Causes and Costs of Italian Port Underdevelopment

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June 18, 2021

Utrecht University

Politics, Philosophy, and Economics Bachelor Thesis

Theme 3: Structural Change and Economic Development

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Word Count: 13.168 (12.000 ± 10%)

Abstract

Port infrastructure has been a key driver of development in the history of the Italian peninsula, which has distinguished itself for the presence of thalassocracies since before the Ancient Romans. Today, Italy is poorly connected to global shipping lines, notwithstanding its presence at the heart of one of the world's most important commercial passageways. Given these two pieces of evidence, this paper sets out to investigate what the causes and costs of the current port underdevelopment in Italy are. The research uses an interdisciplinary approach, using the disciplines of *economics* and *history* to create a holistic understanding of the research question. Firstly, through a historical analysis several causes that have led to the loss of the maritime vocation of Italy are identified. Then an empirical analysis, using the gravity model for international trade though a panel regression, is developed to measure the causes and costs, measured in lost trade opportunity, of port underdevelopment. This however first requires the research to present a literature review to identify which explanatory variables are relevant and best suited for the model; identifying port infrastructure, intermodal infrastructure, and customs efficiency. Moreover, through the literature review, other valuable insights that are not possible to include in the empirical analysis, such as the *governance structure*, are determined. Lastly, a simulation of the trade potential under improved conditions is used to quantify what the volume of trade flows would be if ports were more developed, thus identifying the costs of the underdevelopment. The paper concludes with an integration of the various disciplinary perspectives previously considered to provide a holistics conclusion to the research question.

Key Words: Ports and Economic Development, Trade Facilitation, Gravity Model of International Trade, Infrastructure, Italian Port System.

Acknowledgements: For the thoughtful feedback and the guidance throughout the development of the research I would like to thank Dr. Merve Burnazoglu & Dr. Maanik Nath. All errors are my own.

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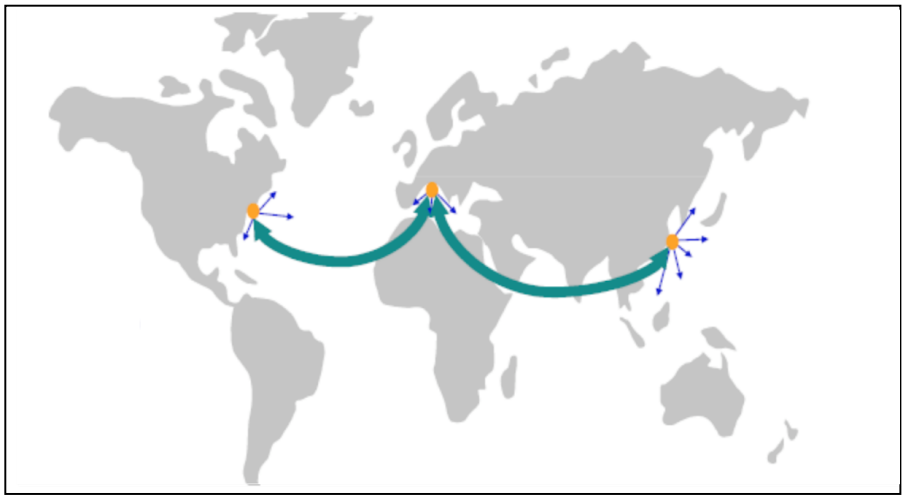
1. Introduction

The association between Italy and the sea is an immediate one, whoever opens an atlas can easily notice that the Italian peninsula is nestled around water in the middle of the Mediterranean Sea. The Italian peninsula is surrounded by water in most of its borders, with 8500 kilometers of coastal territory (ISPRA, 2011). The sea that washes these coasts, famous to the world because of the beauty of its beaches, rather than Mediterranean Sea should be called *Medioceano (Mid-ocean),* as suggested by Caracciolo (2020). In fact, modern maritime globalization, the most important means of international trade with 90% of world trade (Sisto, 2020), uses it as a passageway between the Atlantic Ocean and the Indo-Pacific creating what is referred to as the *pendulum route*. Italy finds itself at the center of this *Medioceano.* It is therefore at the center of the passageway between the Atlantic Ocean, symbol of the post Second World War recovery and home to some of the world's richest regions, from the American East Coast to Northern Europe, and the Indo-Pacific, the world's most populated region and center of Asia's extraordinary growth. It is hard to imagine a better strategic position for geopolitical and trade motives. Strategic position which has been exploited for millennia from the civilizations that have inhabited the peninsula. Thalassocracies, dominant maritime forces, have characterized the area since the Etruscans and Ancient Romans (Abulafia, 2014). Given its geographical position and its history, it would be easy to imagine that Italy is one of the most maritimely well-connected countries of the world and home to some of the most important ports, yet data indicates that this image is far from reality.

Figure I : The Pendulum Route



Source: Beretta et al. (2011a)

The Linear Shipping Connectivity Index (LSCI) developed by the United Nations Conference on Trade and Development (UNCTAD) which "indicates how well countries are connected to global shipping networks based on the status of their maritime transport sector" (The World Bank, n.d.) gives Italy a value of 64.9 in 2018, compared to Spain 86.4, Germany 87.4, Netherlands 89.1, and France 75.9. The largest Italian container port, the Port of Genoa, moved 2.6 million TEU (twenty-foot equivalent units; i.e containers) in 2019, making it the 9th port of the Mediterranean, behind ports from Spain, Greece, Morocco, Turkey, Egypt, and Malta, all countries that have a lower GDP and GDP per capita than Italy (Caracciolo 2020). The total traffic of TEU that same year in Italy was 10 million, while the most similar for demographic and economic dimensions of the countries mentioned above, Spain, moved 17 million TEUs (The World Bank, n.d.).

Considering that maritime trade has been a distinguishing characteristic of the civilizations that have prospered in the Italian peninsula, it is interesting to understand if the underdevelopment of the port system represents a cost, measured in *lost trade opportunity*, for the country and what the causes for this underdevelopment are. It is interesting as it might be insightful to comprehend the development of communities that inhabit the area and how their sources of prosperity might have changed. Furthermore, it is particularly important to understand what the causes and costs are in this historical moment, where Italy disposes of 31.9 billion euros from the Next Generation EU program for investments in infrastructure development (Ministero dell'Economia e Finanza, 2021) of which 3.6 Billion seem to be destined for a "national program of investments for a competitive and sustainable port system" according to leaked drafts of the plan (ANSA, 2021). Thus, knowing the economic impact that an increase in the conditions of an infrastructure network can have and which are the areas that can offer the best return on investment becomes even more relevant.

The research question that will be investigated in this study is the following: **What are the causes and the costs of the current underdevelopment of the Italian port system?**

This question will be tackled using an interdisciplinary approach, where *history* and *economics* will be the main disciplines involved. An overview of the Italian maritime history will be performed to find possible underlying causes that characterize the current underdevelopment, as well as to provide a further understanding of the relationship between port development and economic development in the region. Economics will be used to perform a quantitative analysis using a gravity model of international trade to identify which aspects of the port system represent the largest obstacle to increase the port development using indicators selected through a study of relevant literature. The literature on port competition and competitiveness will also bring the research to focus on the *governance*

structure of ports, as it represents a significant factor for port development. Lastly, a simulation with inflated values for relevant explanatory variables will be performed to quantify how the volume of trade flows would change. This will account for what the costs, measured in *lost trade opportunity,* of the underdevelopment are.

This research beyond contributing to the understanding of the current condition of underdevelopment of the Italian port system and its consequences on the Italian trade, will also bring a contribution to the academic research on trade facilitation measures and on the use of the gravity model of trade. It will be the first research to apply this model to this peculiar case study, by using a series of specific indicators as explanatory variables.

The *'underdevelopment'* of the port system refers to the fact that the whole compartment involved in the port system (i.e., maritime transport sector) is developed at a level which is inferior to the optimal level, where optimal level refers to the level of development achieved by similar countries in the same region. The Italian port system has been the subject of several studies who's focus has been mainly the governance structure (Valleri et al., 2006; Baccelli & Morino, 2020; Ferrari & Musso, 2011; Ferrari et al, 2015; Ferrari & Tei, 2016; Parola et al., 2012; Parola et al., 2017) and comparative studies on both the competitiveness between Italian and foreign ports (Cazzaniga Francesetti and Foschi, 2002; Buonsanti, 2014) and amongst Italian ports (Andreozzi, 2011; Beretta et al, 2011). The relationship between ports and development has been subject to numerous empirical studies. Mainly studies that aim at understanding specifically how ports can impact development (Yochum and Agarwal, 1987; Munim and Schramm, 2018; Ferrari, 2011; Ferrari et al., 2010) and studies that cover port efficiency whilst studying the impact of trade facilitation measures (Wilson et al, 2003; Wilson and Otsuki, 2007; Soloaga et al, 2006).

This paper is structured as follows: section 2 will provide a review of the current and historical Italian port system. A review of the state-of-the-art literature on ports and economic development will be found in section 3. Section 4 will present the Gravity Model of International Trade. Section 5 will contain the empirical analysis, firstly explaining the econometric model used for the analysis, it will then illustrate the methods in which data was selected and its limitations, then the estimation results, and lastly an estimation of the trade potential through a simulation. Section 6 provides a conclusion to the paper.

2. Overview of the Italian Maritime History

This section will be developed in two parts. Firstly, an overview of the maritime powers that characterized the Italian peninsula will be presented as it serves to provide an understanding

of how important the control of Mediterranean trade routes and the maritime vocation has been for the wealth and development of civilizations that want to prosper in this geographic area. The following part will investigate how the relationship between Italy and the sea has evolved in recent history to try and identify underlying causes for the current underdevelopment of the Italian port system.

The Italian peninsula has throughout history been repeatedly characterized by the presence of powerful and prosperous civilizations, from the Etruscan and the Ancient Romans to the four maritime republics during the Middle Ages and the city states of the Renaissance. One of the most significant traits they share, other than originating from the Italian peninsula, is that they were thalassocracies. The relationship between coastal cities and economic development has not been unique to Italy (Bosker et al., 2008). However, the Italian peninsula being characterized by 8500 kilometers of coast and being placed in the center of the Mediterranean was able to offer a competitive advantage to its civilizations to exploit the benefits of maritime trade more than other areas during much of the early modern history. This led Italy to be one of the first urbanized areas of early modern history, being defined by Russell, in his studies on Medieval regions and cities, as 'the most advanced and urbanized country in Europe and probably even in the world' (Russell, 1972, as cited in Bosker et al., 2008, pp. 99). Bosker et al. (2008) find that being a city with navigable waterways or a port, has a positive correlation with city size. The most populous cities around the 11th Century were found in the south of the peninsula, however, northern cities experienced a substantive growth between the 11th and the 14th century, dominating, under the leadership of Venice and Genoa, the economic life of the Mediterranean and Europe. The economic growth of the area derived from the control that Venice exerted over the trade flows of textiles and spices that came from the east towards Europe (Strano, 2019). The competitive advantage that Venice and Genoa were able to exploit however diminished with the discovery of oceanic routes and the formation of colonies, making the harbours of the Atlantic more competitive than the Mediterranean ones (Bosker et al, 2008).

The decentralization of the Mediterranean can therefore be seen as one the key causes in history that reduced the relevance of the Italian ports in global trade and for Italian economic development. However, there are other factors to be considered when analyzing the downfall of Italian maritime forces. Firstly, the decentralization of the Mediterranean coincided temporally with the Italian wars of the 16th century, also referred to as the Great Wars of Italy, which decreased the stability of the region and forced Italian cities to concentrate efforts in fighting against foreign military forces (Bosker et al, 2008). Moreover, the decentralization of the Mediterranean can only partially explain the decrease of relevance of the Italian ports, as today the Mediterranean is back to being at the center of the most important trade corridor of

the world, the Europe - Far East route. This is mainly due to the economic growth of Asia and the diffusion of post-panamax containerships (i.e. containerships that are too large to cross the Panama canal) (Fardella and Prodi, 2017*).*

The first part of this section has served the purpose of illustrating how impactful the maritime vocation has been for the development of the civilizations that have inhabited this geographic area in the past. The upcoming section wants to instead investigate if there are some underlying causes, phenomenons developed through history, for the underdevelopment of Italian ports. It therefore will be illustrated, through the use of literature, that Italy has lost its maritime vocation, by losing interest and strategy in the Mediterranean and focusing on what lies above the Alps.

Fabbri (2020) argues that what determined the disregard of the maritime vocation are historical, strategic, and geopolitical events. The unification of Italy occurred under the Kingship of the Savoy in 1861, the least maritime of the powers that inhabited the peninsula. It was aided and welcomed by the British, who supported the campaign of the Savoy financially and militarily (Fabbri, 2020). They had several reasons to do so; first of all, it represented the triumph of the Victorian liberalism principles over the continental conservative ideals. In fact, it has several parallelisms with the events in Ireland, legitimizing the actions of the British in their campaign (Wright, 2019). Furthermore, British leaders looked upon the unification of Italy under the rule of the Savoy as a possibility to unify the region by incorporating it within their sphere of influence in the Mediterranean region. Moreover, this meant to weaken, if not cancel, the power of the Kingdom of the Two Sicilies, a Mediterranean power whose areas of interests significantly overlapped with those of the British (Wright, 2019). The influential newspaper '*The Times'* published an editorial inviting the Queen to take action because "a Mediterranean Japan ", only a few miles from Malta, could not be tolerated (*Mieli, 2013)*.

The most significant testimony of how the Kingdom of Italy was losing its maritime vocation is *The story of a beach watchman: free translation of the battle of Dorking Capria 189...*[1] (Rossi, 1872), a fictional narrative placeable in the genre of invasion literature. The publication used the literary technique introduced by George Tomkyns Chesney with *The Battle of Dorking: Reminiscences of a Volunteer* (1871) which made use of a fictional narrative to discuss and take a stance on military and political phenomenons. The booklet, conceived by high rank navy official Paolo Orengo, written by Lieutenant Carlo Rossi, and published anonymously in Rome, was a form of dissent and protest arranged with navy leaders following the reduction in funds and rank of the Italian Royal Navy. The publication

[1] Title translated by the author from Italian. Original: *"Il racconto di un guardiano di spiaggia: traduzione libera della battaglia di Dorking"*

became central to the current political debate on the Royal Navy, which after the defeat in the Battle of Lissa had lost significant support (Caracciolo, 2020). Yorick, the narrator, concludes the narrative of the imaginary battle in which the French navy defeated the Italian in the Tyrrhenian Sea with a more general remark:

> *This sea that lies before us is Italian sea. We have neglected it. We believed in the power of a single army, forgetting how much of our border was on the sea, and how many sailors were among our fellow citizens. We have disregarded the glorious traditions of our ancestors, proclaiming that Italy was not a great maritime power, and placed the desire to economize in front of the honor, of the very existence of the country.*
>
> *(Rossi, 1872, pp.29)*[2]

Another interesting period of recent Italian Maritime history is that of fascism. Since the unification of Italy in 1861, the strongest maritime aspirations and interests in the Mediterranean have been represented by Fascist Italy, which considered the control of the Mediterranean as the highest strategic objective. Mussolini in 1922 said that "only by making the Mediterranean our [Italian] lake, allying with those that live in it and kicking out those that are parasites in the Mediterranean; by doing this patient hard work of cyclopic size will we truly inaugurate a great period of Italian history"[3] (Fabbri, 2020, pp.52). Irish historian Denis Gwynn when illustrating the aims of the Fascist regime in the Mediterranean spoke plainly: "Their [French and British] naval hegemony must be broken and the Mediterranean must once again become an Italian sea" (Gwynn, 1940, p.1). The blockade that the British navy was placing Italy under, by controlling the two gateways of the Mediterranean, Suez and Gibraltar, was holding Italy prisoner in the Mediterranean. Farinacci, secretary of the Fascist National Party, writes that Italy "above all wants to break the chains which hold her prisoner in the Mediterranean, hence she cannot issue forth without the permission of others, although the whole of her life is in this sea, while the others have only a passage through it." (Gwynn, 1940, pp. 205). The fascist interests in the Mediterranean are one of the elements that brought Italy closer to Germany, as the German naval expansion in the Baltic Sea was forcing the British to increasingly concentrate naval power in North of Europe at the expense of the Mediterranean fleets (Gwynn, 1940; Saporetti, 2013). The high interest of the Fascist regime for the surrounding sea and in Naval affairs did not however bring positive results.

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[2] Quote translated by the author from Italian. Original: *"Questo mare che ci sta innanzi è mare italiano. Noi l'abbiamo negletto. Abbiamo creduto alla potenza unica di un esercito, dimenticando quanta parte del nostro confine avevamo sul mare, e quanti marinai si contavano fra i nostri concittadini. Abbiamo posto in non cale le gloriose tradizioni degli antenati, proclamando che l'Italia non era una gran potenza marittima, e anteponendo la brama di risparmiare all'onore, all'esistenza stessa del paese"*

[3] Quote translated by the author from Italian. Original: *"... facendo del Mediterraneo il lago nostro, alleandoci cioè con quelli che nel Mediterraneo vivono ed espellendo coloro che del Mediterraneo sono i parassiti; compiendo questa opera dura paziente di linee ciclopiche noi inaugureremo veramente un periodo grandioso della storia italiana*".

The peace treaty between the Allied forces and Italy, ratified under the Paris Peace Treaties (1947), represented a heavy loss for the Italian Navy. The General Restrictions (Section II) implied the demilitarization of the islands of the channel of Sicily and of the Adriatic Coast (Art.49) and the prohibited naval fortification of the major islands Sicily and Sardinia (Art. 50). Section III of the Treaty, *Restrictions Imposed on the Italian Navy*, caused significant losses both on technical terms and on a moral perspective. Many limitations on the shipbuilding possibilities and on the technical equipment as well as the disposal of battleships to foreign naval forces were agreed. The Italian Navy still defines the event as "full of negative meanings"[4] (Marina Militare, n.d.), and that for such a reason at the time when it was being ratified it was being considered by navy officials to imitate the French navy in Toulon (1942) and the German in Scapa Flow (1919) and sink the fleet. However, an event of the Second World War that might be considered more tedious and that surely well represents the recent history of the Italian Navy, is the sinking of the Littorio-class battleship Regia Roma, the flagship of the Regia Marina, by the German Luftwaffe in the Strait of Bonifacio on 9 September 1943. The 'Roma' was headed towards Salerno to fight the Anglo-American forces when Italy signed an armistice with the Allied forces on the 8th of September 1943, leaving the battleship without clear orders. The day after as it was cruising without a clear destination it was bombed by the Luftwaffe, sinking with more than 1300 men and without fighting back (Marina Militare, 2013).

Hence the fascist period was another factor which induced the negation of the maritime vocation. The regime had brought the country into a war which had left the Marine heavily reduced in size and humiliated. Another negative consequence it caused was that the Republic succeeding the regime had to deal with the aftermath of the 'ventennio' and therefore in the attempted to distance itself from the fascist ideology it also distanced itself from the regime's first strategic objective: the control of the Mediterranean, forgetting that it had been a characterizing feature of almost all the civilizations of the peninsula (Montanelli et al, 1974).

Thirdly, another significant phenomenon that played into the negation of the Italian maritime vocation has been the relationship with the United States. After the Second World War, Italy entered the American sphere of influence, which has distinguished the Italian foreign policy since. In the aftermath of the War, the Mediterranean became an area of high interest, being the aim of expansionary interests of the Soviet Union and consequently heavily militarized with United States forces (Marina Militare, n.d.). In Naples, the United States based the headquarters of their 6th Fleet, responsible for the Mediterranean (Magri, 2020). The United

[4] Quote translated by the author from Italian. Original: *"... sotto l'aspetto morale l'evento era colmo di significati negativi"*.

States being the largest naval power of the World, never desired to have thalassocracies in the Mediterranean, a sea where it had high interests (Fabbri, 2020).

The Italian republic was born in 1946 under the American sphere of influence and has been fully part of what progressively became the European Union, both which have been crucial for the development of the 'Western' world. In the 'West', Italy was a border country: on the east, it shared borders with the Soviet sphere of influence and Yugoslavia, and on the south, North Africa. With the making of the western world Italy thus became a peripheral area, a cultural shift since for millennia it had considered itself mediterranean rather than western, and therefore nucleus rather than peripheral. The current President of Confindustria (The General Confederation of Italian Industry), Carlo Bonomi, when addressing an audience in Lombardy, said: "we are mitteleuropean" (Caracciolo, 2019, pp. 13). To this phenomenon, and most probably in some way as a cause of it, Fabbri (2020, pp. 47) adds what he calls an "atavistic complex of inferiority towards Mitteleuropa"[5]. Moreover, arguing how Italy developed a desire to blend in a context considered morally superior, that beyond the alps, and contemporary developed a negligence towards the Mediterrenean.

Other than the arguments identified by Fabbri that have been previously expanded, another factor leading to the de-maritimization of Italy that is often argued upon and worth mentioning is the absence of a museum or institute for the preservation and promotion of the Italian history on the seas (Eliseo, 2020; Sisto, 2020). The first to express himself for the preservation of such memory was Giuseppe Garibaldi, the leader of the 'Expedition of the Thousand', who wrote, in vain, a letter to the first Italian Prime Minister, Camillo Benso conte di Cavour, asking to preserve the two streamers used by the expedition to reach and conquer the south and unify it under the Kingdom of Savoy, for the memory of the future generations (Caracciolo, 2020).

The historical overview presented in this section of the research has a twofold objective. Firstly, provide evidence about the relevance that the sea and its exploitation have had for the development of the civilizations that occupied the peninsula over the course of history. Secondly, investigate possible transformations in the way Italy relates to the sea, given that this might represent an underlying cause for the underdevelopment of the port system. Through this analysis it was possible to understand that there have been a series of historical events for which Italy has decreased its maritime vocation, which can be assumed to have had a negative impact on the development of ports.

[5] Quote translated by the author. Original: "*... atavico complesso di inferiorità verso la MItteleuropa*"

3. Literature Review and Theoretical Background

This section will provide a literature review to the topics discussed in the research, with the exception of the theory behind the empirical model which will be presented separately in the following section. The literature on ports and economic development will be important to justify why this research explores a link between the two. Whilst the literature regarding port competitiveness and competition will be important to explain the reasons for which specific indicators are selected for the quantitative analysis and their expected relationship with development. Furthermore, other than considering literature that focuses on the theoretical aspects that interest this research there will also be use of literature to better understand the case of Italy.

A. Port and development

The relationship between ports and economic development can be derived both from current economic theory and through a historical analysis. The quality and efficiency of transport infrastructure are a key element for economic development, this is because they are a determinant of transport costs, which highly affect trade between countries (Ferrari et al, 2010; Clark et al, 2004). Wilson et al. (2003) find that infrastructure is the trade facilitation measure with the largest impact on trade flows and economic growth. Another interesting view regarding the relationship between ports and economic development is offered by a historical analysis of wealth concentration. Bosker et al. (2008) find, through a panel analysis of historical data of Italian cities, that being a seaport or having access to navigable waterways is the most significant determinant of demographic size, highlighting the relationship in history between ports and wealth concentration, also suggested by Shan et al, (2014).

Innumerate studies have been done to investigate the effects of investments in port facilities as a boost for economic development of specific regions (Bottasso et al., 2014; Munim and Schramm, 2018; Li et al., 2017). The great majority finds there to be a positive impact on economic growth, however, as noted by Munim and Schramm (2018) many studies found the impact of a port on development to be diminishing over the course of time. Furthermore, Munim and Schramm (2018) highlight how there is a tendency to focus on the employment generated by ports in the studies that find diminishing effects and underline how ports increasingly generate external economies that are hard to notice. A phenomenon that has increased as port activities shifted from being labor intensive to being capital intensive, reducing the number of direct employment possibilities created in the immediate surroundings (Helling, 1997). This emphasizes that it is relevant to distinguish in economic

impact analysis, and thus in evaluating the economic impact of a port, between the four impact categories that can be identified: direct impact, indirect impact, induced impact, and catalytic impact, these can also be referred to as effects. Direct impact refers to the income and employment that is directly connected to the construction and operation of the port. Indirect impact is the business to business activity derived from direct effects. The induced impact refers to the income and employment derived from the spending of the incomes generated by the direct and indirects effects. Lastly, catalytic impact is the income and employment that is achieved as a result of the port's capacity to increase the productivity of its hinterland (Ferrari et al, 2010). The catalytic effect is the impact that most interests the scope of this study given that it focuses on the broader and most significant effects that ports have on development. Studies that focus on catalytic effects, such as Munim and Schramm (2018) and Bottasso et al., (2014) find significant positive effects.

The baseline concept for which ports generate a catalytic impact is simple; as suggested in Smith (1776), trading between countries brings significant increases in wealth and port infrastructure is a means of trade facilitation (Wilson et al, 2003). Therefore, the more developed and efficient a port is, the more competitive the goods produced in its hinterland become in global markets since they can be supplied in less time and at a lower cost. Therefore, with an efficient port one can increase the demand for export as well as reduce the costs of the imports of the hinterland.

B. Containerization

This research makes extensive use of the word port, however as noted by Notteboom and Yap (2012), it is a word that has many definitions. What is referred to as a port can extend from the Port of Ginostra, where no more than a few couple dinghies can be docked at the same time, to large scale logistics centers with multiple terminals that manage millions of containers per day and are spread over thousands of square kilometers. It is therefore relevant to make a distinction. In this study, the definition of Notteboom (2001, as cited in Notteboom and Yap, 2012, pp. 550) is used to define a *container port*: “a logistic and industrial center of an outspokenly maritime nature that plays an active role in the global transport system and that is characterised by a spatial and functional clustering of activities that are directly and indirectly involved in 'seamless' transportation and information processes in production chains.” Within container ports, it is possible to make further distinctions. *Gateway ports* are ones that serve as nodes between the maritime trade routes and the hinterland. In these ports, cargo is unloaded from ships to be transported by land to their final destination. Conversely,

transshipment ports serve as nodes between maritime trade routes. In these ports, cargo is unloaded and reloaded on ships.

As clarified by the definition this research will focus on container ports. This is because container ports have been one of the engines of globalization, boosting international trade, and represent the type of port that transports the largest variety of goods. Liquid bulk ports for instance are ports that are highly specialized in the transport of specific commodities, such as crude oil or other liquid bulks, and whose traffic is highly affected by the trading activities around few products, and generally in one direction, and thus less suitable for the purpose of this research.

During the second half of the 20th century and the beginning of the 21st century global maritime trade has been characterized by the rise of the container. The container is a metal box of standardized dimensions, which as Levinson notes "has the romance of a tin can" (Demil and Lecocq, 2006, pp.73), but cuts significantly costs and time of transportation of goods, setting a revolution in international trade. Containerization, according to economic historian Alfred Chandler (1977, as cited in Demil and Lecocq, 2006, pp. 74), has had the same impact in connecting international markets as the railroad had in the 19th century for national markets. Containerization did not occur simultaneously in all regions and ports of the globe. Guerrero and Rodrigue (2014) divide containerization in different waves, with the first wave (Wave A) of pioneers happening in the 1960s in the United States, northern Europe, and Japan. Italian ports have started to adopt containers since the second wave (Wave B.1) with the ports of Genova, Livorno, Naples, and Trieste in the mid and late 1970s, a period in which also ports in the Indo-Pacific started their first phases of containerization. Other Italian ports arrived later, with the ports of Gioia Tauro, Taranto, and Cagliari shifting to containers only around the turn of the century. This revolution in the shipping industry changed the characteristics of the sector as well as the configuration of ports. The necessities in the area around the port changed, thus changing the factors that created a competitive advantage in port competitiveness. With break-bulk cargo there was the need for warehouses adjacent to the dock, container terminals do not need warehouses instead, but paved yards to accommodate containers of areas that often were inconceivable in the old port cities (Levinson, 2006).

With the diffusion of the container worldwide, the distribution of goods around world ports concentrated in major ports, with 1% of ports controlling 25% of traffic (Guerrero and Rodrigue, 2014). The disproportionate growth of the main ports reinforces the argument that container ports experience important benefits from economies of scale (Cullinane and Khanna, 1999), as well as reinforce the hypothesis that a first mover advantage gives long

lasting competitive advantage, given that one can extract benefits from economies of scale sooner. This can be seen as one of the causes that hampered the growth of Mediterranean ports which started containerizing from Wave B compared to the ports of Northern Europe which started during Wave A.

Containerization was however also an important driver of competition amongst ports as the increased connectivity with other methods of intermodal transport made the hinterlands, the area in which the port has most of its business, experience a noticeable growth in size (Hayuth, 1981). Ports no longer enjoy a monopolistic position over their immediate surroundings, creating *contestable hinterlands.* The increase of competition between ports incentivized the development of intermodal corridors for rail and road transport, which increased further the competition and reach of the hinterlands. Notteboom (2008) illustrated how the hinterlands of the Mediterranean ports and the Northern range ports overlap, with Northern Range ports extending their hinterland through inland corridors until the industrial Po Valley.

C. Port Competitiveness

Like port, port competition can be a very broad concept, as it varies strongly according to the type of port and cargo that it handles. For this reason, this research will concentrate on understanding container port competition, which is the most impactful for shipping connectivity. Container port competition can be separated into two different levels, *intra-port* competition and *inter-port* competition. *Intra-port* competition relates to the competition that occurs amongst different terminals that operate within the same port. *Inter-port* competition relates to the competition that occurs amongst terminals that operate within different ports. This form of competition can occur on a regional, national, and international level. Given the aim of this research, the focus will be on *intra-port* competition.

Notteboom and Yap (2012) and Notteboom (2008) provide a review of the factors of competitiveness of a port. They are discussed below:

Firstly, the *level of port infrastructure*, both technical and physical, is indicated as a factor that increases the competitiveness of a port. Port infrastructure considers a variety of elements. It considers the nautical accessibility of the port, which has become increasingly more relevant with the increase in size of containerships, given that many ports don't have a sufficient draft to allow the 24,000 TEU post-panamax ships to dock. Furthermore, it considers the technical infrastructure present and equipment of the terminals, as these affect the efficiency of the service. This equipment includes the cranes as well as the related

auxiliary terminal equipment, such as warehousing. With the rise of containerization and the continuous growth of TEU traffic, the possibility that a port has to expand over time in order to meet future demand and to deal with the upcoming challenges of the logistics sectors has become a factor of competitiveness, especially in the capacity to attract investments from shipping companies.

The distance to the hinterland and to large centers of production and consumption is also a determinant of port competition. In this respect, it becomes clear that a further key element of port infrastructure is the *infrastructure of intermodal transport*, as increasing the connectivity reduces the distances and accessibility of the hinterland.

Other sets of relevant factors for the competitiveness of a port regard the efficiency of the services and the environment around the port's activities. The productivity of a port and the efficiency in port management increases its competitiveness as it reduces the costs and the time employed to deliver services. One of the most significant examples where efficiency is a relevant factor are *customs procedures*. In this respect, Notteboom and Yap (2012) note that a higher degree of involvement of the private sector in the ports activities increases the competitiveness. The environment around the port's activity is instead relevant as Notteboom (2008) states that port reputation, the involvement of criminal organizations, and the way in which the port is viewed by the community and the stakeholders, both local and national, are all factors that influence competitiveness. Involvement of criminal organizations being the only of the three to have a negative impact. Lastly, it is highlighted how ports enjoy benefits from *economies of scale* given that the higher *sailing frequency* (also referred as port-call frequency) increases the interconnectivity of the port and thus its competitiveness.

The degree to which the factors presented by Notteboom and Yap (2012) and Notteboom (2008) matter depends on the type of port. For instance, for a transshipment port it is not essential to be close to centers of consumption and production and to have a high degree of connectivity with other means of intermodal transport while distance from trade lanes and the degree of productivity are highly relevant factors.

Beretta et al (2011a) present a study which allows us to understand the competitiveness of Italian ports focusing on the different factors that affect competitiveness. Their study concentrates on semi-finished and finished products and excludes energy products and raw materials, thus focusing on goods typically transported by containers. The study first presents a table, here reported in a more synthetic version, elaborated by the authors and Banca d'Italia that reports the considerations of operators from the main shipping firms on how the

Italian ports compare with ports from the Northern Range and the WestMed regarding different areas of competitiveness.

Table I: Advantages and Disadvantages of Italian port system

	Vs. Northern Range	Vs. West Med
Position	1.3	1.1
Intermodal infrastructure	-1.7	-1.6
Port Infrastructure	-1.3	-1.0
Logistics centers	-1.2	-0.8
Terminal efficiency	-1.5	-1.1

Source: Banca d'Italia and Beretta et al. (2011b). Key: +2: fundamental advantage; +1: medium importance advantage, 0: non important factor; -1: medium importance disadvantage; -2: fundamental disadvantage.

The first factor analyzed is *position,* this is the only factor where Italy enjoys an advantage over the two competitor ranges. In fact, a container that comes from Southeast Asia and needs to reach central Europe takes five days less of navigation on average if it uses an Italian port instead of a port from the Northern Range. Moreover, Italian ports will suffer less from the rising sea level compared to northern range ports (D'Agostino, 2020).

The second factor is *intermodal infrastructure*, this is the factor where the Italian port system suffers the largest disadvantage. The most significant issue with intermodal infrastructure regards railroad connectivity. Italy transports almost 90% of goods that arrive by ship using road transport, in comparison Germany sets around 65%. This creates challenges on highways, which experience a yearly average of tonnage of goods per kilometer significantly higher than the EU average. Moreover, road transport being less reliable than rail in terms of timing contributes to making the Italian ports less reliable in terms of delivery, which is a highly determinant factor for firms, especially with the diffusion of just-in-time production (Buonsanti, 2014).

Thirdly, *port infrastructure* is indicated as a disadvantage of medium importance. The major issues seem to concern the dimensions of the yards that accommodate containers, especially critical aspect for ports located in large urban areas, and the dimensions of the cranes, often

not sufficient for larger containerships. Moreover, in some ports there is a discrepancy between the machinery used and international standards, creating operational complications. Lastly, with the increase of naval gigantism, not all ports will be able to allow the largest containerships given the draft, this however is a diffused problem also in other port ranges.

Logistics centers are also a cause of disadvantage. The main issues in this factor seem to be caused by the organizational arrangement, although even the logistics infrastructure could benefit from advances. In particular the shipping operators highlight how if the rear-port facilities were managed by the same operators of the terminals there would be a higher efficiency and how these need to be adapted to spaces where the transformation and repackaging of goods is possible.

Lastly, *terminal efficiency* is rated as a disadvantage mainly due to the methods and inefficiency of the customs. These use different methods from other countries, creating more inefficiency in the customs procedures which can cause delays to entire containerships, causing significant losses. Beretta et al (2011) further suggest that a problem in the Italian port system is the elevated number of ports, which causes a high fragmentation of the traffic not allowing to capitalize benefits for economies of scale and from the sailing frequencies.

D. Port Governance

Through the analysis of the factors of competitiveness of a port it is noticeable how relevant the governance structure of the port is for competitiveness. Port governance has become more relevant as the competition amongst ports increased and the sector became more capital intensive and integrated in intermodal logistics. For decades there have been ongoing reforms to port governance in all regions of the world, with a tendency to increase the involvement of the private sector and the autonomy of port authorities. This has been further demonstrated in various studies that focus on port governance (De Langen & van der Lugt, 2006; Brooks & Cullinane, 2006; Brooks & Pallis, 2008). The governance of the Italian port system will be analyzed to understand if it may be a cause of port underdevelopment. The governance structure has been one of the most studied areas regarding the Italian port system (Valleri et al., 2006; Baccelli & Morino, 2020; Ferrari & Musso, 2011; Ferrari et al, 2015; Ferrari & Tei, 2016; Parola et al., 2012; Parola et al., 2017).

After the abolition of the Ministry of the Mercantile Marine in 1993, the ports have been under the authority of the Ministry of Infrastructure and regulated according to law n.84/1994 (Camera, 2015). More recently, the port governance has been further reformed by legislative

decree n.169/2016 (Gazzetta Ufficiale, 2016). The governance structure established under laws n.84/1994 and n.124/2015 will be below analyzed as they are the most relevant for the period taken into analysis in this study.

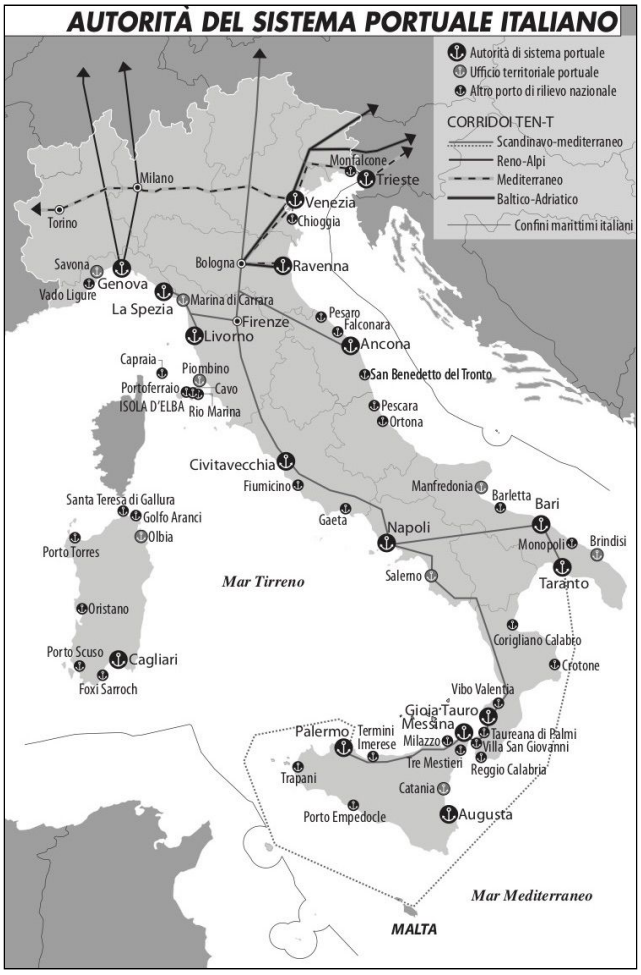
The reform of 1994 abolished the public port model and established a governance model referred to as *landlord ports*. The reasons for the reorganization, other than the political decision to dismantle the Ministry of the Mercantile Marine which brought the portal infrastructure under the authority of the Ministry of Infrastructure, were mainly two. Firstly, the public port model had generated a high debt income ratio that was no longer sustainable, and secondly, the containerization of global shipping was requiring significant investments in terminals, which were becoming capital-intensive. The landlord model consisted of two actors, the newly established Port Authority (PA) and the Terminal Operation Company (TOC). The Port Authority is an entity which oversees port management in terms of planning, promoting, and organising port activities but without any operational power, as it is given by concession to a private TOC. The PA has authority over a limited number of sectors that are involved in port activities. Customs and Maritime Authority for instance are controlled by separate institutions.

The internal governance of the PA is composed of two organisms, the president and the port committee. The president is selected by the Ministry of Infrastructure from three names that are proposed by the local authorities, merely city council, local chamber of commerce, and regional government. The port committee instead is formed by 20 members which represent the private and public actors that are involved in the port's activities. All major decision making is proposed by the president but needs approval of the port committee before they can be operational.

The governance structure presents several limitations. Firstly, the number of PA has varied between 16 to 24 being contemporary operating in the national territory since their introduction, this has led to the authorities being small in size, thus less able to attract investments and make use of economies of scale. Furthermore, the high degree of influence of local interest within the organizational structure along with the limited power and delayed executional process of the president has restrained the capacity to construct a long-term strategy (Ferrari et a., 2015). Lastly, the devolution of the income to the state which then redistributed the budgets amongst PA regardless of performance created an unsound incentive structure as well as financial complications for the most proactive ports (Carbone & Munari, 2006).

The TOCs after being first allowed with the reform of 1994 have passed from being local companies to international shipping companies. Private operators in terminals are generally seen as a source of increased productivity and competitiveness, Italy seems to be no exception. The reform stimulated the growth of the port system, growing at above 10% in cargo handling per year until 2002. In fact, Italy reached its highest point before the turn of the century, handling one third of container traffic in the Medittereanen (Parola et al., 2017). However, the regulatory framework still presents several difficulties for these to maximize productivity. For instance, each terminal operator can have only one concession agreement for each type of traffic in the port. This measure, which was designed to keep barriers to entry low, creates damaging operational limitations as companies either struggle to reach technically efficient volumes or end up handling oversized terminals. Moreover, the bureaucratic process presented difficulties and risks while the legal nature of the public concession impeded opportunities to renegotiate terms, thus limiting the margins of action of the operators (Ferrari et a., 2015).

Figure II: Italian Port System



Source: Panaro (2020)

The governance structure has been reformed by legislative decree n.169/2016 (Gazzetta Ufficiale, 2016) to address several of the issues that the previous structure presented, this is the current legislation. The reform introduced 12 (later became 16) Autorità di Sistema Portuali (AdSP; Authority of port system) that substituted the 24 PA in managing the 54 national ports. The first and most significant benefit that these new authorities exhibit compared to the previous is the integration of multiple ports that operate in the same area under one governance. For example, in the West Ligurian Sea the ports of Genova, Savona, Vado Ligure, and Prà which are all within a range of 50 kilometers are now all under the same AdSP, making it the largest of the country (AdSP Mar Ligure Occidentale, n.d.). However, further integration with other ports that are strongly reliant on the function of the Port of Genoa as a hub port can still occur, for instance with the ports of the East Ligurian Sea. Other benefits of the newly formed authorities are the wider scope of action over which they are given authority, now including the rear-port areas for industrial and logistical infrastructure, and the simplified process for the selection of the president, which is now slightly less dependent on local institutions. The other areas of concern of the earlier governance model, such as the lack of financial autonomy and the rigidity of concession agreements, remain. Research that assesses this new governance model in more depth is still very limited. However, there are several recent publications that propose alternative organizational models (Pistilli et al., 2020; Marino, 2020).

4. Theoretical Framework: The Gravity Model for Trade

In 1954, Walter Isard in his study on Location Theory and Trade Theory first introduced the *Income Potential Concept*. Arguing that the income potential produced by any country *i* over country *j* would have an inverse relationship to the distance between the two, ceteris paribus. Isard further argued how the *potential* concept was not limited to economic relationships, but that it could be applied to a variety of sciences, as for instance done by Stewart (1948) with demographic studies. The Gravity Model however found its name and success after Jan Tinbergen (1962) proposed a model that had a similar functional form to the Law of Universal Gravitation proposed by Isaac Newton in 1687 which instead of being applied to physics was applied to a variety of social interactions, including international trade. The gravity formula for social interactions was the following:

$$F_{ij} = G \frac{MiMj}{D_{ij}} \quad \text{(I)}$$

Notation:

- F_{ij} is the attractive force. It is the flow between *i and j.* When the model is applied to international trade, it is the volume of the trade flow. If applied to migration instead, it would represent migration flows.
- M_i and M_j are the masses. When the model is applied to international trade, the masses are typically measured in economic size (GDP, GNI, or GNP) for the countries *i* and *j.* However, population can also be used as a mass, as typically done in migration studies.
- D_{ij} is the distance between the two objects, i.e. the distance between the two countries. This can be measured in various ways; capital to capital, center to center, border to border.
- G is a constant term; in physics it would be the gravitational constant.

The model, just like Newton's Law of Gravity, states that the attractive force between two entities is proportional to their masses and inversely related to their distance. Therefore, in the gravity model, distance behaves as a form of friction, increasing trade costs, and lowering the volume of trade flows. The economic masses instead act as gravitational masses, the larger the two masses are the larger the volumes of trade flows will be.

Krugman et al. (2018) note how a more general gravity model is commonly used by economists, having the following form:

$$F_{ij} = G\frac{M_i^a M_j^b}{D_{ij}^c} \qquad \text{(II)}$$

Equation (II) implies that there are three factors that determine the trade flows between country i and country j which are their respective economic masses and the geographic distance between i and j, however, conversely to equation (I) it does not specify that the trade volume is inversely proportional to distance and proportional to economic masses. It includes *a, b,* and *c* to best fit the data. When *a, b,* and *c* equal 1, then equation I = equation II. Krugman et al (2018) however note that equation (I) is a good estimate according to the values of *a, b,* and *c* that are commonly found in studies.

The underlying premise of the gravity model is the existence of direct proportionality of the product of the economic mass of two countries and the volume of trade observed between them, and an inverse proportionality between trade volume and the distance between the two economies. Critics of the gravity equation often label it as a naive model due to the analogy of trade volume as being akin to a gravitational pull not being founded on solid theoretical

foundations. Moreover, observations from trade data do not satisfy the gravity equation perfectly, and as a result deviations persist. However, this limitation can be significantly minimised through the use of stochastic versions of the traditional model:

$$F_{ij} = G \frac{MiMj}{D_{ij}} \eta_{ij} \quad \text{(III)}$$

The sole difference is the inclusion of the error term, η_{ij}, which is taken to be independent of the regressors in the model and is assumed to have an expected value of 1. By extension, since many studies involving the gravity model use a log-linearised form, the term $\ln\eta_{ij}$ is also assumed to be statistically independent. As long as independence is maintained, the variance of the error term is unaffected by the economic masses of the countries and by their distance, making the attainment of consistent results from the model a possibility. Real-world observations, however, reveal heteroskedasticity of the error terms in the log-linearised form of the equation. Heteroskedasticity is the event whereby the variance of a variable fluctuates over time. This leads to a breakdown in the consistency of results derived from the model across multiple time periods, which has a negative impact on the reliability of the conclusions drawn on the association between trade flow volume, economic mass and distance.

When the model was first used by Tinbergen (1962) and Poyhonen (1963), it did not have a developed theoretical economic explanation, but only the intuitive Newtonian justification. The intuitive justification being that the larger the economy of a country is, the larger will be the amount spent by the country on imports given the large income. Distance instead is a proxy for trade costs, the larger the distance, the larger the trade costs. Even though the theoretical background was not well developed, the model enjoyed an initial success given the strong fit to data in empirical applications. As Anderson noted: "[the gravity model] is probably the most successful empirical trade device of the last twenty-five years" (Anderson, 1979, pp.1).

Following the growing interest, theoretical support for the model started to be researched. Linneman (1966) provided a theoretical economic explanation demonstrating how by deriving a partial equilibrium model it was possible to obtain a reduced form of the equation of the gravity model. An approach criticized by Bergstrand (1985), who instead dervies trade demand and supply using microeconomic principles to then derive, through the market equilibrium, the gravity model equation. However, as noted by O'Rourke et al (2020), many theoretical models of international trade can be used to derive the gravity equation, including the Ricardian (Eaton and Kortum, 1997) and Heckscher Ohlin (Deadroff, 1998) Models.

The area continues to be studied, with truly recent works available. Allen et al. (2020) develop a universal framework that tries to unify the gravity regression analysis with the quantitative general equilibrium approach. Showing how under their framework, gravity models revolve around the two parameters named “gravity constants”, merely the elasticities of supply and demand.

Empirical studies that apply various forms of the gravity model are common and pertinent to different areas. For instance, Wilson et al (2003), Solanga et al. (2006), and Wilson and Otsuki (2007) use the model to measure the role of trade facilitation in different regions of the world. While Karemera et al (2000) and Ramos and Suriñach (2017) apply it to migration studies in North America and Europe respectively. Further interesting studies are those of O'Rourke et al. (2020) and Barjamovic et al. (2019) which investigate the relevance of the gravity constants in the past, respectively in the 13th to 20th Century British exports and Assyrian settlements in the Bronze Age. O'Rourke et al (2020) find that the distance factor, also referred to as gravity pull, is significant in the 12th Century, but then fades, regaining significance only in the second half of the 20th Century.

5. Empirical Analysis

a. Model

The model in this research is a form of the gravity model used to investigate the causes of Italian port underdevelopment by observing the impact that indicators for port development have on the volume of trade flows between Italy and 39 major trading partners. This model is augmented by adding three variables for port development, specifically port infrastructure, customs efficiency, and intermodal transport infrastructure. Moreover, GDP growth is included to account for external effects that might influence the volume of trade flows. The economic mass is measured using GDP and population, while distance is measured as distance between capitals. Lastly, two dummy variables are included to account for countries that are located in continental Europe and that are contiguous with Italy. The estimated gravity model has the following form:

$$Log(F_{ijt}) = \alpha_0 + \alpha_1 log(M_{it}M_{jt}) + \alpha_2 log(P_{it}P_{jt}) + \alpha_3 G_{it} + \alpha_4 G_{jt} + \alpha_5 log(D_{it}) + \alpha_6 Po_{it} + \alpha_7 Ct_{it} + \alpha_8 I_{it} + \alpha_9 E_{jt} + \alpha_{10} C_{jt} + e_{ijt} \quad \text{(IV)}$$

Where:

j = 1, 2, 3, …, 39 (trading partners)

i = Italy

t = 2009, 2010, 2011, …, 2017.

F_{ijt} = Italy's volume of trade with country j in year t

M_{jt} = GDP of country j in year t

M_{it} = GDP of Italy in year t

P_{jt} = Population of country in year t

P_{it} = Population of Italy in year t

G_{jt} = GDP growth of country in year t

G_{it} = GDP growth of Italy in year t

D_{it} = Distance between Italy and country j, measured in km, bilateral

E_t = Continental Europe dummy

Ct_j = Dummy for countries that are contiguous with Italy

Po_{it} = Port infrastructure indicator for Italy

C_{it} = Customs efficiency indicator for Italy

I_{it} = Intermodal transport indicator for Italy

The variables Po_{it} for Italian port infrastructure, C_{it} for Italian customs efficiency, and I_{it} for Italian intermodal transport infrastructure are used as indicators for three different factors that influence the competitiveness and development of a port. Beretta et al (2011) identified five factors that are significant when analyzing port competitiveness in Italy, these are: Position, Intermodal infrastructure, Port Infrastructure, Logistics centers, Terminal efficiency. This research however only focuses on three of the factors as these are the ones that were possible to quantify given the availability of data. All three variables are expected to have a positive sign, i.e when the variables increase the volume of trade flow increases.

1. Port Infrastructure Po_{it}

The data collected by the World Economic Forum to measure port infrastructure from 2009 to 2017 (one entry per year), published in the Global Competitiveness Report is used as an indicator for port infrastructure.

2. Custom's efficiency C_{it}

Customs efficiency is being used as a proxy for terminal efficiency given that this was the factor that most influenced the measure of terminal efficiency in the study by Beretta et al (2011a). The data for customs efficiency is collected from the World Economic Forum Global Competitiveness Report from 2009 to 2017 (one entry per year).

3. Intermodal Infrastructure I_{it}

The indicator for intermodal infrastructure has been created by integrating the World Economic Forum Global Competitiveness Report indicators of Road infrastructure, Air infrastructure, and Rail Infrastructure from 2009 to 2017 (one entry per year) by averaging the three components. Intermodal transport is typically made up of port, air, rail, and road infrastructure, however, port infrastructure was not included in the indicator as it is being analyzed individually.

The dummy variable E_t indicates the countries that are in continental Europe. Whereas continental Europe all European countries other than the islands, Ireland and United Kingdom, and the Scandivan peninsula are included. The reason for the exclusion of the Scandivan peninsula is that even though it is connected to continental Europe by land, the vast majority of the traffic crosses the Baltic Sea. The reason to include this variable is that it is likely that the trade between Italy, which is part of continental Europe, and other countries which are part of continental Europe occurs by land. A second dummy Ct_j is included in the model to signal countries that share a border with Italy. This is a variable commonly used in gravity models to account for border effects (Head, 2003).

GDP Growth of Italy (G_{jt}) and of country j (G_{jt}) are included in the model to reduce the possibility of having an omitted bias error. It would be likely that if Italy or one of the partner countries experienced a change in the GDP growth, an increase for instance, there would be some degree of increase also in the trade flows it experiences.

The regression model for the study uses the log form as a functional form for the core variables in the gravity model of trade equation. This approach presents the advantage of standardising variables and reducing errors which may otherwise be very high in regressors of a nonlinear relationship. This is particularly helpful in the case of highly-skewed variables, as the log form transforms their distribution into a more normally-shaped bell curve, allowing for more accurate predictions to be made from the model. In this case, the product of the GDP of Italy and the GDP of country j ($M_{it}M_{jt}$), the product of the population of Italy and the population of country j ($P_{it}P_{jt}$) and the distance between italy and country j (D_{it}) were used in their log form.

The study makes use of a panel data approach to investigate the research question. Also called longitudinal data, this method allows one to investigate the characteristics of multiple single units (in this case individual trading partners of Italy) across multiple time periods (from 2009 to 2017). Panel data presents a range of advantages over other methodologies, such as time series and cross-sectional data. Firstly, it can account for heterogeneity within

each single unit (unique attributes of trading partners), including cases of omitted variable bias for each unit, which would otherwise skew the conclusions derived from the model. Secondly, the panel data approach is by definition a more comprehensive investigation, simultaneously factoring in trade partner effects and time effects in a single model, both of which are established considerations influencing trade flow volume. Moreover, this method offers more flexibility in identifying and resolving issues of collinearity, and as such can provide more accurate results. The use of panel data approach is suggested as a possible improvement in several studies that make use of the gravity model though cross-sectional data (Wilson et al., 2003; Soloaga et al., 2006)

When structuring the study, one of the decisions to be made was selecting between fixed, random and pooled effects as the basis for the model. A pooled effects regression was straightforward to eliminate as an option as the data collected was from the same countries for the entire 9-year span of the study period. It was decided that a fixed effects regression model be used for the investigation based on the logic that the properties of Italy's individual trade partners would not fluctuate substantially over a relatively-short time of 9 years (i.e. the factors at the state level do not experience significant variation).

b. Data

The dataset contains unilateral data on annual GDP, GDP growth, population, and the dummy for countries located in continental europe for 39 countries that represent the largest trading partners of Italy. The 39 countries are spread around the world, including all continents, they are merely: Algeria, Australia, Austria, Bangladesh, Belgium, Brazil, Bulgaria, Canada, China, Croatia, Czech Republic, Denmark, Egypt, Finland, France, Germany, Greece, Hong Kong SAR, Hungary, India, Indonesia, Ireland, Japan, Korea, Rep., Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Tunisia, Turkey, United Kingdom, United States, Vietnam. The same data is also included for Italy for the same time period, making the total number of countries in the dataset 40. Some of the largest trading Italian partners have been excluded from the model, this has been the case of Russia, United Arab Emirates, Azerbaijan, and Saudi Arabia. The reason for the exclusion of these countries is that they are large exporters of energy products. Furthermore, the model contains bilateral data between Italy and the above-mentioned countries. The bilateral data regard distance between capitals in kilometers, a dummy for contiguous territory and volume trade flows. Lastly, three variables that are used as a proxy for Italian port infrastructure, customs efficiency, and intermodal transport are used.

The CEPII Gravity Model Database (Conte et al, 2021) has been used to collect data for GDP, population, distance between capitals, contiguous territory, and volume trade flows. The CEPII dataset reports data from the World Bank's Development Indicators (WDI) for GDP and population, which are measured in thousands USD and thousands respectively. Data on the volume of trade flows comes from CEPII's BACI database and is measured in thousand current USD. Distance between capitals, measured in kilometers, and the contiguous territory dummy have been collected from CEPII's GeoDist database. For GDP growth, measured in percentage, data by The World Bank has been used (World Bank, n.d. b). The World Economic Forum Global Competitiveness Report data has been used for the port infrastructure, customs efficiency, and intermodal infrastructure (Schwab, 2009; Schwab, 2010; Schwab, 2011; Schwab, 2012; Schwab, 2013; Schwab, 2014; Schwab, 2015; Schwab, 2016; Schwab, 2017). The data is collected using surveys and ranges from a minimum level of 1 to a maximum of 7, 7 being the best. For port infrastructure, indicator 2.04 'quality of port infrastructure' was used. For Customs efficiency, indicator, indicator 6.13 'burden of customs procedure' was used. For intermodal infrastructure, indicators 2.02 'Quality of roads', 2.03 'Quality of railroad infrastructure', 2.05 'Quality of air transport infrastructure' were used.

c. Estimation Issues

One of the problems associated with regression models, panel data-based regressions being no exception, is multicollinearity. This is the presence of intercorrelations between regressors in a model to the point where one or more independent variables can be used to predict other independent variables. Multicollinearity can compromise the statistical significance of a variable. The first step towards resolving such an issue is testing for its presence in the first place. In the case of panel data, a Variance Inflation Factor (VIF) test can be carried out to ascertain the extent to which multicollinearity is a problem. It assesses how much of a variable's variation is explained by the variation of another. The VIF value for a regressor *'i'* is calculated as follows:

$$VIF_i = \frac{1}{1-R_i^2} \quad \text{(V)}$$

A VIF result of 1 would indicate no correlation, a result between 1 and 5 would indicate moderate correlation and a score between 5 and 10 would suggest high correlation between regressors. While the coefficients and p-values of the variables in question can be affected by multicollinearity, the predictive power of the model is not, and hence the issue may not be of consequence in a study aiming to predict an overall outcome. However, in the case of this

study, the individual causal effect of the transportation infrastructure is of direct interest, hence a VIF test is performed to investigate for multicollinearity.

The regressors of interest when assessing multicollinearity were the customs efficiency (Customs_ita; C_{it}), port infrastructure (port_ita; Po_{it}), and intermodal infrastructure (intermodal_ita; I_{it}). Performing the VIF test (Table 2 in appendix) on these independent variables revealed moderate multicollinearity in the port infrastructure and customs efficiency regressors (with VIF scores of 4.518 and 1.783 respectively), as well as high multicollinearity for the intermodal infrastructure regressor with a score of 5.160. One of the primary solutions for multicollinearity is the removal of the regressor exhibiting this property. By the VIF test, a case could have been made for the exclusion of the intermodal infrastructure variable, however upon balancing the borderline VIF statistic with the insights the regressor could provide, it was decided that it be kept in the regression model.

The issue of heteroskedasticity must also be considered when seeking to establish causality via the regression model. Its presence can have the effect of reducing the precision of coefficient estimates and increasing standard errors. Furthermore, heteroskedasticity can result in lower p-values, upon which hypothesis testing relies, thus invalidating any conclusions drawn from such an investigation. This is one of the reasons why the log form was used for some of the regressors, as it reduces the effect of substantial standard errors in relation to the smaller standard errors (Silva and Tenreyro, 2006). Moreover, robust standard errors are produced as part of the regression output to minimise the effects of heteroskedasticity. The presence of this property in a dataset may formally be examined using the White test.

d. Results

Table II: Model 1 Coefficients and Significance

	Coefficients	p-value	
Port_ita; Po_{it}	-498054	0.2760	
Customs_ita; C_{it}	-1.78828e+06	0.0054	***
Intermodal_ita; I_{it}	3.78037e+06	0.0017	***

The regression model (Model 1 in the Appendix) reveals that the port_ita regressor is not significant in determining the trade flow in Italy. On the other hand, both the customs efficiency and the intermodal infrastructure were shown to have a statistically significant link to trade activity. The intermodal infrastructure coefficient estimate was positive, in line with the expectations established prior to running the model. The customs efficiency result is more surprising. Contrary to expectations, its coefficient was negative. The sign of the port infrastructure regressor was also negative, contradicting predictions, however its lack of significance makes this result unreliable. The F-test statistic exhibits a low p-value of 0.0002, demonstrating the joint statistical significance of the regressors included in the model. Furthemore, the R^2 value of 0.985 signifies a high explanatory power for the regression.

Table III: Model 2 Coefficients and Significance

	Coefficients	p-value
Port_ita; Po_{it}	1.25438e+06	0.0306 **
Customs_ita; C_{it}	71923.7	0.8742

A separate scenario was modelled whereby the intermodal infrastructure regressor was excluded (Model 2 in the Appendix). This produced a positive, statistically significant coefficient estimate for port infrastructure. Meanwhile, the customs efficiency regressor became positive, but highly insignificant, with a p-value of 0.8742. The model retained a high explanatory power ($R^2 = 0.984$) and joint statistical significance according to the F-test.

e. Improvements to the Model

In this model fixed effects have been considered because of assumptions that have been previously presented, however it is worth noting that it is possible to perform a Huasman Test to verify which type of effects are the most appropriate to use. The reliability of the regression model could be enhanced by the inclusion of a two-way fixed effects (2FE) estimator, which would account for unobserved confounders for individual trade partners and specific time periods in the model, as demonstrated by Kien (2009).

As previously mentioned, the data used to create the indicators, taken from the WEF, is survey data. For this reason, it is proper to make a reflection on how this data can be biased. For instance, if there is a reduction in the volume of trade flows and thus in the amount of cargo that passes through the ports it might appear to operators that the infrastructure is of a more adequate level as it is better able to cope with the traffic. It is therefore plausible to

imagine that given the methodology used by the World Economic Forum there could be a relationship between trade flows and port infrastructure for which a decrease in trade flows creates an increase in indicator for port infrastructure. The same reasoning can be applied to the other indicators taken from the same source. This problem could be resolved by using data collected with other methodologies, which however is hard to find for a consistent time period. Another solution is proposed by Wilson et al. (2003) when using survey data for trade facilitation indicator, merely to oversample to reduce dependency on individual sources, however this does not seem to solve the possible causal relationship explained above.

A second limitation of the indicators is that the data is generic and not specific to cargo or commercial traffic. For instance, the port, rail, road, and air quality of infrastructure measured is composed of both levels of infrastructure for the transport of goods and that of people. As indicated by Wilson et al. (2005) this does not represent a significant problem as it can be assumed that there is a correlation between the two levels. However, more specific data always increases the accuracy of the study. The same reasoning can be applied within the realm of commercial transport. For instance, if there is a significant increase in the infrastructure that is used for the shipment of liquid bulk, creating an increase in the indicator for port infrastructure, the trade with most countries is not going to be affected because the trade of liquid bulk is limited to a few countries, and thus affects only on their value of trade flow. This is further stressed by the characteristics of Italian ports, where few ports handle all traffic typologies, while the rest are specialized in a few cargo typologies; Massa di Carrara in Marble, Taranto in solid bulk, Augusta in liquid bulk (Ferrari et al, 2015).

Another area of improvement of the model is the use of variables to reduce the omitted variable bias. As explained previously, in this model, GDP growth has been applied for this purpose, however there are also other variables that can be used. One example are tariff rates, which have a negative effect on trade and thus can be a cause of a variation in the volume of trade flows. Applying tariff rates in further studies is for this reason advisable.

f. Trade Potential

Having measured what the impact of the different variables of interest is on the volume of trade flow, it is also possible to consider how the volume of trade flows in Italy would change using one or more scenarios of “improved” port and/or intermodal infrastructure. There can be more than one objective in simulating an improved condition. Firstly, it can be used to proxy for the costs of the underdevelopment, measured in “lost” trade flows. Secondly, it can be used to inform policymakers on what the returns to investments in specific areas could be. To measure the costs it is appropriate to estimate what the trade flow would have been if the

variables were inflated to the level of other better performing European countries with similar characteristics of size, considered the 'optimal level'. To measure the effects of an investment there are two methods that can be used to create the improved scenario, firstly an indicator can be increased by a given percentage, otherwise, a degree of improvement towards the better performing countries can be selected, for instance decreasing by half the gap between Italy and average of other European countries with similar characteristics of size. The ' optimal level' will be calculated by the average level of France, Germany, and Spain.

In the last year of the data, 2017, Italy had a level of Port infrastructure of 4.4. In that same year Germany (5.5), France (5.1), and Spain (5.5) had an average of 5.366666667. Based on a 2017 total trade flow of $961,013,270,796 (Comtrade, n.d.) and the results of model 2, the cost of the port underdevelopment can be quantified to be $211.04 billion *lost export opportunity.* Considering a simulated scenario of a half-way improvement in the level of port infrastructure, which would require Italy to experience a 10.98% increase, trade flow would increase by $105.52 billion.

In the last year of the data, 2017, Italy had a level of Intermodal infrastructure of 4,4. In that same year Germany (5.6), France (5.8), and Spain (5.6) had an average of 5.666666667. Based on a 2017 total trade flow of $961,013,270,796 (Comtrade, n.d.) and the results of model 1, the cost can be quantified to be $276.58 billion *lost export opportunity.* Considering the simulated scenario of a half-way improvement in the level of intermodal infrastructure, which would require Italy to experience a 14.39% increase, trade flow would increase by $138.29 billion. It has to be mentioned that in case of an increase in the intermodal infrastructure the increase in trade flow cannot be entirely attributed to the increase in port development, but also to the direct effects that a more developed rail, road, and air transport infrastructure have on trade flows. It is however appropriate to assume that the majority of the increase is due to the relationship that intermodal infrastructure has for the development of ports given that maritime trade represents by far the largest means of international trade.

6. Concluding Remarks

This paper set out to understand what the causes and costs of the underdevelopment of the Italian port system are. To develop an understanding of this issue it made use of multiple disciplines and approaches. A historical analysis of the relationship between Italy and the sea has been made in section 2 to investigate possible underlying causes for the port underdevelopment. A literature review, performed in section 3, has illustrated the state of the art literature in respect to the relationship between ports and development, the factors that

determine the competitiveness of ports, the impact of the container on ports, and the governance structure of the Italian port system. This section has served multiple purposes, each part having a specific role within the research. Understanding the relationship between ports and economic development (a) was necessary to justify given that the research question can be seen as to imply that there is an expected relationship between the two. Containerization (b) has characterized and strongly impacted the shipping industry during the last half century and is therefore essential to understand in order to study port development. Investigating the characteristics that determine the development and competitiveness of ports (c) was necessary in order to identify the explanatory variables that were necessary to include in the empirical model. Lastly, the governance structure (d) of the Italian port system has been considered as a relevant contribution to the research given that the literature review on the factors of competitiveness shows that port governance is determinant for several factors. Following the literature review, an econometric analysis using the gravity model of international trade is performed to measure the impact that port infrastructure, intermodal infrastructure, and customs efficiency have on the trade flows between Italy and 39 trading partners. The results are then used to create a simulation of the trade flow volume under improved characteristics to measure the lost export opportunity. The results of the simulation can also be used to measure the returns for the national economy for an investment in one of the variables included. The insights that have been collected will now be integrated to lead to a new understanding.

The historical analysis brings evidence of the determinant role of ports for the development of Italy in history. Moreover, it illustrates that Italy has suffered from a loss of its maritime vacation since it's unification. Identifying direct causes between the de-maritimizaation of the country and the underdevelopment of the port system is arduous. Nonetheless, the historical context brings relevant contributions in understanding the context in which political decisions that have characterized ports and national maritime strategy have been made; such as the abolition of the Ministry of the Mercantile Marine, the governance structure of the port authorities, the tardiness in declaring exclusive economic zones (EEZ) (Sisto, 2020), and the lack of control over the Strait of Sicily and other strategic areas over which Italy benefits from an advantageous geographical position (Caffio, 2020).

The literature review provides two insights on the shipping sector and international trade routes that are key to develop a holistic understanding. The Mediterranean is increasingly reappearing as the center of world trade routes given the growth of Asia and the diffusion of the post-panamax containerships. The rise of the container has revolutionized the shipping industry and has changed the factors of competitiveness of a port. Moreover, it provides relevant insights in respect to the case of Italy. The most important being that the fragmented

governance structure is strongly connected to local interests and does not design the ideal incentives and administrative mechanisms for long term planning and that the elevated number of ports decreases the individual efficiency and thus the competitiveness with foreign ports.

Furthemore, the literature review provides three factors of port competitiveness that are analysed through an empirical model, these are: port infrastructure, intermodal infrastructure, and bureaucratic efficiency (measured using customs procedures as a proxy). The analysis indicates that intermodal infrastructure is the most determinant factor in limiting the development of ports, as it has a positive and significant effect on trade volumes, as expected. Customs efficiency instead presents results that are harder to analyze, as the variable turns out significant but negative, which is contrary to what the literature predicts. This result, which does not find any grounding in the literature, is most likely a cause of the survey nature of the data or a consequence of the relationship to other variables; it in fact appears as positive and non-significant when removing intermodal infrastructure from the model. The third explanatory variable, port infrastructure, included results as non-significant in the first model, however this appears to be a consequence of its correlation with intermodal infrastructure; as it results positive and significant when tested without intermodal infrastructure.

The data collected for the empirical analysis indicates that attributing the poor quality of port infrastructure entirely to the fact that Italy has diminished its interest in maritime affairs would be unsound given that the data on other means of intermodal transport are on the same level as ports (Table 5). It is therefore possible to individuate a more structural issue with regards to infrastructure development. However, the data does not specifically measure how well connected the ports are to the other means of intermodal infrastructure, which is instead a concern raised in the literature.

The simulation of potential trade flow (f) which had the aim of quantifying the costs in lost potential trade indicates that there are substantial costs experienced by the Italian economy as a consequence of the underdevelopment of Italian ports. Considering the trade flow of 2017, the simulation using results from model 1 determines that the costs of the underdevelopment is $276.58 billion of lost trade. Alternatively, the simulation using results from model b determines that the costs of the underdevelopment is $211.04 billion of lost trade. Indications on what the effects of investments that increase the infrastructure level of port and intermodal transport are also determined, respectively $105.52 billion and $138.29 billion for a half-way increase towards the ‘optimal level’.

The main takeaway that can be derived from integration of the different disciplines and methods used in this research is the following. The Italian port system has the potential to be an important instrument for the growth of Italy thanks to its geographic position, as port development can increase the volume of international trade significantly, and currently represents a high cost. However, for it to develop it is necessary to implement an efficient governance structure that is able to create an efficient and well-connected intermodal infrastructure and determine a long term strategy that is independent of local interests in order create a selected number of hub ports that are able to compete in terms of TEU volume and port call frequency with WestMed and Northern Range ports. Nonetheless, it is clear that until Italy will not renew its maritime vocation and return to consider the development of port infrastructure and control of maritime trade routes as imperative for its cultural and economic development there will be no major evolution in the governance structure. As ruled by the President of the Port of Trieste Zeno D'agostino: "We will have the coordination of the Italian port system when Italy will have a strategy, not vice versa"[6] (D'Agostino, 2020).

[6] Quote translated by the author. Original: *"Avremmo il coordinamento della Portualità Italiana quando l'Italia avrà una strategia, non viceversa"*.

References

Abulafia, D. (2014). Thalassocracies. A Companion to Mediterranean History, 137-153.

Allen, T., Arkolakis, C., Takahashi, Y. (2020). Universal Gravity. Journal of Political Economy, 128(2).

Anderson, J. E. (1979). A theoretical foundation for the gravity equation. The American economic review, 69(1), 106-116.

Andreozzi, D. (2011). Centro e confine: Porto, spazi e strategie portuali a Trieste tra XVIII e XXI secolo. *I porti della penisola italiana: Due mari a confronto tra storia e sviluppo futuro; Atti del convegno di studi, Ancona, 8–9 aprile 2011*, 13-24.

ANSA. (2021). Piano Nazionale di Ripresa e Resilienza. Ansa.it. Retrieved 4 June 2021, from https://www.ansa.it/documents/1610403841219_Bozza_Recovery_01_Cover.pdf.

Anwar, M. (2019). Digitalization in Container Terminal Logistics: A Literature Review. In 27th Annual Conference of International Association of Maritime Economists, Athens (pp. 1-25).

Autorità di Sistema Portuale del Mar Ligure Occidentale. Autorità di Sistema Portuale del Mar Ligure Occidentale. Retrieved 5 June 2021, from https://www.portsofgenoa.com/it/chi-siamo/autorita-di-sistema.html.

Baccelli, O., & Morino, P. (2020). The role of port authorities in the promotion of logistics integration between ports and the railway system: the Italian experience. *Research in Transportation Business & Management*, *35*, 100451.

Barjamovic, G., T. Chaney, K. Coşar, and A. Hortaçsu (2019), "Trade, Merchants, and the Lost Cities of the Bronze Age." Quarterly Journal of Economics 134(3): 1455–1503.

Bergstrand, J. H. (1985). The gravity equation in international trade: some microeconomic foundations and empirical evidence. The review of economics and statistics, 474-481.

Beretta, E., Vacche, A. D., & Migliardi, A. (2011). Connessioni logistiche, efficienza e competitività: un'indagine sul sistema portuale Italiano.

Beretta E., Vacche A.D, & Migliardi A (2011), Competitività ed efficienza della supply-chain: un'indagine sui nodi della logistica in Italia, Banca d'Italia, in questo volume.

Bosker, M., Brakman, S., Garretsen, H., De Jong, H., & Schramm, M. (2008). Ports, plagues and politics: explaining Italian city growth 1300–1861. European Review of Economic History, 12(1), 97-131.

Bottasso A, Conti M, Ferrari C, Tei A (2014) Ports and regional development: a spatial analysis on a panel of European regions. Transp Res A Policy Pract 65:44–55

Brooks, M. R., & Cullinane, K.. (2006). *Devolution, port governance and port performance*. Elsevier.

Brooks, M. R., & Pallis, A. A. (2008). Assessing port governance models: process and performance components. Maritime Policy & Management, 35(4), 411-432.

Buonsanti, A.A.. (2014). Port competitiveness in the Mediterranean and Northern Europe: comparison among regional systems. Florence: Srm.

Caffio, F., 2020. Non lasciamo ad altri la delimitazione del Canale di Sicilia. Limes Rivista Italiana di Geopolitica, (10), pp.209-216.

Camera dei Deputati della Repubblica Italiana. Schema di decreto legislativo recante riorganizzazione, razionalizzazione e semplificazione della disciplina concernente le autorità portuali di cui alla legge 28 gennaio 1994, n. 84 (2015). Rome.

Caracciolo, L. (2019). Prefazione. In Ilari, V. (ed.) , Italy on the Rimland: Storia Militarre di una Pensiola Euroasiatica (pp. 11-15). Nadir Media Edizioni

Caracciolo, L., 2020. Non moriremo guardiani di spiaggia. Limes Rivista Italiana di Geopolitica, (10), pp.7-37.

Carbone, S. M., & Munari, F. (2006). La disciplina dei porti tra diritto comunitario e diritto interno. Milan: Giuffré.

Cazzaniga Francesetti, D., & Foschi, A. D. (2002). Mediterranean versus Northern Range Ports. Why do Italian containers still prefer routing via the Northern Range Ports? Advice for a new policy. *Why do Italian Containers Still Prefer Routing via the Northern Range Ports*.

Chesney, G. T. (1871). The Battle of Dorking: Reminiscences of a Volunteer. William Blackwood and Sons.

Clark, X., Dollar, D., & Micco, A. (2004). Port efficiency, maritime transport costs, and bilateral trade. *Journal of development economics*, *75*(2), 417-450.

Classe, L. (2020). La Serenissima Repubblica di Venezia e gli Stati Uniti d'America: due modelli di leadership a confronto. Università degli Studi di Ferrara.

Comtrade. (n.d). UN Comtrade | International Trade Statistics Database. Comtrade.un.org. Retrieved 6 June 2021, from https://comtrade.un.org/.

Conte, M., Cotterlaz, P., & Mayer, T. (2021). The CEPII Gravity Database.

Cullinane, K., & Khanna, M. (1999). Economies of scale in large container ships. Journal of transport economics and policy, 185-207.

Strano, M. (2019). La rete dei commerci a Ponente e Levante della penisola italiana. Rassegna critica su tre contributi. EuroStudium.

Chesney, G. T. (1871). The Battle of Dorking: Reminiscences of a Volunteer. William Blackwood and Sons.

D'agostino, Z. (2020). 'La vera storia dei Cinesi a Trieste'. Limes Rivista Italiana di Geopolitica, (10), pp.147-154.

Deardorff, A. (1998). A Theoretical Foundation for Gravity Model. The Regionalization of the World Economy, University of Chicago Press, Chicago.

De Langen, P. W., & van der Lugt, L. M. (2006). Governance structures of port authorities in the Netherlands. *Research in Transportation Economics*, *17*, 109-137.

Demil, B., & Lecocq, X. (2006). The box: how the shipping container made the world smaller and the world economy bigger. M@ n@ gement, 9(2), 73.

Di Vaio, A., & Varriale, L. (2020). Digitalization in the sea-land supply chain: experiences from Italy in rethinking the port operations within inter-organizational relationships. Production Planning & Control, 31(2-3), 220-232.

Duncan, J.B. (2020). The Etruscan Thalassocracy. University of Colorado.

Dwarakish, G. S., & Salim, A. M. (2015). Review on the Role of Ports in the Development of a Nation. Aquatic Procedia, 4, 295-301.

Eaton, J., & Kortum, S. (1997). Technology and bilateral trade (No. w6253). National Bureau of Economic Research.

Eliseo, M. (2020). La storia che ci raccontiamo: come recuperare la memoria marittima. Limes Rivista Italiana di Geopolitica, (10), pp. 107-113.

Fabbri, D. 2020. Italia, pensiola senza mare. Limes Rivista Italiana di Geopolitica, (10), pp. 47-56.

Fardella, E., & Prodi, G. (2017). The belt and road initiative impact on Europe: An Italian perspective. China & World Economy, 25(5), 125-138.

Ferrari, C. 2011. Ports and regional economic development: Global Ports and Urban Development: Challenges and Opportunities, OECD, Paris, 9th December 2011

Ferrari, C., & Musso, E. (2011). Italian ports: towards a new governance?. *Maritime Policy & Management*, *38*(3), 335-346.

Ferrari C, Percoco M, Tedeschi A (2010) Ports and local development: evidence from Italy. Int J Transport Econ 37(1):9–30)

Ferrari, C., Tedeschi, A., & Percoco, M. (2010). Ports and local development: Evidence from Italy. *Ports and Local Development*, 1000-1022.

Ferrari, C., & Tei, A. (2016). La riforma dei porti italiani: innovazioni e questioni irrisolte. *Rivista di economia e politica dei trasporti*, (1).

Ferrari, C., Tei, A., & Merk, O. (2015). The Governance and Regulation of Ports: the case of Italy.

Gazzetta Ufficiale della Repubblica Italiana. Decreto Legislativo 4 agosto 2016, n. 169 (2016). Rome.

Guerrero, D., Rodrigue, J.P. (2014) The Waves of Containerization: Shifts in Global Maritime Transportation. Journal of Transport Geography, Elsevier, 34, pp 151-164.

Gwynn, D. (1940). Italy and the Mediterranean. *Studies: An Irish Quarterly Review*, 197-208.

Hayuth, Y. (1981), Containerization and the load center concept. Economic Geography, 57:2, 160-176

Head, K. (2003). Gravity for beginners. University of British Columbia, 2053.

Helling A (1997) Transportation and economic development a review. Public Works Manag Policy 2(1):79–93

Host, A., Pavlić Skender, H., & Zaninović, P. A. (2019). Trade logistics–the gravity model approach. Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu, 37(1), 327-342.

Isard, W. (1954). Location theory and trade theory: short-run analysis. *The Quarterly Journal of Economics*, 305-320.

ISPRA. (2011). Mare e Ambiente Costiero. Isprambiente.gov.it. Retrieved 15 April 2021, from https://www.isprambiente.gov.it/files/pubblicazioni/statoambiente/tematiche2011/05_%20Mare_e_ambiente_costiero_2011.pdf.

Karemera, D., Oguledo, V. I., & Davis, B. (2000). A gravity model analysis of international migration to North America. Applied economics, 32(13), 1745-1755.

Kien, N. T. (2009). Gravity model by panel data approach: an empirical application with implications for the ASEAN free trade area. ASEAN Economic Bulletin, 266-277.

Krugman, P., Melitz, M., & Obstfeld, M. (2018). International Economics: Theory and Policy, Global Edition (11th ed.). Pearson.

Levinson, M. (2006). Container shipping and the decline of New York, 1955-1975. Business History Review, 49-80.

Li, K. X., Jin, M., Qi, G., Shi, W., & Ng, A. K. (2018). Logistics as a driving force for development under the belt and road initiative–the Chinese model for developing countries. Transport Reviews, 38(4), 457-478.

Linnemann, H. (1966). An Econometric Study of International Trade Flows. North-Holland Publishing Co.

Magri, P. (2020). Gli USA e il mondo: il futuro dei rapporti con l'Italia. ispionline. Retrieved 16 June 2021, from https://www.ispionline.it/it/pubblicazione/gli-usa-e-il-mondo-il-futuro-dei-rapporti-con-litalia-27921.

Marchese, U., Musso, E., & Ferrari, C. (1998). The role for ports in intermodal transports and global competition: A survey of Italian container terminals. In Parola, F., Ferrari, C., Tei, A., Satta, G., & Musso, E. (2017). Dealing with multi-scalar embeddedness and

institutional divergence: Evidence from the renovation of Italian port governance. Research in Transportation Business & Management, 22, 89-99.

Marina Militare. (2013). L'opera della Marina Militare dopo l'8 Ottobre 1943. Ministero della Difesa.

Marina Militare. Il Trattato di Pace e le sue conseguenze. Ministero della Difesa. Retrieved 16 June 2021, from https://www.marina.difesa.it/noi-siamo-la-marina/storia/la-nostra-storia/storianavale/Pagine/trattato.aspx.

Marino, A. 2020. Idee per un nuovo governo del mare. Limes Rivista Italiana di Geopolitica, (10), pp.101-102.

Mieli, P. (2021). Paolo Mieli, al Corriere della Sera, racconta il libro di Eugenio Di Rienzo: Il Regno delle Due Sicilie e le Potenze europee (1830-1861). *Corriere Della Sera*. Retrieved 4 May 2021, from https://www.store.rubbettinoeditore.it/rassegna-stampa/paolo-mieli-al-corriere-della-sera-racconta-il-libro-di-eugenio-di-rienzo-il-regno-delle-due-sicilie-e-le-potenze-europee-1830-1861/.

Migliardi, A., Beretta, E., & Dalle Vacche, A. (2012). Competitività ed efficienza della supply-chain: un'indagine sui nodi della logistica in Italia. Competitività ed efficienza della supply-chain: un'indagine sui nodi della logistica in italia, 135-173.

Ministero dell'Economia e Finanza. (2021). The Recovery and Resilience Plan: Next Generation Italia. Retrieved 4 June 2021, from https://www.mef.gov.it/en/focus/The-Recovery-and-Resilience-Plan-Next-Generation-Italia/.

Ministero delle Infrastrutture dei Trasporti, M.D.I. (2015). Piano strategico nazionale della portualità e della logistica.

Montanelli, I., Gervaso, R., & Cervi, M. (1974). Storia d'Italia. Rizzoli.

Munim, Z. H., & Schramm, H. J. (2018). The impacts of port infrastructure and logistics performance on economic growth: the mediating role of seaborne trade. *Journal of Shipping and Trade*, *3*(1), 1-19.

N° 747. Treaty of peace with Italy. Union of Soviet Socialist Republics, United Kingdom of Great Britain and Northern Ireland, United States of America, Cina, France, Australia, Belgium, Soviet Socialist Republic of Belrus, Brasil, Canada, Checoslovaquia,

Ethiopia, Greece, India, Netherlands, New Zealand, Poland, Soviet Socilist Republic of Ukraine, Union of South Africa, Federal Popular republic of Yugoslavia, Italy. 10 February 1947. Cvce.

Noto, L. (2020). Genova contro Venezia: le remote radici di una rivalità permanente. Limes Rivista Italiana di Geopolitica, (10), pp.123-128.

Notteboom, T., & Yap, W. Y. (2012). Port competition and competitiveness. *The Blackwell companion to maritime economics*, 549-570.

Notteboom, T. (2008). The Relationship Between Sea Ports And Intermodal Hinterland In Light Of Global Supply Chains: European Challenges", Discussion Paper 2008-10, University of Antwerp, Belgium, 2008.

Notteboom, T. (2009). The relationship between seaports and the intermodal hinterland in light of global supply chains: European challenges.

O'Rourke, K. H., Jacks, D. S., & Taylor, A. M. (2020). The Gravitational Constant? (No. w27904). National Bureau of Economic Research.

Panaro, A. 2020. Manuale di Sopravvivenza nella Savana Mediterranea. Limes Rivista Italiana di Geopolitica, (10), pp.155-173.

Parola, F., Ferrari, C., Tei, A., Satta, G., & Musso, E. (2017). Dealing with multi-scalar embeddedness and institutional divergence: Evidence from the renovation of Italian port governance. Research in Transportation Business & Management, 22, 89-99.

Parola, F., Tei, A., & Ferrari, C. (2012). Managing port concessions: Evidence from Italy. Maritime Policy & Management, 39, 45–61.

Pistilli, G., Campagna, A., Persia, L., & Saporito, M. R. (2020). Regionalization of ports as a strategic leverage to improve competitiveness: A study on central Italy ports and related hinterland. International Journal of Transport Development and Integration, 4(1), 51-61.

Pöyhönen, P. (1963). A tentative model for the volume of trade between countries. Weltwirtschaftliches Archiv, 93-100.

Presidenza del Consiglio dei Ministri P.D.C. (2013). Iniziativa di Studio sulla Portualità Italiana.

Sanchez, R. J., Hoffmann, J., Micco, A., Pizzolitto, G. V., Sgut, M., & Wilmsmeier, G. (2003). Port efficiency and international trade: port efficiency as a determinant of maritime transport costs. *Maritime economics & logistics*, *5*(2), 199-218.

Savoretti, A. (2013). *La Marina Mercantile Durante Il Ventennio Fascista* [Ebook]. Ministero Della Difesa. Retrieved 4 April 2021, from https://www.marina.difesa.it/media-cultura/editoria/bollettino/Documents/2013/Dicembre/Savoretti.pdf.

Schwab, K. (2009). The Global Competitiveness Report 2009-2010. World Economic Forum.

Schwab, K. (2010). The Global Competitiveness Report 2010-2011. World Economic Forum.

Schwab, K. (2011). The Global Competitiveness Report 2011-2012. World Economic Forum.

Schwab, K. (2012). The Global Competitiveness Report 2012-2013. World Economic Forum.

Schwab, K. (2013). The Global Competitiveness Report 2013-2014. World Economic Forum.

Schwab, K. (2014). The Global Competitiveness Report 2014-2015. World Economic Forum.

Schwab, K. (2015). The Global Competitiveness Report 2015-2016. World Economic Forum.

Schwab, K. (2016). The Global Competitiveness Report 2016-2017. World Economic Forum.

Schwab, K. (2017). The Global Competitiveness Report 2017-2018. World Economic Forum.

Shan J, Yu M, Lee C-Y (2014) An empirical investigation of the seaport's economic impact: evidence from major ports in China. Transport Res E-Log 69:41–53

Silva, J. S., & Tenreyro, S. (2006). The log of gravity. The Review of Economics and Statistics, 88(4), 641-658.

Sisto, L. 2020. Senza una una regia unica per l'economia del mare l'italia affonda. Limes Rivista Italiana di Geopolitica, (10), pp. 99-105.

Smith, A. (1776). The wealth of nations.

Soloaga, I., Wilson J., Mejìa, A. (2006). Moving Forward Faster: Trade Facilitation Reform and Mexican Competitiveness. World Bank Policy Research Working Paper 3953.

Stewart, J. Q. (1947). Empirical mathematical rules concerning the distribution and equilibrium of population. *Geographical review*, *37*(3), 461-485.

Ramos, R., & Suriñach, J. (2017). A gravity model of migration between the ENC and the EU. Tijdschrift voor economische en sociale geografie, 108(1), 21-35.

Ricardo J. Sánchez, Alejandro Miccó, Jan Hoffmann, Georgina V. Pizzolitto Martín Sgut (2002), Port efficiency and international trade: Port efficiency as a determinant of the maritime transport cost. IAME Panama 2002, Panama.

Rossi, C. (1872). Il racconto di un guardiano di spiaggia: Traduzione libera della "Battaglia di Dorking" Capraia 189… . Tipografia Eredi Botta.

Tiburzi, F. (2018). Italia, Cina e la Nuova Via della Seta. *Geopolitical Report*, 66.

Tinbergen, J. (1962). Shaping the world economy; suggestions for an international economic policy.

The World Bank. (n.d.). Container port traffic (TEU: 20 foot equivalent units) | Data. [online] Available at: <https://data.worldbank.org/indicator/IS.SHP.GOOD.TU> [Accessed 26 March 2021].

The World Bank. (n.d). GDP growth (annual %) Data. Data.worldbank.org. Retrieved 4 June 2021, from https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG.

The World Bank. (n.d.) Liner shipping connectivity index | Data. Data.worldbank.org. Retrieved 4 June 2021, from https://data.worldbank.org/indicator/IS.SHP.GCNW.XQ.

Train, A. H. (1988). Maritime strategy in the Mediterranean. *Adelphi Papers*, *28*(229), 49-60.

Valleri, M. A., Lamonarca, M., & Papa, P. (2006). Port governance in Italy. *Research in Transportation Economics*, *17*, 139-153.

Vego, M. (2018). *Maritime Strategy and Sea Denial: Theory and Practice*. Routledge.

Vining, A. R., & Boardman, A. E. (2008). The potential role of public-private partnerships in the upgrade of port infrastructure: normative and positive considerations. Maritime Policy & Management, 35(6), 551-569.

Wilson, J., Mann, C., & Otsuki, T. (2003). Trade facilitation and economic development: measuring the impact. The World Bank.

Wilson, J. S., & Otsuki, T. (2007). Regional integration in South Asia: What role for trade facilitation. The World Bank.

Wright, O. J. (2019). *Great Britain and the unifying of Italy: a special relationship?*. Springer.

Yochum, G. R., & Agarwal, V. B. (1987). Economic impact of a port on a regional economy: note. *Growth and Change*, *18*(3), 74-87.

Appendix

Table 1: Regression Overview

Variable	Expected Sign
Port Infrastructure Po_{it}	(+)
Custom's efficiency C_{it}	(+)
Intermodal Infrastructure I_{it}	(+)

Table 2: VIF test

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-2.706E+8	22785731.0		-11.875	<.001		
	gdpgrowth_other (%)	-37727.734	143365.719	-.011	-.263	.793	.596	1.677
	gdpgrowth_ita (%)	82671.305	254483.299	.014	.325	.745	.540	1.853
	contig	5987584.55	1855098.29	.115	3.228	.001	.831	1.203
	port_ita	-695862.58	3252078.46	-.015	-.214	.831	.221	4.518
	Customs_ita	-708371.85	4959557.61	-.006	-.143	.887	.561	1.783
	Intermodal_ita	3777696.11	5548537.93	.050	.681	.496	.194	5.160
	E	4261962.49	1408841.18	.162	3.025	.003	.370	2.706
	log(MM)	16485091.5	1063310.00	.778	15.504	<.001	.420	2.379
	Log(PP)	2092471.65	1139250.13	.105	1.837	.067	.323	3.100
	log(D)	-14306738	1605349.47	-.497	-8.912	<.001	.340	2.945

a. Dependent Variable: tradeflow_baci

Model 1: Panel Regression Analysis with Customs, Intermodal, and Port

```
Modello 1: Effetti fissi, usando 351 osservazioni
Incluse 39 unità cross section
Lunghezza serie storiche = 9
Variabile dipendente: tradeflow_baci
Errori standard robusti (HAC)
Omesse per perfetta collinearità: E logD

                    coefficiente       errore std.     rapporto t  p-value
  ------------------------------------------------------------------------------
  const                -1.13918e+08       4.18366e+07   -2.723     0.0097   ***
  gdpgrowth_other    85347.4           51691.0            1.651     0.1070
  gdpgrowth_ita      28585.8           30062.7            0.9509    0.3477
  contig                1.67996e+06  433021              3.880     0.0004   ***
  Port_ita           -498054          555964             -0.8958    0.3760
  Customs_ita          -1.78828e+06  605943             -2.951     0.0054   ***
  Intermodal_ita        3.78037e+06       1.12268e+06    3.367     0.0017   ***
  logMM                 9.92841e+06       2.26126e+06    4.391     8.72e-05 ***
  LogPP                -6.65226e+06       3.15280e+06   -2.110     0.0415   **

Media var. dipendente   10110873   SQM var. dipendente     13144887
Somma quadr. residui    8.84e+14   E.S. della regressione   1705279
R-quadro LSDV           0.985382   R-quadro intra-gruppi   0.231831
Log-verosimiglianza    -5509.401   Criterio di Akaike      11112.80
Criterio di Schwarz     11294.26   Hannan-Quinn            11185.02
rho                     0.446132   Durbin-Watson           0.795608
Note: SQM = scarto quadratico medio; E.S. = errore standard

Test congiunto sui regressori -
  Statistica test: F(8, 38) = 5.22369
  con p-value = P(F(8, 38) > 5.22369) = 0.000192312

Test robusto per la differenza delle intercette di gruppo -
  Ipotesi nulla: i gruppi hanno un'intercetta comune
  Statistica test: Welch F(38, 109.4) = 300.669
  con p-value = P(F(38, 109.4) > 300.669) = 9.26013e-95
```

Model 2: Panel Regression Analysis with Customs and Port

```
Modello 2: Effetti fissi, usando 351 osservazioni
Incluse 39 unità cross section
Lunghezza serie storiche = 9
Variabile dipendente: tradeflow_baci
Errori standard robusti (HAC)
Omesse per perfetta collinearità: E logD

                    coefficiente      errore std.     rapporto t  p-value
  ------------------------------------------------------------------------
  const               -1.21662e+08       3.87423e+07   -3.140     0.0033   ***
  gdpgrowth_other  99658.3           55261.2             1.803     0.0793   *
  gdpgrowth_ita    11615.0           31322.0             0.3708    0.7128
  contig               1.69620e+06  402642              4.213     0.0001   ***
  Port_ita             1.25438e+06  558648              2.245     0.0306   **
  Customs_ita      71923.7           451113              0.1594    0.8742
  logMM                1.00555e+07       2.20656e+06    4.557     5.24e-05 ***
  LogPP               -5.95687e+06       2.50361e+06   -2.379     0.0225   **

Media var. dipendente   10110873   SQM var. dipendente     13144887
Somma quadr. residui    9.13e+14   E.S. della regressione   1730600
R-quadro LSDV           0.984895   R-quadro intra-gruppi   0.206247
Log-verosimiglianza    -5515.151   Criterio di Akaike      11122.30
Criterio di Schwarz     11299.90   Hannan-Quinn            11192.98
rho                     0.447696   Durbin-Watson           0.796081
Note: SQM = scarto quadratico medio; E.S. = errore standard

Test congiunto sui regressori -
  Statistica test: F(7, 38) = 5.87842
  con p-value = P(F(7, 38) > 5.87842) = 0.000113786

Test robusto per la differenza delle intercette di gruppo -
  Ipotesi nulla: i gruppi hanno un'intercetta comune
  Statistica test: Welch F(38, 109.4) = 303.48
  con p-value = P(F(38, 109.4) > 303.48) = 5.49256e-95
```

Table 3: Port infrastructure Improvement scenario

PORT INFRASTRUCTURE INDEX					
Country	Index (1-7; 7)	Average	Half-way	Improvement	% Improvement
ITA	4,4		4,883333	0,483333333	0,109848485
		5,366667			
FRA	5,1				
DEU	5,5				
ESP	5,5				

Table 4: Intermodal Infrastructure Improvement scenario

INTERMODAL INFRASTRUCTURE INDEX					
Country	Index (1-7; 7)	Average	Half-way	Improvement	% Improvement
ITA	4,4		5,033333	0,633333333	0,143939394
		5,666667			
FRA	5,8				
DEU	5,6				
ESP	5,6				

Table 5: Infrastructure development in Italy (1-7; best 7)

Year	Ports	Road	Air	Rail
2009	3,660	4,032	4,100	3,397
2010	3,910	4,223	4,265	3,635
2011	3,909	4,196	4,596	3,527
2012	3,859	4,339	4,728	3,606
2013	4,284	4,365	4,353	4,238
2014	4,472	4,255	4,294	4,138
2015	4,321	4,422	4,525	3,961
2016	4,373	4,554	4,597	4,107
2017	4,400	4,500	4,600	4,100