TO BID OR NOT TO BID?

"The effect of hosting the summer Olympics on a European country's local economy"

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Abstract: In this paper, the impact of hosting the summer Olympics on the local economy is investigated by means of tourism, telecommunication infrastructure, and foreign direct investment in order to review the argumentation of European bidding committees of the former hosts Barcelona, Athens, and London. Macro-economic data on countries that have been part of the EU since 1987 are used. In addition, the Take Part survey is used to evaluate the effect of hosting the summer Olympics on sport participation. Four different econometrical models are performed: Static fixed effects, dynamic fixed effects, and bias-corrected LSDV and a logistic regression with fixed effects specification. Results show a negative net effect of hosting the summer Olympics on Tourism, possibly because of the crowding out effect in years preceding the summer Olympics. A negative relationship between hosting the summer Olympics and telecommunication infrastructure was found for the years preceding the summer Olympics. On the contrary, the effect on FDI stocks is significantly positive, in the years preceding and the years following the summer Olympics. In addition, the paper finds evidence for sport participation to be endogenous. However, there was no evidence found of a relationship between hosting the summer Olympics in London in 2012 and UK sport participation.

Keywords: *Olympic games, fixed effects, DFE, bias-corrected LSDV, tourism, telecommunication infrastructure, FDI, sport participation, individuals choice.*

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1. Introduction

The summer Olympics of 2016 in Rio de Janeiro are approaching. Much attention goes out to the athletes, their current form and speculations about potential winners. Simultaneously, journalist reports question certain aspects of the financial side of hosting the summer Olympics. Is hosting the Olympics worth the investment? Is not hosting the summer Olympics only beneficiary to the top layer of society? Do bidding committees keep their promises regarding the economic effect of hosting the summer Olympics? Answers to these questions might come too late for the Brazilian authorities but are of great value to potential hosts. One of the potential host is the Netherlands, which makes the outcome of this research valuable for local authority policy makers.

Major costs are involved with hosting the summer Olympics, not only with the bidding process, e.g., the Netherlands estimated that already more than €100 million direct costs are involved with the investigation of the option to host (Nooij, 2014). Most costs are incurred when actually hosting the summer Olympics. According to Maening and Zimbalist (2012), the costs of hosting the most recent summer Olympics (London 2012) were approximately 15 to 20 billion Euros (Maening & Zimbalist, 2012) of which about 50% is public money. To justify these costs, most bidding committees publish reports about the positive effect hosting the summer Olympics has on the local economy. These promises often include positive contributions to the tourism sector, telecommunication infrastructure, foreign direct investment (FDI), and more recently, sport participation (Meta-Evaluation of the Impacts and Legacy of the London 2012 Olympic and Paralympic Games, 2011; Official Report of the XXV Olympiad, 2003; Official Report of the XXVIII Olympiad, 2007).

Although academic papers about the effect of hosting the summer Olympics on tourism have been published (Fourie & Santana-Callego, 2011; Kasimati, 2005; Li & Blake, 2009; Li & Jago, 2013; Owen, 2005), the literature on telecommunication infrastructure, foreign direct investment, and sport participation are rather scarce. Also, many of the published reports about the effect of particular summer Olympics on the local economy are produced by parties directly or indirectly linked to the host. Considering the high costs and the amount of pressure to justify these costs, some of these reports might be biased toward more a more positive effect.

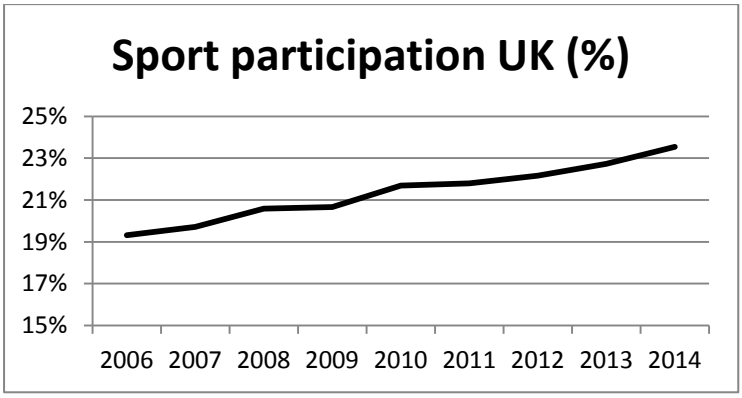

Figure 1: Sport participation rates in the United Kingdom (source: TAKEPART survey).

Furthermore, many of these reports do not make use of more advanced econometrical models to test the effect of hosting the summer Olympics on the local economy. Figure 1 shows the increased sport participation of the UK between 2006 and 2014. However, this increase is not necessarily caused by hosting the summer Olympics in 2012, but it could be presented like this in opportunist reports in order to justify expenditures with public money.

This paper aims to present objective and academic results, reviewing the most important arguments used by former bidding committees to justify the investments. The main research question this paper hopes to answer in order to address the ambiguity of the economic effects of hosting the summer Olympics is as follows: What is the effect of hosting the summer Olympics on a European country's local economy?

In order to answer this question, it is divided into different sub-questions to measure the effect of hosting the summer Olympics on separate parts of the local economy: Tourism, telecommunication infrastructure, and foreign direct investment. In addition, an analysis on sport participation rates in the United Kingdom is presented. The paper is split into two separate parts to make the analysis comprehensible. First, the effect of hosting the summer Olympics on tourism, telecommunication infrastructure, and foreign direct investment will be analysed. Thereafter, the effect of hosting the summer Olympics on the sport participation rates in the United Kingdom will be analysed. Argumentation behind the partition is as follows: (1) The theory and mechanisms behind the two subjects are extremely different. Tourism, telecommunication infrastructure, and FDI are mostly influenced by macroeconomic variables and macroeconomic forces, while sport participation is mainly driven by individual circumstances and social factors and (2) The necessary data is different: for the analysis on tourism, telecommunication infrastructure, and foreign direct investment, macroeconomic data is used, whereas UK sport participation rates are analysed with the help of the Take Part survey data (DCMS, 2015). Since both parts are fundamentally different, they require separate theory, data, method, and results sections. In the discussion and conclusion, both parts are merged and overarching discussion points and conclusions with regard to the main question and sub-questions are drawn.

The first part of the paper investigates the effect of hosting the summer Olympics on tourism, telecommunication infrastructure, and FDI. The subject of analysis is framed to European countries for reasons of external validity. The Netherlands, as well as Germany and France (Olympic movement, 2016), is willing to host the summer Olympics in 2028 (exactly 100 years after the previous organisation by the Netherlands in 1928). There are more candidates willing to host the summer Olympics of 2028. However, to keep the research manageable and convenient the analysis solely contains the effect on European countries that hosted the summer Olympics in the past 25 years. These former hosts are as follows: Barcelona, 1992; Athens, 2004; and London, 2012. Homogeneity between the previous hosts and the potential hosts are desirable because of external validity. Similarities between these previous and potential hosts are, for example, the incentives for organising the Olympic games are overlapping: The European developed countries are aiming to benefit local stakeholders by hosting the summer Olympics, while China and Brazil might want to showcase their maturity as organising country to the world while partly ignoring local stakeholders. Additionally, all

countries included in the research have been members of the EU since 1987, which means that they are tied through EU institutional forces. Therefore, it is expected that they have followed the same economic cycle and react similarly to external economic shocks. These similarities provide a homogenous framework for the analysis and simultaneously increase the external validity of the results. The data used to perform the analysis on tourism, telecommunication infrastructure, and foreign direct investment is mainly macroeconomic data extracted from the World Bank and Eurostat. Six different econometrical models in the analysis were used in order to perform robust static and dynamic panel analysis. The three exploited estimators are the static fixed effects estimator, the dynamic fixed effects estimator, and the dynamic bias-corrected least-square dummy estimator.

The second part of the paper investigates the effect of hosting the summer Olympics on sport participation in the United Kingdom. The reason to investigate the effect of hosting the summer Olympics on sport participation rates is that it was one of the goals of the hosts of the London 2012 summer Olympics (Meta-Evaluation of the Impacts and Legacy of the London 2012 Olympic and Paralympic Games, 2011): "London 2012 became the first Olympic and Paralympic Games to explicitly and pro-actively set out to use the Games to deliver increases in sport participation levels" (Weed et al., 2015, p. 197). Potential future hosts, like the Netherlands, are also aiming to increase sport participation levels through hosting the Olympics, which makes the actual effect of hosting the Olympics in London on the sport participation rates in the UK extremely convenient going forward. In order to perform the analysis, survey data was extracted from the Department of Culture, Media and Sport (DCMS). This survey data is the first kind of consistent high quality data that contains in-depth socio-demographic respondent information, as well as respondent information on many aspects of leisure, culture, and sport in England, and covers the years 2005-2014. An econometric model was developed on basis of the Logistic regression estimator with a fixed effects specification in order to investigate the changes within an individual over the years.

Results show that the crowding out effect on tourism might be larger than expected in the years preceding the Olympics. The effect in the following years shows an increased number of tourist. Telecommunication infrastructure is not influenced by hosting the summer Olympics. Foreign direct investments increased, as expected, due to hosting the summer Olympics. Nonetheless, many of these investments could also be the result of policy changes in the hosting country. There were no causal relationship found between hosting the summer Olympics and an increase in sport participation, which means Figure 1 is misleading. There were relationships found between age, income, vehicle ownership, and educational level and sport participation, which is a confirmation of the theory that the choice to participate in sports is endogenous. However, hosting the Olympics did not increase UK sport participation, according to this study.

Results of this paper try to fill a gap in current literature by increasing knowledge on the effect of hosting the summer Olympics on tourism. In addition, it is one of the first papers to investigate the effect of hosting the summer Olympics on telecommunication infrastructure, foreign direct investment, and sport participation. Subsequently, this paper helps to create a foundation on which future research can be built. Moreover, it is an objective and academic

paper reviewing the most important arguments used by former bidding committees to justify the investments. Consequently, the results contribute to increased general knowledge of society about the effect hosting the summer Olympics has on the local economy. In this way, the paper hopes to provide guidance to bidding committees and authorities who deciding whether to participate in the bidding process to host the summer Olympics in the future.

The rest of the research is organized as follows. In the second chapter, a broad summary of the history and meaning of the Olympics is provided in order to put the goal of the paper into context. This summary is followed by the ways hosting the summer Olympics could have an effect on the local economy. Then, the goals and accomplishments of Barcelona, Athens, and London, as well as their respective investment costs, are reviewed in order to identify which factors should have influenced their local economies. Subsequently, there is a review on the existing literature on the effect of hosting the Olympics on tourism, telecommunication infrastructure, and foreign direct investment. Then, the data and method are described for the analysis of the effect of hosting the summer Olympics on tourism, telecommunication infrastructure, and foreign direct investment. Subsequently, the results and the implication of the results will be described. This section is followed by second part of the paper, which investigates the effect of hosting the summer Olympics in London in 2012 on sport participation rates in the UK. This part includes a separate chapter on theory, data and method, results, and implications of results of hosting the summer Olympics on sport participation in the UK. Thereafter, the overarching results and research limitations of both parts are discussed. Finally, conclusions on the effect of hosting the summer Olympics on the local economy will be drawn in the last chapter.

2. Theory

2.1. The summer Olympics

The current summer Olympics are based in the ancient Greek Olympics, which date back to 776 B.C. (Raschke, 1988). These competitions were held in Greece in the city of Olympia, which is the origination of the name Olympics. Greek athletes would come to the five-day event in Olympia once every four years, and the winner would receive the famous olive wreath and high status. The ancient Greek Olympics were held every four years for more than 1000 years without any interruption until 393 A.D. (Raschke, 1988).

The first modern Olympics were held in 1896 in Athens. They were reinvented by Pierre Freddy baron de Coubertin, a French aristocrat. De Coubertin studied in England and believed that the incorporation of sports in the educational system was a way to balance the body and mind. Unfortunately, his initial reforms found little ground in Westminster. As an alternative, he turned his attention to reinventing the ancient Olympic games (Barney et al., 2002).

Initially, there were two important pillars that formed the basis for the Olympic games. The first pillar obliges athletes to be amateurs. The second pillar describes the idea that the Olympics can bring people and nations closer together, creating common understanding and peace. Current fundamental principles are slightly different than the original fundamentals. The most important fundamentals of the current Olympics, as stated by the International Olympic Committee (IOC), include the following:

> Olympism is a philosophy of life, exalting and combining in a balanced whole the qualities of body, will and mind. Blending sport with culture and education, Olympism seeks to create a way of life based on the joy of effort, the educational value of good example, social responsibility and respect for universal fundamental ethical principles. (Olympic Charter, 2014, p.13).

The Olympic Charter (2014) also states, “The goal of Olympism is to place sport at the service of the harmonious development of humankind, with a view to promoting a peaceful society concerned with the preservation of human dignity.” (p.13).

The pillar of amateurism is no longer part of the Olympic Charter. The necessity of competitors to be amateurs was abandoned in 1971 by the IOC. Before 1971, athletes had to rely solely on private funds and gifts by family members. Giving the more wealthy people in society an advantage over people who played their sports as hobby and had to work to pay for their living (Olson, n.d.). The reasoning behind the change in rules is that the principle of amateurism would induce unfair competition. Thus, from 1971 onwards, athletes could receive prizes and compensation for their efforts in order to create fair competition. In addition, the new rules included the possibility to be sponsored by national organizations and sports organisations

The increase in professionalism caused by the change in rules in 1971 is one of the reasons that there has been an impressive growth in the number of athletes from different countries. The first modern Olympic games of 1896 in Athens hosted 295 athletes from 14 countries

who participated in 43 events. In the most recent edition of the Olympics in London 2012, 10,568 athletes from 204 countries in 304 events participated (Olympic factsheet, 2012). Such an increase greatly stimulates the global attention of such an event, thus increasing the impact for cities hosting the summer Olympics. Nevertheless, the extra attention does not have to be positive. The Olympics received much negative attention in the years that followed after the decision to abolish the amateur principle. In Munich in 1972, there were terrorist attacks; in 1976, Montreal garnered high debts for the city; and the 1980 Olympics in Moscow were boycotted by 65 countries because Russia was fighting a war in Afghanistan (IOC, 2015). These negative incidents at the summer Olympics caused the popularity of hosting the Olympics to decrease to a minimum by the end of the 1970s.

The summer Olympics of 1984 in Los Angeles would mark the great turn-around in popularity of cities to host the summer Olympics (Gratton et al., 2000). An explosion of television rights, the introduction of a new corporate sponsor strategy, and Juan Antonio Samaranch's move as IOC president to emphasize the professionalism caused the 1984 summer Olympics in Los Angeles to generate a surplus of 215 million dollars (Zimbalist, 2015). Although the changes seem separate events, they all lead back to the decision to abolish the amateur principle. With the best athletes at the Olympics, the event became more attractive to watch and to visit, inducing an increase in television rights. The increased attention for the summer Olympics increased attraction of potential sponsors as well. Accordingly, sponsors were offering to sign exclusive contracts through The Olympic Partner program (TOP) (IOC, 2015), giving them the sole right to advertise during the Olympics. Examples of partner firms are Coca-Cola and McDonalds.

The increasing global reach through TV broadcasts, which were at an all-time high in London in 2012 (London factsheet, 2012). In combination with the presence of the best athletes in the world, TV broadcasts have increased the popularity of the summer Olympics among global citizens. These developments cause cities to see the Olympic games as a potential opportunity to advertise their cities for 17 straight days, reaching almost everyone on the planet. In addition, in 1984, Los Angeles proved that the possibilities of making profit as a city. While Barcelona's 1992 hosting serves as a success story for urban redevelopment.

All of the stated arguments seem to make sense and are, therefore, commonly used by potential host cities in order to justify the enormous investments. Whether these investments are truly justifiable will be investigated in the next sections. First, the understanding of economic effects of mega events like the summer Olympics will be elaborated on. Furthermore, goals and costs of hosting the summer Olympics will be analysed, followed by the impact of hosting the summer Olympics on tourism, telecommunication, and foreign direct investment.

2.2. Hosting the Olympics

2.2.1. Understanding the economic effect

When cities invest public money into the organisation of a major sport event, like the Olympic games, there are many arguments brought to the table. In spite of arguments like urban redevelopment or stimulation of local social cohesion, the economic benefits are likely to rank high among them (Compton, 1995). Cities hosting the Olympics expect a large inflow of new money into the local economy, an infusion of money that otherwise would not be there (Compton, 1995; Sterken, 2007). Extra money inflow a city can expect are the revenue of the sales of broadcasting rights and money spent by attendants and sponsorship deals (Kasimati, 2005; Li & Jago, 2013; Matheson, 2006). In existing literature, the impact of the inflow of this new wealth is often calculated through a multiplier effect. According to Kasimati (2005), "a multiplier estimates the number of times a unit of currency, once spent within an economy, is re-spend within the borders of that economy" (p. 434). This multiplier effect can be broken nto three different effects: A direct effect, an indirect effect, and an induced effect (Compton, 1995; Li & Jago, 2013; Matheson, 2006). The indirect and induced effects are often referred to as secondary effects (Kasimati, 2005).

The direct effect refers to new money flowing into the economy spent by outside visitors. Outside visitors, in this case, means people who do not live in the local economy. This money is spent in different industries in the local economy. An example is someone from outside the local economy spending money on a local hotel.

The indirect effect refers to the expenditures of local organisations who use the received money to buy their inputs from local suppliers, such as a local hotel company that buys soap from a local soap supplier.

The induced effect is the household income that is re-spent in other businesses in the local economy. An example is the hotel cleaning lady and the soap producer using their additional income, generated by the extra hotel visitors, to spend in the local grocery store. This process continues until all the extra money is leaked out of the local economy by, for examples, taxes, imports, or savings (Kasimati, 2005; Li & Jago, 2013).

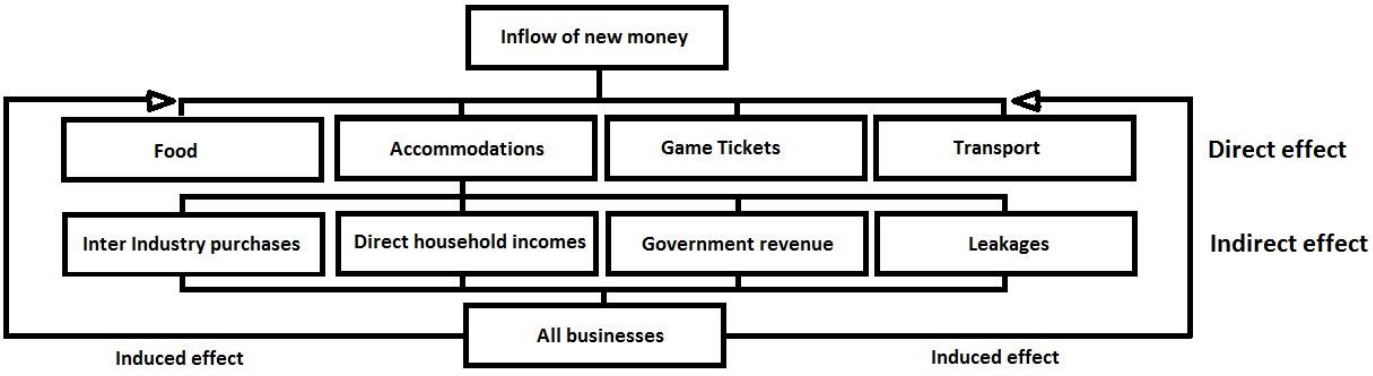

Figure 2: Illustration of the multiplier effect based on Kasimati (2005).

Different categories of direct expenditure, which are of importance to cities hosting the Olympics, can be identified. Game visitors' expenditure, tourism expenditure, infrastructure expenditure, exports, and foreign investments (Li & Blake, 2009; Li & Jago, 2013; Madden, 2006). In most cases, the additional income through these direct expenditures are translated into three common multiplier effects. These multiplier effects are the sales and transaction multipliers, household income multipliers, and the employment multipliers (Crompton, 1995; Li & Jago, 2013; Kasimati, 2005), i.e., the effect of inflow of outside money on the number of sales and transactions, the effect on the household income, and the effect on the number of jobs. Although the sales and expenditure multipliers are most often used, Crompton (1995) argued that, for calculating the impact of a mega event, the effect on household income is the most appropriate measure:

> Residents are interested in knowing how much extra income the host community will receive from the injection of funds from visitors. They have no interest in value of sales per se because it has no impact on their standard of living (p. 21).

Another frequently used multiplier is the employment multiplier. However, this effect is least reliable because of the assumption of full utilisation of existing employees (Crompton, 1995). The assumption that the existing workforce is fully utilized means that, in case of temporary higher demand, there is the need to hire new employees. This assumption may not be viable in many cases. For example, employers or entrepreneurs can work overtime during the 17-day event or can ask friends and family too help out for a small compensation. The temporary demand for extra employees does not necessarily create lasting jobs (Kasimati, 2005; Porter & Fletcher, 2008).

Overall, the estimation of economic impact by a multiplier effect can be valuable "if it is implemented knowledgeably and with integrity" (Crompton, 1995, p. 34), which indicates the importance of clearly stating the identity of the multiplier (sales or income) since sales multipliers are often higher than income multipliers (Kasimati, 2005). The multipliers can be used as a tool by advocates of the summer Olympics to inflate the positive side of hosting such an event (Crompton, 1995). Therefore, outcomes of economic impact analysis containing multiplier effects should be interpreted with caution.

Predicting models

Predicting the consequences of hosting events, such as hosting the summer Olympics, requires the use of economic models. Those models can be used to calculate the economic multipliers (Matheson, 2009). Two frequently used models are the input-output model (I-O model) and the computable general equilibrium (CGE) model. The I-O model is more comprehensible; the CGE model provides more realistic outcomes (Kasimati, 2005; Li & Blake, 2009; Li & Jago, 2013; Madden, 2006). Nevertheless, both approaches have their advantages and disadvantages, which will be described below.

Input-output model

The inputoutput model was originally developed by Wassily Leontief, who received the Nobel prize for his contributions in developing the model in 1973 (Garfield, 1986). Leontief (1986) described his model as "a method of systematically quantifying the mutual

interrelationship among the various sectors of a complex economic system" (p. 19). The I-O model is commonly used in tourism impact analysis (Li & Jago, 2013) and captures the chain of effects in the local economy as a consequence of a change in demand (Blake & Sinclair, 2003).

The original I-O model, as applied in most research, has three critical assumptions necessary to calculate the final demand: (1) Production is characterized by fixed factor production, (2) factor supply is perfectly elastic, and (3) leakages from the economy do not vary over time (Porter & Fletcher, 2008). Fixed factor production means products are treated as a standard package. For example, one visitor to the Olympic games may stay two nights in a hotel, have six meals, and take four cab rides. The package of expenditures of the visitors is the direct effect, as referred to in Figure 2. The indirect effect is calculated by knowing how many expenditures for this hotel stay, food sources, and cab rides are embodied in the satisfaction of this one visitor (Porter & Fletcher, 2008). The second assumption, factor supply, is perfectly elastic and denotes data must be aggregated to make the model work. Connecting each consumed item during a visitor's day to the consumptions own specifications would generate too many specifications. Therefore, the consumptions are aggregated to a certain level (Porter & Fletcher, 2008). For example, hotel stays cost €100, meals €10, and cab rides €15. The attendance of a visitor to the summer Olympics is thus associated with a spending of €320 (€200+€60+€60). The third critical assumption is that leakages are constant over time. Indicating that the part of local companies' expenditures into the local economy is constant over time (Porter & Fletcher, 2008). For example, from the hotel income of €100, half is spent in the local economy and the other half is spent on buying imports from other regions or countries, resulting in the local economy receiving 50% of visitors spending on hotels.

This traditional I-O model approach is still used today despite the many concerns about the overstatement of the impact (Baade & Matheson, 2002; Li & Jago, 2013; Porter & Fletcher, 2008). Most of the critique is targeted on the different assumptions explained above. Fixed factor production (assumption 1) indicates a lack of capacity constraints implying infinite elastic supply curves (Porter, 1999). Subsequently, I-O modelling leaves no room for the crowding out effect, meaning increasing demand will only yield positive indirect effects (Madden, 2006). Factor supply being perfectly elastic (assumption 2) indicates the absence of inputs and resource constraints, meaning price and capacity do not increase as economic activity expands (Jago & Dwyer, 2006; Li & Jago, 2013). Leaving proportions as suggested, regardless of the amount of inflow of new funds, leaves no space for effects like economies of scale or price adaptations. Ignoring effects like this results in inaccurate predictions (Kasimati, 2005). Leakage can be constant over time (assumption 3) within one region. According to Crompton (1995), every region has its own characteristics and under normal conditions they do not change much over time (Crompton, 1995). However, leakage can differ between the normal scenario and the Olympic scenario. State leakages could be higher in the Olympic scenario due to foreign and interstate investment, and negative externalities, like congestion, road accidents, vandalism, and fire protection costs, could increase (Crompton, 1995), influencing the share of income entering the local economy. As described, the assumptions of the I-O model weaken its accuracy. Due to the nature of the assumptions,

economic impacts are often overestimated (Baade & Matheson, 2002; Li & Jago, 2013; Porter & Fletcher, 2008).

Because of the critique on the I-O model, scholars shifted to a different model for their predictions: The computable general equilibrium model. The CGE model has more realistic assumptions (Dwyer et al., 2004) and is commonly used for the estimation of economic impact of Olympic games (Li & Blake, 2008; Madden, 2006). The most important features of the CGE model are described below.

The computable general equilibrium model.

The computable general equilibrium model is a more sophisticated model in applied economics used to predict future demand. The obtained results from CGE models are judged to be more realistic than I-O models. The first CGE model was developed by Leon Walras (1874). The model is called the Walrasian model and was able to fit complex economic interactions. The Walrasian model is considered a major contribution to the field of applied economics (Greenaway et al., 1993).

CGE models are based on mathematical relationships within different sectors of the economy, reflecting the behaviour of the most important contributors to the economy (Li & Jago, 2013). The CGE model is used to simulate the economy and show changes in demand when all markets clear simultaneously (Kasimati, 2005). This simulation is made by using the In-Output structure and behavioural functions of different sectors within the economy in combination with the disaggregated demand function (Kasimati, 2005). Therefore, the supply side as well as the demand side are spilt, creating a disaggregated representation of the production side of the economy, as well as disaggregated demand functions in consumption, sales, and imports (Kasimati, 2005). In this way, CGE models provide a "bottom up" approach for analysing economic relationships in a microeconomic environment, like the summer Olympics, in order to compose a more realistic illustration of the impact of events on the local economy (Li & Jago, 2013; Sugiyarto, 2000). In other words, the model analyses interactions between every sector and its unique production characteristics, as well as different unique parameters on the demand side. Next, markets are cleared at the right price in order to see the effect afterwards. In this way, it is possible to make predictions about the effect of exogenous changes on the production of different sectors and demand of chosen parameters and thus the impact of an event on the local economy as a whole.

As described, most I-O models overestimate the impact due to the lack of incorporation of important factors, like capacity constraints or price adoptions. In the CGE model, these factors are accounted for. For example, households face income constraints, meaning families have to save on certain expenditures when spending part of their income on, for example, event tickets (Madden, 2006). Resources spent on the event and event-related activities, are also drawn from other activities (Madden, 2006). The key result is that negative impacts in sectors are captured by the CGE model (Li & Jago, 2013). In addition, concerning the determination of prices, most of the CGE models makes use of flexible pricing. Prices have to move in order to clear all markets simultaneously (Kasimati, 2005).

These improved assumptions make the CGE model a more reliable model than the I-O model. Li and Jago (2013) mentioned that the CGE model "leads to more conservative but realistic results" (p. 596). Despite all the advantages of the CGE model over the I-O model, the I-O model is still a popular method. An explanation may be that I-O model is relatively simple and inexpensive too construct (Kasimati, 2005). Another cause could be the fact that overestimated impacts could be beneficial for parties trying to organize large events like the summer Olympics (Crompton, 1995; Porter & Fletcher, 2008).

2.3. Identification of economic factors influenced by hosting the summer Olympics

The goal of this paper is to test the impact of hosting the summer Olympics on the local economy. The prior section, described the way an event can impact the local economy, which is the inflow of money that would otherwise not be there. In addition, which models bidding committees use to predict the potential impact, including their shortcomings, are described. However, the ways in which hosting an event can contribute to additional inflows of money are numerous. In order to frame this subject in a manageable manner, economic factors, acknowledged by former hosts, affected by hosting the summer Olympics must be identified.

This section will narrow down to particular summer Olympics. First, why this paper centralises the analysis on Barcelona in 1992, Athens in 2004, and London in 2012 will be identified. To justify the economic costs incurred by hosting the summer Olympics, there have to be beneficial economic returns. This reasoning is supported by the fact that the willingness to host the summer Olympics increased after the LA games in 1984 proved to be profitable in terms of money inflow (Zimbalist, 2015). Therefore, an in-depth analysis of existing literature on the goals of former hosts will be given in order to extract their main economic goals for hosting the summer Olympics. Furthermore, the costs of these previous summer Olympics will be reviewed in order to establish the goals. This section will conclude with a review of existing literature, which outlines the actual accomplishments of the former hosts with regard to the most important economic incentives (tourism, telecommunication infrastructure, and foreign direct investment).

2.3.1. Comparing the right hosts.

The summer Olympics is a global tournament and is, therefore, organized by countries all over the globe. For example, the last five summer Olympics (Atlanta, Sydney, Athens, Beijing, and London) were held in four different continents (North America, Australia, Europe, and Asia), which means that the economic situation of organising countries are likely to differ. The effects of hosting the summer Olympics on the local economy could be different for developed countries (e.g., Spain) and developing countries (e.g., China). Also, incentives for hosting the summer Olympics could differ. While China wanted to expose its capabilities of organising large events and showcase its prosperity to the world, the UK wanted to increase the attention of sport in order to increase sport participation (Beijing government, 2008; Meta-Evaluation of the Impacts and Legacy of the London 2012 Olympic and Paralympic Games, 2011). All these differences could have implications on the costs of investments or on the effects of organising the summer Olympics on particular parts of a

country's economy. Therefore, it is desirable to compare homogenous countries when analysing the effects of hosting the summer Olympics on a local economy.

This research contains the analysis of the economic impact of hosting the summer Olympics on Barcelona, Athens, and London. These cities are part of countries that are reasonably similar (Spain, Greece, and UK). All these countries are part of the European Union and follow basically the same economic development over the years. It could also be assumed that these countries react quit similarly to external economic shocks since they are closely tied through the European Union. Finally, incentives for organising the Olympic games are overlapping (see following paragraphs), which makes it easier to compare the analysis on the economic effects of hosting the summer Olympics.

In addition to institutional and economic similarities, cultural differences are also smaller between different European countries and former hosts in different continents. Cultural differences can be measured by the Hofstede Index. Hofstede (1983) initially described four different dimensions in which cultures can differ: Power distance, individualism, masculinity, and uncertainty avoidance (Hofstede, 1983). Later, he added two additional dimensions: Long-term orientation and indulgence. With regard to hosting the summer Olympics, two of the dimensions are most deterministic in the bidding and organising process. The first is power distance, which Hofstede (2016) described as "the extent to which the less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally*"* (para. 2). When countries score higher on power distance, the elite of the country makes the decision more in its own interest. Long-term orientation is described as "how every society has to maintain some links with its own past while dealing with the challenges of the present and future" (Hofstede, 2016, para. 10). The higher the score on long-term orientation, the more pragmatic the approach, with a higher drive to go forward and less aim at initial traditions.

Figure 3 shows the differences in power distance among different hosts. The power distance in the Netherlands is comparable to the UK, the US, and Australia. Spain and Greece are comparable in terms of power distance but score 20 points higher than the Netherlands and the UK. The power distance in China and Brazil is much higher at 80 points, which indicates differences in power distance between the Netherlands and the UK and Spain and Greece. The scores on power distance indicate that culture with respect to power distance differs between these countries and could lead to differences in the way they organize an event like the summer Olympics. Nonetheless, this difference of 20 points in power distance does not provide enough evidence to reject the assumption that the effect of hosting the summer Olympics will be the same for these countries. However, the difference is important to keep in mind when assessing the results since it might explain differences between particular former hosts.

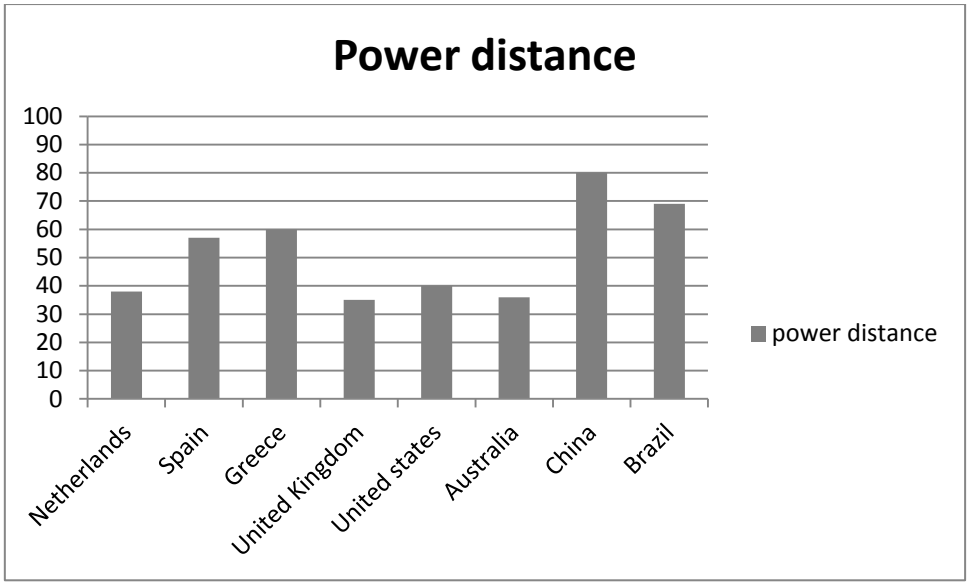

Figure 3: Comparison of power distance between different (potential) hosts.

Figure 4 shows the comparison of long-term orientation among the different countries. The scores of Spain, Greece, and the UK are similar. The Netherlands scores slightly higher but does not differ as much from the former European hosts as the US, Australia, or China. This difference in long-term orientation supports the assumption that the effect of hosting the summer Olympics on the local economy of former and potential European hosts are similar.

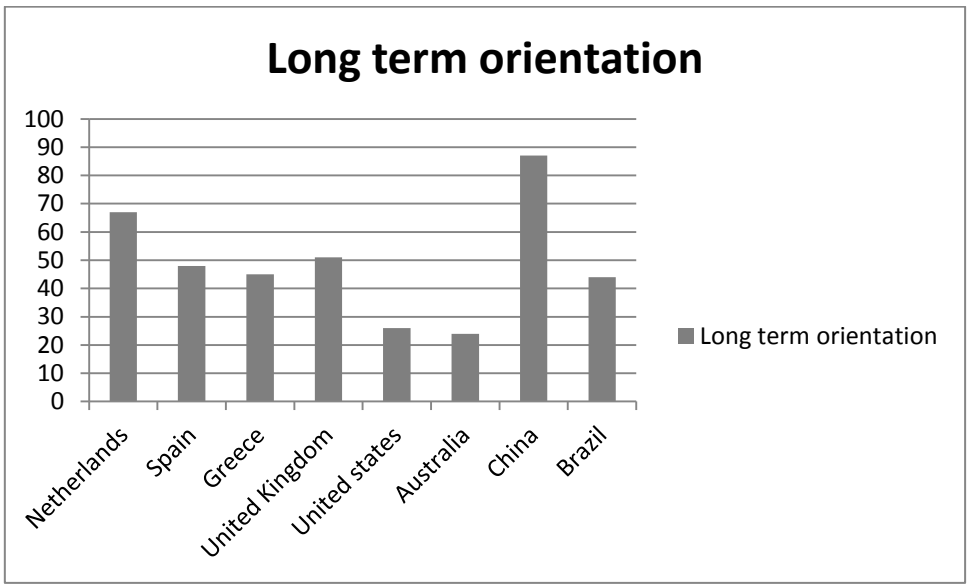

Figure 4: Comparison of long term orientation between different (potential) hosts.

The cultures of the European hosts of the summer Olympics differ, but mutually not as much as the countries outside Europe. In particular, cultural differences between developing and developed countries are greater than the differences between developed countries, which adds to the argumentation that these countries can be compared when analysing the effect of hosting the summer Olympics on the local economy. However, it is important to keep in mind that there are cultural differences, especially between the northern European countries

and the Mediterranean European countries, as shown in Figure 3. These differences could potentially influence the achievements of the goals set by the Olympic bidding committees, as well as\ the effect of hosting the summer Olympics on the local economy.

2.3.2. Goals

Goals of Barcelona in 1992

The goals of the Barcelona bidding committee were mainly focussed on the urban redevelopment of the city, as well as the infrastructural network. In addition, the city stressed the importance of technology and communication networks (Official Report of the XXV Olympiad, 2003).

The goal of the bidding committee was to use the Olympic games as a catalyst for urban redevelopment (Essex & Chalkley, 2010). The infrastructure project consisted of enlarging the airport, stretching the railroad through the centre, and extend cross city lines of the subway system, as well as connecting the subway system to neighbouring towns and transforming the road system to allow traffic to avoid the city centre (Official Report of the XXV Olympiad, 2003). In addition to these infrastructural projects, the bidding committee proposed the creation of an opening to the sea, creating a beach adjacent to the city (Essex & Chalkley, 2010; Official Report of the XXV Olympiad, 2003). In order to achieve this, they had to draw a plan to modify the area and the railroad system and to modernization the sewage system (Brunet,1995).

These projects seem rather ambitious, and they would be if it were just for the summer Olympics of 1992. However, these plans had already existed and were part of an urban redevelopment plan that dated back to the beginning of the 1980s (Zimbalist, 2015). The Olympic games were needed to provide a justification to finally cut the rope and start on some of the projects (Essex & Chalkley, 2010).

The special attention to the technology through the improvement of the telecommunications in Barcelona was of lesser importance than the urban redevelopment projects (Official Report of the XXV Olympiad, 2003). Nevertheless, the bidding committee placed emphasis on the new challenges and advantages of modern telecommunications. Therefore, they wanted to demonstrate the application of the latest technologies in the field of computers, broadcasting, and telecommunications (Official Report of the XXV Olympiad, 2003).

Goals of Athens in 2004

The goals of the Athens bidding committee have many similarities to the goals of the Barcelona 1992 Olympics committee (Preuss, 2004). The regeneration of Barcelona was internationally recognized as a success, and Athens seems to have wanted to use the same recipe as Barcelona to rejuvenate the city (Kasimati & Dawson, 2009; Zimbalist, 2015). Although Greece was the smallest country since Finland, in 1953, to host the summer Olympics, its size did not hold back its ambition (Samitas et al., 2008). The project involved reclaiming the city's sea-front, create major axes through the city's urban web, transferring the airport from the site at Helliniko, expanding the metro network system and creating tram lines, renovating the historical city centre, and highlighting and protecting the mountain

masses that surround the capital's basin locations (the last project was of lesser importance, but due to increasing environmental engagement of the IOC, projects like these were created) (Official Report of the XXVIII Olympiad, 2007). The main argument posted to justify these ambitious plans was that the Olympics would hand the government the tools to create contemporary sporting facilities and infrastructural projects that were lacking in Greece (Kasimati & Dawson, 2009; Official Report of the XXVIII Olympiad, 2007). In addition to the many infrastructural projects, the city wanted to leave a lasting legacy for the people in Greece by repositioning and promoting cultural and historical heritage to the world. In addition, Athens would showcase the achievements of modern Greece and its potential for the future. In this last respect, the Greek bidding committee intended to create an "entire infrastructure network including state-of-the-art telecommunication networks" (Official Report of the XXVIII Olympiad, 2007, p. 74). This goal also has similarities with the Olympic summer games of Barcelona in 1992.

Goals of London in 2012

The bidding committee of the summer Olympics of London, in 2012, was extremely clear about its goals: "DCMS [Department for Culture Media and Sport] aims to improve the quality of life for all through cultural and sporting activities, support the pursuit of excellence, and champion the tourism, creative and leisure industries" (Meta-Evaluation of the Impacts and Legacy of the London 2012 Olympic and Paralympic Games, 2011, p. 2). The goals of the London summer Olympics were split into four: (1) Harnessing the UK's passion for sport, increasing participation, and encouraging the whole population to be more physically active in sports; (2) fulfilling maximum potential concerning the opportunities for economic growth; (3) promoting community engagement; and (4) regenerating east London. All of the four themes are related to other themes, such as sustainability, disability, and wider engagement in subjects concerning equality, inclusion, and diversity (Atkinson et al., 2008).

Interestingly, the similarities between the organisation of Barcelona, in 1992, and Athens, in 2004, concerning urban redevelopment, also appear in the four goals of London, in 2012. However, the urban redevelopment project in London is linked to the argument of improving the conditions in the community itself rather than promoting it to potential tourists. East London is a culturally diverse part of the city, incorporating a mix between wealth and poverty and social inclusion and exclusion (Poynter, 2009). According to the Olympic bidding committee, the Olympic games should have worked as catalyst for the urban renewal of this region (Meta-Evaluation of the Impacts and Legacy of the London 2012 Olympic and Paralympic Games, 2011; Poynter, 2009). Furthermore, London, in 2012, was the first host that focused on opportunities for economic growth. The city hoped to encourage the creative industry by using the Olympic games as promotion and advertisement to show the potential for the creative and technological industries in London in order to attract new innovative companies to the UK. Hence, the aim was to create thriving exports and stimulate formation of international contracts (Meta-Evaluation of the Impacts and Legacy of the London 2012 Olympic and Paralympic Games, 2011).

Table 1: Summary of the goals set by the bidding committees of Barcelona (1992), Athens (2004), and London (2012).

Host	Goals
Barcelona, 1992	- Urban redevelopment (demolish old industry, create a beach adjacent to the city) - Infrastructure improvements (airport, harbour, train roads, subway system, road system) - Telecommunications (application of latest technologies, in field of computers, broadcasting, and telecommunication)
Athens, 2004	- Urban redevelopment (reclaiming sea-front, create major axes in city's urban web, transfer airport, protect mountain mass surrounding Athens) - Infrastructure improvements (major axes in city's urban web, transfer airport, expand metro system, create tram lines) - Tourism (promoting cultural and historical heritage) - Telecommunications (showcase the achievements of modern Greece through state-of-the-art telecommunication networks)
London, 2012	- Urban redevelopment (regeneration of east London) - Economic growth - Community engagement promotion - The increase of participation of the whole population in more physically active sports

2.3.3. Costs.

Tangible Costs

In the process of organising the summer Olympics, there are high costs involved. The largest part of the costs consists of tangible costs, like operating costs and facility costs. However, there are also intangible costs involved in hosting the summer Olympics. Examples of intangible costs associated with hosting the summer Olympics are opportunity costs and the winner's curse. First, this paper will present an overview of the tangible costs that were involved in the summer Olympics of Barcelona in 1992, Athens in 2004, and London in 2012. Subsequently, the theory behind the intangible costs will be described.

Costs of Barcelona 1992 Olympics

The initial costs projected by the Spanish bidding committee were €541 million in 1987 (Official Report of the XXV Olympiad, 2003). According to the initial budget, the amount of public investments was expected to be €48.27 million. Which is roughly 9% of total expenditures. According to Brunet (1995), the actual expenditures were even higher, €1.29 billion, which is roughly three times as much as estimated by the bidding committee in 1986. The number excludes the investments in Olympic-related expenditures like the infrastructural projects. These costs were estimated at a total of €6.49 billion in the period of 1986 to 1993 (Brunet, 1995).

Final investments related to the Olympics are estimated at €7.61 billion (Brunet, 1995). €3.98 billion was designated to civil projects (61.5%), while the remaining €2.52 billion was invested in construction projects. Public investments accounted for €4.46 billion, which is 67.3% of the total costs (Brunet, 1995). Furthermore, only 9.1% of the total Olympic investment was invested in sports infrastructure, conditioning, and facilities, which can, according to Brunet (1995), be explained by "the great level of overall investment, the principal effect that the Games had on Barcelona" (p. 9). Another consequence of the large investments in the city of Barcelona is that 14.5% of expenditures were directed at the Olympic organisation, while 85.5% of total expenditures were investments in the city (Brunet, 1995). An overview of the cost is given in Table 2.

Costs of Athens 2004 Olympics

The initial costs projected by the bidding committee and approved by the organising committee amounted to €1.33 billion (Official Report of the XXVIII Olympiad, 2007). This amount was adapted during the bidding process to €4.5 billion (Kissoudi, 2008). After evaluation, the total expenditure added up to €11,274 billion. Approximately 80% of this amount was publicly funded (Kasimati, 2009; Tziralis et al., 2006). Of the total €11.3 billion, €4.025 billion was invested in context activities, such as infrastructure and urban development, and €4.63 billion was spent on actual Olympic activities. Examples of these expenditures are the €1.975 billion spent on the renovation and construction of Olympic facilities and the €2.382 billion spent on the operating costs of the Olympics (Tziralis et al., 2006).

However, the official report of the Olympics state other numbers. According to the public financial report, only €1.923 billion was invested into the Olympics of which only €267 million (13.5%) was sponsored by the Greek state (Official Report of the XXVIII Olympiad, 2007). Although these numbers originate from an official source, they must be treated with caution since the report is not objective; it was produced after political recrimination, which does not encourage faith in objective analysis (Kissoudi, 2008). Therefore, this paper continues to use the numbers provided by independent sources, who extracted raw data from the general accounting office in Greece (Tziralis et al., 2006). An overview of the costs is given in Table 2.

Costs of London 2012 Olympics

The initial budget of the London bidding committee expected operating costs of €2.27 billion for hosting the Olympic games in 2012 (Atkinson et al., 2007; Berman, 2010). In addition, there were expected costs of €3.61 billion for direct costs, for the investment in Olympic facilities, and indirect costs of other infrastructural and development projects. Direct and indirect costs totalled approximately €5.89 billion. After evaluating the summer Olympics, the estimated costs were €12.18 billion, according to the national audit office (National Audit Office, 2012), which is more than the €10.7 billion listed in the official report of the London Olympics. According to the official report, total public investment was €7.51 billion (UK government, 2012), which amounts to 62% of the total costs. These numbers should be interpreted with caution since they do not originate from completely independent sources. Nevertheless, since the London 2012 Olympics were held recently, there are not yet any

independent papers available that provide more independent costs estimates. Therefore, this paper will continue to use the value of the National Audit Office. An overview of the costs is given in Table 2.

Table 2: Projected and actual investments in summer Olympics.

Host	Projected costs Olympics (millions)	Actual costs (millions)	Total costs (millions)	Public investments (millions)	% Public investment
Barcelona	€541.00	€1,298.00	€7,606.00	€4,461.00	59%
Athens	€1,330.78	€4,346.75	€10,584.20	€8,487.21	80%
London	€5,883.82	€12,175.55	€12,175.55	€7,514.72	62%
Indexed in 2012					
Barcelona	€815.03	€1,955.47	€11,458.61	€6,720.60	59%
Athens	€1,617.72	€5,282.79	€12,864.32	€10,315.87	80%
London	€6,515.08	€10,729.22	€12,175.55	€7,514.72	62%

Table 2 gives an overview of the costs of hosting the summer Olympics. Projected costs refer to the costs estimated by the host city at the moment that city won the bid. Actual costs are direct costs of organising the Olympics, such as investments in Olympic facilities and operating costs. Total costs are the sum of direct and indirect costs in which indirect costs refer to the investments made in city projects that were not directly related to the summer Olympics. The reason actual costs and total costs were similar for London in 2012 is because the projected costs included the indirect costs, which was not the case for Barcelona and Athens. The indexed part of Table 2 refers to the current value of the investments using inflation rates of the last decennia, making it easy to compare the size of the investments. All values are in January 2012 euros.

Interestingly, the high public investments are more than 50% of total costs for every host. Another interesting point is that when the expenditures are indexed, the differences in total costs are not great. Often, the enormous influx of costs of hosting the Olympic games is referred to and could hold for developing countries, like Beijing (2008) and Rio (2016), but seems to a lesser extent the case for Olympic hosts that are European capitals.

Intangible costs

Tangible costs are mostly investigated and evaluated by the public, scholars, and institutions. However, there are also hidden costs in the form of intangible costs. These costs cannot directly be translated into numbers and are, therefore, ignored in many cases (Crompton, 1995; Matheson, 2006; Owen, 2005).

Opportunity costs

Part of the hidden costs are opportunity costs. Opportunity costs are defined by the Organisation for Economic Cooperation and Development (OECD) as follows:

> The opportunities foregone at the time an asset or resource is used, as distinct from the costs incurred at some time in the past to acquire the asset, or the payments which could be realised by an alternative use of a resource. (para. 1)

In other words, resources used for hosting the summer Olympics cannot be used for other investments. Hosting the summer Olympics may even cause a switch in resources from other activities or sectors to the summer Olympics (Baade & Sanderson, 2012). In case of the Olympics, the resources would be spent on sports infrastructure and event operations. Investments like these entail reductions in other government services and may increase government borrowing or taxation (Matheson, 2006). According to Matheson (2006), tax system distortions may result in dead-weight loss of more than €0,20 for every euro spent when funds are raised to build a new stadium. This is money what could otherwise be spent on other public needs, for example, on the health or education system, which might create greater benefits for the economy (Li & Blake, 2008; Owen, 2005). Other negative aspects that are often neglected are the crowding out effect of private spending when public funding is involved in constructions of facilities and the fact that former Olympic venues are often highly specialized with limited use after the Olympics, inducing lingering maintenance costs of the venues when the event is finished (Li & Blake, 2008; Matheson, 2006).

Equally inconceivable is neglecting opportunity cost regarding visitors. Crompton (1995) pointed out that there are differences in types of visitors. A general assumption of hosts of the Olympic games is that the games attract extra tourists (Essex & Chalkley, 2010; Gratton et al., 2010; Porter & Fletcher, 2008). Indeed, some evidence was found by Fourie and Santana-Gallego (2011) that hosting a mega event has a significant positive influence (Fourie & Santana-Gallego, 2011). However, there might still be an effect of other visitors avoiding the city because of the Olympic games (Kasimati, 2005; Li & Blake, 2008): "the contest may simply supplant rather than supplement the regular tourist economy" (Matheson, 2006, p. 10). According to Owen (2005), the Olympic games even hurt local hotels due to an overestimated increase in visitors (Owen, 2005).

The winner's curse

The winner's curse is not mentioned frequently in current literature, yet it may partly explain why costs of hosting the Olympics are increasing: "The Winner's Curse is a term used to describe systematic losses in common-value auctions due to non-equilibrium overbidding, resulting in the winner of an auction wishing that he or she had not won the auction" (Charness et al., 2012, p. 1). The situation of appointing the next host is the same as in an auction bid. The value of the auctioned object is uncertain to all parties, even the IOC. The value is not entirely equal to all potential hosts, like in a normal auction, but the same welfare effects are relevant to every potential host (Nooij & van den Berg, 2013). Direct consequence of refusing to recognize the possibility to over-bid, as a result of the eagerness to win, is that the winners of the auction often pay more than the item's true value (Andreff, 2012), which means that the party that overestimates the true value is thus likely to win the auction. Nevertheless, although the winning city receives the honour of hosting the event, the host can be cursed in two ways, according to Nooij and van den Berg (2013):

> (1) the submitted and winning bid exceeds the actual value of hosting the event, causing the ultimate host to incur a welfare loss; or (2) the value of hosting turns out to be lower than the estimated value, rendering the winner disappointed. (p. 10)

The IOC, in its turn, benefits from this winners curse since the IOC is interested in the best project available. Consequently, the IOC stimulates potential hosts' aggressive bidding by using a multi-stage construct in the bidding process, enhancing candidate cities' aggressiveness (Andreff, 2012). If candidate cities want to have a chance to host the Games, they definitely must outbid other bidders until the date of allocation (Thaler, 2012). The multi-stage construct, likewise, results in candidate cities craving to recoup their sunk costs of previous stages by winning the bid. Every stage increases sunk costs and thus increases the city's eagerness and, subsequently, its risk to overbid (Andreff, 2012; Baade & Sanderson, 2012). By means of adverse selection of the IOC, the most exaggerated plan will often win the bid (Nooij & van den Berg, 2013). The new host city is then stuck with the promises, and resultant costs, it made to the IOC (Andreff, 2012). The mechanism behind the winner's curse might explain why the final costs are always much higher than the initially intended budget; see Table 2 (Zimbalist, 2015). The often megalomaniac plans proposed to the IOC in the final rounds may, through this mechanism, complicate the plans to have positive economic impact on the local economy when the Olympics are assigned.

2.4 The impact of previous Olympic games.

Following the similarity in goals of the summer Olympics of Barcelona (1992), Athens (2004), and London (2012), three main subjects and their impacts on the local economy are of particular interest: The impact of hosting the Olympics on local tourism, the impact of improved telecommunications due to hosting the summer Olympics, and the impact of hosting the summer Olympics on foreign direct investment. The current findings on those three subjects are described below in order to give an overview of existing literature on the topics and, subsequently, to create an understanding of the impact of hosting the summer Olympics on the particular subjects of tourism, telecommunications, and FDI.

Tourism

Multiple papers have been written about the impact of hosting the Olympics on tourism. The term tourism has to be defined in this respect. The United Nations World Trade Organisation (UNWTO, n.d.) defined tourism as follows:

> Tourism is a social, cultural and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes. These people are called visitors (which may be either tourists or excursionists; residents or non-residents) and tourism has to do with their activities, some of which imply tourism expenditure. (p. 1).

Host cities place great emphasis on the positive economic impact of the summer Olympics on tourism to justify their bids (Kasimati, 2005). This positive impact is reflected in academic literature. In the last decennia, scholars increasingly recognize the positive long-term benefits an event like the summer Olympics can bring to the region (Fourie & Santana-Callego, 2011; Kasimati, 2005; Li & Blake, 2009; Li & Jago, 2013; Owen, 2005). The main reason behind

the theory is that the Olympic games provide the city with the opportunity to advertise the city and region for 17 straight days (Kasimati, 2005; Li & Jago, 2013). Similarly, Li and Blake (2009) argued in their paper, "Images of host destinations are likely to be changed or enhanced through the wide media coverage brought by mega events, which may enhance tourists' awareness of host cities" (p.1).

Kasimati's (2005) review stated that through the period 1986-2012 significant positive impacts on tourism were found in *ex ante* analysis, even beyond the occurrence of the event itself (Kasimati, 2005). Moreover, according to Fourie and Santana-Gallego (2011), ex-post analysis can differ in results (Fourie & Santana-Callego, 2011). Li and Blake (2009) confirm idea in their paper. They mention that most Olympic games only bring a short-term tourism increase. For creating a legacy in the long-term, improvements to tourism facilities and the city's infrastructure are needed (Li & Blake, 2009). Then again, improvements in tourism facilities and city infrastructure may also enhance tourism in the absence of the summer Olympics.

The main argument presented by scholars against the impact of the summer Olympics on tourism is the crowding out effect. Crowding out means people who would otherwise visit the host city refrain from going to the city due to the summer Olympics (Owen, 2005). Owen (2005) stated that "In reality, data and anecdotal evidence strongly suggest the Olympics had a significant crowding out effect on the rest of the tourism industry" (p. 7). Fourie and Santana-Callego (2011) found contradicting evidence. They mentioned that, from a tourism perspective, hosting mega events such as the summer Olympics is beneficial, despite skepticism posed by criticasters. In addition, Fourie and Santana-Callego (2011) mentioned that the size of the tourism crowding-out effect depend on the season in which the event takes place. Events taking place during peak season tend to show a decline in predicted tourism, while during the off-season, the host attracts significantly higher numbers of tourist (Fourie & Santana-Callego, 2011).

Telecommunication Infrastructure

As much as there is written about the impact of hosting the summer Olympics on tourism, little evidence can be found for the Olympics' effect on telecommunication. Telecommunication is "a rather broad term which refers to the exchange of information over longer distances by electronic means" (Rouse, n.d., para. 1). The fact that little research has been done on this subject is odd since Barcelona, as well as Greece, had increasing the quality of telecommunication as one of its major goals (Official Report of the XXV Olympiad, 2003; Official Report of the XXVIII Olympiad, 2007). In 2012, London indirectly wanted to stimulate this sector as well and wanted to stimulate the creative and IT clusters in London (Meta-Evaluation of the Impacts and Legacy of the London 2012 Olympic and Paralympic Games, 2011). Therefore, it is of interest that little attention has been paid to this subject.

Neither the Olympics' organisation nor academics published papers focussing primarily on this subject. However, some papers paid some attention to the impact of the summer Olympics on telecommunication quality. Essex and Chalkley (2003) mentioned that the investments in telecommunication placed Barcelona in a much better position to compete in

the global network (Essex & Chalkley, 2003). This finding was confirmed by Burnet (1995), who mentioned that Barcelona indeed moved up in the ranking of European cities concerning telecommunications in the years following the Barcelona 1992 Olympic games (Burnet, 1995). However, more general conclusions cannot be drawn from this small research base. More research regarding this subject needs to be done in order to draw reliable conclusions.

Foreign direct investments
Foreign direct investment refers to the follow:

An investment involving a long-term relationship and reflecting a lasting interest and control by a resident entity in one economy (foreign direct investor or parent enterprise) in an enterprise resident in an economy other than that of the foreign direct investor. (UNCTAD, 2007, p. 245).

In other words, FDI refers to foreign companies, foreign institutions, or foreign private parties investing in the host country. FDI is of importance to regions and countries because it may increase economic growth due to productivity gains, technology transfers, production networks, or access to markets (Alfaro et al., 2004). In the context of the summer Olympics, FDI means that cities using the opportunity to advertise their cities is not limited to potential increased tourism but is also used to enhance international business activities.

London (2012) is the first host that had economic growth as one of its major goals. The city hoped to increase investment in the creative and technological industries by hosting the summer Olympics (Meta-Evaluation of the Impacts and Legacy of the London 2012 Olympic and Paralympic Games, 2011). Fourie and Santana-Callego (2011) published a paper on the effect of hosting the Olympics on international trade flows. They found strong support for the argument that hosting the summer Olympics significantly increases the international trade flows (Fourie & Santana-Callego, 2011). This finding was confirmed by the organization of London 2012 who stated the following:

The Games and related promotional activities have clearly influenced perceptions of the UK as an investment destination, instilled confidence in companies about the future of their UK operations and helped UK businesses to access new export markets because of Games-related contracts. (Olympics report 5 Post-games evaluation summary, 2013, p. 7).

Although these results are positive, the conclusions of the official report must be interpreted with caution. An input-output model was used, which are known to overestimate certain effects (Crompton, 1995; Porter & Fletcher, 2008).

Furthermore, Fourie and Santana-Callego (2011) also found a significant increase in trade flows in countries who did not host the summer Olympics but did compete in the bidding process. The mechanism behind these results is that the Olympics are used to signal increasing openness of the host economy. Fourie and Santana-Callego (2011) explained this as follows:

the Olympic Effect on trade does not stem from a change in economic fundamentals, caused by the activity or infrastructure associated with hosting the Olympics. Instead, our empirical findings suggest that bidding for the Olympics is a costly policy signal that is followed by future liberalisation" *(*p. 675).

Following these conclusions, hosting the summer Olympics increases international relations. However, it might not be necessary to actually host the Olympics since participating in the bid seems to lead to similar results concerning potential FDI inflows. Still, the argument of the Olympics being an opportunity to actually advertise the city and country is convincing, and according to the organisation of London 2012, it also leads to numerous new international contacts that would otherwise not be there.

3. Method & Data

3.1. Method

3.1.1. Choice of Countries

In order to provide viable results, a distinction between countries that were included in the dataset and countries that were not included should be made. Considering the former Olympic hosts, it is of importance to include former Olympic hosts that are as similar as possible to the Netherlands as a potential host of the summer Olympics. As mentioned in the theory section, Greece (Athens), Spain (Barcelona), and Great-Britain (London) are the most appropriate former hosts to analyse in this paper. Those countries followed comparable growth and development paths and are comparable to some of the potential future hosts, like the Netherlands. In addition, according Hofstede's (1983) theory, the culture in these countries are relatively comparable, which was also described in the theory section.

In order to test the effect of hosting the summer Olympics on the local economy, the dataset should include countries that did not host the summer Olympics. When selecting those countries, it was of importance to select countries that reacted the same to possible external shocks, like a financial crisis, natural hazards, or diseases. When assessing these selection criteria, it was obvious that European countries should be chosen to complete the dataset. However, great differences between countries in Europe do exist. For example, some parties are part of the EU and should follow European rules and legislation, while others, like Switzerland, are not part of the European Union. Also, great differences exist between members of the European Union. For example, Bulgaria and the Netherlands have followed different growth paths in the past decades. Since the dataset covered the period 1990-2014, the countries included were countries that were European Union member states in 1986, which means that the final selection of countries was Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom.

3.1.2. Variables

To give sufficient proof of the actual impact of the summer Olympics on the local economy, dependent variables were chosen according to the theory. As explained in the preceding section, the summer Olympics of Spain, Greece, and Great-Britain were chosen for this analysis. In the theory section, the policy reports of Barcelona in 1992, Athens in 2004 and London in 2012 were reviewed, as was complementary academic research focussed on these events. Different goals were identified for the different hosts, which were described in Table 1. The three most important goals were identified: Increase in tourism, increase in telecommunication infrastructure, and increase in foreign direct investment. This section is split into three different parts, one for every goal identified. In each part, which dependent variables are used in existing literature to measure tourism, telecommunication infrastructure, and foreign direct investment are first described. Thereafter, which explanatory variables are used to explain the development of tourism, telecommunication infrastructure, and foreign direct investment in a local European economy are described.

Tourism

Current literature reveals that there are different dependent variables used to explain tourism in an economy. Fourie and Santana-Callego (2011) used tourist arrivals as a dependent variable. Zhang and Jensen (2013) also mentioned tourist arrivals as a measure for tourism. Sequeira and Campos (2007) used a similar dependent variable: Tourist arrivals divided by the total population. Ibrahim (2013) acknowledged that a proper measure for tourism is arrivals of tourists but also proposed the number of tourist nights spent in the destination country as a dependent variable. Finally, Ibrahim (2013) and Zhang and Jensen (2013) mentioned tourist expenditure as a potential measure.

Existing literature focused on the tourism flows between countries used the gravity model to explain tourism (Fourie & Santana-Callego, 2011; Zhang & Jensen, 2007). Although another modelling method is used in this paper, explanatory variables are quite similar. For example, Fourie and Santana-Callego (2011) used Trade, GDP, population, and Price Parities in their model. Zhang and Jensen (2007) used similar explanatory variables, but they included another variable to explain institutional factors. They called this constructed variable Openness: (Import + Export)/ GDP (Zhang & Jensen, 2007). Often, binary variables were included as well, such as in the paper of Fourie and Santana-Callego (2011), who used common language and common currencies as a binary variable (Fourie & Santana-Callego, 2011). Furthermore, Holzner (2011) and Ibrahim (2013) verified the importance of income, population relative prices, and exchange rates (Holzner, 2011; Ibrahim, 2013). Many papers made use of data on tourist expenses. Ibrahim (2013) measured tourist expenses by transportation costs, Sequeira and Campos (2007) measured them by including all pre-payments for goods and services in the destination country, and Holzner (2011) measured them by the travel service exports. Zhang and Jensen (2007) used FDI in hotel and restaurant sectors as a variable, which might reflect the attractiveness of certain residents for particular locations. A summary of explanatory variables used in previous research on tourism is given in Table 3.

Table 3: Variables on tourism in the existing academic literature.

Independent variable	**Source**
GDP	Fourie & Santana-Callego, 2011; Zhang & Jensen, 2007; Holzner, 2011; Ibrahim, 2013; Sequeira & Campos, 2007
Population	Fourie & Santana-Callego, 2011; Zhang & Jensen, 2007; Holzner, 2011; Ibrahim, 2013; Sequeira & Campos, 2007
Openness	Zhang & Jensen, 2007; Sequeira & Campos, 2007
Language	Fourie & Santana-Callego, 2011; Zhang & Jensen, 2007
Currency	Fourie & Santana-Callego, 2011; Zhang & Jensen, 2007
Education	Holzner, 2011
Male enrolment	Sequeira & Campos, 2007
Travel expenses	Ibrahim, 2013; Sequeira & Campos, 2007
Borders	Fourie & Santana-Callego, 2011
PPP	Fourie & Santana-Callego, 2011
FDI in hotel and restaurant sectors	Zhang & Jensen, 2007

Telecommunication infrastructure

As mentioned in the literature review, there are almost no existing papers explaining the impact of the summer Olympics on telecommunications, despite the hosts placing great emphasis on the development of the telecommunication infrastructure through hosting the summer Olympics. Fortunately, literature on diffusion of the internet and personal computers provides a guide to which dependent and explanatory variables should be chosen.

Existing literature proposed different measures for telecommunication infrastructure. The most frequently used measure is a measure of internet penetration. Bauer et al. (2002) used internet hosts per 1000 inhabitants, Beilock and Dimitrova (2003) used the number of internet hosts per 10.000 inhabitants, while Kiiski and Pohjola (2002) and Chinn and Fairlie (2006) used number of internet hosts per 100 inhabitants. Other measures are potential adopters to mobile phones (Gruber & Verboven, 2001) and the number of personal computers per 100 inhabitants (Chinn & Fairlie, 2006). Press et al. (1998) developed the most sophisticated measure, which includes six different characteristics for country-level internet adoption: Pervasiveness, geographic dispersion within the country, sectoral absorption, connectivity infrastructure, organizational infrastructure, and sophistication of internet use (Beilock & Dimitrova, 2003; Press et al., 1998).

According to Bauer et al. (2002), income constraints are an important explanatory variable since income constrains the ability to purchase access to communication services (Bauer et al., 2002). This theory was confirmed by Beilock and Dimitrova (2003), who found that GNP per capita is the most common measure to explain internet penetration. They also showed that richer countries have more telecommunication networks and media penetration overall (Beilock & Dimitrova, 2003). Market size is also important because information goods are often produced with substantial economies of scale (Bauer et al., 2002). Venture capital is of importance to develop content or customized software. Because of differences in the size of capital markets between countries, English speaking countries could have an advantage due to the sophisticated capital markets of the United States and the United Kingdom (Bauer et al., 2002). Kiiski and Pohjola (2002) found explanatory variables like telephone main lines, urban population, and income per capita. Thus, they agree with Beilock and Dimitrova (2003) on the importance of existing telecommunication networks, as well as with the argument that GNP per capita is one of the most important variables for explaining internet penetration (Beilock & Dimitrova, 2003; Kiiski & Pohjola, 2002). Chinn and Fairlie (2006) highlighted the importance of the appreciation of owning a computer or having access to the internet. They stated the following:

> Preferences for owning a computer are also likely to vary across individuals and may depend on exposure to and the perceived usefulness of owning a computer. This may be related to a person's education level, age, presence of children, and urban/rural location. (Chinn & Fairlie, 2006, p. 26).

Finally, Walston (2005) identified that regulatory regime characteristics could also explain the rate of internet penetration. He used agency independence, transparency, and discretion in his model (Walston, 2005). An additional explanatory variable, highlighted by Chinn and Fairlie (2006), is electric power consumption, but Chinn and Fairlie (2006) found no large

significant effect for this variable. Furthermore, the costs of the internet are of importance, according to Bauer et al. (2002) and Kiiski and Pohjola (2002). The more expensive the internet access, the more exclusive the product becomes. They also mentioned competition between internet providers was important. Bauer et al. (2002) found positively significant results for a relationship between internet access and competition, possible because prices might decrease when competition between providers increases. A summary of explanatory variables used in previous research on telecommunication infrastructure is given in Table 4.

Table 4: Variables on telecommunication infrastructure in the existing academic literature.

Independent variable	**Source**
GDP per Capita	Bauer et al., 2002; Beilock & Dimitrova, 2003; Kiiski & Pohjola, 2002; Chinn & Fairlie, 2006; Gruber & Verboven, 2001.
Education	Chinn & Fairlie, 2006; Beilock & Dimitrova, 2003; Kiiski & Pohjola, 2002
Telephone lines	Kiiski & Pohjola, 2002; Beilock & Dimitrova, 2003, Gruber & Verboven, 2001
Age	Kiiski & Pohjola, 2002; Chinn & Fairlie, 2006
Service sector	Chinn & Fairlie, 2006
Urban	Chinn & Fairlie, 2006
Freedom	Walston, 2005
English	Bauer et al., 2002
Price of internet	Bauer et al., 2002; Kiiski & Pohjola, 2002
Unemployed	Chinn & Fairlie, 2006
Literacy rate	Chinn & Fairlie, 2006
Competition	Bauer et al., 2002; Kiiski & Pohjola, 2002

Foreign Direct Investment.

There are multiple measures found in current literature for foreign direct investment. Botrić and Škuflić (2006) used FDI stocks as a measure. FDI stock was also used as a dependent variable by Davies et al. (2008) and Blonigen and Piger (2014). The latter identified more measures, which they collected in their literature review. These measures included sales, FDI stocks, and FDI flows (Blonigen & Piger, 2014). Real affiliate sales, real FDI stocks, and real FDI flows are similar measures used by Davies et al. (2008). Blonigen and Davies (2004) were the only authors who used inbound and outbound FDI flows.

When assessing literature on FDI, the most important framework used to identify potential explanatory factors is Dunning's (1981) OLI framework. Bevan and Estrin (2004) explained that, according to the OLI framework, three conditions must be satisfied to have FDI: "The firm must have both an ownership (O) advantage and an internalization (I) advantage, while the foreign market must offer a locational (L) advantage" (p. 777) In this framework, Dunning (1981) explained three kinds of FDI: (1) Market-seeking, to penetrate a local market; (2) resource-seeking, to decrease costs of inputs; (3) efficiency-seeking, to motivate the creation of new sources of competitiveness (Botrić & Škuflić, 2006). European countries that were part of the European Union in 1986 are relatively expensive to invest in since they

are developed countries (OECD, 2015). Therefore, when firms invest in European countries they are often market-seeking or efficiency-seeking. Explanatory variables that can best be used differ per motivation (Botrić & Škuflić, 2006). There are especially differences between market-seeking firms and resource-seeking firms. For efficiency-seeking firms, a combination of the two suits best. Important explanatory variables for market-seeking are market size, per capita income, market growth, and connection to the regional and global markets (Bevan & Estrin, 2004; Botrić & Škuflić, 2006). On the other hand, explanatory variables for resource seeking- firms are the price of raw materials, unit labour costs, and the pool of skilled labour (Botrić & Škuflić, 2006). Bevan and Estrin (2004) acknowledged the importance of institutional factors like property rights, regulations, and tax systems, as well as the openness of a country (Bevan & Estrin, 2004). Schneider and Frey (1985) confirmed the importance of factors like GDP, GDP growth, wage, skilled workforce and, political stability (Scheider, 1985) Furthermore, Blonigen and0 Piger (2014) wrote about horizontal and vertical motivations for FDI. Horizontal motivations are characterized by replicating operations in other countries, i.e., market-seeking. Vertical motivations are characterized by looking for low-cost locations, i.e., resource-seeking (Blonigen & Piger, 2014). In their paper, Blonigen and Piper tested many variables to check which variables were most likely to explain FDI activity. Among these variables are income, wages and skill levels, price level, and institutional factors (Blonigen & Piger, 2014). A summary of explanatory variables used in previous research on foreign direct investment is given in Table 5.

Table 5: Variables on tourism in the existing academic literature.

Independent variable	**Source**
GDP per capita	Botrić & Škuflić, 2006 Blonigen & Piger, 2014; Davies et al., 2008, Blonigen & Davies, 2004; Schneider & Frey, 1985
Wages	Blonigen & Piger, 2014
Pricelevel	Blonigen & Piger 2014; Schneider & Frey, 1985
Openess	Bevan & Estrin 2004; Botrić & Škuflić, 2006; Blonigen & Davies, 2004; Davies et al., 2008
Unemployed	Blonigen & Piger, 2014; Blonigen & Davies, 2004; Scheider & Frey, 1985
Freedom	Bevan & Estrin, 2004; Blonigen & Piger 2014
Legal	Bevan & Estrin, 2004; Blonigen & Piger 2014
Politics	Bevan & Estrin 2004; Blonigen & Piger 2014; Scheider & Frey, 1985
English	Botrić & Škuflić, 2006; Davies et al., 2008
Economic Growth	Botrić & Škuflić, 2006; Blonigen & Piger, 2014
Cultural differences	Davies et al., 2008
Tax treaties	Blonigen & Davies, 2004; Blonigen & Piger, 2014
Exchange rates	Blonigen & Piger, 2014
Inflation	Botrić & Škuflić, 2006
Privatization	Botrić & Škuflić, 2006
Population density	Blonigen & Piger, 2014

3.1.3. Choice of model

The literature reveals three major economic arguments for hosting the summer Olympics: The increase in tourism, the increase in telecommunication quality, and the increase in foreign direct investment. Different methods and models have been used to test the validity of these arguments. Different models for pre-Olympic event estimation and post-Olympic event estimation can be distinguished. In other words, there are models to predict the impact of the summer Olympics on the local economy, and there are models to measure the actual effect the summer Olympics had on the local economy.

Two frequently used models to predict the impact of hosting the summer Olympics on the local economy are I-O model and the CGE model, which have been described in the theory section. Although this paper focuses on the impact of the summer Olympics, it does not use the I-O or the CGE models as methods. The critique on these models is widely acknowledged (Crompton, 1995; Porter & Fletcher, 2008). The I-O model, especially, is known to overestimate the impact of an event on the local economy. The CGE model provides more realistic outcomes but is complex to perform (Kasimati, 2005; Li & Blake, 2009; Li & Jago, 2013; Madden, 2006). Therefore, the use of the CGE model is out of the scope of this paper.

Alternatively, a more appropriate method is to test the arguments and goals of past Olympic host in order to validate or dismiss the claims those bidding committees made. On basis of the validity of these claims, recommendations for potential future hosts can be made by estimation methods performed after an event took place. These methods are used to identify and test the actual effect the event had on the local economy by means of tourism, telecommunication, and FDI. A framework frequently used to perform these tests is the ordinary least squares (OLS) framework (Fourie & Santana-Callego, 2011; Porter & Fletcher, 2008; Sterken, 2006). The OLS framework provides the opportunity to test the significance and magnitude of the effects of hosting the summer Olympics on the specific sectors of the local economy. In current literature, there are papers that use different models within the OLS framework. The different models used in related papers are discussed below in order to choose the most appropriate model for this study.

Fourie and Santana-Callego (2011) used a gravity model to explain the impact of hosting the summer Olympics on tourist arrivals. Gravity models are often used to explain international trade. Fourie and Santana-Callego (2011) stated the following:

> A gravity model represents a bilateral flow between two countries as a function of their respective economic size; measured in terms of GDP, GDP per capita or population, the distance between the two countries, and a set of other factors such as common border, common language, common currency or colonial ties (p. 1366).

Fourie and Santana-Callego (2011) assumed tourism is a particular kind of trade and successfully used this gravity model several times to explain tourism flows between countries. However, due to time limitations, this paper will only use one method to test the effect of hosting the summer Olympics on tourism, telecommunication infrastructure, and FDI. Although Fourie and Santana-Callego (2011) provided good argumentation why

bilateral trade flows can be used to test the effect on tourism, it seems that using the gravity model will not be able to explain changes in telecommunication infrastructure.

Another method is to make use of a time series. Kasimati and Dawson (2009) utilized the OLS framework by employing a macro economic model that uses time series analysis within the OLS framework. They tested the economic impact of hosting the summer Olympics on Athens (Kasimati & Dawson, 2009). To test the impact of the 1996 summer Olympics and the 2002 winter Olympics on local tourism, Porter and Fletcher (2008) used OLS regressions with a dummy variable for the year of the Olympics to indicate a potential difference in the dependent variable. Sterken (2006) was the first author to use panel data to utilized a simple growth model to test if hosting the winter Olympics or the football World Cup increases GDP growth rate (Sterken, 2006). Sterken (2006) used pooled time series data OLS regressions with a fixed effects estimator. This method seems appropriate for the analysis in this paper and was also recently used by Peeters et al. (2014) in a similar paper. Fixed effects provide opportunities to test differences within one individual through the years, i.e., before and after events. In contrast to Sterken's (2006) paper, this paper specified the countries within the sample, as mentioned in the theory section. Therefore, this paper uses panel data instead of pooled time series.

There are additional reasons why the OLS fixed effects estimator is expected to be the best model to potentially help answering the main question (What effect has hosting the summer Olympics on the local economy?). First, the fixed effects model (FE) is a proper model to investigate differences before and after an event. The summer Olympics are a major event, and therefore, the difference in tourism, telecommunications, and foreign direct investment before and after the summer Olympics can be estimated by the fixed effects model. Similar to Porter and Fletcher's (2008) research, this research added dummies to test these differences. Second, the fixed effects model measures the difference within a country, which is preferred over inter-country analysis as, for example, random effects does. This paper hopes to find statistical evidence on the impact of hosting the summer Olympics on various economic measures. Therefore, it is of interest to analyze whether there is significant evidence for effects caused by the Olympics *within* one region, not *between* regions. In other words, does hosting the summer Olympics have a significant positive or negative effect on tourism, telecommunications, or foreign direct investment *within* the region the Olympics were held. Measuring the "within effect" is most accurately done by the fixed effects model. Third, due to time constraints, it is important that the model can be used to test the impact of the summer Olympics on all three dependent variables. Existing literature suggests that it is possible to perform time series analysis with fixed effects for tourism, telecommunication infrastructure, and FDI (Blonigen & Davies, 2004; Datta & Agarwal, 2004; Davies et al., 2008; Gruber & Verboven, 2001; Neumayer, 2004; Sequeira & Campos, 2007). Finally, fixed effects is easy to implement for unbalanced datasets, i.e., datasets where data on some years is missing. This research's dataset covers the period 1990-2014, and there is data missing for some variables in some years. This missing data creates no problems when using fixed effects (Woolridge, 2012). Table 6 summarizes the advantages and disadvantages of the discussed models.

Table 6: Summary of advantages and disadvantages of different models.

Model	Advantages	Disadvantages
Input-Output model	Comprehensible, inexpensive to construct, model widely available.	The impact is often overestimated due to the nature of the assumptions.
Computable general equilibrium model	Improved assumptions compared to I-O model. More conservative but also more realistic estimations.	Based on difficult mathematical relationships, less comprehensible than I-O model.
Gravity model	Bilateral flows, measures all interactions between different countries in the dataset. Can be interpret as normal OLS regression.	Assumption that dependent variable reacts the same as trade. Year specific effects have to be put in manually. Not able to perform for all dependent variables
Fixed effects model	Long time span, differences *within* a country, unbalanced panel causes no problem	Lose information on differences between counties, slope of curve variables should be similar across time.

Fixed effects model

In order to use the fixed effects model, certain assumptions about the data must be made: (1) The dependent variable has to be measured at least two points in time for the same individual and (2) the independent variables has to change over time in order to explain their effect on the dependent variable (Williams, 2015) A third assumption when exploiting the fixed effects model is that the observations of factors not controlled for in the model are time-invariant. This is an important assumption because it means that all time-invariant independent variables that influence the dependent variable are included in the model. When this third assumption is violated, the regression suffers from omitted variable bias. The fourth important assumption is that the slope of the curve of the variables should be equal across time. When using the fixed effects model, the differences from the mean of the observations of every variable are calculated. Then, the difference between every time period and the mean of the specific individual is calculated. When the fourth assumption holds, it is possible to analyse the variations in and between variables; otherwise, the model will yield biased results.

The fixed effects model described above is a static model. The disadvantage of using a static model is that it does not take into account the effect of the lagged dependent variable. In other words, the previous values of the dependent variable may also have an effect on the value of the current dependent variable. This effect can be included by estimating a dynamic model. There are several estimation methods available for dynamic panel analysis.

Dynamic models

Static models do not include a lagged variable. Another limitation is that there can be heterogeneity between different countries with regard to social and institutional conditions in

the different countries within the dataset. Therefore, ideally, an appropriate model should not only include a lagged variable but should also allow for the heterogeneity in slopes of the variables in the estimation method. Homogeneity is more often rejected (Blackburn III & Frank, 2007), and methods have been developed to allow for slope heterogeneity within panel data estimations. Pesaran, Shin, and Smith (1997) offered two methods to deal with this problem. They developed the pooled mean group (PMG) and the mean group (MG) estimator. The MG estimator averages all different time series within the panel data while the PMG estimator is a combination of pooling and averaging (Pesaran et al., 1997). The PMG model allows for heterogeneous short run dynamics, so averaged short run parameters, while it has the common long-run parameter estimates. The MG estimator is the unweighted mean of the separate country regression coefficients. In addition, there is the common dynamic fixed effects (DFE) estimator that restricts coefficients to equality across panels, in the long and short run, but allows panel specific intercepts. DFE also restricts the speed of adjustment coefficient and the short-run coefficients to equality (Blackburn III & Frank, 2007). Nonetheless, the DFE estimator does assume homogeneity across individual countries in the panel dataset. For this research, the MG estimator and DFE estimator were chosen. Peeters et al. (2014) used the MG method in their paper on the impact of the football World Cup (also a large sporting event) on countries (Peeters et al., 2014). The DFE approach is a more traditional approach.

To test which of the models (MG or DFE) is the most appropriate, a Hausman test was performed between the MG estimator and the DFE estimator (Appendix G). The results indicate that the DFE estimator is preferred for tourism and telecommunication infrastructure, indicating that probable heterogeneity does not bias the results. One of the reasons for this might be that the period is only T = 25. A more reasonable conclusion could be that social and institutional differences are not great, which would be logical since they were selected to be as homogenous as possible, as described in the preceding section. Although theoretically the MG estimator is preferred, empirically, the dynamic fixed effects is the preferred method and will be used in this research to test the effect of hosting the summer Olympics on tourism, telecommunication infrastructure, and foreign direct investment.

Furthermore, Nickel (1981) proved, in his paper, that the specified model may be biased when T is small: T = 25 in the model on tourism and telecommunication infrastructure and T = 17 in the model on foreign direct investment (Nickel, 1981). Therefore, the risk of biased results is severe using the DFE method, which is designed for large-T large-N datasets. Kiviet (1995) developed a new model, the bias-corrected Least-Squares Dummy Estimator (LSDVc). The GMM estimator and standard IV estimation techniques have been found to produce poor results with regard to finite sample situations (Kiviet, 1995), as in the case of this paper. These outcomes were confirmed by a Judson and Owen (1998), who compared different dynamic panel analysis with different Ts and different Ns in their paper in order to find which method fits the best with which situation (Judson & Owen, 1998). Judson and Owen (1998) found that the LSDVc method outperforms all the other estimators, including Anderson and Hsiao IV regressions (1981) and the GMM estimators from Arellano and Bond (1991) (Judson & Owen, 1998). When T = 30 or higher, LSDV performs equally well or

better than LSDVc since the bias in the LSDV estimator decreases with T. In my dataset, I had T = 25 and T = 17; therefore, the LSDVc method was recommended and provided the most consistent and most efficient results (Judson & Owen, 1998). However, these results were tested on a balanced dataset, while the dataset used in this paper is unbalanced. Bruno (2005) developed a bias-corrected LSDV model, which can be use on unbalanced data, removing an important cause for limited applicability of bias corrected LSDV estimators. Bruno (2005) mentioned it is undesirable to reduce unbalancedness at the expense of time observations, which would be more likely to increase than decrease bias in the model (Bruno, 2005). The LSDVc model is thus the appropriate and most proper model for estimation in this paper. The LSDVc dynamic panel model was used in addition to the DFE estimator to estimate the effect of hosting the summer Olympics on tourism, telecommunication infrastructure, and foreign direct investment.

To sum up, three different models were used in this paper: The fixed effects estimation, the dynamic fixed estimation, and the corrected least square dummy estimation. By using three different estimation methods, this paper hopes to produce solid, convincing, and robust statistical results on the effect of hosting the summer Olympics on tourism, telecommunication infrastructure, and foreign direct investment. Table 7 presents the advantages and disadvantages of the three chosen models.

Table 7: Advantages and disadvantages of the three estimators used in this research.

Model	**Advantages**	**Disadvantages**
Fixed effects model	Long time span, differences *within* a country, unbalanced panel causes no problem.	Loses information on differences between counties, assumes homogeneity across individual countries in the panel dataset
Dynamic fixed effects model	Long time span, differences *within* a country, dynamic model. Efficient for Large N, Large T	Assume homogeneity across individual countries in the panel dataset
Corrected least squared dummy estimator	Efficient for Large N, small T. Most efficient and consistent for dynamic panel analysis, can also be used for unbalanced data.	Assume homogeneity across individual countries in the panel dataset

3.1.4. Model specification

In this section, the dependent and independent variables will be described and the model will be specified accordingly. It was important to select the right variables since omitting an important variable causes omitted variable bias, which means that independent variables are correlated with the error term. Omitting a variable would be a violation of one of the classical assumptions and would cause coefficients to be biased. The explanation of variables in this section will be split into three parts: Tourism, telecommunication infrastructure, and foreign direct investment.

Tourism

As mentioned in the previous section, three different measures are used as dependent variables for tourism: Tourist arrivals, nights spent in destination, and expenditure. In this research, nights spent by non-residents was chosen as a dependent variable for several reasons. Nights spent by non-residents is preferred over arrivals since it contains more information on the subject of interest. As mentioned in the theory, residents are interested in how much extra income they generate. Knowing how many nights (and thus days) non-residents spend visiting their destination provides information about the potential extra income for the residents. Measuring the number of arrivals does not contain information about the potential extra income. In addition, number of arrivals is often used in gravity models in order to explain bilateral tourism flows. As explained, this research does not make use of a gravity model so the number of arrivals between countries are of less interest. Finally, tourist expenditure is also mentioned as a potential measure. This measure would be more suitable to this research than nights spent. However, there is no satisfactory data found on gross expenditure of tourists in specific countries for the period 1990-2014. Thus, number of overnight stays by non-residents is used as a dependent variable for tourism in this research.

The choice for number of overnight stays by non-residents as a dependent variable is leading in the choice for explanatory variables. Not many papers used this dependent variable since most of the papers constructed gravity models and, therefore, preferred to use the number of arrivals. However, Ouerfell (2008) used the number of overnight stays as a dependent variable in his paper. The explanatory variables used in his paper are the GDP per capita, the exchange rates, and substitute prices for neighbouring countries (Ouerfell, 2008). Using the substitute price for neighbouring countries is not manageable within the timeframe of this paper. Therefore, this explanatory variable was not used. Not using substitute prices of neighbouring countries could potentially lead to omitted variable bias, but it is not within the timeframe of this paper to include this variable. Wages and openness were included as explanatory variables in addition to GDP per capita and exchange rates. Openness was included since it is often used in existing literature. Openness is an indicator for how open a country is to trading with other countries and may be substituted for a cultural measure about the attractiveness of a country to non-residents. In addition, a dummy variable for Shengen countries was included. Travelling between Shengen countries is easier since there are no border controls, which could partly explain number of overnight stays by non-residents. The most important variables to this study are the dummy variables on the summer Olympics. The Olympic dummy variables were added to investigate whether there is a significant effect of hosting the Olympics on tourism. Furthermore, dummy variables for every year were added to account for universal time-related shocks.

The assessment of the variables leads to the following model specification for the analysis of tourism (fixed effects specification):

$$TOURISM = \beta_0 + \beta_1 GDPCAPITA_{it} + \beta_2 WAGES_{it} + \beta_3 FXRATE_{it} + \beta_4 OPENESSs_{it} + \beta_5 SHENGEN_{it} + \beta_6 PRICELEVEL_{it} + \beta_7 OLYMPIC1_{it} + \beta_8 OLYMPIC2_{it} + YEAR^* + \alpha_i + u_{it}$$

Telecommunication infrastructure

The second measure investigated in this research is telecommunication infrastructure. In the existing literature, the most common measure for telecommunication infrastructure is internet penetration. The use of internet penetration as measure corresponds with the definition for telecommunication infrastructure used in this paper: "Telecommunication is a rather broad term which refers to the exchange of information over longer distances by electronic means" (Rouse, n.d., para. 1). The main tool to exchange information over longer distances is the internet. The internet has made fast communication possible over long distances with almost zero costs (Thurik et al., 2013). The measure proposed by Press et al. (1998), which includes six different characteristics, is preferred over simple internet penetration measures, like access per 100 inhabitants. However, this measure is too time consuming to construct and, therefore, did not within the timeframe of this paper. Another disadvantage is that the construction of such a measure is quite subjective. Considering the above, the most appropriate measure for telecommunication infrastructure is internet access per 100 inhabitants. The percentage of people having access to the internet is the corresponding dependent variable used in this paper.

Explanatory variables used by papers with the dependent variable internet penetration, which are also used for this paper, are GDP per capita, education, telephone lines, wages, freedom, and urban development. GDP per capita is expected to show a positive relationship to telecommunication infrastructure. Education is also expected to positively contribute to internet penetration within a country. It is expected that the higher the wages, the higher the internet penetration since internet is a luxury good. Urban development was included because the rate of urbanisation may be positively related to internet penetration since the internet network has to be less substantial to connect to many people, and because urbanisation is a form of development into a more mature economy (Moomaw & Shatter, 1996). Internet costs, competition, and literacy rates were not used, although these are explanatory variables in similar analyses. Data on internet costs were not available for the time period of this research. Education was included in the explanatory variables; therefore, literacy rates were not used as an explanatory variable since its inclusion could cause problems with regard to multicollinearity. In addition to the explanatory variables used in many similar papers, this paper includes age, which is the mean age of the country's population. Olympic dummy variables were added to investigate whether there is a significant effect of hosting the Olympics on telecommunication infrastructure. Finally, dummy variables for every year were included to account for universal time-related shocks. Explanations of the variables can be found in Table 8.

The assessment of the variables leads to the following model specification for the analysis of telecommunication infrastructure (fixed effects specification):

$$TELECOM = \beta_0 + \beta_1 GDPCAPITA_{it} + \beta_2 GDPgowth_{it} + \beta_3 TELL_{it} + \beta_4 AGE_{it} + \beta_5 EDUC_{it} + \beta_6 EDUC2_{it} + \beta_7 WAGES_{it} + \beta_8 PRICELEVEL_{it} + \beta_9 FREEDOM_{it} + \beta_{10} URBAN_{it} + \beta_{11} OLYMPIC1_{it} + \beta_{12} OLYMPIC2_{it} + \beta_{13} YEAR_{it}^* + \alpha_i + u_{it}$$

Foreign direct investment.

Academic papers use different measures as dependent variables for foreign direct investment. The most common measures are FDI stocks and FDI flows (inbound and outbound). The latter is mainly used in gravity model specifications in order to explain the FDI flows between different countries. As mentioned, this paper does not use a gravity model. For my model specification, static fixed effects, dynamic fixed effects, and corrected LSDV method, the FDI stocks are the preferred measure. With the use of FDI stocks as a dependent variable, the paper aims to test the effect of hosting the summer Olympics on these FDI stocks. Bidding committees suggest that hosting the summer Olympics increases FDI since the host has the opportunity to showcase itself as a potential investment candidate. These commercial advantages should theoretically increase FDI stocks in the country. Therefore, FDI stocks was chosen as s dependent variable in this paper.

The choice for FDI stocks leads to the determination of the explanatory variables. Papers that use FDI stocks as a dependent variable use GDP per capita, wages, price level, openness, unemployment freedom, legal, politics, economic growth, cultural differences tax treaties, exchange rates, inflation, and population density. However, some of these variables were not used in this research's analysis. Cultural differences were not used since the countries selected were partly selected on having homogenous cultures. Using cultural differences would create a selection bias, which could influence the results. Tax treaties were also not included since these are mostly used in papers with gravity model specifications. The variable "tax treaties" specifies certain tax advantages or disadvantages, which could explain disproportionate FDI flows between countries. Tax considerations are not of interest to this study and, therefore, was not included as an explanatory variable. Inflation was not included since most of the countries use the euro. Another reason for excluding inflation is that exchange rates were included as an explanatory variable. Exchange rates are a mechanism that explains the comparative attractiveness of countries based on their currencies. In addition to the explanatory variables used in other academic papers, this paper includes corruption. Corruption might explain FDI stocks since multinational enterprises (MNEs) might refrain from investing in corrupt countries. Additionally, Olympic dummy variables were added to investigate whether there is a significant effect of hosting the Olympics on foreign direct investment. Finally, dummy variables for every year were included to account for universal time related shocks. Explanations of the variables can be found in Table 8.

The assessment of the variables leads to the following model specification for the analysis of foreign direct investment (fixed effects specification):

$$FDI = \beta_0 + \beta_1 GDPCAPITA_{it} + \beta_2 OPENESS_{it} + \beta_3 WAGES_{it} + \beta_4 UNEMPLOYED_{it} + \beta_5 GDPgrowth_{it} \beta_6 FXRATE_{it} + \beta_7 FREEDOM_{it} + \beta_8 LEGAL_{it} + \beta_9 POLITICS_{it} + \beta_{10} CORUPTION_{it} + \beta_{11} OLYMPIC1_{it} + \beta_{12} OLYMPIC2_{it} + \alpha_i + u_{it}$$

3.2. Data

In this section, the data will be described and statistical tests will be presented to test the quality and limitations of the data. Thereafter, the control for the stationarity of the variables

will be explained. Subsequently, the variables will be checked on correlation, linearity, serial correlation, and heteroscedasticity in order to increase the robustness of the model. The section will conclude with the final model specification, which was tested and analysed and which will be discussed in subsequent chapters.

3.2.1. Data description

Data used in this analysis was derived from multiple sources. The main sources were Eurostat, The World Bank, and the OECD. Eurostat is the statistical office of the European Union and has the task and goal to provide the most reliable and objective statistics on the countries of the European Union in order to compare European regions (Eurostat, 2015). The World Bank is a vital source of information and finance for developing countries. The open data source provides downloadable statistics and data about the development of countries in the world (World Bank, 2015). The Organisation for Economic Co-operation and Development is an organisation that tries to promote policies that will improve social well-being and economic prosperity of countries around the world. One of the OECD's main tasks is collecting data and making them publicly available. Committees discuss policy according to this information, and subsequently, governments implement these recommendations (OECD, 2015). In addition, the Heritage Foundation provides data on the economic freedom of countries. The index of economic freedom is annually published by the *Wall Street Journal* and the Heritage Foundation, which is the number one think tank in Washington. The index of economic freedom has been published since 1995 (Heritage, 2015). Table 8 provides further information on the origin of the data for every variable. In addition to the data extracted from online data sources, different dummy variables were constructed to capture some specific external effects. An explanation of the composition of the dummy variables is provided below.

Firstly, two dummy variables were constructed to capture effects concerning two major changes within the European union. These changes were the implementation of the Schengen agreement in 1995 (for most countries) and the introduction of the euro in 2002. These changes were of great influence on transport flows, in goods as well as in persons. In order to capture the effects resulting from these changes, two dummy variables, EURO and SCHENGEN were created. Different countries implemented the Schengen agreement in different years. Therefore, the SCHENGEN variable is 0 for countries not (yet) participating in the Schengen agreement and 1 for countries participating in the Schengen agreement. EURO is 0 before 2002 and 1 for 2002 and later since from 2002 onwards inhabitants were able to pay with euros.

Secondly, OLYMPIC1 and OLYMPIC2 are dummy variables for hosts of the Olympics. These dummy variables were created to test event specific effects of hosting the summer Olympics. A distinction in the years before hosting the Olympics and the years following hosting the Olympics was made. OLYMPIC1 is 1 for the three years preceding the Olympic event and 0 otherwise. This dummy was added to different models to test the impact of hosting the Olympics before the actual event takes place. OLYMPIC2 is 1 the year of hosting and the two subsequent years after a city is the host, and 0 otherwise. This dummy variable

was added to test the effect of hosting the Olympics in the years that follow hosting. A summary of these dummy variables can be found in Table 8.

Finally, yearly dummies were created to control for universal time-related shocks. These dummy variables represent the aggregate effect of all unobserved factors that affect the dependent variable within one year. If these time dummies are not taken into consideration, it might be that these effects are absorbed by other independent variables, which causes the effects of the other independent variables to be underestimated or overestimated.

Table 8: Description of the variables.

Variable	**Explanation**	**Source**
TOURISM	Nights spent at tourist accommodation establishments by non-residents (country level)	Eurostat
TELECOM	Internet usage per 100 inhabitants	World Bank
FDI	Foreign direct investment stocks, investment inflows less disinvestment (millions of current US$)	World Bank
GDP	Gross Domestic Product (country level)	Eurostat
GDPCAPITA	Gross Domestic Product per Capita	Eurostat
POP	Total Population (country level)	
PRICELEVEL	Price level index	Eurostat
WAGES	Average wage (In 2013, constant prices at 2013 USD exchange rates (OECD))	OECD
UNEMPLOYED	Unemployment, total (% of total labour force)	Eurostat
AGE	Mean age of society	Eurostat
EDUC	Tertiary education (% of total population)	World Bank
EDUC2	Total tertiary education students enrolled	OECD
TELL	Fixed-telephone subscriptions (the sum of the active number of analogue fixed-telephone lines)	World Bank
IMPORT	Import of goods and services (% of GDP)	World Bank
EXPORT	Export of goods and services (% of GDP)	World Bank
OPENESS	Constructed (Import + Export)	Constructed
URBAN	% of people living in an urban area	World Bank
LEGAL	Rule of law	World Bank
POLITICS	Political stability and absence of violence	World Bank
CORUPTION	Control of corruption	World Bank
FREEDOM	Index of Economic Freedom	Heritage foundation
FXRATE	Exchange rates to currency: Euro. From 1990 onwards. Foreign currency/EURO	FXtop.com
SHENGEN	Dummy variable. 1 if Shengen agreement is implemented, 0 otherwise	European Commission: "Shengen agreement"
EURO	Dummy variable. 1 if euro is implemented, 0 otherwise.	European Commission: "The Euro"
OLYMPIC1	Dummy variable. 1 for the three years preceding the year of the Olympic event, 0 otherwise	Official Olympic Reports
OLYMPIC2	Dummy variable. 1 in the year of the Olympic event and the two subsequent years when a city is the host, and 0 otherwise	Official Olympic Reports

3.2.2. Stationarity

The variables in the dataset had to be tested for stationarity. Many macro-economic variables, as used in this paper, are often non-stationary (Phillips & Perron, 1988; Wasserfallen, 1986). In a stationary time series, the dependent variable returns to its long-term equilibrium after an external shock, so the properties do not depend on the time at which the series is observed. However, when the dependent variable in a time series does not return to its long-term equilibrium after a shock, the time series are non-stationary, which indicates that the shock is absorbed in the system and becomes part of the system. Accordingly, the time series contains a unit root. The occurrence of non-stationarity in a time series can greatly influence the interpretation of the measured effect (Schwert, 1987). Therefore, the dataset was checked for non-stationarity. A common method for testing whether the time series are stationary is to check for a unit root. Considering the characteristics of the dataset, unbalanced panel data, the Fischer type unit-root test is an appropriate method to test for a unit root (Choi, 2001). In this paper, a unit root with one lag and with two lags was checked for. There are four different tests in the Fisher type unit root test. Choi's simulation suggests using the inverse normal Z statistic since it offers the best trade-off between size and power (Choi, 2001). A 10% confidence interval was used when evaluating the stationarity.

First, the variable was tested for a unit root. If the variable contained a unit root, the first difference of the variable was taken. By differencing, the trend and seasonality were eliminated because differencing removes changes in the level of time series. This is a common method to make time series stationary. After taking the first difference, the variable was again tested for a unit root. There were 22 variables tested for unit roots, so including the separate analyses is excessive. Therefore, all outcomes of the tests are summarized in Table 9. As shown in Table 9, some variables had to be differenced in order to make these variables stationary. Taking the first difference of variables has implications for the model that can be chosen. When taking the first difference, the time invariant observations are eliminated. Therefore, only fixed effects models that measure the *within* variation are sufficient.

Table 9: Stationarity of variables.

Variable	Stationary	Stationary after first difference
TOURISM	No	Yes
TELECOM	No	Yes
FDI	No	Yes
GDPCAPITA	Yes, in natural logarithm	-
EDUC2	No	Yes
PRICELEVEL	Yes	-
WAGES	No	Yes
UNEMPLOYED	No	Yes
AGE	No	Yes
EDUC	Yes, in natural logarithm	-
TELL	No	Yes
OPENESS	No	Yes
URBAN	No	No
LEGAL	Yes	Yes
POLITICS	Yes	-
CORUPTION	No	Yes
FREEDOM	Yes	No
GDPGROWTH	Yes	-
FXRATE	No	Yes

As shown in Table 9, there are several non-stationary variables in the dataset, which has several implications for the data. Firstly, the non- stationary variables are transformed to stationary variables by taking the first difference of the variable. Secondly, due to the differenced variables, these variables are automatically put into a fixed effects specification. However, this result has no direct implications for my method since it was a fixed effects model.

3.2.3. Linearity

To have a correct model specification that satisfies the classical assumptions the model has to be linear. A distinction between linear variables and linear coefficients can be made. Normally, when assessing the classical assumptions, the model has to have linear coefficients. Although some of the variables were transformed with the log, making the variables non-linear, the coefficients were linear in the equation, which satisfies the classical assumption that the model has linear coefficients.

3.2.4. Normality

To prevent a violation of the normality, the independent variable histograms of all three models were plotted and visually compared with a normal distribution. In addition, a normal probability test was performed to investigate whether the data process exhibits a standard normal distribution. The tests are presented in Appendix A and Appendix B. It was of importance to test whether the different variables are normally distributed since the calculations of the confidence intervals and significance are based on a normal distribution. When visually inspecting the histograms, most variables closely follow the bell curve of a normal distribution. However, the variable FREEDOM does not show a perfect normal

distribution. If FREEDOM is transformed by taking the logarithm, it shows the same distribution. Eliminating FREEDOM from the equation is not preferable since it explains economic freedom in the models, which is an important explanatory variable. However, it should be kept in mind in the analysis that FREEDOM does not follow a perfect normal distribution, and therefore, calculations of the significance of the variables may be imperfect. Some other variables have a bit of a skewed normal distribution (ΔTELECOM, lnGDPCAPITA, and POLITICS), as shown in Appendix A, but this should not cause major problems in the analysis. Hence, none of the variables were dropped on the basis of the visual inspection of the histograms. The normal probability distributions show that almost all variables follow the linear line that indicates a normal distribution. However, FREEDOM does not follow the line as perfectly as the rest. The shape of the line (S-shape) indicates that the there is more variance than normally expected in a normal distribution. When this result is compared to the histogram, it can be confirmed that, although the variable shows a bell curve, the variance is quite large. This finding should be kept in mind during the analysis of the results.

3.2.5. Collinearity

The simple correlation coefficients were analysed per model specification. A high simple correlation coefficient between variables in the model is undesirable because it could lead to collinearity. Collinearity would not influence the predictive power of the model. However, it would influence the magnitude of the coefficients and could lead to an overestimation or underestimation of the measured effect. To prevent collinearity, correlation between the variables was analysed for the three different models.

The first model is the model on tourism stated in equation 1. The first difference was taken from the variables that are non-stationary in order to make them stationary. All the continuous variables were rescaled by taking the natural logarithm, which decreases the heteroscedasticity and has the advantage that coefficients can be interpret as elasticities. The correlation between the variables of the model specified in equation 1 can be seen in Appendix C.

(1) $\Delta \ln(TOURISM) = \beta_0 + \beta_1 \ln(GDPCAPITA)_{it} + \beta_2 \Delta \ln(WAGES)it + \beta_3 \Delta \ln(FXRATE)_{it} + \beta_4 (SHENGEN)_{it} + \beta_5 \Delta \ln(OPENESS)it + \beta_6 \ln(PRICELEVEL)_{it} + \beta_7 OLYMPIC1_{it} + \beta_8 OLYMPIC2_{it} + \beta_9 YEAR^* + \alpha_i + u_{it}$

As Appendix C shows, PRICELEVEL and GDP per capita have a high correlation of 0.79. Therefore, PRICELEVEL was dropped from the model. Furthermore, there are no moderate or high correlations between any other variables in the model. Therefore, there was no need to drop any of the other variables.

The second model tested on simple correlation coefficients is the model on telecommunication infrastructure, indicated by equation 2. As shown in equation 2, URBAN was dropped from the equation since URBAN was not stationary after first difference. Almost all of the continuous variables were rescaled by taking the natural logarithm, which decreases the heteroscedasticity and has the advantage that coefficients can be interpret as

elasticities. Nonetheless, AGE was not rescaled to a logarithmic form since the interpretation is more valuable as a continuous variable; the same holds for FREEDOM since this variable is based on an index. TELECOM and GDPgrowth were also not rescaled to logarithmic forms since they are percentages. The correlation between the variables of the model specified in equation 2 is shown in Appendix C.

(2) $\Delta TELECOM = \beta_0 + \beta_1 ln(GDPCAPITA)_{it} + \beta_2 GDPgowth_{it} + \beta_3 \Delta ln(TELL)_{it} + \beta_4 \Delta AGE_{it} + \beta_5 \Delta EDUC_{it} + \beta_6 \Delta ln(EDUC2)_{it} + \beta_7 \Delta ln(WAGES)_{it} + \beta_8 ln(PRICELEVEL)_{it} + \beta_9 FREEDOM_{it} + \beta_{10} OLYMPIC1_{it} + \beta_{11} OLYMPIC2_{it} + \beta_{13} YEAR_{it}^* + \alpha_i + u_{it}$

As indicated in Appendix C, PRICELEVEL and GDP per capita have a high correlation of 0.78. PRICELEVEL also has a moderate correlation (0.59) with FREEDOM. Therefore, PRICELEVEL was dropped from the model. FREEDOM shows a moderate correlation with GDPper capita (0.65). Nevertheless, both variables were kept in the equation since both explanatory variables explain different phenomena. Still, this result is important to keep in mind for the analysis. Furthermore, there are no moderate or high correlations between any other variables in the model. Therefore, there was no need to drop any of the other variables.

The third model tested on simple correlation coefficients is the model on foreign direct investment, as stated in equation 3. Most of the continuous variables were rescaled to logarithms since this decreases heteroscedasticity and has the advantage that the coefficients can be interpret as elasticities. Exemptions are the variables based on indices: FREEDOM, LEGAL, POLITICS, and CORUPTION. For these variables, the interpretation is more valuable as continuous variables. GDPgrowth was also not rescaled to logarithmic form since the variable is a percentage. The correlation between the variables of the model specified in equation 3 is shown in Appendix C.

(3) $\Delta ln(FDI) = \beta_0 + \beta_1 ln(GDPCAPITA)_{it} + \beta_2 \Delta ln(OPENESS)_{it} + \beta_3 \Delta ln(WAGES)_{it} + \beta_4 \Delta ln(UNEMPLOYED)_{it} + \beta_5 GDPgrowth_{it} \beta_6 \Delta ln(FXRATE)_{it} + \beta_7 ln(PRICELEVEL)_{it} + \beta_8 FREEDOM_{it} + \beta_9 LEGAL_{it} + \beta_{10} POLITICS_{it} + \beta_{11} \Delta CORUPTION_{it} + \beta_{12} OLYMPIC1_{it} + \beta_{13} OLYMPIC2_{it} + \alpha_i + u_{it}$

As indicated in Appendix C, PRICELEVEL and GDP per capita have a high correlation of 0.78. PRICELEVEL also has a moderate correlation with FXRATE (0.60) and FREEDOM (0.59). Therefore, PRICELEVEL was dropped from the model. FREEDOM also has a moderate correlation with FXRATE (0.68) and a noteworthy correlation with POLITICS (0.39). However, FREEDOM does explain a different phenomenon than FXRATE. Therefore, FREEDOM was kept in the equation since it might provide additional knowledge. POLITICS and GDPCAPITA have a correlation of 0.39, which is not great enough to drop one of the variables, but it should be kept in mind when analysing the regression results. Furthermore, there are no moderate or high correlations between any other variables in the model. Therefore, there was no need to drop any of the other variables.

3.2.6. Serial correlation

Serial correlation does not bias the coefficients but does causes OLS to no longer be the minimum variance estimator. It also causes the standard errors of the coefficients to be biased, which leads to unreliable hypothesis testing. The data was tested to investigate whether the data exhibited serial correlation. The results of the test are presented in Appendix E. Five of the six models do not contain serial correlation in the current model specification. However, the extended model on foreign direct investment rejected h0: no first order autocorrelation. The result of the test means that this model exhibits autocorrelation. This does not have implications for the dynamic models since these models account for the lagged variables, but it does matter for the static fixed effects model. The consequence of the autocorrelation is that the standard errors of the coefficients are biased for the extended model on foreign direct investment, which causes unreliable hypothesis testing for this model. Clustering at the panel level will produce consistent estimates of the standard errors, and other estimators will produce more efficient estimates (Baltagi, 2001; Wooldridge, 2002).

3.2.7. Heteroscedasticity

Heteroscedasticity, as well as serial correlation, does not bias the coefficient estimates. It does typically causes OLS to no longer be the minimum variance estimator and causes the standard errors of the coefficients to be biased. Typically, heteroscedasticity negatively biases the standard error, meaning there is an increased chance of a Type 1 error and it is more likely a variable shows significance while it actually is an irrelevant variable. A likelihood-ratio test can help identify heteroscedasticity in a model. The tests rejected the h0: homoskedastic for the basic model and the extended model of tourism with at a 1% confidence interval. The basic model for telecommunications also rejected H0: homoskedastic at a 1% confidence interval and H0: homoskedastic at a 1% confidence interval for the extended model. The basic model for foreign direct investment also rejected H0: homoskedastic at a 1% confidence interval and H0: homoskedastic at a 1% confidence interval for the extended model. All tests are presented in Appendix F. Thus, every model exhibits heteroscedasticity. One of the remedies for heteroscedasticity is redefining the functional form by taking the logarithm. However, the variables were transformed to logarithms and still exhibited heteroscedasticity for tourism, telecommunication infrastructure, and FDI. Therefore, the variables were clustered by panel in the analysis to allow for arbitrary dependence between errors within the panel in the dynamic FE model. Clustering in panel helps reducing the chance of Type 1 errors.

3.2.8. Final model specification and robustness

After considering the test for the correct model specification according to the classical assumptions and the tests for stationarity, the models specified were adjusted to their final form. In the model, there are no non-stationary variables, and chances of heteroscedasticity are minimized due to the examination of correlation between the explanatory variables. In order to increase the robustness of the statistical analysis, two models for every dependent variable were specified: A simple model that contains the most common explanatory variables and a more complex model in which several explanatory variables were added. The goal of using different model specifications is to see how a parameter value changes when the

model is specified in a different manner. Therefore, using different model specifications increases the reliability of the outcomes of the model, thus increasing the robustness. The models, as tested in the analysis, are specified in equations 4-9. The descriptive statistics of the specified models are in Appendix D. As mentioned, all of these specified models were tested with static fixed effects, dynamic fixed effects, and the dynamic model bias-corrected LSDV. Testing the model in different statistical estimators increased the robustness of the results.

(4) $\Delta\ln(TOURISM) = \beta_0 + \beta_1\ln(GDPCAPITA)_{it} + \beta_2\Delta\ln(WAGES)it + \beta_3\Delta\ln(FXRATE)_{it} + \beta_4 OLYMPIC1_{it} + \beta_5 OLYMPIC2_{it} + \beta_{6-*}YEAR* + \alpha_i + u_{it}$

(5) $\Delta\ln(TOURISM) = \beta_0 + \beta_1\ln(GDPCAPITA)_{it} + \beta_2\Delta\ln(WAGES)it + \beta_3\Delta\ln(FXRATE)it + \beta_4 SHENGEN_{it} + \beta_5\Delta\ln(OPENESS)_{it} + + \beta_6 OLYMPIC1_{it} + \beta_7 OLYMPIC2_{it} + \beta_8 YEAR* + \alpha_i + u_{it}$

(6) $\Delta TELECOM = \beta_0 + \beta_1\ln(GDPCAPITA)_{it} + \beta_2 GDPgowth_{it} + \beta_3\Delta\ln(TELL)_{it} + \beta_4\Delta AGE_{it} + \beta_5 OLYMPIC1_{it} + \beta_6 OLYMPIC2_{it} + \beta_7 YEAR_{it}* + \alpha_i + u_{it}$

(7) $\Delta TELECOM = \beta_0 + \beta_1\ln(GDPCAPITA)_{it} + \beta_2 GDPgowth_{it} + \beta_3\Delta\ln(TELL)_{it} + \beta_4\Delta AGE_{it} + \beta_5\Delta EDUC_{it} + \beta_8\Delta\ln(WAGES)_{it} + \beta_9 FREEDOM_{it} + \beta_{10} OLYMPIC1_{it} + \beta_{11} OLYMPIC2_{it} + \beta_{12} YEAR_{it}* + \alpha_i + u_{it}$

(8) $\Delta\ln(FDI) = \beta_0 + \beta_1\ln(GDPCAPITA)_{it} + \beta_2\Delta\ln(OPENESS)_{it} + \beta_3\Delta\ln(WAGES)_{it} + \beta_4\Delta\ln(UNEMPLOYED)_{it} + \beta_5 GDPgrowth_{it}\ \beta_6\Delta\ln(FXRATE)_{it} + \beta_7 OLYMPIC1_{it} + \beta_8 OLYMPIC2_{it} + \beta_{12} YEAR_{it}* + \alpha_i + u_{it}$

(9) $\Delta\ln(FDI) = \beta_0 + \beta_1\ln(GDPCAPITA)_{it} + \beta_2\Delta\ln(OPENESS)_{it} + \beta_3\Delta\ln(WAGES)_{it} + \beta_4\Delta\ln(UNEMPLOYED)_{it} + \beta_5 GDPgrowth_{it}\ \beta_6\Delta\ln(FXRATE)_{it} + \beta_7 FREEDOM_{it} + \beta_8 LEGAL_{it} + \beta_9 POLITICS_{it} + \beta_{10}\Delta CORUPTION_{it} + \beta_{11} OLYMPIC1_{it} + \beta_{12} OLYMPIC2_{it} + \beta_{13} YEAR_{it}* + \alpha_i + u_{it}$

4. Results

4.1. Regression results

In this chapter, the results of the three different models and corresponding analyses are presented. The effect of hosting the summer Olympics was tested for the dependent variables tourism, telecommunication, and foreign direct investment.

Tourism

The first model applied in the paper captures the effect of hosting the summer Olympics on tourism. Tourism was measured in overnight stays by non-residents. Three different econometrical methods, explained in the previous chapter, were exploited. As mentioned in the method chapter, in order to increase robustness, a basic model and an extended model were tested by all three econometrical methods. The Pesaran-Smith model can be measured in three different ways (PMG, MG, and DFE). The DFE estimator was used for this research. In the Pesaran-Smith model, the error correction coefficient, which measures the speed of deviations from the long-term equilibrium, is negative and significant. Coefficients are -0.209 (basic model) and -0.187 (extended model), which means the speed of correction to the long-term equilibrium is around five years for both models.

The results are presented in Table 10. First, significance differs between different models and for the different model specifications, which directly signals ambiguity of the effect of the different variables on tourism. The difference can be attributed to the different specifications of the dynamic models. The addition of the extra explanatory variables does not contribute to the understanding of the effect on tourism. The decrease is confirmed by the adjusted r^2 of the basic fixed effect model, which is higher than the r^2 for the extended model. None of the models show a statistically significant result for the effect of GDP per capita on tourism. The bias-corrected LSDV model (further referred to as models 5 and 6) shows, in the basic model, that WAGES are negatively related to the number of overnight stays by non- residents. Higher wages indicate a higher cost of living, which could make it less attractive as a destination for residents of other countries. FXRATE (the exchange rates) is statistically insignificant for models 1, 2, 5, and 6. Nonetheless, the long-run DFE model (further referred to as long-run models 3 and 4) and the short-run DFE model (further referred to as short-run models 3 and 4) show statistically significant effects of exchange rates on tourism. In the short-term, exchange rates are negatively related to exchange rate, meaning depreciation of the currency decreases the number of overnight stays by non-residents. However, in the long-term, the effect of a depreciation of the currency increases the number of overnight stays by non-residents. According to the short-run DFE model (model 4), OPENESS is positively related to the number of overnight stays by non-residents, which is an expected result. Interestingly, models 5 and 6 show no evidence that previous tourism flows have a significant impact on future tourism flows.

The most important variables to this research are the dummy variables OLYMPIC1 and OLYMPIC2. These variables explain the effect of hosting the summer Olympics on the number of overnight stays by non-residents. According to models 3 and 4, the effect of hosting the summer Olympics has a negative effect on the number of overnight stays by non-residents in the period of three years preceding the summer Olympics. When hosting the summer Olympics, the number of overnight stays decreases in the short-term by approximately 6% compared to not hosting the summer Olympics, ceteris paribus, while in the long-term, the decrease in tourism is about 30% compared to not hosting the summer Olympics, ceteris paribus. OLYMPIC2 is positively related to tourism, according to models 1, 5, and 6, which indicates a positive effect of hosting the summer Olympics on the number of overnight stays by non-residents. Hosting the summer Olympics increases the number of overnight stays by approximately 5,6% compared to not hosting the summer Olympics, ceteris paribus.

Table 10: Regression results on tourism.

TOURISM	Model 1	Model 2	Model 3	Model 4	Model 3	Model 4	Model 5	Model 6
	Fixed Effects	Fixed Effects	Pesaran-Smith DFE (long-run)	Pesaran-Smith DFE (long-run)	Pesaran-Smith DFE (short-run)	Pesaran-Smith DFE (short-run)	Bias-corrected LSDV	Bias-corrected LSDV
lnGDPCAPITA	-0.061	-0.039	0.462	0.179	0.096	0.034	-0.038	-0.017
	(-1.07)	(-0.64)	-1.53	-0.33	-0.97	-0.29	(-0.47)	(-0.20)
ΔlnWAGES	-0.478	-0.391	-0.879	-0.503	-0.445	-0.055	-0.687^{+}	-0.619
	(-1.03)	(-0.79)	(-0.69)	(-0.30)	(-1.20)	(-0.17)	(-1.76)	(-1.52)
ΔlnFXRATE	0.006	-0.132	1.963***	1.796***	-0.383**	-0.467***	-0.037	-0.145
	-0.04	(-0.51)	-5.33	-3.74	(-2.99)	(-4.62)	(-0.17)	(-0.53)
SCHENGEN		0.016		-0.034		-0.006		0.015
		-0.89		(-0.35)		(-0.34)		-0.48
ΔlnOPENESS		0.24		0.548		0.270***		0.188
		-1.2		-0.88		-3.82		-0.8
OLYMPIC1	-0.012	-0.007	-0.325*	-0.293^{+}	-0.068*	-0.055^{+}	-0.012	-0.007
	(-0.53)	(-0.31)	(-2.03)	(-1.79)	(-2.11)	(-1.79)	(-0.29)	(-0.17)
OLYMPIC2	0.053^{+}	0.054	0.06	0.068	0.013	0.013	0.056^{+}	0.056^{+}
	-1.8	-1.64	-0.26	-0.26	-0.27	-0.26	-1.78	-1.74
Constant	0.666	0.404			3.374	2.925		
	-1.15	-0.69			-0.93	-0.79		
L.ΔlnTOURISM							-0.059	-0.061
							(-0.77)	(-0.80)
SR ec					-0.209*	-0.187*		
					(-2.18)	(-2.07)		
Observations	249	249					238	238
R^2	0.183	0.189						
Adjusted R^2	0.083	0.082						
Dynamic	no	no	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes

t statistics in parentheses
$^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Telecommunication infrastructure

The second model tests the effect of hosting the summer Olympics on the telecommunication quality in a country, measured in internet access per 100 inhabitants. Three econometrical models were exploited in order to explain the effect of different variables on the telecommunication infrastructure of a country. There was some ambiguity in the different models' results, probably due to differences in estimation methods. The extended model shows a lower R^2 than the basic model, possibly because there were fewer observations because added variables were not available for the entire period, i.e., FREEDOM. In the DFE model, the error correction coefficient, which measures the speed of deviations from the long-term equilibrium, is negative and significant. Coefficients are -0.082 (basic model) and -0.131 (extended model), which means the speed of correction to the long-term equilibrium is 12 years for the basic model and 8 years for the extended model.

The results are presented in Table 11. As expected, the coefficient of GDP per capita indicates a positive relationship between GDP per capita and telecommunication infrastructure (models 3 and 4). According to models 3 and 4, in the long-term as well as in the short-term, an increase in GDP per capita leads to an increase in telecommunication infrastructure. GDP growth confirms the positive relationship between GDP and telecommunication infrastructure. Statistically significant evidence that GDP growth is positively related to telecommunication infrastructure was found. This relationship holds for the long-term, as well as for the short-term (models 3 and 4). According to the short-run DFE model, existing telecommunication infrastructure by means of telephone lines (TELL) has a negative effect on telecommunication by means of internet access. However, existing telecommunication has a positive impact on internet access in the long-term (model 3). The magnitude of the effect is much larger in the long-term than in the short-term (model 3). The average AGE of the population is negatively related to telecommunication infrastructure (model 3), which is an expected result. The effect is confirmed by model 2 (fixed effects), as well as in the short-run coefficient of model 4. Interestingly, AGE is positively related to telecommunication infrastructure in the long-term according to model 2 and short-run model 4. Moreover, an increase in average age of a population decreases the internet access in the long-term, which is an unexpected result (model 4). None of the models found a statistically significant relationship between EDUC (education) and internet access. WAGES are negatively related to telecommunication infrastructure by means of internet access, according to model 2 and short-run model 4. This is a surprising result since it was expected that higher wages would lead to higher internet penetration. Another unexpected result is FREEDOM, which is negatively related to telecommunication infrastructure, according to model 2. Interestingly, both bias-corrected LSDV models (models 7 and 8) did not find evidence that previous telecommunication infrastructure has a significant impact on future telecommunication infrastructure.

Dummy variables OLYMPIC1 and OLYMPIC2 explain the effect of hosting the summer Olympics on telecommunication infrastructure and are of particular interest to this study. Model 2 and short-run model 4 show a statistically significant negative relationship between hosting the summer Olympics and telecommunication infrastructure in the years preceding

the Olympics, indicating that hosting the summer Olympics decreases internet access between approximately 1.8% and 3.6%, according to both static fixed effects models (models 1 and 2), and by 1.22% in the short-term (model 4) compared to not hosting the summer Olympics, ceteris paribus. Short-run model 4 found a statistically negative relationship between hosting the summer Olympics and telecommunication infrastructure by means of internet access in the years following the Olympic event (1.66%). However, this result was not confirmed by any of the other models, which did not find statistically significant relationships between internet access per 100 inhabitants and hosting the summer Olympics preceding or following the Olympic event.

Table 11: Regression results on telecommunication.

TELECOM	Model 1	Model 2	Model 3	Model 4	Model 3	Model 4	Model 5	Model 6
	Fixed Effects	Fixed Effects	Pesaran-Smith DFE (long-run)	Pesaran-Smith DFE (long-run)	Pesaran-Smith DFE (short-run)	Pesaran-Smith DFE (short-run)	Bias-corrected LSDV	Bias-corrected LSDV
lnGDPCAPITA	0.278	6.235	128.844***	77.598+	10.550***	10.200+	-0.311	5.975
	-0.16	-1.79	-4.79	-1.82	-5.73	-1.93	(-0.09)	-0.74
GDPgrowth	-0.149	0.012	2.087*	1.54	0.171*	0.202*	-0.152	0.002
	(-1.04)	-0.06	-2.07	-1.48	-2.53	-2.09	(-0.83)	0
ΔTELL	0.141	0.027	2.927*	1.598	-0.235**	-0.256	0.15	0.034
	-1.46	-0.19	-2.55	-1.58	(-2.60)	(-1.60)	-0.9	-0.12
ΔAGE	-2.81	-7.089**	2.212	6.911*	-1.691	-4.746*	-3.843	-7.136
	(-1.70)	(-4.25)	-0.61	-2.15	(-1.57)	(-2.16)	(-1.31)	(-1.41)
ΔEDUC		0.125		-0.21		0.004		0.149
		-0.69		(-0.55)		-0.04		-0.68
ΔlnWAGES		-33.836+		46.484		-29.718**		-32.829
		(-1.97)		-1.08		(-2.85)		(-1.34)
FREEDOM		-0.341**		-0.186		-0.024		-0.348
		(-3.53)		(-0.16)		(-0.17)		(-1.25)
OLYMPIC1	-1.789+	-3.600**	-5.885	-8.48	-0.482	-1.115*	-2.534	-3.804
	(-2.08)	(-3.38)	(-0.39)	(-1.35)	(-0.42)	(-2.25)	(-1.33)	(-1.50)
OLYMPIC2	0.851	-0.733	-6.013	-12.638	-0.492	-1.661**	0.606	-1.099
	-1.55	(-0.45)	(-0.38)	(-1.63)	(-0.41)	(-2.82)	-0.36	(-0.33)
Constant	2.491	-34.676			-118.869***	-199.664+		
	-0.14	(-0.96)			(-5.89)	(-1.94)		
L.ΔTELECOM							-0.03	-0.023
							(-0.41)	(-0.20)
SR					-0.082***	-0.131**		
ec					(-3.86)	(-2.70)		
Observations	259	177					250	176
R^2	0.405	0.353						
Adjusted R^2	0.333	0.236						
Dynamic	no	no	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes

t statistics in parentheses
+$p < 0.10$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Foreign Direct Investment

The third model tests the effect of hosting the summer Olympics on foreign direct investment. For testing the effect of hosting the Olympics on FDI, three different econometrical models were exploited. The number of observations was lower for the extended model since some of the additional explanatory variables do not exist for the entire period (FREEDOM, POLITICS, CORRUPTION). In the DFE model, the error correction coefficient, which measures the speed of deviations from the long-term equilibrium is negative and significant. Coefficients are -0.233 (basic model) and -0.434 (extended model), which means the speed of correction to the long-term equilibrium is approximately five years for the basic model and a little more than two years for the extended model.

The results of the different econometrical models are presented in Table 12. GDP per capita shows ambiguous results. According to model 2, GDP is negatively related to FDI. However, model 3 indicates that GDP per capita is positively related to FDI in the long-term and in the short-term. OPENESS is positively related to FDI according to models 1, 2, 5, and 6 and in the long-run DFE model (models 3 and 4). In the short-term, OPENESS is negatively related to FDI (model 4). Model 3 shows that unemployment is positively related to FDI in the short-term. However, this result was not confirmed by any of the other models. Model 3 also shows a statistically significant positive relationship between GDP growth and FDI. This relationship holds for the long-term as well as the short-term (model 3) and is statistically significant at a 1% CI. Models 1, 2, 5, and 6 and short-run model 4 found a negative relationship between FXRATE and FDI, meaning a depreciation of the currency decreases foreign direct investment in terms of stocks. The results provide no evidence that the FDI stocks of this year are partly based on the FDI stocks of preceding years (Model 5).

The Olympic dummies are of particular interest to this study. OLYMPIC1 represents the effect of hosting the summer Olympics on the three years preceding the Olympic event. The results on the effect of hosting the summer Olympics on foreign direct investment is positive according to the different models (models 1 and 5). Model 1 and model 5 show a positive and statistically significant effect of hosting the summer Olympics on FDI stocks. FDI is about 11% higher in the preceding years of hosting the summer Olympics compared to not hosting the summer Olympics, ceteris paribus. OLYMPIC2 is the dummy variable that explains the effect of hosting the summer Olympics in the year of the Olympic event and the two years thereafter. The effect is significantly positive in all models, except in model 4. In the fixed effects (models 1 and 2) and bias-corrected LSDV models (models 5 and 6), FDI increases between 12% and 15% when hosting the summer Olympics compared to not hosting the summer Olympics, ceteris paribus. In the short-run DFE model, FDI is 13% larger than when not hosting the summer Olympics and 57.9% larger than when not hosting the summer Olympics in the long-run DFE model (model 3), ceteris paribus.

Table 12. Regression results on foreign direct investment

FDI	Model 1	Model 2	Model 3	Model 4	Model 3	Model 4	Model 5	Model 6
	Fixed Effects	Fixed Effects	Pesaran-Smith DFE (long-run)	Pesaran-Smith DFE (long-run)	Pesaran-Smith DFE (short-run)	Pesaran-Smith DFE (short-run)	Bias-corrected LSDV	Bias-corrected LSDV
lnGDPCAPITA	-0.027	-0.578*	2.516***	0	0.586***	0	0.056	-0.491
	(-0.21)	(-2.13)	-4.27	(.)	-4.5	(.)	-0.36	(-1.42)
ΔlnOPENESS	0.590*	0.626*	1.696*	1.345*	-0.086	-0.574**	0.517+	0.650+
	-2.1	-2.16	-2.39	-1.96	(-0.47)	(-3.25)	-1.71	-1.89
ΔlnWAGES	-0.102	0.974+	-0.076	2.076	-0.009	0.54	-0.096	0.961
	(-0.21)	-1.67	(-0.06)	-1.58	(-0.02)	-0.89	(-0.17)	-1.52
ΔlnUNEMPLYED	-0.012	-0.081	-0.079	0.117	0.141*	-0.073	-0.045	-0.086
	(-0.16)	(-1.03)	(-0.41)	-0.82	-2.25	(-1.11)	(-0.64)	(-0.95)
GDPgrowth	-0.003	-0.005	0.073**	0.011	0.017***	0.005	-0.006	-0.005
	(-0.57)	(-0.71)	-2.73	-1.19	-4.31	-1.17	(-0.83)	(-0.64)
ΔlnFXRATE	-1.047**	-1.571**	1.229	-0.081	-0.161	-0.810*	-0.902*	-1.475**
	(-3.28)	(-3.36)	-1.52	(-0.08)	(-0.82)	(-2.33)	(-2.45)	(-3.24)
FREEDOM		0.004		0.006		0.002		0.002
		-0.67		-0.23		-0.23		-0.33
POLITICS		-0.029		0.021		0.009		-0.025
		(-0.48)		-0.09		-0.09		(-0.33)
ΔCORUPTION		0.021		0.004		0.107		0.032
		-0.23		-0.02		-0.64		-0.31
OLYMPIC1	0.107+	0.036	0.137	0.138	0.032	0.06	0.123*	0.043
	-1.93	-0.53	-1.21	-0.72	-1.2	-0.71	-1.96	-0.55
OLYMPIC2	0.152**	0.132*	0.579***	0.255	0.135***	0.111	0.143**	0.123+
	-3.29	-2.12	-4.02	-1.2	-3.92	-1.2	-2.62	-1.71
Constant	0.327	5.597*			-3.398	-5.087		
	-0.25	-2.1			(-1.44)	(-0.62)		
L.dlnFDI							0.113	0.078
							-1.42	-0.81
SR					-0.233***	-0.434***		
ec					(-5.42)	(-6.40)		
Observations	223	129					217	128
R^2	0.581	0.759						
Adjusted R^2	0.489	0.679						
Dynamic	no	no	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes

4.2. Implications of the results

The results of the regression analysis, reported in the section above, show expected and surprising results. In order to put the results into context, this section will elaborate on the implications of the results. Implications will be discussed separately for tourism, telecommunication quality, and foreign direct investment.

Tourism

The implications of the results of tourism are of importance since bidding committees often try to sell the summer Olympics as an event that increases the number of tourists. Bidding committees often base the potential increase of tourists on predicting models, like the I-O model and the GCE model. However, as stated in reviewed literature, these models tend to over- or underestimate the impact of hosting the summer Olympics on tourism. Therefore, this paper investigates these assumptions on basis of post-event estimation to determine whether the predictions made by bidding committees hold.

The results of the effect of hosting the summer Olympics on tourism are surprising. The results show a negative relationship between hosting the Olympics and nights spent by non-residents in the three years preceding the Olympics. In the short-term, the number of tourists decreases between 5.5% to 6.8%. This result was not expected and does not support the argumentation of most previous research that hosting the summer Olympics has a positive impact on tourism (Fourie & Santana-Callego, 2011; Kasimati, 2005; Li & Blake, 2009; Li & Jago, 2013). However, as mentioned in the theory, there are scholars who argue that the crowding out effect is underestimated in estimations made by bidding committees and academics who investigate the impact of hosting the summer Olympics on tourism (Owen, 2005). The crowding out effect could be larger in the years preceding the Olympics since potential visitors may postpone their visits to the year of the Olympics, or they might want to wait and see whether the 14-day event advertisement for the country lives up to their expectations. This line of thought is confirmed by an increase in nights spent by non-residents in the year of the event and the two years following the event. Models 7 and 8 show an increase of 5.6% in overnight stays by non-residents in the Olympic year and years after the Olympics. This increase of tourists in the years during and following the Olympics is in line with reviewed literature.

Table 13: Direct inflow of extra money by tourism due to hosting the Olympics.

	Pre-Olympic event (*1000)	Post-Olympic event (*1000)	Net increase nights stayed (*1000)	Met inflow (million €)
Barcelona 1992	-4636.40	5109.71	473.31	€26.60
Athens 2004	-2477.09	2288.27	-188.82	€-16.55
London 2012	-5050.50	6267.31	1216.81	€133.61

The net inflow, as stated in Table 13, is the extra money that flows into the economy that would otherwise not be there. This is the direct effect explained in Figure 2 and is solely the extra income generated from nights spent in hotels. It is not possible to include more detailed extra spending since that would acquire knowledge about average spending, which is ambiguous. For the extra inflow generated by hotel stays, it is possible to be quite explicit since the dependent variable is overnight stays. This inflow of extra money has a direct effect on the local economy, as stated in the theory section: "Residents are interested in knowing how much extra income the host community will receive from the injection of funds from visitors" *(*Crompton, 1995, p. 21). The net inflow was calculated on basis of average hotel prices in 2012. These prices were then corrected for inflation in order to represent the value in the year of the Olympic event. The results in Table 13 show that the increase in money inflow in the years following the Olympic event can hardly compensate for the reduction in money inflow in the years before the Olympic event. In Barcelona and London, the net result was positive, but the bidding committee of Athens (2004) did not accomplish its goal. Moreover, according to these results, the net increase in tourism is not as great as proposed by the different bidding committees. There is an increase in the years during and following the event, as predicted by the bidding committees, but the increase in these years hardly compensates for the decrease in tourism in the years preceding the Olympic event.

Telecommunication infrastructure

All hosting countries want to showcase their countries as sublime, with regard to telecommunication (Official Report of the XXV Olympiad, 2003; Official Report of the XXVIII Olympiad, 2007; Meta-Evaluation of the Impacts and Legacy of the London 2012 Olympic and Paralympic Games, 2011). Without decent broadcasting, the Olympics would not draw near the same attention as when all events can be watched at any time in any country (Zimbalist, 2015). Therefore, telecommunication quality is of major importance for the organisation, as well as for the sponsors and the athletes. Also, the large broadcasters that bought the broadcasting rights will demand the necessary telecommunication quality in order to provide their viewers with decent broadcasting quality. Thus, the organisation and broadcasters must make investments in order to meet all demands concerning the events broadcasting. These additional investments can lead to higher communication quality.

The results of the analysis of the effect of hosting the summer Olympics on telecommunication infrastructure in terms of internet access are not as expected. The results show that hosting the summer Olympics has a negative influence on telecommunication quality in terms of internet penetration. Based on existing literature, it was expected that hosting the summer Olympics has a significantly positive effect on the internet access. One of the reasons for this negative relationship could be that the opportunity to increase the telecommunication infrastructure could be postponed to the period after the Olympic event. The period preceding the Olympic event can be stressful, and the organisation often is under pressure to finish the Olympic facilities in time (Guardian, 2003; Telegraph, 2004), which could lead a lower increase in telecommunication infrastructure in the period before the Olympic event. Hence, it would then make sense to finish the projects related to the Olympic events first, while postponing the activities on the telecommunication infrastructure for the

local inhabitants. However, the results indicate a statistically significant result for a negative effect of hosting the summer Olympics on telecommunication infrastructure for the years following the summer Olympics, meaning the proposed improvements in telecommunication infrastructure were not carried out in the foreseen manner. Thus, opportunities and goals regarding telecommunication infrastructure, highlighted by the bidding committees, are not achieved.

Another reason for the failure to increase the telecommunication infrastructure by means of internet access might be that internet access is more driven by the force of demand than of supply (Bauer et al., 2002). The theory that internet access is mainly driven by demand could explain why an external event that supports the supply does not increase the internet access as much as regulatory changes in incentives that increase the demand. On the contrary, the summer Olympics are not meant to increase the internet access directly, the event is merely proposed as an additional advantage of hosting the summer Olympics. This paper shows that these advantages were not capitalized on by former Olympic bidding committees. Reasons for the lack of capitalization of telecommunication infrastructure opportunities are numerous and can be investigated in future research.

Foreign direct investment

The implications for foreign direct investment are of importance since they can provide an indication of the effect hosting the summer Olympics has on attracting foreign capital. Theoretical arguments mainly state that hosting the summer Olympics would give the host extra opportunities to showcase the country as an attractive investment location. Inviting potential investors and lobbying during the Olympics leads to increasing foreign direct investments, according to those theories (Fourie & Santana-Callego, 2011; Report 5 Post-games evaluation summary, 2013).

The results show that there is a significant impact of hosting the summer Olympics on foreign direct investment preceding the Olympic event, as well as during and following the Olympic event, which is in line with the reviewed literature regarding the effect of hosting the summer Olympics on FDI inflows. The additional FDI inflows are approximately 11% in the years preceding the Olympics and between a 12% and 15% increase during and following the Olympic event. This is a severe increase, and it is questionable whether this increase is solely due to hosting the summer Olympics. Table 14 shows the impact in terms of additional money inflow.

Table 14: Direct inflow of FDI stock due to hosting the Olympics.

	Increase stock pre-Olympic event	Increase stock post-Olympic event	Net increase FDI stock index 2012 (Billions $)	Indexed to 2012 (Billions €)
Barcelona 1992	$8.00	$11.82	$37.85	€29.48
Athens 2004	$1.91	$4.45	$8.25	€6.42
London 2012	$126.55	$208.48	$335.03	€260.94

The UK FDI inflows increased by an additional €260.94 billion due to hosting the summer Olympics in London 2012. It seems unrealistic to attribute this additional FDI inflow of approximately €261 billion in London solely to hosting the summer Olympics in 2012. Therefore, recent changes in FDI policy in the UK were investigated in order to explain the huge increase in FDI inflow, apart from hosting the summer Olympics. For example, the FDI policy in the UK changed somewhat over the previous 10 years. The UK decreased the corporate tax rate from 30% in 2006 to 20% in 2015. The European average was 27% in 2006 and 22% in 2015, meaning the UK gradually changed corporate tax rates from higher than average to lower than average (Department for Business Innovation & Skills, 2015; KPMG, 2015). This change could be part of an explanation as to why the FDI inflows increased so much, compared to other years and compared to other European countries, in the period of hosting the summer Olympics. Also, the UK government put extra emphasis on UK trade and investment (UKTI, 2015). Since 2010, the country has invested heavily in the attractiveness for businesses to invest in the UK through the UK Guarantees scheme, which provided £40 billion in government underwritten infrastructural projects, as well as deregulations for businesses saving 1.5 billion a year for businesses (UKTI, 2015). However, when assessing the major investment projects of foreign firms in the UK, it is interesting to note that two of the five areas of major investments can be seen as follow-up programs for the rejuvenation of the London city center, which was initially started due to the summer Olympics. These are the project at the Royal Albert Docks, London and the housing and hotel project at Nine.

This additional exploration of events reveals that there were some additional policies introduced by the UK government, apart from the Olympics, which could be picked up by the Olympic dummy variable in the regression analysis. Nevertheless, many of these policies were in line with goals set by the UK government and the London 2012 Olympic bidding committee when hosting the summer Olympics, of which one goal was to increase foreign capital inflows (Meta-Evaluation of the Impacts and Legacy of the London 2012 Olympic and Paralympic Games, 2011). Thus, it seems that hosting the summer Olympics should be part of a broader strategy to increase the countries attractiveness to foreign investors. It was also no coincidence that hosting the summer Olympics in Barcelona in 1992 fit perfectly into a long-term strategy of rejuvenating the city of Barcelona and Spain following the reign of dictator Franco (Zimbalist, 2015). It could well be that the first results of Spain's economic transformation were yielded due to the "global advertisement" of the summer Olympics of 1992 in Barcelona.

In short, these results imply that it is of importance that the organization of the summer Olympics collaborates with the government in order to maximize the increase in FDI as a result of hosting the summer Olympics. The actual hosting the summer Olympics should be in line with broader FDI government policies and regulations in order to have a significant increase in FDI investments, which means hosting the summer Olympics could effectively be used as part of a strategy to increase FDI and business attractiveness. However, the importance of hosting the Olympics compared to government policies and regulations is rather opaque. To clarify the relative importance of hosting the summer Olympics compared to the importance of policy and regulations, additional research should be conducted.

5. Sport Participation

5.1. Introduction on sport participation

The goal of this thesis is to reveal the actual benefits of hosting the summer Olympics for a local economy. Economics is more than increased spending, foreign capital, or stock markets. Economics is ultimately about welfare and well-being. Part of this well-being is the health of the local economy's population. Therefore, it is in the interest of this thesis to study the effect of hosting the summer Olympics on the health of the local economy. In this case, health is measured in sport participation since it is commonly accepted that participating in physical activities increases a person's health and well-being (Khan et al., 2012).

Another important reason to investigate the impact of hosting the summer Olympics on sport participation rates is that it was one of the goals of the hosts of the London 2012 summer Olympics (Meta-Evaluation of the Impacts and Legacy of the London 2012 Olympic and Paralympic Games, 2011): "London 2012 became the first Olympic and Paralympic Games to explicitly and pro-actively set out to use the Games to deliver increases in sport participation levels" (Weed et al., 2015, p. 197). Hosting the Olympics would be, according to the London 2012 bidding committee, a great event through which the goal of increased sport participation could be accomplished (Meta-Evaluation of the Impacts and Legacy of the London 2012 Olympic and Paralympic Games, 2011). Similarly, the Dutch bidding committee, hoping to host the summer Olympics in 2028, has roughly the same goal. The Dutch bidding committee wants to increase sport participation rates, especially the participation rates of the ethnic minorities and people in lower social classes (Olympisch plan 2028, 2009). In addition, the Dutch bidding committee will also focus on well-being, which means increasing the fitness of inhabitants and decreasing the number overweight people (Olympisch plan 2028, 2009). This goal is closely linked to the sport participation since engaging in physical activities makes a person more fit, which decreases chances of being overweight (Zanin, 2014). The Dutch bidding committee hopes to accomplish these goals by hosting the summer Olympics in 2028.

In order to investigate the impact of hosting the summer Olympics on sport participation rates, an analysis was conducted. Subjects of this analysis are the UK sport participation rates and the impact of hosting the summer Olympics in London 2012 on the sport participation rates of the inhabitants of the United Kingdom. This analysis hopes to confirm or deny the positive impact hosting the summer Olympics has on sport participation rates in the local economy. These outcomes could subsequently be used to predict the potential impact of hosting the summer Olympics in 2028 on sport participation rates in the Netherlands.

5.2. Theory of sport participation

The United Kingdom has suffered from pressure regarding sport participation since the beginning of the millennium (Sport England, 2004). In the United Kingdom, several factors have been identified by UK Sport that seem to cause this pressure on sport participation: An aging population, time pressures, well-being and obesity, levels of investment, variations in access, and volunteers and professionals (Sport England, p. 10; Downward & Riordan, 2007). The relationship of those factors to sport participation can be explained by the neo-classical economic theory of rational approach, which describes the underlying theory of an individual's choice. For example, when people spend more time in the office, they lack the time to invest in sports (participation or volunteering). Ethnic minorities and less wealthy individuals, especially, restrain from participating in sports since the investment costs for participation become too high. These developments increase the variations in access to sports.

According to Sport UK, there are five settings that should be drivers for change: The home, the community, the workplace, primary and secondary school education, and higher and further education. These drivers reveal an important implication. By recognizing that surroundings influence individuals' decision making, Sport UK implies individual choices are affected by people's social environment (Downward & Riordan, 2007), which would mean individuals' choices are endogenous and fosters the argumentation of the heterodox approach, "which draws on wider social-science literature" (Downward, 2007, p. 636), in order to explain an individual's choice. The implication that an individual's choice is endogenous is specifically of importance to this paper since it means that hosting the summer Olympics could influence the choice of an individual to participate in sports.

The next section will elaborate on underlying economic theories that explain an individual's choice. Creating a solid theoretical foundation is necessary for further analysis and to subsequently increase understanding about the impact hosting the summer Olympics could have on sport participation rates. Important economic theories that explain an individual's choice to participate in sports are the neo-classical approach and the heterodox approach. In addition, special attention will be paid to the socio-psychological theory of planned behaviour. This theory was added since it might help explain factors influencing individuals' choices participate in sports and, therefore, contribute to the understanding of the impact of hosting the summer Olympics on sport participation.

The Neo-classical approach

The neo-classical approach "employ[s] a rational-choice framework to model the individual's maximisation of their subjective utility subject to constraints" (Downward, 2007, p. 635). These constraints can vary for every choice but, in the simplest case, refer to a simple decision: Do I work an extra hour or not? If an individual decides to spend an extra hour on leisure, he or she loses the income he or she would have earned when he or she would have worked. These costs are referred to as "opportunity costs". This model is called the labour-leisure trade of model (Downward, 2007; Downward & Riordan, 2007). In this model, leisure is the residual of work and the opportunity costs are related to the wage. As mentioned, the

model assumes that every individual wants to maximize utility, which means, in terms of sport participation, that the dual decision will be as follows: A rational individual will make the trade-off between "do I work an extra hour and receive additional income but also decrease my utility because I have to work?" and "do I spend my time participating in sports, which will increase my utility, but I miss out on additional income?"

An important paper was written by Nobel Laureate Becker (1965) on the subject of allocation of time. The author proposed a theory in which he differentiates between different kinds of leisure (the time when an individual is not working). The work-leisure trade-off is the same as in the original neo-classical model. Time spent "on work" creates a certain monetary income, while "leisure" is consumption and has certain opportunity costs. However, in the model proposed by Becker (1965), leisure is divided into market goods and free time. The earned income is either spent directly on market goods or spent indirectly by enjoying free time instead of working, also called foregone earnings: "Households will be assumed to combine time and market goods to produce more basic commodities that directly enter their utility functions" (Becker, 1965, p. 495). For example, a person buys a washing machines, saving time, or participates in sports during his or her free time to increase productivity.

Becker (1965) evaluated his model even further by distinguishing between the relative importance of differences in foregone earnings (Time). He noted that the costs of time are not the same for all commodities. Cost of time consists of (1) time used per dollar and (2) costs per unit of time (Becker, 1965). For example, time used per dollar is less for the barber than for schooling, and costs of time are less on weekends when firms are closed. The theory of costs of time implies that costs of time spent on consumption that increases productivity, like sleeping, eating, or additional education have lower opportunity costs since these activities indirectly contribute to earnings. On the contrary, there are also less important foregone earnings, like spending time at a nightclub, which contributes to a lesser extent to future earnings (Becker, 1965). Becker (1965) divided these different foregone earnings into work-oriented and consumption-oriented activities. The theory of allocation of time is summarized in Figure 5.

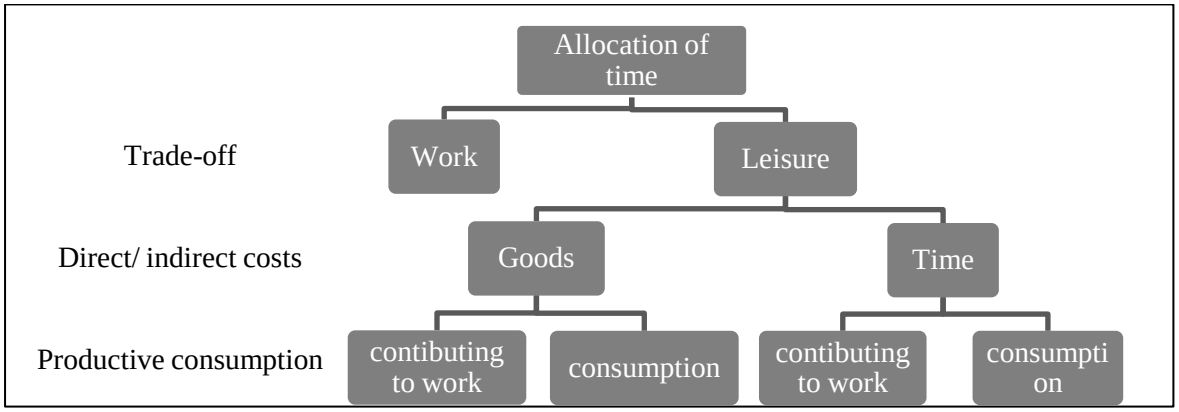

Figure 5: Allocation of time based on a theory of allocation of time (Becker, 1965).

Because of these differences in foregone earnings, it is more difficult to distinguish between work and leisure. Is a business lunch work? Is additional schooling work? Is participating in

sports work? The term "productive consumption" was introduced by Becker (1965) to cover exactly those commodities that contribute to work as well as consumption (leisure). Therefore, it is more comprehensible to note that pure work can be considered limiting joint commodities by not contributing to consumption, and pure consumption can be seen as limiting joint commodities by not contributing to work (Becker, 1965). This trade-off then determines the importance of foregone earnings. The more important the consumption is to work, the less important the foregone earnings associated with this activity because the opportunity costs for these activities are less. See Figure 6 for an illustration.

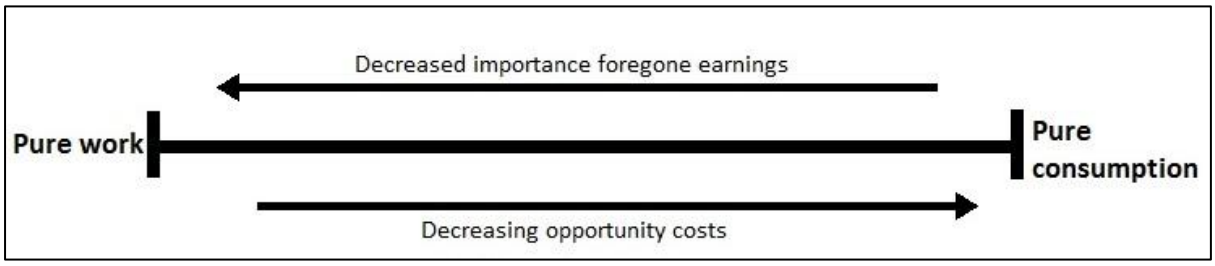

Figure 6: The level of productive consumption determines the importance of foregone earnings and opportunity costs.

Linking this theory of allocation of time to sport participation reveals the increasingly complex trade-off between working or using leisure time to participate in sports. An important question is to which extent is participating in sport productive consumption? When sporting contributes significantly to work, it might be a valuable investment of leisure time because of the low opportunity costs associated with sport participation. Another determining factor is the level of income. Time is more valuable for people with higher incomes; they might choose effective but expensive sports, like going to the gym (since goods are relatively inexpensive compared to time), while lower income households choose less effective, but also less expensive, alternatives like soccer, or even chose to not participate in sports at all since the costs of the goods are too high relative to the costs of their time.

Becker's (1965) theory of allocation of time implies that the choice to participate in sports is more complicated than the simple work-leisure approach of neoclassical economics (Becker, 1965). The heterodox approach broadens the decision-making process by introducing the importance of wider social influences into the decision. This theory was introduced in order to deepen understanding of different factors influencing individuals' choices to participate in sports.

The Heterodox approach

Heterodox economics is "the science of social provisioning process" (Lee, 2008, p. 27). This approach merely aims to explain the involvement of human agency in cultural contexts, and social processes in historical time, as well as how these processes affect consumption patterns (Lee, 2008). This heterodox approach is parallel to the extension of Becker's work (1965). In his 1976 work, he included the characteristics of other agents in his model (Becker, 1976; Downward & Riordan, 2007). According to the theories extension, agents are able to develop desirable characteristics and reduce less desirable characteristics by investing their time and

market goods (Becker, 1976; Downward & Riordan, 2007). For example, an increase in income may cause an individual to reach a higher social class. This higher social class may appreciate other characteristics than the previous class, which would, in theory, lead to a shift in use of time and resources, developing the desirable characteristics and reducing the undesirable characteristics. The development of a person's desirable and undesirable characteristics can be called a "lifestyle", which obviously differs among different social classes (Downward & Riordan, 2007).

These theories lead to the belief that allocation of time, and thus allocation of time into sport participation, is influenced by an individual's social environment. Concerning the particular topic of sport participation, psychological consumption theories, especially, can provide additional explanations for an individual's time allocation. For example, according to Scitovsky (1976), emotions like sensation seeking, anxiety, and or arousal can be put forward as drivers of the demand to participate in sports since individuals are searching for means to balance stimulation and boredom (Downward, 2007; Scitovsky, 1976). Scitovsky (1976) even suggested that utility, unlike in the neoclassical model, is not given. He argued that utility needs to evolve and can be learned (Downward, 2007; Scitovsky 1976). This theory shows similarities to the theory of planned behaviour (Ajzen, 1991). In this socio-psychological paper, Ajzen (1991) proposed a conceptual framework for dealing with the complexities of human behaviour. According to Ajzen (1991), "The theory incorporates some of the central concepts in the social and behaviour sciences, and it defines these concepts in a way that permits prediction and understanding of particular behaviours in specified contexts" (Ajzen, 1991, p. 206). Behavioural intentions are particularly predicted by three concepts: (1) Attitudes toward behaviour, (2) subjective norms toward behaviour, and (3) perceived control of behaviour (Ajzen, 1991). With regard to this study, these concepts refer simply to attitudes toward sport participation, social pressure to participate in sports, and the self-confidence about potential performance in sports. Attitudes toward behaviour could be influenced by hosting the summer Olympics. Influencing the attitude towards certain behaviour can be accomplished by the demonstration effect. The demonstration effect is referred to as an effect "whereby people are inspired by elite sport, sports people or sport events to actively participate themselves" (Weed et al., 2015, p. 197). In other words, the attitude toward sport participation changes positively by hosting the summer Olympics. Attitudes toward behaviour tend to be formed by the attributes, characteristics, or events of a certain activity. These activities are thus associated with costs and benefits, which are reflected in an attitude toward this behaviour. In this way, people favour behaviour with desirable consequences and disfavour activities with undesirable consequences (Ajzen, 1991). Through hosting the summer Olympics, the attitude toward physical activity can change positively if the Olympics are seen by an individual as something that increases the desirability of attributes, characteristics, and events of participating in sport.

Hamilton and White (2008) confirmed the importance of the social environment suggested by Ajzen (1991). They stated that group norms refer to "explicit or implicit prescriptions regarding one's appropriate attitudes and behaviours as a member of a specific reference group in a specific context" (Hamilton & White, 2008, p. 58), which means that normative

influence of people in close social proximity, also called "significant others", greatly influence the behaviour of an individual. Based on the observations an individual makes in a group, that individual wants to reproduce similar behaviour as observed in the group; in this sense, an individual is categorized as a group member (Hamilton & White, 2008). This idea coincides with the "lifestyle" mentioned before in which an individual develops characteristics that are desirable according to his or her social class. Recent literature proves that influences of group norms improves intentions to engage in regular exercise (Johnston & White, 2003; Terry & Hogg, 1996). Having friends who actively participate in physical activities is also important to participation in physical activity, at least for adolescents (Hamilton & White, 2008).

These theories lead to the belief that the thriving places put forward by Sport England (2004), i.e., the home, the community, the workplace, primary and secondary school education, and higher and further education, could indeed create an environment with subjective norms influencing the behaviour of the individuals attending these places, effectively creating an environment in which individuals increase utility by participating in sports in order to satisfy their desire to fit in as group members. Hosting the summer Olympics could contribute to this strategy through the demonstration effect and subsequent changes in attitude toward sport participation. Nevertheless, socio-psychological theories seem to confirm Downward's (2007) statement that not only the choice of an individual is endogenous but utility is as well. Hosting the summer Olympics could help in learning the importance of sports and influence the way a person's utility is shaped.

5.3. Method and Data

5.3.1. Method

In this analysis, the effect of different explanatory variables, and in particular the effect of hosting the summer Olympics, on sport participation was investigated. In order to do this, the logit model was chosen for measurement. In the dataset, the dependent variable is a binary variable. Also, many explanatory variables are binary or categorical variables. Therefore, the logit model was chosen because having a binary or categorical dependent variable violates the linearity assumption in a normal ordinary least squares regression (Zeigler-Hill, 2015), which would make it impossible to use an OLS regression.

The logit regression changes the variable in such a way that it is possible to analyse the association as if it is linear (Zeigler-Hill, 2015). As mentioned, in the dataset, the dependent variable can only have the value 0 or 1. Because the value can only be 0 or 1, a function, F(Y), which takes the [0,1] interval to a real line, was needed. One distribution meeting this requirement is the cumulative normal distribution, which was used in the probit model. Another method is using the logit model, as applied in this research. The logit model transforms the variable by using the following equation:

$$F(\beta 0 + \beta 1X1 + \beta 2X2 + \cdots + \beta kXk) = \frac{\exp(\beta 0 + \beta 1X1 + \beta 2X2 + \cdots + \beta kXk)}{1 + \exp(\beta 0 + \beta 1X1 + \beta 2X2 + \cdots + \beta kXk)}$$

Applying this model to the variables makes it is possible to analyse the non-linear association in a linear way, which makes the Logit model the most comprehensible and appropriate model for the analysis.

The data used in this analysis are panel data, including multiple years (2005-2014), which means the dataset includes multiple measurements on the same individuals over a period of time. Using panel data creates the opportunity to analyse the effects of different explanatory variables across time. In this case, the most appropriate method of measurement is by using fixed effects analysis. When using fixed effect analysis, (1) the dependent variable has to be measured at least two points in time for the same individual and (2) the independent variables have to change over time in order to explain their effect on the dependent variable (Williams, 2015). Both these conditions are met by the data. The advantage of using fixed effects in this analysis is it estimates the within-individual differences, which means that the explanatory variables indicate the effect a change in these variables has on the dependent variable, in this case sport participation. In other words, fixed effects only measures the effect of changes within an individual, not between individuals, which implies that variables that are constant over time will not be subjects of analysis. In some cases, only using changes within an individual, can be seen as a disadvantage since considerable information is lost. For example, it is not possible to measure the effect of race on sport participation. Nonetheless, this disadvantage does not apply to this study since differences between individuals are not particularly relevant for this study. This study focuses on individuals' choices over time and thus investigates the effects of the explanatory variables on sport participation within an individual, meaning that the subject of interest actually are the within differences.

Incidental variable bias is another disadvantage of using the fixed effects specification for the logit model. In case of the fixed effect specification, the maximum likelihood estimator (MLE) can be inconsistent when the length (T) of the panel is fixed (Greene, 2002). With fixed group size, using fixed effects for the logit model leads to biased sample estimators (Greene, 2002). If the number of individuals grows while T remains constant, then the parameters increase at the same rate as the sample size, which inflates the coefficient magnitudes (Allison, 2002; Greene, 2002). In this paper, the incidental variable bias can cause bias in the parameters due to the great sample size of the data, while the average number of observations is only 2.2. A solution to this problem might be conditional maximum likelihood (Allison, 2002). Using conditional maximum likelihood "removes the dummy variable coefficients from the likelihood function and yields coefficient estimates that are consistent" (Allison, 2002, p. 3). Therefore, fixed effects logit for panel date is used in the form of a conditional logit model.

5.3.2. Variables

Dependent variables

The dependent variable chosen is whether an individual did "sufficient moderate intensity sporting the last week (at least 30 minutes three days of moderate intensity sport)". Other variables included in the survey that explain physical activity are as follows: Whether an individual participated in sporting or physical recreational activities in the previous four

weeks, whether an individual participated in a sport in the previous 12 months, and whether an individual participated in an active sporting activity in the previous four weeks.

This part of the research concerns the impact of the Olympic games on sport participation. Sports that are part of the summer Olympics are all in the active sports category (based on comparison between sports categorised as active in the survey and summer Olympic sports; moderate intensity sporting consists of the same sports as active sports). Since individuals' sport participation was measured, the variable of interest should meet the following two conditions: (1) The variable contains information about sporting activities related to the Olympic games and (2) these activities should be performed on a regular basis. These conditions are best met by the variable of moderate intensity sporting, which have to be performed at least three times a week for 30 minutes. Therefore, the variable explaining "had sufficient moderate intensity sporting the last week (at least 30 minutes three days of moderate intensity sport)" was chosen as the dependent variable.

Independent variables

Different types of explanatory factors can be distinguished in the literature on sport participation. Social factors, occupational factors, and educational factors are mentioned in different academic papers as means to explain sport participation (Kimball & Freysinger, 2003; Klostermann & Nagel, 2014; Yang et al, 1999). McPherson (1984), who wrote an extensive review on articles investigating sport participation, explained the importance of social environment as follows:

> Since leisure requires discretionary time and income, leisure life styles are influenced by the varying demands and responsibilities of family, school, and work, by cultural changes in ethics, values, and norms concerning the meaning and function of work and leisure, and by such personal characteristics as marital status, education, occupation, place and type of residence, religion, ethnicity, gender, and health status (p. 219).

Yang et al. (1999) acknowledged these factors in their paper. They included age, place of residence (rural or urban), number of children, marital status, education (three categories), and occupation (four categories) (Yang et al., 1999). Race is of importance, according to Kimball and Freysinger (2003), but will not be included in this research since it does not change over time. Income factors can be of importance because individuals with lower income can see sports as a means to increase social class, especially through professional sports (Kimball & Freysinger, 2003; Sage, 1998). Working time (full time/part time) could also be of influence on the choice to actively participate in sporting activities (Yang et al., 1999).

Taking all of these factors into account led to the following model:

$$PARTICIPATION = \beta_0 + \beta_1 nADULTS_{it} + \beta_2 AGE_{it} + \beta_3 nCHILDREN_{it} + \beta_4 EDUC_{it} + \beta_5 LIV2GETHER_{it} + +\beta_6 FULLTIME_{it} + \beta_7 EMPLOYED_{it} + \beta_8 VEHOWNER_{it} + \beta_9 WELFARESTATUS_{it} + \beta_{10} URBAN_{it} + \beta_{11} INCOME_{it} + \beta_{12} Olympic_{it} + \alpha_i + u_{it}$$

$$\text{PARTICIPATION} = \frac{\exp(\beta 0 + \beta 1\text{nADULTSit} + \beta 2\text{AGEit} + \beta 3\text{nCHILDRENit} + \beta 4\text{EDUCit} + \beta 5\text{LIV2GETHERit} + +\beta 6\text{FULLTIMEit} + \beta 7\text{EMPLOYEDit} + \beta 8\text{VEHOWNERit} + \beta 9\text{WELFARESTATUS it} + \beta 10\text{URBANit} + \beta 11\text{INCOMEit} + \beta 12\text{Olympic1it} + \alpha i + \text{uit})}{1 + \exp(\beta 0 + \beta 1\text{nADULTSit} + \beta 2\text{AGEit} + \beta 3\text{nCHILDRENit} + \beta 4\text{EDUCit} + \beta 5\text{LIV2GETHERit} + +\beta 6\text{FULLTIMEit} + \beta 7\text{EMPLOYEDit} + \beta 8\text{VEHOWNERit} + \beta 9\text{WELFARESTATUS it} + \beta 10\text{URBANit} + \beta 11\text{INCOMEit} + \beta 12\text{Olympic1it} + \alpha i + \text{uit})}$$

There are two additional variables included in the model that were not mentioned in the described literature. The first is vehicle owner, which can be of importance to overcome problems with large distances between the home and the sporting facilities. A dummy variable for the Olympic games, which is 0 pre-2012 and 1 for post-2012, was also included.

5.3.3. Data

The data used to analyse the impact of hosting the summer Olympics in London on the sport participation in the United Kingdom is survey data. The department for culture, media, and sport (DCMS) publishes this data since 2005/2006. The survey carries the name Take Part and is the first kind of consistent high quality data that contains in-depth socio-demographic information of respondents, as well as respondent information on many aspects of leisure, culture, and sport in England (Department for Culture, Media and Sport, 2015). The survey is led by the DCMS and three partners, Arts Council England, Historic England, and Sport England. According to DCMS (2015) the aim of the survey is "to improve the current knowledge base of engagement and non-engagement in culture, leisure and sport by gathering quality-assured data on participation, attendance, attitudes and related factors across the many sectors covered by the DCMS" (n.p.). The survey was hold for 10 consecutive years and contains the data of 10,355 adults, 829 children aged between 11 and 15, and 1040 children aged between 5 and10 (UK dataservice, 2015). The data was gathered by TNS BMRB, which is a leading social research company in Britain. The interviews were held face-to-face at the home of the respondent. The method TNS BMRB applied is computer assisted personal interviewing (CAPI), in which a person answers questions on a personal computer and is guided in the process by a professional.

Creating the dataset

Nine different datasets were used, from 2005-2006 to 2013-2014, which means all of these datasets had to be merged in order to perform a time series analysis. Due to the size of the dataset (more than 2047 variables), it was not possible to import them into Stata directly. Therefore, variables and corresponding names had to be determined before loading the complete dataset into Stata. Using this approach, it was possible to load only the variables into Stata that were needed for the analysis. Specific subsets including the necessary variables were created for every year in the survey. These were exported into excel format to easily construct the dataset. All subsets were merged into one excel dataset containing all nine years of the survey. Adjustments were made for some variables to have the right format. The most

important adjustment was when a respondent answered a question with "I don't know" or "no opinion", these answers had to be adjusted in the dataset from "-2" and "-3" to "no value". After these manual adjustments, the dataset was loaded into Stata to make the final adjustments. There were some duplicates in the dataset, which identified and dropped. After those final adjustments, the dataset contained 25 variables, including 134,189 observations. The variables are explained in Table 15. The descriptive statistics of the variables are in Appendix D.

Table 15: Explanation of variables. (Source: Taking Part survey.)

Variable name	**Variable description**
WELFARESTATUS	Categorical variable for welfare status of the respondent: 1. Wealthy Achievers 4.Moderate means 2. Urban prosperity 5. Hard-pressed 3. Comfortably off
AGE	Continuous variable for the age of the respondent
URBAN	Binary variable for the living environment of the respondent: 0 = Rural, 1 = Urban
EDUC	Binary variable for education attained by the respondent: 0 = did not follow education
FULLTIME	Binary variable for working intensity of the respondent: 0 = part-time 1 = full-time
INCOME	Categorical variable for income of the respondent: 1. Under £2,500 7. £25,000 up to £29,999 2. £2,500 - £4,999 8. £30,000 up to £34,999 3.C £5,000 - £9,999 11 9. £35,000 up to £39,999 4. £10,000 up to £14,999 10. £40,000 up to £44,999 5. £15,000 up to £19,999 11. £45,000 up to £49,999 6. £20,000 up to £24,999 12. £50,000 or more.
LIV2GETHER	Binary variable for living together/alone: 0 = alone, 1 = living with someone
PARTICIPATION	Binary variable for sport participation: 0 = had no sufficient moderate intensity sporting in the previous week (at least 30 minutes three days of moderate intensity sport), 1 = had sufficient moderate intensity sporting in the previous week (at least 30 minutes three days of moderate intensity sport)
nADULTS	Continuous variable for number of adults in the household
nCHILDRENDREN	Continuous variable for number of children in household
OLYMPIC	Binary variable to separate years before and after the summer Olympics: 0 = year 1-6, 1 = year 7-9
EMPLOYED	Binary variable for employment: 0 = unemployed, 1 = employed
VEHOWNER	Binary variable for owning a vehicle: 0 = no vehicle, 1 = owns vehicle

5.3.4. Model specification.

Before the analysis could be performed, it was necessary to conduct a series of statistical tests in order to check whether the specified model meets the necessary requirements in order to be consistent and reliable.

The correlation table (Table 16) shows correlation between different variables is low. There is a moderate correlation between AGE and EMPLOYED (0.45). This value of 0.45 is not high enough to exclude one of those variables, especially since these variables explain different phenomena, which means there was no need to exclude any of the variables from the model to reduce the risk of multicollinearity.

A Wald test was performed to test whether the included variables were a statistically significant improvement of the model. The result of the test is that H0: coefficients are simultaneously equal to zero can be rejected, which indicates that none of these included variables should be removed from the analysis since all variables significantly improve the model. The results are presented in Appendix I.

Furthermore, autocorrelation was tested for. The results of the test are specified in Appendix E. H0: no first-order autocorrelation cannot be rejected, which means the data does not suffer from serial correlation.

Finally, a Hausman test was performed in order to check whether the fixed effects method is empirically preferred over the random effects model. The Hausman test tests the hypothesis if the differences in the coefficients are not systematic. If H0 cannot be rejected, the random effects model is more efficient. According to the Hausman test, H0 cannot be rejected, which means differences are systematic and using fixed effects is the appropriate method. The results of the Hausman test are presented in Appendix H.

The final specification of the fixed effects logit for panel data, which is used in the form of a conditional logit model, is specified according to the equation presented below. The descriptive statistics of the model are presented in Appendix D.

$$\text{PARTICIPATION} = \frac{\exp(\beta 0 + \beta 1\text{nADULTS}it + \beta 2\text{AGE}it + \beta 3\text{nCHILDREN}it + \beta 4\text{EDUC}it + \beta 5\text{LIV2GETHER}it + +\beta 6\text{FULLTIME}it + \beta 7\text{EMPLOYED}it + \beta 8\text{VEHOWNER}it + \beta 9\text{WELFARESTATUS}\,it + \beta 10\text{URBAN}it + \beta 11\text{INCOME}it + \beta 12\text{Olympic1}it + \alpha i + uit)}{1 + \exp(\beta 0 + \beta 1\text{nADULTS}it + \beta 2\text{AGE}it + \beta 3\text{nCHILDREN}it + \beta 4\text{EDUC}it + \beta 5\text{LIV2GETHER}it + +\beta 6\text{FULLTIME}it + \beta 7\text{EMPLOYED}it + \beta 8\text{VEHOWNER}it + \beta 9\text{WELFARESTATUS}\,it + \beta 10\text{URBAN}it + \beta 11\text{INCOME}it + \beta 12\text{Olympic1}it + \alpha i + uit}$$

Table 16: Correlation table for sport participation.

	PARTICIPATION	nADULTS	AGE	nCHILDREN	EDUC	LIV2GETHER	FULLTIME	EMPLOYED	VEHOWNER	WELFAR STATUS	URBAN	INCOME	OLYMPIC
PARTICIPATION	1												
nADULTS	0.07	1											
AGE	-0.19	-0.29	1										
nCHILDREN	0.04	0.08	-0.4	1									
EDUC	-0.16	-0.14	0.37	-0.13	1								
LIV2GETHER	0.02	0.41	0.02	0.18	-0.1	1							
FULLTIME	0.02	-0.03	0.01	-0.1	-0.05	0.01	1						
EMPLOYED	0.14	0.17	-0.45	0.14	-0.35	0.16	-0.01	1					
VEHOWNER	0.11	0.29	-0.11	0.07	-0.27	0.37	0.03	0.29	1				
WELFARSTATUS	-0.09	-0.09	-0.1	0.07	0.19	-0.18	0	-0.09	-0.28	1			
URBAN	-0.03	-0.02	-0.1	0.04	0.03	-0.09	0.01	-0.01	-0.15	0.27	1		
INCOME	0.13	-0.02	-0.05	0.01	-0.26	0.16	0.31	0.44	0.23	-0.23	-0.05	1	
OLYMPIC	0.02	0	0.05	-0.03	-0.05	0.01	-0.01	-0.02	0.01	-0.01	0	0.03	1

5.4. Results

5.4.2 Regression analysis

In this part of the case study, the impact of hosting the 2012 summer Olympics in London on sport participation in the United Kingdom is presented.

Regression results of the model on sport participation are presented in Table 17. Many observations were dropped because there was no difference in the dependent variable or because there was only one observation, which were the two conditions to be able to perform fixed effects analysis. In total, 8066 individuals were analysed, each having a minimum of two observations and a maximum of six observations. The average number of observations is 2.2.

Table 17: Measures of fit for the logit of PARTICIPATION.

Measures of Fit for logit of PARTICIPATION			
Log-Lik Intercept Only:	-5446.689	Log-Lik Full Model:	-4773.701
D(6713):	9547.403	LR(12):	1345.976
McFadden's R2:	0.124	Prob > LR:	0
ML (Cox-Snell) R2:	0.181	McFadden's Adj R2:	0.121
Count R2:	0.637	Cragg-Uhler(Nagelkerke) R2:	0.226
AIC:	1.423	AIC*n:	9571.403
BIC:	-49618.208	BIC':	-1240.212
BIC used by Stata:	9663.09	AIC used by Stata:	9571.403

Table 17 shows the measures of fit. Since there is only one model, it was not possible to compare the log likelihood of the model. Therefore, the McFadden R2 was analysed. The closer the McFadden R2 is to zero, the less predictive capacity the model has. For this model, the McFadden R2 is 0.126. A McFadden R2 between 0.2 and 0.4 is seen as an extremely good fit (Lee, 2013). Thus, 0.126 can be seen as reasonable. Nonetheless, McFadden R2 should be interpret cautiously since it does not give information about the explained variance, but instead measures changes in likelihood and related quantities, which have no obvious interpretation (Orgtheory, 2008).

The results are presented in terms of odds ratios. The odds ratio indicates the change in odds with regard to the dependent variable from switching from one state to the other. In this case, this indication is the change in odds of a person participating in active sports. Using odds ratios makes interpretation more comprehensible and easier to understand than using coefficients. The confidence interval chosen was 1% unless indicated otherwise.

Results, presented in Table 18, show that the number of adults (nADULTS) in a household does not significantly increase/decreases the odds of an individual participating in sports. An increase in age (AGE) significantly decreases the odds of participating in sports by 2.9% for

every additional year, ceteris paribus. The number of children (nCHILDREN) in a household significantly decreases sport participation by 10% for every additional child in the household, ceteris paribus. Having higher education (EDUCATION) significantly decreases odds of an individual participating in sporting activities by 34.5% compared to having no higher education, ceteris paribus. People living together (LIVE2GETHER) significantly (CI = 5%) decreases the odds of an individual participating in sports by 8.6% compared to people who do not live together, ceteris paribus. There is no significant difference in odds for people who work full-time (FULLTIME) and part-time regarding sport participation. There is also no significant difference in the odds of participating in sport between people who are employed and unemployed (EMPLOYED). Having a car at one's disposal (VEHOWNER) significantly increases the odds of an individual participating in sport by 32% compared to individuals having no car, ceteris paribus. A decrease in welfare status (WELFARESTATUS) significantly decreases the odds of an individual participating in sports by13.1% for every decrease in welfare status, ceteris paribus. Living in an urban area (URBAN) decreases the odds of an individual taking part in sporting activities by 15.4% compared to living in a rural area, ceteris paribus. An increase in income category (INCOME) significantly increases the odds of an individual participating in sports by 6.6% per increased income category, ceteris paribus.

The most interesting variable in the regression analysis is that which explains the effect of hosting the summer Olympics on sport participation: OLYMPIC. As shown in Table 18, the dummy variable for hosting the summer Olympics is not significant, which means there is no significant increase/decrease in odds of individuals participating in sports due to the summer Olympics.

Table 18: Impact of hosting the London 2012 summer Olympics on sport participation in the UK.

Variables	**Conditional Logit (fixed effects)**
PARTICIPATION	
nADULTS	0.97
	(-1.18)
AGE	0.972***
	(-18.81)
nCHILDRENDREN	0.903***
	(-4.54)
EDUC	0.655***
	(-7.44)
LIV2GETHER	0.914*
	(-1.98)
FULLTIME	0.941
	(-1.37)
EMPLOYED	1.021
	-0.41
VEHOWNER	1.320***
	-4.84
WELFARSTATUS	0.869***
	(-9.00)
URBAN	0.846**
	(-3.11)
INCOME	1.066***
	-8.51
OLYMPIC	1.028
	-0.51
Constant	-
Observations	15377

Exponentiated coefficients; *z* statistics in parentheses
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

5.4.2. Implication of the results

The results are explicit about the effect of hosting the summer Olympics in London in 2012 on the sport participation rates of the United Kingdom. There is no significant effect of hosting the summer Olympics on sport participation of individuals living in the UK. This result does not mean there is no increase in sport participation rates in the UK. Sport participation in the United Kingdom increased from 19.5% in 2005 to 23.7% in 2014 (Figure 7). However, according to the results of this case study, the increase in sport participation rates are not attributable to hosting the summer Olympics in London 2012.

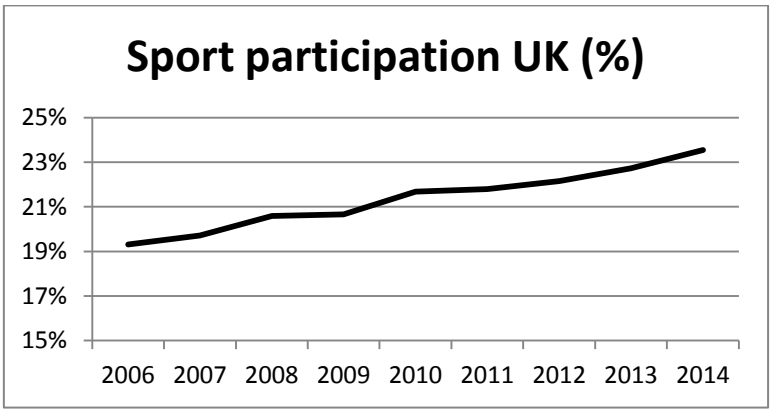

Figure 7: Development in sport participation for United Kingdom (2005-2014). (Source: Tak4 Part survey).

Furthermore, the results provide important implications regarding the theories of allocation of time and the psychological consumption theories, as discussed in the theory section. Results show that when time is more valuable to an individual, in other words the individual has a higher education, he or she does not participate in sports as much as individuals who do not have higher education. On the contrary, results for variables directly related to income show the opposite results: Decreasing odds for sport participation for lower welfare classes. According to the theory, higher welfare classes may have "learned" the importance of sporting or are aware of their desirability to participate in sports because of social pressure by close friends or because it fits their "lifestyle" (Downward & Riordan, 2007; Johnston & White, 2003; Terry & Hogg, 1996). The results are the same for an increase in income, which also increases the odds of participating in sports. This ambiguity in the effect of the value of an individual's time might indicate the complexity of predicting the effect of increased income as suggested by Becker (1965):

> The effect of an uncompensated increase in earnings on hours worked would depend on the relative strength of the substitution and income effects. The former would increase hours, the latter reduce them; which dominates cannot be determined a priori. (p. 502)

According to the results, social factors do significantly influence the behaviour toward sport participation. For example, having children or living together consumes time that cannot be spent on participating in sports, subsequently decreasing the odds of sport participation. That choices are influenced by social factors implies that individuals' choices are indeed

endogenous as claimed by Downward (2007). Nevertheless, hosting the summer Olympics is not a factor that influences an individual's choice to participate in sports according to this case study.

6. Discussion and Limitations

6.1. Discussion of the results

The results show mixed results with regard to the effect of hosting the summer Olympics on tourism. There is a negative effect of hosting the Olympics on tourism in the years preceding the Olympics, while the effect is positive during and following the Olympic event. This result is not completely in line with the general consensus on this subject. Most academic literature finds a significantly positive relationship (Kasimati, 2005; Li & Blake, 2009; Li & Jago, 2013; Fourie & Santana-Callego, 2011). This paper can confirm the positive relationship between hosting the summer Olympics and tourism during and following the Olympic event. However, the net effect is negative due to a significant drop in tourism in the period preceding the Olympics. These results provide additional evidence for academic literature proposing the crowding out effect is underestimated when assessing the impact of hosting the Olympics on tourism (Owen, 2005). As mentioned, many papers, including the papers published by the bidding committee itself, make use of more simplified models, like the I-O model. These are known to overestimate the impact of an event like the summer Olympics (Crompton, 1995; Porter & Fletcher, 2008), and the results of this paper confirm this overestimation. Hence, this research provides additional argumentation to increase the attention paid to the crowding out effect when assessing the impact of hosting the summer Olympics on tourism. Future research could be directed toward understanding the role of the crowding out effect. It would be interesting to know the mechanisms behind the crowding out effect and investigate why people refrain from visiting the hosting country in the years preceding the Olympic event.

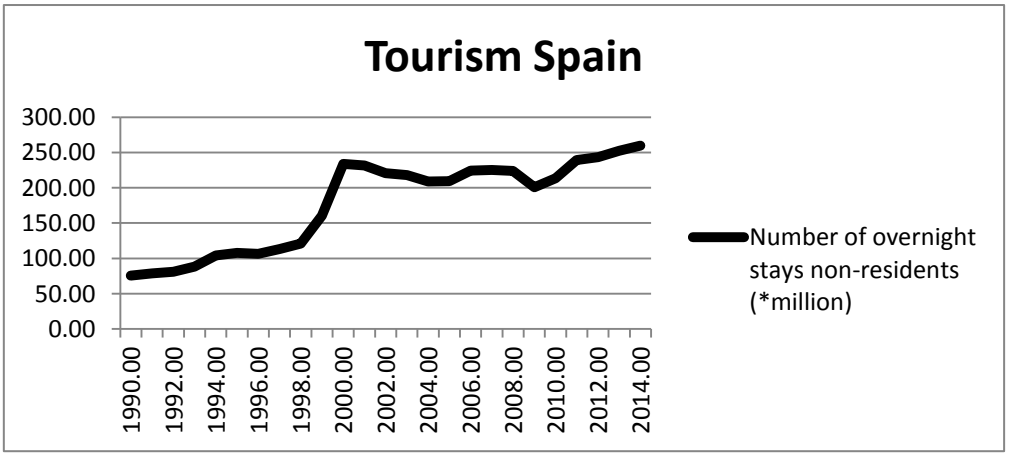

Figure 8: Tourism in Spain measured by overnight stays of non-residents.

Although the results speak for themselves, why the effect attributable to the Olympics is so small remains of interest. It is widely acknowledged that the Olympic games contributed to the success of Barcelona as a vacation destination (Zimbalist, 2015). One of the reasons could be that the dummy variable took only three years, which means for Barcelona the years 1992-1995. According to Figure 8, which explains the number of overnight stays by non-

residents in Spain, an enormous increase occurred between 1998-2000. The number of overnight stays in this period almost doubled. Between 1992 and 1995, this increase is not yet noticeable. However, it seems non-logical to fully contribute this increase to the summer Olympics, which were held five years before the start of the tourism boom. When assessing possible reasons for this steep increase in tourism, policy changes seem to be the major reason. Around 1996, there were some decentralising policies introduced in Spain. In 1995, the regions became autonomous with regard to tourism legislation and, in 1997, the liberalization of telecommunications, land use for urban housing, energy, and tobacco. These liberalizations led to that from 1995 onwards the centralised responsibly of tourist certificates was decentralised and became the responsibility of the autonomous regions (Cánoves et al, 2004), which greatly enhanced the competition between the different regions (Almeida, 2013). In 1997, land use for urban housing were decentralized, making it the responsibility of the autonomous regions to give out construction permits for tourist accommodations (OECD, 1998): "Within this process, the inclusion of the industry in the regional development strategy of every autonomous community meant an important qualitative jump in tourism policy" (Baidal, 2003, p. 335). These changes in price/quality could have resulted in an increase in attractiveness as a vacation destination. These changes could explain the sudden increase in overnight stays from non-residents. The increase in tourism could be better explained by these liberalization policies than by hosting the summer Olympics. Both of these events basically happened in the same timeframe and future research could reveal valuable information regarding the actual relationship between these events.

According to the results of this research, there is no direct effect of hosting the summer Olympics on telecommunication infrastructure. This study is the first to conduct research on the relationship between hosting the summer Olympics and Telecommunication infrastructure. Although former hosts indicate the importance of broadcasting and communication for the success of the Olympic games, this has no effect on the accessibility of the internet for the inhabitants of the hosting country. Since this study was the first research on this subject, it might be that the dependent variable, internet access per 100 inhabitants, was not the right indicator to measure the effect of hosting the summer Olympics on telecommunication infrastructure, especially since the internet access for most countries was already above 90% in 2005. In the future, research could be conducted on the same topic but with the use of another indicator. In addition, the results showed that few macro-economic variables could explain the increase in internet access. Reasons for this might be that internet access is more driven by the force of demand than of supply (Bauer et al., 2002), which could explain why an external event that supports the supply does not increase the internet access as much as regulatory changes in incentives that increase the demand. If this is the case, it might be more related to the theory on individual choice behaviour as explained in the theory regarding the sport participation rates. This would also be an interesting subject to explore in future research.

This study confirms the positive relationship between hosting the summer Olympics and the amount of inward FDI flows. Academic literature suggests that inflow of FDI increases due to an event like the summer Olympics because of the increased attention for a region or

country, which would then eventually result in additional inward FDI flows (Fourie & Santana-Callego, 2011). This paper confirms this line of thought, and the statement is supported by the results. However, although the results showed a statistical significant relationship, it seems unlikely that the effect is solely due to the Olympic event. It seems that the countries that hosted the summer Olympics also benefited from stimulating policies with regard to FDI in the same timeframe as the summer Olympics were held in their countries. Hosting the 1992 Olympic games in Barcelona fit perfectly (on purpose or not) into a long-term strategy of rejuvenating the city of Barcelona and Spain following the reign of dictator Franco (Zimbalist, 2015). It could well be that the first results of the economic transformation of Spain were yielded due to the "global advertisement" of the 1992 summer Olympics in Barcelona. The UK introduced favorable financial tax incentives to increase the attractiveness of the UK as an investment in the years preceding the Olympics. These additional policy changes in the timeframe of the summer Olympics could be conscious or unconscious choices and could be investigated in future research. In a scenario where enough investment opportunities are provided in the years following the Olympics combined with an increasingly attractive business climate in the host country, hosting the summer Olympics is a great way to showcase a region or country. Hence, hosting the summer Olympics is only a piece in a puzzle to make a country or region more attractive for inward foreign direct investments. The extent to which the Olympic event contributes can be investigated more specifically in future research.

The results of the analysis in the case study on the impact of hosting the 2012 summer Olympics in London on UK sport participation are quite explicit. No significant evidence for a positive relationship between hosting the 2012 summer Olympics in London and UK sport participation was found. While UK sport participation did increase over the last years (from 19.5% in 2005 to 23.7% in year 2014), according to this research, none of this increase is significantly related to hosting the 2012 summer Olympics in London. Nonetheless, this research makes important contributions to the understanding of human behaviour with regard to sport participation. Results confirm that individuals' choices to participate in sports are endogenous, as proposed by previous academic literature (Downward, 2007). This finding means that it is possible to influence an individual's choice to actively participate in sports, e.g., social factors like having children influence the decision-making process of participating in sports. Still, there is some ambiguity in the valuation of the time of individuals. Thus, the results of this paper can be seen as confirmation of the complexity of the choice of individuals. It is widely recognized that it is hard to determine the impact *a priori* because of this complexity (Becker, 1965, 1976), and this paper adds to this viewpoint. A statement reflected by the results of this paper is that there is no significant evidence of an impact of hosting the summer Olympics on sport participation in case of the 2012 summer Olympics in London. However, since the human choice behaviour has been proved to be endogenous, it might be possible to increase sport participation in the future with the help of the summer Olympics. This goal was not accomplished by the bidding committee of London for 2012 but remains a challenge for potential future host with the same ambitions.

The results of the effect of hosting the summer Olympics on the local economy seem satisfying when presented on their own. However, the results can be disappointing when compared to the costs of hosting the summer Olympics and the expectations generated by the Olympic bidding committee. An overview of the goals and the accomplishments are given in Table 19.

Table 19: Goals and accomplishments of bidding committees for Barcelona, Athens, and London.

Goals	*Accomplished*
Increase attractiveness for tourists (measured in number of tourists) pre-Olympics.	X
Increase attractiveness for tourist (measured in number of tourists) post-Olympics.	V
Increase telecommunication infrastructure (measured in internet access) pre-Olympics.	X
Increase telecommunication infrastructure (measured in internet access) post-Olympics.	X
Increase economic growth (measured in FDI) pre-Olympics.	V
Increase economic growth (measured in FDI) post-Olympics.	V
Increase in sport participation in the UK (measured in weekly activity).	X

Table 19 shows that only half of the goals set by the bidding committees were accomplished, which raises the question of whether hosting the summer Olympics is the most efficient catalyst or tool to enhance economic prosperity in the country, especially when taking the costs into account. At least eight billion euros of public money is invested into each of the Olympic games. Hence, the question arises as to whether this public money is spent in the most efficient way. In addition to economic benefits, there are potential other benefits that are harder to measure, such as fun or happiness. People might be willing to pay for an event in order to increase their feeling of wealth or happiness. These incentives could be investigated in future research; A potential method could be a contingent valuation method (CVM approach), which could give insight into the inhabitants' willingness to pay with respect to hosting the summer Olympics.

6.2. Limitations.

6.2.1 Internal validity

The research was conducted on a country level. However, in most of the cases, the Olympics are hosted and advertised by one city. It may be that hosting the Olympics is mainly beneficial to this host city instead of to the country as a whole. Since there was not enough NUTS2 data available, it was not possible to conduct this analysis within this research. However, it might be an interesting subject for future research to rerun the analysis on a NUTS 2 level whenever there is enough data available.

The research used the fixed effects model within the OLS framework for the analysis. An advantage of using fixed effects is that it greatly reduces the chance of omitted variable bias. Although many things are done (for example, a literature review for independent variables and adding variables not yet tested in literature but that could intuitively have an effect on the dependent variable and applying the fixed effects model) in order to reduce the chances of omitted variables, it is impossible to say with absolute certainty that all factors are accounted for. When there are omitted variables, the results are biased and effects could be larger or smaller than presented.

The variables in the research were tested on normality by analysing their normal probability plots. There were no variables that clearly did not follow a normal distribution. However, there were some variables that were skewed or imperfectly normally distributed. The results could be slightly affected by these skewed variables since the calculations of the confidence intervals and significance are based on the normal distribution.

According to the tests for heteroscedasticity, there is heteroscedasticity in the models on tourism and telecommunication infrastructure. This heteroscedasticity does not bias the coefficients, but it could lead to an underestimation of the standard errors of the coefficients, which increases the chance of a type 1 error and some variables may be significant while they are actually irrelevant. The research tried to minimize the heteroscedasticity by clustering on panel ID and transforming the variables to logarithms. However, the results could still be influenced by heteroscedasticity.

This research assumed that the slope of the variables is constant across time. The theory suggests the slopes might be heterogeneous due to cultural and institutional differences across time and countries. Nevertheless, the homogeneity of the slopes may be a justifiable assumption since the DFE estimator is preferred over the MG estimator (which allows for heterogeneous slopes across time). The Hausman test showed that, for every model, the differences between the DFE model and MG model were not systematic, which led to the choice of the DFE model.

The data on the analysis on sport participation had an average of 2.2 observations per individual, which indicates that many individuals were measured at only two points in time. Since the Take Part survey has quite specific questions, it could be that having only two points in time does not represent the overall profile of an individual through the years, which could lead to results that are over- or underestimated.

In the analysis on sport participation, the coefficients could be inflated due to the incidental variable bias. In order to decrease this problem, conditional logistic regression was used.

6.2.2. External validity

This research aimed to analyse the impact hosting the Olympics had on the local economy. The aim was to isolate certain economic effects of hosting the Olympics in order to increase the understanding of economic consequences of hosting the summer Olympics. The study set out to test the claims of bidding committees of past summer Olympics and test whether they are legitimate by giving an objective review of the accomplished goals and economic effects

of past hosts. In this way, the research should help in the decision process of whether a city or country should enter the bidding process.

In order to secure the external validity, the data and method were selected to a maximum extent of homogeneity between former and future hosts. Still, there are some limitations to the data that could have decreased the external validity of the conducted research. Firstly, the data chosen were from countries that it is justified to assume follow the same economic development because all of the selected countries were part of the European Union in 1987. Although these countries are similar, there are also some differences. For example, the Netherlands would be more comparable to Finland (which is not in the dataset) than to Greece. Also, the economic cycle of Great Britain is sometimes said to differ from other European countries (Foster, 2002). These differences could be a threat to the external validity of the results. Secondly, the analysis was conducted on a country level. Some countries are larger than others, and some hosting cities have greater economic weight on their countries than others. It would be valuable if the analysis was conducted on a NUTS2 level; unfortunately, this data was unavailable. Finally, the results on sport participation contribute to the literature on individual's choice, which is universal (Becker, 1965, 1976; Downward, 2007). However, there could be differences in the individuals' choices regarding sport participation between different countries. Results show that the willingness to actively participate in sports is endogenous, which means it is also likely that local culture influences this choice. The fact that sport participation is endogenous could lead to different results in different countries and, therefore, is a threat to the external validity.

7. Conclusion

In this paper, the effect of hosting the summer Olympics on the local economy of European countries was investigated. The local economy is defined by four measures: Tourism (measured by overnight stays by non-residents), telecommunication quality (measured by internet access per 100 people), foreign direct investments (measured by foreign direct investment stock), and sport participation (measured by weekly sporting activities in the UK). The research was conducted in two separate parts. First, the effect of hosting the summer Olympics on to tourism, telecommunication infrastructure, and foreign direct investment was measured. The data consisted of mainly macro-economic variables, which were analysed by using three different estimators: The fixed effects estimator, the dynamic fixed effects estimator, and the corrected least square dummy estimator. Thereafter, the effect of hosting the summer Olympics on sport participation rates in the United Kingdom was measured. Survey data was provided by the Take Part survey, which was held by the Department for Culture, Media and Sport. A logistic regression with fixed effects specification was used to analyse the effect of hosting the summer Olympics on sport participation rates.

The results show that hosting the summer Olympics contributes to a decrease in overnight stays in the years preceding the Olympic event.
This loss is compensated for in tourism by an increase in overnight stays during and following the summer Olympics. Nevertheless, the net result on tourism is negative. With regard to telecommunication infrastructure, no significant relationship between hosting the summer Olympics and telecommunication infrastructure with respect to internet access was found. Foreign direct investment stocks were significantly positively stimulated by hosting the summer Olympics. The FDI stocks increased significantly before and after the Olympic event. On the contrary, there was no statistical evidence found for an increase or decrease in sport participation rates due to the summer Olympics.

With those answers for the different sub-questions in mind, it is possible to answer the main question: What is the effect of hosting the summer Olympics on A European country's local economy? There are positive economic effects due to hosting the summer Olympics, especially with regard to FDI. However, there are a few major drawbacks revealed by this study. The first is that the expectations and promises made by bidding committees cannot be matched by the actual economic benefits of hosting the summer Olympics, according to this study. Secondly, the crowding out effect for tourism in the years preceding the Olympic event might be larger than the positive stimulus for tourism in the years following the Olympic event. Third, the FDI stock increase might be due to additional policies implemented by local institutions in the same timeframe as the Olympics event. Complementary plans and policies seem to help maximize the impact of hosting the summer Olympics on FDI stocks. However, the actual division of the effect of the Olympics and these additional policies remains rather opaque. Finally, the costs of the summer Olympics are high, and in the past, much of these costs have been paid for by public money. One of the questions a potential host should ask itself is whether these conclusions are convincing enough to justify the public investment of around eight billion euros. There are considerable opportunity costs involved in organising

the summer Olympics. Other policy measures of investments might be more efficient than hosting the summer Olympics in order to accomplish a country's economic goals. Subsequently, a question that remains legitimate after this study is whether hosting the summer Olympics is the most efficient and adequate catalyst for positive change in the presented measures. The public might be willing to pay for the Olympics since it may increase their welfare or happiness. The amount that a society is willing to pay regardless of economic benefits cannot be estimated without objective research. This research can be conducted, for example, by using the CVM approach in the future.

With regard to the results of this paper, the promises made by bidding committees are not justifiable and the economic effect they predicted overestimated the actual impact. These findings adds to existing literature stating that many predictions by bidding committees overestimate the results. This paper was one of the first papers to investigate the effect of hosting the summer Olympics on telecommunication infrastructure, FDI, and sport participation. In that sense, this paper fills the gap in literature by adding objective and autonomous research on the effect of hosting the summer Olympics to the literature on the Olympics. The paper contributes to the literature on human choice behaviour since it found significant evidence that the choice to actively participate in sport is endogenous. Therefore, the challenge remains to stimulate sport participation through hosting the summer Olympics. However, no evidence for increased sport participation due to hosting the summer Olympics in London 2012 was found. Furthermore, questions regarding some of the effects (for example, the effect of hosting the summer Olympics on FDI), which could not be answered due to the scope and time constraints of this study, remain but might be answered in future research. Final conclusions from the results of this paper are that it seems that hosting the summer Olympics is more an extremely expensive catalyst for existing economic policies than a tool to accomplish economic prosperity on its own.

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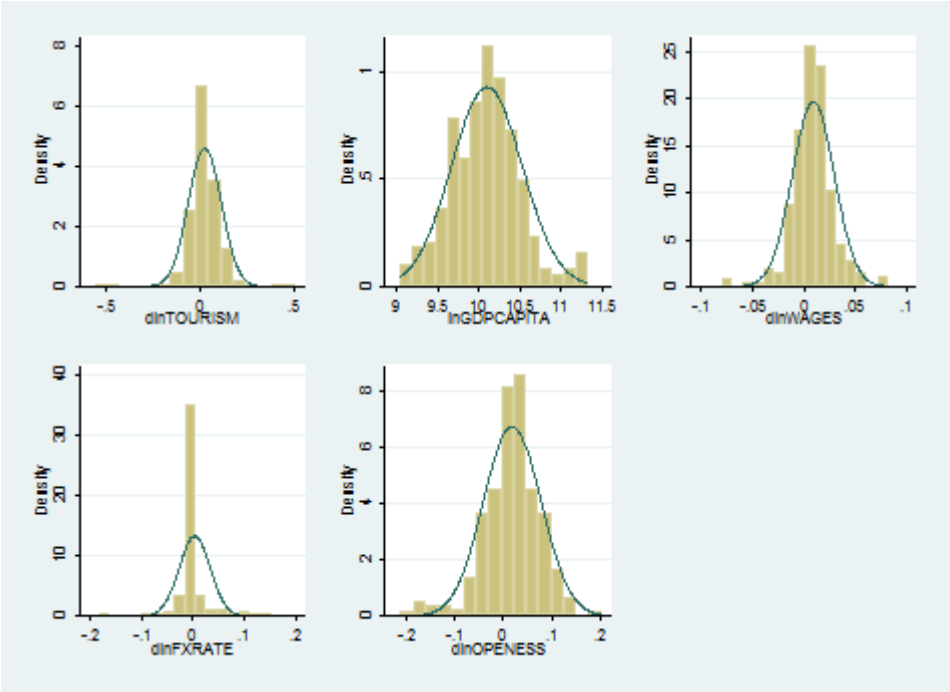
10. Appendix.

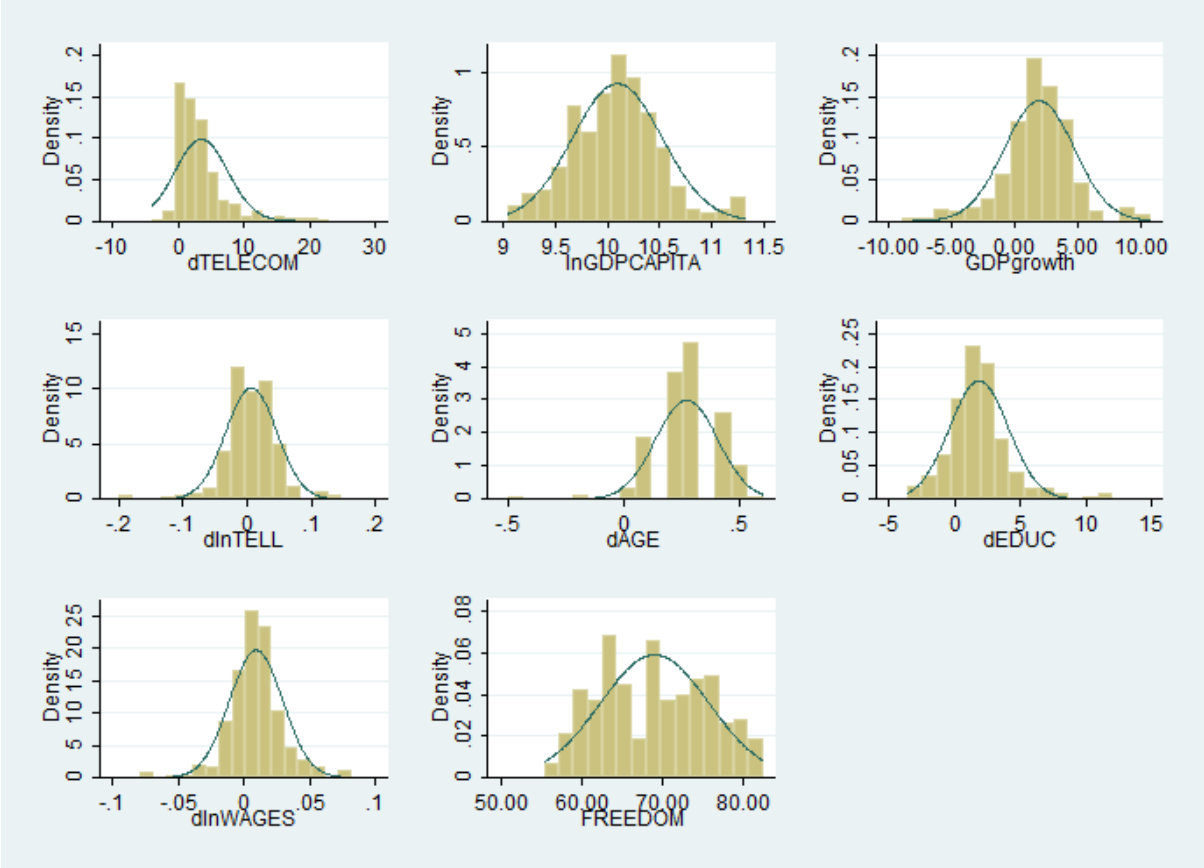
10.1. Appendix A: Histograms.

Visual inspection of the normality of the variables.

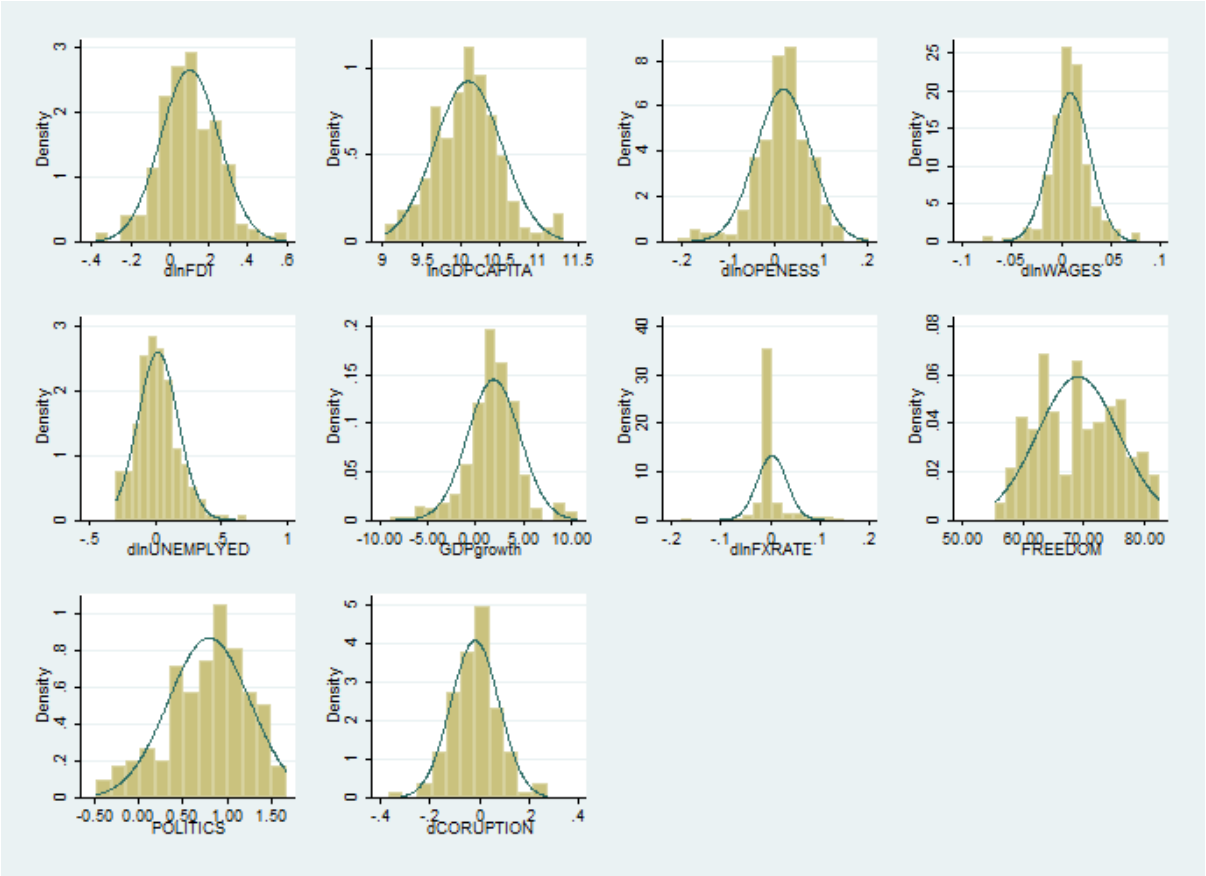
Histogram 1: Variables for analysis on tourism.



Histogram 2: Variables for analysis on Telecommunication Infrastructure.

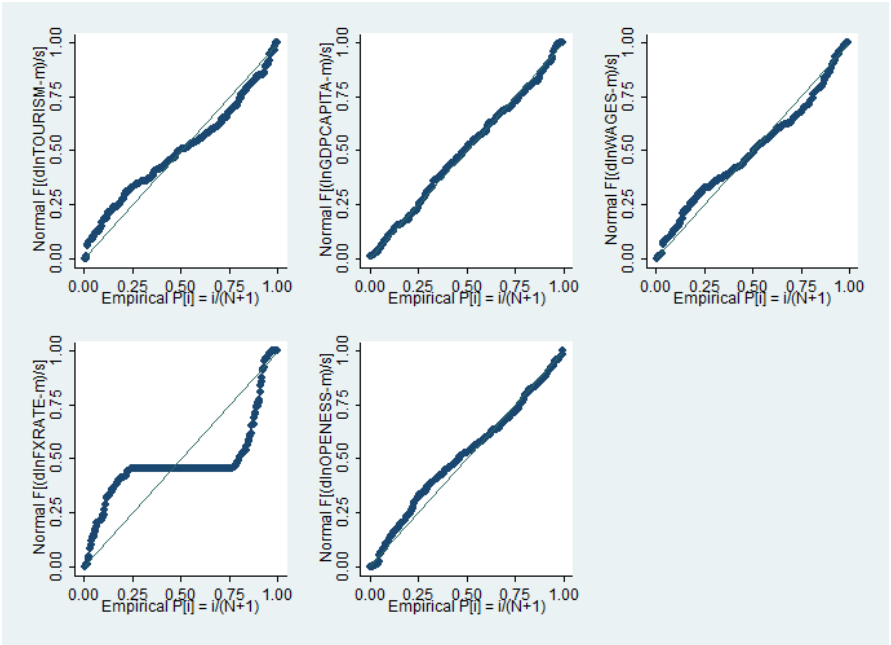


Histogram 3: Variables for analysis on Foreign Direct Investment.

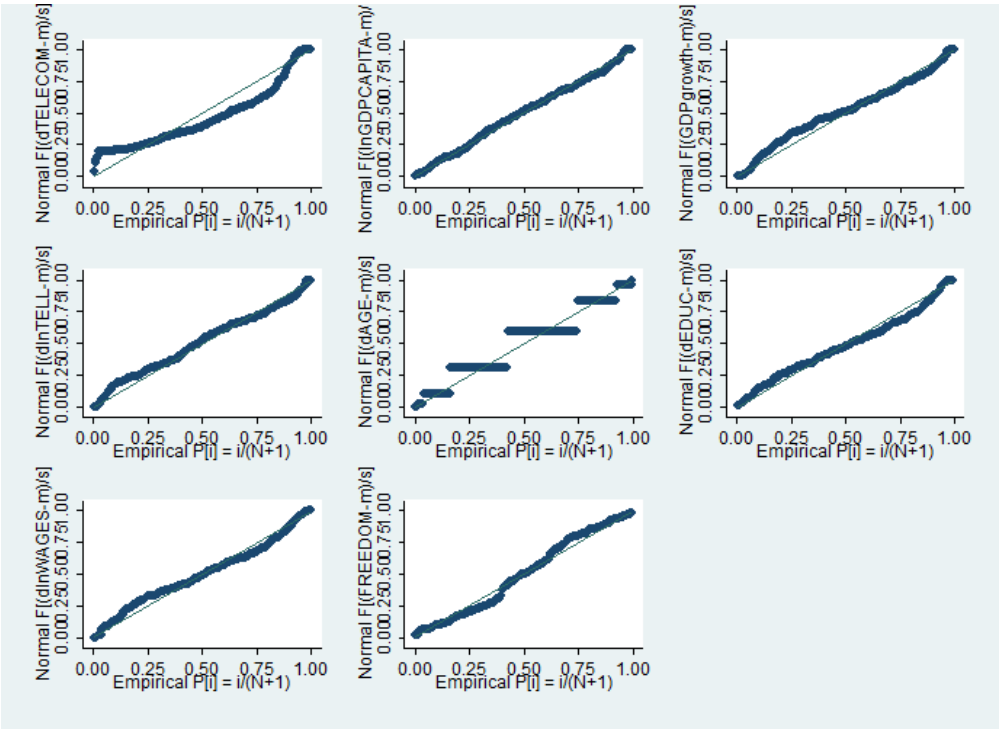


10.2. Appendix B: Normal probability plots.

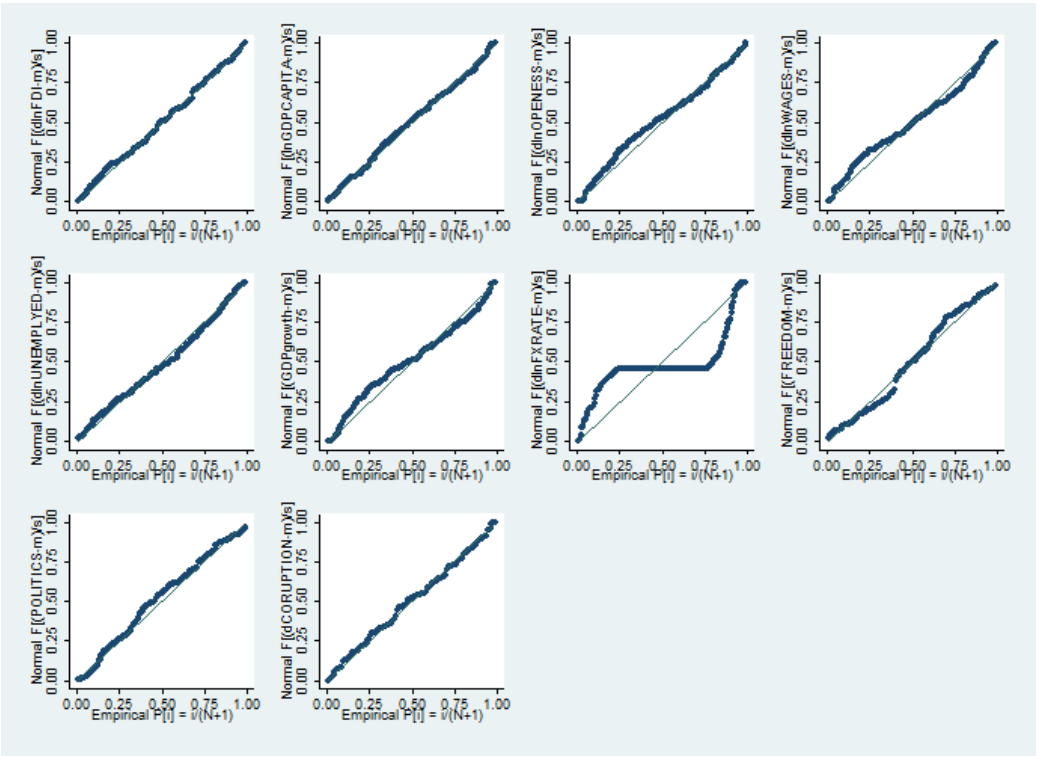
Normal probability plot 1: Variables for analysis on Tourism.



Normal probability plot 2: Variables for analysis on Telecommunication Infrastructure.



Normal probability plot 3: Variables for analysis on Foreign Direct Investment.



10.3. Appendix C: Correlation tables.

Correlation table 1: Tourism.

	dlnTOURISM	lnGDPCAPITA	dlnWAGES	dlnFXRATE	SCHENGEN	dlnOPENESS	lnPRICELEVEL	OLYMPIC1	OLYMPIC2
dlnTOURISM	1								
lnGDPCAPITA	-0.098	1							
dlnWAGES	-0.141	-0.025	1						
dlnFXRATE	-0.033	-0.131	-0.122	1					
SCHENGEN	0.041	0.206	-0.242	-0.116	1				
dlnOPENESS	0.261	-0.008	-0.324	0.143	0.079	1			
lnPRICELEVEL	-0.112	0.788	0.124	-0.123	-0.156	-0.057	1		
OLYMPIC1	-0.021	-0.107	0.053	0.043	-0.065	-0.091	-0.192	1	
OLYMPIC2	0.095	-0.146	0.087	0.079	-0.105	0.006	-0.071	-0.031	1

Correlation Table 2: Telecommunication Infrastructure.

	dTELECOM	lnGDPCAPITA	GDPgrowth	dlnTELL	dAGE	dEDUC	dlnWAGES	FREEDOM	lnPRICELEVEL	OLYMPIC1	OLYMPIC2
dTELECOM	1										
lnGDPCAPITA	0.206	1									
GDPgrowth	0.063	-0.084	1								
dlnTELL	-0.125	-0.338	0.253	1							
dAGE	-0.064	-0.319	-0.066	-0.026	1						
dEDUC	-0.073	-0.238	0.118	0.122	0.079	1					
dlnWAGES	0	-0.025	0.273	0.233	-0.245	0.066	1				
FREEDOM	0.097	0.65	0.088	-0.16	-0.365	-0.098	0.157	1			
lnPRICELEVEL	0.131	0.788	-0.027	-0.167	-0.439	-0.181	0.124	0.589	1		
OLYMPIC1	-0.049	-0.107	0.056	0.036	0.009	0.163	0.053	-0.033	-0.192	1	
OLYMPIC2	-0.046	-0.146	0.026	0.007	-0.016	0.139	0.087	-0.05	-0.071	-0.031	1

Correlation table 3: Foreign Direct Investment.

	dlnFDI	lnGDPCAPITA	dlnOPENESS	dlnWAGES	dlnUNEMPLYED	GDPgrowth	lnFXRATE	lnPRICELEVEL	FREEDOM	POLITICS	dCORUPTION	OLYMPIC1	OLYMPIC2
dlnFDI	1												
lnGDPCAPITA	-0.009	1											
dlnOPENESS	-0.071	-0.008	1										
dlnWAGES	0.129	-0.025	-0.324	1									
dlnUNEMPLYED	-0.073	0.052	-0.258	-0.006	1								
GDPgrowth	0.303	-0.084	0.031	0.273	-0.286	1							
lnFXRATE	-0.043	-0.341	0.005	-0.176	0.112	-0.182	1						
lnPRICELEVEL	0.009	0.788	-0.057	0.124	-0.018	-0.027	-0.596	1					
FREEDOM	-0.003	0.65	-0.069	0.157	0.06	0.088	-0.679	0.589	1				
POLITICS	0.174	0.393	0.103	0.225	-0.138	0.287	-0.326	0.408	0.392	1			
dCORUPTION	0.054	0.206	0.029	0.104	-0.107	0.077	-0.128	0.18	0.089	0.168	1		
OLYMPIC1	0.025	-0.107	-0.091	0.053	0.022	0.056	0.041	-0.192	-0.033	-0.136	-0.013	1	
OLYMPIC2	0.045	-0.146	0.006	0.087	0.019	0.026	0.039	-0.071	-0.05	-0.107	0.05	-0.031	1

10.4. Appendix D: Descriptive statistics.

Descriptive Statistics 1: Tourism.

	mean	sd	min	max	count
dlnTOURISM	0.0219	0.0874	-0.5598	0.5102	267
lnGDPCAPITA	10.0955	0.4309	9.0478	11.3314	269
dlnWAGES	0.009	0.0202	-0.0791	0.0817	263
dlnFXRATE	0.0033	0.03	-0.1804	0.1515	288
SCHENGEN	0.6221	0.4857	0	1	299
dlnOPENESS	0.0182	0.059	-0.2103	0.2032	284
OLYMPIC1	0.0301	0.1711	0	1	299
OLYMPIC2	0.0301	0.1711	0	1	299

Descriptive Statistics 2: Telecommunication Infrastructure.

	mean	sd	min	max	count
dTELECOM	3.462	4.0579	-3.9382	22.9989	272
lnGDPCAPITA	10.0955	0.4309	9.0478	11.3314	269
GDPgrowth	1.8963	2.7553	-8.8637	10.7781	286
dlnTELL	0.0063	0.0396	-0.1981	0.1484	274
dAGE	0.2677	0.1335	-0.5	0.6	285
dEDUC	1.868	2.2355	-3.5831	12.09	224
dlnWAGES	0.009	0.0202	-0.0791	0.0817	263
FREEDOM	69.0868	6.7527	55.4	82.6	235
OLYMPIC1	0.0301	0.1711	0	1	299
OLYMPIC2	0.0301	0.1711	0	1	299

Descriptive Statistics 3: Foreign Direct Investment.

	mean	sd	min	max	count
dlnFDI	0.102	0.1502	-0.3766	0.6002	232
lnGDPCAPITA	10.0955	0.4309	9.0478	11.3314	269
dlnOPENESS	0.0182	0.059	-0.2103	0.2032	284
dlnWAGES	0.009	0.0202	-0.0791	0.0817	263
dlnUNEMPLYED	0.0173	0.1536	-0.2992	0.6931	262
GDPgrowth	1.8963	2.7553	-8.8637	10.7781	286
dlnFXRATE	0.0033	0.03	-0.1804	0.1515	288
FREEDOM	69.0868	6.7527	55.4	82.6	235
POLITICS	0.7932	0.46	-0.4656	1.6681	180
dCORUPTION	-0.018	0.0981	-0.3665	0.2776	132
OLYMPIC1	0.0301	0.1711	0	1	299
OLYMPIC2	0.0301	0.1711	0	1	299

Descriptive Statistics 4: Sport participation.

	mean	sd	min	max	count
PARTICIPATION	0.2096	0.407	0	1	131961
nADULTS	1.9012	0.8582	1	9	134189
AGE	49.777	18.7603	16	100	133793
nCHILDREN	0.5203	0.9345	0	10	134105
EDUC	1.2475	0.4316	1	2	133955
LIV2GETHER	0.5445	0.498	0	1	132874
FULLTIME	0.7246	0.4467	0	1	126909
EMPLOYED	0.544	0.4981	0	1	134189
VEHOWNER	0.7653	0.4238	0	1	134166
WELFARSTATUS	3.0001	1.4471	1	6	134189
URBAN	0.8005	0.3996	0	1	134189
INCOME	4.7135	3.0595	0	12	110859

10.5. Appendix E: Wooldridge test for autocorrelation in panel data.

Test 1: Basic model tourism.

Wooldridge test for autocorrelation in panel data	
H0: no first-order autocorrelation	
F(1, 11) =	0.219
Prob > F =	0.649

Test 2: Extended model tourism.

Wooldridge test for autocorrelation in panel data	
H0: no first-order autocorrelation	
F(1, 11) =	0.007
Prob > F =	0.934

Test 3: Basic model telecommunication infrastructure.

Wooldridge test for autocorrelation in panel data	
H0: no first-order autocorrelation	
F(1, 11) =	0.267
Prob > F =	0.615

Test 4: Extended model telecommunication infrastructure.

Wooldridge test for autocorrelation in panel data	
H0: no first-order autocorrelation	
F(1, 10) =	0.574
Prob > F =	0.466

Test 5: Basic model foreign direct investment.

Wooldridge test for autocorrelation in panel data	
H0: no first-order autocorrelation	
F(1, 11) =	2.118
Prob > F =	0.1735

Test 6: Extended model foreign direct investment.

Wooldridge test for autocorrelation in panel data	
H0: no first-order autocorrelation	
F(1, 11) =	17.826
Prob > F =	0.0014

Test 7: Sport participation.

Wooldridge test for autocorrelation in panel data	
H0: no first-order autocorrelation	
F(1, 854) =	0.114
Prob > F =	0.736

10.6. Appendix F: Likelihood-ratio test

Test 1: Basic model tourism.

Likelihood-ratio test	LR chi2(12) = 107.02
(Assumption: homosk nested in hetero)	Prob > chi2 = 0.0000

Test 2: Extended model tourism.

Likelihood-ratio test	LR chi2(12) = 129.56
(Assumption: homosk nested in hetero)	Prob > chi2 = 0.0000

Test 3: Basic model telecommunication infrastructure.

Likelihood-ratio test	LR chi2(12) = 49.81
(Assumption: homosk nested in hetero)	Prob > chi2 = 0.0000

Test 4: Extended model telecommunication infrastructure.

Likelihood-ratio test	LR chi2(12) = 36.93
(Assumption: homosk nested in hetero)	Prob > chi2 = 0.0002

Test 5: Basic model foreign direct investment.

Likelihood-ratio test	LR chi2(12) = 30.63
(Assumption: homosk nested in hetero)	Prob > chi2 = 0.0022

Test 6: Extended model foreign direct investment.

Likelihood-ratio test	LR chi2(12) = 27.12
(Assumption: homosk nested in hetero)	Prob > chi2 = 0.0074

10.7. Appendix G: Hausman tests.

Hausman tests between the mg and the dfe estimator in the Peseran-Smith model.

Hausman test 1: Tourism.

	Coefficients (b) mg	(B) dfe	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lnGDPCAPITA	.5410039	.2756249	.265379	79.68916
lnWAGES	-1.453127	-.9388643	-.5142628	244.3279
lnFXRATE	2.068177	1.554109	.5140678	243.7732
SCHENGEN	-.1435252	-.0375838	-.1059414	28.73974
lnOPENESS	.3038205	.598858	-.2950375	111.2446
OLYMPIC1	.1172655	-.2928816	.4101471	15.99416
OLYMPIC2	.1480596	.054604	.0934556	18.5399

b = consistent under Ho and Ha; obtained from xtpmg
B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

Test: Ho: difference in coefficients not systematic

chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 0.02
Prob>chi2 = 1.0000

Hausman test 2: Telecommunication infrastructure.

	Coefficients (b) mg	(B) dfe	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lnGDPCAPITA	9.647067	104.2646	-94.61754	4810.188
GDPgrowth	9.884059	-.1723928	10.05645	2366.112
TELL	1.986338	.7615941	1.224744	763.305
AGE	58.96352	4.144812	54.81871	11506.06
EDUC	2.966005	-.0320496	2.998055	502.5773
lnEDUC2	-187.3181	-43.0367	-144.2814	26612.42
lnWAGES	-68.87735	69.91665	-138.794	34212.31
FREEDOM	12.3567	-1.409949	13.76665	3320.851
OLYMPIC1	-33.38517	-2.919758	-30.46541	8662.025
OLYMPIC2	-34.37921	-14.31364	-20.06557	9004.719

b = consistent under Ho and Ha; obtained from xtpmg
B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

Test: Ho: difference in coefficients not systematic

chi2(9) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 0.00
Prob>chi2 = 1.0000

Hausman test 3: Foreign direct investment.

	Coefficients (b) mg	(B) dfe	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lnGDPCAPITA	1.040811	2.559581	-1.51877	276.3303
lnOPENESS	.76681	1.705856	-.9390458	199.4579
lnWAGES	-1.248628	-.1913263	-1.057301	1152.862
lnUNEMPLYED	.3026155	-.0562187	.3588342	53.26342
GDPgrowth	.0279791	.0716514	-.0436723	5.488642
lnFXRATE	5.297499	1.158171	4.139328	419.8806
OLYMPIC1	-.0309048	.1305813	-.161486	6.541297
OLYMPIC2	-.0099286	.5649786	-.5749071	4.136082

b = consistent under Ho and Ha; obtained from xtpmg
B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

Test: Ho: difference in coefficients not systematic

chi2(8) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 0.28
Prob>chi2 = 1.0000

10.8. Appendix H: Hausman test sport participation.

Hausman test to test which is the most appropriate estimator: fixed effects or random effects.

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
nadults	-.0306027	-.0148036	-.0157991	.0234117
age1	-.0288233	-.0281003	-.000723	.0013627
nchil	-.1020586	-.1107895	.0087309	.020145
educ1	-.4225844	-.5040748	.0814904	.0495815
livharm0	-.0895765	-.0579062	-.0316703	.0406587
ftptw	-.0613217	-.0697681	.0084464	.0397305
rwork	.020747	-.0229016	.0436486	.0449279
vehowner	.2778216	.349105	-.0712834	.0513702
acorncat	-.1402443	-.1274394	-.0128049	.0141373
areatyp	-.1676767	-.1036864	-.0639904	.0495873
indinc	.0639355	.0738305	-.009895	.0067483
Olympic1	.0271313	.1784916	-.1513603	.0495483

b = consistent under Ho and Ha; obtained from xtlogit
B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

Test: Ho: difference in coefficients not systematic

chi2(12) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 24.78
Prob>chi2 = 0.0159

10.9. Appendix I: Wald test for sport participation.

```
(1)  [PARTICIPATION]nADULTS = 0
(2)  [PARTICIPATION]AGE = 0
(3)  [PARTICIPATION]nCHILDREN = 0
(4)  [PARTICIPATION]EDUC =0
(5)  [PARTICIPATION]LIV2GETHER = 0
(6)  [PARTICIPATION]FULLTIME = 0
(7)  [PARTICIPATION]EMPLOYED = 0
(8)  [PARTICIPATION]VEHOWNER = 0
(9)  [PARTICIPATION]WELFARESTATUS = 0
(10)  [PARTICIPATION]URBAN = 0
(11)  [PARTICIPATION]INCOME = 0

chi2( 11) = 1048.26
Prob > chi2 =    0.0000
```