and the identification of the name regarding the corresponding Brazilian state.

The analytical model investigates the relationship among four variables, two representing the regular aviation and two representing the economy. The first is the *PAX* natural logarithm of the city classified as remote or isolated area in the national territory, and the second is the natural logarithm of the average fare applied in air links of the sample (*PRICE*). The other two variables represent the economic context through natural logarithms of GDPs of origin (*GDPO*) and destination (*GDPD*) cities. Table 4 shows the descriptive statistics of the variables considered for analysis in the model.

Table 4 – Demand elasticities model's descriptive statistics – Remote cities in Brazilian Amazon.

	ln(PAX)	*ln(GDPO)*	*ln(GDPD)*	*ln(PRICE)*
Mean	3.67	14.60	16.60	6.75
Maximum	11.47	17.20	20.41	8.34
Minimum	0.00	11.64	10.76	3.68
Std. Dev.	2.41	1.09	1.72	0.47
Observations	5231	5231	5231	5231

The standard deviation of the *ln(PAX)* variable indicate an accentuated flow variety in air links involving remote cities. The small standard deviation observed in *ln(PRICE)* indicates a certain uniformity in the airfares. This is because these cities, in general, are distant from economic centres, at distances not so diversified. The difference observed between *ln(GDPO)* and *ln(GDPD)* is explained by the fact that the destination includes the economic centres interacting with remote cities. The small standard deviation of both indicates a small size variation among the cities.

Some selected cities are touristic cities or cities presenting strategic interest for the country. Tabatinga, in Amazonas state, for example, is a city bordering Colombia, with the city of Leticia beside it – strategic city for the control of Brazilian borders. Tucuruí, in Pará state, is the host city of the municipality where one of the biggest hydroelectric plants in Brazil is located. Santarém, also in Pará state, is a historic city, founded in 1661, which is located at the junction of the Amazonas and the Tapajós rivers. Ourilândia do Norte is a city in a mining area in Pará state. Parauapebas, as well in Pará state, is settled in one of the biggest mineral provinces of the planet called Serra dos Carajás, with iron ore, manganese, copper and gold reserves. Coari, in Amazonas state, where there is a significant production of natural gas. Parintins, also in Amazonas state, holds the Parintins Festival (Festa do Boi), which is an annual famous manifestation of the local culture acknowledged and appreciated internationally. In general, each city has an attractive feature which demands more efficient transport, where public and private interests are connected.

It is important to note that, in this remote areas approach, only links coming from interior (remote) cities of the Brazilian North region are considered the target for the analysis. The links between capitals of Brazilian states (mentioned in this study as trunk-links) are employed as an analysis reference.

3.2.3 Models

a) Geographical approach: Brazil and its macro-regions

The general model applied for estimating the regression parameters is presented in Equation 28 as below:

$$ln\, PAX_{i,j,t} = \omega_{i,j} + \varphi_t + \alpha\, lnPRICE_{i,j,t} + \beta\, lnGDP_{i,j,t} + \varepsilon_{i,j,t} \qquad (28)$$

Where,

- ln: natural logarithm;
- $\omega_{i,j}$: cross-section effect coefficients;
- φ_t: period effect coefficients;
- α e β: coefficients estimated in the regression model;
- $PAX_{i,j,t}$: seats sold on the air link between cities i and j at year t;
- $PRICE_{i,j,t}$: weighted average fare on the air link between cities i and j at year t;
- $GDP_{i,j,t}$: aggregated GDP of the cities i and j involved in the air link at year t;
- $\varepsilon_{i,j,t}$: error of the regression.

For constructing comparative analyses in the temporal and territorial dimensions, regressions were conducted for Brazil and for each of its five macro-regions. Moreover, for each area, regressions were performed considering the complete period of analysis (2011-2019) and the two sub-periods investigated (2011-2013 and 2014-2019). Thus, eighteen econometric regressions were performed. The econometric software for statistical modelling Eviews 11 was the tool applied to run all the regressions (Eviews, 2019).

Worth mentioning that the two-stage least squares (2SLS) method could be appropriate to correct the possible endogeneity of the price variable. Nevertheless, a limitation of the study is finding a same instrumental variable suitable for geographic regions that are notably heterogeneous.

b) Geographical approach: Brazilian Amazon (remote cities)

The general model used to estimate the regression parameters for the remote areas investigation is shown in Equation 29.

$$ln\, PAX_{i,j,t} = c + \omega_{i,j} + \alpha\ lnGDPO_{i,t} + \beta lnGDPD_{j,t} + \gamma lnPRICE_{i,j,t} + \varepsilon_{i,j,t} \quad (29)$$

Where,

- c: constant;
- *ln*: natural logarithm;
- $\omega_{i,j}$: cross-section effect coefficients;
- α, β and ɤ: coefficients estimated in the regression model;
- $GDPO_{i,t}$: GDP of the origin city (remote area) i at year t;
- $GDPD_{j,t}$: GDP of the destination city j at year t;
- $PRICE_{i,j,t}$: weighted average fare on the O-D, cities i and j involved in the air link at year t;
- $PAX_{i,j,t}$: seats sold on the O-D between cities i and j at year t;
- $\varepsilon_{i,j,t}$: regression error.

3.3 Analytical methodology of the drivers of international tourism

3.3.1 Drivers: theoretical model

The analytical model of this stage of the research assumes that international tourism (*inb*, *rec*, *outb*, *exp*, and *opentour*) across the world is oriented by three drivers (Figure 11). The first is the countries' economic dynamics, represented by the income growth rate (*GDP*), the international trade (*opentrad*), the national currencies' purchasing power (*currence*) and the air passenger transport sector's vitality (*flights*, *PAX*, and *trcost*).

The second driver is the globalisation process, as reflected by the time-evolution itself. In fact, one of the global economy's main distinguishing features since the 20th century's last decade is the increasing flow of goods, services, capital, and people around the world, which directly impacts international tourism.

Finally, besides the national economies' growth rate, the structural socio-economic level of each country also determines the international tourism. This third driver therefore proposes that the tourist flow among countries is influenced by their relative weight in the world economy on a macroeconomic and demographic basis, represented by indicators such as population, GDP, and international trade.

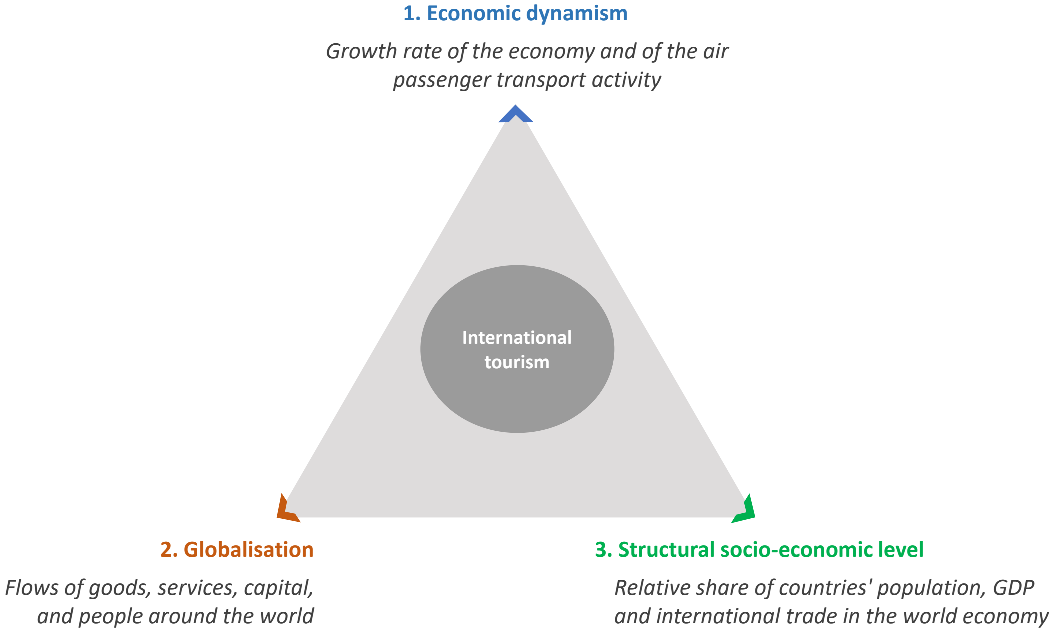

Figure 11 – Theoretical model: drivers of the world tourism.

For examining these three drivers, the investigation begins by using a set of unbalanced panel data regression analysis with period and cross-section fixed effects. The approach considers the international tourism indicators as dependent variables (*inb*, *rec*, *outb*, *exp*, and *opentour*) and as explanatory variables the selected indicators of the countries' economic dynamism for the period 1995 to 2019 (i.e. the set of variables related to Driver 1 - see Figure 11).

The second step consists in analysing the period fixed effect, which indicates the globalisation impact (Driver 2) on the international tourism indicators evolution. Considering a constant year-to-year effect is a study limitation, since it is known that the globalisation process presented distinct dynamics throughout the considered period: more intense at the beginning and moderate after the effects of the global financial crisis that erupted in 2008. Nevertheless, we consider this estimate already acceptable if the model presents a high determination coefficient (adjusted R-squared).

The third step involves the discussion of the country's structural socioeconomic level (Driver 3), represented by the unbalanced panel data regression estimate constant added to the cross-section fixed effect of each selected nation, per tourist macro-region of the planet. This cross-sectional analysis uses the correlation of the countries' structural levels with socioeconomic variables that differentiate them in terms of their magnitude and relevance in the international scenario.

3.3.2 Data

The statistical information used in this stage of the research is from the World Bank database, DataBank – World Development Indicators[8]. A total of 130 countries with registered data for the period 1995 to 2019 were considered for this study[9]. It is worth noting that more recent data, post 2019, did not enter the analysis as they needed a more specific approach due to the impacts of the COVID-19 pandemic that erupted later that year.

The analytical model investigates the interrelationship between five variables of international tourism and six variables of economy and air passenger transport. The first group includes the following: (i) inbound tourism (*inb*), indicating the volume of tourists arriving from other countries; (ii) tourism receipts (*rec*), representing how much non-resident tourists spend in the country, i.e. the volume of resources entering the country; (iii) outbound tourism (*outb*), indicating the volume of tourists going to other countries; (iv) outbound tourism expenditures (*exp*), showing the volume of resources that are withdrawn from the country by tourists; and (v) tourism openness (*opentour*), representing the share of tourism revenues and expenditures in the GDP of the country, that is, the level of tourism openness of the country.

The second group includes the following variables: (i) income level (*GDP*), represented by GDP per capita in constant 2015 US$, indicating the country's level of

[8] Available at: https://databank.worldbank.org/source/world-development-indicators

[9] See Annex 4 for the full list of countries investigated.

development or level of purchasing power of residents; (ii) flight departures (*flights*), represented by the number of aircraft take-offs from regular flights, indicating the country's level of air mobility; (iii) air passengers (*PAX*), represented by the number of air transport passengers (domestic and international), indicating the level of access to air transport in the country; (iv) currence power (*currence*), defined by the exchange rate for constant value of GDP in PPP 2017 minus exchange rate for constant value of GDP in US$ 2015, indicating the purchasing power of the local currency (a negative value indicates a strong currency of the country, zero value indicates equivalence to the dollar, and a positive value indicates a weak currency in relation to the dollar); (v) transport cost (*inb trcost* and *outb trcost*) defined by the share of transport cost in inbound revenues or outbound spending in the country, indicating the share of transport costs in the tourist's resource availability for the trip; and (vi) trade openness (*opentrade*), represented by the share of imports and exports in the country's GDP, indicating the level of openness to foreign trade of the country.

The World Development Indicators database organises the world economy into five touristic macro-regions: Europe, America, Asia & Pacific, Africa, and the Middle East[10]. The analysis is also carried out for the group of countries that comprise the BRICS (Brazil, Russia, India, China, and South Africa), as well as the nations of the G7, which consists of the richest countries in the world. Following are the descriptive statistics of the variables used in this comparative approach.

Table 5 – Tourism Indicator variables model's descriptive statistics.

Statistics	***ln(inb)***	***ln(outb)***	***ln(rec)***	***ln(exp)***	***ln(opentour)***
Mean	15.06	15.01	21.63	21.19	-2.92
Maximum	19.17	18.88	26.16	25.86	-0.11
Minimum	9.39	10.34	15.10	16.21	-6.64
Std. Dev.	1.50	1.71	1.63	1.82	0.96
Observations	3072	1918	2598	2545	2275

[10] The countries in each region/cluster are listed in Annex 4.

Table 6 – Explanatory variables model's descriptive statistics.

Statistics	***ln(GDP)***	***ln(flights)***	***ln(PAX)***	***ln(inb trcost)***	***ln(outb trcost)***	***ln(currence)***	***ln(open trade)***
Mean	9.04	10.79	15.05	-2.29	-1.93	1.41	4.37
Maximum	11.57	16.13	20.65	1.25	-0.02	8.90	6.24
Minimum	5.34	3.09	6.47	-9.27	-9.12	-0.43	2.59
Std. Dev.	1.34	1.75	2.03	1.24	0.91	1.31	0.52
Observations	3150	2663	2646	2295	2396	3046	2999

The model variables' descriptive statistics (Table 5) indicate that, regarding tourism indicators, there is a greater heterogeneity among the selected countries in terms of tourist arrivals and tourism revenue in comparison with the outbound flows of tourists and travel expenses abroad. In addition, there is more homogeneity among the sampled countries regarding the tourism openness level. With respect to economic and air transport variables (Table 6), a higher variability of the flight flows and, therefore, of the air passengers transported is noted among the selected countries. In contrast, the share of transport costs in the travellers' available tourism budget is relatively more homogeneous. The trade openness variability is also comparatively low among the countries.

Figure 12 presents an overview of international tourism indicators from a temporal (historical series) and geographical (macro-regions of the globe) perspective. From 1995 to 2018, an upward trend is observable for tourism indicators, followed by a pronounced drop in 2019 (already due to the pandemic effects that erupted at the end of that year). The European tourism market largely predominates in terms of inbound and outbound movements. Regarding financial flows (revenues and expenditures), this predominance is shared with both the Asia & Pacific and the Americas tourism markets. With respect to tourism openness, with the exception of Africa, there is a greater regional balance. In fact, the African market is markedly less prominent among the five tourist regions analysed by the selected indicators.

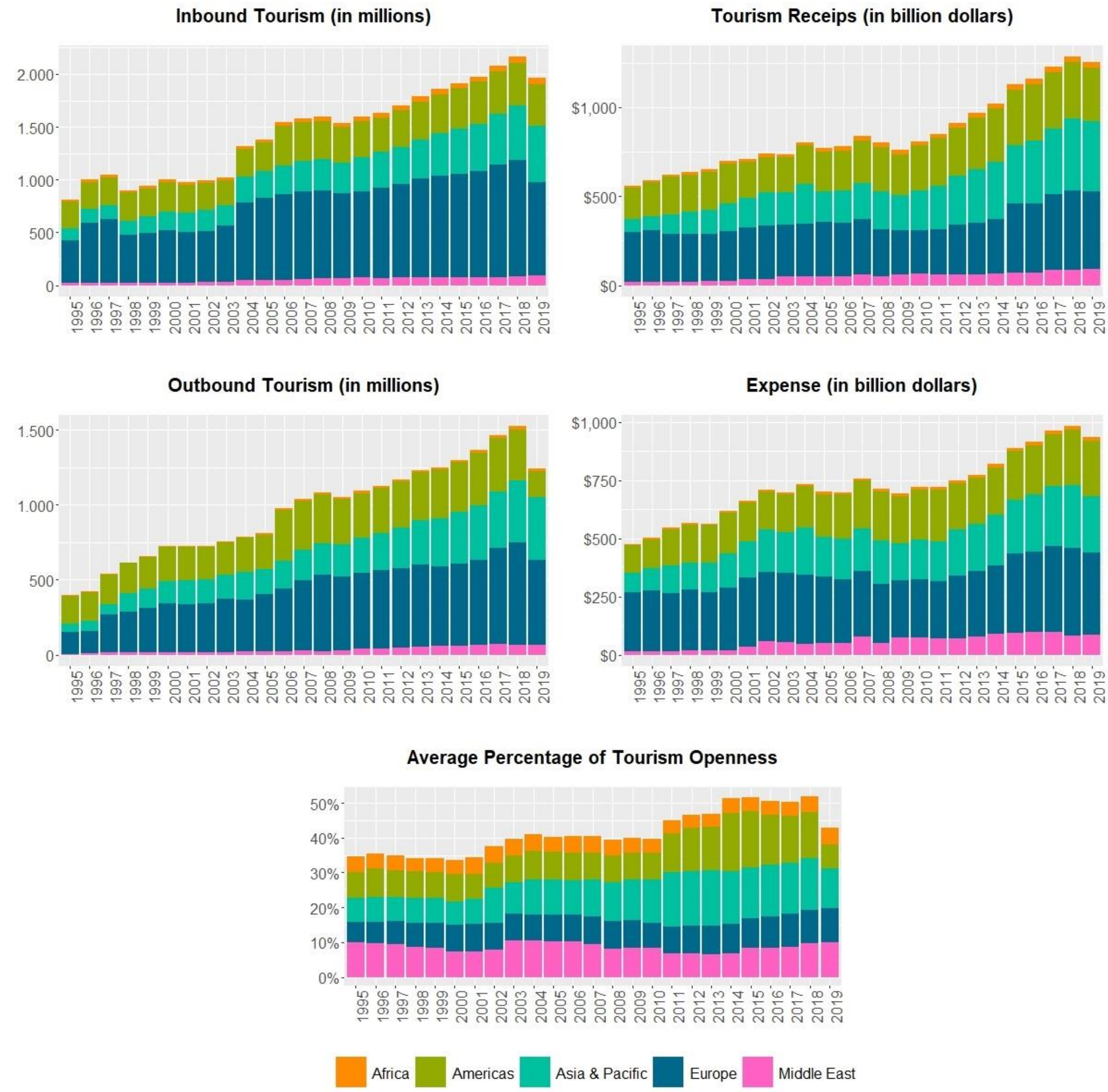

Figure 12 – Overview of tourism indicators across the world. Source: World Bank Database.

3.3.3 Models

The methodology for investigating the drivers of international tourism, considering the five tourist macro-regions defined by the World Bank, is based on the model defined by Equation 30. Such mathematical expression is used in the analysis framework at this stage of the research to estimate the regression parameters. The tourism indicators where the explanatory variables did not present significant coefficients (greater than or equal to 0.90) were eliminated from the regression.

$$ln(tourism\ indicator_{i,t}) = \omega_i + \varphi_t + C + a\ ln(GDP_{i,t}) + b\ ln(flights_{i,t}) + c\ ln(PAX_{i,t}) + d\ ln(currence_{i,t}) + e\ ln(trcost_{i,t}) + f\ ln(opentrade_{i,t}) + \varepsilon_{i,t} \quad (30)$$

Where,

- ln: natural logarithm;
- ω_i: cross-section effect coefficients;
- φ_t: period effect coefficients;
- C: constant;
- $a, b, c, d, e,$ and f: coefficients estimated in the regression model;
- $tourism\ indicator_{i,t}$: tourism indicator j in country i at year t,

▪ where j can assume:

  - $inb_{i,t}$: non-resident tourists arriving at the country's border;
  - $rec_{i,t}$: inbound tourism receipt;
  - $outb_{i,t}$: resident tourists leaving the country;
  - $exp_{i,t}$: outbound tourism expenditure; and
  - $opentour_{i,t}$: tourism receipts and expenditures as a share of the country's GDP.

- $GDP_{i,t}$: GDP per capita constant US$ 2015 of the country i at year t;
- $flights_{i,t}$: domestic and international air transport carried out by registered air carriers, departing from country i at year t;
- $PAX_{i,t}$: domestic and international air transport passengers carried from country i at year t;
- $currence_{i,t}$: exchange rate for constant value of GDP in PPP 2017 less exchange rate for constant value of GDP in US$ 2015 in country i at year t;
- $trcost_{i,t}$: participation of transport costs relative to inbound revenues (*inb trcost*) and outbound expenses (*outb trcost*) in country i at year t;
- $opentrade_{i,t}$: participation of imports and exports in the country's GDP, indicating the country i level of openness to international trade at year t;
- $\varepsilon_{i,t}$: error of the regression.

In line both with the modeling described by Equation 30 and with the methodology proposed for this stage of the research, a comparative analysis is also conducted, in the temporal and territorial dimensions, for emerging and developed economies. Thus, a more parsimonious version of the modeling, focusing on inbound and outbound tourism, is used for the regressions of the BRICS countries and the G7 countries. The comparative analysis of the BRICS and G7 models is based on Equations 31 and 32.

$$ln(inb_{i,t}) = \omega_i + \varphi_t + C + a\ ln(GDP_{i,t}) + b\ ln(currence_{i,t}) + c\ ln(trcost_{i,t}) + d\ ln(opentrade_{i,t}) + \varepsilon_{i,t} \quad (31)$$

$$ln(outb_{i,t}) = \omega_i + \varphi_t + C + a\ ln(GDP_{i,t}) + b\ ln(flights_{i,t}) + c\ ln(currence_{i,t}) + \varepsilon_{i,t} \quad (32)$$

Here, like the previous stage of the research, the econometric software for statistical modelling EViews 11 was the tool applied to run all the regressions (Eviews 11, 2019).

4 CASE STUDY

This chapter presents the research case study. The description of the objects of analysis is organized into two subsections. The first one provides an overview of the passenger air transport sector in Brazil, highlighting the macroeconomic context in which the industry is inserted and the regional diversity of a country of continental dimensions. Special attention is dedicated to the remote cities of the Brazilian Amazon, a region internationally known and of great global relevance for the achievement of a low carbon economy. In the second subsection, an overview of the international tourism is presented, detailing its importance for the countries' economic development and the relative importance of each within the context of the industry. In this sense, the dynamics of international tourism is analysed both from a geographical and a geopolitical perspective, by country groups/clusters.

4.1 Passenger air transport

4.1.1 Brazil: a country of continental dimensions and marked interregional heterogeneity

Brazil has 208.5 million inhabitants (IBGE, 2018a) spread over an area covering 8.51 million Km^2 (IBGE, 2018b). It is the fifth biggest country in the world by land area and the seventh most populous (CIA, 2020). Its economy in 2018 was the largest in Latin America and ranked ninth globally (IMF, 2019). Such continent-wide dimensions are considered attractive for air transport operations, especially when a given city is more than a certain distance from other cities.

Brazil's political-administrative organisation comprises 27 federative units (26 states and the national capital) and contains 5570 cities grouped into five macro-regions – North, Northeast, Southeast, South and Midwest (see Figure 13, elaborated for the year 2018). Each region with its particular geographical, demographic, economic, social, environmental, and cultural conditions (IBGE, 2020d).

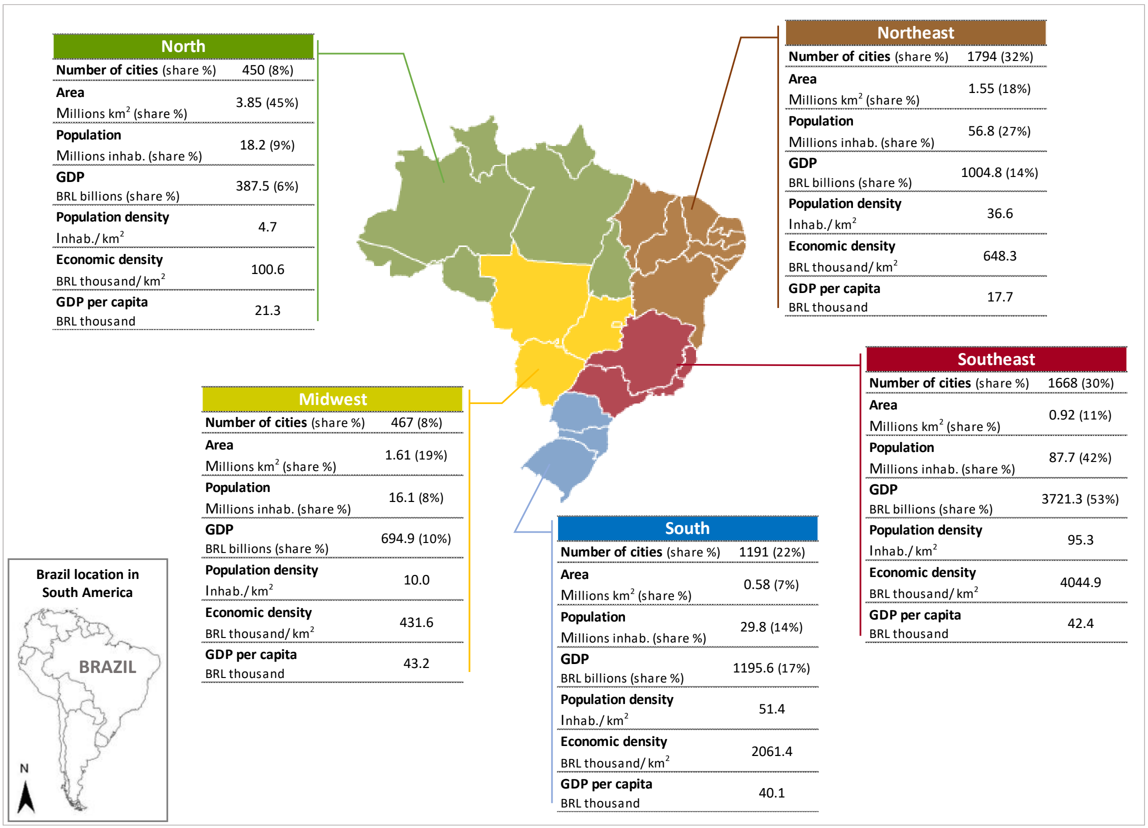

Figure 13 – Overview of the Brazilian territory, according to selected geographic, demographic, and economic indicators - 2018. Data source: IBGE.

Although the North is the largest region in size (45% of the total area), it has the country's lowest population and economic densities. A large portion of the North is covered by the Brazilian Amazon, an area of great scientific interest due its importance to the global climate agenda. Northeast is the region with the largest number of cities and the second largest population, even though only representing 14% of the national economy. This region features the lowest GDP per capita in the country. Southeast has the highest population and economic densities. Despite covering the second smallest area, the region comprises 42% of the country's population and accounts for more than half of the Brazilian GDP. South is the smallest region in terms of geographical extension (7% of Brazil). However, it accounts for 14% of the population and 17% of the country's economy. This region has the second-highest GDP per capita in Brazil. Midwest is the second largest region in territorial extension and the less populated. Responsible for 10% of the national economy, it features the highest GDP per capita among the five macro-regions (IBGE, 2018a; 2018b; 2020b; 2020c). Therefore, one must recognise the complexity of the Brazilian territory, which is related to the evident economic and social disparities between the regions (Klein and Ferrera de Lima, 2016; Lima et al., 2016; Araujo and Flores, 2017).

These disparities and the heterogeneity of the Brazilian territory are also reflected on the unequal distribution of the density of its transport logistics network (IBGE, 2014a; Aprigliano Fernandes et al., 2019). This is particularly noted between the North and the rest of the country, resulting in complete isolation of some municipalities of the Brazilian Amazon. Thus, the nation's diversity can also be seen in terms of the essentiality of the air transport system in each macro-region's transport logistics, since some states are comparatively more aviation system-dependent for their regional development (IBGE, 2017).

4.1.2 Civil aviation and the Brazilian economic outlook 2011-2019

Brazilian GDP grew at an average annual rate of 0.8% between 2011 and 2019 (IBGE, 2020a). Nevertheless, such growth was not uniform throughout the years. The reference period for this study can be divided into two sub-periods with completely different macroeconomic dynamics (see Figure 14).

Between 2011 and 2013, the first is characterized by high GDP growth for the patterns of the Brazilian economy in recent history. Driven by household consumption and positively influenced by both a booming credit market and good employment and income indicators, Brazil's GDP has grown by an average of 3.0% in these three years.

The year 2014 brought signs of a downturn in this trajectory, affected by a fiscal crisis that fuelled a severe political crisis that culminated, in 2016, in the impeachment of Brazil's president. The Brazilian economy entered into a recession in 2015 and 2016, recovering at a low growth rate in the following three years. In the second sub-period analysed, between 2014 and 2019, the Brazilian GDP registered a negative annual average variation: -0.3% (Pessôa et al., 2011; Baltar and Leone, 2015; Pessôa, 2016; Paula and Pires, 2017; Oreiro, 2017).

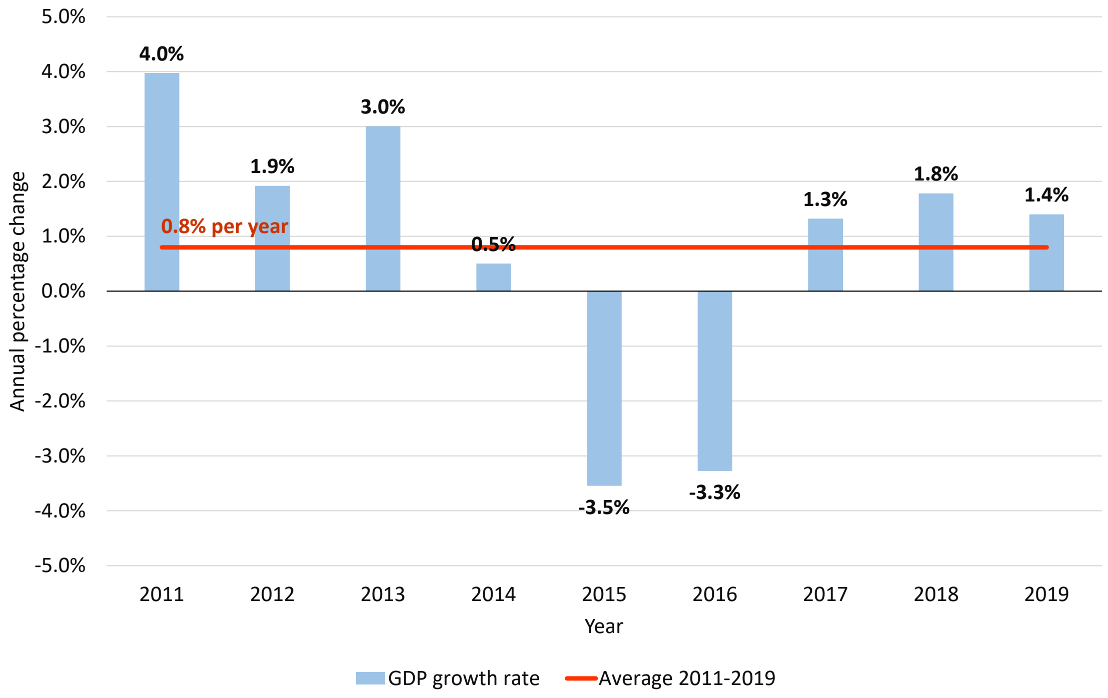

Figure 14 – Brazilian real GDP growth rate – 2011/2019. Data source: IBGE.

The air industry liberalization in Brazil took place throughout the 1990s, as part of the national economy opening. The investigated period is characterized by the predominance of a market environment, i.e., the absence of subsidies for suppliers and consumers of air tickets. Besides the economic scenario, some developments between 2011 and 2019 also affected the airlines' decisions and the air travel demand. The concession launching of the main Brazilian airports (Fernandes and Pacheco, 2018), the nation's election to organise the 2014 FIFA World Cup and the city of Rio de Janeiro's selection to host the 2016 Olympic Games, among other factors, all led to an optimistic atmosphere about the air transport future scenario in the country.

This favourable outlook prevailed until 2014, when the country's political and economic downturn deepened. Still, the share of the expenditure on domestic air tickets in the total monetary expenditure made by Brazilian households increased by 78% accumulated over the period (IBGE, 2011; 2019c).

Influenced by both the macroeconomic conditions and the developments in the sector, the airfares consumption in Brazil, measured using the number of domestic passenger seats sold (*PAX*), was higher during the economic growth sub-period – annual average of 50.4 million between 2011 and 2013 versus 43.3 million in the subsequent six years (Table 7). The average value of the airfares commercialized (*PRICE*) was negatively affected by the recessive situation, remaining at a lower level in the second sub-period investigated (BRL 1353.51 between 2014 and 2019 compared to BRL 1532.91 in the previous three years).

Table 7 – Boarding domestic passengers at Brazilian airports and average airfares – 2011/2019. Source: ANAC microdata.

Year	*PAX*	*PRICE* (BRL)
2011	49 037 265	1520.20
2012	50 537 561	1486.14
2013	51 717 998	1592.38
2014	53 412 274	1553.59
2015	49 126 497	1305.24
2016	40 582 179	1294.13
2017	39 693 932	1319.84
2018	38 453 993	1325.88
2019	38 445 641	1322.40
Period averages		
2011-2019	45 667 482	1413.31
2011-2013	50 430 991	1532.91
2014-2019	43 285 753	1353.51

4.1.3 Remote cities in the Brazilian Amazon

The North region comprises seven states: Acre (AC), Amapá (AP), Amazonas (AM), Pará (PA), Rondônia (RO), Roraima (RR) and Tocantins (TO). Its biggest and main cities are the capitals Manaus (AM) and Belém (PA), the only ones with a population of more than one million inhabitants (IBGE, 2019a). The following state capitals are also important regional centres: Porto Velho (RO), Macapá (AP), Palmas (TO), Rio Branco (AC), and Boa Vista (RR).

The North has the largest territorial extension among the five macro-regions, covering around 45% of the territory (see Figure 13). Amazonas is the largest Brazilian state. It exceeds the sum of South and Southeast areas. The largest Brazilian municipality is Altamira, in Pará, which is larger than several Brazilian states. The ten cities with the largest territorial dimension in Brazil are located inside the Amazon region (IBGE, 2018b). On the other hand, the North region population accounts for only 9% of the country. Consequently, the North presents the lower population density among the macro-regions (IBGE, 2019a). The region's economy contributes with 6% of the Brazilian GDP.

Five of the six states with the lowest regional GDPs in Brazil are located in North. Thus, the economic density and the GDP per capita of the region are below the national average (IBGE, 2019b).

A major part of the named Legal Amazon is in the North[11]. This is a region of international interest due to its relevance and role regarding the sustainable development of the planet. Its growing importance in the worldwide agenda concerning sustainability is due to the carbon stock, weather, water, and biodiversity existing in the region (Araújo and Léna, 2011). Amazon has the largest drainage basin of the planet (one fifth of the world's freshwater reserves) and comprises one of the greatest biodiversity in the world (one-third of the world's broadleaf forest reserve), which makes the region strategic for the global weather regulation (Garda et al., 2010; Kauano et al., 2020). Among the potentialities of Amazon, is highlighted the mineral reserves found in the region, with emphasis in iron ore, manganese, niobium, oil, and natural gas (Araújo and Léna, 2011).

The North region presents the most humid weather in Brazil, with a period of a large volume of rains, flooding several areas and roads, which makes access only possible by air. Consequently, since the arrival of the first colonizers to the Brazilian territory, it may be verified that the occupation of Amazon has, as one of its main bottlenecks, the precarious link to the rest of the country (Lima et al., 2012). It is in this Amazonian immensity that the logistics, especially with regard to transport, face big challenges and barriers to be operationalized, due to the characteristics of the region. The large distances to be crossed are combined to the deficiencies existing in different modes (IBGE, 2017).

The study of Territory Flows and Networks, performed by IBGE, points out an uneven distribution of the density regarding transport logistics network between the North region and the rest of the country, resulting in a complete isolation of certain areas of Brazilian Amazon (Annex 3). In Brazil, the road mode in the transport logistics prevails; however, the Amazon region is an exception to this rule. In North, the passengers water transport prevails and the distances among municipal capitals are long, resulting in long journey times. The interaction among urban centres became rare once the transport is

[11] Legal Amazon is comprised by the seven states which are part of the North region, by the state of Mato Grosso, that is included in the Central-West region, and by the cities of the Maranhão state, part of the Northeast region, that are located at east of the meridian 44°. Legal Amazon covers about 61% of the Brazilian territory (IBGE, 2014b).

predominantly performed through waterways and is, therefore, slower, considering the fact that the municipal capitals are distant.

The air modal is essential in the transport logistics of the North region. The regional highway network is insufficient, with low quality and poorer integration, which makes the North states more dependent of the aviation system for the socioeconomic development and for humanitarian activities (IBGE, 2017). In 2019, 59% of Brazilian roads were assessed as regular, bad or terrible in research performed by the Brazilian National Confederation of Transport (CNT). In the North region, this percentage was even higher: 77% (CNT, 2019). Table 8 shows some statistics related to the regular domestic air transport in remote cities of the North region of Brazil for the period analyzed. It is important to note that the investigated time period for this remote cities approach (2011-2016) covers the years of greater economic and political stability of the Brazilian scenario among those available in the research database used.

Table 8 – Evolution regarding the coverage of regular domestic air transport in remote locations of the Brazilian North region. Source: ANAC micro data.

Year	Cities	*PAX*	*POP* (millions)	*GDPO* (BRL billions)	*PRICE* (BRL)
2011	31	633,805	2.526	73.793	290.31
2012	28	680,136	2.340	69.380	311.63
2013	27	781,275	2.376	73.399	300.41
2014	26	755,907	2.335	64.237	355.40
2015	26	746,508	2.409	58.180	323.32
2016	20	482,963	2.084	50.112	314.15

Although there is an increase in passenger demand from 2011 to 2013, from about 23%, there is already a reduction in the cities served by air transport, which is accentuated until 2016 with the reduction in travel demand in the studied region. It is observed that the number of cities covered by regular air transport reduces over the years, minimizing the population quantitative (*POP*) potentially covered by the civil aviation system. This reduction indicates the optimization of routes by companies and the search for profitability in operations related to air routes in remote regions.

The reduction in the total of passengers boarding in airports of the region (*PAX*) is a result of two movements: first, the economic crisis experienced by the country in the end of the analysed period, visible in the GDP reduction in remote cities (*GDPO*), and the second, the reduction of the air transport service offer according to the lowest number of cities served. The price analysis of air tickets (*PRICE*) considers the weighted average of fares practiced in each link of the sample. The average price of tickets was directly influenced by the behaviour of the Brazilian economy in the period.

4.2 International tourism

4.2.1 Globalisation and the world economy's centre of gravity shifting

The process of globalization undertaken by developed countries has led to a shift in world production towards the East, although developed countries continue leading world consumption. However, over the years, this movement led to the rise of an emerging middle class, with consumption capacity augmentation in the countries where production has been moved in. As a result, these countries began to have technological and innovation capacities. This globalization movement alerted the least developed countries of the immense disparities in living standards on the planet, where a small portion of the population, of over 7 billion inhabitants, has disproportionate access to the benefits of production and the planet's natural resources.

Studies such as the one by Kharas (2010) have shown a perspective of radical change for the future, especially in relation to the two most populous countries in the world, China and India. Figure 15 shows the share in world consumption projection of certain groups and individual countries. This figure reveals, in the years to come, a substantial reduction in the share of world consumption by the European Union (EU), the United States, and Japan, which are the hard-core developed countries. Cooperation between emerging countries, the productive, technological, innovation capacities, and raw material availability of emerging economies will promote significant changes in the relationship between countries. The hegemony of rich countries in the world order is being challenged by a desire of emerging countries for an order based on the multilateralism of a multipolar world. Countries like China and India, even without sharing the essential values considered by developed countries, are thriving sharply and assuming fundamental roles in the world economy.

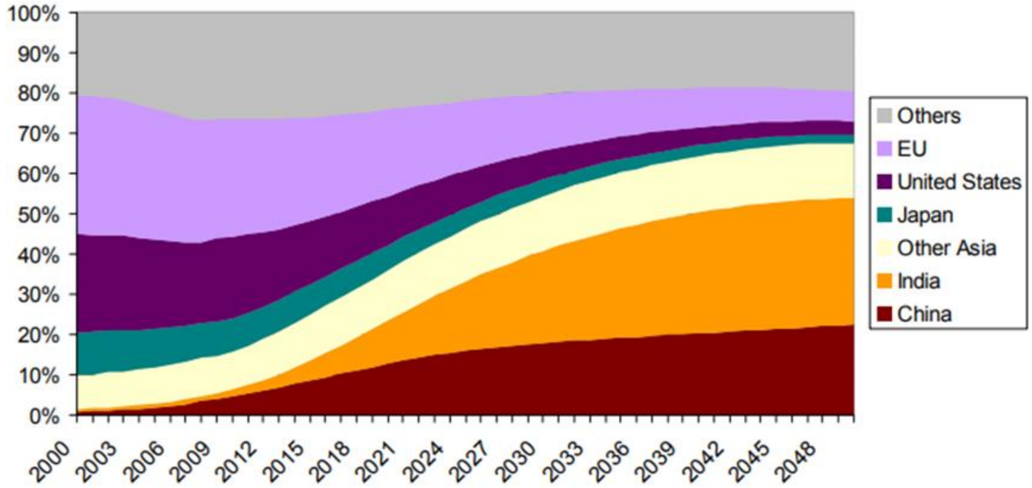

Figure 15 – Perspective of people consumption across the world 2000-2050. Source: Kharas (2010).

Kharas (2010) presents a perspective of the growth of the middle class in the world. Figure 16 shows that the set of countries of the so-called Global South will hold the middle-class evolution, mainly in Asia. Several years ago, the United Nations (UN) notice this trend, which led to the United Nations Office for South-South Cooperation (UNOSSC) creation, operating since 1974 in the United Nations Development Program (UNDP), which points to a UN perception for direct cooperation between Global South countries to promote the development of these countries[12].

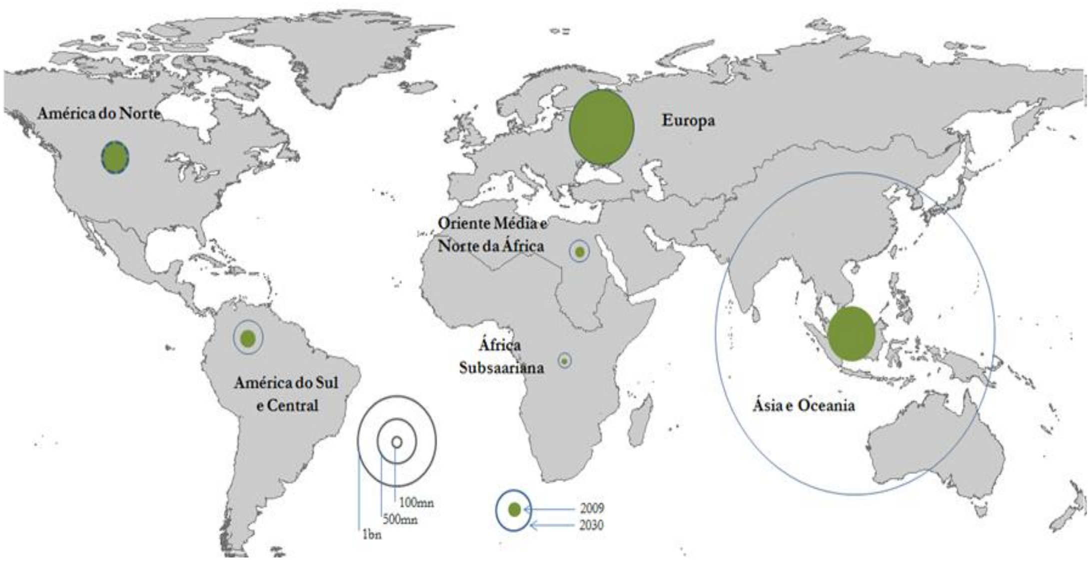

Figure 16 – Distribution, in 2009, and perspective 2030 of the middle class in the world. Source: Kharas (2010).

[12] For more information, see: https://unsouthsouth.org/about/about-unossc/.

Besides this initiative, it is later seen an initiative outside the context of the UN, BRIC, which soon became BRICS and is becoming BRICS plus. Searching the development and sustainability of their growth, large emerging economies established the BRIC multilateral cooperative arrangement in 2009, involving Brazil, Russia, India, and China, becoming BRICS in 2011 with the accession of South Africa. BRICS is an important multilateral cooperative arrangement that brings together the main emerging economies of the world, comprising 41% of the world's population, 24% of the world's GDP, and over 16% of participation in world trade (Ambardar, 2017). BRICS countries have been the main engines of global economic growth over the past few years.

Figure 17 presents a historical movement and a forecast of the Earth´s economic centre of gravity evolution calculated by the McKinsey Global Institute (2012). This figure shows that this gravity centre was in the world eastern part and move to the western between Europe and North America in the early times after World War II. From them it starts to return to the eastern. Quah (2011), using data from 1980 to 2007, forecasted the world gravity centre position until 2050 and forecasted that it goes steadily to somewhere between India and China by 2050 (Figure 18).

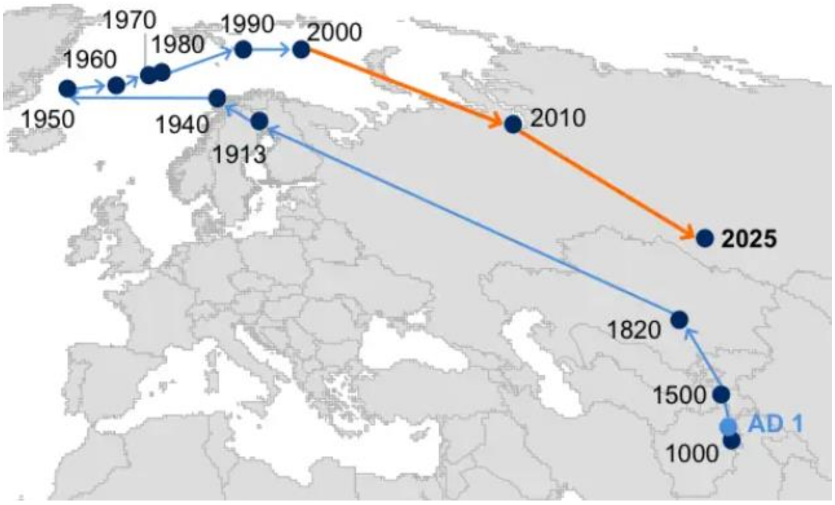

Figure 17 – Evolution of the Earth’s economic centre of gravity trend to 2025. Source: McKinsey (2012).

Figure 18 – World’s economic centre of gravity trend to 2050. Source: Quah (2011).

There are enough signs nowadays that Global South countries will hold a significant influence on the world's future economic relations order. The increasing South-South cooperation movements show that emerging and underdeveloped countries will join these cooperations and see them as an important way to promote their so-awaited development.

4.2.2 Air transport routes concentration across the world

The most important air routes in the world are in the North Hemisphere, between North America, Europe, and Asia. Figure 19 shows the concentration of air transport routes in the world. Over the past few years, countries from the Middle East have been making large investments to restore the area's past role as a commercial gateway between the West and the East, with a lot of the money going towards tourism (Syed, Bouri, Zafar, & Adekoya, 2021). However, all alternatives are finding geopolitical problems, which may inhibit or even block people and goods flows between Global North and Global South countries. Figure 19 shows an enormous gap in connections between the continents of the Global South countries. Asia, Africa and Latin America have a low connection density, suggesting that there is a low number of people moving between these continents, since air transport is the primary mean of moving people over long distances. Internal movement in Asia is already quite dense in 2018, however, the objectives of South-South cooperation are still modest across continents.

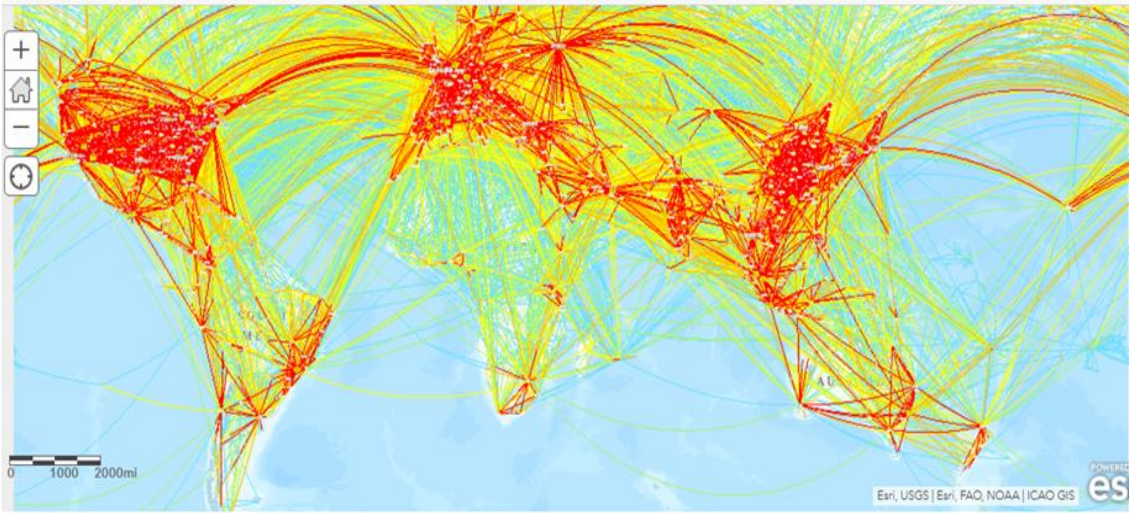

Figure 19 – Concentration of air transport across the world. Source: ArcGIS Enterprise - ICAO Traffic Flow Forecast 2018 real.

It is natural that in the first moment of the world economic gravity centre movement to the East; it is seen an increase in the movements among Asia, Europe, and North America. This is because of leading countries want to explore the wealth and opportunities created by the Global South counties' growth. However, with time is also natural that the Global South countries want to enjoy their own wealth with the increasing South-South cooperation. So, it is expected that direct transport routes and commercial links will be established, and tourism may play an important role in this new scenario.

4.2.3 International tourism outlook: a regional view

Tourist expenditure gives a dimension of the income available for this activity in the world. Figure 20 shows a relative position of outbound tourism expenditure in 2019, highlighting the BRICS countries. Although the source is still the Global North countries, there is a very relevant role for the Global South countries, especially India and China, which should hold a significant growth of the middle class in the coming years and therefore should expand their participation.

Figure 20 – Tourism expenditure across the world. Source: World Bank data (Base: Google Map).

From another angle, Figure 21 shows the relative size of countries in relation to revenues from inbound tourism across the world. The scenario in this case is quite different, showing a much less significant participation of the Global South in these revenues, especially the BRICS countries.

Figure 21 – Tourism Receipts across the world. Source: World Bank data (Base: Google Map).

Table 9 presents a sample of the most populous countries in the world, with data on international tourist arrivals. India and Brazil, based on the index (ITurArr), represented by the number of tourists arriving in the country (TurArr) per capita, have the lowest relations between the countries sample. This indicator shows the modest position that these countries occupy in relation to international tourism in the world. Except some countries like Mexico, emerging and underdeveloped countries have low ITurArr, which is a sign that these countries did not develop this important sector of the economy.

Comparing the BRICS indicators with the G7 (block of the richest countries in the world) in the sample, it is seen a very distinct scenario.

Table 9 – Population (Pop), international tourism arrivals (TurArr) and Intensity of TurArr (ITurArr) by country in 2019. Source: World Development Indicators, World Bank.

Country Name	Country Code	Pop	TurArr	ITurArr*
China	CHN	1,397,715,000	162,538,000	0.12
India	IND	1,366,417,756	17,914,000	0.01
United States	USA	328,329,953	166,009,000	0.51
Indonesia	IDN	270,625,567	16,107,000	0.06
Brazil	BRA	211,049,519	6,353,000	0.03
Russian Federation	RUS	144,406,261	24,419,000	0.17
Mexico	MEX	127,575,529	97,406,000	0.76
Japan	JPN	126,264,931	31,882,000	0.25
Philippines	PHL	108,116,622	8,261,000	0.08
Egypt, Arab Rep.	EGY	100,388,076	13,026,000	0.13
Vietnam	VNM	96,462,108	18,009,000	0.19
Turkey	TUR	83,429,607	51,747,000	0.62
Germany	DEU	83,092,962	39,563,000	0.48
Iran, Islamic Rep.	IRN	82,913,893	9,107,000	0.11
Thailand	THA	69,625,581	39,916,000	0.57
France**	FRA	66,987,240	211,998,000	3,16
United Kingdom	GBR	66,836,327	40,857,000	0.61
Italy	ITA	59,729,081	95,399,000	1.60
South Africa	ZAF	58,558,267	14,797,000	0.25
Tanzania	TZA	58,005,461	1,527,000	0.03
Myanmar	MMR	54,045,422	4,364,000	0.08
Kenya	KEN	52,573,967	2,049,000	0.04
Korea, Rep.	KOR	51,709,098	17,503,000	0.34
Colombia	COL	50,339,443	4,529,000	0.09
Spain	ESP	47,133,521	126,170,000	2.68
Argentina	ARG	44,938,712	7,399,000	0.16
Canada	CAN	37,593,384	32,430,000	0.86

*ITurArrr=TurArr/Pop. In blue are G7 countries, in yellow are BRICS countries.
** France 2018.

Table 10 shows the flow of inbound tourists in BRICS countries in the year of its foundation, 2009, and in the latest available data for this research. In Table 8, except for India, it is seen that that the BRICS countries tourists' movement grew at different rates. China and South Africa had a positive international tourism balance movement. The largest volume of inbound tourists is in China and Russia. The other flows are very shy. Brazil is the country that receives the least tourists from BRICS partners. In the BRICS countries, Brazil is the country that is far away in physical distance from the major world markets in the Northern Hemisphere, mainly the Asian market. India had an impressive improvement for inbound tourism.

Table 10 – Arrivals of non-resident tourists at national borders, balance between inbound and outbound 2018, and growth by country. Source: UNWTO – United Nations World Tourism Organization.

Country	2009	2018	Balance 2018	Change 2018-2009
Brazil	4,802,217	6,621,376	- 4,565,579	1.38
Russia	21,338,650	24,550,910	- 19,090,543	1.15
India	5,167,699	17,423,420	- 1,971,775	3.37
China	126,475,923	158,606,390	80,929,046	1.25
South Africa	9,531,615	15,004,384	8,471,754	1.57

5 RESULTS AND DISCUSSION

This chapter presents and discusses all the findings of the research. It gathers the results of the statistical tests applied, the estimated models and the economic interpretation of the cross-section and period effects for each approach considered. As in the previous chapters, the results are subdivided into two sections, one for each stage of the research: elasticity of air passenger transport demand and drivers of international tourism.

5.1 Elasticity of air passenger transport demand

5.1.1 Elasticity dynamics over time and across the Brazilian territory

For defining the model applied, the Chow, Breusch-Pagan, and Hausman statistical tests are performed to identify the appropriate effects of each airline connection and each period, namely: no effect, fixed effects, or random effects. The Chow test (Table 11) rejected (p-value <0.05) the null hypothesis of no effect for both cross-section and period, implying that fixed effects could be more suitable.

Table 11 – Brazil and macro-regions – Redundant fixed effects tests (Chow test).

Test cross-section and period fixed effects			
Effects test	Statistic	d.f.	*p*-value
Cross-section F	53.15	- 3 924.19	0.00
Period F	42.94	-8.23	0.00

Similarly, the Breusch-Pagan test (Table 12) was conducted to verify the possibility of no effect *vis-a-vis* random effects. The no effect null hypothesis was also rejected (p-value <0.05), suggesting, in this case, that the random effect might be more adequate.

Table 12 – Brazil and macro-regions – Lagrange multiplier tests for random effects (Breusch-Pagan test).

	Test hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	48 017.09	5 347.20	53 364.29
p-value	0.00	0.00	0.00

The subsequent stage, the Hausman test, is intended to compare the estimates considering random effects in contrast to fixed effects. Significant divergences between them point to the unsuitability of the estimators that consider random effects. The test results (Table 13) indicate that the null hypothesis of random effects is rejected (*p*-value <0.05), thus indicating that the model employed should include the presence of fixed effects for both cross-sections and periods.

Table 13 – Brazil and macro-regions – Correlated random effects tests (Hausman test).

Test summary	Chi-Sq. stat.	Chi-Sq. d.f.	*p*-value
Cross-section random	43.14	2	0.00
Period random	106.50	2	0.00

Therefore, after considering a range of possibilities, the best estimator selection procedure identified the OLS regression model using panel data and with fixed effects in cross-section and period as the most appropriate for the analysis proposed in this stage of the research. Figure 22 illustrates the *dummy* variable of the cross-section fixed effects for Brazil as a whole, in increasing order. Introducing this *dummy* accommodated the effect of the discrepancies in density of the air links contained in the sample, therefore making the model able to estimate the actual impact on passenger demand from changes in cities' incomes, and from the airfares' values. In this case, *dummies* with positive coefficients show the most attracting routes for civil aviation. Analogously, the *dummy* variable of the period fixed effects (Figure 22), demonstrates that years of economic growth are more favourable for air transport activity.

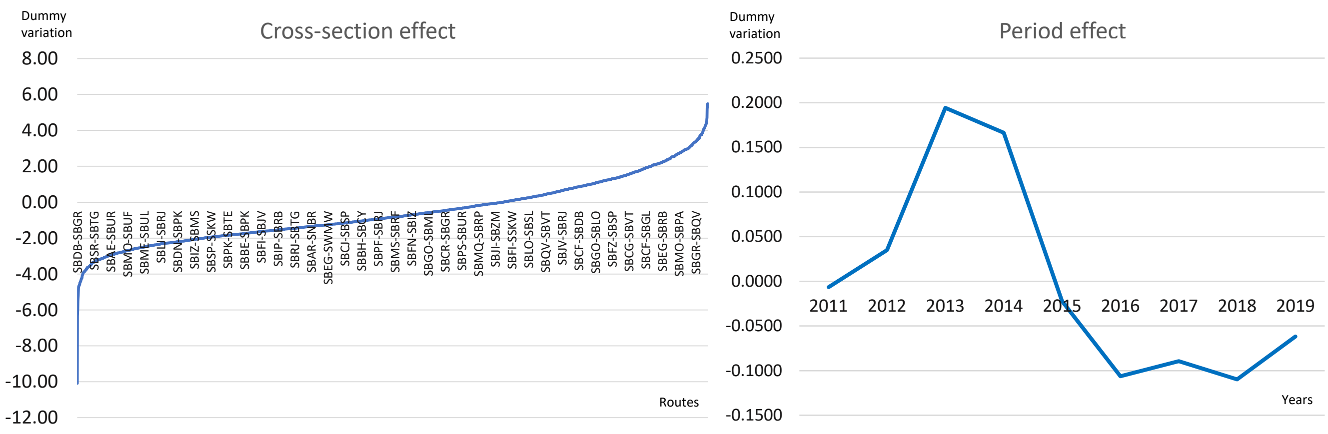

Figure 22 – Brazil – Cross-section and period fixed effects.

The same regression model was applied both to Brazil and to its macro-regions, in order to comparatively analyse the subject under investigation and discuss the results. The estimated models provide a good level of explanation (adjusted R-squared) for the passengers' flow on the examined air routes. There, the elasticities reflect what can be expected of the demand for assumed price and income variations. Statistical tests validate the explanatory power of airfare on demand, since the *LPRICE* variable has its significance confirmed for all geographic and temporal sub-samples studied. The same occurs regarding the income in most of the estimated models. For those circumstances in which the GDP of the cities involved in the air route was not statistically or economically significant, the *LGDP* variable was removed from the model. The following coefficients estimated by the models for the explanatory variables of demand (*LPAX*) had all their significance confirmed by statistical tests at a 90% confidence level.

Table 14 presents the results obtained for Brazil, for which 6874 air links with valid data from 2011 to 2019 were identified. The air travel demand in Brazil remains elastic to changes in its prices (1.47) and inelastic to changes in the income (0.71). Even though these features are maintained across the diverse economic contexts, the air tickets consumer is comparatively more sensitive to fare changes during the low growth or economic stagnation/recession period (1.59 versus 1.29). This is attributable to the influence of the households' financial situation and the consumers' psychological conditions (future expectations) on the demand elasticity (Smeral and Song, 2015). It is noted that, in Brazil, such price elasticity estimates are at the lowest levels observed in the literature (Brons et al., 2002; Mumbower et al., 2014; Wang et al., 2018), that may indicate lower competitiveness of the domestic aviation market. The standardisation of the Brazilian airlines' fleet on large aircraft (Cabo et al., 2020) may be limiting competition in general (low differentiation perspective), mainly on routes with lower passenger movement. Furthermore, competition with other transport sectors is practically non-existent in the Brazilian air market. There is no long-distance passenger rail transport in Brazil – this service is only available for urban transport. Regarding the road sector, competition with air transport is limited to a few routes in the Southeast and South regions of the country.

In contrast, income elasticity maintains some stability in both economic scenarios (0.54 versus 0.52). Understanding income elasticity can highlight the market's maturity level, which can help decision making regarding the exploration of investment opportunities in higher growth potential markets (concentration on trunk links). Graham (2000) describes an immature air market having a demand income elasticity greater than 1 (i.e., the growth potential is higher), a fully mature market with an income elasticity of 1 or less (the growth potential is lower) and a fully saturated market with an income elasticity of 0 (no growth potential).

Table 14 – Brazil - Panel least squares regression models.

Dependent variable: LPAX									
Period	2011-2019			2011-2013			2014-2019		
Total panel (unbalanced) observations	23197			6667			16530		
Variable	Coefficient	t-Stat.	Prob.	Coefficient	t-Stat.	Prob.	Coefficient	t-Stat.	Prob.
LPRICE	-1.47	-78.79	0.00	-1.29	-30.43	0.00	-1.59	-78.69	0.00
LGDP	0.71	11.76	0.00	0.54	2.71	0.01	0.52	6.82	0.00
C (intercept)	5.02	4.67	0.00	6.99	1.95	0.05	9.15	6.76	0.00
Adjusted R-squared	0.941			0.950			0.961		

The sample includes a total of 1214 air connections related to the North Region along the whole investigated period. Results presented in Table 15 show that, although price elasticity remains close to the country's average for the entire period (1.46), it drops to a lower level during the economic growth period (1.14). This consumer's less sensitivity to airfare changes can be explained by the region's air transport essentiality, which is particularized by logistical constraints, notably the scarcity of substitute transport modals (IBGE, 2014a), and encompasses remote areas that face repressed demand for the service. The opposite is seen in the low GDP growth period: the price elasticity estimate is higher as compared to the national average (1.68). This is attributable to the longer-distance air connections linking the region, implying more expensive flights. So, the region's tourism opportunities are limited and very costly. The greater weight of the air travel involving the North in the households' budget also explains both the fact that the income elasticity estimated for the region for the whole period (0.88) is the highest in the country, and the circumstance that income cannot explain demand in the first sub-period.

Table 15 – North Region – Panel least squares regression models.

Dependent variable: LPAX									
Period	2011-2019			2011-2013			2014-2019		
Total panel (unbalanced) observations	7326			2261			5065		
Variable	Coefficient	t-Stat.	Prob.	Coefficient	t-Stat.	Prob.	Coefficient	t-Stat.	Prob.
LPRICE	-1.46	-45.60	0.00	-1.14	-14.76	0.00	-1.68	-48.78	0.00
LGDP	0.88	9.29	0.00	-	-	-	0.72	5.26	0.00
C (intercept)	2.05	1.25	0.21	15.33	26.52	0.00	6.38	2.68	0.01
Adjusted R-squared	0.932			0.937			0.957		

In the Northeast Region, 1355 air connections were observed between 2011 and 2019. In this case, the price elasticity of air travel demand estimate for the whole period (1.62) is the highest among the country's macro-regions (Table 16). It can reflect the fact that the Northeast is the most economically impoverished Brazilian region – according to microeconomic theory, the greater the weight of a given good or service in the household budget, the greater the consumer's sensitivity to changes in both income and price (Mas-Collel et al., 1995). Income elasticity in the region (0.81) is also well above the national average. This is justified because Northeast is one of the country's most touristic regions, highly desired for domestic tourism. The income-price elasticity of demand is markedly different in the two economic scenarios, but in both it remains above the country's average.

Table 16 – Northeast Region – Panel least squares regression models.

Dependent variable: LPAX									
Period	2011-2019			2011-2013			2014-2019		
Total panel (unbalanced) observations	9230			2394			6836		
Variable	Coefficient	t-Stat.	Prob.	Coefficient	t-Stat.	Prob.	Coefficient	t-Stat.	Prob.
LPRICE	-1.62	-58.75	0.00	-1.53	-24.41	0.00	-1.70	-57.35	0.00
LGDP	0.81	8.19	0.00	0.61	1.86	0.06	0.57	4.46	0.00
C (intercept)	4.66	2.68	0.01	7.72	1.31	0.19	9.34	4.18	0.00
Adjusted R-squared	0.958			0.965			0.969		

The results for the Southeast Region, which concentrates the largest number of airline connections (1941 covering the region for the whole period), provide income-price elasticity of demand estimates below the country's average (Table 17). The price elasticity for the entire period (1.28) is the lowest among the five regions. This is the region with the highest GDP, where the weight of air passenger transport services in the household budget tends to be relatively smaller, making its sensitivity to oscillations in income and fares lower (Mas-Collel et al., 1995). The price elasticities estimates are quite different under the distinct economic conditions. The consumer's sensitivity is greater during the sub-period of economic stagnation and recession (1.42 versus 1.28), something that can be explained by the availability of substitute goods – the region has a larger possibility of alternative modals of transport. During the economic growth period, air travels can be categorized as a luxury good in the Southeast (income elasticity of demand equal to 1.15). Luxury goods are those whose demand by consumers increases more than proportionally to the increase in their income (Varian, 2009). This outcome is consistent with that outlined in Fernandes et al. (2019): after buying a car, air travel is the main consumer desire of the emerging middle class that resulted from the first sub-period of higher GDP growth.

Table 17 – Southeast Region – Panel least squares regression models.

Dependent variable: LPAX									
Period	2011-2019			2011-2013			2014-2019		
Total panel (unbalanced) observations	11837			3557			8280		
Variable	Coefficient	t-Stat.	Prob.	Coefficient	t-Stat.	Prob.	Coefficient	t-Stat.	Prob.
LPRICE	-1.28	-45.12	0.00	-1.28	-20.72	0.00	-1.42	-45.36	0.00
LGDP	0.59	6.87	0.00	1.15	3.92	0.00	0.60	5.73	0.00
C (intercept)	5.75	3.72	0.00	-4.21	-0.79	0.43	6.54	3.52	0.00
Adjusted R-squared	0.936			0.950			0.959		

There were 1324 airline connections involving the South Region during the investigated period, and the estimated income-price elasticities were situated above the national average (Table 18). The country's two geographically extreme regions present similarities regarding the estimated elasticity patterns due to the air routes longer distance. Just as in the North, also in the South the income has no statistical significance in the first sub-period. In the second subperiod, the income elasticity above the country's average for the period (0.72) may be justified by the region's tourist attractions, mostly leisure-oriented, where the consumer's sensitivity to income oscillations is more affected by the macroeconomic conditions.

Table 18 – South Region – Panel least squares regression models.

Dependent variable: LPAX									
Period	2011-2019			2011-2013			2014-2019		
Total panel (unbalanced) observations	7961			2113			5848		
Variable	Coefficient	t-Stat.	Prob.	Coefficient	t-Stat.	Prob.	Coefficient	t-Stat.	Prob.
LPRICE	-1.51	-49.82	0.00	-1.30	-18.67	0.00	-1.58	-46.71	0.00
LGDP	0.88	8.78	0.00	-	-	-	0.72	5.66	0.00
C (intercept)	2.21	1.24	0.21	16.61	33.05	0.00	5.41	2.41	0.02
Adjusted R-squared	0.947			0.952			0.963		

The Midwest included the analysis of 1040 air connections between 2011 and 2019. The region's special feature is that income is not significant in explaining the demand for airline tickets in any of the sub-periods investigated. Moreover, the price elasticity maintains some stability under the different economic scenarios (Table 19). The economic strength of the Midwest is connected to the agribusiness, being the largest producer of the agriculture sector in Brazil (Forster-Carneiro et al., 2017). The activity is characterized by its own pattern of development, sometimes dissociated from the rest of the domestic economy, since its production is mostly focused on the international trade. Furthermore, it is also influencing economic conditions of the North Region, particularly in frontier states, such as Tocantins and Roraima.

Table 19 – Midwest Region – Panel least squares regression models.

Dependent variable: LPAX									
Period	2011-2019			2011-2013			2014-2019		
Total panel (unbalanced) observations	4891			1266			3625		
Variable	Coefficient	t-Stat.	Prob.	Coefficient	t-Stat.	Prob.	Coefficient	t-Stat.	Prob.
LPRICE	--1.51	-36.95	0.00	-1.53	-13.76	0.00	-1.53	-35.69	0.00
LGDP	-	-	-	-	-	-	-	-	-
C (intercept)	18.00	61.44	0.00	18.62	23.23	0.00	17.99	58.57	0.00
Adjusted R-squared	0.951			0.948			0.968		

The findings confirm the assumption that, particularly in the Brazilian case, the estimated income-price elasticities of demand for air passenger transport led to significantly different results throughout the territory, depending on the geographical location of the cities involved in the air links. In addition to their regional non-rigidity, the estimates also vary over time, influenced by the macroeconomic conditions.

The practical effects of this non-rigidity of the demand's sensitivity to price and income changes can be exemplified through an illustrative exercise using Tables 7 and 14 as a reference. Considering different income elasticities for distinct economic scenarios would imply a relative deviation of almost 50 thousand passengers per year for Brazil as a whole in terms of aggregate demand prediction. Under a positive macroeconomic scenario, as represented by the period 2011-2013, an increase in the Brazilian GDP by 1% in current values (about 70 BRL billions), *ceteris paribus*, would generate an average annual increase of 272 thousand air passengers. By contrast, under an unfavourable macroeconomic scenario, such as the one observed between the years 2014 and 2019, the demand increase would be proportionally lower, around 225 thousand passengers per year. The implications for policy makers and civil aviation industry stakeholders when using dynamic estimates for elasticities are also evidenced when considering airfare variation. Under an economic growth scenario, an 1% increase in the fare average value would lead to a demand decrease of approximately 651 thousand passengers. But in a scenario of economic stagnation and recession, the demand reduction would be even more severe, on the order of 688 thousand passengers per year – a difference of almost 40 thousand passengers per year in the comparison between the two scenarios.

These outcomes are in line with some evidence found in the literature. Peng et al. (2015), for example, point out that, upon fluctuations in economic activity or changes in consumers' expectations regarding their income or employment, the assumption of constant income elasticities of demand is likely to result in larger forecast errors. From a territorial perspective, Ssamula (2012) highlights the relevance of considering the different price elasticities of demand involving capital cities and cities located in remote areas to ensure the effectiveness of civil aviation development policies.

5.1.2 Elasticity in remote areas: the case of Brazilian Amazon

As with the approach described in the previous subsection, Chow, Breusch-Pagan, and Hausman tests were applied for the definition of the effects regarding the model used. The Chow test (Table 20) rejected (p-value <0.05) the null hypothesis of pool estimation for the cross-section, suggesting that the fixed effects would be more appropriate.

Table 20 – Brazilian Amazon remote cities – Redundant fixed effects tests (Chow test).

Test cross-section and period fixed effects			
Effects Test	Statistic	d.f.	*p*-value
Cross-section F	11.29	- 13,713,856	0.00
Cross-Section/Period F	8,434.62	1,371	0.00

The Breusch-Pagan test (Table 21), performed with the purpose of verifying the presence of random effects *versus* no effect (pool), also rejected the null hypothesis of the pool modelling (p-value <0.05), suggesting, in this case, that the random effect would be more appropriate.

Table 21 – Brazilian Amazon remote cities – Lagrange multiplier tests for random effects (Breusch-Pagan test).

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	4220.44	136.29	4356.74
p-value	0.00	0.00	0.00

The results of Hausman test (Table 22) point out that the null hypothesis for random effects (p-value <0.05) is rejected, recommending that the modelling developed considers the existence of fixed effects for transversal sections and periods.

Table 22 – Brazilian Amazon remote cities – Correlated random effects tests (Hausman test).

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	*p*-value
Cross-section random	76.093436	3	0.00

The period fixed effect was not considered, bearing in mind the fact that the historical series is six years. Thus, after examining different possible options, the regression model of OLS with panel data and with fixed effect in cross-section was selected as the most appropriate estimator for this analysis.

Table 23 shows the results of the regression model applied, containing the *GDPO*, *GDPD*, and *PRICE* elasticities of the demand (*LPAX*) in O-Ds of remote cities. *Dummies* with positive coefficients indicate the most attractive routes for air transport and the elasticities portray what can be expected from demand for the hypotheses of price and income variations.

Table 23 – Brazilian Amazon remote cities – Panel least squares regression models.

Dependent Variable: LPAX			
Cross-section fixed (dummy variables)			
Total panel (unbalanced) observations: 5231			
Variable	Coefficient	t-Statistic	Prob.
LGDPO	0.66	6.74	0.00
LGDPD	0.55	3.23	0.00
LPRICE	−0.93	−18.26	0.00
C (intercept)	−8.88	−2.99	0.00
Adjusted R-squared	0.821		

The explanation level of the estimated model (Adjusted R-squared) is reasonable for the passengers' flow in O-Ds of remote cities, given the complexity of estimation. Statistical tests confirm the significance of the income indicators regarding the cities involved in O-D, and the ticket price. All coefficients were inelastic, i.e., lower than 1. However, if we consider the two income indicators ranging together in the same direction, an income elasticity higher than 1 may be observed. If they range in different directions, one may cancel the other. The price elasticity of the demand is almost unitary, so that in the case of remote cities, a variation in the demand of an O-D in the same proportion of the price may be expected.

Figure 23 shows the *dummy* variation of the cross-section fixed effects of remote cities, sorted in ascending order. It shows that the introduction of this *dummy* absorbed the effect of density difference regarding O-Ds of the sample, allowing the model to estimate the real effect on the passengers demand, from the variations in the income of cities, and from the price of air tickets. The basic motivation for the implantation of links with remote cities will always occur by specific motivators, isolated or jointly, among the O-D locations, as: tourism, energetic resources, mining, agricultural activities, migrations, regional development policies, national defense logistics, among others.

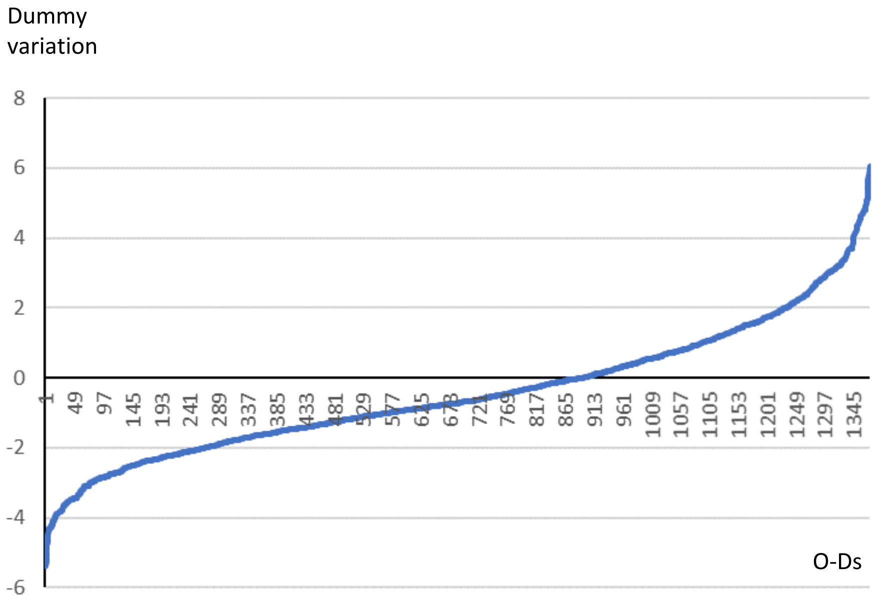

Figure 23 – Brazilian Amazon remote cities – Cross-section fixed effects.

For purposes of comparative analysis and discussion, the same model of regression was applied in the trunk-links, or among capitals. Table 24 shows the results for such links. In this case, 865 O-Ds with valid data were identified.

Table 24 – Brazilian capital cities (main trunk links) – Panel least squares regression models.

Dependent Variable: LPAX			
Cross-section fixed (dummy variables)			
Total panel (unbalanced) observations: 5141			
Variable	Coefficient	t-Statistic	Prob.
LGDPO	1.15	10.54	0.00
LGDPD	0.62	7.11	0.00
LPRICE	−1.03	−32.63	0.00
C (intercept)	−15.89	−7.51	0.00
Adjusted R-squared		0.956	

The model of O-Ds among capitals (Table 24) shows a level of explanation higher than the one of remote cities (Table 23), observed in the adjusted R-squared of 0.956. All explanatory variables of the demand (*LPAX*) present statistical tests confirming the estimated coefficients significance. Figure 24 shows the same characteristics of Figure 13 for the capitals. It is observed that few links have a large adjustment promoted by the *dummy*. This is due to the case of positive adjustment to the O-D observations with the cities of São Paulo, Rio de Janeiro and Brasília. In case of negative adjustments, they are applied to links with state capitals of less developed states, as Roraima and Tocantins.

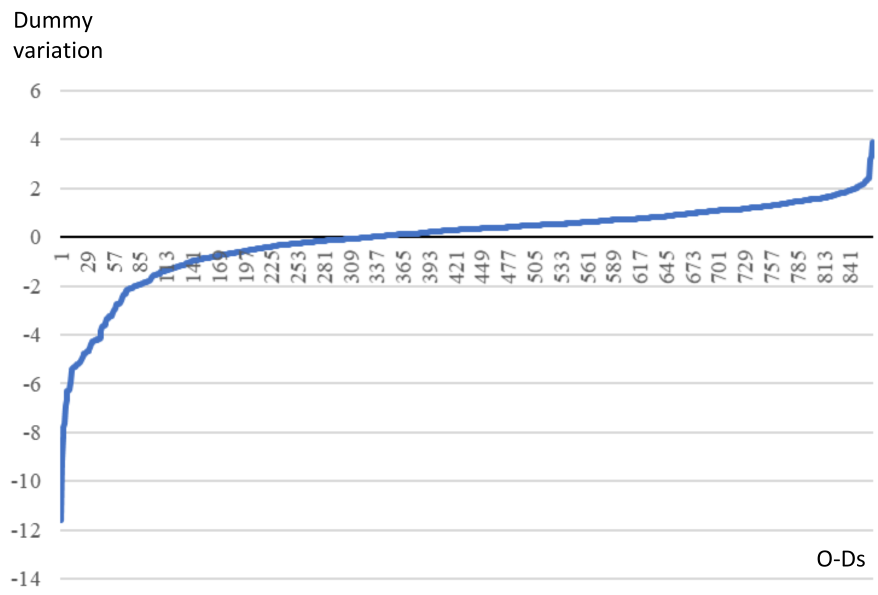

Figure 24 – Brazilian capital cities (main trunk links) – Cross-section fixed effects.

Different from the remote cities model, the income elasticity of demand in relation to the city of origin is higher than 1, i.e., elastic. The result of trunk lines is similar to the one observed in You and Xiong (2017), which obtained evidence that the demand for passenger air transport in China is elastic in relation to the income for the majority of the period considered in the research (1995-2015). This illustrates that the economic development of the capital cities makes civil aviation more popular, which is reflected in the proportionally greater increase in the air transport flow of its residents. The income elasticity of the destination city in the demand, on the other hand, is close in both estimated cases. Although it is bigger than the one for remote cities, the income elasticity for the destination city is still lower than 1, i.e., inelastic demand. An issue that should be noted is the neutralizing effect in relation to the evolution of the demand that the drop in the income of one of the link cities may have on the growth of the other.

According to the report from Brazilian Secretariat of Civil Aviation (SAC, 2014), most parts of domestic air travels in the North region of the country are for business/study purposes. This finding indicates a lower sensitivity to price, mainly in remote cities, where there is no competition of other modes and, in many cases, only one company is able to offer the service. Consequently, the estimation of non-elasticity price regarding the demand in remote cities is expected.

The geographical extent and the logistical void of the Brazilian North region are other important explanatory factors for the different estimations regarding price–income elasticity of demand, since, like the purpose of the trip, they act directly on the essentiality of air transport for the consumer. The possibility of alternative modes of transport and, consequently, the value of elasticities is directly related to the access difficulty. Long distances and difficulties of construction regarding terrestrial accesses, due to the geographical conditions of Amazon, are associated to less alternative possibilities of displacement, resulting in a greater stiffness in the demand regarding air transport to variations in price and income (Brons et al., 2002). Differences among the income–price elasticities of demand regarding links between capitals and remote cities may be considered by planners and decision makers in the air transport sector, under penalty of having their demand expectations frustrated, mainly in the case of remote cities.

5.2 Drivers of international tourism

5.2.1 Overview of the global tourist macro-regions

Different formulations for panel regression analysis were tested. After examining the many possible alternatives for panel data modelling, a least squares panel regression model was selected as the most appropriate estimator for analysis. A model was run for each tourism indicator depending on the explanatory variables' significance (Table 25):

Table 25 – International tourism – Summary of the significant variables in each model.

	Models
Model 1: ***(inb)***	*tourism inbound ~ effects + a ln(GDP) + b ln(fligths) + e ln(outb trcost) + f ln(opentrade)*
Model 2: ***(rec)***	*tourism receipts ~ effects + a ln(GDP) + b ln(fligths) + d ln(currence) + e ln(inb trcost) + f ln(opentrade)*
Model 3: ***(outb)***	*tourism outbound ~ effects + a ln(GDP) + d ln(currence) + e ln(outb trcost)*
Model 4: ***(exp)***	*tourism expenditures ~ effects + a ln(GDP) + e ln(outb trcost)*
Model 5: ***(opentour)***	*tourism openness ~ effects + a ln(GDP) + c ln(PAX) + e ln(inb + outb trcost)/2 + f ln(opentrade)*

Table 26 presents a summary of the model tests[13]. The Chow test (for cross-sectional fixed effects) indicated that the fixed effect model fits better than the pool approach. In the Breusch-Pagan test, the Lagrange multiplier indicated that the random effect is better than the pool approach. Finally, the Hausman test (for cross-sectional random effects) showed that the fixed effect also fitted better than the random effect for both section and period in all models (Hsiao, 2014).

Table 26 – International tourism – Model test summary.

Models	Chow Test		Breusch-Pagan LM			Hausman Test	
	Cross-section F	Period F	Cross-section	Time	Both	Cross-section random	Period random
Model 1	212.51 (0.00)	6.44 (0.00)	13,933.25 (0.00)	3.83 (0.00)	13,937.08 (0.00)	284.86 (0.00)	36.18 (0.00)
Model 2	128.49 (0.00)	3.20 (0.00)	10,699.5 (0.00)	0.58 (0.44)	10,670.08 (0.00)	269.06 (0.00)	25.50 (0.00)
Model 3	373.93 (0.00)	8.00 (0.00)	12,721.01 (0.00)	23.49 (0.00)	12,7444.50 (0.00)	72,76 (0.00)	62.54 (0.00)
Model 4	389.61 (0.00)	6.42 (0.00)	18,612.02 (0.00)	1,61 (0.20)	18,613.63 (0.00)	9.67 (0.00)	27.82 (0.01)
Model 5	261.30 (0.00)	2.66 (0.00)	7075.287 (0.00)	8.34 (0.00)	7,083.63 (0.00)	19.69 (0.00)	2.35 (0.67)

Test statistics and respective p-values in parentheses

Table 27 presents the estimated coefficients for the explanatory variables of the panel data regression for the five equations described in Table 25 (considered most relevant for analysis with a significance level greater than 90%)[14].

[13] Detailed results for the tests are presented in Annex 5.

[14] Detailed regressions results are presented in Annex 5.

Table 27 – International tourism – Panel data regression results (variables with level of significance greater than 0.90).

Variables	*ln (inb)*	*ln (rec)*	*ln (outb)*	*ln (exp)*	*ln (opentour)*
ln (GDP)	1.321*	1.299*	0.844*	0.898*	0.030*
ln (flights)	0.048*	0.104*			
ln (PAX)					0.002**
ln (currence)		0.039*	-0.100*		
ln (trcost)	-0.116*	-0.180*	-0.053*	-0.215*	-0.015*
ln (opentrade)	0.230*	0.548*			0.023*
C	1662	6227	7355	12729	-0.316
Adjusted R-squared	0.960	0.967	0.964	0.968	0.955
Cross-sections	107	106	87	116	83
Periods	25	25	25	25	25

Level of significance: *0.99; **0.90

The findings suggest that the country's level of socioeconomic development (expressed by GDP per capita) is the main catalyst for international tourism, visible in both inbound and outbound tourism indicators and in the country's tourism openness. Regarding inbound tourism indicators, the GDP per capita effect is aligned with the expectation of a country to provide adequate conditions to receive tourists, while for outbound indicators, the income effect indicates the resident population's potential to have an international experience (something that reflects the motivation of the international tourist, mainly when the travel purpose is leisure).

The countries' civil aviation industry (expressed by flights or passengers' movement) features positive coefficients, supporting several studies of causality between air transport and tourism in the literature. It is worth noting that some studies show a bidirectional causality, suggesting a degree of endogeneity between air transport and tourism.

In respect to the purchasing power of each country's currency, it is noted that in countries where the currency is weaker, there is a positive relationship with outbound tourism (whereas for inbound tourism, the coefficient is not significant). Although economies with weaker currencies present lower purchasing power at the international level, it is possible to infer that in these countries there is a great repressed demand for the experience of an international travel, something that is an important part of the desires of the emerging middle class that lives there.

Estimators for the share of transport cost in tourist expenditure indicated that an increasing proportion of this cost in tourist expenditure is an inhibitor to both inbound and outbound tourism. Higher transport cost implies a decrease in the amount of available financial resources that tourists have to satisfy their leisure expectations.

The trade openness, an indicator which reflects the country's emphasis on commercial activity, proved to be positively relevant for both inbound tourism and tourism openness. Trade openness suggests that the country maintains a wider international network, a feature that is favourable not only to trade flows, but also to the movement of people for business tourism.

The findings also suggest the positive effect that the globalisation produced over the period. Each year, an advance in the tourism movement was observed through all four inbound and outbound tourism indicators, although with a degree of stagnation between 2004 and 2010. The introduction of the period fixed effect helps to analyse the evolution of tourism indicators over the economic business cycles.

Figure 25 reveals an increasing trend for the impact of time on all tourism indicators, mostly in inbound and outbound tourism. The financial variables – receipts and expenses – had an increasing trajectory at the end of the 1990s, stabilizing in the first decade of the 2000s. By the second decade of the 21st century, the growing impact followed that of the movement of tourists.

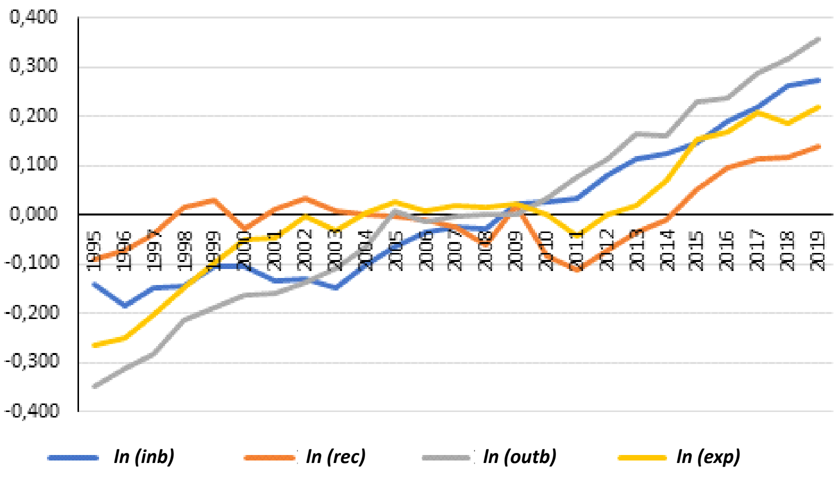

Figure 25 – International tourism – Period fixed effects tourism movement and finance indicators.

Regarding the tourism openness (Figure 26), a minor cyclical movement is observed. Although air transport has been sensitive to crises in the analysed period, the same was not seen in the case of world tourism. This suggests that tourism flows are resilient to crises, which would reinforce their strategic role for national economies. Receipts and expenditures seem to stagnate in periods of crisis, as observed in the first decade of the 2000s. However, the passenger traffic continues to be stimulated by globalisation throughout the investigation period.

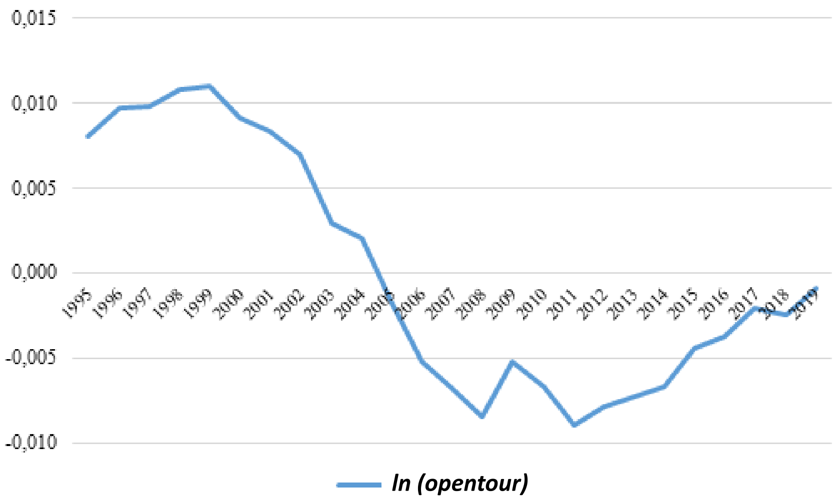

Figure 26 – International tourism – Period fixed effect tourism openness.

Given the diversity of countries considered in the study, it is important to consider cross-section fixed effect to represent variables not made explicit in the regression analysis. It is useful to observe such effects in regional and level-of-development terms. The inclusion of the cross-section fixed effect considerably improves the model.

The transversal analysis of the cross-section fixed effect in addition to the panel data regression constant provides an insight on the potential tourism level of each country, by region, considering socioeconomic variables. It provides evidence of how the tourism level is affected by these variables.

Figure 27 illustrates a low correlation (0.24) between the level of inbound tourism in the countries and the total income generated by their economies (measured by GDP). However, it is noted that there are clusters of countries in each region that are close to the curve plotted by the cross-section fixed effects. For example, in the case of Africa, three clusters are identified: ZAF, DZA, LKA and CIV; MAR, KEN, TUN, TZA, ZMB and NAM; MOZ, ZWE, RWA and SWZ[15].

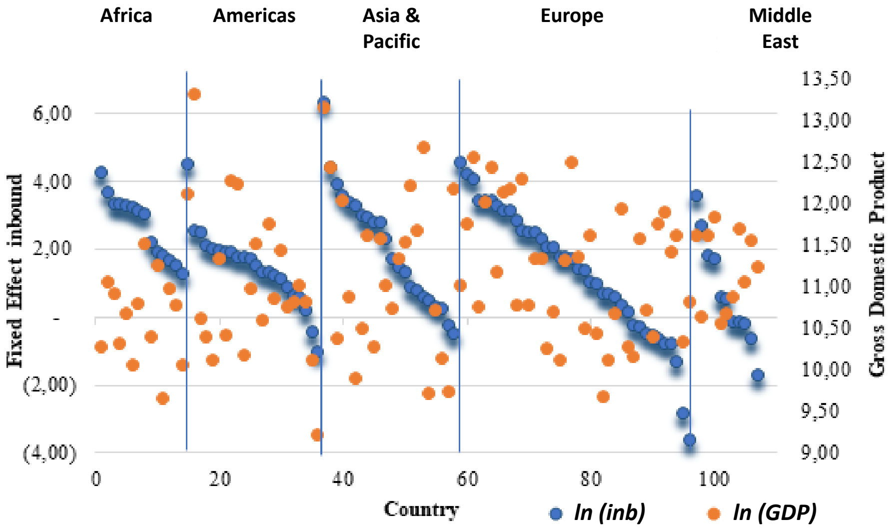

Figure 27 – International tourism – Inbound tourism regression intercept for each country considering the fixed effect of the cross-section and its respective GDP, grouped by tourism region.

Figure 28 shows a relevant correlation (0.66) between the countries' inbound tourism plateau and their population. It is observed that in each region the trend of the cross-sectional view of the population follows the curve outlined by the cross-section fixed effects.

15 See Annex 4 for the list of acronyms associated with the countries investigated.

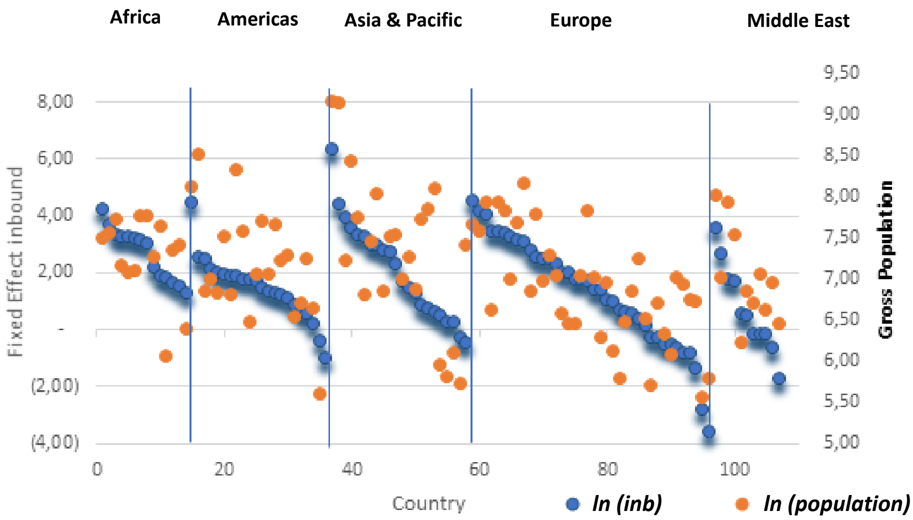

Figure 28 – International tourism – Inbound tourism regression intercept for each country considering cross-section fixed effect and its respective population, grouped by tourism region.

5.2.2 Comparative analysis between BRICS group versus G7 countries

From the application of the statistical tests to evaluate the use of no effect, fixed effect, or random effect it was concluded that there was a predominance for considering fixed effects (Tables 28, 29, 30, and 31). Given the unbalanced panel data approach, it is necessary to assume the possibility of fixed effects both for the cross-section – i.e., the countries - and for the period.

Table 28 – BRICS inbound tourism – Redundant fixed effects tests (Chow test).

Test cross-section and period fixed effects			
Effects test	Statistic	d.f.	*p*-value
Cross-section F	411.02	-4.58	0.00
Period F	1.92	-23.58	0.02

Table 29 – BRICS outbound tourism – Redundant fixed effects tests (Chow test).

Test cross-section and period fixed effects			
Effects test	Statistic	d.f.	*p*-value
Cross-section F	151.06	-4.89	0.00
Period F	2.79	-23.89	0.00

Table 30 – G7 inbound tourism – Redundant fixed effects tests (Chow test).

Test cross-section and period fixed effects			
Effects test	Statistic	d.f.	*p*-value
Cross-section F	348.42	-6.90	0.00
Period F	1.21	-23.90	0.25

Table 31 – G7 outbound tourism – Redundant fixed effects tests (Chow test).

Test cross-section and period fixed effects			
Effects test	Statistic	d.f.	*p*-value
Cross-section F	306.13	-6.11	0.00
Period F	2.87	-23.11	0.00

The model presented in Table 32 shows the panel data regression estimation for inbound tourism of the BRICS and G7 countries. The four explanatory variables of inbound tourism represent the dynamics of the countries in terms of income, purchasing power of their currency, cost of air transport and trade openness.

In this model, the only variable considered elastic is income level, with a coefficient greater than 1 for the BRICS. This variable does not refer to the tourist's income, but to the average income of the country's inhabitants, which can be interpreted as an indicator of their socioeconomic level. Thus, the BRICS country with positive income evolution is interpreted as more attractive to foreign tourists. This variable did not show representative for the G7 countries. Tourists already know that they are going to find an organised society.

Although inelastic (coefficient less than 1) for the BRICS, trade openness is shown as the second most important variable, giving a positive contribution to inbound tourism evolution. The trade flow with other countries indicates that the country evolves in terms of trade relations in an amplified manner, and the commercial partnership strengthening may cause greater interest of tourists in visiting the country. For G7 countries, this is an elastic variable, and it shows how important is trade openness even for developed countries' tourism development.

The third variable, the transport cost participation in the total expenditure of tourists in the BRICS countries, is an element that imposes restrictions on the trip of the tourist, because it decreases the resource that the tourist has available to use in other services in the trip. In general, the tourist has a limited budget for his trip, so that the growth of the expenditure with transport decreases the available resource for the other touristic activities. For the G7 countries, this variable works the same way as in BRICS, however, the statistical test does not show much significance.

The fourth variable shows that a weaker currency stimulates the tourist's choice of destination in the country. The weaker currency will enable the tourists to purchase more services and goods in the country they are visiting and thus be more satisfied with their trip. For the G7 countries, this variable shows to be the most important and elastic. These elements give an idea of BRICS inbound tourism dynamics evolution extent.

Table 32 – BRICS and G7 inbound tourism – Panel least squares regression models.

Dependent Variable: *ln(inb)*
Method: Panel Least Squares
Sample: 1995 2018 Periods included: 24

Variable	BRICS		G7	
	Coefficient	Prob.	Coefficient	Prob.
ln(GDP)	1.612167	0.00	-0.116929	0.69
ln(currence)	0.150289	0.09	1.378725	0.10
ln(trcost)	-0.276255	0.00	-0.144363	0.15
ln(opentrade)	0.489155	0.01	1.320593	0.00
C (intercept)	-0.169159		13.21927	
Effects Specification				
Cross-section fixed (dummy variables)				
Period fixed (dummy variables)				
Adjusted R-squared	0.97		0.96	

In the model described in Table 33, however, not all the variables used in the previous model (Table 32) were significant in representing the BRICS outbound tourism evolution dynamics. A variable selected for analysis, but which was not significant in the inbound tourism model, proved to be significant for BRICS outbound tourism. The selected indicators for the BRICS countries did not show good significance for the G7. There are studies that show that the second greatest desire of the emerging middle class is to make an international trip. In this sense, this analysis's considered the country's air mobility indicator represented by regular aviation departures. This variable has a significant statistical test in G7 regression estimation, however with a negative influence, which is not expected.

Although not elastic, the income level showed the highest coefficient in the regression analysis, highlighting the income evolution importance for outbound tourism.

The income level evolution allows the emerging middle class of the countries to look forward to making international touristic travel. With G7 countries, the coefficient is not significant, what show that the income level is high enough and will not make any difference. The air mobility evolution was the second most important value in the analysis for BRICS tourists.

Paradoxically, the purchasing power of the currency in the country showed that the propensity to international tourism in BRICS countries increases with weaker currency. A weaker currency perception in the country shows that tourists will have access to services and products at cheaper prices in other countries, thus creating a positive sentiment that motivates this desire. As for income level, currency power does not mean much for G7 tourists. An example of emerging economies is the case for Brazilians who go to Miami, a city in the State of Florida, in the United States, to shop. These elements show outbound tourism variation regarding the socioeconomic dynamics.

Table 33 – BRICS and G7 outbound tourism – Panel least squares regression models.

Dependent Variable: *ln(outb)*
Method: Panel Least Squares
Sample: 1995 2018 Periods included: 24

	BRICS		G7	
Variable	Coefficient	Prob.	Coefficient	Prob.
ln(GDP)	0.764022	0.00	0.151397	0.38
ln(flights)	0.435334	0.00	-0.184540	0.07
ln(currence)	0.135103	0.00	0.307126	0.40
C (intercept)	3.735494		18.72957	
Effects Specification				
Cross-section fixed (dummy variables)				
Period fixed (dummy variables)				
Adjusted R-squared	0.97		0.96	

A second element that the regression equation estimates is the tourism indicators variation regarding the period. Figure 29 shows this variation, expressed by the period fixed effect. It is possible to associate this variation with the impact of globalisation on the BRICS and G7 tourism evolution, whether inbound or outbound. Although with an increasing positive impact trend, the outbound tourism impact evolution is sharper than that of inbound in both cases. However, both stagnate, and, with the impact of the pandemic, from 2020 onwards, might go to a new beginning.

These trends show BRICS countries characterised more than originator of tourists than as destination of them. The interest of visitors from developed countries in tourist travel to emerging countries, influenced by education in these countries, intense media under evaluation or misleading information about emerging countries, and tourism promotion work done within these countries will be very difficult to change. However, emerging countries are developing and maturing these fundamental elements for the people's education and for alerting them of the principles and expectations formation of what is best for them. In this sense, the globalisation process is a very relevant theme to be investigated in the international tourism field. While the period fixed effect of G7 inbound tourists' variation was 0.42 points, the one for BRICS was 0.32. With outbound, G7 had a variation of 0.55 while BRICS had 0.86.

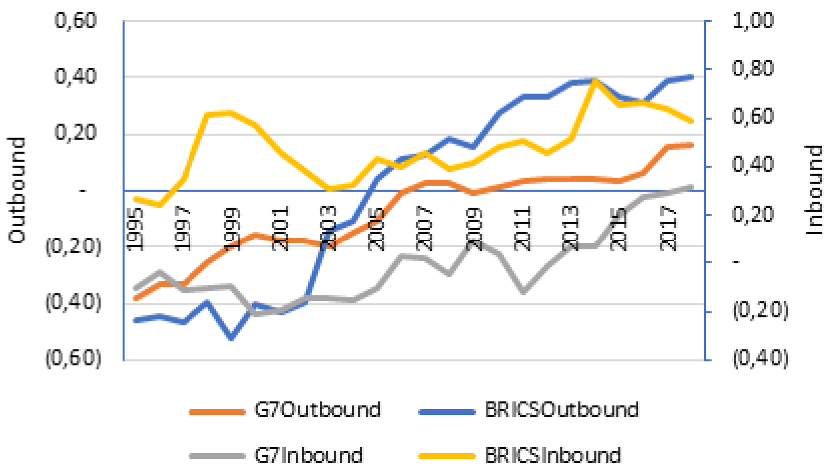

Figure 29 – BRICS and G7 countries tourism – Inbound and outbound period fixed effect.

The third element of the panel data regression analysis is the cross-section fixed effect, which this analysis interprets as the demographic and economic structure of the country regarding the reception and emission of tourists. Tables 34 and 35 show the coefficients of these effects for each BRICS and G7 countries. China stands out as the most robust indicator for both receiving and sending BRICS tourists and the USA hold this position in G7. India, although well below the level of reception, has the second-best structure in BRICS. Russia and South Africa are equivalent in terms of the structural level for tourist arrivals (although Russia is better positioned in terms of outbound tourism). Brazil presents the lowest indexes both for reception and outbound tourism, and with inbound tourism, the indicator is much lower. In the case of G7 countries, France shows an important position in Europe.

The countries have different structural dimensions, such as population, territory, import and export levels, besides other factors that need to be analysed. The structural level indicators show that even regarding the BRICS countries, there is disproportion among these indicators, which can be improved in relation to the world and among these countries, especially by improving intra-BRICS relations and more broadly among emerging countries.

Adding the cross-section fixed effect to the constants (intercepts) of the inbound and outbound tourism models presented in Tables 32 and 33, the socioeconomic structural difference between BRICS and G7 countries shows a sizeable gap. This gap gives a large tourism competitive advantage to G7 economies over the BRICS ones.

Table 34 – BRICS countries tourism – Inbound and outbound cross-section fixed effects.

Acronym	Country	Inbound	Outbound
CHN	China	2.66	0.92
IND	India	0.66	0.89
RUS	Russian Federation	-0.75	0.37
ZAF	South Africa	-0.75	-1.05
BRA	Brazil	-1.82	-1.13

Table 35 – G7 countries tourism – Inbound and outbound cross-section fixed effects.

Acronym	Country	Inbound	Outbound
USA	United States	2.04	1.12
FRA	France	1.15	- 0.64
ITA	Italy	-0.13	- 0.29
GBR	Great Britain	-0.24	0.25
CAN	Canada	-0.54	- 0.02
JPN	Japan	-0.85	- 1.14
DEU	Germany	-1.41	0.73

6 CONCLUSIONS AND FUTURE WORKS

In this final chapter of the thesis, all the insights arising from the findings obtained from the two stages of the research by the different models are integrated, then compared and interpreted together. This expands the discussions about the determinants of the income-price elasticity of air passenger transport demand in Brazil and its impact on the organizational strategies of the multiple stakeholders interested in the industry. Then, there is a discussion of the implications of the economy's evolution on tourism in the world, exploring the particularities of developed and emerging countries with regard to this issue.

The outcomes of the investigation of the influence of socioeconomic and geographic conditions on civil aviation suggest the non-rigidity of the elasticity of air passenger transport demand in Brazil, thus fulfilling the assumptions outlined in the thesis' objectives. The results suggest that the macroeconomic conditions, measured by the GDP, have impact on the consumption decisions of airline tickets mostly through the price mechanism. Consumers become more sensitive to airfare changes in periods of low economic growth, stagnation, or recession. Regarding the income, although the air travel demand becomes more inelastic under such conditions, as the second subperiod analysed in this research (2014-2019) illustrates, it is observed that the consumer's sensitivity to GDP fluctuations is relatively less influenced by the economic scenario.

In addition to presenting different patterns in the two sub-periods studied, the income-price elasticities estimates revealed considerable variability across regions, reflecting the economic, demographic, and logistical heterogeneity of the vast Brazilian territory. The macroeconomic conditions that individualise each sub-period influenced in different ways the consumer's sensitivity to price-income changes in each region.

The thesis, thus, contributes in providing evidence that geographic and spatial factors are determinants of how the airfare demand in Brazil responds to income and price variations. This is a finding of considerable strategic relevance in a continent-sized country, which contributes to the decision-making process and the formulation of public and private policies, programs and projects for this industry. This strategic aspect becomes even greater in the case of air connections linking cities located in remote regions.

The main findings in this thematic area indicate that the air travel demand involving remote cities in the Brazilian Amazon is inelastic to price and income variations. This is an important factor for air transport planning in the region, since most studies published in the literature suggest an elastic demand (that is, greater than 1). The differences between the results obtained for routes from remote areas and trunk links involving state capital cities suggests the need to adopt a regional perspective when planning for the future.

In fact, more broadly, the observed results differences from a regional and time perspective emphasise both the need for a geographical approach and the importance of considering the macroeconomic assumptions when formulating plans for the future. For example: although airports in the Southeast are clearly more relevant regarding air flows and number of connections, there is a slight decentralization taking place towards the Midwest and Northeast regions, as evidenced by the increasing airports' network capacity and changes in the regional economies (Aprigliano Fernandes et al., 2019; Oliveira et al., 2020). In this context, strategic information about the air travel demand behaviour at the regional level is of high importance for the integrated development of the Brazilian territory, especially considering the role of air transport in employment creation and inclusive economic growth in emerging countries, as highlighted by Njoya and Nikitas (2020).

Another important evidence is that, in remote cities, income has a relatively greater influence than ticket price on the decision-making process regarding the use of air transport. The distinction between the income effect of the city of origin and that of the city of destination offers the planner a new perspective, since future income scenarios may differ from one city to another.

Although the elasticity estimates obtained in this thesis are in line with other studies in the literature, the results found for Brazil are among the lowest levels observed. It suggests a country's fragility regarding the domestic air market's competitiveness. This aspect can be interpreted from the viewpoint that the standardization of the Brazilian airline fleet in large aircraft (Cabo et al., 2020) is a limiting factor for competition on low-density routes.

This thesis also provides a contribution to the investigation of air passenger behaviour in a market situation free of subsidies. Throughout the studied period, airlines received no government incentives to operate on specific routes, and there were no major airport infrastructure investments supported by government programmes. Under such market circumstances, airlines select cities and routes based on their own cost effectiveness by operating without subsidy and paying compulsory airport and aeronautical tariffs. This research, therefore, provides insights for discussing the best strategies that should be considered under these market conditions, those that, based on consumer behaviour, will have a greater influence on the airlines' financial results and the mitigation of negative externalities by aviation authorities. In this sense, Abate (2016) stresses the importance of studying how demand behaves regarding fare changes in different air market situations.

In a market based economy, therefore, understanding the price-income relationship with the air travel demand is essential for the decision-making on the implementation of air connections by airline companies, as well as for the formulation of regional air transport development policies. In addition to the provision of subsidies, public policies should be able to enhance the business environment for airlines as an integral part of a regional development strategy for the Brazilian Amazon boosted by the air transport system.

As a suggestion for future research, one line to be investigated could be the identification of seasonal patterns regarding the behaviour of the elasticities given each region's particularities. The segmentation of the elasticities analysis by travel motivation (business versus leisure) or by traveller profile under different macroeconomic conditions are also possible paths for the research refinement.

It is important to point out that a difficulty found in terms of bibliometry refers to the study of this theme within Latin America, which highlights a gap in the literature that the thesis is contributing to fill. Research on air transport in remote cities in Latin America is even more limited, despite its relevance in different aspects, notably the environmental concern with the occupation of areas in the Brazilian Amazon. Nevertheless, the sustainable development requires that environmental concerns must always be combined with the socio-economic agenda, which is what defines people's living conditions.

Socio-economic and geographical disparities can lead to unequal access to air transport, which may adversely affect the tourism industry in more disadvantaged regions. Airlines may become more reluctant to provide services in areas with lower demand and profitability, resulting in a reduced number of flights and increased fares for consumers. On the other hand, the passenger air transport industry can play an important role in promoting economic growth and social inclusion in less developed regions. The supply of regular flights could stimulate tourism, generating local jobs and supporting the regional economy. Furthermore, air transport may also provide access to health and education services in remote regions. To face these challenges, public policies and concerted actions by the tourist related industry and the airlines are needed to ensure air connectivity in less favoured regions. This may include tax incentives, transportation infrastructure investments, subsidies, and public-private partnerships.

With respect to the impact of both the economy and the air passenger transport sector's performance on tourism, the findings reveal that the proposed theoretical model, anchored on three drivers, provides a solid structure for analysing the industry, thereby satisfying the assumption stated in the thesis' objectives. The model the thesis used to discuss the international tourism indicators evolution across the world presented a significant explanation level, represented by the determination coefficients of the panel data regression models with period fixed effect and cross-section fixed effect.

The three drivers assumed in the research's theoretical model provide an analytical structure that allows a clear visualization of the evolution of the international tourism indicators, both from a global viewpoint and regarding the particularities of the different tourist regions. Other variables can certainly be designed to represent each of the drivers, but the contribution of the thesis is to propose an investigation analytical framework for the sector.

The thesis highlights that the determinants of the inbound and outbound tourism flows can be explained by the selected socioeconomic variables, although the weight (level) of the tourism industry in each country's economy is related to other elements. The use of period and country fixed effects indicates an important variability in the relative level of tourism activities in each economy.

The period fixed effect evolution revealed a constant positive trajectory of the tourism sector in the countries, which can be attributed to globalisation and the increasing inter-country interactions that characterise this phenomenon. This trend is materialized both by the reduction of trade barriers for the movement of goods and services and by the lower imposition of restrictions on the flow of people between countries. Tariff and nontariff barriers to such movements can have a very negative impact on international tourism.

Another key element to understand the relative weight of tourism sector in the national economies is expressed by each country's fixed effect estimated in the panel regression analysis. This effect analysis shows different levels and evolution lines between countries, which suggests that these differences implications should be analysed considering clusters of countries in different regions of the planet.

One of the thesis' objectives is to explore the similarities and particularities of tourism from a geopolitical perspective, focusing on the investigation of the economics' influence on this industry in developed and emerging countries, such as Brazil. In this sense, the results show significant differences between emerging and advanced economies. Advanced economies from North America and Europe have an enormous advantage over emerging economies in terms of socioeconomic structure to attract tourists. Actual globalisation characteristics favour advanced economies. Emerging economies have more dynamic socioeconomic characteristics, however this results just in marginal tourism gains for them.

This scenario is unfavourable for emerging economies to compete in the arena of advanced economies. A paradigm shift would be along the line of creating more balance in the world tourism industry. Instead of trying to achieve North American or European standards to catch-up with the advanced economies, emerging countries should focus on its own emerging middle-class market, which will drive the world economy growth in the coming years. The Global South should create a particular South-South tourism environment so that tourists can travel among these countries as they do in national tourism. Emerging countries must improve the transport corridors among them, with affordable costs. They must stimulate South-South people-to-people exchange and cultural integration based on their values. In this sense, education and media among emerging and underdeveloped economies must improve to preserve national cultures and to produce an equilibrium in cultural integration. Following this line, as a suggestion for future work, it would be interesting to examine the different impacts of the global economic-financial crises or health crises, such as the COVID-19 pandemic, on tourism in developed and emerging economies.

REFERENCES

ABATE, M. Economic effects of air transport market liberalization in Africa. **Transportation Research Part A: Policy and Practice**, 92, p.326-337, 2016.

ABED, S.Y.; BA-FAIL, A.O.; JASIMUDDIN, S.M. An econometric analysis of international air travel demand in Saudi Arabia. **Journal of Air Transport Management**, 7(3), p.143-148, 2001.

AMBARDAR, A. Tourism and hospitality industry in BRIC Nations: An analysis. In: **Opportunities and Challenges for Tourism and Hospitality in the BRIC Nations** (p. 83-94), IGI Global, 2017.

ANAC (AGÊNCIA NACIONAL DE AVIAÇÃO CIVIL). **Anuário do Transporte Aéreo 2019**. 1ed. Brasília: Agência Nacional de Aviação Civil, 2020.

APRIGLIANO FERNANDES, V.; PACHECO, R.; FERNANDES, E. A dynamic analysis of air transport and tourism in Brazil. **Journal of Air Transport Management**, 105, 102297, 2022.

APRIGLIANO FERNANDES, V.; PACHECO, R.R.; FERNANDES, E.; CABO, M.; VENTURA, R.V.; CAIXETA, R. Air Transportation, Economy and Causality: Remote Towns in Brazil's Amazon Region. **Sustainability**, 13, 627, 2021.

APRIGLIANO FERNANDES, V.; PACHECO, R.R.; FERNANDES, E.; CABO, M.; VENTURA, R.V. A Regional View of Passenger Air Link Evolution in Brazil. **Sustainability**, 14, 7284, 2022.

APRIGLIANO FERNANDES, V.; PACHECO, R.R.; FERNANDES, E.; DA SILVA, W.R. Regional change in the hierarchy of Brazilian airports 2007–2016. **Journal of Transport Geography**, 79, 102467, 2019.

ARAÚJO, R.; LÉNA, P. **Desenvolvimento Sustentável e Sociedades na Amazônia**. 1ed. Belém: Museu Paraense Emilio Goeldi, 2011.

ARAÚJO, V.; FLORES, P. Income redistribution, poverty, and territorial inequality in Brazil. **Revista de Sociologia e Política**, 25 (63), p.159-182, 2017.

ASSAF, A.G.; DWYER, L. Benchmarking international tourism destinations. **Tourism Economics**, 19 (6), p.1233-1247, 2013.

ATAG (AIR TRANSPORT ACTION GROUP). **Aviation: Benefits Beyond Borders**. 1ed. Geneva: Air Transport Action Group, 2020.

ATHANASOPOULOS, G.; DENG, M.; LI, G.; SONG, H. Modelling substitution between domestic and outbound tourism in Australia: A system-of-equations approach. **Tourism Management**, 45, p.159-170, 2014.

BAFAIL, A.O.; ABED, S.Y.; JASIMUDDIN, S.M.; JEDDAH, S.A. The determinants of domestic air travel demand in the Kingdom of Saudi Arabia. **Journal of Air Transportation World Wide**, 5(2), p.72-86, 2000.

BAKER, D.; MERKERT, R.; KAMRUZZAMAN. Regional aviation and economic growth: cointegration and causality analysis in Australia. **Journal of Transport Geography**, 43, p.140-150, 2015.

BALAGUER, J.; CANTAVELLA-JORDA, M. Tourism as a Long-Run Economic Growth Factor: The Spanish Case. **Applied Economics**, 34(7), p.877-84, 2002.

BALTAR, P.; LEONE, E. Perspectivas para o mercado de trabalho após o crescimento com inclusão social. **Estudos Avançados USP**, 29(85), p.53-67, 2015.

BENKRAIEM, R.; LAHIANI, A.; MILOUDI, A.; SHAHBAZ, M. A new look at the tourism development and economic growth nexus: International evidence. **Tourism Economics**, 27(8), p.1707-1735, 2021.

BESANKO, D.; DRANOVE, D.; SHANLEY, M.; SCHAEFER, S. **Economics of Strategy**. 7ed. New Jersey: Wiley, 2017.

BIANCHI, R. The political economy of tourism development: A critical review. **Annals of Tourism Research**, 70, p.88-102, 2018.

BIJMOLT, T.; VAN HEERDE, H.; PIETERS, R. New empirical generalizations on the determinants of price elasticity. **Journal of Marketing Research**, 42(2), p.141-156, 2005.

BLANCHARD, O.J.; SUMMERS, L.H. Hysteresis and the European Unemployment Problem. **NBER Macroeconomics Annual**, v.1, p.15-78, 1986.

BOYACK, K.; KLAVANS, R. Co-citation analysis, bibliographic coupling, and direct citation: which citation approach represents the research front most accurately? **Journal of the American Society for Information Science and Technology**, 61, p.2389-2404, 2010.

BRÅTHEN, S. Air transport services in remote regions. **International Transport Forum Discussion Paper**, 13, p.1-23, 2011.

BRÅTHEN, S.; HALPERN, N. Air transport service provision and management strategies to improve the economic benefits for remote regions. **Research in Transportation Business & Management**, 4, p.3-12, 2012.

BRONS, M.; PELS, E.; NIJKAMP, P.; RIETVELD, P. Price elasticities of demand for passenger air travel: a meta-analysis. **Journal of Air Transport Management**, 8, p.165-175, 2002.

CABO, M.; FERNANDES, E.; ALONSO, P.; PACHECO, R.R.; FAGUNDES, F. Energy Effectiveness of Jet Fuel Utilization in Brazilian Air Transport. **Sustainability**, 12, 303, 2020.

CABO, M.; FERNANDES, E.; PACHECO, R.R.; PIRES, H. Economic Growth Relations to Domestic and International Air Passenger Transport in Brazil. **International Journal of Transport and Vehicle Engineering**, 12, 10, p.1475-1480, 2018.

CASCETTA, E.; COPPOLA, P.; VELARDI, V. High-Speed Rail Demand: Before-and-After Evidence from the Italian Market. **The Planning Review**, 49:2, p.51-59, 2013.

CHACON-HURTADO, D.; KUMAR, I.; GKRITZA, K.; FRICKER, J.D.; BEAULIEU, L.J. The role of transportation accessibility in regional economic resilience. **Journal of Transport Geography**, 84, 102695, 2020.

CHÈEZE, B.; GASTINEAUC, P.; CHEVALLIERD, J. Forecasting world and regional aviation jet fuel demands to the mid-term (2025). **Energy Policy**, 39(9), p.5147-5158, 2012.

CIA (CENTRAL INTELLIGENCE AGENCY). **The World Factbook 2020**. 1ed. Washington: Central Intelligence Agency, 2020.

CLINE, R.; RUHL, T.; GOSLING, G.; GILLEN, D. Air transportation demand forecasts in emerging market economies: a case study of the Kyrgyz Republic in the former Soviet Union. **Journal of Air Transport Management**, 4, p.11-23, 1998.

CNT (CONFEDERAÇÃO NACIONAL DO TRANSPORTE). **Anuário CNT do transporte: estatísticas consolidadas 2019**. 1ed. Brasília: Confederação Nacional do Transporte, 2019.

COHEN E. Globalization, Global Crises and Tourism. **Tourism Recreation Research**, 37 (2), p.103-11, 2012.

DUBOIS, G.; PEETERS, P.; CERON, J.-P.; GÖSSLING, S. The future tourism mobility of the world population: Emission growth versus climate policy. **Transportation Research Part A: Policy and Practice**, 45(10), p.1031-1042, 2011.

DUVAL, D.T. Critical issues in air transport and tourism. **Tourism Geographies**, 15(3), p.494–510, 2013.

EVIEWS. Eviews 11 User´s Guide II - Instrumental Variables. In: **Eviews 11**. IHS Global Inc., p. 1038-1040, 2019.

FAGEDA, X.; SUÁREZ-ALEMÁN, A.; SEREBRISKY, T.; FIORAVANTI, R. Air transport connectivity of remote regions: the impacts of public policies. **Regional Studies**, 53, p.1161-1169, 2019.

FAYED, H.; FLETCHER, J. Report: Globalisation of Economic Activity: Issues for Tourism. **Tourism Economics**, 8(2), p.207-30, 2002.

FENLEY, C.A.; MACHADO, W.V.; FERNANDES, E. Air transport and sustainability: Lessons from Amazonas. **Applied Geography**, 27 (2), p.63-77, 2007.

FENLEY, C.A.; MACHADO, W.V.; FERNANDES, E. Air transport and sustainability: Lessons from Amazonas. **Applied Geography**, 27, p.63-77, 2007.

FERNANDES, E.; MARAZZO, M.; SCHERRE, R. Air Transport Demand and Economic Growth in Brazil: A Time Series Analysis. **Transportation Research Part E: Logistics and Transportation Review**, v.46, p.261-269, 2010.

FERNANDES, E.; PACHECO, R. R. Managerial performance of airports in Brazil before and after concessions. **Transportation Research Part A: Policy and Practice**, 118(1), p.245-257, 2018.

FERNANDES, E.; PACHECO, R. R. The Causal Relationship between GDP and Domestic Air Passenger Traffic in Brazil. **Transportation Planning and Technology**, v.33, p.569-581, 2010.

FERNANDES, E.; PACHECO, R.R.; APRIGLIANO FERNANDES, V. Tourism openness, trade openness, and currency-purchasing power in Brazil: A causality analysis. **International Journal of Tourism Research**, 21(2), p.197-205, 2019.

FORSTER-CARNEIRO, T.; BERNI, M.D.; LACHOS-PEREZ, D.; DORILEO, I.L.; ROSTAGNO, M.A. Characterization and analysis of specific energy consumption in the Brazilian agricultural sector. **International Journal of Environmental Science and Technology**, 14(10), p.2077-2092, 2017.

FREEMAN, R.E. **Strategic Management: A Stakeholder Approach**. 1ed. Boston: Pitman, 1984.

FREES, E.W. **Longitudinal and panel data: analysis and applications in the social sciences**. 1ed. Cambridge: Cambridge University Press, 2004.

GALLET, C.; DOUCOULIAGOS, H. The income elasticity of air travel: a meta-analysis. **Annals of Tourism Research**, 49, p.141-155, 2014.

GANDELMAN, N.; SEREBRISKY, T.; SUÁREZ-ALEMÁN, A. Household spending on transport in Latin America and the Caribbean: A dimension of transport affordability in the region. **Journal of Transport Geography**, 79, 102482, 2019.

GARDA, A.A.; DA SILVA, J.M.C.; BAIÃO, P.C. Biodiversity conservation and sustainable development in the Amazon. **Systematics and Biodiversity**, 8, p.169-175, 2010.

GARIDZIRAI, R.; MATIZA, T. Exploring the Tourism-Poverty Alleviation Nexus in the Brics Groupof Nations. **Ekonomika**, 99(1), p.93-109, 2020.

GILLEN, D. Canadian International Aviation: Policy and Challenges. In: GILLEN, D.; WOLF, H.; FORSYTH, P.; HÜSCHELRATH, K.; NIEMEIER, H. **Liberalization in Aviation: Competition, Cooperation and Public Policy**. 1ed. Farnham: Ashgate, 2013.

GÖKOVALI, U.; BAHAR, O. Contribution of tourism to economic growth: A panel data approach. **Anatolia**, 17(2), p.155-167, 2006.

GRAHAM, A. Demand for leisure air travel and limits to growth. **Journal of Transport Management**, 6(2), p.109-118, 2000.

GRANADOS, N.; GUPTA, A.; KAUFFMAN, R. Online and offline demand and price elasticities: evidence from the air travel industry. **Information Systems Research**, 23, p.164-181, 2012.

GROSCHE, T.; ROTHLAUFOTHLAUF, F.; HEINZL, A. Gravity models for airline passenger volume estimation. **Journal of Air Transport Management**, 13(4), p.175-183, 2007.

GWENHURE, Y.; ODHIAMBO, N.M. Tourism and economic growth: a review of international literature. **Tourism**, 65(1), p.33-44, 2017.

HENAMA, U.S. Attracting Indian outbound tourists to South Africa: A BRICS perspective. **India Quarterly**, 69(3), p.229-247, 2013.

HOLDEN, A. **Tourism, Poverty and Development**. 1ed. Abingdon: Routledge, 2013.

HSIAO, C. **Analysis of panel data**. 1ed. Cambridge: Cambridge University Press, 2014.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Pesquisa de Orçamentos Familiares 2008-2009**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2011.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Economia do Turismo: uma perspectiva macroeconômica**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2012.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Logística dos transportes**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2014a.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Amazônia Legal**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2014b.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Ligações rodoviárias e hidroviárias 2016**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2017.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Estimativas da população residente para os municípios e para as unidades da federação com data de referência em 1º de julho de 2018**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2018a.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Área dos municípios 2018**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2018b.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Estimativas da população residente para os municípios e para as unidades da federação com data de referência em 1º de julho de 2019**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2019a.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Produto interno bruto (PIB) dos municípios 2017**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2019b.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Pesquisa de Orçamentos Familiares 2017-2018**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2019c.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Sistema de contas nacionais: Brasil: 2018**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2020a.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Sistema de contas regionais: Brasil: 2018**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2020b.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Produto interno bruto dos municípios 2018**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2020c.

IBGE (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA). **Brazil in figures 2020**. 1ed. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 2020d.

IMF (INTERNATIONAL MONETARY FUND). **World Economic Outlook: Global Manufacturing Downturn, Rising Trade Barriers**. 1ed. Washington, DC: IMF, 2019.

JEYACHEYA, J.; HAMPTON, M.P. Wishful thinking or wise policy? Theorising tourism-led inclusive growth: Supply chains and host communities. **World Development**, 131, 104960, 2020.

JOHNSTON, J. Econometric Methods. **Journal of Applied Econometrics**, 3(3), p.252-254, 1988.

JOHNSTON, J.; DINARDO, J. **Econometric methods**. 1ed. New York: McGraw-Hill/Irwin, 1996.

JORGE-CALDERÓN, J.D. A demand model for scheduled airline services on international European routes. **Journal of Air Transport Management**, 3(1), p.23-35, 1997.

KAUANO, E.E.; SILVA, J.M.C.; DINIZ FILHO, J.A.F.; MICHALSKI, F. Do protected areas hamper economic development of the Amazon region? An analysis of the relationship between protected areas and the economic growth of Brazilian Amazon municipalities. **Land Use Policy**, 92, p.1-12, 2020.

KLEIN, C.F.; FERRERA DE LIMA, J. O desenvolvimento econômico regional do Brasil. **Desafios**, 2(2), p.155-180, 2016.

KLEIN, R.; KOCH, S.; STEINHARDT, C.; STRAUSS, A. K. A review of revenue management: recent generalizations and advances in industry applications. **European Journal of Operational Research**, 284, p.397-412, 2020.

KOPSCH, F. A demand model for domestic air travel in Sweden. **Journal of Air Transport Management**, 20, p.46-48, 2012.

KREMERS, H.; NIJKAMP, P.; RIETVELD, P. A meta-analysis of price elasticities of transport demand in a general equilibrium framework. **Economic Modelling**, 19(3), p.463-485, 2002.

LIMA, A.C.; SIMOES, R.; HERMETO, A.M. Desenvolvimento regional, hierarquia urbana e condição de migração individual no Brasil entre 1980 e 2010. **EURE**, 42(127), p.29-54, 2016.

LIMA, W.T.; SILVA, I.O.; SOUSA, L.F. Breve Retrospectiva das Estratégias Geopolíticas de Incorporação Territorial da Amazônia Brasileira. **RAEGA: O Espaço Geográfico em Análise**, 24, p.18-37, 2012.

MAS-COLLEL, A.; WHINSTON, M.D.; GREEN, J. **Microeconomic Theory**. Illustrated ed. New York: Oxford University Press, 1995.

MCKINSEY GLOBAL INSTITUTE. **Evolution of the earth´s economic center of gravity**. Data from Angus Maddison, Groningen: University of Groningen, 2012. Available online: https://www.businessinsider.com/mckinsey-worlds-economic-center-of-gravity-2012-6.

MISHRA, P.; ROUT, H. B.; SAHOO, D. International Tourism and Economic Growth: Empirical Evidence from BRICS Countries. **African Journal of Hospitality, Tourism and Leisure**, n.10, v.6, pp.1994-1958, 2021.

MORIARTY, J.P. Theorising scenario analysis to improve future perspective planning in tourism. **Journal of Sustainable Tourism**, 20(6), p.779-800, 2012.

MORLOTTI, C.; CATTANEO, M.; MALIGHETTI, P.; REDONDI, R. Multi-dimensional price elasticity for leisure and business destinations in the low-cost air transport market: evidence from easyJet. **Tourism Management**, 61, p.23-34, 2017.

MUMBOWER, S.; GARROW, L.; HIGGINS, M. Estimating flight-level price elasticities using online airline data: a first step toward integrating pricing, demand, and revenue optimization. **Transportation Research Part A: Policy and Practice**, 66(1), p.196-212, 2014.

NJEGOVAN, N. Elasticities of demand for leisure air travel: a system modelling approach. **Journal of Air Transport Management**, 12, p.33-39, 2006.

NJOYA, E.T.; NIKITAS, A. The role of air transport in employment creation and inclusive growth in the Global South: The case of South Africa. **Journal of Transport Geography**, 85, 102738, 2020.

NOWAK, J. J.; PETIT, S., SAHLI, M. Tourism and Globalization: The International Division of Tourism Production. **Journal of Travel Research**, 49(2), 228–45, 2010.

OLIVEIRA, R.P.; OLIVEIRA, A.V.M.; LOHMANN, G.; BETTINI, H.F.A.J. The geographic concentrations of air traffic and economic development: A spatiotemporal analysis of their association and decoupling in Brazil. **Journal of Transport Geography**, 87, 102792, 2020.

OREIRO, J.L.C. A Grande Recessão Brasileira: diagnóstico e agenda de política econômica. **Estudos Avançados USP**, 31(89), p.75-88, 2017.

OUM, T.; FU, X.; ZHANG, A. Air transport liberalization and its impacts on airline competition and air passenger traffic. **Transportation Journal**, 49(4), p.371-390, 2010.

OUM, T.; WATERS, W.; YONG, J. Concepts of price elasticities of transport demand and recent empirical estimates: an interpretative survey. **Journal of Transport Economics and Policy**, 26, p.139-154, 1992.

PAPATHEODOROU, A. A review of research into air transport and tourism: launching the annals of tourism research curated collection on air transport and tourism. **Annals of Tourism Research**, 87, 103151, 2021.

PASIN, J.A.B.; LACERDA, S.M. A Reestruturação do Setor Aéreo e as Alternativas de Política para a Aviação Comercial no Brasil. **Revista do BNDES**, 10 (19), p.217-240, 2003.

PAULA, L.F.R.; PIRES, M.C.C. Crise e perspectivas para a economia brasileira. **Estudos Avançados USP**, 31(89), p.125-144, 2017.

PENG, B.; SONG, H.; CROUCH, G.; WITT, S.F. A Meta analysis of International Tourism Demand Elasticities. **Journal of Travel Research**, 54 (5), p.611-33, 2015.

PENG, B.; SONG, H.; CROUCH, G.; WITT, S.F. A Metaanalysis of International Tourism Demand Elasticities. **Journal of Travel Research**, 54 (5), p.611-33, 2015.

PESSÔA, S.A. Uma investigação das causas do fraco crescimento da economia brasileira nos ultimos anos. In: BONELLI, R.; VELOSO, F. (Org.). **A Crise de Crescimento do Brasil**. 1ed. Rio de Janeiro: Elsevier, 2016.

PESSÔA, S.A.; BARBOSA FILHO, F.H.; BLANCO, F. Brazil: Resilience in the Face of the Global Crisis. In: NABLI, M.K. (Org.). **The Great Recession and Developing Countries**. 1ed. Washington: The World Bank, 2011.

PETRICEK, M.; CHALUPA, S.; CHADT, K. Identification of Consumer Behavior Based on Price Elasticity: A Case Study of the Prague Market of Accommodation Services. **Sustainability**, 12, 9452, 2020.

PINDYCK, R.; RUBINFELD, D. **Microeconomics**. 9ed. London: Pearson, 2017.

POP, I. The role of tourism in the economies of BRICS countries. **Knowledge Horizons - Economics**, 6(2), 136, 2014.

POP, I.; KANOVICI, A.; GHIC, G.; ANDREI, M. The economic effects of the mega sport events on tourism in the BRICS countries case. **Amfiteatru Economic Journal**, 18(Special Issue No. 10), p.960-975, 2016.

PORTER, M. **Competitive Strategy: Techniques for Analyzing Industries and Competitors**. Illustrated ed. New York: Free Press, 1998.

PRIDEAUX, B.; THOMPSON, M.; PABEL, A. Lessons from COVID-19 can prepare global tourism for the economic transformation needed to combat climate change. **Tourism Geographies**, 22(3), p.667-678, 2020.

QUAH, D. The Global Economy's shifting Centre of Gravity. **Global Policy**, 1, p.3-9, 2011.

RABAHY, W.A. Análise e perspectivas do turismo no Brasil. **RBTUR Revista Brasileira de Pesquisa em Turismo**, 14 (1), p.1-13, 2019.

RASOOL, H.; MAQBOOL, S.; TARIQUE, M. The relationship between tourism and economic growth among BRICS countries: a panel cointegration analysis. **Future Business Journal**, 7(1), p.1-11, 2021.

RISSO, W.A. Tourism and economic growth: a worldwide study. **Tourism Analysis**, 23(1), p.123-135, 2018.

RODRIGUEZ-DÍAZ, B.; PULIDO-FERNÁNDEZ, J.I. Sustainability as a key factor in tourism competitiveness: A global analysis. **Sustainability**, 12(1), 51, 2020.

SAC (SECRETARIA DE AVIAÇÃO CIVIL DA PRESIDÊNCIA DA REPÚBLICA). **O Brasil que voa**. 1ed. Brasília: Secretaria de Aviação Civil da Presidência da República, 2014.

SCHEYVENS, R. **Tourism and Poverty**. 1ed. Abingdon: Routledge, 2011.

SCHEYVENS, R.; BIDDULPH, R. Inclusive tourism development. **Tourism Geographies**, 20(4), p.589-609, 2018.

SEGUÍ-AMORTEGU, L.; CLEMENTE-ALMENDROS, J.A.; MEDINA, R.; GALA, M.G. Sustainability and competitiveness in the tourism industry and tourist destinations: A bibliometric study. **Sustainability**, 11(22), 6351, 2019.

SIVRIKAYA, O.; TUNÇ, E. Demand forecasting for domestic air transportation in Turkey. **The Open Transportation Journal**, 7(1), p.20-26, 2013.

SMERAL, E. Tourism forecasting performance considering the instability of demand elasticities. **Journal of Travel Research**, 56 (7), p.913-926, 2017.

SMERAL, E. Tourism forecasting performance considering the instability of demand elasticities. **Journal of Travel Research**, 56 (7), p.913-926, 2017.

SMERAL, E.; SONG, H. Varying Elasticities and Forecasting Performance. **International Journal of Tourism Research**, 17 (2), p.140-150, 2015.

SONG, H.; LI, G.; CAO, Z. Tourism and Economic Globalization: An Emerging Research Agenda. **Journal of Travel Research**, 57(8), p.999-1011, 2018.

SPASOJEVIC, B.; LOHMANN, G.; SCOTT, N. Air transport and tourism - a systematic literature review (2000-2014). **Current Issues in Tourism**, 21 (9), p.975-997, 2018.

SSAMULA, B. Comparing air transport network operations in sparse networks in Africa. **Research in Transportation Business and Management**, 4, p.22-28, 2012.

STRAUSS, A.K.; KLEIN, R.; STEINHARDT, C. A review of choice-based revenue management: theory and methods. **European Journal of Operational Research**, 271, p.375-387, 2018.

SYED, Q. R.; BOURI, E.; ZAFAR, R. F.; ADEKOYA, O. B. Does geopolitical risk mitigate inbound tourism? Evidence from panel quantile regression. **Journal of Public Affairs**, e2784, 2021.

TOLCHA, T.D.; BRÅTHEN, S.; HOLMGREN, J. Air transport demand and economic development in sub-Saharan Africa: Direction of causality. **Journal of Transport Geography**, 86, 102771, 2020.

TONG, T.; YU, E. Transportation and economic growth in China: A heterogeneous panel cointegration and causality analysis. **Journal of Transport Geography**, 73, p.120-130, 2018.

TWISK, J.W. **Applied longitudinal data analysis for epidemiology: a practical guide**. 1ed. Cambridge: Cambridge University Press, 2003.

UNWTO (WORLD TOURISM ORGANIZATION). **World Tourism Barometer**. 1ed. Madrid: World Tourism Organization, 2019.

UNWTO (WORLD TOURISM ORGANIZATION). **International Tourism Highlights 2020**. 1ed. Madrid: World Tourism Organization, 2020.

VALDES, V. Determinants of air travel demand in Middle Income Countries. **Journal of Air Transport Management**, 42, p.75-84, 2015.

VALDES, V.; RAMIREZ, J. Una evaluación sobre la desregulación de las aerolíneas en México. **Economía Mexicana Nueva Época**, 20(1), p.5-35, 2011.

VARIAN, H.R. **Microeconomic Analysis**. 3ed. New Delhi: Viva Books, 2009.

VEDANTHAM, A.; OPPENHEIMER, M. Long-term scenarios for aviation: demand and emissions of CO2 and NOX. **Energy Policy**, 26(8), p.625-641, 1998.

VENTURA, R.V.; CABO, M.; CAIXETA, R.; FERNANDES, E.; APRIGLIANO FERNANDES, V. Air Transportation Income and Price Elasticities in Remote Areas: The Case of the Brazilian Amazon Region. **Sustainability**, 12, 6039, 2020.

VENTURA, R.V.; FERNANDES, E.; APRIGLIANO FERNANDES, V.; CABO, M.; CESAR FASEL, A.; CAIXETA, R. Consumer behaviour analysis based on income and price elasticities: the case of the air transportation in Brazil. **Case Studies on Transport Policy**, v. 10, p. 1262-1272, 2022.

VENTURA, R.V.; FERNANDES, E.; CABO, M.; APRIGLIANO FERNANDES, V.; CARVALHO; C.F.M. Drivers of the world tourism: a regional view. In: **The 2nd BRICS Research Conference**, 2023, Kota. BRICS Research Conference, University of Kota, India, 2023.

VENTURA, R.V.; FERNANDES, E.; TSHIKOVHI, N.; SHARMA, A.J. BRICS and G7 countries tourism: a comparison. In: **XIV Russian International Studies Association (RISA) Convention**, 2022, Moscow. World Beyond Convention, MGIMO University, Russia, 2022.

WADUD, Z. Imperfect reversibility of air transport demand: Effects of air fare, fuel prices and price transmission. **Transportation Research Part A: Policy and Practice**, 72, p.16-26, 2015.

WANG, K.; ZHANG, A.; ZHANG, Y. Key determinants of airline pricing and air travel demand in China and India: policy, ownership, and LCC competition. **Transport Policy**, 63, p.80-89, 2018.

WEATHERFORD, L.R.; BODILY, S.E. A taxonomy and research overview of perishable-asset revenue management: yield management, overbooking, and pricing. **Operations Research**, 40, p.831-844, 1992.

WEF (WORLD ECONOMIC FORUM). **The travel & tourism competitiveness report 2019**. 1ed. Geneva: WEF, 2019.

WOOLDRIDGE, J.M. **Introductory Econometrics: A Modern Approach**. 7ed. Boston: Cengage Learning, 2019.

WU, T.-P.; WU, H.-C.; WU, Y.-Y.; LIU, Y.-T.; WU, S.-T. Causality between tourism and economic growth. **Journal of China Tourism Research**, 18 (1), p.88-105, 2022.

YOU, K.; XIONG, J. Airline passenger numbers impact analysis based on the income elasticity. In: **Proceedings of the International Conference on Computer Engineering**, Information Science and Internet Technology (CII 2017), Sanya, China, p.560-565, 11–12 November 2017.

ZHANG, F.; GRAHAM, D.J. Air transport and economic growth: a review of the impact mechanism and causal relationships. **Transport Reviews**, 40(4), p.506-528, 2020.

ANNEXES

Annex 1 - Airports in the North region: spatial distribution

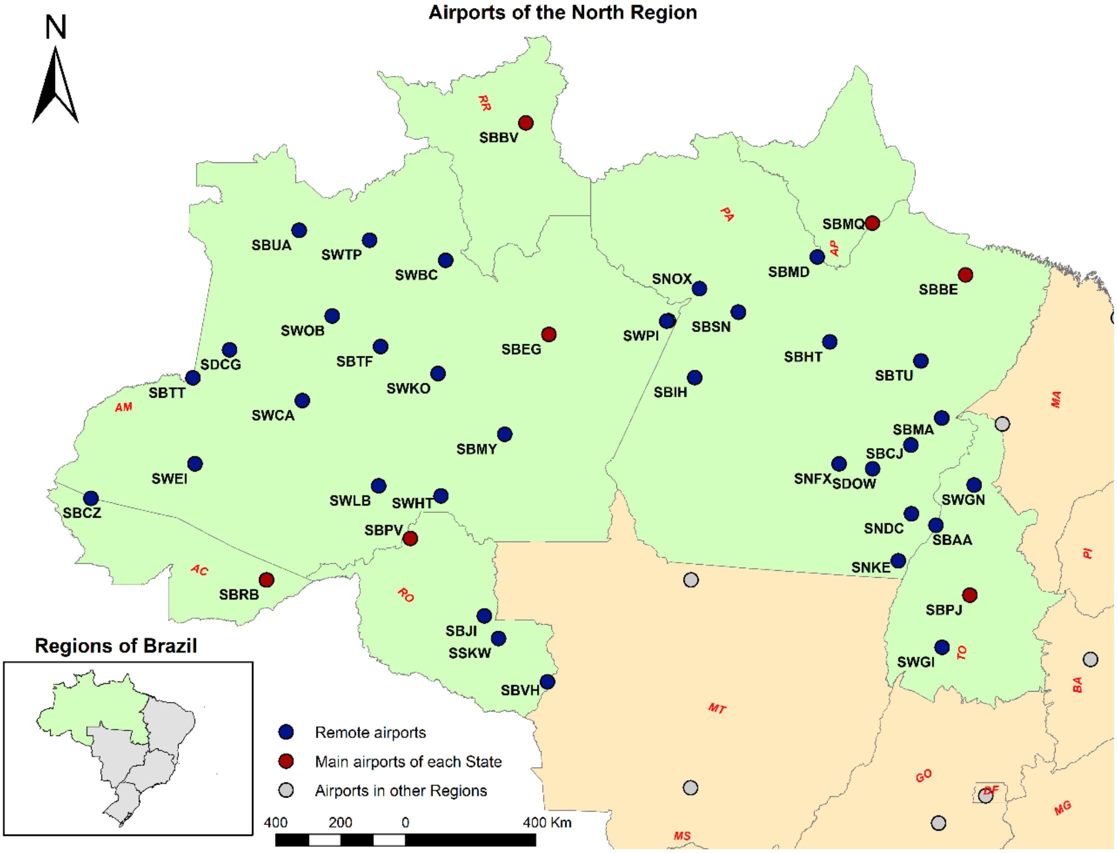

Figure 30 – North region airports with regular passenger transport operation throughout the study period.

Annex 2 - North region Airports: ICAO abbreviations

Table 36 – ICAO acronyms of the analysed airports, by remote city in the North region, related to Figure A.1.

ICAO	City	State	Number of cities
SBCZ	Cruzeiro do Sul	Acre (AC)	1
SWBC	Barcelos	Amazonas (AM)	14
SWCA	Carauari		
SWKO	Coari		
SWEI	Eirunepé		
SWOB	Fonte Boa		
SWHT	Humaitá		
SWLB	Lábrea		
SBMY	Manicoré		
SWPI	Parintins		
SWTP	Santa Isabel do Rio Negro		
SBUA	São Gabriel da Cachoeira		
SDCG	São Paulo de Olivença		
SBTT	Tabatinga		
SBTF	Tefé		
SBMD	Almeirim	Pará (PA)	13
SBHT	Altamira		
SBAA	Conceição do Araguaia		
SBIH	Itaituba		
SBMA	Marabá		
SNOX	Oriximiná		
SDOW	Ourilândia do Norte		
SBCJ	Parauapebas		
SNDC	Redenção		
SNKE	Santana do Araguaia		
SBSN	Santarém		
SNFX	São Félix do Xingu		
SBTU	Tucuruí		
SSKW	Cacoal	Rondônia (RO)	3
SBJI	Ji-Paraná		
SBVH	Vilhena		
SWGN	Araguaína	Tocantins (TO)	2
SWGI	Gurupi		

Annex 3 - Brazil's transport logistics: road and waterway modes

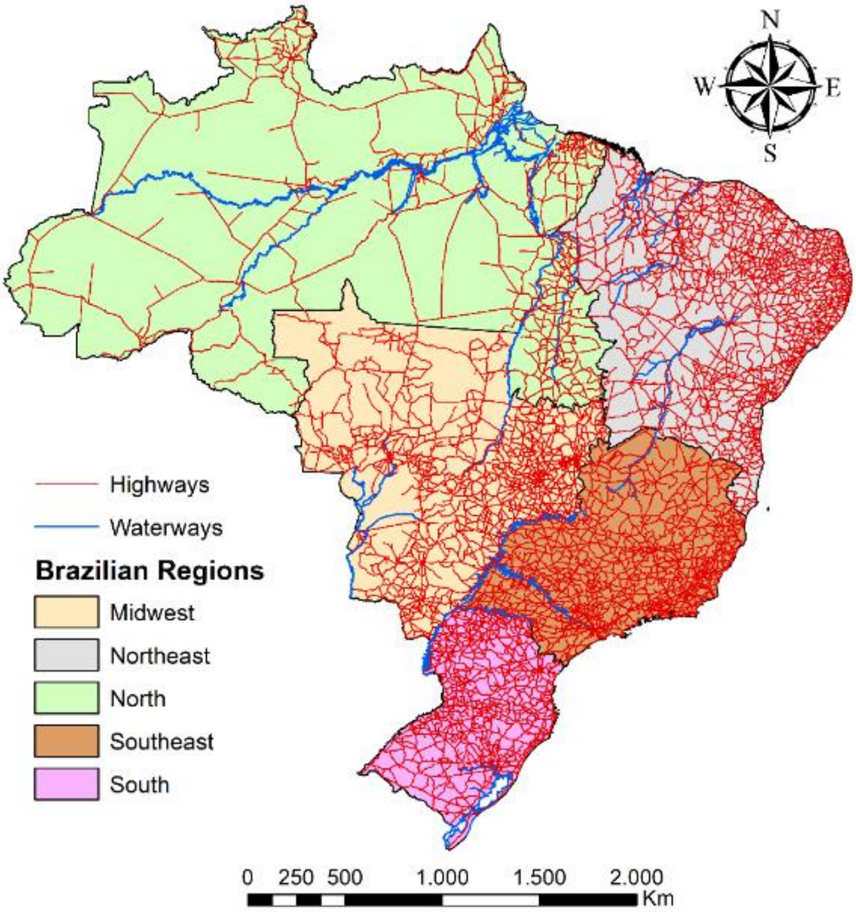

Figure 31 – Brazil's road and waterway infrastructure. Source: IBGE (IBGE, 2014a).

Annex 4 - List of countries investigated grouped according to their respective tourist macro-regions

Table 37 – Investigated countries with their respective acronyms, by tourist macro-region. Source: World Bank database – DataBank.

Europe

Acronimy	Country name
ALB	Albania
AND	Andorra
ARM	Armenia
AUT	Austria
BGR	Bulgaria
BIH	Bosnia and Herzegovina
BLR	Belarus
CHE	Switzerland
CYP	Cyprus
CZE	Czech Republic
DEU	Germany
DNK	Denmark
ESP	Spain
EST	Estonia
FIN	Finland
FRA	France
GBR	United Kingdom
GEO	Georgia
GRC	Greece
HRV	Croatia
HUN	Hungary
IRL	Ireland
ISL	Iceland
ITA	Italy
LTU	Lithuania
LUX	Luxembourg
LVA	Latvia
MLT	Malta
MNE	Montenegro
NLD	Netherlands
NOR	Norway
POL	Poland
PRT	Portugal
ROU	Romania
RUS	Russian Federation
SMR	San Marino
SRB	Serbia
SVN	Slovenia
SWE	Sweden
TUR	Turkey
UKR	Ukraine

Asia & Pacific

Acronimy	Country name
ARE	United Arab Emirates
AZE	Azerbaijan
CHN	China
HKG	Hong Kong China
IDN	Indonesia
IND	India
JPN	Japan
KAZ	Kazakhstan
KGZ	Kyrgyz Republic
KHM	Cambodia
KOR	Korea Rep
LAO	Lao PDR
MAC	Macao China
MDV	Maldives
MMR	Myanmar
MUS	Mauritius
MYS	Malaysia
NPL	Nepal
PHL	Philippines
SGP	Singapore
SYR	Syrian Arab Republic
THA	Thailand
UZB	Uzbekistan
VNM	Vietnam
NZL	New Zealand
FJI	Fiji
AUS	Australia

Middle East

Acronimy	Country name
BEL	Belgium
BHR	Bahrain
EGY	Egypt Arab Rep
IRN	Iran Islamic Rep
ISR	Israel
JOR	Jordan
KWT	Kuwait
LBN	Lebanon
OMN	Oman
QAT	Qatar
SAU	Saudi Arabia

Americas

Acronimy	Country name
ABW	Aruba
ARG	Argentina
ATG	Antigua and Barbuda
BHS	Bahamas The
BLZ	Belize
BOL	Bolivia
BRA	Brazil
CAN	Canada
CHL	Chile
COL	Colombia
CRI	Costa Rica
CUB	Cuba
CUW	Curacao
CYM	Cayman Islands
DOM	Dominican Republic
ECU	Ecuador
GTM	Guatemala
GUM	Guam
HND	Honduras
JAM	Jamaica
KNA	St. Kitts and Nevis
LCA	St. Lucia
MEX	Mexico
NIC	Nicaragua
PAN	Panama
PER	Peru
PRI	Puerto Rico
PRY	Paraguay
SLV	El Salvador
SXM	Sint Maarten
TCA	Turks and Caicos Isl.
URY	Uruguay
USA	United States
VIR	Virgin Islands (U.S.)

Africa

Acronimy	Country name
CIV	Cote D'ivoire
DZA	Algeria
KEN	Kenya
LKA	Sri Lanka
LSO	Lesotho
MAR	Morocco
MOZ	Mozambique
NAM	Namibia
RWA	Rwanda
SWZ	Eswatini
TUN	Tunisia
TZA	Tanzania
ZAF	South Africa
ZMB	Zambia
ZWE	Zimbabwe

Annex 5 - Detailed results of the regressions used for the estimation of the drivers of international tourism analytical models

Table 38 – Detailed results for Model 1, where inbound tourism (*inb*) is the dependent variable.

(i) Descriptive statistics of the Model 1 variables.

	ln (inb)	*ln (GDP)*	*ln (flights)*	*ln (outb trcost)*	*ln (opentrade)*
Mean	15,25	8,95	10,82	-2,18	4,33
Maximum	19,17	11,57	16,13	-0,09	6,22
Minimum	9,47	5,83	3,09	-8,16	2,75
Std. Dev.	1,50	1,26	1,70	1,11	0,51
Observations	2007	2007	2007	2007	2007

(ii) Redundant fixed effects tests (Chow test).

Test cross-section and period fixed effects			
Effects Test	**Statistic**	**d.f.**	**Prob.**
Cross-section F	212,51	-1.061.872	0,00
Period F	6,44	-241.872	0,00

(iii) Lagrange Multiplier Tests for Random Effects (Breusch-Pagan LM).

	Test Hypothesis		
	Cross-section	**Time**	**Both**
Breusch-Pagan	13933.25	3,83	13937,08
p-value	0,00	-0,05	0,00

(iv) Correlated Random Effects - Hausman Test.

Test Summary	**Chi-Sq. Statistic**	**Chi-Sq. d.f.**	**Prob.**
Cross-section random	284,86	4	0,00
Period random	36,18	4	0,00

Table 39 – Detailed results for Model 2, where tourism receipts (*rec*) is the dependent variable.

(i) Descriptive statistics of the Model 2 variables.

	ln (rec)	*ln (GDP)*	*ln (flights)*	*ln (currence)*	*ln (inb trcost)*	*ln (opentrade)*
Mean	21,81	8,95	10,83	1,49	-2,16	4,33
Maximum	26,16	11,57	16,13	8,90	1,25	6,22
Minimum	15,49	5,69	3,09	-0,43	-8,16	2,75
Std. Dev.	1,61	1,27	1,70	1,29	1,12	0,51
Observations	2051	2051	2051	2051	2051	2051

(ii) Redundant fixed effects tests (Chow test).

Test cross-section and period fixed effects			
Effects Test	**Statistic**	**d.f.**	**Prob.**
Cross-section F	128,49	-1.051.916	0,00
Period F	3,20	-241.916	0,00

(iii) Lagrange Multiplier Tests for Random Effects (Breusch-Pagan LM).

	Test Hypothesis		
	Cross-section	**Time**	**Both**
Breusch-Pagan	10.669,50	0,58	10.670,08
p-value	0,00	-0,44	0,00

(iv) Correlated Random Effects - Hausman Test.

Test Summary	**Chi-Sq. Statistic**	**Chi-Sq. d.f.**	**Prob.**
Cross-section random	269,06	5	0,00
Period random	25,50	5	0,00

Table 40 – Detailed results for Model 3, where outbound tourism (*outb*) is the dependent variable.

(i) Descriptive statistics of the Model 3 variables.

	ln (outb)	*ln (GDP)*	*ln (currence)*	*ln (outb trcost)*
Mean	14,94	9,04	1,38	-1,92
Maximum	18,88	11,57	5,57	-0,45
Minimum	10,34	5,96	-0,38	-9,12
Std. Dev.	1,65	1,19	1,10	0,83
Observations	1562	1562	1562	1562

(ii) Redundant fixed effects tests (Chow test).

Test cross-section and period fixed effects			
Effects Test	**Statistic**	**d.f.**	**Prob.**
Cross-section F	373,93	-861.448	0,00
Period F	8,00	-241.448	0,00

(iii) Lagrange Multiplier Tests for Random Effects (Breusch-Pagan LM).

	Test Hypothesis		
	Cross-section	**Time**	**Both**
Breusch-Pagan	12721.01	23,49	12744,50
p-value	0,00	0,00	0,00

(iv) Correlated Random Effects - Hausman Test.

Test Summary	**Chi-Sq. Statistic**	**Chi-Sq. d.f.**	**Prob.**
Cross-section random	72,76	3	0,00
Period random	62,54	3	0,00

Table 41 – Detailed results for Model 4, where tourism expenditures (*exp*) is the dependent variable.

(i) Descriptive statistics of the Model 4 variables.

	ln (exp)	*ln (GDP)*	*ln (outb trcost)*
Mean	21,12	8,88	-1,92
Maximum	25,86	11,57	-0,02
Minimum	16,21	5,43	-9,12
Std. Dev.	1,82	1,29	0,91
Observations	2376	2376	2376

(ii) Redundant fixed effects tests (Chow test).

Test cross-section and period fixed effects			
Effects Test	**Statistic**	**d.f.**	**Prob.**
Cross-section F	389,61	-1.152.234	0,00
Period F	6,42	-242.234	0,00

(iii) Lagrange Multiplier Tests for Random Effects (Breusch-Pagan LM).

	Test Hypothesis		
	Cross-section	**Time**	**Both**
Breusch-Pagan	18612.02	1.608885	18613.63
p-value	0,00	-0,20	0,00

(iv) Correlated Random Effects - Hausman Test.

Test Summary	**Chi-Sq. Statistic**	**Chi-Sq. d.f.**	**Prob.**
Period random	9,67	2	0,01
Cross-section random	27,82	2	0,00

Table 42 – Detailed results for Model 5, where tourism openness (*opentour*) is the dependent variable.

(i) Descriptive statistics of the Model 5 variables.

	ln (opentour)	*ln (GDP)*	*ln (PAX)*	*ln (inb + outb trcost)/2*	*ln (opentrade)*
Mean	0,08	9,07	15,39	-0,59	3,63
Maximum	0,87	11,57	20,61	0,03	5,25
Minimum	0,00	6,20	6,75	-3,25	2,06
Std. Dev.	0,09	1,18	1,92	0,31	0,51
Observations	1386	1386	1386	1386	1386

(ii) Redundant fixed effects tests (Chow test).

Test cross-section and period fixed effects			
Effects Test	**Statistic**	**d.f.**	**Prob.**
Cross-section F	261,30	-821.275	0,00
Period F	2,66	-241.275	0,00

(iii) Lagrange Multiplier Tests for Random Effects (Breusch-Pagan LM).

	Test Hypothesis		
	Cross-section	**Time**	**Both**
Breusch-Pagan	7075.287	8.340171	7083.627
p-value	0,00	0,00	0,00

(iv) Correlated Random Effects - Hausman Test.

Test Summary	**Chi-Sq. Statistic**	**Chi-Sq. d.f.**	**Prob.**
Cross-section random	19,69	4	0,00
Period random	2,35	4	0,67