The relationship between Infrastructure Development and Economic Growth in Italy, with focus on the possible applications of the Recovery Fund

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Introduction

Infrastructure development is one of the most discussed topics in today's economic world, but it has been this way essentially since forever. In fact basically since the first steps ever taken by human civilization, infrastructures have been put atop of the priorities for the new-born stable settlements. So across the centuries we have seen the birth, first, and the extensive use, subsequentially, of bridges, roads, railroads, airports and so forth, that have helped building the global world as we know it today.

The purpose of this research is to find out if it's possible to find a correlation between the level of infrastructure development in a country and its parallel economic growth, to determine if the first can be a good predictor of the second, meaning that only the countries that are living through a good economic phase can afford a well organized and stable growth of the engineering services for its citizens. This work is focused in detail on the Italian current state, asking if it would be advisable to invest the money lent to the country by the EU, through the so-called Recovery Fund, into the constructions of brand new infrastructures with the purpose of generating a positive GDP growth in the following years.

Of course many elements of this research aren't as tangible as they might seem, and so we'll have to delineate what we include in the term "Infrastructure" and what are the indicators of the general level of its development in a single nation as well as defining the typical economic benchmarks that allow us to analyze the simultaneous economic growth in the country under examination.

The first chapter will start by giving a brief introduction on the concept of Infrastructure, explaining the several existing classes and pointing out on what they differ from each other, and will then move on to present a general overview of today's Italian infrastructures situation, with an extra focus on the two different conditions of the Italian North and South. In order to do that we'll try to isolate some indicators that allow us to grasp the general conditions of the national Infrastructure, considering a number of different factors beyond the simple total invested amount. At that point we'll move to the other important agent of our hypothesis: the Economic Growth of a country, presenting some possible indexes to look at when trying to know the state of a National Economy and then focusing on the most used between all of them, the GDP, and explaining briefly what it is and how it is constructed. The first chapter will end by introducing the concept of the multiplier effect, that represents the direct correlation between the investments in the infrastructure development and the GDP growth, and by giving some notions about the Recovery Fund and the resources it will provide to the infrastructure market.

In the second chapter, firstly we will recap what the existing literature says about the hypothesis of a correlation between number of Infrastructure and Economic Growth, starting from the main theoretical contributions across the last century. Then we will move on to briefly illustrate what is the prevalent point of view in today's economic world, by giving a generic point of view and by bringing up as a practical example the case of the post-recession 2008 United States of America. We will analyze in detail what are considered,

between all the infrastructure investments, the fastest propulsors to economic growth: the telecommunication and the transportation networks, and how they can rapidly pay back the investors.
The last sub-chapters will be dedicated to the specific case of the private sector's investments, and how they differ from the public interventions, and to what are the risks to keep in mind when thinking about infrastructure investment as the only path to economic growth.
In the third chapter we will start by introducing the concept of Infrastructure Gap, how that is used to determine the national level of infrastructure and which are the three main ways to compute it. We'll try to apply the parameters to the current Italian situation in order to determine how the current level relates to its ideal standard and which are the components the create the aforementioned discrepancy. First, we will try to grasp the ideas of a number of private investors and stakeholders in the Italian infrastructure sector about the quality of the current services, the most attractive areas and their predictions for the near future. Secondly, we will make several hypothesis in order to quantify what it would take to fill the gap and what effect that would have on the rest of the economy by using the GDP multipliers by sector. As the next step, we will move on to the analysis of the Italian PNRR ("Piano Nazionale di Ripresa e Resilienza") and the possible exploitation of the Recovery Fund provided by EU by: introducing the areas to which it is destined, the guidelines that it imposes and the total amount which will probably amount to. And, in conclusion, we will try to provide a possible timeline of the utilization of the funds as well as describing the effects that it could have on the National economy in terms of added value.

Chapter 1

Infrastructure and Economic Growth

1.1) Infrastructure

We will start by defining what the centerpiece of our research, the term “Infrastructure”, really means. According to the Cambridge Dictionary, the word Infrastructure stands for “the basic systems and services, such as transport and power supplies, that a country or organization uses in order to work effectively”[1], and we see how this very general idiom can be referring to a huge variety of different services. To better comprehend the full list we need to operate a distinction between the various classes and differentiate them according to their natures

1.1.1) Macro-Classification

In 1987, a panel from the US National Research Council first introduced the term “public works infrastructure”, defining it as: "... both specific functional modes – highways, streets, roads, and bridges; mass transit; airports and airways; water supply and water resources; wastewater management; solid-waste treatment and disposal; electric power generation and transmission; telecommunications; and hazardous waste management – and the combined system these modal elements comprise. A comprehension of infrastructure spans not only these public works facilities, but also the operating procedures, management practices, and development policies that interact together with societal demand and the physical world to facilitate the transport of people and goods, provision of water for drinking and a variety of other uses, safe disposal of society's waste products, provision of energy where it is needed, and transmission of information within and between communities."[2]

First, we must distinguish between Network Infrastructures and Punctual Infrastructures. The first are systems that can be found spread all over a Nation and are characterized by a series of interconnected points, with their economic significance and their all around impact depending crucially on the number of people and/or places connected to the network. It’s clear that, for example, the real utility of a telephonic network

[1] “https://dictionary.cambridge.org/dictionary/english/infrastructure”
[2] “Infrastructure for the 21st Century, Washington, D.C.: National Academy Press, 1987.”

depends on the number of users and from the number of places reached by its network, failing inevitably if the critical thresholds aren't reached.
rete.
The relevance of Punctual Infrastructures, instead, is much easier to grasp. These aren't part of a network and have the characteristic of reaching their full potential even as single units, as for example an hospital.

Going a bit deeper with our differentiation we can distinguish 4 macro-categories of Infrastructure[3]:

Engineering and construction

In the field of engineering, the word "infrastructure" is used referring to fixed assets that are in the form of a large network; or as they're also frequently called, hard infrastructure. When there have been tries to expand the definition of the term, usually the focus has been shifted to the network aspects of most of the structures, and to the accumulated value of investments in the networks as assets. An example of it comes from "The Infrastructure Asset Management Manual", from 1998, who identified infrastructures as the network of assets "where the system as a whole is intended to be maintained indefinitely at a specified standard of service by the continuing replacement and refurbishment of its components". [4]

Civil defense and economic development

Civil defense planners and developmental economists often refer to both hard and soft infrastructure, this comprehends some public services such as schools and hospitals, emergency services such as police and fire fighting, and basic financial services. The notion of infrastructure-based development combining long-term infrastructure investments by government agencies at central and regional levels with public private partnerships has proven popular among economists in Asia (notably Singapore and China), mainland Europe, and Latin America.

Military

Military infrastructure concerns the buildings and permanent installations necessary for the support of military forces, whether they are stationed in bases, being deployed or engaged in operations. For example, barracks, headquarters, airfields, communications facilities, stores of military equipment, port installations, and maintenance stations.

Communications

Communications infrastructure is the informal and formal channels of communication, political and social networks, or beliefs held by members of particular groups, as well as information technology, software

[3] "https://en.wikipedia.org/wiki/Infrastructure#Personal"
[4] "Association of local government engineers New Zealand: Infrastructure Asset Management Manual, June 1998"

development tools. Still underlying these more conceptual uses is the idea that infrastructure provides organizing structure and support for the system or organization it serves, whether it is a city, a nation, a corporation, or a collection of people with common interests. Examples include IT infrastructure, research infrastructure, employment infrastructure and tourism infrastructure.

1.1.2) Other classification

After seeing the main difference between the biggest classes of Infrastructure, according to the purpose they were built for, we can go even further and operate a more thorough distinction based on the nature of the service we're examining.

Using this new criteria, we can find 8 main groups of Infrastructure, delineated as follows[5]:

Personal

A way to embody personal infrastructure is to think of it in term of human capital. Human capital is defined by the Encyclopedia Britannica as "intangible collective resources possessed by individuals and groups within a given population". The goal of personal infrastructure is to determine the quality of the economic agents' values. This results in three major tasks: the task of economic proxies' in the economic process (teachers, unskilled and qualified labor, etc.); the importance of personal infrastructure for an individual (short and long-term consumption of education); and the social relevance of personal infrastructure.

Institutional

Institutional infrastructure branches from the term "economic constitution". According to Gianpiero Torrisi, Institutional infrastructure is the object of economic and legal policy. It compromises the grown and sets norms. It refers to the degree of actual equal treatment of equal economic data and determines the framework within which economic agents may formulate their own economic plans and carry them out in co-operation with others.

Material

Material infrastructure is defined as "those immobile, non-circulating capital goods that essentially contribute to the production of infrastructure goods and services needed to satisfy basic physical and social requirements of economic agents". There are two distinct qualities of material infrastructures: 1) Fulfillment

[5] "https://en.wikipedia.org/wiki/Infrastructure#Personal"

of social needs and 2) Mass production. The first characteristic deals with the basic needs of human life. The second characteristic is the non-availability of infrastructure goods and services.

Immaterial

Although it may sound a bit of an oxymoron, the Immaterial Infrastructure is nowadays one the most crucial for the development of a First World country. It refers to everything that might concern digital technologies, such as the installation of several kilometers of optic fibre, the wireless areas or the centres of POP spread around a country. These infrastructures are vital in this digitalized XXI century to allow the interconnection of the public system and to provide the market with a new resource to exploit.

Economic

According to the business dictionary, economic infrastructure can be defined as "internal facilities of a country that make business activity possible, such as communication, transportation and distribution networks, financial institutions and markets, and energy supply systems". Economic infrastructure support productive activities and events. This includes roads, highways, bridges, airports, cycling infrastructure, water distribution networks, sewer systems, irrigation plants, etc.

Social

Social infrastructure can be broadly defined as the construction and maintenance of facilities that support social services. Social infrastructures are created to increase social comfort and act on economic activity. These being schools, parks and playgrounds, structures for public safety, waste disposal plants, hospitals, sports area, etc.

Core

Core assets provide essential services and have monopolistic characteristics. Investors seeking core infrastructure look for five different characteristics: Income, Low volatility of returns, Diversification, Inflation Protection, and Long-term liability matching. Core Infrastructure incorporates all the main types of infrastructure. For instance; roads, highways, railways, public transportation, water and gas supply, etc.

Basic

Basic infrastructure refers to main railways, roads, canals, harbors and docks, the electromagnetic telegraph, drainage, dikes, and land reclamation. It consist of the more well-known features of infrastructure. The things in the world we come across everyday (buildings, roads, docks, etc).

Complementary

Complementary infrastructure refers to things like light railways, tramways, gas/electricity/water supply, etc. To complement something, means to bring to perfection or complete it. So, complementary infrastructure deals with the little parts of the engineering world the brings more life. The lights on the sidewalks, the landscaping around buildings, the benches for pedestrians to rest, etc**.**

1.2) Overview of Italy's infrastructures

Italy has plenty of efficient and modern infrastructures, even though it performs poorly compared to other Western European countries of comparable size. The whole peninsula is well connected through an extensive system of railways, expressways, national roads, airports and seaports. Most of the infrastructure was rebuilt after the ravages of World War II and is subject to constant improvement and upkeep. However, many important projects have failed to materialize, among them the subway system in Naples, and more railways in the south and east to facilitate the movement of goods. At the same time, funds were given to many useless projects, built solely to line the pockets of those whose political or economic support could thus be counted upon[6].

Italy has a number of important international airports and the national carrier, Alitalia, has a fleet of 166 planes which transport 25 million passengers annually and connect Italy to 60 other countries. Overall, Italy has 136 airports, the most important being Fiumicino (Rome), Malpensa and Linate (both serving Milan), Ronchi dei Legionari (Trieste), Caselle (Turin), and Marco Polo (Venice). Seaports used to be a key element of the Italian transport system; they handle a substantial percentage of cargo until the mid-1970s. Due to the development of alternative means of transportation and competition from neighboring ports, however, their traffic has declined somewhat. The ports of Trieste, Genoa, Naples, Taranto, Augusta, Gioia Tauro, and Livorno are economically important to their respective regions. Italy is a major power in container shipping in the Mediterranean. The Italian merchant fleet consists of over 2,000 ships, 1,331 of which are over 100 tons. The country also has 1,500 miles of waterways that are used for commercial purposes, but this system is relatively undeveloped.

Since most goods in Italy are transported by road, the system is constantly upgraded and improved. It provides a highly developed and efficient network of interconnected highways and lesser roads, particularly in northern regions. The main routes at the hub of the road system are Turin-Milan-Venice-Trieste, Milan-

[6] "https://www.nationsencyclopedia.com/economies/Europe/Italy-INFRASTRUCTURE-POWER-AND-COMMUNICATIONS.html"

Bologna-Florence-Rome, Milan-Genoa, and Rome-Naples. There are 6,460 kilometers (4,014 miles) of expressway, mostly in the northern and central regions, and the system overall is comprised of 654,676 kilometers (406,815 miles) of paved roads. Links to the rest of Europe are excellent. However, even Italy's extensive and sophisticated road network is now barely able to cope with the steadily increasing traffic.

The country's rail system is also highly developed and traverses a distance of 19,394 kilometers (12,051 miles). Italian passenger trains are generally punctual, comfortable, and cheap compared to the rest of Europe. They are the preferred means of travel for many commuters as well as tourists, who can thus avoid congested roads and urban areas. In order to improve the system, the state-owned rail company, Ferrovie dello Stato (FS), is currently developing a project to introduce high-speed trains like the French TGV. Infrastructure is not the same quality throughout the country. While the road and rail networks are intricate and plentiful in the north and center of the country, the southern infrastructure is poor. Northern Italy's impressive economic growth and geographical proximity to the heart of Europe made it a key commercial area, and the infrastructure developed accordingly. By contrast, the geographical isolation and poor economic development of Southern Italy meant that infrastructure was never a priority except for seaports.

Italy has very few natural resources and must import most of them from neighboring countries. Crude oil comes mainly from Libya, Algeria, and countries in the Arab peninsula. Petroleum represents 4.5 percent of all Italian imports. Gas comes from Algeria, Tunisia and Russia through a number of pipelines. Furthermore, unlike Germany and France, Italy has no nuclear power capability and is completely dependent on imported energy. For this reason, Italy is one of the few Western European countries to enjoy very good relations with a number of Arab states. In 1998 and 1999, Italian prime ministers were the first Western leaders to visit countries such as Iran and Libya after many years of diplomatic isolation. In 1998, Italy consumed 266.705 billion kilowatt hours (kWh) of electricity, provided mainly by the formerly state-owned company ENEL, which was privatized in 1999. The generally reliable 220-volt power system covers the whole country.

Until recently, the state-owned company Telecom Italia provided telecommunications services in Italy, but the market recently opened to competition, thanks in part to the privatization of Telecom Italia in 1997, which remains the principal provider. There were 25 million main telephone lines in use in 1999. Like many other Western European countries, Italy is experiencing the Internet revolution, and in 1999 there were 68 Internet hosts per 10,000 people. More recent, but unconfirmed, figures claim that 10 million Italians surf the net. What distinguishes Italians from their neighbors in Western Europe is the quantity of mobile phones in circulation. They have proved particularly popular in Italy, and by 1998 there were 355 mobile phones per 1,000 people. This figure has certainly increased dramatically since then and recent figures record that 48 million cell phones have been sold in Italy since 1995.

1.2.1) The huge gap between Northern and Southern Italy

When talking about Italy a separate discussion needs to be held about one of the main problems of the country, the enormous difference between the North and the South. This gap is easily observable in essentially every Economic data and, in this sense helping the purpose of our research, also when analyzing the conditions of the regional Infrastructure. The differences can be easily synthetized by an Index created by the Guglielmo Institute, which measures the level of Material Infrastructure: in 2009 the Index value was around 80 in the South of Italy against the 110 relative to the Center-North of the country.[7]
Since 1992, there has been a constant decrease in the investments flow towards Infrastructure in the Southern regions, including the "Social" Infrastructure as schools or hospitals, and through the years this process has dramatically impoverished the infrastructural endowment of the South, even though all the media attention has been focused for a long time only on the lack of major Engineering projects.
Much fewer importance has been instead given to the deterioration of the basic Infrastructures such as roads, schools, hospitals and especially railways, that are one of the Infrastructure that has suffered the most from this disparity. It should be enough to point out that in 2019 in all of the South of Italy there are less regional trains that in the lone Lombardia [8], with a much higher average age of the convoys compared to the Northern lines (20,4 years versus 16,6)[9] or that Calabria, Sicilia and Sardegna are the regions with the lower quality of scholastic buildings in all of Italy.

Causes and Effects

An interesting aspect of this bipartite infrastructural analysis is that, unlike the gap in terms of GDP, this difference can be interpreted both as an effect and as a cause of the lack of growth for the South, with a pretty long list of plausible explanations. For example, a good regional Infrastructure can reduce many of the fixed costs that the companies must afford, allowing both an increase in the production volumes for the existing companies and the entrance of new competitors in the market. Moreover an infrastructural improvement can positively influence the concentration of the economic activities and make local markets easily reachable.
The distinction between causes and effects is crucial because you can operate on the latter only by knowing the firsts, however it's not always easy to discern one from the other. The bad railways conditions in the South, for example, may not have any impact on the growth process but only helping when trying to frame the particularly low development of those areas. This is a pretty well known problem to economists, that in recent years have tried to utilize (and develop) techniques that may be able to identify causal effects, also to better understand the impact of infrastructural investments on the economic growth, exactly the core of our

[7] "https://www.tagliacarne.it/files/uploaded/Jannuzzi/ALTA%20FORMAZIONE%20NORD%20SUD.pdf"
[8] "Pendolaria report 2015, Legambiente"
[9] "Pendolaria report 2015, Legambiente"

analysis. In the Italian case, the results have generally indicated a positive correlation between the two variables, as shown by a study of Banca d'Italia which highlights how an increase in the level of public investment towards Infrastructure has led to a GDP increase both in the North and in the South of Italy[10], as we'll see later. That said, this brings up an other factor in this well known gap: how the public investments are handled, as the expected benefit can dramatically decrease if the resources are badly employed. It's important in this regard that part of the South problems are fault of their own citizens, as corruption percentage continues to be drastically higher in the Center-South than in the North[11] and this, combined with other factors, makes the marginal productivity on investments in the South much lower than in the other regions. Even after saying this though, it's important to point out that recently, especially in Italy, there has been a growing tendency to employ resources only where the productivity is perceived as higher and the return time of the investment as lower. This has been confirmed by the recent deal between the Italian department of transportation and Rete delle ferrovie italiane (Rfi)[12], which plans to spread the public contribution heavily towards the Center-North, or other similar investments, as the plan for an ultralarge national broadband, that may accentuate the margin between the two areas even more.

1.3) Relevant factors when assessing National level of Infrastructure

We've seen the numbers on what each one of these countries can provide in terms of Infrastructural network, it's important to remember, though, that we don't want just to depict the current situation of these countries. We want to be able to compare them and to do so we need to establish some univocal and measurable factors that might be able to properly grasp the generic level of Infrastructural development and that might enable to go deeper with our analysis than just measuring the total kilometers of highways or the total kilowatt generated. To go even further we want to know if there are any political or economical factors that might encourage public and private investments or if there are some specifical risks that might complicate the start of a new project.

The main output data that we have to take into account when comparing the Infrastructure situation of different nations are:

[10] "https://www.bancaditalia.it/pubblicazioni/collana-seminari-convegni/2011-0007/7_infrastrutture_italia.pdf"
[11] "https://www.istat.it/it/files//2017/10/La-corruzione-in-Italia.pdf"
[12] "http://documenti.camera.it/leg18/dossier/pdf/TR0037.pdf?_1555579763870"

- **Total Infrastructure investment**[13]

Total economic Infrastructure expenditure based on government and multi-lateral development agency estimates. For the purposes of our examination we'll also provide this number divided by the Country's population in order to have a number which is as much as possible not influenced by the magnitude of the sample.

- **Total value of private finance Infrastructure**[14]

Financial close value of privately financed economic infrastructure.

- **Infrastructure expenditure, % of GDP [%]**[15]

Total economic infrastructure expenditure, % of GDP (5 year average) based on government and multi-lateral development agency estimates.

- **Infrastructure quality**[16]

Infrastructure quality grade (1-7, with 7 being the best), based on the aggregate score for all metrics in the Infrastructure pillar of the Global Competitiveness Index

But to justify the level of these indicators we need to analyze some "less conventional" variables that, even though they might not appear on the front page of most reports, go to impact directly the total numbers of Infrastructure investment. These other factors are:

- **Control of corruption index score**[17]

It's a score (-2.5 to +2.5, where +2.5 represents the best) that measures the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests.

- **Recovery rate, cents on the dollar**[18]

The recovery rate is recorded as cents on the dollar recovered by secured creditors through reorganization, liquidation or debt enforcement (foreclosure or receivership) proceedings.

[13] "Source: Oxford Economics"
[14] "Source: Analysis based on IJ Global data"
[15] "Source: Oxford Economics"
[16] "Source: World Economic Forum, Global Competitiveness Index"
[17] "Source: Worldwide Governance Indicators"
[18] "Source: World Bank, Doing Business Survey"

- **Effect of taxation on incentives to invest [19]**

Subjective score (1-7, with 7 being the best) based on the responses of a large number of people to the World Economic Forum, Executive Opinion Survey question 'In your country, to what extent do taxes reduce the incentive to invest?

- **Cost to start a business, % of GNI per capita [%] [20]**

Cost to start a business as recorded as a percentage of the economy's income per capita. It includes all official fees and fees for legal or professional services if such services are required by law.

- **Dealing with construction permits, No. of days[21]**

The number of days to deal with construcution permits to guage the efficiency and cost of processes that infrastructure companies have to undertake.

- **Quality of land administration index (score from 1 to 30)[22]**

The reliability and transparency of data such as land titles, and the extent of geographic coverage of land administration systems as well as aspects of dispute resolution for land issues.

	Italy	**UK**	**France**	**Germany**	**Spain**	**Developed countries (Avg.)**
Total Infrastructure investment (US$ mil.)	157.615	300.876	262.901	214.137	150.653	138.796
Total Infrastructure investment per capita (US$ '000.)	2,60	4,55	3,92	2,91	3,22	3,70 [23]
Total value of private finance Infrastructure (US$ mil.)	18.341	80.094	40.484	20.290	21.698	20.012

[19] *"Source: World Economic Forum, Global Competitiveness Index"*
[20] *"Source: World Bank, Doing Business Survey"*
[21] *"Source: World Bank, Doing Business Survey"*
[22] *"Source: World Bank, Doing Business Survey"*
[23] *"Source on the average population of developed countries: IMF, World Economic Outlook"*

Infrastructure expenditure, % of GDP [%]	2.0	2.0	2.0	1.0	3.0	2.0
Infrastructure quality	5.4	6.0	6.1	6.1	5.9	5.5
Control of corruption index score	-0.1	1.7	1.3	1.8	0.5	1.3
Recovery rate, cents on the dollar	63.9	88.6	78.5	84.4	78.3	71.4
Effect of taxation on incentives to invest	1.9	4.4	2.9	3.8	3.0	3.8
Cost to start a business, % of GNI per capita [%]	14.0	0.0	1.0	2.0	5.0	3.7
Dealing with construction permits, No. of days	227.5	86.0	183.0	96.0	205.0	141.6
Quality of land administration (score from 1 to 30)	26.5	24.0	24.5	22.0	22.5	22.4

Table 1: Relevant indexes in the evaluation of the national infrastructure level

1.4) Indicators of Economic Growth for a country

After analyzing what we mean with Infrastructure and giving a general overview of the situation across the European's main Countries, we want to shift our attention towards the other crucial element of our analysis: The economic expansion of that same country. Just as we did earlier we have now to establish an univocal method to quantify the economic prog of a nation, and just as we did earlier we'll have to choose between a list of indicators that might properly frame an abstract concept as "growth" in a more measurable way.

Economists and statisticians use several different methods to track economic growth. The most well-known and frequently tracked metric is gross domestic product (GDP). Over time, however, some economists have highlighted limitations and biases in GDP calculation. Organizations such as the Bureau of Labor Statistics (BLS) and the Organization for Economic Co-operation and Development (OECD) also keep relative productivity metrics to gauge economic potential. Some suggest measuring economic growth through increases in the standard of living, although this can be tricky to quantify. These are some of the most used indexes used to analyze economic growth:[24]

Gross Domestic Product

Gross domestic product is the logical extension of measuring economic growth in terms of monetary expenditures. If a statistician wants to understand the productive output of the steel industry, for example, he needs only to track the dollar value of all of the steel that entered the market during a specific period.

Combine the outputs of all industries, measured in terms of dollars spent or invested, and you get total production. At least that was the theory. Unfortunately, the tautology that expenditures equal sold-production does not actually measure relative productivity. The productive capacity of an economy does not grow because more dollars move around, an economy becomes more productive because resources are used more efficiently. In other words, economic growth needs to somehow measure the relationship between total resource inputs and total economic outputs.

The OECD itself described GDP as suffering from a number of statistical problems. Its solution was to use GDP to measure aggregate expenditures, which theoretically approximates the contributions of labor and output, and to use multi-factor productivity (MFP) to show the contribution of technical and organizational innovation.

Gross National Product

Those of a certain age may remember learning about gross national product (GNP) as an economic indicator. Economists use GNP mainly to learn about the total income of a country's residents within a given period and how the residents use their income. GNP measures the total income accruing to the population over a specified amount of time. Unlike gross domestic product, it does not take into account income accruing to non-residents within that country’s territory; like GDP, it is only a measure of productivity, and it is not intended to be used as a measure of the welfare or happiness of a country.

[24] “https://www.investopedia.com/ask/answers/032515/what-are-best-measurements-economic-growth.asp”

The Bureau of Economic Analysis (BEA) used GNP as the primary indicator of U.S. economic health until 1991. In 1991, the BEA began using GDP, which was already being used by the majority of other countries; the BEA cited easier comparison of the United States with other economies as a primary reason for the change. Although the BEA no longer relies on GNP to monitor the performance of the U.S. economy, it still provides GNP figures, which it finds useful for analyzing the income of U.S. residents.

There is little difference between GDP and GNP for the U.S., but the two measures can differ significantly for some economies. For example, an economy that contained a high proportion of foreign-owned factories would have a higher GDP than GNP. The income of the factories would be included in GDP, as it is produced within domestic borders, but not in GNP, since it accrues to non-residents. Comparing GDP and GNP is a useful way of comparing income produced in the country and income flowing to its residents.

Productivity vs. Spending

The relationship between production and spending is a quintessential chicken-and-egg debate in economics. Most economists agree that total spending, adjusted for inflation, is a byproduct of productive output. They disagree, however, if increased spending is in itself an indication of growth.

Consider the following scenario: In 2017, the average American works 44 hours a week being productive. Suppose there is no change in the number of workers or average productivity for 2018. However, Congress passes a law requiring all workers to work for 50 hours a week instead that year. The GDP in 2018 will almost certainly be larger than the GDP in 2017. Does this constitute real economic growth?

Some would certainly say yes. After all, total output is what matters to those who focus on expenditures. For those who care about productive efficiency and the standard of living, this question does not have a clear answer. To bring it back to the OECD model, GDP would be higher, but MFP would be unchanged.

Reduced Unemployment Does Not Always Equal Positive Economic Growth

Suppose instead the world becomes mired in a third world war in 2018. Most of the nation's resources are dedicated toward the war effort, such as producing tanks, ships, ammunition and transportation, and all of the unemployed are drafted into war service. With an unlimited demand for war supplies and government financing, the standard metrics of economic health would show progress. GDP would soar, and unemployment would plummet.

But would anyone be better off? All of the produced goods would be destroyed soon after, and high unemployment is not worse than high mortality rates. There would be no lasting gains from that sort of economic growth.

1.4.1) GDP

Here we want to focus on maybe the most famous and utilized indicator to track the economic situation of a given country, the GDP. As it will come really useful later for our in deep analysis, we want to give now a brief summary of what it is, what kind of GDP we can find, how it can be built and where do we take the datas to compute it, plus a brief history since its introduction in the 1930s.

What Is GDP?

Gross Domestic Product (GDP) is the total monetary or market value of all the finished goods and services produced within a country's borders in a specific time period. As a broad measure of overall domestic production, it functions as a comprehensive scorecard of the country's economic health.

Though GDP is usually calculated on an annual basis, it can be calculated on a quarterly basis as well. In the United States, for example, the government releases an annualized GDP estimate for each quarter and also for an entire year. Most of the individual data sets will also be given in real terms, meaning that the data is adjusted for price changes, and is, therefore, net of inflation.

The Basics of GDP

GDP includes all private and public consumption, government outlays, investments, additions to private inventories, paid-in construction costs, and the foreign balance of trade (exports are added, imports are subtracted).

There are several types of GDP measurements:

- Nominal GDP is the measurement of the raw data.
- Real GDP takes into account the impact of inflation and allows comparisons of economic output from one year to the next and other comparisons over periods of time.
- GDP growth rate is the increase in GDP from quarter to quarter.
- GDP per capita measures GDP per person in the national populace; it is a useful way to compare GDP data between various countries.

The balance of trade is one of the key components of a country's (GDP) formula. GDP increases when the total value of goods and services that domestic producers sell to foreigners exceeds the total value of foreign goods and services that domestic consumers buy, otherwise known as a trade surplus. If domestic consumers

spend more on foreign products than domestic producers sell to foreign consumers —a trade deficit—then GDP decreases.

Calculating GDP

GDP can be determined via three primary methods. All, when correctly calculated, should yield the same figure. These three approaches are often termed the expenditure approach, the output (or production) approach, and the income approach.

a) GDP Based on Spending

The expenditure approach, also known as spending approach, calculates the spending by the different groups that participate in the economy. This approach can be calculated using the following formula: GDP = C + G + I + NX, or (consumption + government spending + investment + net exports). All these activities contribute to the GDP of a country. The U.S. GDP is primarily measured based on the expenditure approach.

The C is private consumption expenditures or consumer spending. Consumers spend money to buy consumption goods and services, such as groceries and haircuts. Consumer spending is the biggest component of GDP, accounting for more than two-thirds of the U.S. GDP. Consumer confidence, therefore, has a very significant bearing on economic growth. A high confidence level indicates that consumers are willing to spend, while a low confidence level reflects uncertainty about the future and an unwillingness to spend.

The G represents government consumption expenditure and gross investment. Governments spend money on equipment, infrastructure, and payroll. Government spending assumes particular importance as a component of GDP when consumer spending and business investment both decline sharply, as, for instance, after a recession.

The I is for private domestic investment or capital expenditures. Businesses spend money to invest in their business activities (buying machinery, for instance). Business investment is a critical component of GDP since it increases productive capacity and boosts employment.

NX is net exports, calculated as total exports minus total imports (NX = Exports - Imports). Goods and services that an economy makes that are exported to other countries, less the imports that are brought in, are net exports. A current account surplus boosts a nation’s GDP, while a chronic deficit is a drag on GDP. All expenditures by companies located in the country, even if they are foreign companies, are included in the calculation.

b) GDP Based on Production

The production approach is something like the reverse of the expenditure approach. Instead of measuring input costs that feed economic activity, the production approach estimates the total value of economic output and deducts costs of intermediate goods that are consumed in the process, like those of materials and services. The expenditure approach projects forward from costs; the production approach looks backward from the vantage of a state of completed economic activity.

c) GDP Based on Income

Considering that the other side of the spending coin is income, and since your expense is somebody else's income, another approach to calculating GDP—something of an intermediary between the two other approaches—is the income approach. Income earned by all the factors of production in an economy includes the wages paid to labor, the rent earned by land, the return on capital in the form of interest, as well as corporate profits.

The income approach factors in some adjustments for some items that don't show up in these payments made to factors of production. For one, there are some taxes—such as sales taxes and property taxes—that are classified as indirect business taxes. In addition, depreciation, which is a reserve that businesses set aside to account for the replacement of equipment that tends to wear down with use, is also added to the national income. All this constitutes national income, which is used both as an indicator of implied production and of implied expenditure.

The Bureau of Economic Analysis (BEA) calculates the U.S. GDP, using data ascertained through surveys of retailers, manufacturers, and builders and by looking at trade flows; the Housing Market Index is one indicator it uses.

GDP vs. GNP vs. GNI

Although GDP is a widely used metric, alternative ways of measuring a country's economy do exist. Many of them are based on nationality rather than geography.

GDP refers to and measures the economic activity within the physical borders of a country, whether the producers are native to that country or foreign-owned entities. In contrast, Gross National Product (GNP) does the opposite: It measures the overall production of a native person or corporation including those based abroad while excluding domestic production by foreigners.

Gross National Income (GNI), another measure, is the sum of all income earned by citizens or nationals of a country regardless of whether the underlying economic activity takes place domestically or abroad. The relationship between GNP and GNI is similar to that between the production approach and the income approach to calculating GDP. GNP is an older measurement that uses the production approach, while GNI is the often preferred modern estimate and uses the income approach. With this approach, the income of a country is calculated as its domestic income plus its indirect business taxes and depreciation, as well as its net foreign factor income. Net foreign factor income is found by subtracting the payments made to foreigners from the payments made to Americans.

In an increasingly global economy, GNI is being recognized as possibly a better metric for overall economic health than GDP. Because certain countries have most of their income withdrawn abroad by foreign corporations and individuals, their GDP figures are much higher than those of their GNI. For instance, in 2014, Luxembourg recorded $65.7 billion of GDP, while its GNI was $43.2 billion. The discrepancy was due to large payments made to the rest of the world via foreign corporations that did business in Luxembourg, attracted by the tiny nation's favorable tax laws.

Usually, the U.S. gross national income (GNI) and gross domestic product (GDP) do not differ substantially.

Nominal GDP vs. Real GDP

Since GDP is based on the monetary value of goods and services, it is subject to inflation. Rising prices will tend to increase GDP and falling prices will make GDP look smaller, without necessarily reflecting any change in the quantity or quality of goods and services produced. Thus, just by looking at an economy's un-adjusted GDP, it is difficult to tell whether the GDP went up as a result of production expanding in the economy or because prices rose.

That's why economists have come up with an adjustment for inflation to arrive at an economy's real GDP. By adjusting the output in any given year for the price levels that prevailed in a reference year, called the base year, economists adjust for inflation's impact. This way, it is possible to compare a country's GDP from one year to another and see if there is any real growth.

Real GDP is calculated using a GDP price deflator, which is the difference in prices between the current year and the base year. For example, if prices rose by 5% since the base year, the deflator would be 1.05. Nominal GDP is divided by this deflator, yielding real GDP. Nominal GDP is usually higher than real GDP because inflation is typically a positive number. Real GDP accounts for the change in market value, which narrows the difference between output figures from year to year. A large discrepancy between a nation's real

and nominal GDP signifies significant inflation (if the nominal is higher) or deflation (if the real is higher) in its economy.

Nominal GDP is used when comparing different quarters of output within the same year. When comparing the GDP of two or more years, real GDP is used because, by removing the effects of inflation, the comparison of the different years focuses solely on volume.
Overall, real GDP is a much better index for expressing long-term national economic performance. Take for example a hypothetical country which in the year 2009 had a nominal GDP of $100 billion, which grew to $150 billion by 2019 its nominal GDP. Over the same period of time, prices rose by 100%. Looking at merely nominal GDP, the economy appears to be performing well, whereas the real GDP expressed in 2009 dollars would be $75 billion, revealing that in fact, an overall decline in real economic performance occurred.

GDP and PPP

There are a number of adjustments to GDP used by economists to improve its usefulness. On it's own, simple GDP shows us the size of the economy, but tells us little about the standard of living by itself. After all, populations and costs of living are not consistent around the world. Nothing much could be gleaned by comparing the nominal GDP of China to the nominal GDP of Ireland, for example. For starters, China has approximately 300 times the population of Ireland.

To solve this problem, statisticians instead compare GDP per capita. GDP per capita is calculated by dividing a country's total GDP by its population, and this figure is frequently cited to assess the nation's standard of living. Even so, the measure is still imperfect. Suppose China has a GDP per capita of $1,500, while Ireland has a GDP per capita of $15,000. This doesn't necessarily mean that the average Irish person is 10 times better off than the average Chinese person. GDP per capita doesn't account for how expensive it is to live in a country.

Purchasing power parity (PPP) attempts to solve this problem by comparing how many goods and services an exchange-rate-adjusted unit of money can purchase in different countries – comparing the price of an item, or basket of items, in two countries after adjusting for the exchange rate between the two, in effect.

Real per capita GDP, adjusted for purchasing power parity, is a heavily refined statistic to measure true income, which is an important element of well-being. An individual in Ireland might make $100,000 a year, while an individual in China might make $50,000 a year. In nominal terms, the worker in Ireland is better off. But if a year's worth of food, clothing and other items costs three times as much in Ireland than China, however, the worker in China has a higher real income.

Criticisms of GDP

There are, of course, drawbacks to using GDP as an indicator. In addition to the lack of timeliness, some criticisms of GDP as a measure are:

It does not account for several unofficial income sources – GDP relies on official data, so it does not take into account the extent of informal economic activity. GDP fails to quantify the value of under-the-table employment, black market activity, volunteer work, and household production, which can be significant in some nations.

It is geographically limited in a globally open economy – GDP does not take into account profits earned in a nation by overseas companies that are remitted back to foreign investors. This can overstate a country's actual economic output. For example, Ireland had GDP of $210.3 billion and GNP of $164.6 billion in 2012, the difference of $45.7 billion (or 21.7% of GDP) largely being due to profit repatriation by foreign companies based in Ireland.

It emphasizes material output without considering overall well-being – GDP growth alone cannot measure a nation's development or its citizens' well-being, as noted above. For example, a nation may be experiencing rapid GDP growth, but this may impose a significant cost to society in terms of environmental impact and an increase in income disparity.

It ignores business-to-business activity – GDP considers only final goods production and new capital investment and deliberately nets out intermediate spending and transactions between businesses. By doing so, GDP overstates the importance of consumption relative to production in the economy and is less sensitive as an indicator of economic fluctuations compared to metrics that include business-to-business activity. Even with that said, the GDP is still vastly recognized as the most reliable single indicator of a National Economy’s level.

1.5) Multiplier Effect

The so-called “multiplier effect” is what brings together the topics we just assessed: The investments in infrastructural development and economic growth, represented by the GDP.

The idea of infrastructure spending as an economic stimulus is rooted in Keynesian economics. In Keynesian theory, when a recession happens the economy can get stuck with sustained high unemployment and a stagnant GDP for an extended period due to a deficiency of aggregate demand. When consumers and businesses buy less stuff, businesses lose sales fire workers, those workers buy less, and the cycle continues in a self-sustaining manner.

According to the Keynesians, one option to deal with this situation is for the government to directly make up for the lack of private sector demand by replacing it with demand from the public sector financed by deficit spending. In the broadest sense, this spending can really be on anything. Keynes created a thought experiment to prove his point that, if unemployment were extreme enough, it would be useful stimulus to the economy to simply bury bottles of money in a coal mine and let people dig them up. While this is often misinterpreted as a literal suggestion, it was meant to show that any form of fiscal stimulus could have a positive effect in closing the output gap in the economy. As Keynes himself said, "It would, indeed, be more sensible to build houses and the like."

How effective stimulus is at closing the output gap depends on the multiplier effect. The multiplier effect is a name for the fact that every dollar of government spending creates some additional amount of private sector spending. For example, the government hires a person to build a road, that person goes out and spends money at a store, the owner of which hires more workers with the money, and so on. The size of this effect depends on where those dollars are spent, if dollars are given to people who are going to save them, then the multiplier effect will be small, but if the government gives those dollars to people who will spend them, allowing them to flow into the economy, then the multiplier will be larger. This can allow a fiscal stimulus to have a significantly larger effect on the economy than just the number of dollars spent by the government, allowing the economy to be brought out of recession while minimizing deficit spending.

Economic Impact of Infrastructure Stimulus

Recent estimates by the Congressional Budget Office and a meta-analysis of empirical results from economic research suggest that public investment spending does lead to a stimulating effect on private spending components of GDP and has a larger impact on GDP via the multiplier effect than other types of spending. On paper then, the aggregate effect of infrastructure spending would seem like an appealing option for fiscal stimulus.

However, if reversing the effects of a negative economic shock by stimulating the economy is the goal, then proponents of economic stimulus generally agree on three principles of what stimulus spending should look like beyond just the sheer size of the multiplier under the best circumstances. To be most effective a stimulus should be:

- **Timely** - In order to stop an economy that is in a rapid downward spiral, stimulus spending must get into the economy quickly. Spending programs that take months or years to complete may take too long to have a timely impact. Delays in spending might not only reduce the impact on a current economic crisis, but might even be counterproductive if they come too late and contribute to overheating the economy.

- **Targeted** - In order to stimulate the economy, spending needs to get into the hands of people who will spend it quickly to multiply its impact. Usually this means lower-income households and people who are most economically distressed by the downturn. Recipients who save the money or use it to pay down existing debt can defeat the purpose of stimulating new spending, and the multiplier effect of the stimulus drops.
- **Temporary** - Stimulus spending needs to be limited to the period when it is needed to deal with a recession. Otherwise, permanent increases in deficit spending can lead to unsustainable government debt, crowd out private investment spending, or create undesirable microeconomic distortions in the economy.

How does infrastructure stimulus stack up here? While empirical research suggests that infrastructure spending may have a strong multiplier effect overall under the best conditions, meeting these criteria may be a challenge.

Infrastructure construction projects may take a few quarters or a few years to even get off the ground due to implementation lag. This means that the stimulus may not be timely, regardless of its total impact. Construction spending tends to peak years after a project is started, by which time the economy is often already recovering. This can create a procylical pattern, where the spending is held up during the time when the economy is suffering and then later overstimulates the economy during times when it isn't needed. In this case, the large multiplier effect associated with this kind of spending can be counterproductive, exaggerating rather than smoothing out economic cycles. While there may be infrastructure projects ready to fully fund at the time of the crisis, there are only a limited number of those. This means there are only so many infrastructure projects that would be useful as stimulus.

Because infrastructure spending is usually for a specific budgeted amount to fund specific projects, on its face it does tend to meet the criterion of being temporary, though cost over-runs and other issues can drag this out. One caveat is that infrastructure strongly influences regional economic development patterns. If infrastructure is built solely for the purpose of providing economic stimulus, not because it provides changes to regional economic development we want, it could cause significant negative long-term effects. This is doubly important to remember as infrastructure might be rushed to provide timely stimulus in a way that doesn't consider longer-term implications. This further limits infrastructure stimulus to projects that are already significantly developed.

Lastly, targeting infrastructure spending effectively to meet macroeconomic goals can be problematic. Such spending tends to inevitably target the heavy construction industry, which may or may not be particularly hard hit in any given recession. Furthermore investment in fixed capital, like infrastructure, is necessarily

highly localized; there is no reason to expect that the regional distribution of infrastructure needs will coincide with the geographic distribution of the impact of a recession.

This can create tension between the goal of economic stimulus and actual public need for the infrastructure. Moreover, several studies have shown that in practice the distribution of stimulus related infrastructure spending is often heavily influenced by political and electoral considerations rather that either of these two goals. While this can make infrastructure spending very appealing to policy makers and politicians, it can work counter to the economic goals of the policy.

The bottom line is that, as we'll further analyze in chapter 2, infrastructure spending can indeed stimulate broad, macroeconomic aggregates such as GDP or total employment. However, because infrastructure projects take a long time to get started, they cannot always provide stimulus in a timely manner to help during a recession. Secondly, if infrastructure is rushed and planning stages are skipped to try and provide more timely stimulus, it could have long-lasting negative consequences to regional economies that do lasting harm well after the recession ends. This means that to be effective fiscal stimulus, the government would need to provide funding for projects that are already planned and started, of which there are only so many. Because of this, infrastructure is further limited as a tool for stimulus, because those existing projects need to be located in regions most severely hit by the recession, further limiting options. Finally, the recession needs to have hit industries like construction and heavy manufacturing that are involved in infrastructure creation, or else the stimulus won't be targeted at the people who most need it. Its strong multiplier effect means stimulus can be a powerful tool for stimulus, but these considerations mean that can only be deployed effectively in a very limited way. If these considerations are ignored then infrastructure becomes a less than ideal fiscal policy tool, or even possibly a counterproductive one.

A very recent analysis conducted by Oxera for ICE, estimated the multipliers of the Infrastructure sector in a range between 1.5 and 2.7. For every unit of money invested in the construction of infrastructure, there will be from 1.5 to 2.7 additional units of money given by the multiplier effect.

More precise is the research on growth multipliers for infrastructure investment conducted by WIOD/McKinsey Global Institute (MGI), which looks at time series of infrastructure investment and subsequent GDP and job benefits and is widely cited in the Infrastructure in a Changing World: Trends and Challenges report by the Institute for International Policy Studies (ISPI). The research defined multipliers capable of estimating expected GDP and job growth from infrastructure investment for the various industries involved in the project[25]:

[25] "Infrastructure in a Changing World: Trends and Challenges" – Ispi Report (2020)

Sector	GDP multiplier	Jobs multplier
Air transportation	0,55	7,95
Constructions	0,81	11,95
Land or pipeline transport	0,79	8,00
Production of transport equipment	0,69	8,26
Telecommunications	0,87	6,09
Warehouse and processing support activities	0,85	8,86
Water management and treatment	0,76	6,58
Water transportation	0,67	7,53

Table 2: GDP multipliers and Jobs multipliers for the main infrastructure segments

- GDP multiplier: This multiplier represents the total $ change in value added (GDP) that occurs in all industries for each additional $ of output that is delivered to final demand by the industry in question;

- Employment/job multiplier: This multiplier represents jobs created in all industries per job created or the additional output delivered to final demand by the industry in question.

So, for example, an hypothetical infrastructure gap of $350 billion per year, would be equivalent to a 0.2-0.3% increase in GDP, and to 2-3 million additional jobs per year.

The very recent analysis conducted by Oxera for ICE in addition to highlighting the strong countercyclical nature of investments in Infrastructure, also informs us that "in most countries, the reduction of investments in infrastructure compared to national needs has led to lower GDP growth and lower employment rates. In recent years, however, countries have also implemented fiscal consolidation policies aimed at reducing their deficits and the accumulation of debt securities. As a result, an increasing number of private players have entered the infrastructure market, generally in partnership with states or other regional or local public authorities."
"In a context of restrained private investment, major powers are regaining an advantage in infrastructure decisions, turning infrastructure plans into geopolitical tools." One example is China: with infrastructure spending at 7% of GDP (in Europe today it is 2% and 1% in the U.S.), Beijing has focused heavily on connectivity. "China has used infrastructure first as an engine for internal growth and more recently as a means of outward projection. The Belt & Road Initiative aims precisely to create a closer economic and strategic interconnection between the country and the Eurasian bloc through an ambitious infrastructure investment program, which - since 2013 - has translated into more than $600 billion in funding."

The Interministerial Committee for European Affairs (Ciae) presented at Palazzo Chigi the "Guidelines for the definition of the national recovery and resilience plan", the draft investment program aimed at the use of Next Generation EU funds to be sent to the European Commission on October 15, 2020.
The text indicates six "clusters" of action: digitalization and innovation, green revolution and ecological transition, competitiveness of the production system, infrastructure for mobility, education and training, equity and social and territorial inclusion, health.
In the in-depth analysis page of the cluster Infrastructure for mobility, we talk in particular about the completion of the TEN-T railway corridor, the development of the High Speed/High Capacity network throughout Italy, the development of the road and freeway network and of bridges and viaducts, integrated logistics intermodality and finally the development of public and private mobility with sustainable environmental impact.
It is not only the Italian government that looks to infrastructure for the relaunch of the country.
The Italian infrastructure sector is also appreciated abroad. This is confirmed by the latest EY report "Infrastructure Barometer", which involved 56 executives from international companies, financial institutions and infrastructure funds.
44% of respondents plan to invest in the next 12 months in the Italian infrastructure sector. A confidence that comes from the consolidation of the Italian construction sector (Progetto Italia) and the introduction of a new procurement code associated (after the collapse of the Morandi bridge) with the dissemination of Covid-19, which has changed and attracted the attention of investors to the Italian infrastructure sector.

"The Italian infrastructure sector is considered a key market for major global institutional investors and is made attractive both by the gap between existing and needed infrastructure and by the greater opportunities that exist compared to other countries with mature economies, where a consolidation process has already been underway for years. In such a favorable context, where the difficulties are represented by political and regulatory uncertainty but the institutions seem to be working in the right direction, we hope that the country will be able to fully seize this opportunity", says Andrea Scialpi, Strategy and Transactions partner at EY.
The research has therefore shown that the world of Italian infrastructure is attractive. Not only do 44% think they will invest in Italy in the coming year with a focus on the infrastructure sector, but the quality of this sector is considered to be in line with the EU average, despite some concerns about the following segments:

- transport (for 39% of respondents below the EU average)
- social infrastructure (for 40% of respondents below the EU average)
- PPP (for 46% of respondents below the EU average).

Added to this, however, is how most investors are attracted to mature segments such as:

- highways (57%)
- railways (54%)
- renewable sources (75%)
- Hospital sector (66%)

In addition, 59% of respondents expect to see increased competition for investment in Italian infrastructure over the next 12 months. Counterbalancing the research, however, appears a negative aspect that has always characterized our country: for 79% of respondents, political and regulatory uncertainty is the main brake for investment in Italy.
"Interventions on infrastructures have a significant multiplier effect, it is estimated that each euro spent multiplies up to 2.5 times in value on GDP, so investments in the sector are considered one of the key levers for recovery. However, in Italy the sector is still partially underdeveloped: the incidence of infrastructure investment on GDP in Italy is 2.1% for public investment and 5.2% for private investment, compared to the EU average of 3% and 7% respectively," says Marco Daviddi, strategy and transactions managing partner of EY.

1.6) Recovery Fund

In 2020, following the outbreak of the Covid-19 pandemic, several countries found themselves faced with a real economic emergency, having had to suddenly close down various production activities to safeguard the health of their citizens. This fact, combined with the need for a large economic outlay to buffer the crisis and draw up a recovery plan, brought the issue to the attention of the European Commission, which, after negotiations lasting several months, set up the so-called "Recovery Fund", with the aim of helping the countries in greatest difficulty.

The Recovery Fund stems from an old French proposal developed with the aim of issuing Recovery Bonds, with a guarantee from the EU budget. All sharing the risk but only looking to the future, without any real mutualisation of past debt. At the heart of the matter, then, always debt securities, but with this "slight" difference. The financing of the fund was designed through the collection of liquidity given by the issuance of Recovery Bonds.[26]

[26] Recovery Fund, tutto quello che c'è da sapere in 10 domande e risposte – Il Sole 24 Ore (https://www.ilsole24ore.com/art/tutto-quello-che-c-e-sapere-recovery-fund-10-domande-e-risposte-ADE6jzp)

In the words of Italian Prime Minister Conte himself, to those who ask what the Recovery Fund is, we could respond by defining it as:

"A recovery fund with common European bonds to finance the recovery of all the most affected countries, including Italy."

To know how it will work for all intents and purposes, the Old Continent had to wait for the outcome of the July European Council in which a 750 billion euro plan was drawn up, broken down as follows:

- 390 billion in grants.
- 360 billion in loans.

The money will probably arrive in the second quarter of 2021 but can also be used retroactively, i.e. to cover expenses incurred from February 2020 onwards. Next autumn each country will present its national reform plan 2021-2023 to which the receipt of Recovery Fund money will be subject.
The plans will be assessed by the European Commission within two months of their submission. This assessment will have to be approved by the European Council, which will act by a qualified majority on a proposal from the EU executive. This will be done through an implementing act that the Council itself will adopt within four weeks of the proposal.
The Commission will ask the Economic and Financial Committee for an opinion on the achievement of the targets, both intermediate and final.

"Where, exceptionally, one or more Member States consider that there are serious deviations from the satisfactory achievement of the relevant intermediate and final targets, they may request that the President of the European Council refer the matter to the next European Council."

In this case, the Commission will not take decisions until the matter is finally resolved and payments approved. However, this phase should not last longer than 3 months. If, on the other hand, no objection is raised, the Commission will decide to approve the payments. In practice, a light emergency brake has been inserted into the Recovery Fund agreement.

Under the terms of the Recovery Fund agreement, Italy will take home €208.8 billion, broken down as follows:

- loans: €127.4 billion (compared with 90.9 proposed by the EU Commission);
- grants: €81.4 billion (slightly less than the initial 90).

Rome, together with Madrid, will be the major beneficiary of the fund. Obviously, Italy's priority now will be to implement the necessary reforms to comply with EU recommendations and relaunch the economy.

There are 17 macro-areas ("clusters") in which the current executive's project is divided, which has been elaborated adopting a step-by-step consultation with the European Commission.
The majority of resources would be allocated, if the project was to be finalized as it stands in the current draft, to the "green revolution and ecological transition" area with 68,9 billion in investments. Other notable sections are digitalization and innovation (46,1 billion euros); infrastructure for sustainable mobility (31,9 billion); education and research (28,4 billion); gender equality on (27,6 billion); healthcare (19,7 billion).

According to estimates provided in the draft in 2021 (graphs below) the implementation of the Recovery plan would already give a first additional boost of 0.3 points of GDP, and then follow in subsequent years with a +0.5 in 2022, +1.3 in 2023, +1.7 in 2024, +2 in 2025 and +2.3 points of GDP in 2026.
"It is clear how crucial it is for the expansion prospects of the economy and for the sustainability of public debt to select public investment projects with a high impact on growth and to increase the efficiency of the Public Administrations in charge of implementing these projects," the document specified.

"There are three main challenges to be addressed to promote acceleration," said Marco Daviddi, EY Strategy and Transactions leader for the Med area, in October 2020, "the completion of strategic infrastructure for the transport of goods and people; a major plan for the maintenance and modernization of existing works; an organic, strategic and bold intervention to review and rethink metropolitan areas. Intervening on the infrastructure endowment of our country is essential to support growth and employment in the short term, to allow businesses and citizens to pursue the transformation processes that Covid-19 has accelerated and make our social and productive system more resilient".

"It is clear - continued Marco Daviddi- as the post Covid-19 restart requires urgent interventions to ensure the maintenance of adequate levels of competitiveness of the country, through an extraordinary plan of infrastructure investments".

It is estimated that every euro spent on infrastructure is transformed into 2.5 euros of GDP in the medium term. It is estimated that Recovery Plan resources can enable an increase of around 25% in public investment spending over the next 5 years, with an annual impact of around 0.5% of GDP in 2019.

In this context, a crucial role is played by investments in "infratech", a now indissoluble mix of digital and physical infrastructures for new urban ecosystems supporting citizens with a view to sustainability, safety and resilience.

Chapter 2

Summary of the existing literature on the matter

Now that we have introduced the most important variables of our analysis, we can move on by examining the correlation in itself, which are the views on the matter from the Economic society all over the world and if this relationship that intuitively might seem obvious is really that strong.

2.1) Main theoretical contributions on the subject

In economic theory, there are five channels where infrastructure can have positive effects on economic growth. Infrastructure might act as follow:

- be regarded as a direct input into the production process and hence serve as a factor of production;
- be regarded as a complement to other inputs into the production process, in the sense that its improvements may lower the cost of production or its deficiency may create a number of costs for firms;
- may stimulate factor accumulation through, for example, providing facilities for human capital development;
- can boost aggregate demand through increased expenditure during construction, and possibly during maintenance operations;
- can serve as a tool to guide industrial policy which government might attempt to activate this channel by investing in specific infrastructure projects with the intention of guiding private-sector investment decisions (Fedderke and Garlick, 2008).

First, even though we have introduced both Public and Private Investments in Infrastructure as equally important to frame the Infrastructure level in a country, it is difficult to separate the impact of Private Investments on industrial growth from the effects of public infrastructure. Therefore, in our study, we will consider only the infrastructure assets in public ownership.
In the last years, the idea of the positive impact of infrastructure on productivity and economic growth is in increased attention[27]. Fig. 1 depicts the most famous work on the subject in this area over the last 20 years.

[27] T. Palei "Assessing the impact of Infrastructure on Economic Growth and Global Competitiveness"

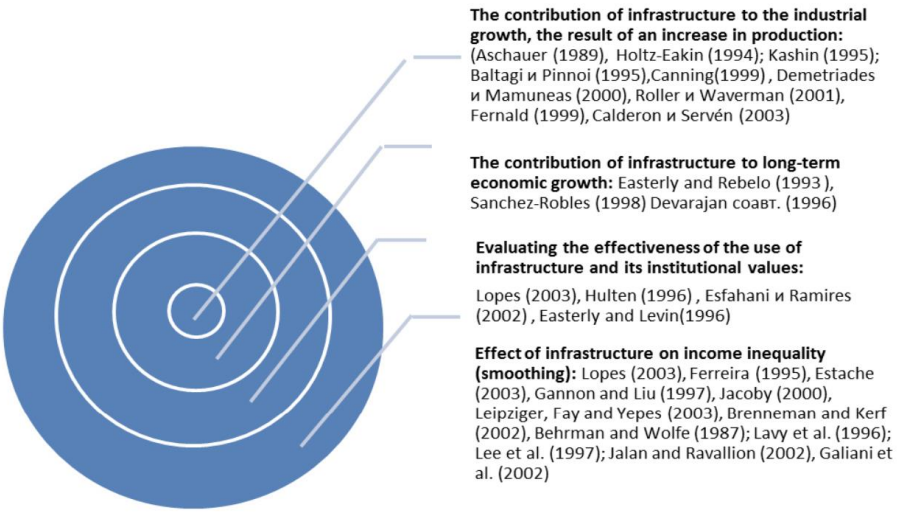

Figure 1: Evolution of the subject of research of the infrastructure factors' impact on industrial growth

Aschauer (1989) found out that almost simultaneously with a reduction of public investment almost everywhere the productivity growth fell sharply. He was the first who proposed that the reduction of productive public services in the United States may be crucial in explaining the overall reduction in the rate of productivity growth in the country. Mamatzakis' (2008) calculations suggest that the infrastructure is an important component of economic activity in Greece. His estimates show that the public infrastructure reduces costs in the most manufacturing industries, as it strengthens the growth of productivity of resources. The efficient infrastructure supports economic growth, improves quality of life, and it is important for national security (Baldwin, Dixon, 2008). The researchers analyze the impact of infrastructure in various aspects: regional competitiveness, economic growth, income inequality, output, labour productivity, the impact on the environment and well-being (in time and cost savings, increased safety, the development of information networks) (Bristow and Nellthorp (2000)). Some authors argue that investment in infrastructure can stimulate organizational and management changes: the construction of the railway system will lead to the standardization of the schedule, which leads to increased revenue in addition to having railway service (Mattoon, 2004). Public infrastructure provides the geographic concentration of economic resources and wider and deeper markets for output and employment (Gu, Macdonald, 2009). It affects the markets and resources of the finished product, helps to determine the spatial patterns of development and provides an extensive network of individual users at low prices. Public infrastructure is generally seen as a foundation on which to build the economy (Macdonald, 2008). Grundey (2008), Burinskiene and Rudzkiene (2009) have conducted an analysis of the implementation of sustainable development policies, they note the development of infrastructure as one of the most important aspects in the field of strategic planning for sustainable spatial and socio-economic development of the country. Aschauer (1998) confirms that the public infrastructure is the basis of the quality of life: good roads reduce the number of accidents and increase public safety, water supply system reduces the level of disease, waste management improves the health and aesthetics of the

environment. Agenor and Moreno-Dodson (2006) examined the association between the presence of infrastructure and health and education in the community, and proved that infrastructure services are essential to ensure the quality and availability of health and education, which provide a wealth effect to a large extent. Damaskopoulos, Gatautis, Vitkauskaite (2008) attributed to the sources of infrastructure performance. Demetriades and Mamuneas (2000) suggest that social capital infrastructure has a significant positive impact on earnings, the demand for private means of production and delivery of products in 12 OECD countries. The results of the assessments that were made by Mentolio, Sole-Olle (2009) confirmed the idea that productive public investment in roads positively influenced by the relative increase in labour productivity in the Spanish regions. Macdonald (2008) analyzed the impact of public infrastructure on the level of private production and found that private infrastructure is vital for the private manufacturing sector. Companies are looking at social capital as an unpaid factor of production while maximizing profits. Nijkamp (1986) confirms that the infrastructure is one of the tools for the region development. It can affect, directly or indirectly, on the social-economic activities and other regional capacity, as well as factors of production. The author emphasizes that infrastructure policy is a condition of the regional development policy: it does not guarantee regional competitiveness, but creates the necessary conditions for achieving regional development objectives. Snieska and Draksaite (2007) say that the competitiveness of the economy is determined by many different factors, and indicator of infrastructure is one of them. Snieska and Bruneckiene (2009) identified infrastructure as one of the indicators of the competitiveness of regions within the country. It refers to the physical infrastructure (consisting of road transport infrastructure, telecommunications, newly built property, external accessibility of the region by land, air and water) as an indicator of the factors of production, competitive conditions in the region. Martinkus and Lukasevicius (2008) consolidate that the infrastructure services and physical infrastructure are factors that affect the investment climate at the local level and increase the attractiveness of the region. Further, we examine the extent of the infrastructure influence for global competitiveness and sources.
telecommunications, newly built property, external accessibility of the region by land, air and water as an indicator of the factors of production, competitive conditions in the region. Martinkus and Lukasevicius (2008) consolidate that the infrastructure services and physical infrastructure are factors that affect the investment climate at the local level and increase the attractiveness of the region.

2.2) Today's generally accepted view

After almost a century of developing theories about its potentially positive influence, nowadays the prevalent point of view is that infrastructure is necessary for the functioning of an economy: it provides citizens with access to basic public services, brings businesses closer to production inputs and markets, and ensures that the economy functions smoothly.

As we have seen, from an economic point of view, investment in infrastructure has a dual role. Firstly, it has a Keynesian impact on demand: it can therefore be assimilated to a fiscal stimulus and can be used by governments to stabilize the level of economic activity in adverse cyclical phases. However, it is important to consider the possible counterproductive effects of such interventions ─ in terms of inefficient allocation of resources (should the the public sector underestimates the cost-benefit ratio of individual interventions by producing "bridges to nowhere"), potential crowding-out of private investment, and introduction of distortionary taxes for the financing of interventions. Second, infrastructure investment influences long-term economic growth through at least four channels: *i)* infrastructure capital is itself an input of the production function (not unlike physical capital in general); *ii)* it reduces the costs of production costs and sustains the productivity of other factors of production; *iii)* it represents a complement for the other productive factors, making them more efficient and stimulating their accumulation (e.g, investments in private facilities); *iv)* directs the choices of private investors towards certain sectors or geographic areas, thereby influencing the processes of economic convergence[28].

By virtue of the channels described above, infrastructures tend to produce positive "externalities" on other economic sectors, justifying intervention by the public sector to guarantee a sufficiently wide range of infrastructure; the same intervention is required if another characteristic of the "public good" aspect of infrastructures is considered: The difficulty of excluding specific certain subjects from the enjoyment of the good itself. A third motivation for public intervention is the characteristic of "network", which distinguishes the main types of physical infrastructure: the consequent natural monopoly conferred on the network operator must be limited through appropriate public regulation. These considerations justify the crucial role played, virtually in all countries, both advanced and not, by public institutions in the realization and management of infrastructures. Even where management is entrusted to the private sector, the public authority retains a key role as regulator. From a theoretical point of view, however, it is possible to imagine situations in which the public sector plans investments sub-optimally, investing in inefficient projects; in this case the realization of infrastructure could have negative, rather than positive, effects on the country's economic growth, as the benefits for the community would be lower than the costs incurred to make the investments.

Although the international economic debate on the quantification and qualification of infrastructure has developed considerably over the last few decades, it has not yet been fully resolved.
quantification and qualification of the effects of infrastructure investments on economic growth is still fervent[29]. In general, the majority position in the empirical literature is that infrastructure investment contributes positively to economic growth, but the relationship appears to be unsteady and not verified for

[28] Cfr. P. Agénor, P and B. Moreno-Dodson, "Public Infrastructure and Growth: New Channels and Policy Implications", World Bank Policy Research Working Paper No. 4064, November 2006.

[29] D.A. Aschauer, "Does public capital crowd out private capital?", Journal of Monetary Economics 24, 1989, 171 – 189

all countries[30]. This should not come as a surprise: Accurately measuring a country's infrastructure endowment, even before than its effects, is a complex exercise, especially for emerging economies, where investment statistics are incomplete and investment statistics are incomplete, and measures of the physical extent of facilities hardly indicative of their true quality.
In addition, given the heterogeneity of infrastructure, it is presumable to different effects depending on the composition of interventions. Even more important is the different efficiency of the sector in carrying out public investment in the various countries, achieving allocations that are not always optimal in size and composition. Further critical issues for researchers derive from the difficulty of dealing with the econometrics of the relationship between growth and investment in infrastructure investment, for example, due to problems of endogeneity (expectations of economic growth in turn stimulate demand for infrastructure), non-stationarity of the variables, and omitted variables.

2.3) A missed opportunity - The 2008 American market crisis

Since the Global Recession of 2008 began, increased infrastructure investment has been suggested as a primary tool to restore the economy to full health, but in many countries, such as the United States, infrastructure was not part of their first stimulus package meant to fight the Recession, the Economic Stimulus Act of 2008, despite some calls for it to be included (Mishel, Eisenbrey, and Irons 2008). The rationale at the time for excluding infrastructure was that stimulus must be "timely, targeted, and temporary" (Elmendorf and Furman 2008). Infrastructure investment apparently violated the "timely" part of this mantra—policymakers were worried that the recession would come and go so fast, and that recovery would be so quick, that the economy would be back at full health before meaningful infrastructure investments could be mobilized. Some of this logic even persisted with the writing of the American Recovery and Reinvestment Act (ARRA), which had a smaller infrastructure component than is commonly recognized. The debates surrounding ARRA and infrastructure often centered on whether or not enough viable infrastructure projects were "shovel-ready," meaning (again) that policymakers worried that infrastructure investment could not be mobilized quickly enough to help the economy while it was still in its unrecovered state.[31]

[30] D.H. Brooks and E.C. Go, "Infrastructure's Role in Sustaining Asia's Growth", ADB Economics Working Paper Series, No. 294, December 2011; M. Fay, M. Toman, D. Benitez, S.Csordas, "Infrastructure and Sustainable Development", in: "Post Crisis Growth and Development: a Development Agenda for the G-20", S. Fardoust, Y. Kim, C. Sepulveda, the World Bank, 2011; E. Dabla-Norris, J. Brumby, A. Kyobe, Z. Mills, C. Papageorgou "Investing in Public Investment: An Index of Public Investment Efficiency", IMF Working Paper WP/11/37, February 2011.
[31] J.Bivens, "The potential macroeconomic benefits from increasing Infrastructure investment"

Given that unemployment in 2016 in the USA was still significantly higher (4,9 percent) than its 4,6 percent average in 2006 and 2007—the years immediately preceding the Recession—this fear was obviously not well-founded. Infrastructure projects started in 2008, 2009, or even in 2013 could have helped the economic recovery. Even as of March 2017, many measures of economic slack indicate that the economy could benefit from a boost in aggregate demand. The share of prime-age (age 25–54) adults who were employed, for example, was 1,4 percentage points lower in March 2017 than the average share in 2006 and 2007. This may not sound like a lot, but this translates into roughly 1.9 million workers just in this age group who need to find jobs before the economy can be declared as having returned to pre–Great Recession health.

The clearest evidence that demand growth, without investments in infrastructure, remained too slow relative to the economy's potential capacity is the unusually slow growth of nominal wages that deep (almost 10 years) into a recovery. Despite unemployment in March 2017 essentially matching its 2007 average, nominal wage growth for production and supervisory workers for the year ending in March 2017 was 2,3 percent. In 2007 this wage growth was 4,0 percent. This sluggish wage growth has in turn made it hard for the Federal Reserve to maintain price inflation at their 2 percent target.

Finally, the agonizingly slow recovery from the Recession and the anemic economic recovery and expansion following the 2001 recession, even as it was aided by an enormous housing market bubble, have raised fears that the shortfall in aggregate demand relative to the economy's productive capacity could be a chronic problem moving forward. This problem, often referred to (somewhat confusingly) as "secular stagnation," suggests that macroeconomic policy—including fiscal policy—would need to adopt a more expansionary stance in the future (see Krugman 2013 and Summers 2016 on this point). So far, the lessons of these analyses have not been heeded. For example, fiscal policy has not been more expansionary during the recovery from the 2008 Recession relative to past recoveries. In fact, the recovery from the 2008 Recession has seen the most austere path of spending during any post–World War II recovery, a fact that explains most of the recovery's slowness (Bivens 2016).

A renewed push to increase infrastructure investment could move fiscal policy from being a drag on growth to being a boost to growth in coming years. Perhaps relevant to upcoming fiscal policy debates, infrastructure investment is routinely estimated to be a much more efficient fiscal stimulus than almost any form of tax cut, and it is significantly more efficient than those tax cuts whose benefits fall mostly on high-income households.

Since 2008, research on the causal effect of infrastructure spending on short-run output and employment has been bolstered by the examination of large, exogenous fiscal events: the large fiscal boost provided by

ARRA in the United States, the large (but quite variable) fiscal contraction undertaken by countries in the European Union (EU), and anti-corruption efforts in Italy.

Acconcia, Corsetti, and Simonelli (2014) examine the fiscal shock that occurs in Italian provinces when public construction projects are halted in response to findings of Mafia involvement. A law issued to combat public corruption provides for forceful and sudden halts to construction activity when local police find evidence of Mafia involvement. This provides an exogenous shock to fiscal spending that can be linked to subsequent changes in economic output. Such exogeneity is needed in studies of fiscal stimulus because of the ever-present possibility of two-way causality: fiscal changes can affect economic growth, but economic growth can also in theory affect fiscal changes. Using this high-quality instrument that isolates exogenous fiscal changes (i.e., fiscal changes uncorrelated with changes in economic output), Acconcia, Corsetti, and Simonelli (2014) estimate multipliers on public investment of between 1,5 and 1,9.

Blanchard and Leigh (2013) examine the large but varied fiscal adjustments undertaken by EU members in response to the Euro crisis of 2009–2010. They regress the fiscal adjustments against the predicted pace of output growth in the next two years (2011 and 2012). They find a systematic (and negative) relationship between the fiscal adjustments and the forecast error of subsequent output growth, suggesting that fiscal multipliers are substantially larger than forecasters assumed a priori. They interpret their results as indicating an overall fiscal multiplier of 1,5. They also find that spending adjustments matter more than revenue adjustments in restraining output growth.

Jovanovic (2017) extends Blanchard and Leigh's (2013) results by examining the fiscal adjustment in government consumption and government investment separately. They find that reductions in government investment have significantly larger (negative) effects on subsequent output growth than reductions in consumption spending.

Finally, Leduc and Wilson (2014) and Wilson (2012) assess the impact of increased infrastructure spending under ARRA. Wilson (2012) uses the fact that much of the ARRA highway spending across states in the USA was allocated according to formulas that were exogenous to economic conditions (for example, miles of highway lanes per resident, or the share of youth in each state's population). Wilson's preferred estimate indicates that each $125,000 in announced highway spending was associated with one added job. If this highway spending created jobs across economic sectors in exact proportion to existing employment shares, this would be consistent with an output multiplier of 1,3 If instead employment generated by this spending were more concentrated in higher-productivity sectors, it would be consistent with a larger output multiplier. Bivens (2017) notes that recent rapid decelerations in productivity growth are likely symptoms of the extended period of slack between aggregate demand and the economy's productive capacity that

characterized the post-2007 period. Productivity is a measure of average income (or output) generated in an hour of work in the economy. One key determinant of productivity growth is capital deepening—supplying the economy's workforce with more and better tools. For example, as construction workers moved from working with shovels and pickaxes to working with cranes and earthmovers, productivity growth in that sector naturally increased. A key reason for the rapid deceleration of productivity growth in recent years has been a long period of weak private investment.

As labor markets normalize and begin putting upward pressure on wage growth, there is strong reason to believe that firms will begin searching harder for ways to reduce upward labor cost pressure and will begin investing in labor-saving capital and technology.

By taking up the last of any remaining demand slack, an increase in infrastructure investment could have an immediate effect in restoring productivity growth to more normal levels. More importantly, there remains a strong economic rationale for investing in infrastructure even after the economy reaches and settles into full employment. Much of the USA's capital stock is comprised of public capital. Highways, airports, dams, sewer systems, and utilities are all necessary inputs for private production, but they are largely supplied with public funds. When the public capital stock is allowed to degrade through lack of investment, this could in theory lead to slower private-sector productivity growth.

Before delving into evidence assessing this effect, however, it is important to note that improving private-sector productivity is just one reason to support expanded public investment. If, for example, public investment had no impact at all on private-sector productivity but allowed public goods to be delivered more efficiently, there would be a benefit. If we were to receive clean water and air, safe food and medicine, and transportation services for less money than we spend currently, this would be a perfectly fine way to enjoy the economic returns to expanded public investment, even if they do not boost private-sector productivity.

Further, the possibility that the benefits of public investment are more broadly shared than the benefits of private-sector investment constitutes another compelling reason to support it. While studies examining the link between inequality and public investment are few, several methodologically sound papers have suggested that countries with larger public capital stocks tend to have greater equality of incomes (see, for example, Calderón and Servén 2004). This should not be a shock—by its nature public capital is more broadly based in its ownership than private capital (in the United States, the wealthiest 1 percent of households own more than 40 percent of private wealth) and so its benefits should be more broadly distributed (Getachew 2008).

Finally, it should be remembered that many possible benefits of public investment may not show up as increases in cash incomes. Clean water and air and shorter commute times provide clear economic benefits, but these benefits do not generally show up in measurable cash incomes.

2.4) The fast propulsors: Transportation and Telecommunication

The two main areas of Infrastructure identified as a major propulsor for the National productivity are Transportation and Telecommunication. Here we are going to focus in detail on what are the main studies that support this theory and on what are the pillars of their analysis.

2.4.1) Telecommunication

Investment on Telecommunication is highly identified as a main factor that has a strong ability to improve productivity and growth in economic[32]. Leff (1984) discusses that development in networks of telecommunications causes cost savings in other markets through decreasing search and transaction costs, improves the information flow and arbitrage capabilities. Telecommunications creates possibility for the firms to take on flexible structure and locations, causing the evolution in complex or large organizations (Wellenius, 1977). An early study established by Hardy (1980) regarding 60 developed and developing countries shows that telephones per capita has a significant effect on GDP but the increase in radio stations does not. However, the results were not significant when the regression estimation was done separately for each developed or developing countries. Norton (1992), also examined the argument of reduction of transaction costs through improvement in telecommunications infrastructure (Leff, 1984), via cross-section data for 47 developed and developing countries. The results show that the telecommunications infrastructure has positive and significant effect economic growth. Another recent study done by Roller and Waverman (2001), both estimates a micromodel for telecommunications investment through a macro production function for the countries of OECD (Organization for Economic Co-operation and Development). The study defines a highly causal relationship among telecommunications infrastructure and productivity, and in addition indicates that it occurs whenever telecommunications services rise to a certain threshold, approximately near universal levels. Since Jipp's (1963) work, several studies have taken a look to the relationship between investment in telecommunications infrastructure and economic growth. Some studies investigate a cross-section of countries over a time period, while others concentrated on national and or sector specific time-series. Found experimental evidence implies a strong positive relationship among investment in telecommunications infrastructure and economic growth, while the investment returns are

[32] B. Elaheh “The relationship between Infrastructure Investment and Economic Growth”

generally greater for developing countries (Dholoakia and Harlam, 1994). In particular, Cronin et al. (1991) and Lee (1994) investigated if growth in telecommunications infrastructure affects economic growth or economic growth affects the telecommunication sector to grow. Lee tested this relationship for main lines growth in South Korean, telephone sets per capita, gross capital investment expenditure (land and buildings), and gross investment for 1963 through 1988. A rigid positive effect on the economic growth was found. The indicated process was that increased telecommunications infrastructure encouraged economic growth through providing necessary infrastructure needed for business. Cronin et al. (1991) apply Granger, Sims and modified Sims researches to US economic growth and telecommunications investment data for 1958 through 1988. A feedback process is indicated that by means of telecommunications investment encouraged economic growth and the growth causes increscent telecommunications infrastructure demand. Madden and Savage (1998) researched the relationship between telecommunications infrastructure and economic growth for transforming Central and Eastern European (CEE) economies. They found a two-way causal relationship between telephone-density and economic growth at the aggregate level. Zhao and Junjia (1994) discussed that increased investment in telecommunications in China has caused reduction in time and space in production process, distribution, exchange and finally consumption. Such externalities have led to a more efficient use of energy, labor and capital.

2.4.2) Transportation

Empirical researches at international level by means of cross sectional and panel datasets has also been reviewed, as these studies help us both in the econometric specification and interpretation and they also allows us to make important comparison. Aschauer (1989c) studied the economic role of public investment, of which transport capital forms part for the G7 (group of seven industrialized nations finance ministers) countries using panel data over the period of 1966-1985. He attempts a Cobb-Douglas function and reaches an output elasticity of 0.34 to 0.73 which shows the importance of public investment in productivity and growth clearly. In a subsequent study, Aschauer (1995) also employed an entire productivity growth function with fixed country and time effects to study the similar effect for 12 OECD countries for the years 1960-1988. He has reported allocation between 33 – 55% of the non-military public capital stock into output growth. However it should be also noticed that various studies at international level have defined the insignificance and diverse results of public investment on productivity and also output growth. For example, Ford and Poret (1991), by means of data on non-military public capital stock, and including infrastructure services provided by private sector as well, for 11 OECD countries for the years 1960-1988, they found that their wide definition of infrastructure (including any structures in water, electricity and gas and also structures in transport and communication) had significant impact on productivity and output for 5 of the 12 countries, namely, US, Germany, Canada, Belgium and Sweden. He attempted an entire factor productivity growth and Autoregressive of order 1 and 2 models for his estimations. It is also necessary to find out the

relationship among transport infrastructure development and economic growth because of the massive investments in infrastructure project. Through establishing the theory, the authenticity of the analyzed topic is proved by many authors effective in this field. Most of the empirical researches are assigned on production function approach and have reached positive relationship between investment in transportation infrastructure and economic growth. Cobb-Douglas production function was not only aggregated national time series data of USA but also was used to find out the relationship between public infrastructure capital and the level of total output of the private sector. He found that a significant linkage exists between these two variables. The output elasticity in regard to the public capital is 0.39, meaning that 1 percent increase in infrastructure capital stock causes 0.39 percent increase in the private sector output. Sanchez-Robles (1998) finely indicated some new indicators for investment in infrastructure through employing physical units of infrastructure. He established that the physical units of infrastructure are positively and significantly correlated with growth. Some researches discover the effect of public capital on the output growth rate. Canning, et al.(2004) used physical measures, kilometers of paved roads, instead of constructing stock of monetary investment in infrastructure in order to investigate "the extended consequences of infrastructure provision on per capita income in a panel of countries" covering the years 1950 and 1992 according to the growth model of Barro (1990, cited Canning, 2004,p.1). His measured results suggested that for the impact of paved road increase in provision on GDP per capita differs across countries. They found witness of over-supply in public capital in some of the developing countries. Herranz-Loncán (2007) studied the impact of infrastructure investment on economic growth between in Spain over the period of 1850 and 1935. By mean of new infrastructure data, he shows that the growth effect of local-scope infrastructure investment measured positively, but returns to investment in large national networks were not significant and it was approximately zero. He prepared two complementary explanations for the recent result. On the one hand, public involvement and the nonefficiency investment criteria were very strong in large network construction however returns to new investment in large networks might have fall down significantly while the basic links were constructed. Furthermore, statistical researches done for United States defined that a direct positive link exists between infrastructure investment and GDP. For example, for the years 1950- 79, growth in public infrastructure caused approximately a one to one for economic growth. During the period infrastructure investment in important areas such as transportation, water management and electricity generation rose at an average rate of 4% while the entire economic or GDP growth had an average of 4.1% during the same period. On the other hand, during the years 1980-2007 growth in public infrastructure investment dramatically fell down to 2.3% while average annual GDP growth fell down to 2.9 percent over the same period (Heintz et al. 2009).

2.5) Private sector

Recourse to private financing makes it possible to reduce the incidence on the public budget of the initial

initial expenses (up-front) of the investment, in exchange for the possibility, for the private operator, of benefiting from future revenues (based on tariffs paid by users, usually regulated by the public authority). In return for this intertemporal transfer of financial flows, the private financier demands a return proportional to the project's risk profile, which, except in countries with public finances in poor condition, tends to be higher than the cost of public debt financing. In particular, the cost of private financing is higher for "greenfield" projects, in which the works are to be carried out completely ex novo, while it is lower for "brownfield" investments, which involve the reconversion and management of existing infrastructure. The most common projects in emerging countries are of the first type, characterized by substantial initial expenses, revenues deferred over time and a high risk profile. The latter is affected by a number of factors: political uncertainty;

- the possible worsening of the economic situation;
- administrative obstacles (especially regarding obtaining concessions for the use of public resources);
- estimated demand for public services;
- changes in regulated tariffs;
- contingencies during the design and construction phases[33].

To lower the financial cost of private investment, the public sector intervenes by providing guarantees on bank loans or other types of indebtedness contracted by the private operator to support investment expenses. In this way, however, contingent liabilities are created, i.e., off-balance sheet items, which represent a risk factor for the solidity of public finances. In countries with a low per capita income, revenues of a monetizable nature from the investment are often less than the costs (so-called "non-bankability" of the investment); therefore, in order to make the investment therefore, in order to make the investment economically convenient for the private investor, the government must intervene introducing an element of public subsidy. Last, some more serious risks, connected with political instability and possible macroeconomic collapse in the country, are not credibly insurable by governments.

For all these reasons, very often private sector involvement can result in an increase in the financial cost of the investment project. In this case, the usefulness of involving the private investor derives from a hoped-for reduction in the operating costs of the project, resulting from a better ability of the private party to: *i)* contribute to the selection of projects, carefully assessing their economic profitability economic profitability; *ii)* design and execute the works more quickly and economically; *iii)* manage public services in line with commercial criteria and reducing waste.

For this to happen effectively, it is good for the private sector to take on the project's operational risks, related to construction costs and possible delays; conversely, it may be counterproductive to transfer to it the major risks it is unable to control.

[33] A. Bhattacharya, M. Romani, N. Stern "Infrastructure for Development: Meeting the Challenge", Policy Paper, Centre for Climate Change Economics and Policy, June 2012.

Since the 1990s, especially following major privatization programs for public companies, the involvement of the private sector in the creation and management of infrastructure has increased in emerging areas as well as in advanced countries.

Based on the Private Participation in Infrastructure Projects (PPI) database managed by the World Bank which collects information on major infrastructure projects announced and participated in by the private sector in emerging markets, over half of the investments of the last 15 years (since 2005) have been in the energy sector, and almost a third in the transport sector.

In imitation of what has taken place in Anglo-Saxon countries, in recent years various types of types of public-private partnership (PPP) agreements have become widespread in recent years, such as:

I. Concessions

In concession contracts, used for networks, the private operator receives the long-term right (between twenty-five and thirty years) to use an existing facility (utility), assuming both the responsibility for the management and therefore the provision of services on the basis of predetermined standards, and the burden of financing the necessary investments, without however acquiring ownership of the resource, which remains public. For the private operator the revenue is made up of direct payments from users; in the absence of competitive conditions in the market, this revenue will be limited by a system of regulated tariffs; on the other hand, clauses will be inserted to safeguard of the economic return to the private operator, which must be commensurate with the commercial risk assumed. For those aspects that can't be rigidly fixed in the agreement, an independent regulator able to arbitrate between the parties involved, is desirable.

II. BOT

Build-operate-transfer (BOT) contracts are used to build completely new greenfield projects.
Since the initial cost of the investment is high, project finance instruments are usually applied. BOT contracts differ from concession agreements because the project company will tend to reduce the commercial risk by agreeing with the public sector (government or utility), so that the latter guarantees the purchase of a predetermined output. In the energy sector, this type of agreement is known as a power purchase agreement

III. Joint ventures

Finally, public-private joint venture agreements have been formed in numerous countries. In the case of existing facilities, this entails transferring the utility's ownership shares to the private sector;
In the case of new works, the special project company will be under mixed ownership.

2.6) Risks connected to infrastructure investing

There are unique problems with infrastructure stimulus that tend to diminish its chances of success. Chief among these are long implementation delays. The Congressional Budget Office reports, For major infrastructure projects supported by the federal government, such as highway construction and activities of the Army Corps of Engineers, outlays during the initial year usually amount to less than 25 percent of the total funding provided. For large projects, the initial rate of spending can be significantly lower than 25 percent. Economists from the IMF studied the impact of implementation delays on the multiplier and found that "implementation delays can postpone the intended economic stimulus and may even worsen the downturn in the short run[34]."Perhaps the most important reasons to be skeptical about further stimulus—particularly infrastructure stimulus—have to do with the way it is implemented. As a general rule, the studies that obtain large multipliers do so by assuming that stimulus funds will be distributed just as Keynesian theory says they ought to be. Keynesian economist and former presidential economic advisor Lawrence Summers has offered a widely accepted summary of how—ideally—fiscal stimulus ought to be applied. He argues that fiscal stimulus "can be counterproductive if it is not timely, targeted, and temporary." In reality, however, infrastructure spending cannot fulfill these criteria.

Timing

By nature, infrastructure spending often fails to be timely. Even when the money is available, it can be months, if not years, before it is spent. This is because infrastructure projects involve planning, bidding, contracting, construction, and evaluation. According to the United States' Government Accountability Office, as of June 2011, 95 percent of the $45 billion in Department of Transportation infrastructure money had been appropriated, but only 62 percent ($28 billion) had actually been spent. In light of these delays, then-President Obama eventually conceded that "there's no such thing as shovel-ready projects[35]."

Targeting

Effective targeting means that stimulus money should be spent in those areas that have been hardest hit by the recession. The goal is to make the most use of idle resources. For instance, depressed areas have a considerable number of unemployed resources (people, firms, equipment, etc.). So, theoretically, government stimulus should be able to put these idle resources to work. A number of studies, however, have shown that stimulus funding tends not to go to those areas that have been hardest hit by a recession[36].

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[34] Journal of Economic Perspectives 14, no. 3 (2000): 21–36.

[35] "Obama: 'No Such Thing as Shovel-Ready Projects,'" CBS, October 13, 2010.

[36] Veronique de Rugy, "Stimulus Facts—Period 2" (Mercatus Working Paper, Mercatus Center at George Mason University, Arlington, VA, April 2010).

Many of the areas that were hardest hit by the recession in 2008 are still in decline because they have been producing goods and services that are not, and will never be, in great demand. Therefore, the overall value added by improving the roads and other infrastructure in these areas is likely to be lower than if the new infrastructure were located in growing areas that might have relatively low unemployment but do have great demand for more roads, schools, and other types of long-term infrastructure.

Job Creation

Unemployment rates among specialists, such as those with the skills to build roads or schools, are often relatively low. Moreover, it is unlikely that employees specialized in residential-area construction can easily update their skills to include building highways. As a result, we can expect that firms receiving stimulus funds will hire their workers away from other construction sites where they were employed rather than from the unemployment lines. This is what economists call "crowding out." The term typically refers to government employment of capital that would have been employed by the private sector. In this case, labor, not capital, is being crowded out.

Long term deficit

Even in Keynesian models, stimulus is only effective as a short-run measure. In fact, Keynesians also call for surpluses during an upswing. In reality, however, the political process prefers to implement the first Keynesian prescription (deficit-financed spending) but not the second (surpluses to pay off the debt). The inevitable result is a persistent deficit that, year in and year out, adds to the national debt. A review of historical stimulus efforts has shown that temporary stimulus spending tends to linger and that two years after an initial stimulus, 95% of the spending surge remains.

No Rushing

There is an inherent tradeoff between speed and efficiency. Policymakers need time to weigh the merits of a project, structure requests for proposals, administer a fair bidding process, select the best firms, competently build the project, and impartially evaluate the results. Quite understandably, economists have found that when funds are spent quickly, they are not spent wisely.

In sum, there are strong reasons to suspect that stimulus—especially infrastructure stimulus—is not likely to be implemented as Keynesian theoreticians say it ought to be. This means that even by Keynesian standards, the newest round of stimulus is likely to fail. Tellingly, the political economy problems that plague the implementation of stimulus were actually significant enough to make John Maynard Keynes himself a skeptic. Toward the end of his life, he wrote:

"Organised public works, at home and abroad, may be the right cure for a chronic tendency to a deficiency of effective demand. But they are not capable of sufficiently rapid organisation (and above all they cannot be

reversed or undone at a later date), to be the most serviceable instrument for the prevention of the trade cycle[37]".

[37] John Maynard Keynes, "The International Control of Raw Materials," in The Collected Writings of John Maynard Keynes, vol. 27.

Chapter 3

Infrastructure Gap and the Italian case

In this chapter we will introduce the notion of Infrastructure Gap, analyze which are the main models by which it is constructed and perform a deeper analysis on how to apply what we have seen thus far.
We will bring up the case of the Italian current situation to see what could be the future situation after investing in Infrastructure the monetary dotation supplied by the recovery fund.

3.1) Infrastructure Gap

Whereas classifying and evaluating the stock of existing infrastructure is still controversial, many attempted, in academic and grey literature, to estimate the potential gap in infrastructure provision. The infrastructure gap, broadly speaking, is defined as the inadequate level of infrastructure (Bourque 1985, Basile et al. 2001, McKinsey 2013) or as the difference between investment needs and actual spending (WEF 2012; 2014; 2016, EIB 2013). In the context of this work, we will adopt the definition by the World Bank, according to whom the infrastructure gap is the difference between where a country is today and where a country would like to be in a given point in time[38].

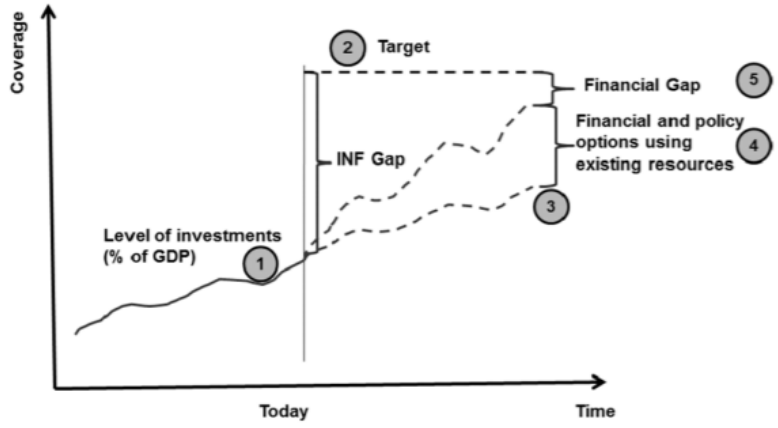

Figure 2: Graphical representation of the Infrastructure Gap evolution through time

The figure shows (1) the current level of infrastructure; (2) where a country will or would like to be in a given point in time; (3) how far business-as-usual scenarios will take the country toward reaching its goal;

[38] L.A. Andres, D. Biller, M.H. Dappe, "Infrastructure Gap in South Asia: Inequality of access to infrastructure services"

(4) and (5) financial and policy options using existing resources and investment resource gap that will need to be bridged.

1) Evaluate a country's level of infrastructure provision needs.

This includes a diagnosis of coverage, quality, and efficiency of infrastructure services, and investments in infrastructure. It involves gathering existing data on access rates to the various infrastructure services; and, to the extent possible, appraising the quality of service provision. In its simplest form, the actual gap is the difference between targets (each one may be priced in a variety of ways) and baseline over a time period in which the gap is aimed to be filled. Different sectors require different methodological approaches. One approach is costing set targets, which involves estimating physical needs as the difference between the baseline and targets. These targets may be defined as universal service access, the Millennium Development Goals (MDGs), or a goal determined by benchmarking—which compares normalized infrastructure performance indicators across countries or areas with similar characteristics (usually socio-economic variables), or predetermined standards defined as optimal. Another approach is costing sector needs, using microsectoral analysis to build estimates based on sector data and sector specialists' views; for water and sanitation, estimates will be based on approximations of the cost of achieving coverage targets under the MDGs. Yet another approach is costing macroeconomic needs using macro-econometric models or micro-engineering economic models. For example, one could look at the infrastructure coverage needed to achieve a particular growth objective, assuming given levels of other inputs.

2) Assess long-term targets and goals for physical infrastructure.

This component analyzes various sets of sector-specific targets and goals, and concludes with an estimation of investment needs. Different sectors inevitably require diverse approaches in terms of methodology.

3) Develop a menu of financial and policy options using existing resources.

This component focuses on key policy options for improving service delivery (including access, quality, and affordability), enhancing the quality and adequacy of public investment in the sector (including performance-based contracting, and prioritization of investments), and encouraging private investment (including PPPs). It emphasizes trade-offs of individual policy recommendations.

4) Develop a menu of financial and policy options for bridging the financial gap.

This component explores possible new sources of finance and how the investment burden can be shared between current and future users and/or society through various financing schemes. It also examines investment climate issues that affect the region's ability to cost-effectively tap private resources. The reality is that even after improving service delivery, enhancing quality and adequacy of public investments, and encouraging private investments, it is likely that long-term targets and goals for physical infrastructure will

remain out of reach. While any increase in investments has to be funded by direct users and/or society, there are options on how to apportion the burden—like higher public spending within a responsible macroeconomic framework, or higher user fees while remaining within accepted norms of affordability. Estimates have been many at local, national, regional and world-wide level and have been calculated with a variety of models that can be categorized in (*i*) bottom-up microeconomic or micro-engineering models, (*ii*) top-down macroeconomic models and (*iii*) hybrid models[39].

3.1.1) Bottom-up models

Microeconomic and micro-engineering models, are both based on bottom up sectorial knowledge, and encompass a wide variety of grey literature, from national project pipelines, that may span from a basic project list identifying local gaps, to comprehensive reports, such as the UK Infrastructure and Projects Authority Report, one of the most articulated one in Europe, to sectorial analyses.

At global level the most renowned micro studies on the infrastructure gap are the "Infrastructure to 2030" reports by the OECD (2006, 2007, 2012). The three reports cover telecoms, electricity, and transports (road, water, airports, ports, rail corridors as well as oil & gas transport). For each sector or sub-sector, specific micro trends, based on the articulacy of the sector, are identified. (e.g. within the telecommunication sector, the transatlantic sub sector and within this the optical cable subsector. In this last subsector two trends are identified: the long-distance fiber network can be expected to grow in both bandwidth per channel (wavelength) and number of wavelengths (time) per fiber.). Population and income projections are then embedded in each sectorial demand analysis and future investment needs per sector are estimated. Projections have been also adjusted to meet climate change demand in the most recent report (OECD 2017).

Regarding Europe, noteworthy, is the European Commission (EC) (2011) estimate on infrastructure needs in transnational energy from a project pipeline priority perspective. On a national and sectorial basis, a wide variety of academic literature discusses the appropriateness of assessing projects based on Computable General Equilibrium (CGE) models or Cost Benefit Analysis (CBA) models for the quantification of the infrastructure project pipeline. In some cases, models were aggregated and generalized to assess infrastructure needs at regional scale.
Regarding sector specific models, the energy sector is the most studied. The first comprehensive model developed in this field is the renowned MARKAL model now updated to the TIMES model. The TIMES (The Integrated MARKAL-EFOM System) model was developed in 2004 as part of the IEA-ETSAP's (International Energy Agency- Energy Technology Systems Analysis Program) methodology for energy

[39] L.A. Andres, D. Biller, M.H. Dappe, "Infrastructure Gap in South Asia: Inequality of access to infrastructure services"

scenarios development to conduct in-depth energy and environmental analyses. The TIMES models encompass all the steps from assessing primary resources through the chain of processes that transform, transport, distribute and convert energy to the evaluation of the supply of energy services demanded by energy consumers. The economic and engineering relationships between energy "producers" and "consumers" is the basis underpinning TIMES models. 7 The model is able to estimate energy demand, and therefore able to accurately estimate the demand driven need for energy infrastructure across the value chain. While we acknowledge the existence of this branch of literature on infrastructure needs assessed by micro-engineering models, either based on CGE or CBA, thorough reviews and considerations on the matter are out of the scope of this conference paper.

3.1.2) Top-down Models

Research on macroeconomic models, which explain and predict levels of infrastructure based on macroeconomic variables, stems from the seminal research conducted by Marianne Fay for the World Bank Group in 2000. This work disentangled the primary relationship between macroeconomic variables and the level of infrastructure needed.

The model assumes that infrastructure has to classes of users: individuals and companies: the first demand infrastructure as a consumption good, the latter as input into production. The research, originally limited to Latin America, found that economic infrastructure demand is explained by aggregated output, sectorial share of GDP; as well as variables such as density, urbanization and trade. This line of research was further expanded at a global level (Fay and Yepes 2003) in which it proved its validity through the registered high explanatory power of the model (R squared over 90 percent across infrastructure classes except water). The model was updated with better or more recent data and adapted to different regions for finer results: Yepes (2004) for East Asia and the Pacific, Fay and Morrison (2007) for Latin America, Estache and Yepes (2004) for Sub Saharan Africa, Fedderke and Bogetic, (2005) for South Africa, Chatterton and Puerto (2005), for South Asia and Bhattacharyay (2010) for the Asia Pacific.

Theory underpinning these works was left basically untouched until Oxford Economics (2017) under a G20 initiative, developed the Global Outlook on Infrastructure making use of stochastic frontier modeling techniques. This allowed the introduction of 'qualityadjusted' performance measures allowing the determination of the spending required for a country to match the performance of its best performing peers. The main theoretical contribution to the Fay (2000) model is the shift in the definition of infrastructure need. Previously it was understood as the need to match the demand required for consumption by individuals and the demand required to satisfy production needs. It's now interpreted dynamically, as the level necessary to

raise the game across the board. Need is evaluated by comparing what peers are doing: countries with similar characteristics are expected to dedicate a similar amount of resources to infrastructure and while countries converge to higher levels of infrastructure the entire model adapts to the new frontier.

3.1.3) Hybrid models

Grey literature produced several models, combining sectorial approaches to macroeconomic evaluations. The McKinsey Global Institute (2013) estimated the global infrastructure need by studying what is required to keep pace with anticipated growth, the report applies the limited 70 percent "rule of thumb" approach , and does not estimate what would be needed to meet a range of broader aspirations. The model uses capital stock values as a proxy of current infrastructure stock and estimates need by projecting global infrastructure through demand drivers in different infrastructure categories sourced from the (OECD 2006, 2007, (IEA), and Global Water Intelligence (GWI), cross checked with historical spending investment for roads, rail, ports, airports, power, water, and telecommunications infrastructure (which averaged about 3.8 percent of global GDP).

A second widely referred to model is the World Economic Forum (WEF) (2012; 2013; 2014) model in which the investment in infrastructure gap is based on OECD (2006; 2007; 2012) expenditure estimates as percentage of GDP. Sector trends were generalized to find an average annual investment need for 2010-2030 of about 3.9 percent of GDP. In 2014 the WEF report was expanded to encompass also social infrastructure, replicating the same model. Most recent among the hybrid models is the Oliver Wyman (2017) report yet based on WEF (2012, 2013, 2014) estimates. Regarding Europe, the European Investment Bank (EIB) (2013) collected, separated out and updated investment in infrastructure gaps with estimates from (OECD 2006, 2007, 2012; EC 2011 and McKinsey 2013).

3.2) Focus on the Italian situation

After taking a general view at the most reliable ways to assess a country's infrastructure gap, we can know focus on the situation in Italy and, by using the 4 variables described in sub-chapter 3.1, see how the concepts we just exposed may be applied and what room is there for Italy to grow its current infrastructure level.

1) Evaluate a country's level of infrastructure provision needs.

As we said, this includes a diagnosis of coverage, and efficiency of infrastructure services, plus an assessment of the access rates to the market for potential investors and the perceived quality of the current services.

This is one of the most important variables as it is the first evaluated by potential investors when discussing their entrance in the market. If the quality of the services isn't satisfying, it could potentially mean greater return on an investment, as it potentially could, by itself, drastically change the overview of the whole sector. Think about a new, modern and perfectly functioning airport and how it could potentially shape the economy of the whole surrounding area, creating new jobs and positively influencing a series of businesses that take place inside or close to it.

On the other hand, if the access rates to the infrastructure sector are perceived to be too high all of it means nothing, as no investor, especially coming from the private sector, would be willing to risk its capital knowingly wasting a good portion of it because of market inefficiencies or because of the long lead times caused by burocratic filings.

As we have seen in sub-chapter 1.3 in regards to the important factors used to assess the quality of a country's infrastructure, Italy isn't well positioned compared to the average of developed countries in a good number of crucial indexes:

	Italy	UK	France	Germany	Spain	Developed countries (Avg.)
Control of corruption index score	-0.1	1.7	1.3	1.8	0.5	1.3

Figure 3: Control of corruption index score

The control of corruption index score measures the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests. Italy has a well below-average score of 0.1, against an average of 1.3 for developed countries, who underscores how many potential threats a project has to go through before the start and during the works.

	Italy	UK	France	Germany	Spain	Developed countries (Avg.)
Cost to start a business, % of GNI per capita [%]	14.0	0.0	1.0	2.0	5.0	3.7

Figure 4: Cost to start a business, as % of GNI per capita

The cost to start a business is recorded as a percentage of the economy's income per capita. It includes all official fees and fees for legal or professional services if such services are required by law. In Italy it is equal to around 14%, against an average of 3.7% for developed countries, showing how expensive it is to launch new initiatives because of all the correlated costs.

	Italy	UK	France	Germany	Spain	Developed countries (Avg.)
Dealing with construction permits, No. of days	227.5	86.0	183.0	96.0	205.0	141.6

Figure 5: Number of days to obtain a construction permit

Lastly, the table shows the number of days to deal with construction permits to gauge the efficiency and cost of processes that infrastructure companies have to undertake. In Italy it takes almost 60% more days to obtain the necessary permissions to launch a new infrastructural project than in the average developed country and almost 3 times as many as it would take in a country like the UK or Germany. Obviously this represents a problem on the financial side, on the appetibility side (as private investors are discouraged from taking on new projects) and on the market side, as the conditions that were present at the start of the procedure might change by the time that it comes to an end.

Ernst and Young published a survey in 2020 called "EY Infrastructure Barometer – Italy"[40] addressed to key investors and stakeholders within the Italian infrastructure sector in order to obtain an understanding of their view and appetite for the Italian infrastructure sector and its outlook for the close term future.

[40] "https://media2-col.corriereobjects.it/pdf/2020/dataroom/EY-Italian-infrastructure-barometer.pdf"

Q: Which are the key reasons to invest in the Italian infrastructure sector?

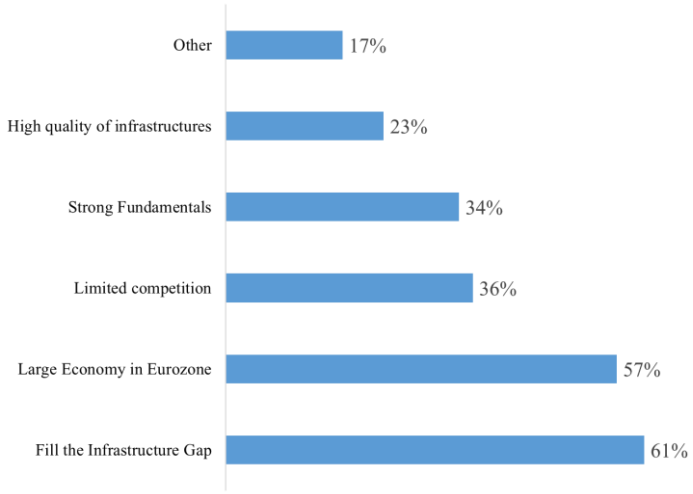

Figure 6: Key reasons to invest in the Italian infrastructure sector, according to private investors and other stakeholders

As we can see the investors are aware about the current Infrastructure Gap in Italy, how the current network isn't at the proper level for a country that's one the most important players in the geo-political configuration of the Western World. At the same time they recognize that this Gap, united with limited competition, a large economy and strong fundamentals, could potentially lead to great opportunities for investments in the infrastructure sector. Based on this data alone Italy might seem one of the most appetible markets for an investor who want to launch a new project and that the whole country could potentially benefit from that, so what is it that prevents this Gap to be filled up to this day?

Q: What is your perception of quality of the PPP tenders in Italy[41]?

- "Below the EU average" 56%
- "In line with the EU average" 41%
- "Above the EU average" 4%

It's clear even though the conditions would be there to invest in greenfield infrastructure in Italy, the deals are not perceived by the stakeholders to be worth the risk most of the time. Let's see what are the mian reasons that prevent the Infrastructure Gap to be filled.

[41] EY Infrastructure Barometer – Italy 2020

Q: What are the key constraints of investing or financing the Italian infrastructure sector?[42]

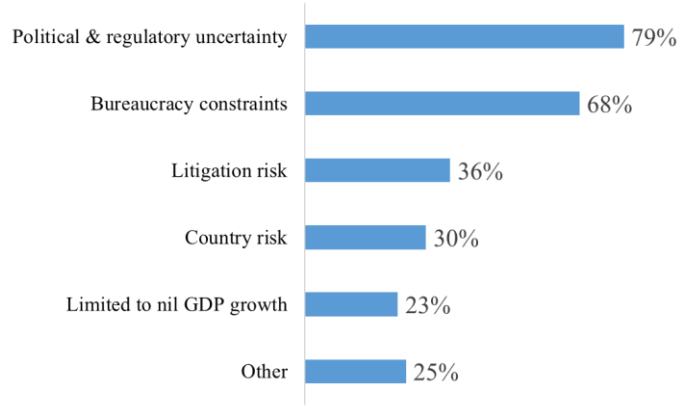

Figure 7: Key constraints of investing in the Italian infrastructure sector, according to private investors and other stakeholders

What is clear from the graph is that the stakeholders perceive a series of obstacles that notably damage the attractiveness of infrastructure investments, in line with the results of our analysis of the previous indexes. The main reason is clear: Italy during the last decade hasn't have political stability, basically no government has ended its normal 4-years term, and this obviously scares away a number of potential investors that don't think their project might have time to develop because of the change in counterparts or in regulatory frameworks. Another issue that the survey underscores are, as we already pointed out, the burocratic costraints and the time needed to explete all the necessary practices in order to launch the project.
One interesting result for our analysis is obviously that 23% of the stakeholders pointed to "limited GDP growth" as one of the reasons to not invest in Italian infrastructure, and that's obviously one of the problems as there can not be a growth sparked by infrastructure investments if there is no hope that the potential project could lead to said growth. In this sense it becomes central the role of the government, that must be the one promulgating the investments so that the machine can be put in motion and must be the one opening the dialog with potential private investors guaranteeing them favorable settings to compensate for the perceived stagnant National Economy.

[42] EY Infrastructure Barometer – Italy 2020

Q: What is the average ticket of each investment / financing[43]?

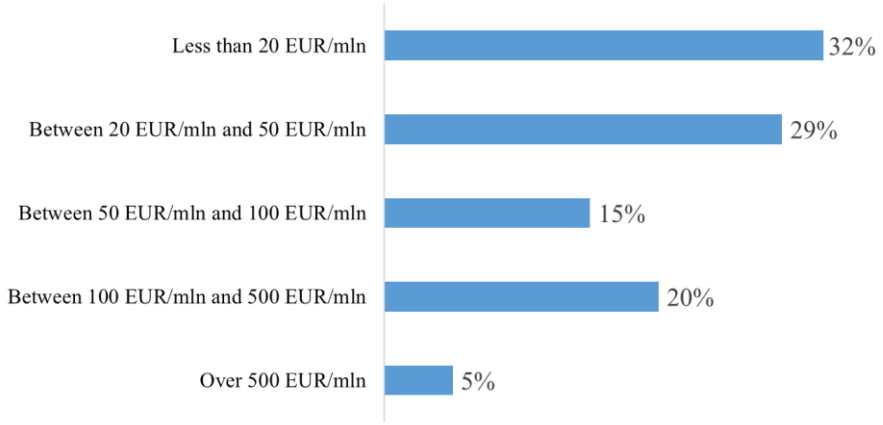

Figure 8: Average amount of each investment in the Italian infrastructure sector, according to private investors and other stakeholders

In virtue of all the factors we have considered previously, it comes as no surprise that the average investment in infrastructure in Italy amounts to less than 20 million of Euros. That not only derives from the fact that obviously the survey is referred to a variety of investors, each with different goals and that may then have different budgets, but also highlights how the biggest investors are often discouraged from taking on new initiatives because of the limits present in the Italian system.

After evaluating the variables that might prevent new investments, we can conclude our "Evaluation of a country's needed level of infrastructure provision" by briefly touching on a second important topic: The perceived quality of existing services.

The main infrastructure sub-sectors in terms of private investments in Italy during 2019 were[44]:

- Energy 36%
- Transportation 27%
- Other PPP Infrastructure 13%
- Telecommunications 13%
- Social Infrastructure 11%

[43] EY Infrastructure Barometer – Italy 2020
[44] EY Infrastructure Barometer – Italy 2020

The largest part of private investments has been directed to the Energy and Transportation sectors, because of reasons related both to the essential nature of those services and to the possible return on the investment that is proved to be larger (especially in the Energy market) than the one on Social Infrastructure.

Perception of quality of the Italian Infrastructures[45]

	Above the EU average	In line with the EU average	Below the EU average
Transportation	9%	52%	39%
Energy	23%	59%	18%
Telecommunications	16%	54%	30%
Social	13%	48%	40%
PPP	4%	50%	46%

Table 3: Perception of quality of the Italian Infrastructure compared to the EU average

As we can see from the table, even though the Italian Infrastructure Gap is still wide, the quality of Italian infrastructure is largely considered to be in line with EU average despite certain concerns on the transportation, social infrastructure and PPP segments. The table reflects the amount of investments in Energy that once again proves to be the sector most aligned with the EU standards, while there's still room to improve in the sectors that we addressed as "fast propulsors" of growth in sub-chapter 2.4: Transportation and Telecommunications.

2) Assess long-term targets and goals for physical infrastructure.

After taking a summary snapshot of the current situation, we can try to delineate some long and mid-term targets for the main Italian infrastructure sectors.

We will see what are the positions of the existing stakeholders about their investments to delineate a possible future general level and then we will try to delineate specific targets for each sector. To do that we will once again look into Ernst & Young 2020 Infrastructure Barometer:

[45] EY Infrastructure Barometer – Italy 2020

Q: Considering the next 12 months, what is your expectation on the number of deal completions by your company compared to the past 12 months in Italy?

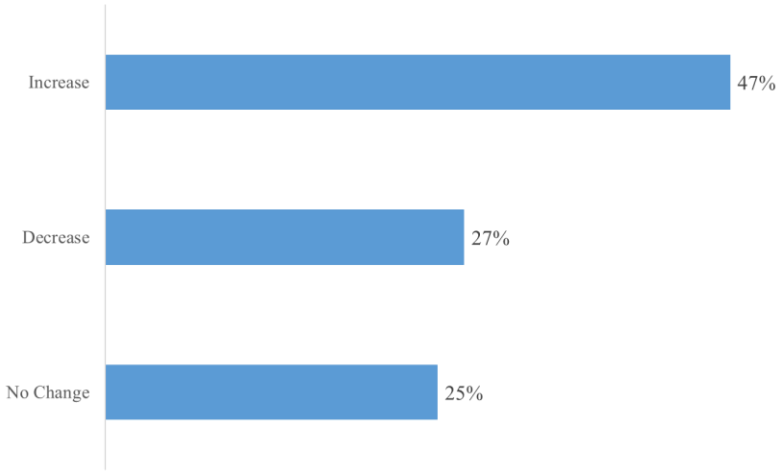

Figure 9: Expectation of completed deals in the next 12 months, according to private investors and other stakeholders

Q: Are you planning to divest any of your current operations / investments in the Italian infrastructure sector?

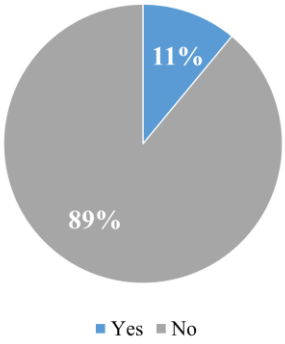

Figure 10: Expectations about future divestments, according to private investors and other stakeholders

It is clear from the graphs that most current investors are generally satisfied with their initiatives and do not intend to divest them anytime soon, as 65% of them said that that their investments in the Italian infrastructure sector has given them returns in line with portfolio average[46] (versus 15% saying they had returns above average and 21% saying they had returns below average). In light of these facts, and of the long-standing national infrastructure gap, we might assume the level of private infrastructure investments to rise in the near future, even considering the possible deterrents given by burocracy and political instability.

[46] EY Infrastructure Barometer – Italy 2020

Q: Considering the next 12 months, where do you expect to invest / provide financing in the Italian infrastructure sector?

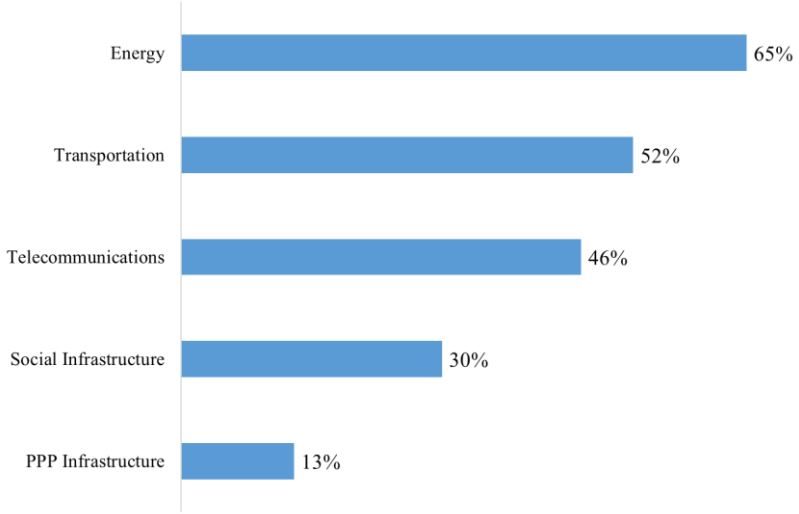

Figure 11: The infrastructure sectors in which private investors and other stakeholders plan to invest in the next 12 months

From the graph, it is easily deducible that the Italian infrastructure sector is expected to increase over the next 12 months with specific focus on the energy, transportation and telecommunication sectors.
We can also dive deeper into the specific segments to understand which are found to be more attractive by most stakeholders[47]:

Transportation	Highway	Railway	Airport	Local Transportation	Ferry business & passengers trasportation	
	57%	54%	46%	23%	16%	
Energy	Renewables	Gas	Waste management	Electricity	District heating	Integrated water cycle
	75%	46%	36%	29%	29%	23%
Telecommunications	Data centres	Broadband	Smart city projects	Telecom towers	Broadcast towers	
	70%	57%	43%	38%	9%	
Social infrastructure	Hospitals	Nursing homes	Public buildings	Prisons		
	66%	46%	30%	11%		
PPP	Commercial ports & logistics	Car parks	Harbour towage	Touristic ports	LGN	Other
	64%	38%	23%	23%	21%	5%

[47] EY Infrastructure Barometer – Italy 2020

Figure 12: The specific infrastructure segments that are considered the most attractive by private investors and other stakeholders

Infrastructure investors are mostly attracted by more mature segments of the Italian infrastructure sector (e.g. highways, railways, renewables, hospitals) exhibiting lower confidence on the less mature segments.

For the purpose of our analysis no we will move on directly to the last part of the Italian Infrastructure Gap evaluation, meaning:

3) Develop a menu of financial and policy options for bridging the financial gap.

As we have seen the gap can be filled with the improvement of the already-present infrastructure by making changes to the key policy options for improving service delivery, by enhancing the quality and adequacy of public investment in the sector and by encouraging private investment (including PPPs).

These are obviously important topic to be discussed but we want to focus on the aspect that involve the exploration of possible new sources of finance and how the investment burden can be shared between current and future users and/or society through various financing schemes.

Sector	GDP multiplier
Air transportation	0,55
Constructions	0,81
Land or pipeline transport	0,79
Production of transport equipment	0,69
Telecommunications	0,87
Warehouse and processing support activities	0,85
Water management and treatment	0,76
Water transportation	0,67

Table 4: GDP multipliers in the main infrastructure sectors

We recall the GDP multipliers analyzed in subchapter 1.5[48] and we can add the Energy sector to the list with the GDP multiplier computed by the U.S. Environmental Protection Agency equal to[49]:

- 0,9 for renewable energy;
- 0,76 for other sources of energy.

Energy

At the moment in Italy there are around 337 USD/bln currently invested in the Energy sector, with an average of around 12 USD/bln invested per year in the last 15 years[50] (equivalent to around 0,7% of Italy's GDP per year). The current estimated Infrastructure Gap is still around 39 USD/bln, meaning that Italy would need to invest 15 USD/bln per year in Energy for the next 20 years to reach its optimal level.[51]

Considering this data, and a GDP of around 2.003 billion of dollars in 2019[52], we can assume that an investment of 15 USD/bln per year would mean a GDP multiplier of:

15.000.000.000 x 0,76 = 11.400.000.000$

and **11.400.000.000 / 2.003.000.000.000** is roughly equal to **0,6%.**

Meanwhile an investment of 12 billion a year (the current average) would produce a GDP increase around 0,48%, with a difference around 2,5 billion of value added produced.

So by investing 3 more USD/bln a year for the next 20 years Italy could fill the Infrastructure Gap in the Energy sector and produced around 2,5 extra billion of value added per year, that could benefit all the connected sectors.

It is also worth pointing out that we have considered a generic GDP multiplier for the Energy sector, but a bigger investment into renewable sources of energy would influence positively not only the environment but the whole economy.

Land Transport

At the moment in Italy there are around 556 billion of dollars currently invested in the Land Transport sector, with an average of around 13 USD/bln invested per year in the last 15 years[53] (equivalent to around

[48] "Infrastructure in a Changing World: Trends and Challenges" – Ispi Report (2020)
[49] Estimating the Economic Benefits of Energy Efficiency and Renewable Energy *"https://www.epa.gov/sites/production/files/2018-07/documents/mbg_2-5_economicbenefits.pdf"*
[50] Global Infrastructure Hub - Italy
[51] Global Infrastructure Hub - Italy
[52] The Economist Intelligence Unit
[53] Global Infrastructure Hub - Italy

0,8% of Italy's GDP per year). The current estimated Infrastructure Gap is still around 240 USD/bln, the highest between all the sectors. This derives from the 239 USD/bln of Gap in the rail transportation segment alone, meaning that the Italian railway networks is the single infrastructure most in need of an enhancement. To fill the gap Italy would need to invest around 32 billion of dollars per year in the Land Transport sector for the next 20 years to reach its optimal level.[54]

An investment of 32 USD/bln per year would mean a GDP multiplier of:

32.000.000.000 x 0,79 = 25.280.000.000$

and **25.280.000.000/2.003.000.000.000** is roughly equal to **1,27%.**

It's easy to see why an investment the Land Transport infrastructure would be vital for the Italian economy, just by filling its Infrastructure Gap it would produce an extra 25 USD/bln of value added to the economy and a GDP increase around 1,3%. Obviously that's not easy, as the ideal level of investment is almost 3 times as high as the current average, so it would need a very specific targeted plan to address the issue.

Air Transportation

Italy's current investment in the Air transportation sector amounts to 14 USD/bln, with an average of 0,5 USD/bln invested per year in the last 15 years.[55]

The current estimated Infrastructure Gap is still around 15 USD/bln, meaning that Italy would need to invest roughly 1,1 USD/bln per year to fill the gap in the next 20 years.

An investment of 1,1 USD/bln per year would mean a GDP multiplier of: **1.100.000.000 x 0,55 = 605.000.000 $** . And **605.000.000/2.003.000.000.000** is equal to circa **0,03%.**

Telecommunications

Italy's current investment in the Telecommunications sector amounts to 203 USD/bln, with an average annual investment of about 8,1 USD/bln. As we have seen, it's one of the most desirable segments to invest according to most stakeholders and that is reflected in the sector's Infrastructure Gap that is equal to 0 USD[56].

[54] Global Infrastructure Hub - Italy
[55] Global Infrastructure Hub - Italy
[56] Global Infrastructure Hub - Italy

Italy's current Telecoms situation and level of investment is exactly where it should be according to the Global Infrastructure Hub, and the investment of 8,1 USD/bln per year generates an added value equal to:

8.100.000.000 x 0,87 = 7.047.000.000 $.

And **7.047.000.000/2.003.000.000.000 = 0,35%.**

Italy's investment in the Telecommunications segment already generates a positive impact on the country's GDP of about 0,35%.

Water Transportation

At the moment in Italy there are around 37 billion of dollars currently invested in the Water Transportation sector, with an average of around 1,5 USD/bln invested per year in the last 15 years[57] (equivalent to around 0,1% of Italy's GDP per year). The current estimated Infrastructure Gap is still around 79 USD/bln, this is reflected into the table we illustrated at page 61 in which commercial ports and their logistic activities had been indicated by the stakeholders as one the primary segments in which to invest in Italy.
To fill the current gap Italy would need to invest around 4,6 billion of dollars per year in the Water Transportation sector for the next 20 years to reach its optimal level.[58]

An investment of 4,6 USD/bln per year would mean a GDP multiplier of:

4.600.000.000 x 0,67 = 3.082.000.000$

And **3.082.000.000/2.003.000.000.000** is roughly equal to **0,15%.**

Water management

Italy's current investment in the Water management sector amounts to 87 USD/bln, with an average annual investment of about 3,5 USD/bln. The sector's Infrastructure Gap that is equal to 0 USD[59] meaning that Italy's current Water management level of investment is exactly where it should be according to the Global Infrastructure Hub, and the investment of 3,5 USD/bln per year generates an added value equal to:

3.500.000.000 x 0,76= 2.660.000.000 $.

And **2.660.000.000/2.003.000.000.000 = 0,13%.**

[57] Global Infrastructure Hub - Italy
[58] Global Infrastructure Hub - Italy
[59] Global Infrastructure Hub - Italy

	Current investment level (USD/bln)	Infrastructure Gap (USD/bln)	Investment needed per year (USD/bln)	GDP multiplier	Value added per year (USD/bln)	GDP increase per year (%)
Energy	337	39	15,0	0,76	11,4	0,6
Land Transport	556	240	32,0	0,79	25,3	1,3
Air Transportation	14	15	1,1	0,55	0,6	0,03
Telecommunications	203	0	8,1	0,87	7,0	0,4
Water Transportation	37	79	4,6	0,67	3,1	0,1
Water management	87	0	3,5	0,76	2,7	0,1
TOTAL	**1.234**	**373**	**64,3**		**50,7**	**2,5**

Table 5: Current Infrastructure Gap in Italy for the main infrastructure segments, highlighting the investment needed to fill the gap and the potential impact on the economy in terms of added value and GDP growth

From this table of recap we can see that to fill the 373 USD/bln Infrastructure Gap in approximately 20 years it would take an average investment of 64,3 USD/bln. It would bring to the econonmy approximately 51 USD/bln per year in value added and an annual GDP growth around 2,5%.

However, that is a complicated challenge as we have seen that more than 60% of PPP deals have an amount inferior to 50 EUR/mln.

This is where the Recovery Fund set-up by the EU might play a very significant role in boosting the amount of capital invested per year into the various infrastructure segments.

3.3) Possible applications of the Recovery Fund

After delineating the Italian Infrastructure Gap, highlighting the areas most in need of an immediate intervention and the possible developments of the Public-Private-Partnership sector, we will now move on to analyze how could the European Union Funds come into play in the improvement of the Italian infrastructure system.

3.3.1) The main investment areas

In addition to the funds in grants and loans provided for Italy by the Recovery and Resilience Facility, which the Government has decided to use in full, a further financial contribution is provided, again under the Next Generation EU (NGEU), by the 13.5 billion euros of React-EU and the 1.2 billion euros of the Just Transition Fund. With the inclusion of funds for the South from the Development and Cohesion Fund (FSC), the PNRR comes to 223,7 billion euros.

As we said, these are the funds, divided into 6 main investment areas, destined to Italy according to the last draft of the European Recovery Fund and the national PNRR (EUR/bln):

Green revolution and ecological transition	68,9
Digitalization, innovation, competitiveness and culture	46,1
Infrastructure for sustainable mobility	31,9
Education and research	28,4
Social welfare services, disability and marginality	27,6
Healthcare	18,7
TOTAL	**223,7**

Table 6: Segmentation by investment area of the funds provided by the EU within the Recovery Fund

The three main areas that involve infrastructure investment are:

A) Green revolution and ecological transition

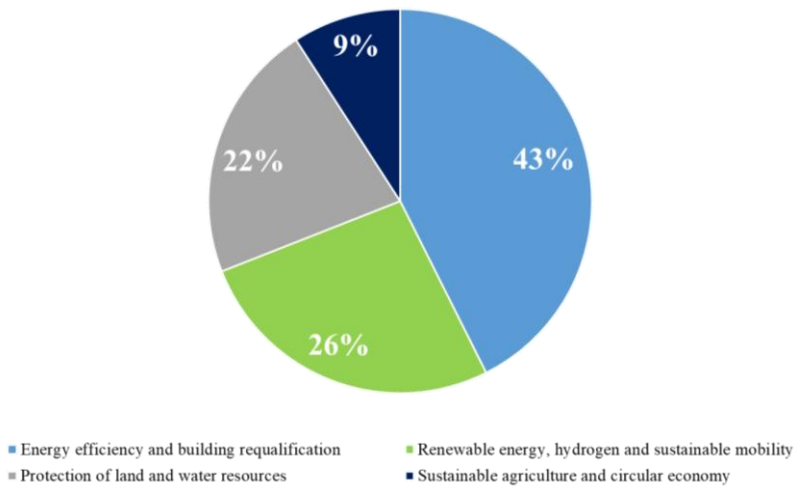

Figure 10: Segmentation by project of the funds destined to the "Green revolution and ecological transition" area.

I) The "Energy efficiency and building requalification" component is worth over 29 billion and consists of two project lines. The first concerns a program of efficiency and safety upgrading of the public building stock, with particular reference to schools, public housing, municipalities and judicial citadels.

The second foresees the introduction of a temporary incentive for energy requalification and anti-seismic adaptation of the private real estate heritage, through a tax deduction equal to 110% of the costs sustained for the interventions. This is the so-called superbonus, but in fact the Recovery leaves unchanged from the formulation already provided by the Manoeuvre, without providing for a further extension of the maxi-deduction.

II) On the energy front, the Recovery Plan focuses primarily on hydrogen. A path almost obliged in light of international developments and the direction taken by Brussels with the EU strategy for hydrogen.
After the public consultation phase, the Ministry of Economic Development is preparing to present the national strategy that will pivot precisely on the 2 billion from the Recovery.

With the PNRR ("Piano nazionale di ripresa e resilienza"), Italy intends to focus on:

- Hydrogen production in disused industrial areas;
- Production of electrolysers and development of a hydrogen supply chain;
- Hydrogen in the hard-to-abate industry, such as steel industry;
- Refuelling stations;
- Hydrogen in railways;
- Research and technological development;
- Technology development actions are also planned to make gas turbines an integral part of the future energy mix, meeting the incoming demand to extend the capacity of existing power generation infrastructure to incorporate green fuels, particularly hydrogen.

In the Recovery it is proposed to increase the share of energy produced from renewable sources in line with European objectives, stimulating the development of an industrial supply chain, through investments for 8.6 billion and interventions on several fronts.

- Development of offshore wind farms and photovoltaic plants;
- Support for the industrial supply chain;

- Upgrading and digitalization of electricity grid infrastructure;
- Interventions aimed at increasing the resilience of the electricity distribution network and installing integrated charging poles for electric vehicles (a fleet of around 6 million electric vehicles is expected by 2030) .

7,5 billion are allocated to the package on "Sustainable local transport, cycleways and renewal of rolling stock", for the following improvements:

- Cycleways and sustainable mobility;
- Calls for tenders and contracts for green transport;
- Renewal of fleets for buses, trains, ships.
- LPT digitalization
- Mass public transport

III) On the circular economy front, the Plan counts on 6.3 billion euros and is divided into two project lines. The first focuses on the sustainable agro-food supply chain and intends to improve the competitiveness of farms and their climatic-environmental performance, as well as to strengthen the logistics infrastructure of the sector.

The second line is dedicated to the Circular Economy and the valorization of the integrated waste cycle and focuses on the revamping of existing installations and the construction of new plants for the valorization and closure of the waste cycle, addressing in particular critical situations currently existing in waste management in large metropolitan areas of Central and Southern Italy. Lastly, the intention is to support, by means of calls for proposals, the reconversion of industries such as the chemical industry towards the replacement of more polluting raw materials with recycled materials.

IV) The fourth component, Protection and enhancement of the territory and water resources, is worth 15 billion euros and aims to strengthen interventions to mitigate hydrogeological instability and intervenes on forestation and protection of forests, reservoirs and sustainable management of water resources.

On the hydrogeological instability front, a series of structural interventions and maintenance of the territory are foreseen:

- Urban green infrastructure and forestation;
- Ponds and sustainable management of water resources;

- Resilience of the irrigation agrosystem, water distribution networks and digitalization, sewerage networks.

B) Infrastructure for sustainable mobility

The "Infrastructure for sustainable mobility" area aims to complete by 2026, "a first and significant stage of a longer-term path towards the creation of a modern infrastructure system", explains the Plan[60], "adding resources to existing projects and accelerating them, as well as introducing new ones".

The objective is, in fact, to carry out and complete works that are part of European infrastructure projects or that go to fill gaps that have so far penalized the economic development of the country and, in particular, of the South and the Islands. To do this, the mission has two components:

I) The first component will be able to count on 28.3 billion euros, of which over 17 billion should be represented by additional resources (including, however, a share of the Development and Cohesion Fund that was already planned but had not yet been directed to specific interventions).

Five proposals for infrastructural interventions are foreseen. First of all, the high speed and speeding up of the network for passengers and goods, in order to favour the connectivity of the territory and the passage of traffic from road to rail over long distances. This is the context in which widely anticipated interventions are included, such as the completion of the Naples-Bari line or the Palermo-Catania-Messina line, also included among the works that should be commissioned to accelerate their realization.
In addition to high-speed rail links, there are four other investment guidelines:

- The completion of the TEN-T rail corridors and that of the pass routes;
- The upgrading of rail nodes and routes;
- Reduction of the North-South infrastructure gap in favor of the southern regions;
- Interventions for the safety of the road network, with interventions that will include a strong component of technological modernization and the implementation of an advanced digital monitoring system for greater safety of road infrastructure against seismic risks, instability and accidents.

II) The second component, on the other hand, looks at logistics and the port system in particular.

[60] Funding Aids Strategies Investments: *"https://www.fasi.biz/it/notizie/approfondimenti/22515-idrogeno-superbonus-pniec-energia-nel-recovery-plan.html#"*

"Intermodal freight traffic in Italy is typically land-based, road-rail, but the connection with maritime traffic is inefficient," reads the document. "Considering that the terminals of the rail freight corridors are often ports, the realization of the so-called "last mile" is crucial for a rapid connection between the railway line and the port infrastructure, in order to improve the competitiveness of Italian ports.

Due to the inefficiencies of the sector, our companies pay, in fact, an extra cost of logistics 11% higher than the European average", illustrates the draft PNNR. A burden too much heavy for the economic development of all the Country, also to light of that worrying -40,5% of recorded marine traffic in the second semester 2020 from our ports, in comparison to a European average of - 17%.

In this context, therefore, the second component concerns the improvement of competitiveness, capacity and productivity of ports in a green key:

- Considering ports not only as transit points, but as integrators of the sea-land system;
- Proposing an effective and reliable logistics offer for inland transport to/from final destinations;
- Creating a critical mass that allows economies of scale and efficiencies in environmental terms, and developing traffic towards the area geographically north of the Alps;
- Carrying out a series of systemic interventions, port accessibility and rail and road connections to ports (last mile);
- Improving the environmental situation and reducing the climate-altering emissions of the ports (reducing polluting emissions from fossil fuels of both buildings, plants and service vehicles, both land and naval).

Also in this case there are some works that could be commissioned, such as the construction of the new breakwater in Genoa, necessary to allow two-way navigation and an adequate evolution basin for the large ships operating today in the Ligurian port.

C) Digitalization, innovation, competitiveness and culture

Interventions for the digitalization of public administration focus on the modernization of technological equipment and the strengthening of digital skills of personnel.

The priority is the development of a national cloud - in synergy with the European project Gaia-X - through the creation of one or more National Strategic Poles (PSN) to which the Cat. B Data Centers of central public administrations will be migrated. The objective is to encourage data sharing and interoperability, while at the same time strengthening the cybersecurity of digital services for citizens and businesses.

Ad hoc investments are also envisaged for generational turnover within the PA, together with upskilling and reskilling paths to enhance the digital skills of personnel. There are also interventions to simplify administrative procedures, especially in the judiciary, and for the reorganization of PA workplaces, through the creation of coworking and smart working spaces, training centers and poles of technical and organizational innovation.

In order to reduce the digital divide, the Recovery Plan foresees various infrastructural interventions, starting with the Italy 1 Gbit/s Plan for the completion of the ultra-wideband project, with initiatives for the diffusion of ultra-fast connections, also in gray areas.

The PNRR, then, supports fiber optic coverage in public areas considered priority (school, health, museums, etc.) and the development of 5G throughout the country, without forgetting the suburban areas.

As regards the space economy, Italy is ready to finance projects in the field of tracking and satellite telecommunications.

E) Education and research

The first component can count on a budget of 11.7 billion euros, divided between two lines of intervention:

- Strengthening R&D and IPCEI initiatives (€7.29 billion)
- Technology transfer and support for innovation (4.48 billion euros)

The first line of intervention includes measures aimed at strengthening the Italian research system and relations with companies, through the strengthening of large research infrastructures - thanks also to the Fund for building and research infrastructures - and partnerships between universities, research centers and companies.

Agreements for innovation, on the other hand, will be used to finance projects that are able to test and introduce high-profile innovative solutions, also through collaboration with technology transfer centers, research organizations and knowledge dissemination.

In order to support young researchers, ad hoc financing is foreseen - on the model of the European Research Council calls for proposals - for five-year projects, together with a mobility program for short periods.

With the resources of the Recovery Plan, Italy also intends to strengthen the participation of its companies in strategic value chains, resorting to initiatives such as the Important Projects of Common European Interest (IPCEI) and the partnerships for research and innovation of Horizon Europe.

The PNRR will also finance new Research Projects of National Interest (PRIN) to encourage Italian participation in Horizon Europe initiatives and an 850 million fund to support the measures envisaged in the National Research Program (PNR) 2021-2027.

The second line of intervention, on the other hand, is dedicated to technology transfer, and primarily supports the creation of 7 centers - half of which are in the southern regions - dedicated to key enabling technologies:

National Center for Artificial Intelligence (the Institute will be based in Turin)
National Center for High Technology Environment and Energy
National Center of High Technology for quantum computing
National Center of High Technology for Hydrogen
National High Technology Center for Biopharma
National Agri-Tech Center (the Agri-Tech Pole will be based in Naples)
National Fintech Center (the Pole will be based in Milan).

In addition to these centers, there will be the creation of 20 territorial champions of R&D, which will systemize competences and infrastructures according to the productive and research vocations of a territory.

Also planned is the reorganization and rationalization of technology transfer centers for industry segments (Competence Centers, Digital Innovation Hubs, Digital Innovation Points), along with the definition, together with companies, of innovative doctorates to enhance high-profile skills. In addition, there are also new doctoral programs in line with the strategies of eco-sustainability and digitalization, together with the creation of a hub for technology transfer from research to the real economy.

In order to support the high-tech sector of microelectronics, a 750 million euro project is planned, which will support investments in machinery, equipment and production facilities.

E) Social Infrastructure and Infrastructure dedicated to healthcare

Lastly it’s worth mentioning that the first line of intervention of the component, entitled "Social welfare services, disability and marginality", is worth 3.8 billion euros and is divided into three measures:

- Social infrastructure in municipalities and involvement of the Third Sector (2.6 billion euros)
- Paths of autonomy for the disabled (500 million euros)
- Temporary Housing and Post Stations (730 million euros)

Meanwhile the mission "Healthcare" of the PNNR takes home 19.72 billion (of which more than 12 billion in additional resources) with which an ambitious program in support of the health of Italians will be realized, which will stand on two legs (components):

- proximity care and telemedicine;
- innovation, research and digitalization of health care, to strengthen hospital equipment, scientific research, technology transfer and the preparation of doctors.

3.3.2) EU Guidelines and Recommendations

Through the guidelines, Brussels has defined the criteria that Member States must meet when preparing National Recovery and Resilience Plans to access Next Generation EU funds, divided between general recommendations and specific guidelines for each state:

A) General recommendations[61]

The final version of the EU guidelines, consisting of 55 pages plus a template, opens by emphasizing the inextricable link between reform and investment, both of which are of equal importance in obtaining the Next Generation EU treasury.

These two elements will have to be coherent, substantial, credible and, above all, useful in addressing the challenges in the individual member state. On this last point, the guidelines state that the challenges should be declined within the six key pillars we analyzed in the previous section, namely:

- Green Transition;
- Digitization;

[61] European Union Working Document: Guidance To Member States Recovery And Resilience Plans *"https://ec.europa.eu/info/sites/info/files/document_travail_service_part1_v2_en.pdf"*

- Sustainable and inclusive growth, including issues such as social cohesion, labor, productivity, competitiveness, research, development and innovation, and strengthening the single market that can support SMEs;
- Social and territorial cohesion;
- Health, along with economic, social and institutional resilience, with a focus on crisis response and preparation for future emergencies;
- Policies for the new generation, children and youth, including education and skills topics.

Along with these challenges, made more urgent by the Covid-19 crisis, each country must make an overview outlining how the Plan can provide a comprehensive and balanced response to the specific economic and social context, through projects and key figures. This also provides not only qualitative, but also quantitative insights into the overall estimated impact of the Plan and its synergies with other European programming instruments.

Another indispensable factor that emerges in the updated version of the Guidelines is the link between the definition of Recovery Plans and the European Semester. Specifically, the Recovery Plan should contain at least a significant subset of the 2019-2020 country recommendations and provide detailed explanations of how they are addressed by the proposed measures, i.e., how critical issues are resolved.

Along with recommendations for the rapid implementation of reforms and investments that are specific to each member state, there are priorities that are found throughout the European ecosystem that the 27 will need to address as "European Flagships." There are seven common missions: Power up, Renovate, Recharge and Refuel, Connect, Modernise, Scale-up, Reskill and upskill.

B) Italy's specific guidelines[62]

In the case of Italy, in particular EU guidelines are centered around:

- Measures in the area of public administration, justice and competition will contribute to the implementation of the first recommendation for the euro area regarding resilient product markets and quality of institutions;
- A more targeted economic policy with regard to investment in the specified areas and the use of windfall revenues for public debt reduction will contribute to the implementation of the second recommendation for the euro area with regard to investment support and the rebuilding of reserves;

[62] European council recommendation on Italy's 2020 national reform program, delivering a Council opinion on Italy's 2020 stability program: *"https://eur-lex.europa.eu/legal-content/IT/TXT/PDF/?uri=CELEX:52020DC0512&from=EN"*

- Measures aimed at improving employability and easing the tax burden on productive factors will contribute to the implementation of the third recommendation for the euro zone regarding the functioning of the labor market;
- Measures aimed at improving banks' balance sheets will go in the direction of the fourth recommendation for the eurozone regarding the reduction of impaired loans.

According to the document, Italy has excessive macroeconomic imbalances. In particular, the high public debt and the prolonged weakness in productivity dynamics entail risks of cross-border significance. For this reason, "the need to act to reduce the risk of negative repercussions on the Italian economy and, given its size and cross-border relevance, on the Economic and Monetary Union is particularly significant".

Moreover, the Italian tax system continues to weigh heavily on production factors, to the detriment of economic growth. The high tax burden on labor and capital discourages employment and investment. Budget 2019 slightly reduced the tax burden on the self-employed but, overall, temporarily increased it on businesses. Therefore, since the tax bases that are less penalizing for growth, such as wealth and consumption, are underutilized, "there is room to lighten the tax burden on labor and capital without burdening the state budget."

Then there is the problem of pensions. Italy's spending on old-age pensions, at around 15% of GDP in 2017, is among the highest in the Union and is set to rise in the medium term due to the worsening old-age dependency ratio. To avoid this increase, "the already planned pension reforms aimed at reducing the implicit liabilities arising from population aging should be fully implemented."

Among other notes and reminders is the fact that Italy has made limited progress in shifting the tax burden away from labor, in reducing tax expenditures, in reforming the cadastral system, in combating undeclared work, in supporting the participation of women in the labor market. These are all things that need to be taken care of in order to best relaunch the economy and put the accounts in order.

Specifically, the recommendations drawn up for Italy in 2020 have in the anti-coronavirus measures the new component of a document otherwise very similar to that of the previous year. In summary, the memos point to the continuation of a number of critical issues: too much debt, too many taxes on labor, no reform of the land register, a work environment that is too unfriendly to women, and still delays in justice reform.

The first recommendation concerns debt. The document suggests adopting all the necessary measures to effectively address the pandemic, sustain the economy and support the subsequent recovery. It is suggested,

therefore, to spend resources and then when economic conditions allow, pursue policies aimed at achieving prudent fiscal positions in the medium term and ensure debt sustainability, while strengthening investments.

Another recommendation for Italy is to support the real economy, "including small and medium-sized enterprises, innovative businesses and the self-employed, avoiding late payments". Here it is also invited to promote private investment to foster economic recovery, focusing such investment on the green and digital transition, "in particular on clean and efficient production and use of energy, research and innovation, sustainable public transport, waste and water management as digital infrastructure strengthened to ensure the provision of essential services".ùThird is work support. It seems more necessary than ever "to provide adequate income replacement and access to social protection, in particular for atypical workers". Italy is asked to mitigate the impact of the crisis on employment, "also through flexible working arrangements and active employment support", and to invest in distance learning and the acquisition of skills, "including digital ones".

The last recommendation, already made several times in previous years, concerns the reform of justice. The document states that Italy must "improve the efficiency of the judicial system and the effectiveness of the public administration".

The Recovery and Resilience Plans should be composed "of reforms and investments, grouped into coherent components," which "should have sufficient granularity/specificity to show a direct link between the proposed measures." In addition, member states are asked to detail the investments and reforms included in the component, their expected contribution, objectives, related targets and timelines, and their financing and cost.

The document repeatedly indicates the need to measure precisely how much each of the individual measures proposed contributes to the two major objectives of the Next Generation EU, namely digitalization and the green revolution. In addition, a specific annex specifies the methodology to be used to associate a coefficient to each investment or reform measure, so that Member States can not provide generic objectives or give an apparent green or digital facade to interventions that do not fit into these strands.

Added to this is that "all types of reforms should be considered under the instrument, including those that do not require any specific funding" if they are needed to address national challenges or for investment implementation.

There is also a more detailed description of the targets. Disbursements may occur no more than twice a year and will be tied "to the satisfactory completion of a set of milestones and targets." Disbursement requests

will be submitted by states in the first and third quarters or second and fourth quarters of each year through 2026. Finally, the 12 EU countries with excessive imbalances, which include Italy, "are invited to explain how their plans will help address them."

3.3.3) Possible developments

So Italy, according to the last draft of the PNRR, should count on about 223,7 EUR/bln, divided between:

- 127,4 EUR/bln in loans (calculated as the maximum that can be drawn given the expected level of Gross National Income (GNI) and the cap of 6.8% in relation to the GNI itself.);
- 96,3 EUR/bln in grants (even though the actual amount will depend on the fall of the GDP in 2020-2021).

The EU guidelines specify that 70% of the grants must be utilized by the 2023, and the guidelines for the PNRR hypothesize an increasing deployment of the funds in the period 2021-2023 in order to then decrease in 2024-2025.

We can then assume a theoretical pattern for the utilization of grants similar to this:

Year	Grants invested (EUR/bln)	*Cumulative %*
2021	17,4	*18%*
2022	22,5	*41%*
2023	27,5	*70%*
2024	18,5	*89%*
2025	10,4	*100%*

Table 7: Possible investment plan for the grants provided by the EU to Italy in the next 5 years, highlighting the percentage of the funds invested during each year

For simplification we will assume, for the period 2021-2025, a constant spending of the 127,4 EUR/bln consisting in loans, hypothesizing that the urgency for the immediate needs will be partially offset by the extended timelines deriving from the necessary burocracy and the preparatory phase to define and launch the different projects.

The amount invested each year would then be equal to 25,48 EUR/bln, to be added to the grants invested in each year and that would give a pattern close to this:

Years	Amount invested in Grants/Loans (EUR/bln)
2021	42,9
2022	48,0
2023	53,0
2024	44,0
2025	35,9

Table 8: Possible investment plan for the total amount of the funds provided by the EU to Italy in the next 5 years

Finally, only for the purposes of our analysis and in absence of true data about the real timelines of the projects, we can assume that the same proportion will be applied to the singular initiatives included in to the PNRR macro-areas:

1) Green revolution and ecological transition

The 4 main infrastructure initiatives included in the "Green revolution and ecological transition" area are *(i)* the requalification of several buildings towards an improved energy efficiency, *(ii)* an investment into renewable sources of energy, *(iii)* an enhancement of the local transportation network and *(iv)* a series of interventions on the national territory in order to improve the management of the country's water resources.

The total amount that the Government is planning to invest into these projects is equal to 62,1 EUR/bln circa, that in our analysis have been distributed based on the aforementioned hypothesis of *(i)* a growing amount in the 2021-2023 period and a decreasing amount in the 2024-2025 period for the grants and *(ii)* a constant amount for the loans.

The predicted GDP is based on the estimations of the Economist Intelligence Unit for Italy published in December 2020, and it's equal to 1693,3 EUR/bln in 2021, 1737,3 EUR/bln in 2022, 1768,6 EUR/bln in 2023, 1791,6 in 2024 and 1813,1 EUR/bln in 2025.

The total value added generated by the initiatives would be around 9,4 EUR/bln for 2021, 10,6 EUR/bln for 2022, 11,7 EUR/bln for 2023, 9,7 EUR/bln for 2024 and 7,9 for 2025, for a total amount of around 49,3 EUR/bln across the period 2021-2025.

The average percentage of the value added to the GDP by the 4 initiatives is equal to 0,56%, with a maximum value of 0,65% in 2023 and a minimum value of 0,43% in 2025.

Project	Year	Investment (EUR)	GDP multiplier	Value added (EUR)	GDP growth (%)	Predicted GDP (EUR/bln)
Energy efficiency and building requalification		29.000.000.000	0,81			
	2021	5.562.200.000		4.505.382.000	0,27%	1.693,3
	2022	6.223.400.000		5.040.954.000	0,29%	1.737,3
	2023	6.870.100.000		5.564.781.000	0,31%	1.768,6
	2024	5.704.300.000		4.620.483.000	0,26%	1.791,6
	2025	4.640.000.000		3.758.400.000	0,21%	1.813,1
Renewable Energy		10.600.000.000	0,80			
	2021	2.033.080.000		1.626.464.000	0,10%	1.693,3
	2022	2.274.760.000		1.819.808.000	0,10%	1.737,3
	2023	2.511.140.000		2.008.912.000	0,11%	1.768,6
	2024	2.085.020.000		1.668.016.000	0,09%	1.791,6
	2025	1.696.000.000		1.356.800.000	0,07%	1.813,1
Sustainable local transport		7.500.000.000	0,79			
	2021	1.438.500.000		1.136.415.000	0,07%	1.693,3
	2022	1.609.500.000		1.271.505.000	0,07%	1.737,3
	2023	1.776.750.000		1.403.632.500	0,08%	1.768,6
	2024	1.475.250.000		1.165.447.500	0,07%	1.791,6
	2025	1.200.000.000		948.000.000	0,05%	1.813,1
Protection and enhancement of the territory and water resources		15.000.000.000	0,76			
	2021	2.877.000.000		2.186.520.000	0,13%	1.693,3
	2022	3.219.000.000		2.446.440.000	0,14%	1.737,3
	2023	3.553.500.000		2.700.660.000	0,15%	1.768,6
	2024	2.950.500.000		2.242.380.000	0,13%	1.791,6
	2025	2.400.000.000		1.824.000.000	0,10%	1.813,1

Table 9: Possible investment plan for the projects within the "Green revolution and ecological transition" area, computing the possible impact on the national economy in terms of added value and GDP growth

2) Infrastructure for sustainable mobility

The 2 main infrastructure initiatives included in the "Infrastructure for sustainable mobility" area are *(i)* the enhancement of the national transportation network and *(ii)* an improvement of national port infrastructure.

The total amount that the Government is planning to invest into these projects is equal to 31,9 EUR/bln circa, that in our analysis have been distributed based on the aforementioned hypothesis of *(i)* a growing amount in the 2021-2023 period and a decreasing amount in the 2024-2025 period for the grants and *(ii)* a constant amount for the loans.

The predicted GDP is based on the estimations of the Economist Intelligence Unit for Italy published in December 2020, and it's equal to 1693,3 EUR/bln in 2021, 1737,3 EUR/bln in 2022, 1768,6 EUR/bln in 2023, 1791,6 in 2024 and 1813,1 EUR/bln in 2025.
The total value added generated by the initiatives would be around 4,8 EUR/bln for 2021, 5,3 EUR/bln for 2022, 5,9 EUR/bln for 2023, 4,9 EUR/bln for 2024 and 4,0 for 2025, for a total amount of around 24,9 EUR/bln across the period 2021-2025.

The average percentage of the value added to the GDP by the 2 initiatives is equal to 0,28%, with a maximum value of 0,33% in 2023 and a minimum value of 0,22% in 2025.

Project	Year	Investment (EUR)	GDP multiplier	Value added (EUR)	GDP growth (%)	Predicted GDP (EUR/bln)
Land transport enhancement		28.300.000.000	0,79			
	2021	5.427.940.000		4.288.072.600	0,25%	1.693,3
	2022	6.073.180.000		4.797.812.200	0,28%	1.737,3
	2023	6.704.270.000		5.296.373.300	0,30%	1.768,6
	2024	5.566.610.000		4.397.621.900	0,25%	1.791,6
	2025	4.528.000.000		3.577.120.000	0,20%	1.813,1
Port system enhancement		3.600.000.000	0,67			
	2021	690.480.000		462.621.600	0,03%	1.693,3
	2022	772.560.000		517.615.200	0,03%	1.737,3
	2023	852.840.000		571.402.800	0,03%	1.768,6
	2024	708.120.000		474.440.400	0,03%	1.791,6
	2025	576.000.000		385.920.000	0,02%	1.813,1

Table 10: Possible investment plan for the projects within the "Infrastructure for sustainable mobility" area, computing the possible impact on the national economy in terms of added value and GDP growth

3) Digitalization, innovation, competitiveness and culture

The main infrastructure initiative included in the "Digitalization, innovation, competitiveness and culture" area are is the improvement of all the digital and network infrastructure in the country.

The total amount that the Government is planning to invest into the project is equal to 19,85 EUR/bln circa, that in our analysis have been distributed based on the aforementioned hypothesis of *(i)* a growing amount in the 2021-2023 period and a decreasing amount in the 2024-2025 period for the grants and *(ii)* a constant amount for the loans.

The predicted GDP is based on the estimations of the Economist Intelligence Unit for Italy published in December 2020, and it's equal to 1693,3 EUR/bln in 2021, 1737,3 EUR/bln in 2022, 1768,6 EUR/bln in 2023, 1791,6 in 2024 and 1813,1 EUR/bln in 2025.
The total value added generated by the initiative would be around 3,8 EUR/bln for 2021, 4,3 EUR/bln for 2022, 4,7 EUR/bln for 2023, 3,9 EUR/bln for 2024 and 3,2 for 2025, for a total amount of around 19,9 EUR/bln across the period 2021-2025.

The average percentage of the value added to the GDP by the initiative is equal to 0,98%, with a maximum value of 0,23% in 2023 and a minimum value of 0,15% in 2025.

Project	Year	Investment (EUR)	GDP multiplier	Value added (EUR)	GDP growth (%)	Predicted GDP (EUR/bln)
Digital Infrastructure		19.850.000.000	0,87			
	2021	*3.807.230.000*		*3.312.290.100*	*0,20%*	*1.693,3*
	2022	*4.259.810.000*		*3.706.034.700*	*0,21%*	*1.737,3*
	2023	*4.702.465.000*		*4.091.144.550*	*0,23%*	*1.768,6*
	2024	*3.904.495.000*		*3.396.910.650*	*0,19%*	*1.791,6*
	2025	*3.176.000.000*		*2.763.120.000*	*0,15%*	*1.813,1*

Table 11: Possible investment plan for the projects within the "Digitalization, innovation, competitiveness and culture" area, computing the possible impact on the national economy in terms of added value and GDP growth

3.3.4) Summary of the main infrastructure initiatives included in the PNRR**:**

Project	Investment (EUR/bln)	GDP Multiplier	Value Added (EUR/bln)
Energy efficiency and building requalification	29,0	0,81	23,5
Renewable Energy	10,6	0,80	8,5
Sustainable local transport	7,5	0,79	5,9
Protection and enhancement of the territory and water resources	15,0	0,76	11,3
National land transport enhancement	28,3	0,79	22,4
Port system enhancement	3,6	0,67	2,5
Digital Infrastructure	19,85	0,87	17,2
TOTAL	**113,85**		**91,3**

Table 12: Summary of the potential added value generated by the investment of EU funds into the main Italian infrastructure segments in the next 5 years

So the main infrastructure initiatives included in the PNRR would bring an added value of about 93,1 billion of euros to the national economy, and would allow a significant improvement of current infrastructure as well as the construction of several new networks that the country currently needs.

The last deadline for submitting the PNRR to Brussels is April 30, 2021, and that would be the day we will know more about the exact amount of the funds initially available and about the exact areas that will be addressed first.

Conclusions

So, in conclusion, what is possible to say about the correlation between infrastructure investing and economic growth? We have seen that investment in infrastructure can have a beneficial effect on a national economy in a variety of different ways:

- The investment has a Keynesian impact on demand;
- Infrastructure capital is itself an input of the production function (not unlike physical capital in general);
- It reduces the costs of production costs and sustains the productivity of other factors of production;
- It represents a complement for the other productive factors, making them more efficient and stimulating their accumulation (e.g, investments in private facilities);
- It directs the choices of private investors towards certain sectors or geographic areas, thereby influencing the processes of economic convergence.

We have also described how this positive influx of the economic investment is not exclusive to the public initiatives, but it can also be reached through a series of public-private partnership (PPP) agreements such as Concessions, Build-operate-transfers or Joint Ventures that allow to reduce the incidence on the public budget of the initial expenses of the investment, in exchange for the possibility, for the private operator, of benefiting from future revenues.

Even though we have established a positive correlation between the investment in infrastructure and the general national economy, it is always important to keep in mind that there are some caveats to account for:

- The investment has a very complicated timetable as infrastructure projects involve planning, bidding, contracting, construction, and evaluation;
- It’s very difficult to target the economic benefit deriving from the project to make sure that it primarily involves the areas of the economy which are most in need;
- It’s not always true that an infrastructure investment can improve the employment rate, as (for example) it is unlikely that employees specialized in residential-area construction can easily update their skills to include building highways;
- Infrastructure investment can create a large long-term deficit that adds to the national debt;
- It’s very difficult to balance the need to be as fast as possible with the take-off of the project and the need for efficiency during the evaluation process, as policymakers need time to weigh the merits of a project, structure requests for proposals, administer a fair bidding process, select the best firms, competently build the project, and impartially evaluate the results

As long as most of these warnings are kept in mind by the policymakers, infrastructure investing is a powerful tool to have to get a struggling economy back on track. But is it possible to quantify the "beneficial influence" generated by the project?

The most accurate research on growth multipliers for infrastructure investment has been conducted by WIOD/McKinsey Global Institute (MGI), by looking at time series of infrastructure investment and subsequent GDP defined multipliers capable of estimating expected GDP and job growth from infrastructure investment for various industries:

Sector	GDP multiplier
Air transportation	0,55
Constructions	0,81
Land or pipeline transport	0,79
Production of transport equipment	0,69
Telecommunications	0,87
Warehouse and processing support activities	0,85
Water management and treatment	0,76
Water transportation	0,67

Table 13: GDP Multipliers for the main industrial sectors according to the MGI

Moreover, the U.S. Environmental Protection Agency estimated the GDP multiplier for the energy sector equal to:

Sector	GDP multiplier
Renewable energy	0,90
Other source of energy	0,76

Table 14: GDP Multipliers for the energy sector according to the U.S. E.P.A.

We can use these GDP multipliers to compute the effect that it would have on the Italian economy an investment aimed to fill the current national's Infrastructure Gap. The Infrastructure Gap is defined as the inadequate level of infrastructure or as the difference between investment needs and actual spending, and Italy's current gap across all sectors is equal to $373 billion.
We estimated a level of investment needed by each sector to fill the respective gap by 2035-2040 and used the GDP multipliers to compute the effect that said investment would have annually on the national economy in terms of value added.

	Current investment level (USD/bln)	Infrastructure Gap (USD/bln)	Investment needed per year (USD/bln)	GDP multiplier	Value added per year (USD/bln)	GDP increase per year (%)
Energy	337	39	15,0	0,76	11,4	0,6
Land Transport	556	240	32,0	0,79	25,3	1,3
Air Transportation	14	15	1,1	0,55	0,6	0,03
Telecommunications	203	0	8,1	0,87	7,0	0,4
Water Transportation	37	79	4,6	0,67	3,1	0,1
Water management	87	0	3,5	0,76	2,7	0,1
TOTAL	**1.234**	**373**	**64,3**		**50,7**	**2,5**

Table 15: Current Infrastructure Gap in Italy for the main infrastructure segments, highlighting the investment needed to fill the gap and the potential impact on the economy in terms of added value and GDP growth

Just by filling the current Infrastructure Gap, Italy could generate approximately $50 billion a year in value added and therefore grow its GDP by 2,5 points per year[63].

As a last step we tried to include into the analysis the funds that Italy should receive from the EU through the Recovery and Resilience Facility. The total funds should be equal to 223,7 billion euros (127,4 EUR/bln in loans and 96,3 EUR/bln in grants), and they should be destined to 6 main investment areas: Green revolution and ecological transition, Digitalization, innovation, competitiveness and culture, Infrastructure for sustainable mobility, Education and research, Social welfare services, disability and marginality, Healthcare.

As the funds haven't been transferred yet, there is not an actual investment timetable. So the only guidelines included in the PNRR ("Piano Nazionale di Ripresa e Resilienza") relating to the spending of the funds specify that 70% of the grants must be utilized by the 2023, and the guidelines for the PNRR hypothesize an increasing deployment of the funds in the period 2021-2023 in order to then decrease in 2024-2025. So we estimated a theoretical possible timetable in regard to the investing of the funds:

[63] The hypothetical percentage growth is computed based on Italy's 2019 GDP.

Years	Amount invested in Grants/Loans (EUR/bln)
2021	42,9
2022	48,0
2023	53,0
2024	44,0
2025	35,9

Table 16: Possible investment plan for the total amount of the funds provided by the EU to Italy in the next 5 years

Of all the six areas included in the PNRR, the main infrastructure projects involve: Energy efficiency and building requalification, Renewable Energy, Sustainable local transport, Protection and enhancement of the territory and water resources, National land transport enhancement, Port system enhancement, Digital Infrastructure.

Project	Investment (EUR/bln)	GDP Multiplier	Value Added (EUR/bln)
Energy efficiency and building requalification	29,0	0,81	23,5
Renewable Energy	10,6	0,80	8,5
Sustainable local transport	7,5	0,79	5,9
Protection and enhancement of the territory and water resources	15,0	0,76	11,3
National land transport enhancement	28,3	0,79	22,4
Port system enhancement	3,6	0,67	2,5
Digital Infrastructure	19,85	0,87	17,2
TOTAL	**113,85**		**91,3**

Table 17: Summary of the potential added value generated by the investment of EU funds into the main Italian infrastructure segments in the next 5 years

We can multiply the planned investment into each project for the next five years by the relative sector's GDP multiplier and obtain the added value that each initiative will generate for the Italian national economy: 91,3 billion euros for the 2021-2025 period.

If we divide the generated annual added value of each project by the predicted GDP for Italy for the years 2021-2025, we can estimate a potential GDP growth given only by these 7 projects equal to 5,2%, with an average of 1,04% per year.

So in conclusion we have seen that the correlation between economic growth and infrastructure investing is real, and it can be really powerful as long as it use with the right approach. In Italy's specific case, employing a good portion of the Recovery Fund into infrastructure projects could not only help in solving the national long-standing Infrastructure Gap but also in giving a boost to the whole economy after the dramatic effects of the Covid-19 pandemic.

Bibliography And Sitography

- Testo Integrale Dell'euco 10/20 Sul Tema Recovery Fund: *https://www.consilium.europa.eu//media/45118/210720-euco-final-conclusions-it.pdf?utm_source=dsms-auto&utm_medium=email&utm_campaign=Conclusioni+del+Consiglio+europeo%2c+17-21+luglio%c2%a02020*

- Cambridge Online Dictionary: *https://dictionary.cambridge.org/dictionary/english/infrastructure*

- National Research Council: *"Infrastructure for the 21st Century, Washington, D.C.: National Academy Press, 1987."*

- Association Of Local Government Engineers New Zealand: "*Infrastructure Asset Management Manual, June 1998"*

- Tagliacarne.it: *https://www.tagliacarne.it/files/uploaded/Jannuzzi/ALTA%20FORMAZIONE%20NORD%20SUD.pdf*

- Ernst & Young: *"EY Infrastructure Barometer – Italy, 2020"*

- Legambiente.It, Pendolaria report 2015: *https://www.legambiente.it/sites/default/files/docs/pendolaria2015finale.pdf*

- Bancaditalia.It: *https://www.bancaditalia.it/pubblicazioni/collana-seminari-convegni/2011-0007/7_infrastrutture_italia.pdf*

- Bancaditalia.It: *"Gli investimenti in infrastrutture nei principali paesi emergenti"*

- European Union Working Document: Guidance To Member States Recovery And Resilience Plans: *"https://ec.europa.eu/info/sites/info/files/document_travail_service_part1_v2_en.pdf"*

- European Council Recommendation On Italy's 2020 National Reform Program, Delivering A Council Opinion On Italy's 2020 Stability Program: *"https://eur-lex.europa.eu/legal-content/IT/TXT/PDF/?uri=CELEX:52020DC0512&from=EN"*

- Ispi Report: *"Infrastructure in a Changing World: Trends and Challenges"*

- "Funding Aids Strategies Investments" Website: *"www.fasi.biz"*

- Istat.It: *https://www.istat.it/it/files//2017/10/La-corruzione-in-Italia.pdf*

- George Mason University Report: "*Would more infrastructure spending stimulate the economy in 2017?"*

- Global Infrastructure Hub.Org: *"https://www.gihub.org/countries/italy/"*

- Economic Policy Institute: *"The potential macroeconomic benefits from increasing infrastructure investment"*

- Deloitte & Touche Market Report: *"Gli investimenti in infrastrutture - Relazione con la distribuzione del reddito e attese di remunerazione finanziaria degli investitori"*
- P. Agénor, P and B. Moreno-dodson: *"Public Infrastructure and Growth: New Channels and Policy Implications"*
- D.A. Aschauer: *"Does public capital crowd out private capital?"*
- J.Bivens: *"The potential macroeconomic benefits from increasing Infrastructure investment"*
- D.H. Brooks and E.C. Go: *"Infrastructure's Role in Sustaining Asia's Growth"*
- M. Fay, M. Toman, D Benitez, S.Csordas: *"Infrastructure and Sustainable Development"*
- A. Kyobe, Z. Mills, C. Papageorgou: *"Investing in Public Investment: An Index of Public Investment Efficiency"*
- A. Bhattacharya, M. Romani, N. Stern: *"Infrastructure for Development: Meeting the Challenge"*
- Veronique De Rugy: *"Stimulus Facts—Period 2"*
- B. Elaheh: *"The relationship between Infrastructure Investment and Economic Growth"*
- T. Palei: *"Assessing the impact of Infrastructure on Economic Growth and Global Competitiveness"*
- U.s. Environmental protection agency: estimating the economic benefits of energy efficiency and renewable energy *"https://www.epa.gov/sites/production/files/2018-07/documents/mbg_2-5_economicbenefits.pdf"*
- John Maynard Keynes: *"The International Control of Raw Materials"*
- The Economist Business Unit
- Oxfordeconomics.com
- Ijglobal.com
- World Economic Forum: "*Global Competitiveness Index, 2015"*
- The World Bank: "*Doing Business Survey, 2015*"
- International Monetary Fund: "*World economic outlook report"*
- Investopedia.com
- Wikipedia.com
- Ilsole24ore.com
- Nationsencyclopedia.com