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The Foreign Direct Investments: on the main drivers and the economic effects in the US

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INTRODUCTION

During the last thirty years the World economy has experimented several changes, mainly due to the phenomenon of globalization: new customers and market spaces can be easily reached, information flows and innovation can be transmitted through advanced and faster ways, mobility of factors of production is enhanced and resources can be acquired and exploited in a more accessible method: as a result, firms and companies all over the world have started to widen their horizons, pursuing strategies that involved the purchase and the production of resources and final products out of the national borders, as well as the sale of goods and services to customers of different markets, that before were not reachable.

In order to implement these kinds of strategies, businesses all over the world have realized investments outside the national borders in which they were based: if they accomplish some criteria, these expenditures of money can be classified as Foreign Direct Investments, or FDI.

This thesis has been designed to explore and investigate the main themes related to Foreign Direct Investments, and in particular:

- The definition and the typologies of this complex phenomenon, together with the theoretical basis behind FDI, focusing on the existing academic literature and the main models that try to explain this economic event.
- The analysis of the main drivers and possible general explanations that influence economic actors' behaviour and decisions: in particular, the focus will be concentrated on the causes that impact on the process of decision-making when a firm is deciding whether and where wants to conduct a Foreign Direct Investment.
- A statistical examination of the consequences and the output of FDI in an economy, utilising the Ordinary Least Squares technique and the linear regression model to better understand the dynamics and the impact of this

economic variable, together with other indexes and measures, on the Gross Domestic Product.

Foreign Direct Investments net inflow has exponentially grown in the last 30 years all over the world, passing from $196.315 billions in 1990 to $1.957 trillion in 2017, according to the World Bank Data. This typology of economic transaction has increased its importance and popularity among companies from all over the world, that for different scopes have started to invest their money in other countries.

In particular, the so-called multinational enterprises have played a fundamental role in the development of emerging economies, sharing expertise and knowledge, as well as creating new jobs and workplaces.

On the other hand, MNEs have heavily contributed to enhance the process of innovation and development in mature economies through their investments.

For these reasons mainly, I have decided to focus and concentrate the work of this thesis on the study and the understanding of the mechanics and the dynamics of Foreign Direct Investments, due to the fact that this practice is gaining more and more success among companies: in fact, an always increasing number of businesses have started to undertake this methodology for expanding themselves in the last years. Under some circumstances that will be elaborated on in this work, FDIs can produce beneficial effects not only for the economic agent that is expending his resources, but also can be advantageous for the environment and the State in which they are created: the creation of spill-over effects in terms of transmission of technology, knowledge and innovation are very important principles that must be taken into consideration when investigating this phenomenon. Moreover, it has to be noticed that MNEs perform a fundamental role for integration of developing economies inside the economic fabric of this globalized World, ensuring a higher grade of openness and potential development.

Beyond these concepts, it is useful to investigate the economic and real effects that FDIs produce in a country: the methodology of the regression analysis has been chosen in order to capture the magnitude of the effects that investments

from another States have on the economic growth and the Gross Domestic Product of the receiving nation. Furthermore, also other indexes and economic measures have been taken into account, in order to provide a clearer and more complete framework of analysis, and better understand the relation and the interdependence among different variables with respect of GDP.

The country that will be object of examination are the United States of America; this choice is related to several factors:

- First of all, US is the nation that in 2017, according to the OECD data available on the website of the organisation, have been able to attract the highest amount of Foreign Direct Investments worldwide, with the total sum that reached the level of $354,828 million dollars. This datum is essential to comprehend the importance and the centrality of this country in the World economy: United States are one of the most attractive locations for MNEs that want to invest abroad, and own one of the most complete and functional frameworks for the prosperity of FDIs.
- United States' organisation of economic data collection and distribution is very efficient and allows the user to analyse and examine in a detailed way many aspects of the US system with a precise method: the presence of continuously updated statistics, with different sampling rates is essential whenever a statistical analysis has to be conducted. The website of the American Central Bank, the Federal Reserve, makes available a huge quantity of economic indexes and measures that are very useful in this kind of work, and the use of this statistics will be fundamental in order to investigate the effect of FDI and other key indicators on the economic growth of United States of America.
- Lastly, US have been chosen as focus of the investigation because their economy is developed and mature: in the last few years, we have seen a change in the trend of Foreign Direct Investments. Many MNEs have changed the direction and the scope of their strategy, moving from a resource and efficiency seeking, usually achievable in developing countries, to a strategic

asset or new market seeking, verifiable in developed economies. This shift inside the motivations that influence MNEs to pursue FDIs have obviously changed also the destinations of these investments, moving from emerging economies to mature ones; in this optic the choice of the US as unit of investigation is crucial in order to comprehend and analyse this new trend.

It is now useful to include in this introduction a descriptive analysis of the structure of this work, and the main contents that will be illustrated in the next paragraphs of this thesis:

- In the first chapter the main concepts and theories behind Foreign Direct Investments will be exposed, together with the review of the existing literature regarding this phenomenon. In particular, the main typologies of FDI will be discussed, introducing also the most important and famous theoretical models developed by researchers and authors on the topic, such as the internalization theory of Buckley and Casson and the subsequent Eclectic Paradigm of Dunning and the Product Life Cycle Theory of Vernon.
- The second chapter will concentrate on the discovery and the explanation of the main drivers that influence the choice of a company to invest in a country rather than in another one: every rational economic agent follows some criteria in the decision-making process related to the location of the new foreign investments, and the main aim of chapter two is to capture and analyse the most important principles that impact on the choices of a firm regarding FDI.
- The third part of this paper is dedicated to the investigation of the consequences of Foreign Direct Investments, together with other economic measures, on the economic growth of the United States of America, selected as sample country. A multivariate linear regression model will be used in order to accomplish this result: first of all, a theoretical analysis of the bases of the model will be conducted, in order to better understand the characteristic and the features of the statistical tool utilised. Then, an investigation on the variables will be implemented, to verify if they comply all

the standards required by the regression model. Finally, the output of the analysis will be showed, together with an economic interpretation of the stochastic results: this process of clarification is crucial when statistical analysis is used, because attributing an economic meaning to rational and analytical numbers is the key in order to really comprehend the results of a model.

- Finally, in the conclusive part of this work the key concepts of each chapter will be summarised, together with the main results and the further developments of the concepts involved in this thesis.

1.FOREIGN DIRECT INVESTMENT: CONCEPT AND LITERATURE REVIEW

1.1 Concept of Foreign Direct Investment

1.1.1 Definition of FDI

According to the IMF and OECD definitions, direct investment reflects the aim of obtaining a lasting interest by a resident entity of one economy (direct investor) in an enterprise that is resident in another economy (the direct investment enterprise) (UNCTAD, 2010-2012). In order to be considered as *"lasting interest"*, the investor must engage itself in a lasting business relationship with the direct investment enterprise, and maintain a substantial weight inside the decisions and its management.

It has to be said that the foreign direct investment not only involves the initial cash out of the parent company[1], but also all the further monetary transactions that may arise during the normal life of the affiliated enterprises[2]. In order to be defined as direct investor, the entity has to acquire, directly or indirectly, at least 10% of the voting power of a corporation operating in a different economy[3]; direct investors may be classified both as an individual, a public or private enterprise, a group of related ones, a government body or any combination of the above.

With respect of the typology of FDI conducted, usually direct investment enterprises are firms, which can be either subsidiaries, in which, as said before, the

[1] Parent company: the firm that invest in a foreign country
[2] Affiliated enterprise: the firm that benefits from a foreign direct investment
[3] The definition of direct investor is contained inside the Fifth Edition of the IMF's Balance of Payment Manual

parent company hold a participation of at least 10%, or they could be a quasi-firm, such as a branch[4], totally owned by the holding.

As the World Trade Organisation said (1996) a foreign direct investment (FDI) occurs when an investor based in one country (the home country) acquires an asset in another country (the host country) with the intent to manage that asset. Surely, inside this definition the management dimension is the key in order to differentiate between an FDI and a portfolio investment in foreign stocks, bonds or other financial instruments: the cash out of the investor must lead to a control over the direct investment enterprise.

In order to support and confirm this classification, inside their paper Lipsey, Feenstra, Hahn & Hatsoupulos (1999) sustain the binding existence of a long-term relationship between the two parties involved and a significant degree of influence on the organisation of the firm.

As Denekamp states (1995), FDI may not only involve tangible assets, but also intangible ones, like R&D, brand reputation or process innovation: indeed, due to their "public good"[5] nature, and the fact that they can be easily transferred and then removed from one place to another, an always increasing number of firms may decide to adhere an FDI plan with the main goal to exploit the usage of on intangible asset in another market or at different conditions.

Foreign direct investments are acquiring more and more importance inside the modern economy; due to several factors, that will be investigated inside this thesis in the further chapters, firms all over the world decide to invest in foreign economies. As reported by the United Nations, in 2017 the total quote of foreign direct investment globally reached a value of $1.52 trillion[6], one of the highest levels in the history: this phenomenon is acquiring more and more importance inside the

[4] Even if branch and subsidiary are quite common used as synonyms, the meaning is slightly different: a branch is a firm that perform the same business operations, but in a different place; a subsidiary is defined as a firm in which a holding has control on

[5] Intangible assets are considered with a public good nature because they are available to supplementary production facilities at a relatively low cost

[6] Data available inside the United Nations Conference on Trade and Development report (2018)

modern economic landscape, and drew the attention of many researcher and analysts, both in the past decades, but also nowadays, where the globalisation is deeply and fast changing our industrial and financial system.

According to the 2018 UNCTAD report data, the top 100 Multi National Enterprises' (MNEs) foreign operations represented 9% of the world foreign assets, 17% of the global foreign sales and 13% of foreign employment.

Variable	100 largest MNEs worldwide					100 largest MNEs from developing and transition economies		
	2015[a]	2016[a]	2015–2016 Change (%)	2017[b]	2016–2017 Change (%)	2015[a]	2016	Change (%)
Assets (billions of dollars)								
Foreign	8 015	8 337	4.0	9 004	8.0	1 716	1 886	9.9
Domestic	4 875	4 894	0.4	5 491	12.2	4 289	4 511	5.2
Total	12 891	13 231	2.6	14 495	9.6	6 004	6 397	6.5
Foreign as share of total (%)	62	63	0.8	62	-1.4	29	29	0.9
Sales (billions of dollars)								
Foreign	4 802	4 765	-0.8	5 170	8.5	1 734	1 559	-10.1
Domestic	2 851	2 737	-4.0	2 793	2.1	1 903	1 965	3.3
Total	7 653	7 502	-2.0	7 964	6.2	3 638	3 524	-3.1
Foreign as share of total (%)	63	64	0.8	65	2.2	48	44	-3.4
Employment (thousands)								
Foreign	9 130	9 535	4.4	9 757	2.3	4 003	4 603	15.0
Domestic	7 141	6 920	-3.1	6 889	-0.4	7 900	7 434	-5.9
Total	16 271	16 455	1.1	16 646	1.2	11 903	12 038	1.1
Foreign as share of total (%)	56	58	1.8	59	1.2	34	38	4.6

Table 1: The 100 largest non-financial MNEs statistics regarding worldwide data and from developing economies (Billions of dollars, thousands of employees and per cent)
Source: UNCTAD World Investment Report (2018)

As the table above shows, the FDI trend is almost increasing everywhere from 2015 to 2017.

Surely, this aspect of the modern economy has not only to be intended and associated with large multinational players, but also at a lower level: a growing number of medium enterprises may decide, for several reasons, to invest in another country. This choice may regard economic reasons, like the lower cost of production or the proximity to a fundamental raw material in the chain of activities for example, but also strategic ones, like the exploitation of a new potential market in another State or the presence of a specific category of strategic assets inside the beneficiary nation; this non-exhaustive list of "drivers" of choice can explain the fact that not only MNEs are interested in a foreign direct investment strategy: also smaller firms

may decide to choose this path, trying to enhance their performances in a globalised competitive market.

1.1.2 Typologies of FDI

Foreign direct investments can be classified looking at many different criteria: the market entry methodology, the geographical area, the economic activity and the main purpose.

As stated in the UNCTAD Training Manual on Statistics for FDI and the Operations of TNCs (2009), the first substantial differentiation that has to be highlighted is between inward and outward FDI: first of all, in order to better understand this classification, it must be set a country, that will be further called *"reported country"*: inward direct investments are flows of money that come from a non-resident investor in the home market of the so called reported country; on the contrary, outward FDI are flows of capital that an agent inside the reported country utilises to invest in other economies.

With reference to the actions and the purpose that the investor wants to achieve, foreign direct investments can be divided into horizontal and vertical: horizontal FDIs take place when the agent reproduces roughly the same activities in different countries, spreading in diverse States the same production process.

On the other hand, when a company decides to situate different stages of production in different countries, this action can be classified as vertical FDI.

Moreover, these two typologies can be subdivided in other two categories each: in particular, horizontal FDI can be defined as follows:

- Market seeking: this locution is utilised to connote an acquisition or a building up of new plants for entering in the local market. Usually, the results that derive from the implementation of this strategy brings to an optimisation in the information gathering process and consequently a

better knowledge of the local market; in addition, the exploitation of the economies of scale production is another fundamental factor inside the choice of a market seeking FDI; furthermore, the receiving country typically obtains economic benefits from the investment, in terms of employment, resources from taxation and knowledge spill-overs[7].

The final aim of this strategy is to reach the final customers of other States, adapting the product or the service to their specific tastes and needs, saving also the cost that the firm usually incurs serving a distant market.

- Strategic asset seeking: this kind of direct investment improves the competitive position of the firm in a given market or in an expanding market's strategy. These assets complement and enhance the existing core competencies of the business (i.e. human capital, distribution networks, brands). The fundamental motive of a strategic asset seeking FDI is based on this concept: the presence of a Multinational Company at an international level provides a better information advantage compared to other firms, grounded "in the scanning and learning potential of the company network", as Bartlett and Ghoshal model of International Strategy[8] suggests.

  Generally, the counties in which strategic asset seeking Foreign Direct Investments are addressed distinguish themselves by high innovation levels, availability of synergistic industries, presence of innovation clusters and sophistication of demand.

The previous paragraphs have been useful in order to define and explain the main aspects related to the horizontal FDI; on the other hand, vertical Foreign Direct Investments can be subdivided in this way:

- Resource seeking: this typology of FDI is characterized by the research of strategic inputs: the fundamental goal is to diminish the cost of production

[7] The locution spill-over effect is utilized to describe further positive consequences in one field caused by phenomena and activities realized in another ambits.

[8] For further readings please consult the book Managing Across Borders: The Transnational Solution by Bartlett C. and Ghoshal S.

by obtaining raw materials (such as oil, minerals or agricultural products) directly in the country of origin, avoiding transportation and intermediation costs.

Due to the fact that the majority of raw materials and resources available for production are located in developing countries, usually the resource seeking FDI have few positive economic impacts in terms of knowledge spill-overs and innovation in the receiving nation.

According to the UNCTAD, this typology of direct investment was the most utilized by firms during the 19th and 20th century, determining the core of colonial relationships between Europe and other States.

According to the World Bank, about 40% of developing countries grant an incentive system that implies fiscal inducements or very low corporate taxation in almost every sector of their economy: this fact can be connected with the so-called phenomenon of the resource curse[9] of developing countries.

- Efficiency-seeking: this classification of FDI is realised in order to exploit the enhancement of the cost efficiency of a company. According to Rugman & Verbeke (2001) the intention is to exploit specific location advantages for specific activities and design a production network that rationalises the manufacturing processes.

  The main purposes for this kind of investment regard the exploitation of economic differences in production factors such as the cost of labour or the creation of a logistic platform in the receiving countries, and in general the enhancement of the economies of scale.

  Often the new production plants or the subsidiaries are in charge of the manufacturing of components or final goods in an optic of cross-border

[9] The locution resource curse is utilised to define the paradox that usually afflicts developing countries with a high availability of natural resources; in particular, despite of the economic potentiality that these Nations own, the real data demonstrates a low level of growth, democracy and development.

production processes, where the parent company is able to take advantage of the creation of a network of international relationship.

Due to their particular configuration and the purpose they want to achieve, the efficiency-seeking direct investments result the most sensible FDIs to changes in customs, tariffs and duties, since usually the subsidiaries export their production to the parent company.

It has to be said that this typology of FDI is not only suitable for firms that produce goods, or in general tangible products, but also for companies that usually offer services: a practical case in order to explain this phenomenon is the outsourcing and offshoring of particular kind of facilities, such as the call-centres of the telephone operators.

1.2 Literature review

1.2.1 Classification of FDI theories

Since the end of eighteenth century, many researchers and economists have tried to define and develop a theory able to explain the roots of Foreign Direct Investments; following the school of thought which is majorly accepted by the economic community and described in many scientific articles, FDI theories can be classified in such a way:

- Macroeconomic perspective: from a macroeconomic point of view, FDIs can be described as a typology of cross border capital flows, from country of origin to host States, which are found in the balance of payments. The major variables of interest are: capital flows and stocks and revenues obtained from the investment (Denisia, 2010)
- Microeconomic perspective: The micro view tries to explain the motivations for investment in controlled foreign operations, from the viewpoint of the

investor. It also examines the consequences regarding the economic actor, and concerning home and host countries, of the operations of multinationals or affiliates created by these investments, rather than the size of the flows or the value of the investment stock. (Lipsey R. , 2008)

These two classifications can be seen as two sides of the same coin, and capture different facets of the same phenomenon, utilising different approaches and methodologies: on one hand microeconomics looks at the effect of foreign direct investments bringing as unit of account the individual or the company level, analysing the origin and the effects of FDI at a micro scale; on the other hand macroeconomics takes into account the genesis and the properties of this kind of investments looking at an "aggregate" level, combining and summing all the needs of individual and studying them as an integrated system.

The following paragraphs will illustrate the main theories regarding foreign direct investments, starting from the first investigations on international trade of absolute and comparative advantage elaborated from the end of eighteenth century to the beginning of nineteenth century by respectively Adam Smith and David Ricardo; subsequently, this work will analyse the most important and recognized models that try to explain the functioning and the mechanism of foreign direct investments; nowadays there is not consensus among researchers and the economic community on a superior or generally accepted theory regarding FDI. The one that will be presented in the next paragraphs are the Product Life Cycle (PLC) of Vernon, the Internalization theory and the Eclectic Paradigm of Dunning.

1.2.2 The absolute advantage theory

Although the first studies of the phenomenon of Foreign Direct Investments date back to the eighteenth century, and in particular concerning the work of Adam Smith in 1776, the genesis of the modern way of thinking about this topic can be led back to the book *"An inquiry into the nature and causes of the wealth of nations"*

(Smith, 1776): in particular, in Adam Smith's work, the major driver of trade between two nations is primary dictated by the so called "absolute advantage": following this theory, a country should focus and specialize on producing a specific good or providing a specific service in which it is efficient: in other words, this country is able to produce a specific commodity at a lower cost, or utilising fewer production factors in comparison with other international players, in order to obtain the same amount of final product. In this way, every nation will specialize in the production of the good in which it has an absolute advantage; in such a framework, an open trade between countries will bring benefits among every player in the market, exploiting the cost efficiency.

However, this theory is rooted on quite strong assumptions, that are hardly achievable in reality:

- Production factors, and especially labour, is mobile within a country, but cannot move between countries.
- Absence of economies of scale: Smith in his work assumed that returns to scale[10] are constant.
- Absence of trade barriers: governments do not impose duties and custom fees concerning import or export of goods or services.

Obviously, all these assumptions cannot be taken into consideration anymore in the economic environment of today: production factors can circulate among countries, the existence of economies of scale is widely recognized by the economic researchers and many States, also nowadays, adopt protectionist measures such as tariffs or quantitative restrictions on import in order to defend their own economy.

Moreover, another critical issue is represented by the statement that nations should trade only with bilateral exchanges, involving only two commodities: this assumption became no more realistic when the needs and the necessities of nations changed and started to increase; for this reason mainly, the absolute advantage

[10] The returns to scale investigate the magnitude of change of output, produced by a constant increasing of all production inputs.

theory did not take into consideration the potential multisided trade that can be seen nowadays between countries.

1.2.3 The comparative advantage theory

Several years after the publication of the Adam Smith's book *"An inquiry into the nature and causes of the wealth of nations",* another English economist investigated on the main causes and explanations of international trade: in particular, David Ricardo presented a new theory regarding the free trade between States inside his book *"On the Principles of Political Economy and Taxation"* (Ricardo, 1817).

This model, based on the concept of opportunity cost[11], postulates that a nation will produce more, and subsequently export, a good or a service in which it has a comparative advantage. The concept of comparative advantage should not be confused with the previously mentioned absolute advantage: in fact, a country which owns an absolute advantage on producing one typology of commodity may not have a comparative advantage on that good.

Comparative advantage can be defined as the capability of an economy of a country to manufacture products or provide services at a lower opportunity cost, compared to its competitors.

In order to better understand this concept, the following example is the one utilised by Ricardo inside his book. The British economist took into consideration England and Portugal: Ricardo analysed the production of cloth and wine in both countries, under the point of view of hours spent in order to produce one unit of these goods.

[11] The opportunity cost can be defined as the missed value, profit or benefit, derived from discarding an alternative or a different choice in decision making.

The results can be summarised in the following table:

Product / Country	Cloth	Wine
England	100	120
Portugal	90	80

Table 2:Hours spent in order to produce one unit of product in the two countries
Source: On the Principles of Political Economy and Taxation" (Ricardo, 1817).

As it can be seen in the table, Portugal has an absolute advantage on both cloth and wine, since this economy can produce these two typologies of goods at a lower economic cost compared to England.

Despite of this, according to Ricardo's model England will concentrate its production on cloth and Portugal will concentrate its production on wine.

In fact, taking into account the production of cloth, England is able to utilise 100 hours in order to produce one unit of this good, or 5/6 units, (0.833) units of wine; on the other hand, Portugal is able to produce one unit of cloth utilising 90 hours, or 9/8 (1.125) units of wine.

Bringing back the concept of opportunity cost, England has a lower opportunity cost in the production of cloth, and so a comparative advantage on this good, and Portugal has a lower opportunity cost in the production of wine, having therefore a comparative advantage on the alcoholic beverage.

Specialising in one good makes the whole production of both wine and cloth increase; nevertheless, without trade this surplus of production will be useless.

The two countries should trade in order to exchange the advantages in production and increase the total wealth of the population.

The assumptions of this model can be summarised as follows:

- Presence of constant returns to scale: as the previous model considered, the comparative advantage theory assumes that the returns to scale are

constant, so increasing the input factors by one unit has an impact on the output of one unit.

- Total absence of transportation costs: a firm that exports does not incur into costs derived from the transportation of the good.
- Perfect mobility in production factors: the factors of productions can be easily moved from one part of a country to another, without incurring in any cost or problem related to the shift of the means of production.
- Absence of barriers to trade: the international market is frictionless, there is no presence of customs duties or fees regarding import or export of goods and services.

As in the previous model of absolute advantage, these assumptions are quite strong and not realistic. As argued by King (2013), the main critics to this theory can be led to the assumption on returns to scale, which are not constant but increasing; moreover, the absence of transportation costs and barriers to trade is something that is not observable in reality.

Nevertheless, this model, and in particular the concept of comparative advantage, has been utilised as base for further theories explaining international trade, such as the Heckscher–Ohlin model[12], built on the abundancy of production factors in a country.

1.2.4 The Internalization Theory

The internalization theory has been developed at the end of 1960' by Buckley and Casson (1976); their main aim was trying to explain why international transaction of intermediate products were organised in a hierarchical way, instead of simply using market mechanisms.

[12] For further readings, please consult the article "The Heckscher-Ohlin Model in Theory and Practice", written by Edward E. Leamer and published inside the No. 77 of the Princeton Studies in International Finance (1995).

The internalization theory stems from and has been inspired by the work of an English economist, Ronald Coase, that wrote an article entitled *"The Nature of the Firm"* (1937); Coase sustained that market imperfections entail various and different costs, regarding research and information gathering, negotiation and contract application. Firms' goal is to minimize these typologies of costs in order to increment profits.

Applying the Coasian analysis at an international business level, Buckley and Casson reached the conclusion that when an international market is characterized by imperfections and failures, with the consequence of transaction costs increasing, firms are encouraged to realize their own internal market through the acquisition of production facilities abroad, also recognized as foreign direct investments.

However, even if the presence of market imperfections can be seen as a sufficient condition in explaining the existence of multinational firms and FDIs, the incentive of internalization depends also on different factors, such as the business activity of the company, its country of origin and the characteristics of the organisation: these variables can be defined respectively as *activity, country and firm specific*.

The main intuition was related to the fact that hierarchical structure of Multinational Enterprises could represent an alternative instrument, with respect to the market, in order to coordinate linked activities, but located in different places.

Following this idea, then, MNEs tend to realize international investments when the benefits derived form the ownership of the activity, and so the link between parent company and subsidiaries, are higher then the one offered by the traditional market relationships.

According to Rugman and Verbeke (2008) "Buckley and Casson demonstrate that the MNE organizes bundles of activities internally such that it is able to develop and exploit firm-specific advantages (FSAs) in knowledge and other types of intermediate products". Firm-specific advantages can be defined as manifestation in

higher productivity of comparable assets (both tangible and intangible) than competitors (Caves, 1996).

Knowledge can be categorized as a public good: knowledge is non-rivalrous and non-excludible, which means that this typology of "goods" is not diminished once consumed, and it is almost impossible to prevent an individual to benefit from the consumption of the product.

Due to the fact that knowledge is a public good, MNEs try to overtake this externality utilising Foreign Direct Investments: internalization can be seen as a way to overcome the knowledge market failure[13].

Competitors all over the world try to copy the knowledge achieved by multinational enterprises; due to the fact that the system of patents and trademarks is weak, MNEs perceives they are not fully protected and defended against this phenomenon; consequently, companies prefer to invest in their own production facilities abroad, exploiting the firm-specific advantages (Casson, 2015).

Generally speaking, Buckley and Casson proved that multinational enterprises decide to internalize in order to overcome any typology of market imperfection, exploiting the FSAs inside their governance structure and transferring the public goods, such as knowledge, utilising subsidiaries abroad and internalizing the market failure.

Not only firms with superior knowledge compared to other market participants in the business they are running find convenience in internalizing markets, but also companies with no special knowledge can perceive benefits in implementing a policy of FDI: according to Casson (2015), these organisations may become multinational if they need to internalise supplies of components or raw materials in order to guarantee quality or continuity of supply or if there are tax advantages from transfer pricing.

[13] Market failure is a locution that describes a phenomenon in which the circulation of goods and services is inefficient.

Another important point inside this theory is represented by "the cost of doing business abroad", concept developed by Hymer (1976): if a MNE decides to invest in a foreign country, the company may face commercial risks and political risks, related to the newness of the foreign legal, political, cultural and environmental framework.

When cost of doing business abroad is perceived to be too high, with respect of the benefits achievable with the FDI policy, companies may decide to utilize a licensing system, committing the production to an independent foreign firm, or it may decide to adopt a strategy of producing in the home country and export the final product.

Many economists and article authors utilised internalization theory as base for further explanations and models regarding international business theory[14]; one of the most important contributions inside this sector was the one of Dunning, which in the '70 formalized a dynamic perspective which integrates the variables of internalization with the localization specific factors: the eclectic paradigm, that will be discussed and examined in the next paragraph.

1.2.5 The Eclectic Paradigm

The Eclectic Paradigm, also known as Ownership, Location and Internalization (OLI) theory, is a model which tries to explain and deeply analyse the phenomenon of Foreign Direct Investments, and the sources of advantage that a multinational enterprise can exploit when performing an FDI oriented strategy.

The initial concepts of this model were presented by Dunning in the 1976 Nobel Symposium in Stockholm, it was an intellectual reply to the growing position of international production and the multinational enterprises in the world economy.

[14] For further readings on these topics, please consult Rugman (1981), Buckley and Stranger (2011).

As previously proposed, OLI is an acronym that stands for Ownership, Location and Internalization; these three macro areas of potential benefits can be seen as drivers of decision in order to expand the boundaries of business and become a multinational enterprise.

Like Tolentino (2001) suggests, location advantages derive from macroeconomic theories; instead, ownership advantages and internalisation ones are linked to microeconomic and mesoeconomic concepts.

As far as this paradigm concerns, it is useful to analyse in deep each of the three aspects of this theory, to better understand the functioning and the main purposes of this model. In an article written on *the International Journal of the Economics of Business*, Dunning (2001) gives further explanation of the main aim of the theory, which can be summarized in the extent and pattern of international production; moreover, Dunning analyses three set of forces that are recognized as the main drivers in the determination of patterns of FDI:

1. The competitive advantage[15] that one company owns with respect to its competitors: these benefits may be caused by the ownership of a series of income-generating assets, or the superior management ability of this organisation to control these assets compared with the one of other market participants.
2. The importance that which businesses perceive as a good and beneficial choice to internalise the market failures and create an internal process in order to overcome them and use the previous cited assets in order to create value.
3. The degree of attention which companies identifies in the choice of locating the productive activities outside their country of origin.

[15] The location competitive advantage is used to describe a state in which a business is able to produce the same typology of good at a lower cost, and consequently at a lower price, with respect to its competitors. Alternatively, competitive advantage can be defined as a characteristic of a product or a service where a company has an advantage over its competitors; moreover, this feature must be linked to a purchase criterion which is fundamental for customers.

The following part of this paragraph will be useful to analyse and focus on each advantage proposed by the model, explaining in deep the causes and the consequences of these three pillars for multinational enterprises.

- Ownership advantages: this pillar is based on the differentiations in efficiency and productivity of MNEs, caused by the ownership of intangible assets, which are fully movable from the parent company to the subsidiaries abroad. In this situation multinational firms possess a competitive advantage over their competitors in the foreign market (Dunning, 1988).

  Ownership endowments have two fundamental features: first of all, as mentioned before, intangible assets, and in particular knowledge, can be classified as public good, with the consequence that the spreading cost in different countries is almost equal to zero. Consequently, there are virtually no restriction on geographical location in which ownership advantages can be exported and exploited.

  These features encourage companies to pursue a Foreign Direct Investment policy, exploiting increasing economies of scale and justifying market expenditures for these investments.

  Availability of technological processes, consciousness of technological occasions, human resources production capacities, logistics and distribution services can be configurated as ownership advantage inside a multinational firm.

  Dunning (1988), classified the previous defined ownership advantages into two main clusters: transaction advantages and asset advantages. The first ones refer to the fact that the common governance of a network of assets ubicated in different countries, which by definition is the main activity of a multinational enterprise, can lead to benefits for the firms that decide to invest in foreign countries.

  On the other hand, asset advantages can be defined as the possession of a specific resource created or acquired by the company.

The benefits arising from this superior position of MNEs in the market should be satisfactory to remunerate the set-up costs and the functioning costs of a branch in a foreign country.

The ownership advantage can also be affected by the grade of economic and technological development of the home country: in fact, Dunning (1980) specifies that "the ability of enterprises to acquire ownership endowments is clearly not unrelated to the endowments specific to the countries in which they operate and particularly their country of origin."

- Location advantages: which can be also defined as country specific advantages, are referred to the benefits received by a multinational enterprise which decides to locate totally or partially the production in another country in order to exploit the lower costs of manufacturing, or the lower cost of resources.

  Locations advantages can also be linked to the definition of vertical FDI, which has been previously discussed in this work[16]: lower cost of labour or lower capital requirements, availability of natural resources and favourable taxation policy by the government can be seen as location benefits that could drive the decision of a firm in investing in a particular country.

- Internalization advantages: like it has been discussed previously[17], a multinational firm possesses internalization advantages when the organisation finds convenient to open a new plant, a new factory, or move the production to a subsidiary in a foreign country, rather than utilize the market mechanism of exporting or licensing the production to an independent foreign firm.

  In this way MNEs are able to internalize market failures such as the knowledge protection, and using the governance structure of the organisation as an internal marketplace to overcome these kinds of problems,

[16]Paragraph 1.1.2: Typologies of FDI
[17]Paragraph 1.2.4: The Internalization Theory

augmenting the profitability of the company and the attractiveness of the foreign direct investment.

If a business is able to exploit the three advantages described above, it will find convenient and profitable to enter into foreign markets through an FDI. The essential condition which is the starting point for a decision in investing abroad is the possession of the ownership benefits: in fact, according to this theory, firms that have a competitive advantage over their competitors will be able to fully exploit the new opportunities of growth in a market abroad.

Once it has been ascertained that the company owns a superior capability in producing one typology of good or providing a certain service, it will be useful to analyse in which way the firm wants to approach the new market and the new customers: in other words, the MNE can follow the path of internalization, entering directly into the foreign market and internalizing the market failures, or it can choose the way of licensing, monetizing its ownership advantage through the sale of the authorization to a foreign firm.

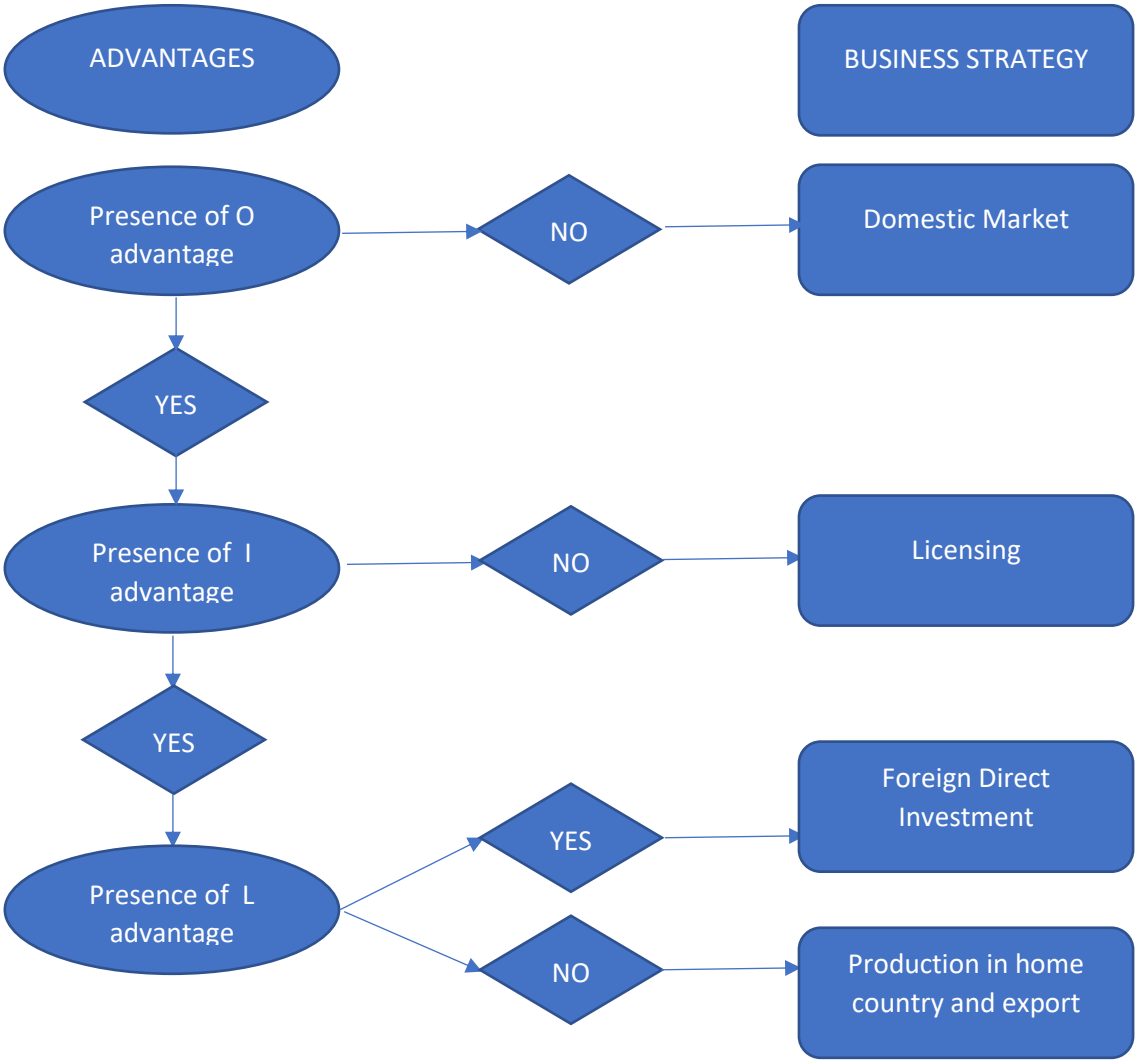
Given the fact that a company is both able to exploit ownership and internalization advantages, the MNE's decision process will move to the choice of the new foreign market that has to be approached: if the firm will scout the presence of benefits in investing in the foreign country, and consequently the presence of location benefits, the MNE will adopt the strategy of FDI in order to serve the foreign market.

As discussed by Dunning (2001), the eclectic paradigm can not be defined as a static model: in fact, there is an interdependence between the three pillars of this theory. The dynamic aspects of this theory can be identified as follows: once a company has invested in a foreign State, the finding of strategic assets, new market shares or resources at a lower price will obviously increase competitive rivalry[18], with the main consequence of a reduction in the so-called location advantage. At this

[18] The competitive rivalry can be defined as the evaluation of the degree of competition among different companies operating in the same sectors. For further readings, please consult the book *Competitive Strategy* of Micheal E. Porter

point, MNEs involved in FDI will react seeking new markets, or trying to strengthen the ownership advantage through an innovation policy.

The influence that each pillar has on the others is a point in favour of this theory, that has been widely recognized as a suitable model for describing the mechanisms and the dynamics behind FDIs: many researchers wrote articles in academic journals on this topic, identifying the validity of the OLI theory, such as Guimon (2016), Bayari (2012), Tolentino (2001), Madhok & Phene (2001), Cantwell & Narula (2001) and many other researchers towards the globe.



Graph 1: The decision-making process of an FDI related to the presence of advantages. Source: own elaboration

1.2.6 The Product Life Cycle Theory

The product life cycle theory, abbreviated PLC, is a model developed by the American economist Raymond Vernon in 1966; Vernon was trying to give an answer to the Leontief paradox[19] by emphasising the timing of innovation and the importance of economies of scale (Bényei, 2016). The main field of studying of Vernon was the U.S. manufacturing industry after the Second World War, and in particular the Foreign Direct Investments conducted by these firms in Western Europe.

According to Denisia (2010), Vernon's PLC theory bases on four stages of product cycle which each firm in every industry has to experiment during its business life: innovation, growth, maturity and decline.

It is beneficial to split and analyse each stage of the life cycle of a product, in order to better understand under which circumstances a firm is pushed to follow a foreign direct investment policy.

As discussed in the article entitled *"International investment and international trade in the product cycle"*, in which Vernon (1966) exposes its new theory, the main aspects of this model can be summarized as follows:

In the first stage of PLC, titled innovation, new products are invented, and sold only in the internal market; due to the fact that the product is not fully mature and needs further development, profits are not so high and market penetration rate is low.

Moving to the second stage, denominated growth stage, the procedure of production is more settled, sales volume augments and profits tend to increase, also due to the fact that economies of scale has a positive effect on costs, reducing them. In this particular phase, it is useful for the firm to bring into consideration the

[19] Leontief paradox can be defined as the paradoxical outcome obtained by the economist Wassily Leontief, which was trying to verify empirically the Heckscher-Ohlin model. For further readings please consult (Paraskevopoulou, Tsaliki, & Tsoulfidis, 2016)

possible choice to expand the production abroad, through a Foreign Direct Investment, to better fulfil the growing demand in overseas markets.

When the product reaches the third stage, which is entitled maturity one, the production techniques can be considered as established and mature. More and more customers continue to buy this product, and the cost component continues to reduce due to economies of scale; the maturity of the production technique encourages the imitation of the good by firms with lower level of technology or strategic assets, determining a drop-in price due to the higher competition level and rivalry. A possible way to overcome this impasse and increase profits for the MNEs is to differentiate the product, to exploit the uniqueness and attract new customers.

If the multinational enterprise decides not to follow the path of differentiation, the fourth stage of decline will happen: product standardization will take place, and the main consequence is that every firm will steer incremental investments in the product to the lowest possible production site, referring to both resources and possible strategical assets.

In this phase, the final product will be manufactured more in foreign plant, and exported all over the world, including also the home country in which the good was invented and perfectionated.

Over time, the product will be phased out by the original creator, and the life cycle will start over again, allowing to the multinational firm to surpass the decline phase and starting a new profitable project with an advanced innovation cycle (Nayak & Choudhury, 2014).

Bringing back to the example of U.S. manufacturing industry after the Second World War, Vernon observed that American companies were forced to open new plants in the local market to preserve their market share, due to the fact that European firms had started imitating their product, increasing competitiveness in the sector and decreasing the prices.

In order to summarize, this model tries to explain the reasons for which a firm is to pursue a Foreign Direct Investment strategy, focusing primarily on the complementary and substitution connection during the process.

Starting from the beginning, MNEs start to develop a product and sell it in the internal market; once the product is considered mature, companies begin to export to foreign markets; as soon as the foreign demand can not be satisfied utilising only the home country production capacity, new plants abroad are set up. Product maturity and production technique fullness increase rivalry, with the main consequence that also competitors start to produce the good in object, causing a decrease in prices. The majority of firms in the industry will be forced to move production to countries with low resource costs, and the country in which the product was invented will become an importer of this good.

Although the PLC theory has some advantages in explaining the dynamics of Foreign Direct Investments, numerous economists and researchers identified pitfalls inside this model.

First of all, Boddewyn (1983) argued that there are no empirical tests that can be conducted in order to prove the efficiency of the PLC theory; moreover, one important point that has not taken into account by Vernon was the presence of other FDI determinants, apart from the so-called location advantages by Dunning, such as the ownership ones.

This theory can be reassumed as too simplistic, painting the decision-making process of a firm as a linear one, without possible complications, and it is mainly applicable to technological driven industries.

Other critics came from Nayak & Choudhury (2014), that pointed out that there were some pitfalls in determining in which context is more advantageous for a company to follow the path of foreign direct investments, rather than continuing the export strategy.

2.THE MAIN DETERMINANTS OF FOREIGN DIRECT INVESTMENTS

2.1 Classification of FDI drivers

When a business is determining the best option for a Foreign Direct Investment, the choice of the country in which commit financial and knowledge resources plays a central role in the decision-making process. The selection of the destination of FDIs can be influenced by several factors, which can be different with respect of the final aim of the firm: pursuing an efficiency seeking or a resource seeking strategy will lead to completely dissimilar result in comparison with a new market seeking approach.

The main goal of this chapter is to analyse and study the drivers that impact on the scheme of choice of a company when selecting a country for its FDI; the approach used in this part of the thesis links the selection criteria with the main purpose of the direct investment. In particular, three main areas can be defined:

- Principles that can be connected to horizontal FDI associated with the penetration of new markets or the appropriation of strategic assets that are not reachable in the host country, as explained in the paragraph 1.1.2 of this work.
- Drivers related to vertical Foreign Direct investments, which have completely different purposes, and in particular the main aim to exploit low cost resources and efficiency.
- Preferences' options that influence the decision-making process in both cases mentioned above, and play a fundamental role as a basis layer for further conclusions.

In the next paragraphs each point of the bulleted list will be further investigated, providing a non-exhaustive list of the main economic and social drivers that lead a firm to invest in a foreign country rather than in another one.

2.1.1 Horizontal FDI drivers

Horizontal FDIs are designed to create a subsidiary of the parent firm in another country, in order to exploit new market opportunities offered by different and unserved segments of customers or to take advantage of strategic assets that are present only in that kind of environment, such as information and knowledge.

Usually this typology of investments is pursued by firms that produce goods and provide services that are value driven, and are less concentrated on the cost of creation of the product: the main aim of this strategy is to acquire new portions of clients in another country, or alternatively expand the already existing core competencies that must be employed in the production process.

The main drivers that impact on these kinds of decisions form their base on the presence in the selected country of certain aspects that have not to deal mainly with the cost structure of the firm, or a cost reduction strategy; on the contrary, the main focus is on the achievement of the so-called quid pluris, that enhances and improve the value creation process or enables the firm to compete in a different market.

A non-exhaustive list of horizontal FDI determinants is provided hereafter, taking into consideration also the existing literature on the phenomenon; the main aim is to better understand some criteria that business utilise in the decision-making process of horizontal Foreign Direct Investments:

- Average educational level of the population of the foreign country: this statistical measure, that is calculated yearly by the statistical division of the United Nations, can be considered as one of the major drivers of horizontal

FDIs. In order to achieve their scope, firms which want to implement this kind of direct investments need skilled and prepared workforce, that is able to fulfil the tasks assigned to them. As a consequence, usually companies select countries in which the average educational level is high, together with the educational attainment[20].

Moreover, an expert and capable labor pool has higher possibilities to exploit the existing core competencies of the firm and create new ones with the information available in the foreign environment.

Citing Agosin & Machado (2007), *"*countries with higher levels of education are less likely to impose restrictions on FDI. This could be indicating that countries with a highly educated labour force would naturally attract FDI to activities intensive in technology and human capital*"*: as a matter of fact, activities that use intensively human capital are those one that invest horizontally in developed countries, in which skilled workforce is more abundant.

- Presence of targetable consumers and related average income: this economic index is more important for firms that are oriented on the pursuing of market seeking FDIs: in fact, companies that have the main objective to exploit new customer segments in a different nation has to deal with the propensity to consume of the new clients, and one fundamental index is given by the amount of money available for these people.
- Foreign country innovation intensity: researchers have attributed many definitions to the word innovation; Joseph Schumpeter can be considered the father of this branch of study, and in his book "The Theory of Economic Development" (1926) he described it as "a new or improved product, process or technology, which is commercially successful on the market". This explanation has been refined over time by other academicians, implementing

[20] The educational attainment is a statistical measure that gives information on the highest level of education carried out by a group of the population, that usually is identified by a range of age.

and adding also the concept of competitive advantage and the achievement of the market leadership for an innovative business.

All these notions are useful to delineate the meaning of the locution of innovation intensity, which can be described as the capacity of an economic environment to generate and produce the process of novelty and revolutions. Countries with a high innovation intensity will be more attractive for firms that are pursuing a strategy of horizontal Foreign Direct Investments: companies with this kind of objectives usually search for an environment in which enhance and augment their core competencies and capabilities, and the presence of favourable conditions for development and renovation are essentials in order to create new and productive processes, as argued by Fu (2008).

2.1.2 Vertical FDI drivers

The main scope of vertical Foreign Direct Investments is to reduce costs of production or to acquire resources easily in order to enhance the efficiency and the productivity of the firm. In this optic, businesses that usually invest their money vertically are those one that are concentrated on cost driven goods and services: the predominant focus is minimizing expenditures whenever achievable, and maintain costs as low as possible.

Taking these concepts into consideration, companies that utilise this method of investment search for countries which enable them to decrease the amount of financial resources needed for the production process; alternatively, the examination may focus on geographical locations in which a key raw material is abundant, in order to diminish transportation costs for example, or nations in which it is easier to achieve economies of scale, enhancing the overall efficiency.

It has to be said that usually vertical FDIs are conducted within developing economies, in which key resources are frequently abundant and cost of production are lower with respect of mature economies.

A partial list of determinants that influence the decision-making process of firms that decide to pursue vertical FDI can be summarised as follows, examining also the existing academic literature related to these aspects:

- Cost of labour in the foreign country: surely one of the most important drivers of choice in the decision-making process of a vertical FDI is represented by the average cost of workforce of the selected nation. A good measure proxy for this economic variable can be researched in the average wage per sector in a certain region of the country object of examination, in order to evaluate the magnitude of cost benefits reachable with this kind of strategy.

  Labour expenses are one of the balance sheet items that highly impact on the value creation process of a cost driven firm, and in the past years many companies have decided to shift their production plants in developing economies to exploit low cost opportunities.

  Esiyok & Ugur (2017) sustain this statement in their article, in which they conduct a regression analysis in order to understand the main causes of FDI in Vietnam.

- Presence of tariffs and custom duties in the taxation framework of the foreign country: in most cases with vertical FDIs companies establish new production plants in the host economy to take advantage of the presence of raw materials and lower costs; subsequently, final products or semi-finished components are exported from the foreign country, being used in other manufacturing sites, or being sold in the market.

  The presence of custom duties and other kind of tariffs on the exportation of products can function as a brake for firms that want to invest vertically in another State: in fact, this category of taxes increase the effective cost incurred by the investing business to provide their products, acting as a restraint for FDIs.

Asirvatham, Rasiah, Thangiah & Naghavi (2017) cited tariffs, and in particular tariff reduction in the original members of ASEAN[21] countries over the period 1970-2015, as one of the most important drivers for Foreign Direct Investments.

- Abundance of key raw materials: one aspect that must be taken into account analysing the decision-making process of vertical FDIs regards the presence in the foreign country of abundant key resources for production: in fact, companies that want to reduce expenses and increase efficiency usually focus themselves on the cost of input supplies, one of the most important items in their balance sheets.

  Developing economies frequently have at their disposal a huge amount of key natural resources which can be used in production; moreover, these raw materials are available at lower relative cost compared to the home economy of the MNE, and this is a core condition for the prosperity of vertical Foreign Direct Investments.

  Bhavan, Xu & Zhong (2011) corroborate the previous statement, claiming that the abundancy of resources at a relative low cost for developing economies is one of the key drivers for FDIs in those geographical area; in particular, the analysis was conducted in the South Asian economies through a panel data examination.

2.1.3 Drivers applicable to both categories

The last paragraph of this chapter is dedicated to that kind of determinants of Foreign Direct Investments which has an impact and can be applied to the strategy selection method of both the categories previously detected. These choice criteria

[21] ASEAN is an acronym which stands for Association of Southeast Asian Nations, and indicates a regional intergovernmental organisation originally composed by Indonesia, Malaysia, Philippines, Singapore and Thailand. The main aim of this organisation is to promote collaboration among the member states in different fields, such as economic, political, military and socio-cultural.

are so fundamental that influence the final result regardless of the main scope of the FDI, because they play an essential role in the key aspects of formation and further operations of the new economic entity in the foreign country.

A non-exhaustive index of the most important drivers that impact on the decision-making process of the two classes of Foreign Direct Investments can be reassumed as follows:

- Presence of efficient infrastructures in the host economy: transportation and logistic of goods and input materials can be considered as one of the most important phases in the production and distribution process. If the host country does not dispose of an efficient and diffused network of transport infrastructures it could make impossible or very expensive for the subsidiary to sell its products in the foreign market or to export them to the home economy.

  Furthermore, the existence of an effective communication network is fundamental for MNEs that want to invest in foreign countries, either to create cooperation systems with other firms located in the State or to be able to successfully connect the parent company with its subsidiaries, for the conjoint development of new competencies and core capabilities.

  Many authors have tried to investigate the link between the presence of efficient infrastructures and the ability of the country to attract FDIs; Manpreet, Apalak & Surendra (2016) in their article find evidence of a positive relation between the availability of well-organized infrastructures and the attractiveness of an economy for Multinational Enterprises.
- Trade openness of the foreign country: this economic index is calculated as a ratio between the total sum of imports and exports of a country, divided by its Gross Domestic Product; it represents a measure of the outward orientation of an economy, and gives information on the degree of importance of international trade in the national system.

The higher this coefficient is, the more outward oriented the investigated nation is, and as a result foreign enterprises may decide to invest in these States.

A high degree of trade openness is fostered by governments that do not impose trade barriers, such as limitations to import and tariffs, but sign agreements for free movement of capital and people for example; other possible factors that increase trade openness are the presence of efficient infrastructures and a well-functioning legal framework for investments and businesses.

Moreover, in a country in which the level of this index is high, MNEs find easier to transfer financial resources, as well as raw materials and also competencies and knowledge with respect to other States that apply barriers to international trade.

In an article written by Lal (2017), the author investigates on the relation between FDI and the index of trade openness from 1980 to 2011 for three emerging economies: India, Mexico and China. The results suggest that there is a positive relationship between this measure and FDI, validating the statements descripted above.

- Financial and political stability of the foreign country: one aspect that must be taken into account in the decision making process of the destination of Foreign Direct Investments is represented by the political and financial condition of the foreign state; one possible measure of this determinant could be given by the so-called Fragile State Index, a statistical indicator provided by the Fund For Peace that considers different perspectives of the geographical area under investigation, such as state legitimacy, respect and consideration of human rights, rule of law and the security apparatus.

  The investment appeal of a geographical area is heavily influenced by political facts and events: in a climate of uncertainty, that can be related to wrong economic policies or governmental instability, economic agents are less incentivized to spend their money and pursue FDI strategies, as the entire

economic system would be negatively affected by this scepticism, that act as a brake for consumption and investments.

The main task of the legal authority is to ensure and guarantee a stable and efficient legal framework in which MNEs are able to operate accurately and effectively.

Moreover, also financial solidity of a country is a parameter that must be taken into consideration when deciding the location of a Foreign Direct Investment: the last 2007-2008 Crisis demonstrated that financial and real economy are heavily interconnected. Instabilities in one sector considerably reflect on the other, in contrast with the common thinking of the majority of researchers and academicians before that recession. The implementation of competent and capable regulatory organisations is one of the key instruments to guarantee financial stability, together with an effective control system.

Shen & Li (2017) and Şıklar & Kocaman (2018) in their articles have provided evidence of the effectiveness and the importance of political and financial stability of a country as a driver in the decision-making process of a business that has to decide in which foreign economy to invest.

- Taxation applied in the foreign country: one of the most important determinants in the choice of the location of a Foreign Direct Investment is represented by the average tax burden applied by the foreign government to businesses. Countries that want to sustain the presence of FDIs usually implement political measures that have the main aim to decrease the total amount of fiscal impositions, creating an attractive incentive for those firms that are interested in expanding its business abroad.

  A low-taxation environment leads incontrovertibly to savings for companies, that are therefore able to reinvest their profits or distribute them to shareholders.

Several academic articles underline the importance of this aspect of the foreign country in the selection process of FDI location, including Glass & Saggi (2014) and Simões, Ventura & Coelho (2015).

3.THE MAIN EFFECTS OF FDI AND OTHER ECONOMIC VARIABLES ON GDP: ANALYSING TIME SERIES THROUGH OLS MODEL

3.1 The model

3.1.1 Theoretical basis of the model

Following the econometric methodology, in order to better understand the dynamics and the mechanics that constitute and govern the link between Foreign Direct Investments and economic performances of the receiving country, it is useful to design and build a linear model, with the main objective to fully comprehend in which way FDIs and other economic variables impact and influence the Gross Domestic Product of the United States of America.

Assuming that the trend can be reassumed with a straight line, the linear model can be summarized as follows:

$$E(Y_t|I_t) = \mu_t = f(I; C_o, \theta) \; and \; Y_t = g(I_t, \varepsilon_t, C_o, \theta)$$

Where:

I = information available at time t

ε_t = errors committed inside the model, or random disturbance terms

Θ = matrix vector of parameters

C_0 = initial set of conditions

f(…) = multidimensional function that has the main purpose to link the behaviour of k explicative variables to the dependent variable

The information available denoted as the capital letter I do not strictly depend on time, and for the purpose of the model, this set of information is being intended

as a group of variables, that for simplicity are collected in a vector, or a matrix denominated X.

The linear model that has been taken into account in order to explain the phenomenon in this work can be written down in this manner:

$$Y = \beta_0 + \beta_1 X$$

where β_0 can be intended as the intercept of the straight line on the vertical axis, and β_1 is the slope of the previous cited curve.

Considering the fact that there is a time dimension in the series that will be considered inside this model, it is useful to rearrange the terms of the previous formula, reaching the following result:

$$Y_t = \beta_0 + \beta_1 X_t \; \forall \; t = 1,2, \dots, T$$

In this model, both Y_t and X_t can be considered as a random variables, in which it is possible to perceive a sample of T observations, y_t, t=1,2,…,T, as well as it is possible to observe an equal amount of observation in the explanatory variable X_t, x_t, t=1,2,…,T.

Mainly for this reason, it is possible to rewrite the previous equation as follows:

$$y_t = \beta_0 + \beta_1 x_t \; \forall \; t = 1,2, \dots, T$$

Due to the fact that Y is considered as random variable, building the model in such a way can lead to an error in explaining the behaviour of the dependent variable. In this optic, it is useful to bring into account the presence of an error term of disturbance, ε_t. The error term is fundamental because considering it potential errors committed by the model can be taken into account in order to better estimate the mechanism and the dynamics of Y: to be more specific, this means potential errors in the variable measurement, possible errors in the model specifications, the contribution of eventual omitted variables and the possible diversity of the coefficients.

Taking into account the presence of the term of disturbance error, the equation can be rewritten as:

$$Y_t = \beta_0 + \beta_1 X_t + \varepsilon_t \qquad t = 1,2,\dots,T$$

regarding the assumption that Y and X are random variables.

Substituting the observed value of the two random variables X and Y we obtain the following equation:

$$y_t = \beta_0 + \beta_1 x_t + \varepsilon_t \qquad t = 1,2,\dots,T$$

3.1.2 Matrix notation of the model

The representation of the model as a function, like the notation used above, is useful in order to understand the theoretical basis behind this theory; however, another notation known as matrix one can be used. In order to do this, it is convenient to write the linear model in an extended manner:

$y_1 = \beta_0 + \beta_1 x_1 + \varepsilon_1$

$y_2 = \beta_0 + \beta_1 x_2 + \varepsilon_2$

…

$y_T = \beta_0 + \beta_1 x_T + \varepsilon_T$

Once the model has been written down in extended form, the matrix notation can be used to compact the data inside the model, and exploit the matrix properties to work with time series in an efficient and a well-organized way.

The matrix notation can be reassumed as follows:

$$\begin{pmatrix} y_1 \\ y_2 \\ \dots \\ \dots \\ y_T \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \\ \dots \\ \dots \\ 1 \end{pmatrix} \beta_0 + \begin{pmatrix} x_1 \\ x_2 \\ \dots \\ \dots \\ x_T \end{pmatrix} \beta_1 + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \dots \\ \dots \\ \varepsilon_T \end{pmatrix}$$

The matrix used in this notation can be renamed, to obtain a more compact result:

$$y = v\beta_0 + x\beta_1 + \varepsilon$$

where each vector is represented by a letter, and T is the total amount of observation in the sample, such that:

y is a vector of dimension Tx1[22]

v is a vector of dimension Tx1

β_0 is a vector of dimension 1x1

x is a vector of dimension Tx1

β_1 is a vector of dimension 1x1

ε_t is a vector of dimension 1x1

Taking into consideration the fact that the model can be built utilising more than one explanatory variable, up to k variables, the k-th coefficient will be named β_k.

Therefore, it is imaginable to rearrange the terms of the previous equations:

$$y = W\beta + \varepsilon$$

where:

y is a vector of dimension Tx1

W is a matrix Txk

β is a matrix kxT

[22] The notation RxC has the meaning that the matrix is constituted by R rows and C columns

ε_t is a vector Tx1

3.1.3 Assumptions of the model

The regression model that has been described in the previous pages is funded on six assumptions that must be considered whenever an analysis using these equations has been conducted; the following paragraph has the main purpose of understanding and comprehend in depth the presumptions of the linear regression model.

1. Parameters forecasted by the model are linear and stable in time. The main consequence of this assumption is linked to the fact that data observed must be stationary, i.e. the parameters of mean and variance of a variable are supposed not to change over time, or to reach a stability in the long run.
2. The expected value of the residual term ε_t is equal to zero, for each t that goes from 1 to T. The term of error ε_t can be either considered as a random variable, assuming the fact that its expected value is equal to zero: there is no reason at all in order to believe that error terms can assume only positive or negative values.

   In fact, rearranging the terms of the previous equation we obtain:

   $$\varepsilon_t = Y_i - \beta_0 - \beta_1 X_t$$

   So, in order to generalize this rule:

   $$E(y) = W\beta$$

   this formula has been derived utilising the property of the expected value of the sum of two random variables, that is equal to the sum of the two expected values of each random variable, so that:

   $E(A + B) = E(A) + E(B)$, then $E(Y) = E(W\beta) + E(\varepsilon_t)$, but $E(\varepsilon_t) = 0$

   To conclude, due to the fact that the expected value of the disturbance error term is zero, the expected value of Y is equal to the above-mentioned equation.

3. Homoscedasticity of the error term ε_t: the homoscedasticity is a property of a set of random variables in which the variance of these aleatory variables is constant and finite over all values of x_t and over time.

   The statistical demonstration of this assumption can be summarized as follows:

   $Var(\varepsilon_t) = E(\varepsilon_t \varepsilon_t') = \sigma^2$ because

   $= E\{[(\varepsilon_t - E(\varepsilon_t)][\varepsilon_t - E(\varepsilon_t)]'\}$

   $= E[(\varepsilon_t \varepsilon_t')]$

   $= \sigma^2 I$

   Where the letter I identifies the identity matrix[23].

   The homoscedasticity property identifies the set of data as a unique population, which cannot be subdivided in different groups according to different variances: the phenomenon of subdividing the dataset into different groups is applicable in presence of heteroscedasticity.

4. The errors of the model can be defined as statistically independent one on another: in other words, the conjoint trend and the behaviour of two set of errors of the model i and j is not reciprocally dependent, and the covariance of these two set of errors is equal to zero.

$$Cov(\varepsilon_i, \varepsilon_j) = 0 \; \forall \; i \neq j$$

5. There is no relationship between the error term and the corresponding independent variable: to be clearer, the covariance between these two factors is equal to zero, meaning that the behaviour of the independent variable does not affect the trend of the error term.

$$Cov(X_t, \varepsilon_t) = 0 \; \forall \; t = 1,2, \dots, T$$

   An alternative assumption that can be taken into consideration regarding this point, which is slightly robust, is that the random variable X_t can be defined as non-stochastic, or fixed in repeated samples.

[23] The identity is defined as matrix where all the elements inside the matrix are zero, except for the diagonals, in which the value of the elements is one.

The matrix notation is helpful and efficient in better explaining the meaning and the implications of this assumption: in the previous notations the factor W has been defined, which expresses the set of observations inside a matrix of dimension T x k. The dataset is non-stochastic or fixed in repeated samples, when the rank of the W matrix is equal to k, its number of columns.

This typology of matrix can be determined as full-rank matrix, which means that there are not linear dependent vectors inside it.

Linear dependency is a property of vectors, and can be observed when a vector in a matrix can be obtained as a linear combination of other vectors contained in the previous mentioned matrix.

The presence of linear dependency, and as consequence the decrease of the rank of the W matrix, is symptom of multicollinearity, a phenomenon that can affect models in which different variables contain redundant information. Multicollinearity can artificially increase the value of the R^2, the indicator that provides evidence on the goodness of the model, conducting to misleading results and forecasts (Grewal, Cote, & Baumgartner, 2004).

6. The disturbance term random variable ε assumes a normal distribution, with the central values of mean and variance respectively equal to zero and $\sigma^2 I$.

$$\varepsilon \sim N(0, \sigma^2 I)$$

The assumptions mentioned above are useful to understand the main characteristics and the properties that the data observation must respect in order to be used inside the model.

3.1.4 Mathematical demonstration

The linear model that has been described up to now is derived from an optimization technique denominated Ordinary Least Squares, shortened OLS, that has the main feature of creating a function, the so-called regression curve, that is able to encase the information contained in a quantitative dataset.

Representing the observations registered in a cartesian space, there is an infinite number of straight lines that can be plotted trying to understand the magnitude of the relationship between the two variables analysed; every time we assign a theoretical value to the dependent variable y, based on a regression model, we commit an error whenever the theoretical value diverts from the real value of y; the OLS regression method owns the main feature of minimizing the sum of the square of the differences between the real observed explanatory variable, and the one predicted by the model.

Recalling the previous cited equation that summarise the model:

$$Y = W\beta + \varepsilon$$

where:

Y is a vector of dimension Tx1

W is a matrix Txk

β is a matrix kxT

ε is a vector Tx1

The parameter β have to be considered as unknown, and must be estimated utilising the OLS method; we proceed to substituting the unknown value of β with a theoretical value $\hat{\beta}$, committing an error in the dependent variable calculation. $\hat{\beta}$ is defined as the estimator of the model, and the error is expressed by the value of residuals e; it has to be noticed that the residual term e has not to be confused with the disturbance term ε: in fact, they have two strong different meanings inside the model. The first (e) is the difference between the real and the fitted values obtained by the model; on the other hand, ε can be seen as a factor that has to be added to the population regression function in order to capture a numerous number of features and mistakes that may affect the model.

The new equation obtained is the following:

$$y = W\hat{\beta} + e$$

Taking into account the previous considerations, the main scope if the OLS technique is to minimize the sum of square of residual errors committed inside the model:

$$min \sum_{t=1}^{T} e_t^2$$

From the previous cited equation, it is now possible to obtain an estimation of the error term, and substitute it inside the formula of the minimization of the errors:

$$e = W\hat{\beta} - y$$

$$\min \sum e'e = \min(y - W\hat{\beta})'(y - W\hat{\beta})$$

$$= \min(y'y - \hat{\beta}'W'y - y'W\hat{\beta} + \hat{\beta}'W'W\hat{\beta})$$

$$= \min(y'y - 2\hat{\beta}'W'y + \hat{\beta}'W'W\hat{\beta})$$

where this progress is based on the mathematical rule that the transpose of a scalar is the scalar itself. For example, $y'W\hat{\beta} = \left(y'W\hat{\beta}\right)' = \hat{\beta}'W'y$

In order to find the best estimator $\hat{\beta}$ that minimizes the sum of squares of residual errors e, the mathematical concepts of derivative have to be taken into account: if we impose the first order conditions, i.e. the first derivative with respect to $\hat{\beta}$ equal to zero, we are able to discover the minimum point of the function. The previous cited concepts produce the following equation:

$$\frac{\partial e'e}{\partial \hat{\beta}} = -2W'y + 2W'W\hat{\beta}$$

$$-2W'y + 2W'W\hat{\beta} = 0$$

$$W'W\hat{\beta} = W'y$$

From the list of properties listed in the previous paragraph, one fundamental condition for the OLS model is that the matrix W must be a full rank matrix, with no linear dependent vectors; if this is true, the W matrix can be considered as invertible.

If we multiply the two sides of the equation by the inverted matrix of (W'W)=(W'W)$^{-1}$ we obtain the result:

$$(W'W)^{-1}(W'W)\hat{\beta} = (W'W)^{-1}W'y$$

Knowing the fact that, recalling the fundamentals of matrix mathematics, multiplying a matrix by its inverted gives the result of the identity, and so the final formula of the estimator $\hat{\beta}$ is:

$$\hat{\beta} = (W'W)^{-1}W'y$$

The further step that has to be taken into account is the verification of the fact that the result achieved by this demonstration is truly a minimum point of the function; in order to do so, we calculate the second derivative:

$$\frac{\partial e'e}{\partial\hat{\beta}\partial\hat{\beta}} = 2W'W$$

due to the fact that W is a full rank matrix, it can be considered as a positive fixed matrix, and therefore, $\hat{\beta}$ is always defined as a minimum point: this means that the value of the estimator calculated with the OLS method is the one that returns the lowest value of the sum of the squares of residual errors of the regression.

3.1.5 Properties of the model

1. **Unbiasedness**

   The bias of an estimator can be defined as the difference between the expected value of the estimator and the estimate; it can be calculated as:

   $$bias(\hat{\beta}) = E(\hat{\beta}) - \beta$$

   If the bias is equal to zero, and in this case the expected value of the estimator is equal to the parameter estimated, the estimator is described as unbiased; otherwise, it will be an biased estimator. The estimator detected with the OLS method is a random variable that has its own probability distribution, that can

be approximated to a normal one. The main consequence of this statement is that the value of the estimator $\hat{\beta}$ should be located in the maximum point of the distribution.

It can be demonstrated that $\hat{\beta}$ is an unbiased estimator:

Substituting $y = W\beta + \varepsilon$ to $\hat{\beta} = (W'W)^{-1}W'y$

We obtain $\hat{\beta} = (W'W)^{-1}W'(W\beta + \varepsilon)$

$$= (W'W)^{-1}(W'W\beta + W'\varepsilon)$$

$$= (W'W)^{-1}(W'W\beta) + (W'W)^{-1}(W'\varepsilon)$$

Knowing the fact that $(W'W)^{-1}(W'W)$ is an identity matrix:

$$= \beta + (W'W)^{-1}W'\varepsilon$$

Therefore $E(\hat{\beta}) = E[\beta + (W'W)^{-1}W'\varepsilon]$

$$= E(\beta) + E[(W'W)^{-1}W'\varepsilon]$$

$$= \beta + (W'W)^{-1}W'E(\varepsilon)$$

utilising the assumptions for the model cited before $E(\varepsilon) = 0$, we can obtain the following result:

$$E(\hat{\beta}) = \beta$$

This condition allows to affirm that the estimator $\hat{\beta}$ has a bias equal to zero, and therefore it can be considered as an unbiased estimator.

2. **Orthogonality**

The straight line that interpolates the data generates a set of residual errors; the sum of this residuals is always equal to zero. In other words, there is a compensation between positive and negative residuals, and mainly for this reason the square of errors is being utilised.

$W'W\hat{\beta} = W'y$ but $y = W\hat{\beta} + e$

$W'W\hat{\beta} = W'(W\hat{\beta} + e)$

$W'W\hat{\beta} = W'W\hat{\beta} + W'e$

$$W'e = W'W\hat{\beta} - W'W\hat{\beta}$$

$$W'e = 0$$

3. Variance of the OLS estimators

The higher is the value that the variance of the estimator assumes, the higher is the uncertainty regarding the estimated value; mainly for this reason it is desirable that the variance of the estimators is as lowest as possible.

Taking into account that:

$$\hat{\beta} - E(\hat{\beta}) = \hat{\beta} - \beta = \hat{\beta} - [\hat{\beta} - (W'W)^{-1}W'\varepsilon]$$

$$Var(\hat{\beta}) = E\left[\left(\hat{\beta} - E(\hat{\beta})\right)\left(\hat{\beta} - E(\hat{\beta})\right)'\right]$$

$$= E\{[(W'W)^{-1}W'\varepsilon]\,[\varepsilon'W'(W'W)^{-1}]\}$$

$$= (W'W)^{-1}W'E(\varepsilon\varepsilon')W(W'W)^{-1}$$

$$= (W'W)^{-1}W'\sigma^2 I\, W(W'W)^{-1}$$

$$= \sigma^2(W'W)^{-1}W'W(W'W)^{-1}$$

As $W'W(W'W)^{-1}$ is an identity matrix, the final result is:

$$Var(\hat{\beta}) = \sigma^2(W'W)^{-1}$$

4. Consistency

If the numerosity of the considered sample tends to infinitive, the value of the estimates will converge to their real values, and the variance of the estimator will tend to zero.

In order to prove the consistency of the estimator, it is useful to recall two assumptions stated in the previous paragraph:

$$cov(X_t, \varepsilon_t) = 0 \;\forall\; t = 1,2,\dots,T$$

$$Var(\varepsilon_t) = \sigma^2 < \infty$$

The property of consistency has the following implication:

$$\lim_{t\to\infty} \Pr[|\hat{\beta} - \beta| > \delta] = 0 \;\forall\; \delta > 0$$

5. **Efficiency**

   Considering the statistical theory on estimators, $\hat{\beta}$ is said to be an efficient estimator of the real value β whenever $\hat{\beta}$ is an unbiased estimator, and no other estimators owning the same feature have a lower variance.

   Among the different estimators, the one that is said to be efficient allows us to minimize the probability that the theoretical value of $\hat{\beta}$ may diverts from the real value of β.

According to the Gauss-Markov theorem, each and every time the properties from 1 to 5 are satisfied, the OLS estimator $\hat{\beta}$ can be defined as Best Linear Unbiased Estimator or B.L.U.E. It is worth to analyse every component of this acronym, in order to better understand the implications and the characteristics of the estimator:

- Estimator: $\hat{\beta}$ can be defined as an estimator of the real value of the unknown factor β
- Linear: the estimator $\hat{\beta}$ is inserted in a linear model, and produces an output of a straight line
- Unbiased: the forecasted value of the estimator $\hat{\beta}$ will be equal on average to the true values of β; in other words, the estimator is said to be unbiased.
- Best: among the set of unbiased estimators, the OLS $\hat{\beta}$ has to be considered as the one with the lowest variance, as the Gauss-Markov theorem demonstrates; for this reason, $\hat{\beta}$ is the estimator that approximates the real value of β in the best way.

Once the estimator has been calculated, it is useful to calculate an interval containing β, the true and unknown value of the parameter, with an a priori fixed probability.

Knowing the fact that the difference of the estimator $\hat{\beta}$ and the unknown parameter β divided by the standard error of the estimated value $\hat{\beta}$, also defined as s.e.($\hat{\beta}$), is distributed as a Student's T with n-k degrees of freedom, where n indicates the number of parameters of the sample considered and specifies the number of regressors utilized in the model, i.e.:

$$\frac{\hat{\beta} - \beta}{s.e.(\hat{\beta})} \sim Student's\ T(n-k)$$

Fixing a level of significance equal to α, it will be possible to identify a critical value t_c, such that:

$$\Pr(t > t_c) = \frac{\alpha}{2}\ and\ \Pr(t < -t_c) = \frac{\alpha}{2}$$

Knowing the level of significance α and the number of the degrees of freedom it will be possible to calculate the value of t_c utilizing the distribution table of the Student's T.

Compacting the previous formulas in a smarter and more intuitive way, it can be shown that:

$$\Pr(-t_c \leq t \leq t_c) = 1 - \alpha$$

substituting to t the value of the test statistic of β in terms of $\hat{\beta}$ we obtain:

$$\Pr\left(-t_c \leq \frac{\hat{\beta} - \beta}{s.e.(\hat{\beta})} \leq t_c\right) = 1 - \alpha$$

Rearranging the terms of the equation we are able to calculate the length of the confidence interval:

$$\left[\hat{\beta} \pm t_c * s.e.(\hat{\beta})\right]$$

Therefore, meanwhile $\hat{\beta}$ can be interpreted as a punctual estimator for the unknown value β, using the interval estimation, $\left[\hat{\beta} \pm t_c * s.e.(\hat{\beta})\right]$ can be considered as an estimator for the interval with a confidence level of (1- α)%.

Now, after the demonstration of the model and its statistical properties, there will be introduced an analysis of the variables taken into consideration to better understand and explain the relations and the impact of foreign direct investments into the economy of the United States of America, that is represented in the model by the dependent variable of the national GDP.

3.2 Analysis of the variables

3.2.1 Descriptive analysis

When we are dealing with regression models and time series, which can be defined as a sample of observations during a specified time frame, it is useful to introduce and analyse each variable that is present in the model with a descriptive lens: observing the major summary statistics, describing the trend and the course of each variable, and examining the main reasons that have modelled the data considered is fundamental as preparatory job for a further implementation of the regression model.

All the statistical observations that have been used in this work are quarterly data, regard the US economy in a period of time that goes from 1990:Q1 to 2018:Q1; the total number of observations is 113 and can be found inside the database of the Federal Reserve Bank of St. Louis, https://fred.stlouisfed.org/, and specifically the variable observed are the following:

- Dependent variable: Gross Domestic Product (GDP)
- Explanatory variables: Consumer Price Index (CPI)
  Level of stock of Gross Fixed Capital Formation (GFCF)
  Level of stock of Foreign Direct Investments (FDI)
  Unemployment rate (UNEMP)

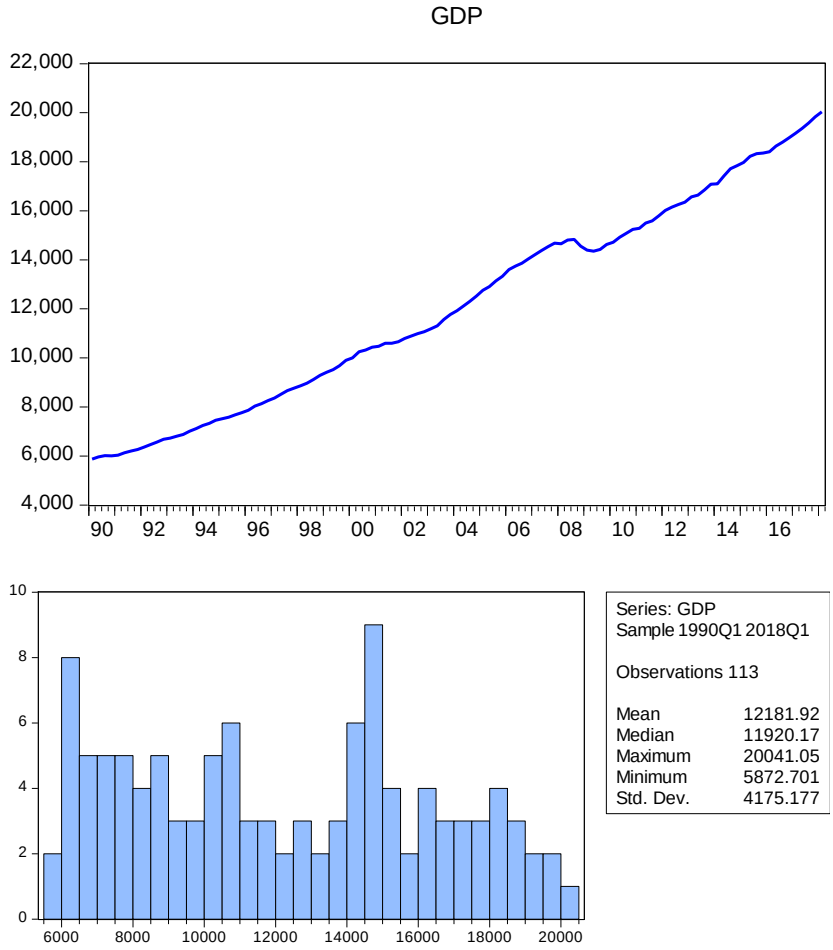
It has to be said that all the time series considered are seasonally adjusted inside the Federal Reserve database, in order to avoid further problems in the model.

Now it is useful to introduce a single analysis for each variable, both using an analytical and a qualitative perspective, in order to preliminary understand the properties and the statistical feature of each time series considered, and the events and the causes that have brought to this final result.

From a statistical point of view, the summary statistics took into consideration are mean[24], standard deviation[25], median, maximum and minimum, together with two statistical representations of the trend and the histogram of the observations.

Regarding the qualitative perspective, a research concerning the major determinants of critical shifts in the observations has been conducted among academic articles and specialized books, and the results will be summarized for each variable.

GROSS DOMESTIC PRODUCT



[24] Mean is a statistical index useful to acquire information about the central tendency of the time series we are analysing. It is obtained dividing the total sum of the observations by the number of the latter.
[25] Standard deviation can be defined as a statistical measure that expresses the dispersion of the data considered with respect to the mean, and consequently it describes the spread between values in the observations. It is calculated as the square root of the variance, an index that is obtained by summing all the squared differences of the real data and the mean, and dividing them by the total number of observations.

According to Leamer (2009), and many other authors that gave a definition to this economic measure, “GDP is the market value of goods and services produced within a selected geographic area (usually a country) in a selected interval in time (often a year)”.

There are at least three different ways to conceptualize and measure the Gross Domestic Product of a country, that many researchers and analysts perceive as an approximation of the wealth of a nation:

- The expenditures approach computes the GDP as an algebraic sum of four components: private consumption, investments, government expenditure and net export (which is the difference between export and import)
- The income approach takes into account the whole sum of money earned by the totality of production factors, such as for example salaries, rents, interests acquired in operations of lending and borrowing and of course also earnings derived by entrepreneurial activities.
- The output approach that concentrates on the production of goods and services, and in particular identifies the Gross Domestic Product as the total sum of the value added by each firm in the process of creation of a product or a service; in order to calculate it, it is useful to subtract from the price at which a firm sells a good the cost that this company sustained to acquire it.

Looking carefully at the line graph, that shows the positive trend that this variable assumed in the time frame considered, it has to be highlighted that, particularly in three occasions, there has been a phenomenon inside the American economy, that has negatively impacted on the value of GDP: the recession[26].

Going deeply into this fact, the three periods in which conjunctural negative economic conditions have been observed in the US can be identified as follows:

[26] With the economic term recession, it is defined a period of time, of at least six months, when a vast slowdown of economic activities can be noticed. Usually, in these periods the major indicators that tend to decrease are employment rate, industrial production and per capita income.

- The first two years of the nineties, remembered in history as the “Early 1990s recession”
- The so called “2001 US recession”, that affected the American economy in the second year of the XXI century
- One of the most unfortunately famous financial crises after the Great Depression of 1929, the Great Recession that severely impacted on the US from 2007 to 2009.

It is now useful to understand the causes of each of these periods of negative tendency of the GDP variable, and its consequences on the United States economy.

Regarding the first point of this list, the “Early 1990s recession” has signified an economic downturn from July 1990 to March 1991 after the most important development chapter in the US history (Brown & Pagan, 1998).

The causes of this negative period for the US economy, that had a heavy impact on job losses until 1992, have been clearly summarized by an American economist, Carl E. Walsh, inside an article of the Economic Review published by the Federal Reserve Bank of San Francisco (1993): in particular, the first component identified by Walsh was the constrictive monetary policy conducted by the United States’ national bank, the Federal Reserve, with the main aim to decrease the growing consumer price index, which translated into an higher inflation rate. Moreover, in these years in the US also a drop regarding prices of the assets and properties in the real estate sector manifested, marking the cessation of the so-called real estate boom: one measure that amplified this drop of prices was the Tax Reform Act, signed by Ronald Reagan in 1986.

Nevertheless, the economy in the US showed a positive trend until the 1st quarter of 1990; the straw that broke the camel’s back was the 1990 oil price shock, caused by the invasion of Kuwait by Iraq, that mined an already fragile framework: correspondingly, aggregate spending factors sharply decreased, mostly due to uncertainty, and the result was a period of recession that lasted two years.

The particular fact of this period of crisis relies into the fact that this recession heavily impacted on the labour market of the US, changing the shape and established conditions, particularly looking at the full-time and part-time contracts: this aspect will be deepen in a further paragraph of this thesis. According to Brown & Pagan (1998), in some cases the recovery to the pre-crisis status quo in the market labour lasted more than 15 months past the official ending date of the recession.

The second point of the list, that represents the so-called "2001 US recession" was a period of conjunctural negative trend in the American economy; it has to be said that already in 2000 undesirable economic performance had been registered in other developed countries, and especially in the European Union.

According to the National Bureau of Economic Research (NBER) that studies the evolutions and the cycles of the US economy through time, this crisis started in March 2001 and ended in November 2001; taking into account all the other recessions after the Second World War, this one can be labelled as shorter than the average; moreover, the effects of this negative economic period on private consumption, and especially on the durable goods and new residential housing continued to grow in this time frame (Kliesen, 2003). This particular observation indicates the fact that the effects of this crisis had a minor impact on the real economy.

Kliesen in his work highlighted also the major causes of this recession, that can be summarized as follows: the end and the explosion of the so-called dotcom bubble, a phenomenon of speculation in the high-tech NASDAQ index of the Wall Street Stock Exchange that rapidly increased its value and its trading volume due to the formation and the expansion of new profitable companies based on internet and tech revolution.

Moreover, the 9/11 terroristic attack contributed, in particular in the fourth quarter of 2001, to a heavy drop in investments, mainly due to the climate uncertainty in which US economy fell, especially regarding the political and the sociological side.

Lastly, a series of scandals and investigations affected a large number of top US firms, increasing the feeling of hesitation of investors and lenders in the economic circuit of United States of America.

The last point of the bulleted list mentioned above regards the so-called Great Recession, a period of negative trend of the US economy that started in 2007: even if in the United States the recession is declared to end in 2009 by the major economic institutions like the NBER and the International Monetary Fund, its effects have lasted for a very long period of time: moreover, this crisis expanded and damaged also other economies of developed and developing countries in the world, and some States are still facing the effects of this phenomenon.

It is now useful to investigate which are the more important and significant causes that led to the Great Recession, that affected both financial but also real aspects of the US economy.

In particular, the mainstream approach suggested in the article of Tim Congdon (2014), considers as propagation factor the banking sector, and specifically the explosion of the speculative bubble concerning the subprime mortgages in the US economy. To be more specific, the explosive rise of loans that banks were willing to grant, increasing the level of risk that these financial institutions bore, led to a dramatic accretion in interest rates, higher than the adjustment of the salaries of borrowers. Soon people who signed for a mortgage were no more able to repay the interests and the debt, leading to a crush in the system that set off the fundamental of the recession.

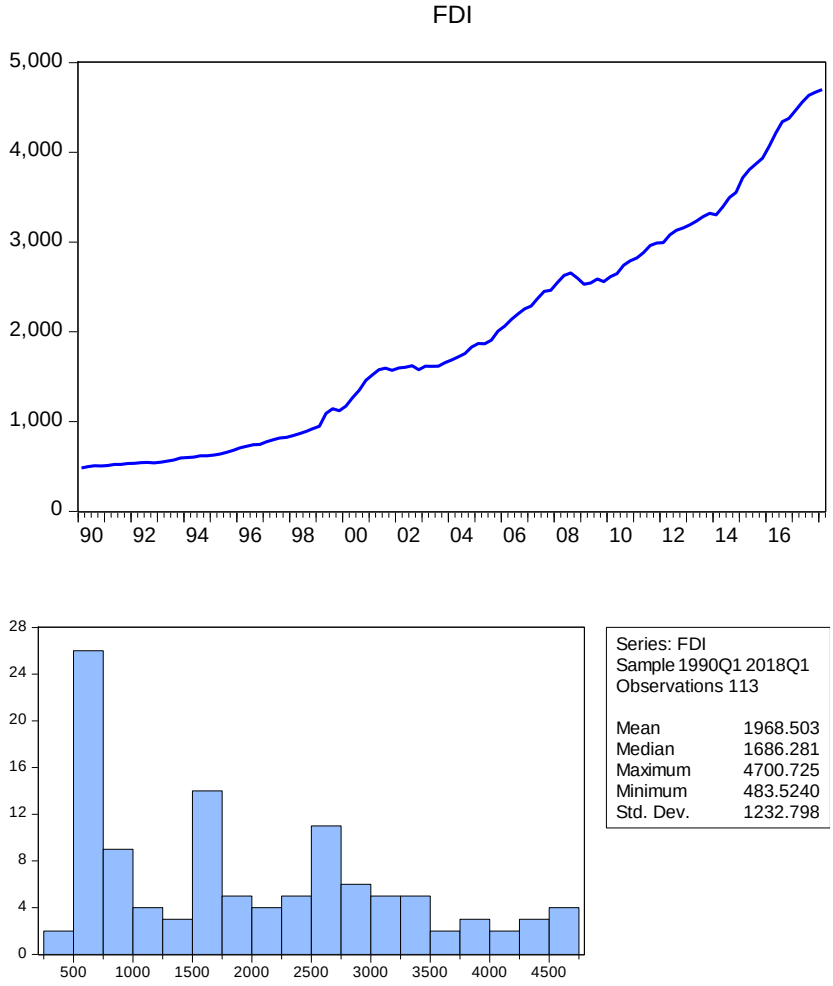
Moreover, the sudden growth of prices in the real estate in the first five years of the XXI century simply increased the investments in the sector, augmenting also the value of the mortgages granted by financial institutions: the 2007 drop of prices of private houses and buildings fed the vicious circle of inability of debt repayment, with all the consequences explained before.

Furthermore, the author pointed out that actual or potential bank insolvency can be interpreted as a reason of the negative period of the US economy, together

with the so-called animal spirit[27] of the bankers and a deep lack of regulation and recapitalization rules by institutions such as the Federal Reserve and the American Government.

All these factors led to the most impacting crisis after the Second World War, that as mentioned before propagated also in the real sector, demonstrating the fact that these two fields of the economy are strictly interconnected, concept that was not so clear and shared by the economic community before the Great Recession.

LEVEL OF STOCK OF FOREIGN DIRECT INVESTMENTS



[27] The locution animal spirit, first used by the economist J.M. Keynes, indicates the complex set of sentiments, instinctive emotions, non-rational processes that guide the human behaviour, especially in the field of management and entrepreneurship.

According to the OECD, the stock of foreign direct investments is an economic measure that tells us information about the total amount and the total level of FDIs conducted by foreign firms in the reporting economy, usually at the end of a quarter. To be more specific, the dataset that has been used in the regression contains the data of the stock of inward FDI, that is the total share of non-resident investors' equity and net loans in favours of companies based in the American territory.

According to the OECD data, available on the website, in 2012 in the US the industrial sector with the higher value of Foreign Direct Investments was the manufacturing one, and in particular chemical products, followed by mechanical products; another important stake of FDI regarded services, especially management holding companies.

Looking at the trend that this variable has followed during the period considered, we can easily detect the presence of an increasing progress of the level of stock of Foreign Direct Investments in the US economy, mainly due to several factors that have been generically explained before in the second chapter of this work: the high stability and safety of the US system as a whole, together with an attractive economic environment and an overall positive effects of taxation policies conducted by the governments of the US (Slemrod, 1989) led to an increasing level of stock of FDI.

Nevertheless, it has to be observed that during the periods of crisis and recession that have been described in the previous paragraph, the negative effects of the economic slowdown affected also this variable: in fact, particularly speaking about the 2001 US recession and the Great Recession, peaks and subsequent decreases have been registered in the observations. This phenomenon can be declassified as a normal process, since during recession periods the overall economy suffers; moreover, the uncertainty climate and the reluctance of investors to catch and exploit investment opportunities influence and worsen this process.

Predominantly, as explained by Contessi & De Pace (2012), the 2007 crisis was classified as one of the most damaging recessions for foreign direct investments in

the United States, taking into account also the fact that other developed countries did not experienced drops in this economic measure.

Moreover, a specific phenomenon distinguished the time frame between 2007 and 2009: the absence of resiliency[28] of inward foreign direct investments.

The main causes of non-resiliency of inward FDI in the US should be identified among different singularities, according to Contessi & De Pace:

- The global nature and the main characteristics of the economic recession, that heavily damaged the globe economy and therefore diminished also the propensity to invest of professional subjects, and in particular commercial banks that resented the effects of this negative period more than other institutions.

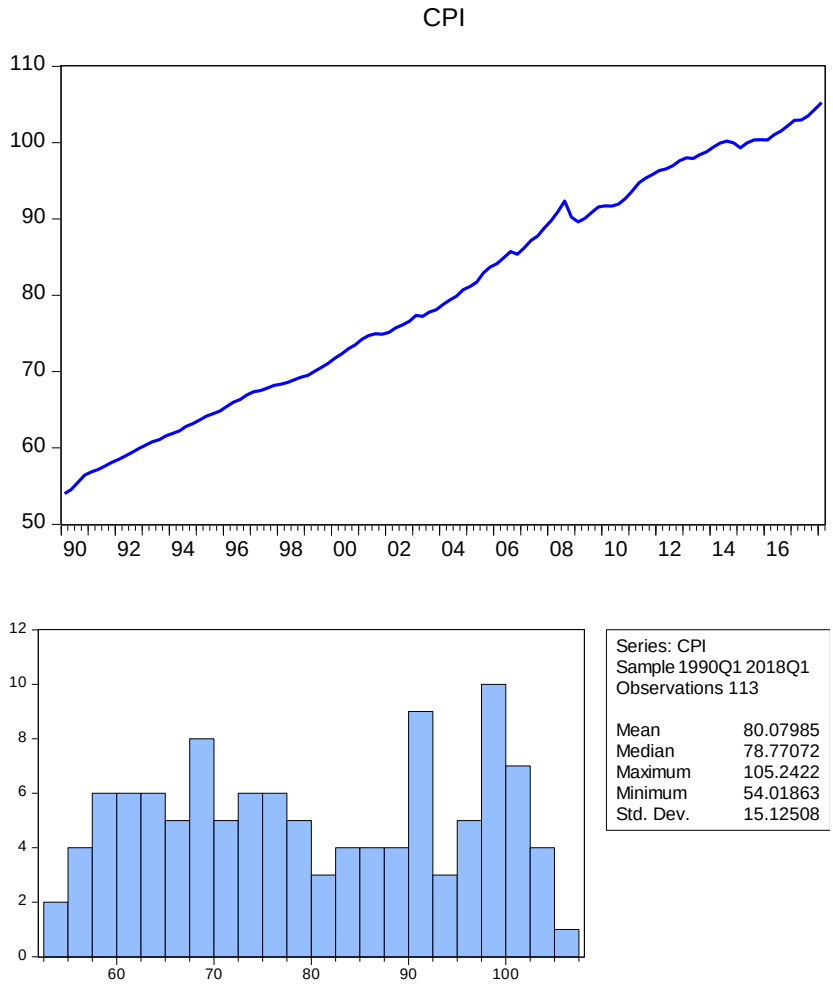
  This concept, and more generally the notion of global banks as principal transmission chain of the 2007 recession emerged in many other papers, and specifically in the one of Cettorelli & Goldberg (2011)
- An overall acceleration in the cost of financing FDIs in the economies in which the flows originate; the general increasing of systemic risk after the 2007 facts that led to the crisis obviously had a negative impact on the access to credit for firms all over the word, with a consequent contraction in the investment field.

Subsequently to this negative period, the level of stock of inward Foreign Direct Investments in the US economy recovered to the previous level and then increased until the value reached in the first quarter of 2018.

Especially after the end of 2013 the rise of Foreign Direct Investments sharpened, mainly due to the recovery state of the World Economy that in that years restarted to take off again.

[28] The term resiliency usually identifies the capacity and the attitude of an individual or a phenomenon to face up and overcome a period of difficulty or a traumatic event.

CONSUMER PRICE INDEX (CPI)



The consumer price index (CPI) is an economic ratio published by the US Bureau of Labor Statistics, which measures the average variations in prices paid by final consumers: the prices of goods and services considered in the computation form the so-called market basket, a set of products that are chosen conducting surveys and market analysis, asking to private people and families what they actually buy.

Bredin & Fountas (2018), who studied the evolution and the trend of the prices in the US economy for 200 years, discovered that "the founding of the Fed is associated with lower inflation[29] uncertainty".

[29] Inflation rate is an economic measure that give information on the magnitude of the change of prices in a pre-determined period of time. It is calculated as a growth rate of the Consumer Price Index,

Obviously, a huge number of factors are able to influence both positively and negatively the trend of prices in an economy, but one of the most important is surely the policies conducted by the central bank of the country considered, given the fact that this institution actually controls the level of currency present in the system and the monetary strategy of the State.

According to the data published by the American Central Bank in 2018, a stable 2% level of inflation in the medium term is fundamental in order to achieve the goals of price stability and an acceptable level of employment.

The policies conducted by the Fed have been able to maintain a certain level of credibility of this institution, and together with a strong economic system the result was that the level of uncertainty of the inflation index has been low, a very important aspect for the creation and growth of productive activities and investments.

Looking carefully at the graph, the previous statement by Bredin & Fountas finds evidence and reinforcement also considering the quarterly data in the 28 years measured: with some exceptions regarding the periods of crisis mentioned in the paragraph related to the Gross Domestic Product, and especially the Great Recession of 2007, where the trend of inflation decreases, generally speaking the US system has experimented a slightly rise of prices, index of progress and innovation in products and processes in the value chain.

Moreover, a controlled and slightly increasing level of prices is fundamental also because it engraves on the status of the real interest rate applied in the economy, which obviously is calculated as difference between the nominal one minus the inflation: this phenomenon of moderate inflation positively impacts on the cost of borrowing, that clearly remains almost stable for all the agents in the system, encouraging the purchase of durable goods for private people, and investments for firms.

backing out from the value of the current year the value of the previous year, and dividing the whole amount by the value of the previous year CPI.

It is now useful to carefully observe the movements and the shifts of the Consumer Price Index variable during and after the Great Recession of 2007, in which the inflation rate has substantially leaked from the optimal range fixed by the Federal Reserve.

Even if, according to the NBER, the Great Recession started in 2007, the general increase of prices that characterized the previous five years persisted until the second quarter of 2008: the peak has been reached right before the stock market crash of September 2008, moment in which the crisis became clearly visible.

This negative period, which was primarily caused by the financial sector, ended up hitting the real economy, and as a result also the level of prices of goods and services.

The unusual singularity of the data observed after the peak of 2008 is that, consequently to a period of decrease lasted few months, the inflation restarted to increase though the economy was in a state of difficulty.

This phenomenon has been studied by many authors and researchers, due to the fact that the level of prices in reality diverted from the predicted one. In particular, Ball & Mazumder (2011) conducted a stochastic analysis utilising the economic model known as Phillips Curve[30], and the results suggested that "inflation should have fallen by more than it did".

Also, Huang & Luo (2018) published an article regarding this field: in particular, the two researchers applied the so-called Phillips Curve in the Keynesian perspective, considering as variables the inflation rate and the potential output of the US economy, and in particular the difference between the real output and the potential one.

The results they found were very similar to the ones of Ball & Mazumder, in the sense that a discrepancy is actually present between the theoretical value of

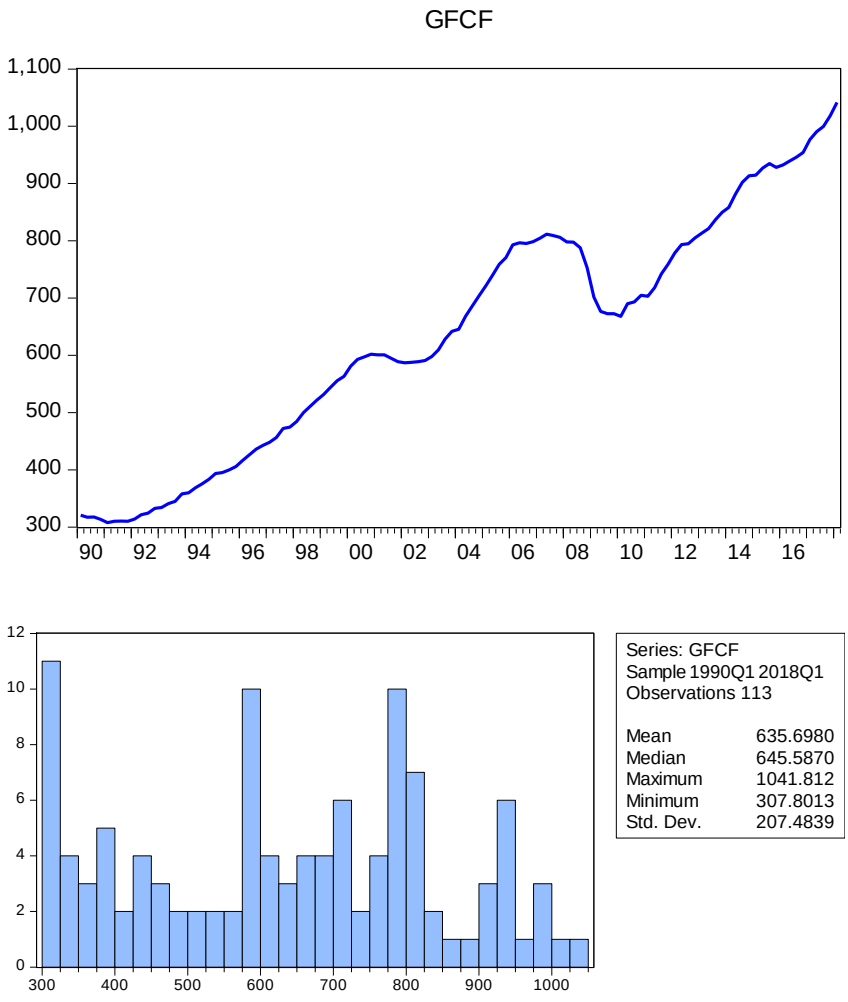
[30] The Phillips Curve is an economic model that put into relation the inflation rate and the unemployment rate; in particular, the curve identifies a negative interdependence between the two variables. For further readings please see "The relationship between unemployment and the rate of change of money wages in the UK 1861-1957", published in 1958.

inflation expressed by the model and the observed one in the real facts; this is mainly due to a permanent output loss in the US economy. Looking carefully at the models showed in the article, a large share of the declines in the real GDP during the 2007-2009 crisis seems to be irreversible and permanent, and this is the major cause that led to an unbalance between the forecasts and what really happened.

Taking into account all these effects and restructuring the model with these assumptions led to a prediction which is closer to the real observations.

After the settlement period due to the Great Recession, the CPI index restarted to increase at levels in line with the ones scheduled by the Federal Reserve, that with the policies conducted (mainly related to low interest rates with the main scope of pushing investments) has been able to reequilibrate the monetary system after the shock and keep under control the inflation situation.

GROSS FIXED CAPITAL FORMATION



According to the OECD, the gross fixed capital formation (GFCF) can be defined as the purchase or the creation of assets by firms and companies for their own use, less disposals of already existing factors of production; moreover, assets must be thought for use in the production phase for a time frame higher than one year in order to be considered as GFCF.

This variable is a measure of the total level of gross investments, in fact it does not take into account the depreciation of the existing factors of production; nevertheless, the disposal of old assets is considered.

Regarding the statistical and econometric field, this variable is able to capture and give information concerning the willingness of the economic agents in an economy to invest in productive factors; the higher the inclination to invest is, the better is the quality and the reliability of the entire system considered. Obviously, when we talk about quality of the system, it is intended as the ability of the regulator to implement and sustain a positive and functional framework, both from the legal and the political point of view. It has to be said that not all the variability of the GFCF can be explained with the previous statement; willingness to invest of economic agents is also influenced by external and non-controllable factors, such as the overall trend of the economy and level of uncertainty regarding the future.

As it can be seen from the line graph that describes the variable, the value of Gross Fixed Capital Formation has almost grown between 1991 and 2000; subsequently a decrease in level of GFCF can be observed during the period of the so-called “2001 US Recession”: as explained before, a slowdown in the entire economic system provokes hesitation in the economic agents, that are less willing to take risk and invest their money.

After a period of recovery lasted from 2002 to 2006, we can observe a peak in the second quarter of 2007: after that date, the Great Recession started its tremendous effects, that obviously affected also the generation of new investments by firms and companies.

It is now useful to investigate and concentrate on the drivers and the main causes that lead to a drop in investments during a period of crisis, phenomenon that can be observed also looking at the previous data.

It is widely recognized in the macroeconomic theory that interest rate at which financial institutions grants loans and credit to companies is one of the most important factors that influence the magnitude of the willingness to invest of agents in a system: in fact, in every period of crisis one of the most common and immediate reactions of Central Banks is to decrease this index in order to stimulate investors. Nevertheless, an interesting research conducted by the economist Simmons-Süer (2015) showed that not only the market interest rate at which firms are able to borrow money is fundamental in order to determine the level of investments: in fact, the cut operated by the FED in interest rates and the falling credit risks have not immediately brought to the desired effects, as the level of investments remained stagnant since 2011.

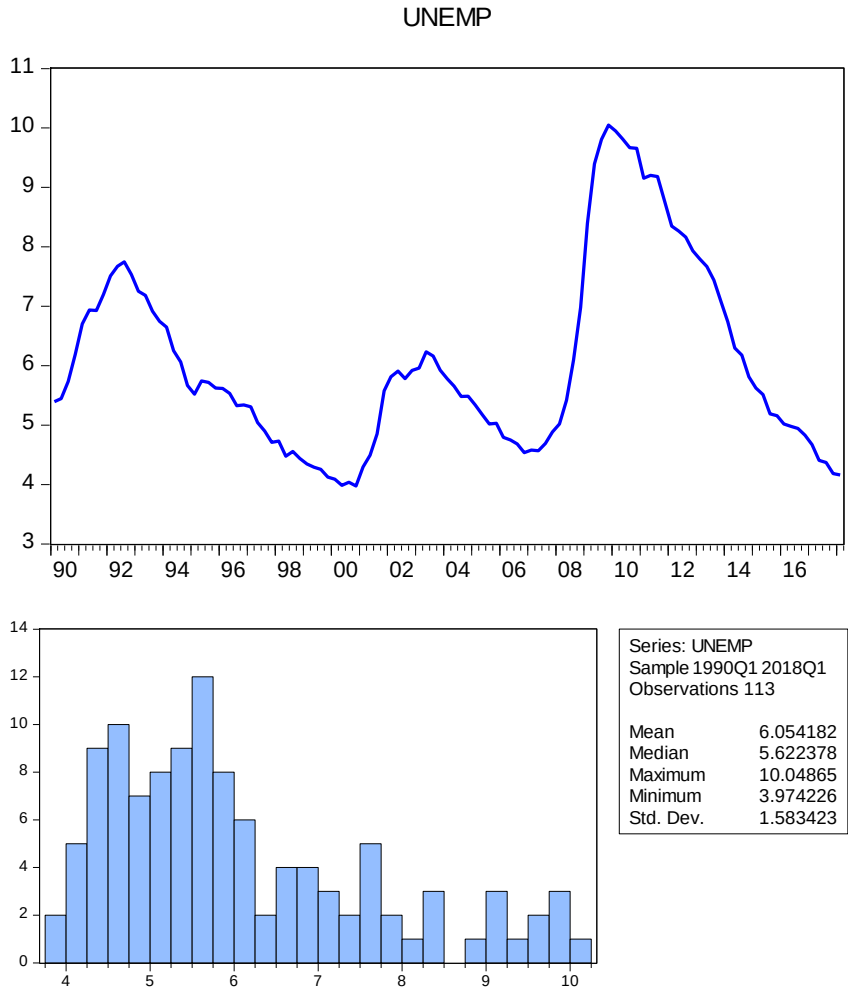
The author suggests other ways to determine the main causes of investments, such as the level of the weighted average cost of capital[31] (WACC), leverage, dividends and also capital market imperfections; in particular, a suggestion related to the last indicator named in the list is the following: "The futility of cutting interest rates when companies are reluctant to reduce dividends should prompt policy makers to consider taxing dividends at a higher rate to stimulate investment".

The variable of Gross Fixed Capital Formation started to raise consistently after the first quarter of 2011, reaching pre-crisis levels and overcoming them in 2013: the recovery in the data observed is mainly due to the end of the Great Recession which led to an increasing confidence for private people and companies: in this way economic agents were more willing to invest their money in an economy which restarted to produce and offer opportunities of gaining.

[31] The weighted average cost of capital is a measure that gives information regarding the quantity of money that a firm is going to pay to all different investors; it can be calculated as a weighted average of cost of equity and cost of debt, deducted of the tax shield.

Summing up, the value of Gross Fixed Capital Formation is heavily dependent on the business and economic cycle that the entire system is facing, and heavy contractions in this variable can be observed in correspondence of recessions and crises.

UNEMPLOYMENT RATE



As stated by the OECD, the unemployment rate is a labour statistic that gives us information regarding the state of health of an economic system and the social well-being.

It can be calculated as a ratio between the total number of unemployed people, divided by the entire amount of labour force[32].

Looking carefully at the graph, it can be observed that in correspondence of the periods of crisis described before the variable considered tended to increase and reach three peaks in 1992, 2003 and 2009. As previously specified, data registered confirm the general statement that unemployment rate is associated with the economic cycle of a country: when this variable increases, we usually detect a negative period of recession; on the other hand, when it drops, we are able to witness a state of recovery and expansion.

It is now significant to analyse and better understand the causes that have led in particular to the critical levels of unemployment reached during the first and the third downturns considered: the "Early 1990s recession" and the "Great Recession".

The "Early 1990s recession" has been studied by many authors and economists, due to the fact that an apparently meaningless phenomenon was observed in the following years: even though the economy restarted to grow and expand in a short time frame, the unemployment rate continued to increase and reached its peak one year after the end of the crisis. In an article written by Christopher J. Singleton (1993), the author highlighted that even if job losses were less harsh with respect of the other crises experimented by the US economy, they have affected several economic sectors; moreover, the recovery has demonstrated to be less energetic, dragging the rise of the unemployment rate after the end of the crisis, dated March 1991.

The main causes of this slow recovery have to be researched inside the changes in the demographic structure of unemployment (Ilg, 1994): to be more specific, the distribution of long-term unemployment (shortened LTU)[33] shifted with respect of the previous downturns. People who suffered more of job losses during

[32] According to the OECD, the labour force can be defined as that category of people aged 15 and over who fulfils all the criteria for the subjection in the employed or the unemployed population.
[33] The long-term unemployment can be explained as a period of inactivity of a person that fulfils the criteria for the subjection in the employed or the unemployed population which lasts more than twenty-seven weeks.

the crises of 1976 and 1983 were mostly population aged 25 to 34: the effects of the "Early 1990s recession" hit primarily 25 to 34, but also 35 to 44 and 45 to 54 years. For example, the rate of losses for people aged 45-54 increased from the 13.2% of 1983 to the 18.5% of 1992[34], and this trend can be observed also in all the other categories of population older than 34 years.

Taking into account the dynamics of the labor market, it is physiologically more difficult for older people to find a new employment after a dismissal, and this phenomenon can be identified as one of the reasons of the durable worsening of the unemployment rate after the end of the 1991 crisis.

Another possible explanation that many researchers and authors suggest to elucidate the persist of negative conditions in the labor market in the United States economy after the 1991 downturn is imputable to the so-called jobless growth: this phenomenon will be fully investigated in a following paragraph of this work, related to the analysis of the output of the regression model and the statistical examination conducted on the data available. Nevertheless, in this instance it is beneficial to define the meaning of the locution "jobless growth": according to Borgersen & King (2016), this circumstance is characterized by a growth in almost every economic indicator, including gross domestic product and total factor productivity[35], with exception for only one measure: employment rate.

Another definition is given by Martus (2016), that explains the jobless growth as the achievement of economic growth, without a soundly reduction of the unemployment.

In particular, the authors identify different interrelated causes of this problem: the industrial structure together with differences in productivity growth across economic sectors, create an imbalance in sector efficiencies; these inefficiencies lead to a disparity in the structure of employment and in the organisation of work, which can raise unemployment rate in the long term.

[34] Source: Article by (Ilg, 1994)
[35] The total factor productivity, or TFP, describes the remaining amount of production output which is not captured by the classical measures of inputs utilised in production (labour and capital).

The other crisis in the US unemployment rate that will be discussed in this work regards the peak of 10.05% reached in the last quarter of 2009, mainly due to the "Great Recession": concerning this downturn, many economists and researchers have primarily connected the rise of this variable to the increasing level of uncertainty that permeated the economic actors like companies and consumers: this field of research attributed to scepticism and distrust in the future one of the preeminent roles in reducing firms' hiring, investments and consumers' spending (Bloom, 2009) and (Bloom, 2014).

However, only a few authors have tried to measure and quantify the magnitude of uncertainty and its impact on the most important economic measures: in particular Born, Breuler & Elstner (2017) conducted a statistical research utilizing a VAR model including six uncertainty proxies and measuring their influence on the worsening of Gross Domestic Product and unemployment rate. The results they achieved can be defined as surprising: only 10% of drop in GDP and 0.6 percentage points of the enlarged unemployment can be explained by the increased level of financial uncertainty, differently from the general thought and conception elaborated by the doctrine.

Moreover, also Born, Breuler & Elstner focused on the jobless recovery, another locution that possess the same meaning of the previous cited jobless growth, and in particular studied the links between this phenomenon and the uncertainty that permeated the economic system after the Great Recession: the results the authors found were in line with the earlier statement declared above, i.e. scepticism can be considered as a concomitant of negative shocks rather than a true element of explanation of the jobless growth.

Another important aspect that has to be highlighted regards a phenomenon that hit the US economy also in the previous discussed downturn, the systematic rise of the long-term unemployment during the crisis, and the persistence of this condition for the unemployed for a long period of time after the end of the crisis.

In fact, as explained by Kroft, Lange, Notowidigdo & Katz (2015) in their article the characteristics of the variable observed can be split into two main categories, with different meanings and diverse implications: the short term unemployment, that increased during the recession but returned to normal levels by 2013 and the LTU, that continued to achieve very high levels for a long period of time after the formal end of the downturn.

The main conclusions these authors focus and highlight concern the vicious circle that a financial and real economy crisis can bring into the market labor: citing the article *"*The longer one has been unemployed, the less likely one is to get a call back from an employer, and job search effort also is likely to decline*"*.

In case of a huge shock in the labor demand, like in a period of crisis, the labor market could not be able to totally absorb this impact and disturbance, beginning to cause this negative imbalance that lead to long-term unemployment.

As a result, the total market labor efficiency is downscaled, and the mechanism of matching between supply and demand is disempowered by long term unemployment: in this chain of negative circumstances the recession generates LTU, but once LTU is created it affects negatively the system, generating other market inefficiencies.

The aftermaths of the Great Recession have reduced their effects after several years, reaching pre-crisis level only in 2013; nowadays the situation of this economic measure in the US has reached optimal levels, with the last available overall data of 4.0% in June 2018.

PREPARATORY TRANSFORMATIONS APPLIED TO THE VARIABLE

After having exposed a descriptive and historical analysis of all variables taken into consideration in the model it is now useful to introduce and explain the statistical and mathematical transformations that will be applied to the raw data to obtain more precise and usable time series; in order to avoid problems of scale of variables, to reduce heteroscedasticity issues and to dampen the exponential trend

of the majority of the variables considered, the logarithmic transformation has been applied to all the observations.

Moreover, the new set of transformed variables characterized by the addition of an L to the acronym that identifies them has been submitted to the stationarity test: the reasoning behind this procedure and the results are summarized in the following paragraph.

3.2.2 Stationarity

Once a descriptive analysis of the variables has been conducted, it is useful for the further implementation of the regression model to carefully verify whether the observed values gathered respect one fundamental condition for the soundness and the correctness of the statistical analysis: the stationarity.

As the book of Greene (2002) explains, stationarity can be defined in two different ways:

- A time series process is strongly stationary whether given m values of the temporal index $t_1,t_2,\dots,t_m$ and a random value Υ, the conjoint distribution of the aleatory vector $(X_{t1},X_{t2},\dots,X_{tm})$ is equal to the one of $(X_{t1+\Upsilon},X_{t2+\Upsilon},\dots,X_{tm+\Upsilon})$; the result of the matrix notation is that the probability distribution does not change over time, and remain the same regardless of the origin, t, in the time scale; looking at the reality, none of the economic variables recorded in the databases of the whole world is characterized by this property.
- A time series process, $\{z_t\}$ is weakly stationary (or covariance stationary) if $\mathrm{E}[z_t]$ is finite and is the same for all t and if the covariances between any two observations (labelled their autocovariance), $Cov[Z_t, Z_{t-k}]$ is a finite function only of model parameters and their distance apart in time, k, but not of the absolute location of either observation on the time scale.

Obviously, only weak stationarity is taken into consideration when a variable is analysed; non-stationary variables usually show a mean and a variance that are not constant, but tend to evolve over time, and therefore a long term mean for these kind of variables does not exist. Variance will consequently become an increasing function of time and observed values today will strongly depend from the past realizations of the variable. In other words, there will be a trend inside the variable.

Using non-stationary series in a regression model infringes also the assumptions of the so-called B.L.U.E.; moreover, the distributions of the random variables utilized for the hypothesis testing does not correspond to the ones correctly employed for the calculations of the critical values of the hypothesis tests. The values of the Student's-t divert if the sampling number increase, and the result is that critical values of the test are not correct asymptotically (Phillips & Durlauf, 1986).

Finally, another problem of non-stationary series is the possible output of spurious regression[36], a locution that indicates the obtaining of significant results in a model, even if the variables considered have no relationship; this fact is due to the presence of a third factor, also called "lurking variable", that affects both the observation considered and brings to misleading results in the regression.

A valid method in order to detect the presence of non-stationarity in the time series considered is the ADF (Augmented Dickley Fuller) test: this test is funded on a hypothesis test:

$$\begin{cases} H_0: presence\ of\ unit\ roots: absence\ of\ stationarity \\ H_1: absence\ of\ unit\ roots: presence\ of\ stationarity \end{cases}$$

The test is based on an autoregressive model AR(p); the critical values of the test change if trend, intercept or both are considered. If the variable is stationary, we have to refuse the null hypothesis, showing an observed value lower than the critical one.

[36] The concept of spurious regression finds its roots in the research conducted by C.W.J Granger in the early 1970'

The test has been conducted inserting in the model five lags, trend and intercept, and gradually eliminating the coefficients that were not significant, keeping as significance level 5% of the p-value of the t-statistic.

If the series does not result stationary at level, the test is repeated on the first differences of the variables, meaning that the new variable considered is equal to:

$$x_t = x_t - x_{t-1}$$

until the coefficient of the last lagged variable has a p-value lower than 0.05.

GROSS DOMESTIC PRODUCT

The dependent variable identified with the acronym LGDP describes the natural logarithm of the Gross Domestic Product of the US economy from the first quarter of 1990 to the first quarter of 2018; the results of the ADF test at level of this variable with 5 lags, trend and intercept show that it is not possible to reject the null hypothesis of non-stationarity.

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.566736	0.7996
Test critical values:	1% level	-4.046072	
	5% level	-3.452358	
	10% level	-3.151673	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDP)
Method: Least Squares
Date: 12/07/18 Time: 15:42
Sample (adjusted): 1991Q3 2018Q1
Included observations: 107 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGDP(-1)	-0.020295	0.012954	-1.566736	0.1204
D(LGDP(-1))	0.285233	0.098243	2.903330	0.0046
D(LGDP(-2))	0.179829	0.101694	1.768337	0.0801
D(LGDP(-3))	0.060524	0.100717	0.600936	0.5493
D(LGDP(-4))	0.088083	0.100233	0.878784	0.3816
D(LGDP(-5))	-0.084484	0.096276	-0.877520	0.3823
C	0.184091	0.112515	1.636142	0.1050
@TREND("1990Q1")	0.000191	0.000145	1.318023	0.1905

R-squared	0.282829	Mean dependent var	0.011076
Adjusted R-squared	0.232120	S.D. dependent var	0.006322
S.E. of regression	0.005540	Akaike info criterion	-7.481922
Sum squared resid	0.003038	Schwarz criterion	-7.282084
Log likelihood	408.2828	Hannan-Quinn criter.	-7.400911
F-statistic	5.577489	Durbin-Watson stat	1.994449
Prob(F-statistic)	0.000019		

The test has been recursively repeated until only one lag has been inserted, conducting always at the result of non-rejection of the null hypothesis.

It is therefore necessary to move to the study on first differences, and the results of the ADF test show that inserting the correct number of lags and intercept, the time series can be considered stationary, as we can reject at all three level of significance of 10%,5% and 1% the null hypothesis.

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.584516	0.0003
Test critical values:	1% level	-3.490772	
	5% level	-2.887909	
	10% level	-2.580908	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGDP,2)
Method: Least Squares
Date: 12/07/18 Time: 15:51
Sample (adjusted): 1990Q4 2018Q1
Included observations: 110 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	-0.464904	0.101407	-4.584516	0.0000
D(LGDP(-1),2)	-0.218346	0.091973	-2.374031	0.0194
C	0.005089	0.001236	4.116121	0.0001

R-squared	0.309495	Mean dependent var	1.18E-05
Adjusted R-squared	0.296589	S.D. dependent var	0.006823
S.E. of regression	0.005722	Akaike info criterion	-7.462002
Sum squared resid	0.003504	Schwarz criterion	-7.388352
Log likelihood	413.4101	Hannan-Quinn criter.	-7.432129
F-statistic	23.97957	Durbin-Watson stat	2.001858
Prob(F-statistic)	0.000000		

In this case, the variable LGDP can be considered as integrated of order 1, or using the mathematical formulas:

$$LGDP \sim I(1)$$

This means that this time series can be defined as stationary utilising one time the logical operator difference; in the further models that will be presented in this work, the new variable DGDP, that encases this operation, will be utilized.

It is important to be noticed that working on the difference of natural logarithm is equivalent to work with variation rates, so in this case the new variable DGDP can be also interpreted as growth rate of the American GDP for the period considered.

LEVEL OF STOCK OF FOREIGN DIRECT INVESTMENTS

The first independent variable, identified as LFDI, describes the trend of the natural logarithm of the level of stock of foreign direct investments in the economy of the United States of America in the period considered (1990: Q1 – 2018: Q1); firstly, an ADF test at level has been conducted, utilizing a lag length of 5, trend and intercept:

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.936445	0.6285
Test critical values:	1% level	-4.046072	
	5% level	-3.452358	
	10% level	-3.151673	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LFDI)
Method: Least Squares
Date: 12/07/18 Time: 16:50
Sample (adjusted): 1991Q3 2018Q1
Included observations: 107 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LFDI(-1)	-0.038590	0.019928	-1.936445	0.0557
D(LFDI(-1))	0.332237	0.098550	3.371246	0.0011
D(LFDI(-2))	-0.082361	0.103888	-0.792789	0.4298

D(LFDI(-3))	0.205774	0.102458	2.008380	0.0473
D(LFDI(-4))	0.076652	0.103667	0.739407	0.4614
D(LFDI(-5))	0.094405	0.099877	0.945210	0.3469
C	0.245668	0.120875	2.032414	0.0448
@TREND("1990Q1")	0.000805	0.000438	1.836236	0.0693

R-squared	0.191999	Mean dependent var	0.020519
Adjusted R-squared	0.134868	S.D. dependent var	0.021411
S.E. of regression	0.019915	Akaike info criterion	-4.922842
Sum squared resid	0.039265	Schwarz criterion	-4.723005
Log likelihood	271.3721	Hannan-Quinn criter.	-4.841831
F-statistic	3.360658	Durbin-Watson stat	1.973397
Prob(F-statistic)	0.002947		

As the result shows, we are not able to reject the null hypothesis of non-stationarity; moreover, the coefficients of the lag terms are not significant.

For mainly these reasons, a recursively approach has been utilized, diminishing in each test the number of lags: in all the cases it is not possible to reject H_0, and so a new test is conducted on the first difference of the variable.

The following table reassumes the outcome of the ADF test with two lags and intercept, as these coefficients are the first that can be considered significant at a level of 5%:

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.239022	0.0009
Test critical values:	1% level	-3.491345	
	5% level	-2.888157	
	10% level	-2.581041	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LFDI,2)
Method: Least Squares
Date: 12/07/18 Time: 16:51
Sample (adjusted): 1991Q1 2018Q1
Included observations: 109 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFDI(-1))	-0.541350	0.127706	-4.239022	0.0000
D(LFDI(-1),2)	-0.105174	0.113646	-0.925450	0.3569
D(LFDI(-2),2)	-0.205528	0.095041	-2.162507	0.0328
C	0.011085	0.003232	3.429230	0.0009

R-squared	0.362727	Mean dependent var	9.55E-05
Adjusted R-squared	0.344519	S.D. dependent var	0.024512
S.E. of regression	0.019845	Akaike info criterion	-4.965686

Sum squared resid	0.041353	Schwarz criterion	-4.866921
Log likelihood	274.6299	Hannan-Quinn criter.	-4.925633
F-statistic	19.92153	Durbin-Watson stat	2.034598
Prob(F-statistic)	0.000000		

The results show that the variable LFDI can be considered stationary at the first differentiation level, as the t-statistic of the ADF test calculated by the software is lower than the critical values; so the new variable DFDI that will be considered in the following models of this work will represent the difference between the two consequential logarithmic values of the stock of Foreign Direct Investments in the US economy; this new variable can be considered, as the previous considerations for the dependent variable of Gross Domestic Product, a variation rate for the level of stock of FDI that is present in the US for the period examined.

CONSUMER PRICE INDEX

The variable regarding the natural logarithm of the consumer price index (LCPI) concerns the evolution of the prices of goods and services in the US economy from the first quarter of 1990 to the first quarter of 2018; the results of the Augmented Dickey Fuller test inserting five lags, trend and intercept at level demonstrate that the null hypothesis cannot be rejected at any level of significance.

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.097595	0.9241
Test critical values:	1% level	-4.046072	
	5% level	-3.452358	
	10% level	-3.151673	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI)
Method: Least Squares
Date: 12/07/18 Time: 16:24
Sample (adjusted): 1991Q3 2018Q1
Included observations: 107 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPI(-1)	-0.030097	0.027420	-1.097595	0.2750

D(LCPI(-1))	0.255822	0.102009	2.507837	0.0138
D(LCPI(-2))	-0.164144	0.104076	-1.577156	0.1179
D(LCPI(-3))	0.063463	0.104095	0.609665	0.5435
D(LCPI(-4))	-0.122650	0.100536	-1.219968	0.2254
D(LCPI(-5))	0.116430	0.099465	1.170562	0.2446
C	0.127849	0.109963	1.162652	0.2478
@TREND("1990Q1")	0.000149	0.000163	0.909448	0.3653

R-squared	0.132749	Mean dependent var	0.005699
Adjusted R-squared	0.071428	S.D. dependent var	0.004748
S.E. of regression	0.004575	Akaike info criterion	-7.864581
Sum squared resid	0.002072	Schwarz criterion	-7.664743
Log likelihood	428.7551	Hannan-Quinn criter.	-7.783569
F-statistic	2.164820	Durbin-Watson stat	2.001016
Prob(F-statistic)	0.043742		

For this reason, a new ADF test has been conducted on the first differences, and the outcomes inserting two lags, that is the first coefficient with a p-value lower that 0.05 starting from five lags, trend and intercept, can be summarized as follows:

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.815661	0.0052
Test critical values:	1% level	-2.586350	
	5% level	-1.943796	
	10% level	-1.614784	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCPI,2)
Method: Least Squares
Date: 12/07/18 Time: 16:31
Sample (adjusted): 1991Q1 2018Q1
Included observations: 109 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPI(-1))	-0.207224	0.073597	-2.815661	0.0058
D(LCPI(-1),2)	-0.283153	0.097104	-2.915978	0.0043
D(LCPI(-2),2)	-0.285306	0.090860	-3.140074	0.0022

R-squared	0.263196	Mean dependent var	-7.54E-05
Adjusted R-squared	0.249294	S.D. dependent var	0.005919
S.E. of regression	0.005129	Akaike info criterion	-7.680867
Sum squared resid	0.002788	Schwarz criterion	-7.606793
Log likelihood	421.6072	Hannan-Quinn criter.	-7.650827
Durbin-Watson stat	2.053256		

The t-statistic of the test implies that in the case of first difference it is possible to reject the null hypothesis of non-stationarity at every standard level of significance; due to this fact, we can consider the variable LCPI as integrated of order 1, or I(1). The variable that will be used in the following models will be denoted as DCPI, and will represent the log difference of the consumer price index in the US economy in the years starting from 1990 to 2018.

GROSS FIXED CAPITAL FORMATION

The time series denoted as LGFCF represents the natural logarithm of the level of gross fixed capital formation accumulated in the United States economy in the period starting from 1990: Q1 to 2018: Q1.

Initially, the Augmented Dickey Fuller test has been conducted on level, inserting five lags, trend and intercept; the results from the software Eviews show that in this case the variable can not be considered stationary, due to the fact that the t-statistic of the test is higher than the critical one, and also because the coefficients of the lags does not seem to be significant.

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.447912	0.3532
Test critical values:	1% level	-4.046072	
	5% level	-3.452358	
	10% level	-3.151673	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGFCF)
Method: Least Squares
Date: 12/08/18 Time: 15:36
Sample (adjusted): 1991Q3 2018Q1
Included observations: 107 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGFCF(-1)	-0.031075	0.012694	-2.447912	0.0161
D(LGFCF(-1))	0.495677	0.097338	5.092301	0.0000
D(LGFCF(-2))	0.142585	0.107176	1.330389	0.1864
D(LGFCF(-3))	0.021240	0.108126	0.196434	0.8447
D(LGFCF(-4))	0.162448	0.106939	1.519081	0.1319
D(LGFCF(-5))	-0.072897	0.097604	-0.746868	0.4569

C	0.184962	0.073447	2.518319	0.0134
@TREND("1990Q1")	0.000298	0.000138	2.162000	0.0330

R-squared	0.471045	Mean dependent var	0.011324
Adjusted R-squared	0.433644	S.D. dependent var	0.015821
S.E. of regression	0.011907	Akaike info criterion	-5.951619
Sum squared resid	0.014035	Schwarz criterion	-5.751781
Log likelihood	326.4116	Hannan-Quinn criter.	-5.870607
F-statistic	12.59449	Durbin-Watson stat	1.978101
Prob(F-statistic)	0.000000		

Starting from the previous considerations, a new ADF test is conducted on the first differences, initially with five lags, trend and intercept.

The outcome of the test suggests that utilizing one lag, that results to be significant at a 5% level, can be interpreted in this way: it is possible to reject the null hypothesis of non-stationarity; the first difference of the variable LGFCF satisfies the assumptions of the OLS, and this new variable can be utilized inside the model that will be presented afterwards.

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.815441	0.0052
Test critical values:	1% level	-2.586154	
	5% level	-1.943768	
	10% level	-1.614801	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LGFCF,2)
Method: Least Squares
Date: 12/08/18 Time: 15:38
Sample (adjusted): 1990Q4 2018Q1
Included observations: 110 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGFCF(-1))	-0.187767	0.066692	-2.815441	0.0058
D(LGFCF(-1),2)	-0.216732	0.094175	-2.301369	0.0233

R-squared	0.159235	Mean dependent var	0.000199
Adjusted R-squared	0.151450	S.D. dependent var	0.013571
S.E. of regression	0.012501	Akaike info criterion	-5.907991
Sum squared resid	0.016878	Schwarz criterion	-5.858892
Log likelihood	326.9395	Hannan-Quinn criter.	-5.888076
Durbin-Watson stat	2.011137		

To summarize, the variable LGFCF is integrated of first order, or I(1). The new variable DGFCF can be reassumed as the logarithmic difference of the gross fixed capital formation; like the previous variables considered, this logical operation has the feature to transform the variable into variation rate, as the properties of logarithm indicate.

UNEMPLOYMENT RATE

The unemployment rate is a ratio between the number of unemployed people divided by the total labour force; in this work, this variable has been reaaranged utilizing the logarithmic transformation, in order to normalize the trend of the time series, and also to homogenize the values of this variable to the figures contained in the other time series, in which the logarithmic transformation has been used.

Initially, an Augmented Dickey Fuller test has been conducted on the level of the variable LUNEMP, fixing five lags, trend and intercept. The results displayed below show that it is not possible to refuse H_0, as the critical values are higher than the t-statistic of the test.

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.584216	0.2884
Test critical values:	1% level	-4.046072	
	5% level	-3.452358	
	10% level	-3.151673	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LUNEMP)
Method: Least Squares
Date: 12/08/18 Time: 16:17
Sample (adjusted): 1991Q3 2018Q1
Included observations: 107 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LUNEMP(-1)	-0.037177	0.014386	-2.584216	0.0112
D(LUNEMP(-1))	0.502295	0.097494	5.152044	0.0000
D(LUNEMP(-2))	0.284457	0.108692	2.617085	0.0103
D(LUNEMP(-3))	0.048252	0.112695	0.428166	0.6695

D(LUNEMP(-4))	-0.102919	0.111442	-0.923527	0.3580
D(LUNEMP(-5))	0.092333	0.099784	0.925334	0.3570
C	0.061868	0.025181	2.456928	0.0158
@TREND("1990Q1")	4.17E-05	0.000100	0.415306	0.6788

R-squared	0.536825	Mean dependent var	-0.004782
Adjusted R-squared	0.504075	S.D. dependent var	0.044226
S.E. of regression	0.031145	Akaike info criterion	-4.028499
Sum squared resid	0.096031	Schwarz criterion	-3.828661
Log likelihood	223.5247	Hannan-Quinn criter.	-3.947488
F-statistic	16.39170	Durbin-Watson stat	2.022998
Prob(F-statistic)	0.000000		

As a consequence, a new ADF test is conducted on the first differences, starting with five lags, trend and intercept. The final test performed with one lag, that is the first coefficient that proved to be significant at a 5% significance level, leads us to the concluding result of rejection of the null hypothesis, as the t-statistic of the test is lower than all the critical values; the variable can be considered stationary at the first difference level.

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.282456	0.0012
Test critical values:	1% level	-2.586154	
	5% level	-1.943768	
	10% level	-1.614801	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LUNEMP,2)
Method: Least Squares
Date: 12/08/18 Time: 16:25
Sample (adjusted): 1990Q4 2018Q1
Included observations: 110 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LUNEMP(-1))	-0.237866	0.072466	-3.282456	0.0014
D(LUNEMP(-1),2)	-0.218571	0.093692	-2.332862	0.0215

R-squared	0.195346	Mean dependent var	-0.000523
Adjusted R-squared	0.187895	S.D. dependent var	0.035151
S.E. of regression	0.031677	Akaike info criterion	-4.048449
Sum squared resid	0.108369	Schwarz criterion	-3.999349
Log likelihood	224.6647	Hannan-Quinn criter.	-4.028534
Durbin-Watson stat	1.991776		

The variable LUNEMP can be considered integrated of first order, or I(1). The new time series generated using the logical operator difference is described in the further pages of this work as DUNEMP, and represent the variation rate of the unemployment ratio in the United States from 1990: Q1 to 2018: Q1.

In the following paragraphs an introduction of the linear model built using these time series will be presented, and further explanation of the coefficients and the significance of this model will be covered in this work.

3.3 Estimation of the model

3.3.1 Static estimation

At the first stage a static estimation is being introduced inside this work; the equation considered in the model can be summarized as follows:

$$DGDP_t = \hat{\beta}_0 + \hat{\beta}_1 DFDI_t + \hat{\beta}_2 DGFCF_t + \hat{\beta}_3 DCPI_t + \hat{\beta}_4 DUNEMP_t + e_t$$

An equation designed in this way implies that the Gross Domestic Product at time t is related to all the explanatory variables at time t; this strong assumption is not always true, and the evolution of the GDP can also be influenced by past events, mostly if investments are analysed.

Nevertheless, a static estimation has been introduced in order to better understand the dynamic model that will be suggested in the following pages of this work.

The output of the OLS estimation is summarized in the subsequent table:

Dependent Variable: DGDP
Method: Least Squares
Date: 12/10/18 Time: 17:24
Sample (adjusted): 1990Q2 2018Q1
Included observations: 112 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006828	0.000692	9.869557	0.0000
DFDI	-0.000105	0.019163	-0.005455	0.9957
DGFCF	0.263365	0.037029	7.112328	0.0000
DCPI	0.225312	0.083428	2.700670	0.0080
DUNEMP	-0.009803	0.012605	-0.777715	0.4385

R-squared	0.609153	Mean dependent var	0.010960
Adjusted R-squared	0.594542	S.D. dependent var	0.006345
S.E. of regression	0.004040	Akaike info criterion	-8.141577
Sum squared resid	0.001746	Schwarz criterion	-8.020215
Log likelihood	460.9283	Hannan-Quinn criter.	-8.092337
F-statistic	41.69109	Durbin-Watson stat	2.110508
Prob(F-statistic)	0.000000		

The output of the model obtained with the software E-views allows us to identify the values of the coefficients estimated, the related standard errors, the t-statistics in case of null hypothesis of $\beta = 0$, and the p value of the t-statistic.

The lower the standard error of the parameter estimated is, the more precise would be the resulting coefficient, meaning that the model will be more accurate in the estimation. As explained in the paragraph 3.1.5 of this work, the t-statistic of the model highlighted before is the ratio between the coefficient estimated and its standard error; an high t-statistic linked to the low value of the standard error denotes an high precision of the estimation, and as a consequence a low level of p-value, that has to be compared with the a priori critical level of significance chosen for the model; in this case, the level of significance 0.05 will be used as the majority of researchers and participants in the economic community consider, and so the p-values lower than 0.05 will lead to the rejection of the null hypothesis considered $(\beta = 0)$.

In the lower part of the output table are indicated coefficients and parameters that give information on the reliability, the efficiency and the correctness of the OLS model; in particular, two factors are fundamental in order to better

understand the effectiveness of the estimates computed: R^2 and adjusted R^2. These amounts, also denoted as determination coefficients, are able to provide evidence on the percentage of variability of the dependent time series captured by the model. The range of R^2 goes from 0 (the model does not actually fit the original data) to 1 (OLS method is able to capture all the changes and shifts of dependent variable).

Taking into account the fact that the real data are equal to the sum of the fitted values and the error term, in formulae: $Y_i = \hat{Y}_i + e_i$ it is possible to calculate the value of the coefficient of determination, that is formed by the following components:

- Total sum of squares (TSS) is the total variability of the observed data, or Y_i
- Explained sum of squares (ESS) is the amount of variance explained by the straight line of the model
- Residual sum of squares (RSS) is the remaining part of variance that is not explained by the regression, and it is related to the error term.

It can be easily demonstrated that:

$$TSS = ESS + RSS$$

The coefficient of determination provides information on the quantity of explained sum of squares in comparison with the total sum of squares, and its formula is showed below:

$$R^2 = \frac{ESS}{TSS} = 1 - \frac{RSS}{TSS}$$

Nevertheless, there is a pitfall in the coefficient R^2: in particular, the value of this statistical measure tends to increase if the number of explanatory variables is augmented in the model; for this reason, also an adjusted version of this coefficients has been calculated by E Views: the $\overline{R^2}$, that takes into account also the number of regressors that are inserted in the model.

$$\overline{R^2} = 1 - \frac{RSS/(T-k)}{TSS/(T-1)}$$

where T is the number of observations and k is the number of regressor.

Other statistical measures are the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan-Quinn Information Criterion, three coefficients that give information about the quality of the model: the lower the values are showed by this measure, the higher is the correctness and the ability of the model to fit the observed data.

The Durbin-Watson statistic (DW) is a measure of serial autocorrelation of the error terms in the model, and it is calculated as follows:

$$DW = \frac{\sum_{t=2}^{T}(e_t - e_{(t-1)})^2}{\sum_{t=1}^{T} e_t^2}$$

This coefficient can be reduced with an approximation to this formula:

$$DW = 2(1 - \hat{p})$$

where $\hat{p}$ indicates the sample autocorrelation coefficient of first order. Due to the fact that $\hat{p}$ can range from -1 to 1 the value can the DW statistic can assume goes from -4 to 4; an optimal value for this measure is 2: in this case $\hat{p}$ is equal to zero and the residuals are not correlated. If the DW is higher than 2 it means that there is a positive correlation of the residuals; if it is lower than 2 a negative correlation of the residuals arises. The statistical community suggests that accepted values for this statistic range from 1.5 to 2.5.

The last coefficient that gives information on the quality of the model is the estimation of the F-Statistic:

$$\frac{R^2/(k-1)}{(1-R^2)/(T-k)} \sim F(K-1, T-k)$$

Through the application of this test it is possible to verify a conjoint set of null hypotheses, in which all the coefficients of the regressors are forced to be equal to zero; the alternative hypothesis states that at least one coefficient is different from zero.

$$\begin{cases} H_0: \beta_1 = \beta_2 = \beta_n = 0 \\ H_1 = at\ least\ one\ \beta \neq 0 \end{cases}$$

Like the other tests that have been conducted on the model, it is possible to reject the null hypothesis whenever the p-value of the test is lower than the critical one considered, in this case 0.05.

Regarding the statistical measures that have been descripted in this paragraph, the static version of the model presents a value of adjusted R^2 of 0.5945, and a p-value of the F-statistic nearly close to zero: this means that the model fits in a good way the real data, even if some coefficients are not statistically significant; it can also be noticed that the value of the DW statistic is close to the optimal value of 2.

Due to the fact that the static model gives data and information only regarding the instantaneous relationship between the dependent and the explanatory variable, it is not possible to deep understand which is the real link among these observations: in fact, economic processes can be considered as dynamic and systemic, and a behaviour of an economic agent in an economic environment can have impact and repercussion over time and over other actors in the context; it is limiting to consider only the instantaneous influence of a phenomenon in the growth of the US Gross Domestic Product; for example the investments that one firm has completed today will have also positive resonance on the following periods considered, and will lead to a positive effect not only in the period in which it has been completed.

These introductive considerations are the foundation of the introduction of a dynamic model, in which there have been inserted also lagged variables, to introduce inside the regression also the temporal factor and overcome the problem of instantaneous relationship.

3.3.2 Dynamic estimation and analysis of the residuals

As discussed in the previous paragraph, a dynamic model is useful in order to better understand the long run relationships among the variables.

The particular feature of the dynamic model is the presence of the explanatory variables at time t, the lagged explanatory variables and the lagged dependent variable among the regressors; the features of this typology of regression are useful in order to capture and consider the past events and their relapse on the present, and for these reasons it can be considered a powerful tool in the economic analysis.

Specifically, the technique used to design this new regression is based on the insertion of the explanatory variable in the regressors, each of them with 4 lags, for the main aim to cover the temporal space of one year, and the dependent variable with one lag, in order to better understand whether the past facts of GDP growth influence the current value of the US economy.

Subsequently, an analysis on the residuals will be conducted, to comprehend if they meet all the assumptions of the OLS model: indeed, the error term ε of the regression cannot be estimated, as discussed in the previous paragraphs of this thesis; nevertheless, the residual term e, which represents the distance between the straight regression line and the real observations, can be utilised as proxy of the error term, and various tests can be conducted on the residual series, to better understand the quality and the effectiveness of the model.

The following table will summarize the results of the dynamic estimation:

Dependent Variable: DGDP
Method: Least Squares
Date: 12/10/18 Time: 17:19
Sample (adjusted): 1991Q1 2018Q1
Included observations: 109 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005907	0.000659	8.967848	0.0000
DFDI(-1)	0.036540	0.018154	2.012769	0.0467
DCPI	0.193260	0.085293	2.265851	0.0255
DGFCF	0.303214	0.027579	10.99427	0.0000
DUNEMP(-3)	0.021621	0.009459	2.285662	0.0243

R-squared	0.651075	Mean dependent var	0.011057
Adjusted R-squared	0.637655	S.D. dependent var	0.006301
S.E. of regression	0.003793	Akaike info criterion	-8.266442
Sum squared resid	0.001496	Schwarz criterion	-8.142986
Log likelihood	455.5211	Hannan-Quinn criter.	-8.216376
F-statistic	48.51460	Durbin-Watson stat	2.184242
Prob(F-statistic)	0.000000		

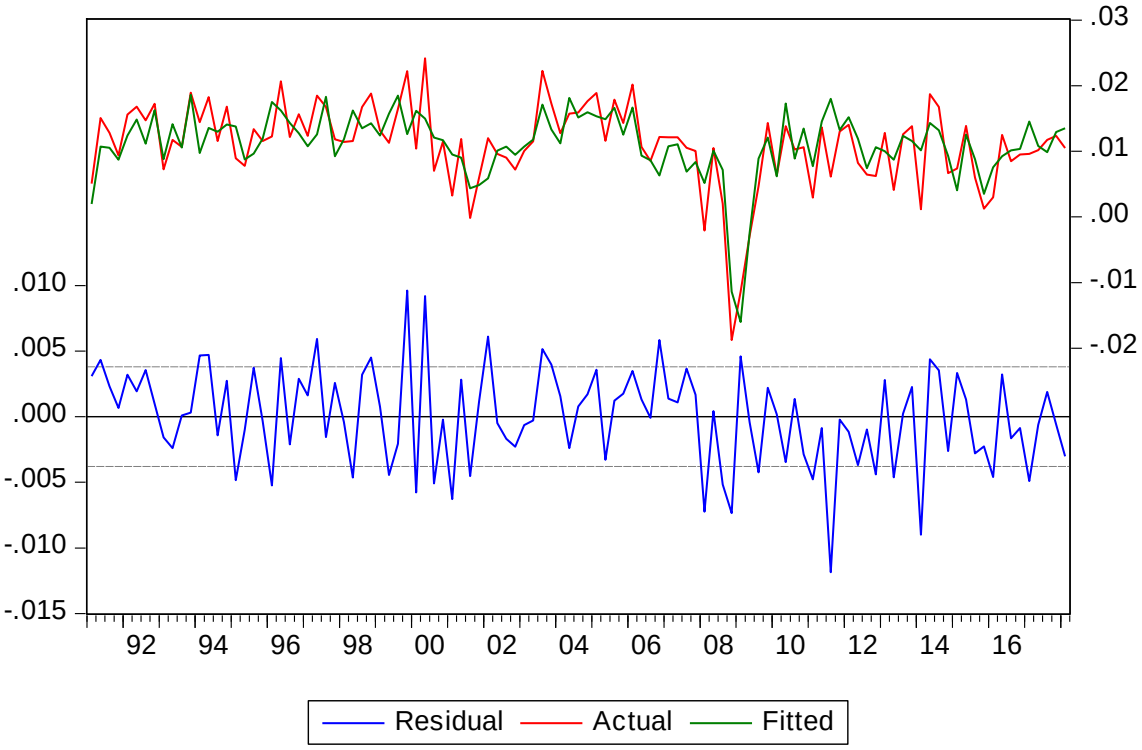
As explained before, in order to obtain this output 4 lagged versions of each explanatory variable and the lagged version of the dependent variable have been inserted in the model; afterward, the coefficients with p-value higher than 0.05 have been sequentially removed, reaching this final result.

The efficiency of the whole model has been demonstrated by the value of adjusted R^2, which is 0.63; moreover, the value of the Durbin-Watson statistic is nearly close to the optimal value of 2, and however in the accepted range of 1.5-2.5. Finally, the statistical value of the F is approximately close to zero, which means that the coefficients can be considered as significant.

Apart from the introductory considerations, a further paragraph will be dedicated at the analysis and the explanations of the output found with the regression; particular attention has to be given to the analysis of the residuals of the model, in order to evaluate the correct specifications of the statistical tool and the assumptions stated before in this work.

Starting from the econometric literature, different tests have been identified and conducted and the results will be summarized in this paragraph.

First of all, it must be taken into account the fact that the scope of the estimation is to explain the most part of variability of the real data; it is therefore desirable that the residual term should assume a random trend; a preliminary analysis on this topic can be done looking at a graphical representation.



Apart from the periods 1998-2001 and 2010-2012, in which the residual terms fall out of the confidence bands, which means that the model is not able to fully fit the real data, the trend of the rest of the considered error series is contained between the two confidential bands; furthermore, the residual series often returns on the zero line, which is expected to be its mean.

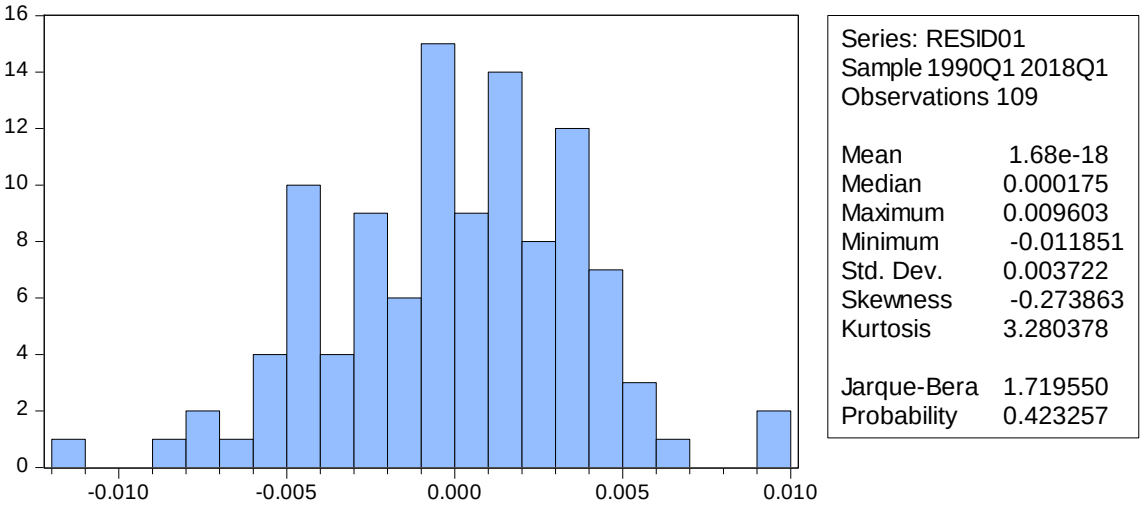
The final consideration regarding the residual term regards the homoscedasticity: the variability of these terms seems not to monotonic increase when the sample size grows, and therefore a preliminary analysis, which will be toughen with following test, should reject the presence of heteroscedasticity in the residuals.

Normality test

Jarque-Bera Test

The normality distribution hypothesis of the residuals is not strictly necessary when we are talking about the B.L.U.E. features of the estimators, when all the other assumptions of the model are not violated; however, it can be considered very useful whenever inference on samples that are not so large is made.

The Jarque-Bera test is useful is detecting the presence of a normality distribution in a series of data, like the residuals that we are analysing. The following graph, together with the statistical values of the test is showed below:



Looking at the probability of the test, that is higher than every level of significance that is widely recognized by the statistical community, we can accept the null hypothesis of the test, which is the presence of the normality distribution inside the residual data; in fact, the values of skewness[37] and kurtosis[38] of the considered

[37] Skewness: regarding the statistical terminology, the index of skewness represents the level of asymmetry of a statistical distribution with respect of its mean: for the normal distribution its value is 0, because this typology of random variable is symmetric regarding its mean.

[38] The term kurtosis refers to an index which gives us information on the shape of a statistical distribution, and in particular on the concentration of the values around the mean: the kurtosis' standard values for a normal distribution is three.

series are near the theoretical ones for a normal distribution, which are respectively 0 and 3.

Homoscedasticity tests

The further step in residual analysis concerns the investigation of the presence of heteroscedasticity inside the considered series; as explained in the previous paragraphs, the absence of heteroscedasticity is one of the assumptions of the model. Heteroscedasticity implies a growing level of variance in the residuals' series when the amount of the explanatory variable progressively increases; in this case the regression cannot be considered as truly efficient, and problems regarding the evaluation of the estimated coefficients may arise. Moreover, the conventional formula of the variance, which is $\sigma^2(W'W)^{-1}$ is no more considerable as correct, and the property regarding the minimum variance of the estimators cannot be conceived as valid.

With the main aim to then verify the presence of heteroscedasticity in the residual series, various tests have been identified looking at the academic literature on the topic; the final choice has regarded the White test and the ARCH test; to be more specific, the first one tests whether the residuals' variance could be explained by the explanatory variables, while the second investigates the existence of autoregressive conditional heteroscedasticity, which can be captured by an autoregressive model.

White Test

The hypothesis system of the White test is the following:

$$\begin{cases} H_0: \sigma_i^2 = \sigma^2 \\ H_1: \sigma_i^2 = f(\gamma + \delta Z) \end{cases}$$

The null hypothesis states that the variance of the regressors is constant through time, while the alternative hypothesis suggests the existence of a relation

between the explanatory variable and its variance, considering the following regression: $e_i^2 = \gamma + \alpha x + \beta x^2 + \upsilon$ which allows us to calculate the statistical value of the test through the coefficient $W=TR^2$. The W value is assimilable to a chi squared distribution, in formulas:

$$W \sim \chi^2(q)$$

where q is the dimension of Z.

The following table summarizes the results of the test:

Heteroskedasticity Test: White (no cross terms)

F-statistic	1.357612	Prob. F(4,104)	0.2538
Obs*R-squared	5.409086	Prob. Chi-Square(4)	0.2478
Scaled explained SS	5.614545	Prob. Chi-Square(4)	0.2298

The values of the statistic associated to the White test allows us to accept the null hypothesis of constant variance, as they are higher than every level of significance which is widely accepted by the statistical community (1%,5% and 10%), and as a result we can accept the presence of homoscedasticity in the residual series, and therefore the assumption is not violated.

ARCH Test

The ARCH test investigates the presence of autoregressive conditional heteroscedasticity, supposing the fact that the model's error term variance could be considered as a linear function of the square of the residuals. The non-conditional variance $E(e_t^2)$ is considered to be constant in this regression, while the conditional variance $E(e_t^2|x_t)$ is believed not to be constant, and depend on the past observations of the residual series. The fundamental equation of the ARCH test is the following:

$$\sigma_t^2 = \sigma_t^2 + \sum_{i=1}^{p} \gamma_i e_{t-i}^2$$

The null hypothesis of the statistical measure states that the γ_i factors of the model are all equal to zero, and as a result the variance of the series which we are investigating is not linked to the previous realization of the residuals. It is desirable to accept the null hypothesis, and therefore certificate the presence of homoscedasticity in the data we are considering.

Here we can find the results of the test, inserting respectively four lags and one lag in the equation, in order to better understand the trend and the cyclical impact of the eventual conditional variance, as in this work quarterly observations have been utilized:

Heteroskedasticity Test: ARCH (4 lags)

F-statistic	0.549493	Prob. F(4,100)	0.6998
Obs*R-squared	2.258236	Prob. Chi-Square(4)	0.6884

Heteroskedasticity Test: ARCH (1 lag)

F-statistic	0.124030	Prob. F(1,106)	0.7254
Obs*R-squared	0.126223	Prob. Chi-Square(1)	0.7224

In both cases, the values of the probability of the statistical test are slightly higher than the critical values accepted by the statistical community, and consequently it is possible to accept the null hypothesis of homoscedasticity also using this test.

Autocorrelation test

One of the assumptions of the regression model is the absence of correlation between the error disturbance terms, in formula:

$$Cov(\varepsilon_i, \varepsilon_j) = 0 \; \forall \; i \neq j$$

As the disturbance terms cannot be easily detected, it is possible to conduct an analysis regarding autocorrelation on the residual terms: in fact, in presence of autocorrelation leads to a loss of efficiency of the model, as the error term does not have a random trend.

The source of autocorrelation may be derived by the absence of some explanatory variables in the model or the wrong specification of the shape of the curve utilised as proxy of the real observations.

Among the wide range of tests that have been recognized as valid by the literature in order to detect the presence of autocorrelation, in this work there will be considered the correlogram and the Breush-Godfrey test.

Correlogram

To better understand the presence of autocorrelation, a useful graphical tool is represented by the correlogram, which considers two functions: the autocorrelation (which will be denoted as AC in the results' table) and partial autocorrelation (PAC), taking into account the presence of k lags, a priori defined by the conductor of the test.

The correlogram output usually contains also a statistical measure, denoted as Ljung-Box test, or Q statistic, which under the null hypothesis of conjunctural absence of correlation is asymptotically distributed as a Chi-squared; through hypothesis testing we are able to investigate whether the model is efficient and the assumption is not violated.

The formula of the Q-statistic is the following:

$$Q_j = T(T+2)\sum_{i=1}^{j}\frac{\hat{p}_i^2}{T-1}$$

$$Q_j \sim \chi^2(j)$$

and the null hypothesis states that all the correlations at the j-th lag are equal to zero.

The following table summarizes the results of the correlogram, utilizing the measure of 12 lags:

Date: 12/17/18 Time: 16:01
Sample: 1990Q1 2018Q1
Included observations: 109

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
*|. |	*|. |	1	-0.138	-0.138	2.1442	0.143
.|* |	.|* |	2	0.098	0.081	3.2385	0.198
.|* |	.|* |	3	0.113	0.141	4.7043	0.195
.|. |	.|. |	4	-0.013	0.013	4.7250	0.317
.|. |	.|. |	5	0.006	-0.021	4.7286	0.450
.|* |	.|* |	6	0.159	0.147	7.6921	0.262
.|. |	.|* |	7	0.058	0.109	8.0848	0.325
.|. |	.|. |	8	-0.030	-0.041	8.1928	0.415
.|. |	.|. |	9	0.055	-0.010	8.5587	0.479
.|. |	.|* |	10	0.074	0.081	9.2223	0.511
.|. |	.|. |	11	-0.021	0.008	9.2755	0.596
.|* |	.|* |	12	0.137	0.092	11.628	0.476

As it can be seen in the columns of AC and PAC, all values are almost equal to zero, and this result lead to a preliminary ascertainment of absence of autocorrelation; moreover, all the probability values associated with the Q-statistic are higher than the 5% of significance level that has been chosen as threshold in order to assess the acceptance or rejection of the null hypothesis; therefore, looking at the results of the correlogram it is possible to assert that the residual series is not autocorrelated.

To better comprehend and investigate the eventual presence of autocorrelation, also the LM test has been taken into consideration, in order to have a further confirmation of the correlogram results.

Breush-Godfrey LM test

The Breush-Godfrey LM test investigates the presence of correlation of order *m* inside the residual series; the factor *m* is decided a priori by the conductor of the test, and consulting the academic and scientific literature regarding this problem, two measures of lags have been identified, which are 5 and 1.

It has to be said that the presence of the lagged dependent variable inside the regressors may cause problems and interferences to the results of the test, but as the final dynamic model does not contain the lagged version of the DGDP variable this complication should be avoided.

The test funds its results on the statistic indicated below; as preparatory step, it should be defined a parameter before, denoted as $\hat{r}_j$:

$$\hat{r}_j = \frac{\sum_{t=j+1}^{T}(e_t e_{t-j})}{\sum_{t=1}^{T} e_t^2}$$

$$LM\ statistic = T(\sum_{j=1}^{m} \hat{r}_j^2) \sim \chi^2(m)$$

Whether the disturbance error terms are not correlated, also the proxy that we are examining, constituted by the residuals series, should have low values of correlation between them, and as a result the value of the parameter $\hat{r}_j$ should be low.

The hypothesis system is based on the null supposition of absence of serial correlation inside the residual series, whether the alternative one states the presence of correlation inside the considered observations.

The results of the LM test can be summarized in the following tables, inserting respectively one lag and five lags as *m* parameter inside the computation of the test statistic:

Breusch-Godfrey Serial Correlation LM Test: (1 lag)

F-statistic	2.128406	Prob. F(1,103)	0.1476
Obs*R-squared	2.206789	Prob. Chi-Square(1)	0.1374

Breusch-Godfrey Serial Correlation LM Test: (4 lags)

F-statistic	1.256585	Prob. F(4,100)	0.2922
Obs*R-squared	5.216510	Prob. Chi-Square(4)	0.2658

Looking carefully at the results, it is possible to accept the null hypothesis of absence of serial correlation for both the tests conducted with the *m* factors chosen for this test, as the probability values associated with the statistic is higher than the chosen 5% as significance level.

Variance Inflation Factor (VIF)

The variance inflation factor, or VIF as acronym, is a measure of multicollinearity of the multiple regression model. This index can be calculated for each variable of the model or each estimator calculated, and the formula in order to compute it is showed here below:

$$VIF_i = \frac{1}{1 - R_i^2}$$

Like the name suggests, the VIF is able to give information on how much the variance of an estimator is inflated by the presence of multicollinearity: R_i^2 is a measure that can be found regressing the i^{th} predictor on the remaining predictors, which means to create a new regression model with the selected estimator as explanatory variable and the other estimators as independent variable.

The minimum value that this statistical measure can assume is 1 when R_i^2 is equal to zero, and as a result we can claim the absence of multicollinearity for the variable considered.

A general rule of thumb accepted by the statistical community postulates that when VIF takes values higher than 10 the model has serious problems of multicollinearity, while when VIF is higher than 5 we have to keep under examination and enquiry the variables considered.

For this work the threshold selected is 3.5, and the results of the calculation of the variance inflation factor can be summarized in the following table:

Variance Inflation Factors
Date: 01/08/19 Time: 17:13
Sample: 1990Q1 2018Q1
Included observations: 109

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	4.34E-07	3.286547	NA
DFDI(-1)	0.000330	2.162526	1.127027
DCPI	0.007275	3.010772	1.209634
DGFCF	0.000761	2.148134	1.448245
DUNEMP(-3)	8.95E-05	1.392407	1.390060

In the table elaborated by the software two different measures of VIF are shown: the centered and the uncentered VIF. The first one is used whenever the constant term C is not considered as explanatory variable, due to p-values higher than the selected threshold. The uncentered VIF can be utilised when the constant term is relevant and significant, as it is in this case.

The results show that for each variable considered the value of variance inflation factor is lower than the considered limit, conferring the fact that multicollinearity does not heavily affect the model.

It has to be said that many authors and researchers include in their papers the correlation matrix in order to identify the presence of multicollinearity in the regression: in this case the decision of omitting this table from the present work was dictated by the fact that correlation matrix can lead to misunderstanding and misconceptions regarding multicollinearity, as this measure contains several pitfalls when applied to a multivariate regression model. VIF has been introduced because offers a more precise and accurate estimation regarding the presence of multicollinearity.

3.4 Economic interpretation of the obtained output

The regression examination has the ability and the feature to analyse in deep a dataset and return as output a statistical model in which we can comprehend the interactions between variables observed; nevertheless, the sole presence of factors and numbers in the regression is not sufficient to fully understand the behaviour of the Foreign Direct Investments in relation with the Gross Domestic Product for example. Data must also be interpreted having in mind and considering the economic environment in which they came into reality; to correctly measure the impacts and the magnitude of the effects that one economic index has on the others also a rational and interpretative approach must be inserted in the model.

In order to fulfil this task, each explanatory variable will be taken into consideration, comparing the expected result ex-ante with the actual outcome obtained, and investigating the causes of a possible divergence between the two dimensions considered.

LEVEL OF STOCK OF FOREIGN DIRECT INVESTMENTS

Regarding the level of stock of Foreign Direct Investments in the US economy the rational ex-ante assumption is that a positive relation between the variable considered and the Gross Domestic Product exists: the majority of the related economic literature recognizes a beneficial effect of FDIs to the overall economy, in terms of knowledge transfer, spill-over effects, and increasing productivity of factors. These concepts are well summarised and explained in an article wrote by Borensztein, De Gregorio & Lee (1998), in which the authors run a cross-country regression on 69 countries: their results confirm the previous statement, consolidating the earlier expectation of a positive relationship between FDI and GDP.

Taking into account the output of the regressive model exposed in this work, the coefficient associated to the foreign direct investments is positive, confirming the forecasts and the predictions on this variable.

Moreover, the time dimension inserted in the dynamic version of the model has to be taken in consideration: in fact, the only variable that has an acceptable level of significance is that one with one lag, or DFDI (-1): this means that, according to the results of the regression, Foreign Direct Investments carried out in the previous quarter have positive effects on the actual Gross Domestic Product.

This assumption can be easily verified looking at the real economy and the implications of an investment in a complex system: commiting an amount of money in a productive activity usually requires time and effort in order to be profitable: when an economic actor invests financial means in a foreign country with the main aim to open a new plant or expanding an existing one, results in terms of output and productivity are not immediately visible and deeply understandable: the firm as organisation, once inserted in a new context and a new environment, must adapt gradually to the new foreign framework, from both the cultural, legal and technological perspective. Keeping this assumption in mind, it is now clearer to interpret the meaning of the lagged variable inside the regression: this significant coefficient finds its roots on the intrinsic characteristic of foreign direct investments to produce positive and consistent economic effects with a time delay.

Once investments are made, the new entity created is immersed in a completely different ecosystem compared to the one of its home market, and the firm has to be able to familiarise with the new context; this aspect must be taken into account when investigating the impact and the magnitude of the consequences of Foreign Direct Investments: in particular, according to the academic literature and the economic research, the US framework has demonstrated to be very fertile with respect of FDIs. Moreover, firms that invest in this country find less difficulties to adapt and habituate to the new economic structure, with the main result that FDIs employ on average less time to influence GDP with respect of other States.

The transparent and stable business environment, together with the presence of a skilled, productive workforce, a beneficial taxation for foreign enterprises, a favourable framework for research and development and innovation and lastly a fluent access to debt capital can be considered as key factors for the

rapid transformation of Foreign Direct Investments to beneficial effects on Gross Domestic Product.

COSUMER PRICE INDEX

Discovering the relationship between Consumer Price Index (CPI) and Gross Domestic Product, the preliminary assumption regarding the direction of the association is that it should be positive: in fact, almost the totality of academicians and researchers in their papers and books demonstrated through statistical analysis that there is a positive linkage between the growth of GDP and the presence in the economy of a controlled and stable level of inflation (usually the threshold considered is 10% for developing countries and 3% for industrial countries, according to Ghosh and Phillips (1998)). Taking into account the fact that for the time frame considered in the US a slightly increasing but controlled level of Consumer Price Index (and as a consequence this is also applicable to inflation) has been registered in the economy, we can preliminary assert that the CPI coefficient of the regression should be positive.

In fact, looking at the results of the dynamic model, CPI has a positive influence on the dependent variable: this outcome can be explained looking at the positive benefits that a low and stable level of inflation are able to generate in an economy. First of all, in a context in which the Central Bank is recognized as a credible entity, able to positively influence the level of prices through its monetary policies, the presence of low and stable inflation is beneficial for relative-price uncertainty: if the economic agents in a system have negative perceptions regarding the value of their money in the future, they will be less willing to consume and invest, and as a result a contraction of these economic measures could lead to negative effects for the economy. Bringing this concept to the extreme, it might be thought that also a decrease of prices can be considered as beneficial looking at this perspective: this is not the case. The reduction of prices from one period to another, also called deflation, is very harmful for a system: in particular, if we consider a period of crisis,

the diminishing of prices is associated with a deceleration of industrial production that lead to decreasing of revenues and profits; even investments in this circumstance fell, and as a result a rise of unemployment may verify. Private people will dispose of less income for consumption, leading to a contraction in the demand, and creating a vicious cycle of downturn and recession.

This oversimplified explanation is however useful to better understand the effects of deflation in the economy, and the danger in which some policy makers can incur addressing their policies to a too low, or even negative, level of inflation: a right balance has to be found, and this threshold for advanced economies has been identified around a range of 2-3% of increasing.

Another important benefit of low inflation can be recognised on the existence of inflation itself in the economy: economic agents, both private people and firms, in their day-to-day decision-making regarding consumption and investment do not assess prices only based on the real value of goods and services taken into consideration; instead, they carefully look at the relative value compared with the total amount of unit of account available. This circumstance can be related to the presence of inflation for mainly two reasons:

- Economic agents dispose of a lower amount of money in the future, referring to the real aspect of the phenomenon, and so they see their purchase power reducing over time.
- A feature connected to the previous point concerns the personal beliefs of firms and private people on the trend of real value of the unit of account in the future: if it is difficult to predict the direction of inflation in an economy, choices made day-by-day on consumption and investment will result more difficult, especially if we find in a condition of high inflation. As a result, inflation uncertainty inflicts to economic agents a cost surplus, denoted also as “direct welfare cost” (Ragan, 1998), which aggravates and alters the process of decision making. In order to eliminate, or heavily reduce this distortion, inflation uncertainty should be as lower as possible in a developed economy, granting to the system a major degree of freedom and

consciousness during the selection and exploitation of opportunities of investment and consumption.

All these considerations have to be taken into account whenever interactions and connections between the consumer price level, and as a reflection also the inflation, and the Gross Domestic Product are investigated.

Investigating the time dimension of this variable, the model's output suggests us that the effects of CPI transmit immediately to the Gross Domestic Product, as inflation can be considered as a variable that rapidly impact on the real economy, and as a result also on GDP.

To conclude, while analysing this relation in the context of the economy of the United States of America, the positive relation between CPI and GDP has to be intended in the framework and the context of the US economy, which is characterized by a high level of development, a stable and almost totally controlled level of prices and a low uncertainty regarding CPI in the future, product of a reliable policy conducted over the years by the American Central Bank, the Federal Reserve.

GROSS FIXED CAPITAL FORMATION

Gross Fixed Capital Formation is an economic measure that encases the total level of investments made by economic agents in a system less disposals of already existing factors of production; looking at this definition, we can preliminary assert that there should be a positive relation between GFCF and the Gross Domestic Product, as a higher level of investments should increase productivity, output and as a result the GDP.

GFCF embodies not only investments carried out by single firms during their activities, but in this variable converge also all the expenditures made by governments in infrastructures: power grids, streets, rails, water systems, communications structures such as telephone and internet, airports and other systems and services built to enhance the efficiency and the effectiveness of the country both under an economic perspective and a social one.

In view of the statements just described above, it is now clearer that theoretically a positive relation between GFCF and the dependent variable considered should be real and existent.

The regression model's output suggests us that, looking at the data frame considered, a positive association between the two economic measures can be observed: the reasons of this phenomenon numerous, and researchers and academicians have heavily tried to discover the main causes of the connections of GFCF and GDP.

Almost the totality of academic literature agrees on the fact that GFCF can be considered as a positive driver for economic growth both for developing countries and for mature and developed States: for example, in an interesting article wrote by Salazar-Núñez and Venegas-Martínez (2018), the two authors utilise a panel data analysis regarding 73 countries gathered by income level, in order to discover whether and how GFCF impacted on economic development. The outcome suggests us that for every group considered, GFCF positively impact GDP growth.

To capture the existence of a causal relation between these two variables, many authors, including Shuaib & Ndidi (2015) and Joshua (2016), mention the economic growth model developed by Harrod and Domar, between 1939 and 1946: this theoretical framework, mainly utilised for developing economies, postulates that level of savings and the so-called capital output ratio[39] can be considered as key drivers for economic growth: especially, the authors recommend that in order to achieve superior growth, governments have to conduct economic policies to stimulate the creation of savings, and as a reflection investments, on one side and reduce the capital output ratio, improving the quality if resources and infrastructures on the other.

As said before, this theory is usually taken into consideration when analysing and investigating economic systems of developing countries, but the general

[39] The capital output ratio is an economic measure that gives us information about the productivity and the quality of capital investment in a country, and it is calculated as a ratio between the production output in monetary terms and the capital input that has been required in order to create the output.

notional framework can be applied also to mature economies: investments usually increase the total level of productivity, having a positive effect on the final output, and as a consequence also on Gross Domestic Product.

This concept of centrality of investments in economic growth has two important limitations, that prevent to economic actors to increase excessively the amount of money devoted to asset expenditure:

- The so-called law of diminishing return to capital, which assumes that if there is an increase in a factor of production, the output will increase, but marginally less than the amount inserted in production in the form of capital or labour. This implies that if a massive stock of capital is already existing in an economy, heavily increasing investments will produce less benefits, compared to a developing economy.

  Nevertheless, the component of investments is fundamental for expansion and progress also in mature countries, in order to innovate and maintain a high standard in productivity.
- Gross Fixed Capital Formation is an appropriate measure to quantify the total amount of investment in a country, but it does not take into consideration the process of depreciation at which every economic asset is subject due to technical obsolescence or innovation: the higher the whole value of investments is, the higher is the cost that economic agents have to sustain in order to maintain, renew and eventually substitute tangible assets.

If it is true that GFCF has a positive relation with GDP and economic growth, it is also true, bearing in mind the concepts descripted above, not to abuse of this association, according to the nature of asset investments and the consequences that they have in terms of depreciation and diminishing returns to capital; a possible suggestion asserted by the academic literature is to concentrate and foster expenditure in intangible assets, such as knowledge and R&D, since these kind of investments partially overcome the problems descripted before. In particular, knowledge and innovation do not suffer from the diminishing return to capital, and once realized they never lose value or depreciate (Romer, 1986).

Harrod-Domar model has been used as base and inspiration for other economic growth theories, such as the one developed by Solow in 1956, in which also the labour factor of production is included in the equation of growth. Nevertheless, investments remain central and play a fundamental role for development also in this framework of hypothesis.

Regarding the time dimension utilised in the model, the variable considered is significant with no lags, which means that GFCF has immediate impact on the Gross Domestic Product and the economic growth of a country.

To sum up, the regression model's output suggests us the presence of a positive relationship between Gross Fixed Capital Formation and Gross Domestic Product: this association is widely recognized also in the related literature, in which investments play a fundamental role in the development and growth of a country. This concept, however, has some limitations regarding the physical and tangible assets, that possess two features (law of diminishing marginal returns and depreciation) that reduce the effects in terms of output reached when employed, especially in mature economies such as US. Nevertheless, this measure can be still considered fundamental when investigating the determinants of the economic growth of a developed country.

UNEMPLOYMENT RATE

Unemployment rate is a statistical index that gives information regarding the percentage of active population that is not working but is searching for a workplace.

The preliminary assumption regarding the direction of the relation between unemployment and GDP states that there should be a negative association between this variable and economic growth: when the country's system performs in a good way, more jobs are created and as a result unemployment rate should decrease.

Evidence of this introductory reasoning can be found in the paper of Dritsakis & Stamatiou (2017) and Castells-Quintana & Royuela (2012), that using statistical

methodologies found a negative association regarding these two economic measures.

Nevertheless, looking at the results of the model, the output of the regression shows a positive sign in the item DUNEMP.

Even if the direction of the association could appear meaningless at a first glance, a possible and partial explanation for this phenomenon could be found in the so-called jobless growth: this paradox, which has been partly explained in the paragraph 3.2.1 concerning the descriptive analysis of the variables considered, can be carefully examined in order to understand the causes of this regression's output.

Resuming the previous definition provided in the 2.3.1 paragraph, jobless growth can be identified as the presence of financial development in almost every economic measure, including GDP, with the only exception of unemployment rate, that does not decrease.

This circumstance usually appear after a period of crisis, in which recession first alters the conditions of labour market, decreasing the work places available; subsequently to the peak of the downturn, the economic system starts its period of recovery, but usually unemployment rate follows different and slower dynamics with respect of the other economic indexes considered: the labour market is not fully able to absorb cyclical shocks, and, due to uncertainty and ambiguity, firms and businesses are less willing to assume new people, sometimes losing permanently the work places created before the crisis.

This partial non-alignment between unemployment rate decrease and GDP after a crisis could have led to the results showed in the regression's output, due to the fact in the period considered three recessions have affected the United States' economy, and in each case extended effects on the unemployment rate have been registered.

In this optic, the outcome of the statistical model should not be seen as a postulate that is always true and valid, but it has to be also interpreted looking at the period considered in the data frame, and the events and the proceedings that have

characterized that period of time: in this case the coefficient of the DUNEMP variable is positive, but if we take as sample another time frame in which crises are not present, the result could be completely different and aligned with the academic literature.

However, another possible clarification of the outcome reached in the regression could be found in the technological progress that has undoubtedly distinguished the interval of time considered: surprisingly, an increase of efficiency due to the introduction and exploitation of a new technology could have positive effects on TFP, and as a reflection on GDP, but mild or even decreasing repercussion on the employment rate: this fact can be detected as an illustration of the reasonings and studies behind the jobless growth. With the advent of new ICT[40] for example, the traditional communication systems have almost completely disappeared, bringing at the same time an enormous advantages and progress for businesses and private people. It has to be admitted that usually radical innovations deeply change the processes and the mechanisms in the field where they are introduced, and over time new ways of exploitation come into reality, generating new jobs; but this progression, and the deep and complete understanding of all possible features of a new technology usually take a huge amount of time and resources. In this framework, the loss of occupation imputable to a new technology is not promptly repaid by the growth of employment, generating the so-called jobless growth.

Regarding the time dimension inserted in the model, the variable considered is significant applying three lags, and as a result the level of unemployment of the past third quarter has an impact on the actual Gross Domestic Product: as explained before, the unemployment rate follows different and slower dynamics with respect of the other economic measures considered, and this could be a possible elucidation for this result.

[40] ICT is an acronym which stands for Information and Communications Technologies and describes the new means of interaction and communication that have been spread all over the world after the revolution brought by Internet.

To conclude, in the regression model's output there is a positive direction between unemployment rate and Gross Domestic Product, which was unexpected if we look at the preliminary assumption and at the related literature: nevertheless, a partial explanation of this kind of relationship could be given by the presence of the so-called jobless growth. Moreover, also the time frame considered and the presence of several crises and economic downturns in it have engraved on the results.

CONCLUSIONS

The main objective of this work was to analyse and understand the determinants and the implications of Foreign Direct Investments, a phenomenon that has obtained an increasing importance in the recent years, mainly due to globalization.

At the beginning we have presented an investigation of the definition, the typologies and the review of the existing literature and theories that regard FDIs: especially, one of the most important and recognized academic frameworks that explain the presence of Foreign Direct Investments is the Ownership, Location and Internalization Theory, that successively evolved in the so-called eclectic paradigm.

The success of this theorem is represented by the capacity of this scheme to capture the key factors for successful expansions in a foreign country, giving the essential information without imposing any assumption or restriction.

In the second chapter we have provided an overview concerning the main drivers that influence the firm's decision-making process of the location of a Foreign Direct Investment.

Bringing back the distinction between horizontal and vertical FDI, the major determinants related to the two typologies have been taken into consideration: in fact, resource/efficiency-seeking FDI on one side and strategic asset/new market-seeking FDI on the other have completely different scopes, and therefore dissimilar motivations. Nevertheless, some contact points exist, and consequently there are certain determinants that are valuable and real for both the classified methods of Foreign Direct Investments.

Finally, we have conducted a regression analysis in order to better understand the consequences and the impact of FDIs, together with other economic measures, on the economy of the United States of America: utilising the OLS regression model, we have gathered data from the Federal Reserve website, and we studied the relationship between the US Gross Domestic Product, taken as dependent variable,

and other statistical and economic measures, including the level of stock of Foreign Direct Investments, in order to comprehend the association between the GDP and the other explanatory variables.

The results we found suggests us that a positive linkage between GDP and FDI exists; moreover, through the application of a dynamic dimension in the regression, we discovered that this phenomenon does not produce its positive effects immediately, but needs time to show beneficial outcomes.

To sum up, the existing research on this topic has contributed to underline the importance of Foreign Direct Investments both in developing economies and in mature ones: it has to be said that, according to the level of progress of the economic system of the country considered, the scope and the aim of the firm conducting the FDI usually change, and therefore different typologies of measures should be taken into consideration to measure the determinants and the impact of this phenomenon, as explained in the second chapter of this work.

Foreign Direct Investments constitute a powerful instrument that companies, and especially MNEs, have at their disposal to expand the business and reach new market segments and customers; moreover, this typology of expenditure can be utilised to decrease costs and increase efficiency. According to the literature, this phenomenon leads beneficial effects on the host economy: in particular, the results obtained in the third chapter of this thesis can be considered valid and applicable in those States that have contact points with the US system and similar commercial characteristics.

In these kind of contexts Foreign Direct Investments could be beneficial not only for the output of the economic framework, impacting on the GDP like previously demonstrated, but could increase also the innovation rate of the economy, bringing new ideas and new methods of production inside the host country.

Looking beyond the results achieved in this thesis, Foreign Direct Investments could represent a way to boost also the financial situation in developing economies that are able to attract this kind of capital flows: the input of new technologies,

together with the creation and growth of jobs could represent an interesting and stimulating challenge for emergent markets: the key point in this situation regards the ability of these kind of countries to attract and encourage investors to pursue an FDI strategy in their economy.

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