Master Thesis
Urban, Port and Transport Economics

Port-city interface under pressure: providing more port related local benefits through waterfront redevelopments based on the attraction of the creative class

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Abstract

Due to the disequilibrium between the local costs and benefits of a port, the port-city interface is under pressure. More port related local benefits for the city must be created, to strengthen the relationship between the port and the city. This thesis investigates whether waterfront projects effectively create port related benefits for the port-city by attracting the creative class and therefore improve the relationship between the port and the city. For this research the Rotterdam Makers District will be featured as waterfront redevelopment project. This district consists of two areas: *Rotterdam Droogdok Maatschappij* (RDM) and *Merwe-Vierhavens* (M4H) area. According to the literature review, the RDM is already considered as a successful waterfront redevelopment project. This is not suggested for the M4H area; therefore, the empirical research focuses on the M4H area. Two different datasets are used for deriving a conclusion to the research question. The first dataset is a *company overview* of the M4H, which consists of information regarding the economic activities of the companies in that area. Based on this information is determined whether a company is port and/or creative related. The other dataset is an extract of the *LISA database.* This dataset provides information about the economic growth in the M4H area. In this research, economic growth is considered as a local benefit and the indicator for this growth is job growth. The *Ordinary Least Square* (OLS) method is used for providing regression results regarding job growth. In addition, the dataset is used for making descriptive statistics regarding the economic growth of port and creative related companies. The descriptive statistics of the LISA dataset and the company overview suggest that the creative class is attracted in the M4H area and creates local benefits, such as job growth. However, the attracted creative capital is not suggested to be port related. The OLS regression results were not significant, and no further conclusions can be drawn from these regressions. The results regarding the statistics imply that through waterfront redevelopment projects the creative class can be attracted, which can lead to local benefits. Nevertheless, the results suggest that these local benefits do not contribute to the strengthening of the port-city relationship, because the benefits are not port related.

Contents

1. Introduction

Port-cities are important nodes of international transport, regulating transport flows all over the world (Kokot, 2008). In the past the relation between the port and the city was considered as strong. (Hesse, 2018). However, the port-city interface, as we traditionally refer to the overlap of the physical site and the overlap of the economic functions of the port and city, has been changing over the past century (Hesse, 2018). Consequently, the relationship between the port and city has transformed drastically. According to Musso et al. (2000), a disequilibrium of the local costs and local benefits of the port has arisen. Due to globalisation, local benefits have become more global benefits and at the same time port related costs are increasing, such as congestion and pollution (Musso, Benacchio, & Ferrari, 2000). To strengthen the relationship between the port and the city, more port related local benefits for the city must be created. One of the opportunities to generate local benefits is port related waterfront development (Merk, 2013). Port related waterfront development projects are focusing on transforming old industrial port sites into something new (Merk, 2013). Sepe (2013) suggests that particularly waterfront revitalisation projects are a great starting point for innovative redevelopment strategies for the whole urban region. Florida (2005) adds that an innovative environment is one of the critical factors of attracting creative capital. Based on a relational assets in the urban region, creative capital has the ability to generate innovation in different fields, such as scientific research, technological improvements and art (Jansen, 2020). Florida (2005) points out that one of the major positive effects of the attraction of the creative capital is that members of the creative class power local economic growth. Therefore, the attraction of creative capital through waterfront redevelopment can create local benefits. To strengthen the port city relationship, it is important that local benefits are also partly port related. This leads to the following main research question:

> *"Do waterfront redevelopment projects effectively create port related local benefits for the port-city by attracting the creative class and therefore, improve the relationship between the port and the city?"*

This research question will be answered by analysing former studies about the port-city relationship, waterfront redevelopment and the creative class (e.g. Hoyle & Wright, (1999); Merk, (2013); Cowen & Bunce, (2006); Gordon, (1996); Daamen & Louw, (2016); Douglas, (1984); Daamen (2010); Florida (2005)) and by investigating a specific waterfront redevelopment project, namely the Rotterdam Makers District. This project consists of two

areas: the RDM and the M4H and has a focus on a great mix of different goals, such as residential areas, organised events, and workplaces (Rotterdam Makers District, 2017). The main research question is split into the following four sub questions, which are specified on the Rotterdam Makers District:

Sub question 1:   *"To what extent are the economic activities that resulting from the waterfront redevelopment project in the Rotterdam Makers District, port related?"*

Sub question 2:   *"By investigating the economic activities, is the Rotterdam Makers District attracting creative capital and to what extent is this creative capital port related?"*

Sub question 3:   *"Is the Rotterdam Makers district generating economic growth through the attraction of creative capital as a local benefit?"*

Sub question 4:   *"While focussing on attracting creative capital, does the Rotterdam Makers district also continue with generating economic growth through their port companies?"*

The sub questions are partly answered by the existing literature, which is elaborated in chapter two. Besides reviewing literature, more empirical study is needed to provide a better understanding between the relation of waterfront redevelopment projects and creative capital, which might be also port related. Therefore, a case study will be performed in this thesis. The focus of the case study is mainly on the M4H area, because the literature review showed that the RDM is already considered as a successful maritime and the more physical developments will be done in the M4H. Th data that is collected for this case study is presented in chapter three. After showing the data, the research methods are elaborated in chapter four. The first two sub questions are answered by investigating the economic activities of a company overview of the M4H. An answer for the last two sub questions is provided by investigating descriptive statistics and regressions. The hypothesis for sub question three is as follows:

Hypothesis 1: *A creative related company generates more job growth for the M4H area than non-creative companies.*

The hypothesis for sub question four is not focussing on creative capital, but on port related companies:

Hypothesis 2: *A port related company generates less job growth for the M4H area than non-port related companies.*

 In chapter six the results will be presented and discussed. And lastly, the conclusion and discussion are elaborated in chapter seven. New insights will be provided with the Rotterdam Makers District case study, because the primary focus is on the attraction of the creative capital as a port related local benefit. The connection between the creative capital and waterfront redevelopment might be an important addition to the existing literature of waterfront redevelopment projects.

2. Literature framework

2.1 Introduction

The Literature framework provides essential information about previous research that contributes to answering the main research question of this thesis. The framework starts with the elaboration of the port-city interface and the contemporary challenges that it faces. This section demonstrates the importance of strengthening the port-city relation. Waterfront redevelopment is seen as one of the solutions of making the port-city interface more connected, because successful waterfront redevelopment project can lead to economic growth for the urban region. Therefore, in the second section waterfront redevelopment projects will be discussed.

In this thesis, the focus is specifically on a waterfront redevelopment case in Rotterdam. Considering that the development project is in Rotterdam, general urban developments and other waterfront redevelopments in Rotterdam will be elaborated. After discussing the previous developments in Rotterdam, the Rotterdam Makers District waterfront redevelopment project will be explained. This is one of the newest waterfront redevelopment projects in Rotterdam. Due to the innovative environment at the Rotterdam Makers District, it might be able to create economic growth through the attraction of creative capital. Therefore, creative capital is discussed in the final section. Based on the literature of successful waterfront redevelopment, the sub questions will be partly answered in the conclusion.

2.2 Port-city interface

2.2.1 Port-city interface: definition

The general knowledge about the port-city interface and the recent challenges is essential regarding the main research question of this thesis. Hesse (2018) describes in his research some definitions of the port-city interface. The more traditional definition of the port-city interface, which is based on other studies and geography reports, states that the port-city interface is the physical site of overlap between port and city and the overlap between the economic functions of the port and the city. Hesse (2018) suggested that a more relational view of the port-city interface is necessary, since these port-cities are large trade nodes and are connected to many different places. Considering the globalisation trend these connections become simply larger. Depending on this relational view, Hesse (2018) has paraphrased another definition of the port-city interface that is adjusted to modern trends:

"The interface represents not only a concrete site of encounter and overlap, but it is considered to a strategic platform for integration and contestation between port and city, economy and territory. Thus, it is viewed as an artefact that links different subject matters and relates them to each other. In more geographical terms, it is seen as a connector between different spatial scales." (Hesse, 2018)

The relational view has become essential, because the port-city interface has changed substantially in the last century and was in need for a deeper understanding.

2.2.2 Port-city relations

Ducruet (2006) made a matrix of different port-cities to show the relation between port and city and is demonstrated in figure 1. The identification of the port-cities depends on the city size and the port size. According to Ducruet and Sung-Woo Lee (2006), Rotterdam is an example of a *gateway* port-city, where the port is considered larger than the city. A *gateway* creates few activities apart from heavy industry and logistics. Barcelona is an example of a *maritime city*; the city is larger than the port. The port functions of a maritime city are efficient with a large and important urban environment. Despite of the differences between port-cities, they face some of the same challenges nowadays (Geerlings, Kuipers, & Zuidwijk, 2018). These challenges are generally about finding the balance of land use between port and city, the environmental impact of the port and traffic congestion (Geerlings, Kuipers, & Zuidwijk, 2018). Due to these challenges, it might be a better option to locate ports away from cities. However, most of the worlds important ports remain urban. Therefore, policymakers should care about the relationship between the port and the city (Hall & Jacobs, 2012).
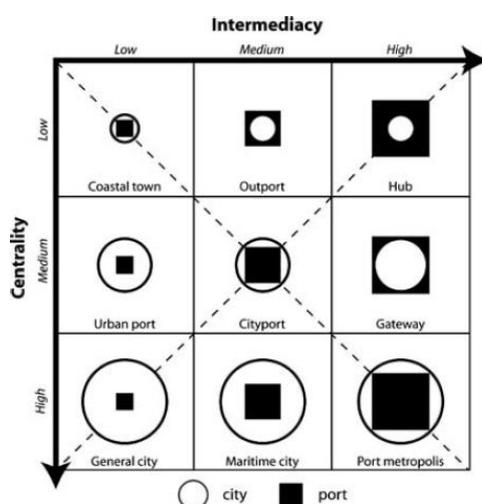

Figure 1: A matrix of port-city relations. The larger the circle, the larger the urban environment. The larger the square, the larger the port hub. Source: (Ducruet & Lee, 2006)

2.2.3 Port-city evolution

The evolution of the different port-cities seems to be gradual for most of the different types. There are only a few exceptions of rapid changes (Ducruet & Lee, 2006). Hoyle (2000) has described developments of the historical evolution of the port-city interface in a five-stage model. The following table demonstrates the five different stages:

STAGE	SYMBOL ○ City ● Port	PERIOD	CHARACTERISTICS
I Primitive port/city	◖●	Ancient/medieval to 19th century	Close spatial and functional association between city and port.
II Expanding port/city	◖- - - ●	19th–early 20th century	Rapid commercial/industrial growth forces port to develop beyond city confines, with linear quays and break-bulk industries.
III Modern industrial port/city	◐- - - ●	Mid–20th century	Industrial growth (especially oil refining) and introduction of containers/ro-ro (roll-on, roll-off) require separation/space.
IV Retreat from the waterfront	◑ ●	1960s–1980s	Changes in maritime technology induce growth of separate maritime industrial development areas.
V Redevelopment of waterfront	◑ ●	1970s–1990s	Large-scale modern port consumes large areas of land/water space; urban renewal of original core.
VI Renewal of port/city links	◑- - - ●	1980s–2000+	Globalization and intermodalism transform port roles; port-city associations renewed; urban redevelopment enhances port-city integration.

Figure 2: Stages in the evolution of port-city interrelationships. Source: (Hoyle, 2000).

Up until the 19th century, the port-city interface was highly integrated, because of the inner-city ports. Nevertheless, the port and city have segregated in the past century. As a consequence of technological progression in the maritime sector, port facilities have moved away from the city (Hoyle, 2000). Port operations demanded more space over the years, which was not always available in the inner cities. For instance, the development of containerisation forced port operations to move, since the containerisation demanded large container terminals and storage space (Kokot, 2008). Another reason was that vessels became larger and demanded deeper waters (Merk, 2013).

The improvement of maritime technology was one of the main reasons that exposed the separation of port and the city (Hesse, 2018). Besides the port expansion due to the improvements of maritime technology, cities itself have expanded over the last decades and demand even more space for urban goals, such as housing to facilitate the population growth (Geerlings, Kuipers, & Zuidwijk, 2018). In Europe, the ports started to move mainly downstream, towards the sea (Hoyle, 2000). After world war II, the port of Rotterdam started the development to move downstream, by dredging the first and second Maasvlakte (Hoyle, 2000). Therefore, the case of the port-city Rotterdam is a great example of port migration.

Besides the port migration from the inner city, various port related industries, such as storage and distribution, are no longer technologically restricted to port areas (Musso, Benacchio, & Ferrari, 2000). This development leads to the opportunity for these industries to move away from port-cities, which may result in better conditions. As a consequence, port related employment becomes more a global benefit instead of a local benefit (Musso, Benacchio, & Ferrari, 2000). Industries moving away from port-cities has a negative effect on the city itself, because the port city relationship is only considered mutually beneficial, as long as the city is still enabled to provide some port related activities. Only then the growth of the port will contribute to the wealth of a city (Hesse, 2018). On top of the decreasing local benefits, Musso et al. (2000) argues that at the same time port related local costs are increasing, such as congestion and pollution. Concluding that the local benefits may not outweigh the local costs any longer.

2.2.4 Strengthening the port-city relationship

Considering the port migration and the disequilibrium of local costs and local benefits, the port city relationship has changed drastically. Hesse (2018) states that the change in the relationship leads to conflict and tension between urban and port actors. It has become harder to define the common goals of port and city authorities (Daamen & Louw, 2016). Creating more port related benefits might contribute to the establishment of more common goals. Merk (2013) suggests three options for increasing the local benefits, namely; maritime clusters, industrial development and port related waterfront development. Clusters in port related industries are particularly important because these industries need a very specialised local workforce and are dependent on other kinds of services. Maritime clusters that are successful, have a positive impact on the port-city (Merk, 2013). The second option refers to new industrial opportunities port-cities have, where existing industrial plants and infrastructure can be re-used. These facilities create opportunities for the circular economy and the energy transition (Merk, 2013). In this thesis, the focus is on the last option: port related waterfront development. This option will be elaborated below.

2.3 Waterfront redevelopment

2.3.1 Definition

Waterfront redevelopment projects are developments, where old industrial port sites are being transformed in something new (Merk, 2013). Kokot (2008) stated that the removal of port activities from the inner city turned former port areas into urban wasteland. Consequently, these

traditional port waterfronts became ghost districts (Hein, 2016). However, these areas create new opportunities for urban developers.

2.3.2 Amenities

Developers in Rotterdam are very aware of the amenities of waterfront sites (Daamen & Louw, 2016). Gordon (1996) has defined the amenities of the waterfront. The waterfront is located at the edge of the water and therefore there is less traffic and noise pollution. In addition, the waterfront has an open horizon with a long-range view. At the waterfront there is also a cooler climate, than in the inner city. These amenities make waterfronts an ideal location for recreation and leisure. Another amenity for urban waterfronts is that it is located near the central business districts of the city (Cowen & Bunce, 2006). This amenity demonstrates that the waterfronts do not only create opportunities for leisure activities, but also for business opportunities. Cowen and Bunce (2006) add that redevelopment of waterfronts can contribute to competitive city strategies, for instance for city branding campaigns.

2.3.3 Common issues

Besides the amenities that particularly belong to waterfront redevelopment projects, there are also common issues corresponding to these projects. Douglas (1984) elaborated three common issues related to waterfront development. The first issue are the regulations and permits around the waterfront. There are specific regulations and permits to protect the quality of the water environment and shoreline. Due to these regulations and permits, some types of developments are not allowed, and some processes can be more time consuming. This might discourage developers to start projects at the waterfront. The second issue is deciding the appropriate use of the waterfront. On the on the hand, people think that waterfronts should be accessible for water related activities and this should be implemented in developments. On the other hand, the opinion is that waterfront developments should be determined by the market conditions and suitable actors. The last issue is the provision of public access. The local government wants certainty of public access at the waterfronts because waterways are publicly owned, and they have great potential for leisure and recreational activities. However, developers want to maximize their profits with their projects and that is not always achieved while focussing on public access.

2.3.4 Successful waterfront redevelopment

Former studies demonstrate that successful waterfront redevelopment projects lead to new positive economic activities (Merk, 2013). For the research question it essential to provide

background information about the factors that determine whether a waterfront development might become a success and create effectively port related local benefits.

Gordon (1996) points out two important tasks that should be implemented at the beginning of a waterfront development plan. The first task is to change the image of the waterfront. As stated before, abandoned waterfront sites can become ghost districts (Hein, 2016). Gordon (1996) describes these ghost districts as images of isolation. These images must change to be able to attract investors. According to Gordon (1996), an better image of the waterfront site can be done by taking the following options into consideration. The first option is following design guidelines and considering the historic atmosphere of these waterfronts. The second option is providing public access to the waterfront. The last option is building a new park next the waterfront. The other important task Gordon (1996) emphasized, is improving the accessibility of the waterfront. The infrastructure must be extended to the waterfront, because without good connections, physical and psychological barriers persists.

The amenities and common issues, as discussed in the previous section, should also be taken into consideration while making a development plan. The common issues demonstrate some of the contrary opinions between actors that are involved with waterfront redevelopment projects. Different opinions might lead to planning conflicts. For instance, developers want to secure flexibility during the development, because then they can adjust their plans to new market conditions in the future (Douglas, 1984). Meanwhile, the local government wants to have certainty about the local public benefits beforehand (Douglas, 1984). Developers and local governments should face their different points of view and make a development plan where both interests are met (Douglas, 1984). This means that the private and public sector must work together. Not only is the public-private relationship important for avoiding conflicts, but also for speeding up the implementation process of the project (Sepe, 2013). The public-private relationship can also create advantages for both parties. For example, the private sector can contribute to the construction of public infrastructure. In return, developers can get permissions to construct profitable developments (Merk, 2013).

Hoyle and Wright pointed out in their research that along the implementation process of a waterfront development plan, long-term commitment and flexible planning are essential by redeveloping the waterfront (Hoyle & Wright, 1999). Additionally, they stated that these projects are full of challenges and therefore people from different work fields are needed during the planning, such as geographers, architects, planners, sociologists and economists (Hoyle &

Wright, 1999). Planning is essential, because the decisions about waterfront redevelopment that are made now, will determine the future of the waterfront sites of abandoned ports (Hoyle & Wright, 1999). Merk (2013) adds that most of the successful waterfront development projects started with a masterplan. A masterplan that guides the implementation process, but a plan that also creates a common ground for the different actors (Merk, 2013).

Former studies have demonstrated above that planning is essential for the success of a waterfront development project. Another important part of the success is finding the right mix of diversified functions, such as residential areas, offices, port facilities and public spaces (Merk, 2013). Some waterfront developments projects have shown that they do not have to be port related to be successful. However, Merk (2013) states that a connection to the port can contribute to the success. In his research, Merk (2013) has provided a few opportunities to create port related local benefits, such as preserving the historical port areas, attracting leisure boat activities and creating a touristic destination of an old fishing port area. By creating port related local benefits, the port-city relationship can become stronger.

2.4 Urban redevelopment Rotterdam

2.4.1 Phases of developments in Rotterdam

The research question will be answered by looking at a Rotterdam waterfront redevelopment case. The redevelopment of Rotterdam will now be shortly discussed, because this demonstrates which factors have been particularly important for redevelopment projects in Rotterdam.

Nowadays the port of Rotterdam is one of the most important trading locations in the world, in terms of volume and industries (Aarts, Daamen, Huijs, & De Vries, 2012). However, in the fourteenth century Rotterdam was just a small town next to a river with little port related activities, such as trading, ship building and river fishing (Aarts, Daamen, Huijs, & De Vries, 2012). The port of Rotterdam started to move away from the inner city in the late nineteenth century (McCarthy, The redevelopment of Rotterdam since 1945, 1999). Due to the relocation of the port, not only opportunities for the port emerged, but also for redevelopers in the inner city. Next to the redevelopments of old port areas, Rotterdam had been bombed in the World War II and therefore the city needed major redevelopments to rebuild itself after 1945.

Mccarthy (1999) provided the following overview of the phases of redevelopment in Rotterdam from the 1940s up and until the 1990s. In the 1940s and 1950s the focus was on the redevelopment of the port in Rotterdam, because the national goal was improving the economy

in the Netherlands. The increasing population in the 1950s and 1960s led to an increase in the housing demand and the city had to focus on the construction of housing supply. In the 1970s, residential areas in the city centre were improved, because in 1974 more social democratic politicians were chosen. They wanted to promote the urban culture and neighbourhoods more instead of the business districts. In the 1980s and 1990s, it became important for the city to get another image and a more diversified economy. Consequently, new developments projects were more focused on recreational and cultural uses. In addition, the national government implemented a new policy in that period, namely cultural dissemination (McCarthy, The redevelopment of Rotterdam since 1945, 1999).

2.4.2 Important key factors for developments in Rotterdam

Besides the redevelopment phases, Mccarthy (1999) described a few important key factors for redevelopment in Rotterdam. The first key factor he described is the *national government role*. The government emphasized on a more market orientation to developments, to be able to attract more international investors to the Netherlands. According to Mccarthy (1999), another important key factor has been *cultural regeneration*. Rotterdam needed a more cultural approach for developments in the city because the city did not have a strong attractive cultural identity. Additionally, the *municipality* has been an important key factor, the landownership role of the municipality has a large influence on developments. For municipalities, the public-private relationship has become particularly important over the past decades, because they became more dependent on the financial support of the private sector (McCarthy, 1999). As stated before, a good public-private relationship is important of successful waterfront redevelopments projects.

2.4.3 Waterfront redevelopment Rotterdam: First wave

The phases and key factors about developments in Rotterdam are provided above. In this thesis, the focus is particularly on waterfront development projects. The port authority and municipality are trying to strengthen the relationship between the port and the city (Aarts, Daamen, Huijs, & De Vries, 2012). As already discussed before, waterfront redevelopment projects can contribute to the reinvention of the port-city relationship. The Rotterdam's waterfront development projects of the past decades will be elaborated. This demonstrates whether waterfront redevelopment projects are able to contribute to the port-city relationship in the past, the success factors of these projects and the challenges.

Aarts et al. (2012) made a distinction between two waves of inner city waterfront redevelopment in Rotterdam. The largest waterfront development project during the first wave was the "Kop van Zuid" project. In the nineteenth century the north and south bank of the river Maas in Rotterdam started to develop in different ways (McCarthy, 1996). The north bank attracted high valued uses, such as businesses and good housing. On the contrary, the south bank hosted the poorest districts in Rotterdam (McCarthy, 1996), such as Katendrecht. Many locals had left that area, due to the large influx of poor minor ethnicities that had started to build a life there (Daamen, 2010).

The goal of the "Kop van Zuid" project was to attract investors to the south bank, by making a connection between the two different sides of the river (McCarthy, 1996). According to McCarthy (1996), one of the most important focal points was creating accessibility to the south bank by making large investments in infrastructure. Other important aspects in the development plan were public-private partnerships, mixed functionalities, and integration with the whole city (McCarthy, 1996). Aarts et al. (2012) described two main developments during the project; reinvent the connection between the river and the city and connect the north and south bank with each other. One of the essential aspects of the project was the Erasmus bridge (fig. 3) and the new subway line , which had to connect physically both sides of the river (Daamen & Louw, The Challenge of the Dutch Port-City Interface, 2016). Aarts et al. (2012) concluded that the project was an overall success. The river is now integrated to the city, the south and north banks are connected, and a mixed use of businesses, infrastructure, housing, and recreation has been achieved.

Figure 3: Erasmus bridge, connection of the north and south bank of the river Maas.

However, before the project started, McCarthy (1996) pointed out one of the major criticism on the development plan of the "Kop van Zuid" project. He suggested that there was not enough attention on the social factors at the south bank. Without focussing on social regeneration,

social exclusion may become a problem, due to social and economic tensions in disadvantaged areas at the south bank. However, Aarts et al. (2012) state that during the implementation of the plan, social goals were considered as very important.

A port related local business that is created during the "Kop van Zuid" project, is the cruise terminal (fig. 4). Attracting cruise ships to a city is not only a great business model that creates local economic benefits. Additionally, cruise ships bring tourists to port related activities This has a positive impact on the port-city relationship (Hesse, 2018).

Figure 4: Cruise terminal, Kop van Zuid.

Other waterfront redevelopment projects during the first wave had different development plans. For the Leuvehaven, Wijnhaven and Zalmhaven projects the main function was developing more houses and creating job opportunities and in the Scheepvaartkwartier the main function was creating high valued houses (Aarts, Daamen, Huijs, & De Vries, 2012).

2.4.4 Waterfront redevelopment Rotterdam: Second wave

The second wave of waterfront redevelopment projects in Rotterdam consists of the Cityports (Aarts, Daamen, Huijs, & De Vries, 2012). As shown in figure 5, the cityports area is outlined with a white line and embodies the Waalhaven, Eemhaven, Heijplaat, Rotterdam Droogdok Maatschappij (RDM), Merwehaven and Vierhavens. This area consists of 1500 hectares of land and water of the Meuse (Daamen, 2010). The Merwehaven and Vierhavens are located at the north bank. Therefore, they have the best connection with the inner-city (Gemeente Rotterdam, 2004). There is a mixture of different businesses and time-varying architectural buildings. These ports are the oldest ports in Rotterdam and are seen as the beginning of the port (Gemeente Rotterdam, 2004). At the other side of the riverbank there is a different atmosphere, such as the Eemhaven which hosts large container terminals (Gemeente Rotterdam, 2004).
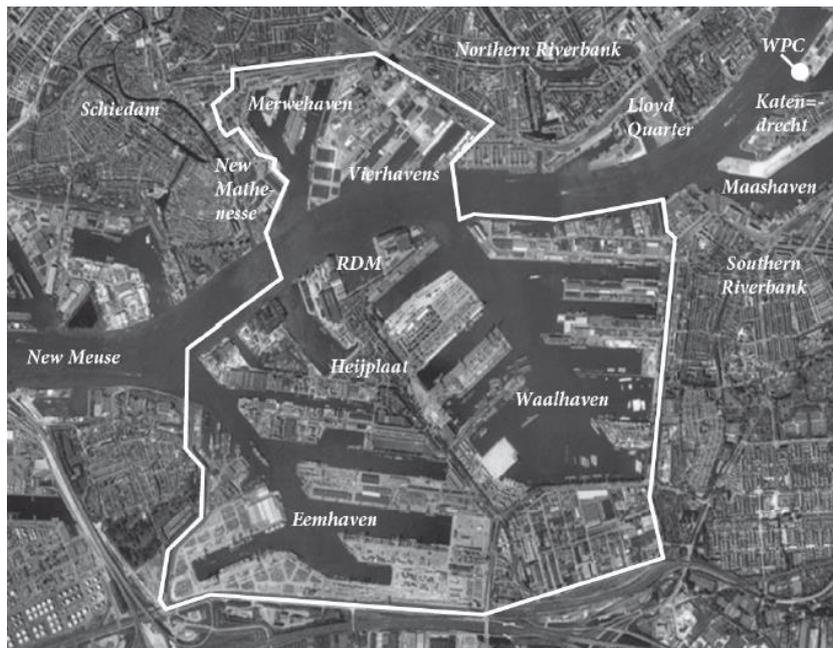
Figure 5: The CityPorts Study Area in 2003 from OMSR. Source: (Daamen, Strategy as Force, 2010)

The expectation was that more port related companies would move away from the Cityports, due to the construction of the Maasvlakte (Daamen, 2010). This would provide development opportunities in the Cityports area, where the port authority of Rotterdam (PA) and the municipal urban development department of Rotterdam (OBR) must work together. Daamen (2010) made a timeline about the beginning of the waterfront redevelopment case of Cityports. The beginning timeline will be shortly discussed. Due to a report about common ambitions of developments in Rotterdam in 2000, the municipality started to see opportunities for the Cityports. In 2002, a research team was sent to London and Hamburg. Their goal was to discuss their recent air and port related developments. The ideas for that trip became later essential motives for the Cityports. In 2003, the *Ontwikkelings Maatschappij Stadshavens Rotterdam* (OMSR) was established. This organisation got the responsibility over the redevelopments in the CityPorts and had to strengthen the relationship between the port and the city, where both actors get the opportunity to express their ideas (Daamen, 2010). The goal of OMSR was to develop the Cityports and transform the old port area into an urban living and working area (Daamen, 2010). However, the PA was focussing on the growth of port related activities in that area (Daamen, 2010). Therefore, the PA and OMSR had different ideas about redeveloping the industrial port area. Nevertheless, the port and the city know they have to work together because they are dependent on each other (Aarts, Daamen, Huijs, & De Vries, 2012).

In the beginning, there were some large radical proposals for the Cityports area (Aarts, Daamen, Huijs, & De Vries, 2012). One of the most outstanding proposal was the construction of a new football stadium. These proposals were unrealistic and therefore the city and the port had to come up with an alternative strategy. The new approach for the redevelopments were the five wildcards (Aarts, Daamen, Huijs, & De Vries, 2012). These wildcards provided flexibility for the development plans. Aarts et al. (2012) described the five wildcards for the Cityports in their research. The first wildcard is called: *Volume and Trade*. This wildcard mainly focusses on the port related activities in the area and the economic potential of these activities. In addition, this wildcard aims at the recycling industry. The second wildcard is *Reinventing delta technology*, where the goal is to excel in knowledge about delta and water technology in the area. The third wildcard is about *Crossing borders*. This wildcard focusses on the more cultural opportunities in the area and must help with connecting the city and the port on a mental level. The fourth wildcard aims at the so-called *Floating communities*, where empty docks get a new purpose. The last wildcard is about *Sustainable mobility,* which must motivate the transportation over water for people and goods. Inland water shipping is a more sustainable way of transporting, due to the low emissions of barges.

Overall, the economic potential plays an important role for the Cityports. The port and the city have been trying to focus on the redevelopments, which might benefit the whole city. The challenge of Cityports area is constantly trying to find joint solutions (Aarts, Daamen, Huijs, & De Vries, 2012). Aarts et al. (2012) add that strategic alliances with educational institutions, the government and businesses are essential for the Cityports redevelopments and finding solutions.

One of the most recent projects in the Cityports is the Rotterdam Makers district. This district is part of the Cityports and consists of the Rotterdam Droogdok Maatschappij (RDM) and the Merwe-vierhavens (M4H). This thesis investigates the creation of local benefits particularly in this area, therefore the Rotterdam Makers District will be further discussed below.

2.5 Waterfront redevelopment: Rotterdam Makers district

2.5.1 Rotterdam Makers District

The next economy is coming, this economy is driven by circularity and digitalisation. Rotterdam wants to flourish in this economy. An important part of the next economy is the innovative making industry. Robotization, additive manufacturing and material science are essential key factors for this industry. These technologies make it possible to produce on small

scale, but highly specialised and cost efficient. The Rotterdam Makers district is the designated area, where the transition of the new economy must become a reality. The district embodies two areas: M4H and RDM (fig. 6). From 23 January 2018, these two areas have been officially combined as the Rotterdam Makers District. The success of the district needs to come from the nearby presence educational institutions, creative talent, and markets. Rotterdam provides opportunities for high educated entrepreneurial talent and is culturally diverse (Rotterdam Makers District, 2017)

Figure 6: Rotterdam Makers district: RDM and M4H. Source: Visie en strategie

The municipality and the port authority have set up five goals for the Makers district. The first goal is attracting and facilitating the innovative making industry. The second goal is to create employment opportunities. Therefore, the makers district must attract students, job seekers and entrepreneurs which want to learn new skills and get a job in the area or start up a company on their own. The third goal is establishing an open innovative environment, where crossovers are made possible between companies and knowledge institutions. The fourth goal is the creation of urban residential environment, because high-skilled workers prefer to live there. The last goal is the focus on the circular economy, which is going to determine the future (website Rotterdam)

The Makers district is going to contribute to the innovative ecosystem. This system consists of interactive and open networks, where educational institutions, public parties and investors support each other (Rotterdam Makers District, 2017). The goal of the ecosystem is the attraction of talent and simultaneously keeping the ecosystem intact and drawing new capital into the ecosystem (Jansen, 2020). Jansen (2020) described seven different types of capital that have an impact on the ecosystem. Namely, natural capital, industrial capital, social capital,

cultural capital, and creative capital. In this thesis, the focus is on creating port related local benefits with waterfront redevelopment projects particularly through attracting creative capital. Therefore, the so-called creative class will be elaborated in the next chapter/section. Before, the creative class is going to be discussed, the two areas which forms the Makers district are going to be further elaborated.

At the south bank of the Rotterdam Makers District is the RDM located (fig. 7). The RDM area is already considered as a successful waterfront redevelopment project. Important crossovers between educational institutions, companies, and maritime sector are established in the RDM area. This refers to the third wildcard of developments of the Cityports. There are four educational institutions located in the RDM: *the Hogeschool Rotterdam, Techniek College Rotterdam, IT Campus, STC Group*. There are opportunities for different educational levels available. In addition, students have access to the laboratories, facilities, and machines at the RDM (RDM).

Fifty-five companies contribute to the innovative ecosystem in the RDM. These businesses vary from start-ups to world players in the maritime sector, but also in the offshore sector. The companies can make use of the available facilities at the RDM and they can work together with the educational institutions. The crossovers between the companies and schools contribute to the fast realisation of innovations (RDM).

Figure 7: RDM Campus. Source: Site Observation Tour

To understand how this area has become a success, a part of the time lapse about the developments in the RDM area will be provided. The whole time lapse is provided on the RDM website (van Asch). At the beginning of the 19th century, de Rotterdamsche Droogdok Maatschappij N.V. was founded. The main business activities of the RDM were ship repair and building. In 1983, the company went bankrupt and the viable parts of the company became property of the government. In 2002, the RDM area was bought by Havenbedrijf Rotterdam

and consequently the redevelopments started. Opportunities for redevelopments became possible, due to the construction of Maasvlakte two. Considering that some companies would move away from the RDM to the Maasvlakte. The municipality and Port authority of Rotterdam wanted to realise new innovative living and working areas. In 2006, it was agreed that the port authority continued the redevelopments of the new future in the RDM. The Albeda College, Hogeschool Rotterdam and Havenbedrijf Rotterdam saw potential in the RDM area and decided to work together. In 2007 the redevelopments started for the *Machineloods* and the surrounding environment. The educational institutions started to use *Innovation Dock*. In 2009, RDM campus was officially opened. The redevelopments continued after the opening and the RDM area got in 2015 the name: RDM Rotterdam. The essential parts of RDM Rotterdam are the businesses, the campus itself and the events that are hosted. These parts need to put the RDM Rotterdam on the map. Rotterdam Hogeschool and Havenbedrijf Rotterdam are still the driving forces for attracting more education and businesses.

2.5.2 M4H

This thesis focuses mainly on the other part of the Rotterdam Makers District, namely the M4H area. The M4H (fig. 8) is located at the north side of the river and that is where most of the physical developments are mostly done, because the RDM is mostly redeveloped already. The M4H was particularly important for fruit transhipment and still today there are companies that do business in fruit. However, due to the containerisation, many fruit transhipments companies have left. The old warehouses create opportunities for redevelopments. These warehouses can be transformed into flexible spaces with common facilities. Strong points of this area are that it has an industrial and maritime character, there are enough working spaces and is located next to the river. Moreover, the M4H has great accessibility because of the metro station *Marconiplein* that is located nearby (Rotterdam Makers District, 2017).

In different facilities at the M4H is already happening various economical activities, such as the *Oranjelijn*, *Keilwerf* and *Rotterdam Science Tower*. Various manufacturing companies are settled at the Keilewerf. The Erasmus Centre of Entrepreneurship (ECE) and PortXL are both located in the Rotterdam Science Tower. As both companies are innovative, they are going to play an important role at the redevelopments of the Rotterdam Makers District (Rotterdam Makers District, 2017).

Figure 8: M4H. Source: Site Observation Tour

Besides the creation of business opportunities, there also need to be developed an urban residential area. Considering that high-skilled workers benefit from the amenities of a city and the urban environment. Therefore, it is essential the construction of a living area need to be a part of the development plans of the Rotterdam Makers District (Rotterdam Makers District, 2017).

The OMSR mentioned in a diverse residential program of 2015 a diverse program that the Vierhavens has opportunities for attracting culture, caters and art. In addition, the RDM would offer perspectives for becoming a museum centre.

2.6 Creative Capital

Former studies demonstrate that successful waterfront redevelopment projects lead to new positive economic activities (Merk, 2013). That might also be the case for The Rotterdam Makers District project. This region wants to be designated place for the innovative making industry (Rotterdam Makers District, 2017). At this waterfront, there are new technologies conceived and applied. Additionally, in 2015 the OMSR mentioned in a residential program for the Cityports that the M4H provide opportunities for attracting culture, caters and art, and the RDM could offer perspectives for becoming a museum centre (Daamen, 2010). Due to the technological and innovative environment and the cultural amenities at the Rotterdam Makers District, the creative class might have the possibility to flourish and create local benefits for that region. Therefore, the creative capital and the corresponding creative class will be elaborated in this section.

The most essential part of creative capital are the people, which form the creative class (Florida, Cities and the Creative Class, 2005). Florida (2005) suggests that the core group of this class consists of scientists, engineers, university professors, poets, novelists, artists, entertainers,

actors, designers, architects, nonfiction writers, editors, cultural figures, researchers, analysts and other opinion makers. Besides this outstanding creative group, creative professionals who work in high-skilled knowledge jobs in financial sectors, technology sectors, business management and health-care professions do also take part in the creative class (Florida, Cities and the Creative Class, 2005). These professions need high educated people that are creative in problem solving.

Many cities are trying to follow the creative vision of Florida (Peck, 2005). A new important objective for city municipalities is not only attracting creativity, but also producing creativity from the inside of the city (Sepe, 2013). Florida (2005) states that every city that have a good political system and possesses some of the essential amenities, such as a good educational institutions, availability of high-tech workers and unique neighbourhoods, have the ability to become a creative city and make creative regions. According to Florida (2005), members of the creative class are drawn to places which possesses three critical factors. Namely, what he describes as the 3T's of economic development, technology, talent, and tolerance. The technology level is based on the concentration of innovation and high technology. Talent is based on the number of people who have a bachelor's degree or higher. And a tolerant region is defined as a place that is diverse and open to all races, ethnicities, and sexualities.

Peck (2005) describes ways to attract or generate the creative class. City marketing is seen as essential strategy, where the city is promoted as an open and inclusive society and where the young adult lifestyle is emphasized. Another strategy is providing internships, which lead to the attraction of young adults. It is also important to stay in touch with the former residents, because then they are always able to find their way back to the city.

Sepe (2013) suggests that particularly waterfront revitalisation projects are a great starting point for innovative redevelopment strategies for the whole urban region. In a more recent research of Florida (2020), it is shown that innovative environment is positively related to talent and technology. However, the research also demonstrates that innovation is negatively associated with economic segregation. This demonstrates that creative urban areas with high levels of technology and talent are more innovative, but if that is combined with a higher level of economic segregation, innovation will be hindered at some point. According to Peck (2005), the cause of the relation between economic segregation and an innovative environment is that redevelopments of urban neighbourhoods can lead to an increase of housing prices. Highly educated people can afford more expensive housing, but in many cases lower educated cannot.

However, the creative class is also dependent on low-skilled workers, who provides services in the urban regions. Besides the provision of services, urban redevelopments where segregation arises can lead to social exclusion (Kokot, 2008). Because of these reasons, it is important for redevelopments strategies to also focus on avoiding high levels of economic segregation.

Florida (2005) points out that one of the major positive effects of the attraction of the creative class is that members of the creative class power local economic growth. Therefore, by investigating whether the Makers District attracts the creative class to the region and quantifying the economic growth, would allow this thesis to suggest whether the creative class is attracted as a local benefit.

2.7 Conclusion Literature framework

The Literature framework provides a comprehensive understanding of the port-city interface, waterfront redevelopments and creative capital. The framework has demonstrated the new challenges between the port and the city. These challenges create pressure on the port and city relationship. Therefore, policymakers must think about opportunities to strengthen to relationship. One of the opportunities is waterfront redevelopment projects. In this thesis, the focus is on waterfront redevelopments in Rotterdam and therefore the redevelopments in Rotterdam are also elaborated. The Rotterdam Makers District project is discussed in detail, because this waterfront redevelopment project is used for providing an answer to the main research question. At the end of the literature framework, creative capital is explained, because this capital can create local benefits through waterfront redevelopment projects, such as economic growth. Besides, providing a deeper understanding of the essential subjects, the sub questions that are demonstrated in the introduction can be partly answered by the literature framework. Firstly, the first sub question will be discussed below.

Sub question 1:   *"To what extent are the economic activities that resulting from the waterfront redevelopment project in the Rotterdam Makers District, port related?"*

In the vision and strategy of the Rotterdam Makers District is stated that the RDM area is maritime minded and has connections to the maritime sector, such as the port related businesses in that area. However, it is not suggested that the M4H is maritime minded in the vision and strategy. Therefore, further research must be provided to make statements about the port relations of the M4H. Secondly, the second sub question will be elaborated:

Sub question 2:   *"By investigating the economic activities, is the Rotterdam Makers District attracting creative capital and to what extent is this creative capital port related?"*

According to the literature review the creative class is attracted to areas which possesses three crucial factors: Tolerance, Talent and Technology. The vision and strategy of the Rotterdam Makers districts shows that the city Rotterdam is culturally diverse (Rotterdam Makers District, 2017), which is an indicator for *tolerance*. Additionally, in the vision and strategy is presented that the city provides opportunities for high educated entrepreneurial *talent*. Moreover, in the Rotterdam Makers District there are three different educational institutions located. This shows that talent can be attracted to the district. The literature review presented that the technology level of a place is based on the concentration of innovation and high technology. The Rotterdam Makers District focusses on becoming an innovative hub. This means that the district is focussing on the creation of an innovative environment where the level of *technology* can increase. According to all three crucial factors, the Rotterdam Makers District can attract the creative class. However, this might not be the case in practice. Therefore, further research will be provided about whether the companies are creative minded in the Rotterdam Makers District. In this thesis, only the M4H will be investigated for the attraction of the creative class, because most of the physical redevelopments will be done in that area. Moreover, the RDM is already considered as a successful waterfront redevelopment project.

When the results present that the Rotterdam Makers District is attracting creative capital it is important to investigate whether this attracted capital is also port related. Creative capital can bring local benefits to an urban area, such as economic growth. These benefits must be port related regarding the strengthening of the port-city relationship. Therefore, the second part of sub question two investigates whether the creative economic activities are also port related. The third sub focusses on creation of the economic growth by attracting creative capital:

Sub question 3:   *"Is the Rotterdam Makers district able to generate economic growth through the attraction of creative capital as a local benefit?"*

As stated by Florida, economic growth is one of the main positive effects of the attraction of creative. To determine whether creative capital is attracted in the past years, the economic growth in the Rotterdam Makers District will be investigated. The same with sub question two, the M4H will be only further investigated. At last sub question four will be elaborated based on the literature review:

Sub question 4:   *"While focussing on attracting creative capital, does the Rotterdam Makers district also continue with generating economic growth through their port companies?"*

The literature review demonstrated that port activities have moved away from the inner cities, due to maritime technological developments that demanded more space. Rotterdam is a great example of port migration; after dredging the Maasvlakte, many port activities started to move towards the sea. The RDM of the Rotterdam Makers District is still maritime minded, however that might not be the case for the M4H. Fruit transhipment companies were considered particularly important in the M4H. However, some of these companies have left the M4H area. Therefore, it might be the case that the Rotterdam Makers District generates less economic growth through port activities. This suggestion will also be tested with data.

In conclusion, all the sub questions are partly answered by the literature. Besides reviewing the literature, this thesis will also provide a more empirical study to formulate a thoughtful answer to the main research question. This empirical study is based on a Rotterdam Makers District case study. The literature review has shown that this case study is a great example of a waterfront redevelopment project and has the possibilities for attracting creative capital. Therefore, this case study can perform a deeper analysis of the economic activities and the relationship between creative capital and waterfront redevelopments.

3. Data Section

3.1 Introduction

In this chapter this thesis will elaborate on the available empirical data, which will be used in order to answer the sub questions in the Literature framework. At first, the data requirements will be treated for each individual sub question. The first two sub questions require information about the economic activities in the Rotterdam Makers District. Sub questions three and four require information regarding the economic growth in the Rotterdam Makers District. As concluded in the Literature review, the empirical study will focus on the M4H area, because the more physical developments will take place in the M4H and the RDM is already considered as a successful maritime minded waterfront redevelopment project. Therefore, the collected information is based on the M4H area. Based on the information requirements there are two datasets formed: Company Overview M4H and the LISA dataset. The company overview provides information about the economic activities in the M4H and the LISA dataset provides data about the economic growth in the M4H. These datasets will be elaborated after discussing the specific information requirements.

3.2 Information requirements

3.2.1 Economic activities

The first sub question considers whether the economic activities that are resulted from the waterfront redevelopments in the Rotterdam Makers District are port related. As stated in the introduction, it is shown in the Literature review that the RDM is already maritime minded. However, this is not suggested for the M4H area. For this sub question, information about the companies that are in the M4H area is collected to provide an overview of the economic activities. Based on this company overview of the M4H, it will be determined whether a company is port related or not.

The second sub question states whether the Rotterdam Makers District is attracting creative capital and whether this attracted creative capital is port related. Similar to sub question one, the focus is also on the M4H area of the Rotterdam Makers District. To determine whether creative capital is attracted to the M4H, information about the characteristics of the companies in the M4H is required. The same company overview about the economic activities in the M4H will be used as for sub question one.

3.2.2 Economic growth

The information on economic growth in the M4H is essential regarding the remaining two sub questions. The third sub question focuses on whether the Rotterdam Makers District can generate economic growth through the attraction of creative capital as a local benefit. Data about economic growth demonstrates whether the waterfront redevelopments has led to local benefits. Additionally, economic growth is one of the major positive effects of the attraction of the creative class. Therefore, the economic growth in the Rotterdam Makers District provides information about local benefits and creative capital. In this case, job growth is used as a measure of economic growth. The M4H is an industrial area with many economic activities and less living opportunities. Therefore, GDP would not be a good measure. The LISA database is an employment register and provides information about job growth per postcode area. An extract of this database will be used to answer the last two sub questions. The company overview will be used for determining which companies are creative minded in the LISA dataset. In this way, it can be investigated whether the creative characteristic of a company contributes to the economic growth in the M4H.

The last sub question states whether the Rotterdam Makers district also continues with generating economic growth through their port companies while focussing on attracting creative capital. In order to answer this sub question, we need to consider whether the economic growth is related to the port activities. The same extract of the LISA database will be used for providing information about economic growth. The company overview M4H will be used for determining which companies are considered port related in the LISA dataset.

3.3 Company overview M4H

The company overview is in essence a qualitative dataset, as it consists of taglines, company missions and a description of the main activities of the company. I have used three methods in order to get a complete company overview for the M4H area. The initial data source for the company overview is the website of the M4H area itself. The website provides a list of entrepreneurs within the area. This seemed to be a great starting point because the website is maintained by the program office of the M4H. In addition to the M4H webpage, I have used Google maps as a complementary source to verify companies and to find companies that were possibly missing on the M4H website. Lastly, I have personally been to the M4H area for an site observation tour, supplementing and verifying the list of companies in the M4H. Considering the three different sources (M4H website, Google maps, site observation tour), I

have tried to collect most of companies within the M4H area and tried to conceive a high saturation level of the area. Eventually, I ended up with a list of 124 companies. However, some companies did not have a website or a LinkedIn page or could not be found on "Handelsregister" (Business register). Additionally, few companies were located outside of the M4H. These companies are deleted from the dataset. In the end the total company overview consists of 90 companies. 53 companies were found on the M4H website, 19 companies were found on google maps and 18 companies were added to the list after the site observation tour.

After making the company list, the following information was collected for every company; Company name, Company source, Description M4H website, Visitor address, Postcode, HQ location, Facility KVK-number, SBI code, SBI code description, Tagline, Website, Email address, Phone number, Sources, About, Type, Company size, Category number of employees, Industry, Founded, Specialties.

The *Company name* speaks for itself. The *Company source* demonstrates where the company is found. In this research, there are three options for having found a company in the M4H area, namely the M4H website, google maps and the observation tour. As already stated before, the M4H website is used as the starting point of the company list and google maps and the observation tour were used as additions and to check the M4H list. The M4H website provided a short description of the company. This description is added to the dataset because the *Description M4H website* presents in one or two words what the focus of the company is. Continuing with *Visitor address*, *Postcode*, *HQ location and Facility,* this information was mainly found on the website or at the LinkedIn page of the company. In addition, the *KVK-number* (Kamer van Koophandel) is also sometimes given on the website of the company. However, this was not the case for many companies. Therefore, I used "Handelsregister" (Business Register). This register provides the KVK-numbers for every company in the Netherlands. The KVK-numbers can be looked up by inserting the address or the company name. The *SBI code* (Standaard bedrijfsindeling: standard business layout description presents the activity of a company. To collect the *SBI-code* of a company I made use of search engine of the Dutch "Rijksoverheid" (National government), which was made for the corona crisis. With this search engine, companies can easily check whether their companies were entitled for monetary support. By filling in their KVK-numbers in the search engine, the search engine gives their SBI-codes and an answer about whether they are entitled to monetary support. I only used it to look up their SBI-codes and the corresponding description of the codes. The *Tagline* of a company was in many cases clearly given on their website. When the tagline was

not available, I used the "about" section on their website or LinkedIn to formulate a tagline. The tagline presents the company's mission or slogan of the company on one or two sentences.

The *Website* variable shows the website link. For most of the companies the *email address* and *phone number* were found on the contact page of the website. *Sources* refers to the sources that are used to gather mainly the final information. The final information refers to*: About, Type, Company size, Industry, Founded, Specialties.* These variables are summarized on company's LinkedIn pages. Companies have the possibility to provide this information on their profile by themselves. Therefore, I assume this information is legitimate. The *About* variable provides a comprehensive description of the business activities. The *Type* of company refers to whether a company is private, public, non-profit or educational. *Company size* presents the number of employees within a company. The *Industry* variable refers to the type of industry a company is in. The variable *Founded* shows the year of establishment of the company. The last variable *Specialties* demonstrates a few specialities of the company. Based on *Company size* I added another variable: category of number of employees. This variable is based on the company size. When the company has 1 employee, it gets value 0 and when the company has 2 till 10 employees, it gets value 1. And so on: 11 till 50 employees, value 2. 51 till 200 employees, value 3. 201 till 500 employees, value 4. 501 till 1000 employees, value 5. And more than 1000 employees, value 6.

Not every company has a LinkedIn profile available or do not provide all the information on their page. For many companies which did not have a LinkedIn page, I could find an "About" section on their website. However, for the rest information of the information provided by the LinkedIn profile, such as company size, was not given on their website. Therefore, when the company did not have a LinkedIn profile, I could not find the number of employees without other sources. This is the main reason that there are still some gaps in the dataset because it was not possible to find everything of a company.

3.4 LISA dataset

3.4.1 Dataset

The goal of the LISA database is bringing together the regional branch registrations with linked employment data. The database consists of information of employment per postcode and SBI code and provides data about job growth in areas (LISA, 2018), which is essential in answering sub question three and four.

The SBI codes and postcodes are collected for every company in the company overview. Based on these codes, it is possible to get an extract of the LISA database for the M4H area specifically. SBI codes in the company overview are numerical codes that vary from three to five numbers. However, only the first two numbers of the SBI codes could be used as an input for making an extract. This creates a problem, because many SBI codes start with the same two numbers but end with different numbers. For most of the SBI codes, the first two numbers present the general business activity and the other numbers demonstrate the more specific business activity. This means that in the LISA dataset there are more different SBI codes than in the company overview. However, research about determining whether a company is port or creative related, has only been done for the SBI codes that are presented in the company overview. Therefore, the SBI codes that are not in the company overview are deleted from the dataset.

There was the same problem with postcodes, because as an input for the extract, only the first four numbers (3029) were used. However, this postcode area is larger than the M4H and therefore there are companies in the dataset which are not a part of the M4H. Considering this problem, I made a geographical delimitation of the M4H area based on the company overview and google maps. The company overview showed that the last two letters of the postcode started only with an A or a B. Additionally, as shown on google maps, postcodes with different starting letters were outside the M4H area. Therefore, I deleted the postcodes with different starting letters. Moreover, not every postcode letter combination with starting letters A or B were in the company overview. Therefore, I checked every combination that was not present in the company overview but was in the LISA dataset whether it is a part of the M4H area. On google maps, these combinations seem to be a part of the M4H and therefore these postcodes were not deleted. See Appendix A for the exact postcode area.

After deleting observations, the LISA dataset consists of 2109 observations and provides for every observation the following information variables: year, jobs, job growth, job growth percentage, SBI code, X-coordination, Y-coordination, Province, Municipality, SBI description, company name, street, house number, postcode, city. I have added another information variable: category of number of employees. Based on the number of employees, companies are classified in a category. These categories are the same as in the company overview and are already explained in the company overview section. This information variable can demonstrate whether large or small companies have flourished in the M4H area.

The dataset provides information from 2000 till 2017 for companies that have the same SBI code as in the company overview. The dataset does not have data from 2000 till 2017 for every company, because some companies have moved away or moved to the M4H area at different times. There are more companies available in the LISA dataset than in the company overview because the company overview only consists of companies that are located there now. As stated in the previous section, the company overview is a qualitative dataset, but on the contrary the LISA dataset is a quantitative, which means that the dataset consists of numerical data and many observations.

3.4.2 Descriptive statistics LISA dataset

In this paragraph, the descriptive statistics of the LISA dataset will be discussed. First, the total of number of jobs in the M4H area will be elaborated. Figure 9 demonstrates the total number of jobs in the M4H area from 2000 till 2017 based on the data in the LISA dataset. As shown in figure 9, from 2011 there are two job increases. After the two job increases, there has been a large downfall of approximately 1500 jobs from 2014 to 2016. Table 1 in the appendix B demonstrates the exact number of total jobs. In 2014 the total number of jobs was 2509 and in 2017 the total number of jobs was only 1003. This means that there has been a downfall in jobs of 1506 of jobs in the M4H area.
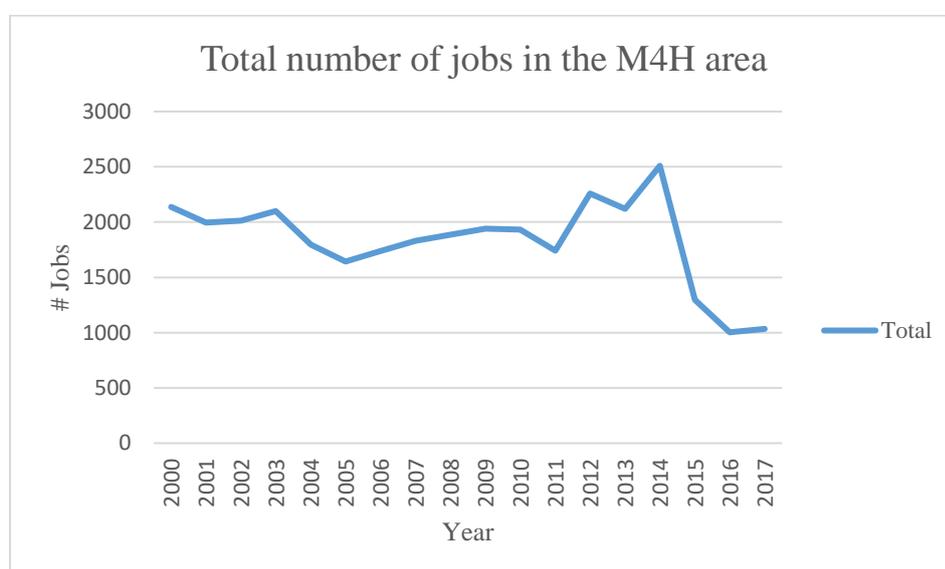
Figure 9: Graph total jobs in the M4H area based on LISA dataset from 2000 till 2017.

First, I started to look for a logical explanation of the large downfall in the total number of jobs in the M4H area. Therefore, I checked the possibility of a large company that might have moved away from the M4H. Only one large company was category six in the M4H area, namely the civil engineering's office of Rotterdam. This means that the company had more than 1000

employees. The data showed that the company had a major drop of employees in year 2014 to 2016. This data is presented in table 2 in the appendix B. While the total number of jobs totalled 1637 in 2014, not a single job remained in 2016 in the M4H area. This means a drop of jobs of 1637 in two years. Probably the civil engineering's office had moved away from the area. This explains for a large part the major downfall in jobs in the M4H area. Figure 10 demonstrates the number of jobs of the civil engineering's office of Rotterdam from 2000 till 2017. There was no data available of the years 2016 and 2017, because the company might have moved away from the M4H. Therefore, at these years, the total number of jobs is 0. Besides the fact that figure 10 partly explains the major downfall in jobs, it also partly explains the two job increases from 2011 as shown in figure 9.
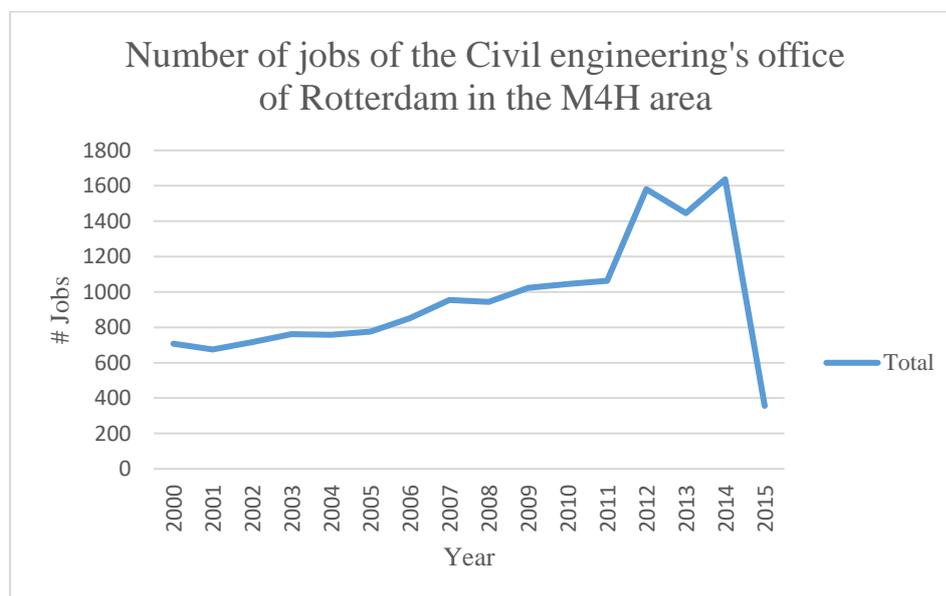
Figure 10: Graph of number of jobs of the civil engineering's office of Rotterdam in the M4H area from 2000 till 2017 based on LISA dataset.

Figure 10 has shown that the civils engineering's office of Rotterdam has a high influence on the number of total jobs in the M4H area and therefore it can be considered as an outlier of the dataset. Considering it as an outlier, I have made another figure that shows the total number of jobs in the M4H without the civil engineering's office (Figure 11). As demonstrated by figure 11, the graph of the total number of jobs in the M4H area strongly deviates from the graph in figure 9. This presents that the number of total jobs is highly influenced by the data of the civil engineering's office of Rotterdam. Consequently, the Civil engineering's office will be dropped from the dataset while making the results.

Instead of a drop in the number of jobs from 2014, figure 11 shows an increase in the number of jobs from 2013 till 2017. As shown in table 3 in Appendix B, in 2013 there were 673 jobs and in 2017 1033 jobs. This is a job growth of approximately 34.8% in four years' time. This might be one of the signs that suggests that the creative class is attracted to the M4H in that period, because economic growth is one of the major positive effects of the attraction of the creative class. Continuing with figure 11, in the year 2004 there has been a drop of approximately 300 jobs. Few companies reduced their number of jobs, such as a port related company called Fruit Wharf BV reduced their number of jobs with 47 in the M4H. Additionally, the Rotterdam City development department of the municipality left the M4H area in 2004 and led to a decrease of 221 jobs.
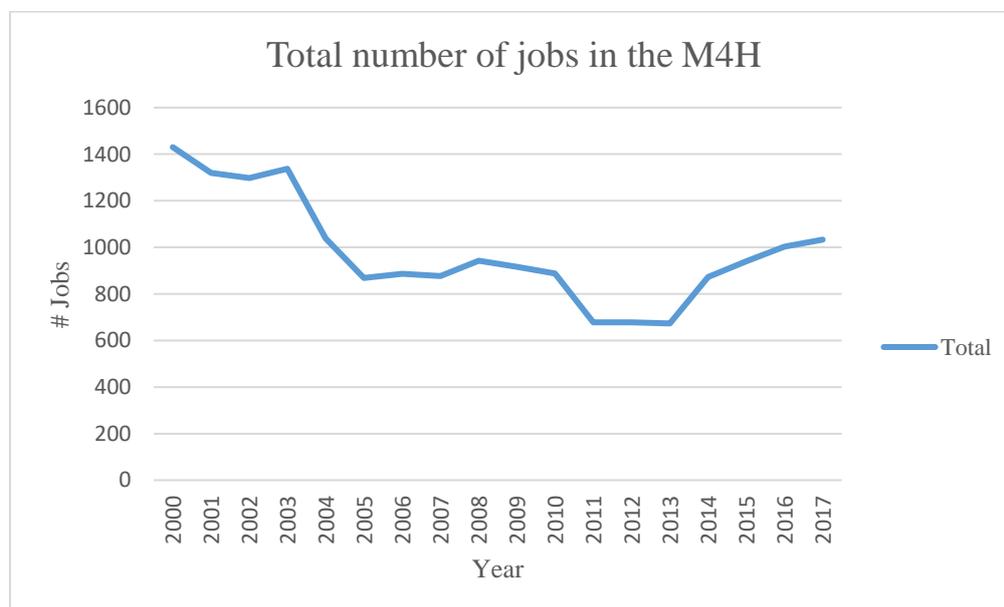
Figure 11: Graph of the total number of jobs in the M4H area without the civil engineering's office of Rotterdam from 2000 till 2017 based on LISA dataset.

Besides describing the economic growth by investigating the number of jobs the M4H, I also checked whether the number of companies has changed from 2000 till 2017. Figure 12 demonstrates the graph of the number of companies in the M4H based on the LISA dataset (without the civil engineering's office of Rotterdam). From 2012 there only has been an increase in the number of companies in the M4H area. However, these results seem contradictory to the steady number of jobs in 2012 to 2013 (Figure 11). A possible explanation might be that there has been a large increase in small companies, but a relatively small decrease in large companies. In that way, the number of jobs can stay almost the same, but the number

of companies can increase.   Therefore, I started to investigate the changes in numbers of companies per different company size, see figure 13.
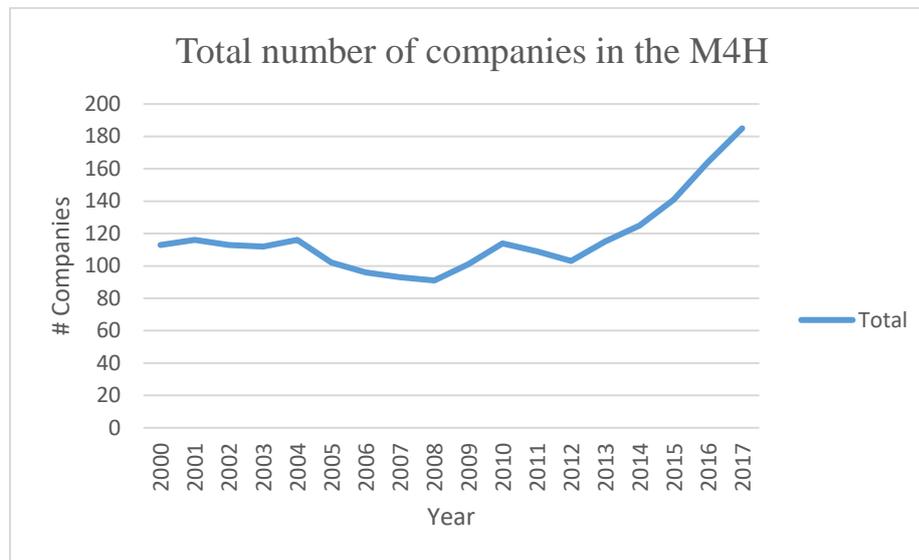
Figure 12: The number of companies in the M4H area from 2000 till 2017 based on the LISA dataset.

Figure 13 presents the number of companies per category from 2000 till 2017. From 2012 there has been a large increase in the number of the small companies in the M4H area. The number of companies with only one employee or between two and ten employees have both almost doubled in five years' time. Therefore, the increase of the number of companies in figure 12 is also mostly caused by the increase of small companies. These results seem to match the theory of the attraction of new creative capital in the M4H: small companies as possible upcoming creative start-ups that are locating in the M4H. The graph also shows that large companies have decreased, because companies of category 5 and 6 have moved away from the M4H.
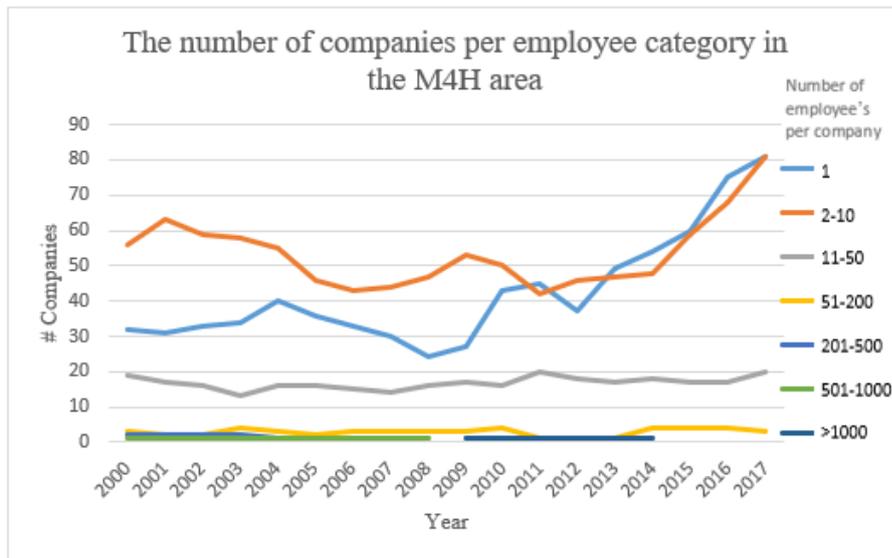
Figure 13: The number of companies per number of employee's category in the M4H area from 2000 till 2017 based on the LISA dataset.

3.4.3 Added information variables: Creative and Port

Considering sub questions three and four, the information regarding the employment in the area, and specifically whether the employment is related to the creative class and/or the port is, is essential in this thesis. To determine whether the employment is port or creative related in the LISA dataset, the company overview is used. When a company is considered creative related in the company overview, it is suggested that the SBI code is also considered creative related. This same applies to port related companies. I have added two new columns in the LISA dataset. These columns show whether a company is port related or creative. When the SBI code is creative/port related according to the company overview, it gets the value 1. If this is not the case, it gets value 0. The results section will show the employment developments regarding the port and creative relation of company.

Based on the *Port* and *Creative* dummy variables there are made two other variables: *Port Jobs* and *Creative Jobs*. These variables are created by multiplying the dummy variable Port/Creative with the number of jobs of a company. These variables demonstrate how many Port/Creative jobs a company has. The results section will show the employment and company developments regarding the port and creative relation of company.

3.4.3 Dataset adjustments regarding job growth

Originally there are 2109 observations in the dataset. The descriptive statistics are made with the original dataset. I have made some adjustments to the dataset for making the regressions

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results. The hypotheses of regressions regarding economic growth, tests whether creative or port related companies create job growth or job decline in the M4H area. However, the dataset shows only the job growth or decline of the companies that are located at the M4H in that specific year. There is no observation that presents the job decline that has occurred by the movement or bankruptcy of a company. Therefore, I have added an extra observation for every company that has moved away or went bankrupt between 2000 till 2017. A total of 252 observations have been added to the original dataset (N=2361). Additionally, I have adjusted most of the first observations regarding job growth of a company when it moved to the M4H after the year 2000. In the original dataset, the job growth is calculated as follows:

$$Job\_Growth_n = \#Jobs_{n-1} - \#Jobs_n \qquad\qquad n = year$$

This calculation presents for many observations the actual job growth that a company has generated in for the M4H area. Only for the first observation this is not always case. For instance, when a company moves to the M4H area, the first observation presents a job growth of the number of jobs at the previous location minus the number of jobs in the M4H area. However, this company has generated a job growth for the M4H area that equals to the total number of employees that have moved along. Therefore, the job growth of the first observation is changed to the total number of jobs. Moreover, the first observation of a company that just started in the M4H area shows a job growth of zero. However, the company has realised a growth of jobs in the M4H area. Therefore, the job growth is also changed into the total number of jobs.

The adjusted dataset is not used for making the descriptive statistics. These statistics focus on the number of jobs and companies for a particular year. The number of companies would be higher with the extra observations than the LISA dataset would originally show, because these extra observations are added to the total number of companies. Therefore, the adjusted dataset will not show the right number of companies in a particular year and therefore the original dataset is used.

4. Methodology

4.1 Introduction

In this chapter we discuss the methods used in order to analyse the datasets resulting from the previous section. First, the analysing methods for the *Company overview* will be elaborated in this chapter. After analysing the company overview, conclusions can be derived regarding sub questions one and two. Secondly, the methodology for sub questions three and four will be presented. These sub questions are answered by performing the Ordinary Least Square (OLS) method on the *LISA dataset*.

4.2 Evaluating the company overview

The first question focuses on whether the Rotterdam Makers District is maritime minded or not. This question will be investigated by analysing the different companies in the M4H in the company overview. As already stated before, the RDM will not be investigated. In the literature review is shown that the RDM has already clear connections to the maritime sector. Based on the information of the company overview of the M4H, it will be determined whether a company is port related or not. The following information variables will be used for determining the possible port relation of a company: *description M4H, SBI code description, Tagline, About, Industry* and *Specialities.* For the determination whether a company is port related, I focus on the following concepts: logistics, maritime, global trade, transhipment, and warehousing. If a company shows at one of the information variables one of these concepts, then it will be considered as port related.

The second sub question looks at the attraction of creative capital in the M4 and to what extent this creative capital is port related. The company overview is also used for answering this sub question. Similar to sub question one, the same information variables will be used for determining whether a company is part of the creative class or not. However, the focus is now on different concepts. Instead of focussing on maritime characteristics of the companies, this sub question focuses on creative occupations, which Florida has described the creative class in his paper (2005). This is also discussed in the literature framework. Based on his description, I will search for connections between the creative class and the company. The following occupations are described as creative by Florida: scientists, engineers, university professors, poets, novelists, artists, entertainers, actors, designers, architects, nonfiction writers, editors, cultural figures, researchers, analysts, and other opinion makers. Besides this outstanding

creative group, creative professionals who work in high-skilled knowledge jobs in financial sectors, technology sectors, business management and health-care professions do also take part in the creative class (Florida, 2005). If one of the "creative" occupations is stated in the information variables of a company, it will be suggested that the company is part of the creative capital in the M4H area and therefore contributes to the creative class.

Besides these creative companies, there are some other companies that are possible contributors to the attraction of the creative class. The literature review showed that the creative class is attracted to innovative hubs and that the creative class demands urban services, such as restaurants, cafés, and events. Therefore, companies that contribute to the innovative environment or provide urban services are possible contributors to the attraction of the creative class. Based on this reasoning and "Creative contributor" option is added to the results, which present the companies that contribute to the attraction of the creative capital. The "Creative contributor" is split up into the urban service provider and the innovative companies.

The second part of sub question two investigates whether the possible attracted creative capital is also port related. For every company in the company overview will be determined whether it is creative, or port related. Combining this information, provides results about how many creative companies are also port related.

4.3 Analysing LISA dataset

4.3.1 OLS regression

For answering sub questions three and four, the Ordinary least squares (OLS) method will be used. The OLS is a linear regression and presents the linear relation between the dependent and independent variable. With the OLS method the values for the parameters of the regression coefficients (β_0 and β_1) are estimated. In this research, the regressions are estimating the effect of the creative or port characteristic of a company on job growth. For both sub questions there are two different regressions tested: the single and multiple regressions. The mathematical form of these regressions is shown below:

Single Regression: $Y_i = \beta_0 + \beta_1 X_{i1} + \varepsilon i$

Multiple Regression: $Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \cdots + \beta_p X_{ip} + \varepsilon i$

The single regression estimates the effect of the main independent variable (X_{i1}) on the dependent variable (Y_i). For both sub questions the dependent variable (Y_i) is *Job Growth*. As stated at the data section, job growth is used for as an indicator of economic growth. The

independent variable (X_{i1}) for sub question three is *Creative*, which shows whether a company is creative related or not. For sub question four, the independent variable ($Xi1$) is *Port*, which presents whether a company is port related or not. The multiple regression also estimates the effect of the main independent variable on the dependent variable, but there are also control variables added (X_{i2}, X_{i3}, ..., X_{ip}) to the regression. These variables control for endogeneity in the regression. Endogeneity and control variables are further explained below the *OLS assumptions*. After discussing the OLS assumptions, the corresponding hypotheses and regressions to the sub questions will be further elaborated.

4.3.2 OLS assumptions

4.3.2.1 Zero conditional mean

The zero-mean condition is the main assumption of the OLS regression and states that the error terms must be independent and normally distributed. This means that the expected value of the error term (εi) must be zero for every value of X. If this is not the case, the regression is biased, and the independent variable is endogenous. Endogeneity can be caused in three ways. Namely, reverse causality, measurement error and omitted variable bias (OVB).

Instead of the independent variable (X) is influencing the dependent variable (Y), *reverse causality* implies that the dependent variable (Y) influences the independent variable (X). When there is reverse causality in the regression, the independent variable is endogenous. This might be a difficulty for the research because *Job Growth* might determine whether a company is creative. Perhaps, creative companies locate in areas where there is an increase in job growth. The higher the job growth, the more creative companies.

Another cause of endogeneity is *measurement error*. If there are measurement errors in the dataset, the derived results of the regressions are erroneous as well. I am aware that with every statistical research the resulting values are susceptible to any form of measurement error. However, considering that the dataset originates from the LISA database, which should be a reliable institution to begin with, I feel confident enough to use this data in my research.

OVB is the last cause of endogeneity in OLS. Omitted variables are related to the dependent and independent variable. If these variables are not included as control variables into the regression, the coefficient of the main independent variable includes partly the effect of the omitted variable. Hence, the regression coefficient β_1 will be biased and does not represent the true relation between the dependent and independent variable. The LISA dataset has one

possible omitted variable that should be included as a control variable. Namely, the *Number of jobs* (#Jobs). This variable is based on the total number of jobs a company has and presents the effect of the size of a company. This omitted variable might have an influence on both the independent and the dependent variable. A large company for instance can have a large decline in jobs while going bankrupt. On the contrary, a small company cannot have a decline of fifty jobs, while only having five jobs. And also the other way around, a large company can create more employment than a small company. This presents that *Job Growth* and the *Number of jobs* might be related. Besides this relation, the characteristics of a company might also be related to the company size. Perhaps, some industries have larger companies than other industries. Therefore, the independent variables *Port* and *Creative* as a characteristic of a company might be related to the company size. Considering these relations, including the company size as a control variable could lower the endogeneity of the regression.

The inclusion of the control variable might lead to another problem, because the effect of the control variable *Number of Jobs* might depend on the independent variables port or creative. Considering that the main characteristics of a company determines the business activities and consequently the number of employees. The possible influence of the independent variables on the control variable is called an *interaction effect.* An interaction effect occurs when one variable influences the effect of the other variable in the regression. The regressions will be biased when the interaction effect is not taken into account. The mathematical form of a regression with an interaction effect is as follows:

Regression with an interaction effect: $Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 (X_{i1} * X_{i2}) + \varepsilon i$

The regression coefficient β_3 present the interaction effect between the independent variable and the control variable. If β_3 is significantly larger or smaller than zero in the regression, then there is heterogeneity among companies based on the number of jobs. This might suggest that a small company does not only have fewer employees in comparison to a large company, but also has different characteristics. Therefore, the addition of the interaction effect is essential.

Besides controlling for the number of jobs, including *time fixed effects* is also useful in dealing with omitted variable bias in this research. Controlling for time fixed effects is done by including dummy variables for every year. These variables capture the influence of time related trends, such as year dependent economic crises. Perhaps in the year 2008, there has been a job decline for many companies in the M4H due to the economic crisis. Without including the year dummy variables, the independent creative or port variable might partly show this effect and

therefore will be biased. The essential requirement regarding time fixed effects is that the dataset must be in panel form. In this research, the LISA dataset is used, which consists of observations from 2000 till 2017. This dataset is in panel data form, therefore year dummy variables for the years 2000 till 2017 can be included in the regressions. Including these year dummy variables and the control variable *Number of Jobs* could lower the endogeneity of the regression. However, there might still be other variables that influence both the dependent and independent variable, but there is no possibility for controlling it in this research.

4.3.2.2 Homoskedasticity

Besides the zero-conditional mean, the OLS method assumes that all error terms from the observations have a constant variance, which is called *homoscedasticity*. The variance is not for every regression constant. When the observations are unequally scattered, the standard errors are not constant over time, which leads to a non-constant variance. When this is the case, the regression is heteroskedastic. With *Stata* command *"hettest"* it can be tested whether the regressions are heteroskedastic. If the test is significant, the regression is heteroskedastic. This can be solved by the following *Stata* command *"robust"*. The robust standard errors will solve the problem with the errors that are not constant.

4.3.3 Hypothesis and regression: Creative

The hypothesis and the regression of the sub question three will be elaborated in this section. The third sub question stated whether the Rotterdam Makers District can generate economic growth through the attraction of creative capital as a local benefit. Based upon this question, the following hypothesis has been formulated and the corresponding regressions has been made:

Hypothesis 1: $\qquad$ *A creative related company generates more job growth for the M4H area than non-creative companies.*

Short regression: $\qquad$ $Job\ Growth = \beta_0 + \beta_1 * Creative + \beta_2 + \varepsilon i$

Long regressions:

Without interaction effect*:* $\quad$ $Job\ Growth = \beta_0 + \beta_1 * Creative + \beta_2 * \#Jobs + \varepsilon i$

With interaction effect: $\quad$ $Job\ Growth = \beta_0 + \beta_1 * Creative + \beta_2 * \#Jobs + \beta_3 * (\#Jobs * Creative) + \varepsilon i$

Added year dummy variables: $\beta_n * Year_{2001} + \beta_{n+1} * Year_{2002} + \cdots + \beta_{n+17} * Year_{2017}$

In all three regressions, *Job Growth* is the dependent variable and presents the number of jobs increase or decrease of a company compared to the previous year. *Job Growth* presents absolute values, for instance when there has been an increase of two jobs in comparison to last year, the variable shows the value 2. The variable is therefore continuous, because it can obtain a large range of values. When the value of *Job growth* is positive, there has been a job increase within a company. And when the value is negative, there has been a decline. Within the short and long regression, the main independent variable is *Creative*. The *creative* variable is a dummy variable. When a company is creative, the company obtains value 1 (*Creative* = 1). While, when a company is not considered creative, the company obtains value 0 (*Creative* = 0). The regression coefficient β_0 is the constant and when the independent variable *Creative* obtains value 0, the coefficient represents the estimate of job growth for non-creative companies. The other regression coefficient β_1 presents the estimate of the effect of the creativeness of a company on the job growth. This coefficient shows the relation between job growth and the creative class in the M4H. The hypothesis states that $\beta_1 > 0$, and suggests that the variable *Creative* has a positive effect on the job growth in the M4H. The null-hypothesis states that β_1 is not significantly different from zero. Only when the null-hypothesis is rejected, it can be assumed that *Creative* has indeed a positive effect on job growth.

Compared to the short regression, the first long regression has one more variable. Namely, the control variable *#Jobs*. This is a continuous variable, because it can also obtain a large range of values. This variable is added to the regression to control for possible endogeneity. The other long regression has controlled for the possible interaction effect (*#Jobs * Creative)* between the two independent variables. Additionally, the three regressions will be provided with and without year dummy variables. These variables are added as control variables and also control for possible endogeneity. These year dummy variables can obtain the values 0 or 1. Every year from 2001 to 2017 has a dummy variable. The year 2000 does not have a dummy variable, because when every year dummy is equal to zero, the regression demonstrates the time effect on job Growth of 2000. The regression coefficient for a particular year presents the effect of that year on job growth.

In total six regressions will be provided. The results of all the regressions will be presented at the result section, because then suggestions can be made about the possible endogeneity caused by the number of jobs, interaction effects or time fixed effects.

4.3.4 Hypothesis and Regression: Port

The regression and hypothesis of sub question four will be discussed in this section. The sub fourth sub question considers whether the Rotterdam Makers District can continue with generating economic growth through their port companies while focussing on attracting creative capital. According to the literature, port activities have moved away from the M4H. This might suggest that port activities are less important economic drivers in that area. The following hypothesis and regression are made for investigating whether this is the case according to the LISA dataset:

Hypothesis 2:   *A port related company generates less job growth for the M4H*
                                         area than non-port related companies.

Short regression: $Job\ Growth = \beta_0 + \beta_1 * Port + \varepsilon i$

Long regressions:

Without interaction effect*:* $Job\ Growth = \beta_0 + \beta_1 * Port + \beta_2 * \#Jobs + \varepsilon i$

With interaction effect: $Job\ Growth = \beta_0 + \beta_1 * Port + \beta_2 * \#Jobs + \beta_3 *$
                                         $(\#Jobs * Port) + \varepsilon i$

Added year dummy variables: $\beta_n * Year_{2001} + \beta_{n+1} * Year_{2002} + \cdots + \beta_{n+17} * Year_{2017}$

The dependent variable *Job Growth* is the same as the regression of hypothesis 1. The same holds for the control variable *#Jobs* and the interaction effect in the long regressions. Therefore, these variables do not need further explanation. Additionally, like hypothesis 1 these regressions are also provided with and without year dummy variables. The main independent variable is different from the regressions of the first hypothesis. The main independent variable is now *Port* instead of *Creative*. The same with the *Creative* variable, the *Port* variable is also a dummy variable. When a company is related to port, the company obtains value 1 (*Port* = 1). On the contrary when the company is not considered port related, the company obtains value 0 (*Port* = 0). The regression coefficient β_0 of the regression represents the estimate of job growth for non-port related companies when the independent variable *Port* obtains value 0. The other regression coefficient β_1 presents the estimate of the effect of the port characteristic of a company on the job growth. This coefficient shows the relation between job growth and in the M4H. The hypothesis states that $\beta_1 < 0$, and suggests that the variable *Port* has a negative effect on the job growth in the M4H. The null-hypothesis states that β_1 is not significantly different from zero. Only when the null-hypothesis is rejected, the assumption can

be made that *Port* has indeed a negative effect on job growth. Similar to hypothesis 1, the results of all regressions will be presented at the result section and suggestions will be made about the possible endogeneity problem.

5. Results

5.1 Introduction

In this section I will discuss the results following from the methods as described in the *Methodology* section. This thesis uses these results to derive the conclusions regarding its research questions. This section will first elaborate on the *Company Overview* results, which is followed by the results regarding the LISA-Dataset. The results shown in this chapter will provide the basis for the discussion and conclusion of this thesis.

5.2 Results: evaluating company overview

In this section the results regarding the first two sub questions will be discussed. Both sub questions focus on the economic activities in the M4H area. The first sub question focuses on the economic activities related to the port and questions whether the M4H area is maritime minded or not. The second question focuses on whether the economic activities are related to creative capital and to what extent this creative capital is port related. In this research, information is collected from 90 companies and based on this information is determined whether a company is port or creative related. The *Methodology* chapter has presented the concepts that are used for this determination. The investigated companies are shown in Appendix C. As shown by the company list in Appendix C, nine companies do not have a port or creative characteristic. All the other companies are either related to the port and/or the creative class. These companies are also shown the figures in the next sections. First, the results of the economic activities regarding the port are elaborated.

5.2.1 Port related economic activities

Figure 14 shows the port related company overview in the M4H and is based on the company list in Appendix C. The figure shows an overview of the established port companies in the M4H area with the logos of the companies. Based on the following concepts is stated whether a company is port related: logistics, maritime, global trade, transhipment, and warehousing. If a company shows at one of the information variables one of these concepts, it will be considered as port related. For instance, the company *Royal Roos* is port related because the information variables: Industry and Specialties described their business activities as maritime related. As stated in the literature, the M4H area was particularly important for fruit transshipment. As shown by figure 14, there are still today companies doing business in fruit, such as *Rotterdam Fruit Wharf, Global Fruit Point* and *Fortuna Fruitos.* Some other port

related companies are focusing their business activities mainly on logistics which are not necessarily fruit related, such as *Jorden Logistics, Alltrans vdv B.V.* and *BSR van Uden.* In addition, figure 14 presents that some contributors to the attraction of creative capital are also port related, such as *Santas Koffie* and *Zero Food Waste Rotterdam.* The next section will further elaborate these companies.

Figure 14: Port related company overview of the M4H area presented by the logos of the companies based on this research (Sources: M4H website, Google Maps and Observation Site Tour)

The number of companies which are port related are presented in table 1. The table shows that 23 out of 90 companies are considered port related in the M4H area. The pie chart in figure 15 visualizes these numbers and shows that only 26% of all the investigated companies are port related. This means that still approximately a quarter of the total economic activities in the M4H area are port related and might contribute to the strengthening of the relationship between the port and the city.

Table 1

Number of port related companies in the M4H area

Overall Results	Number of companies
Port related companies	23
Non-port related companies	67
Total	90

Note: N=90. Sources: M4H Website, Google Maps, Site Observation Tour

Figure 15: Distribution of port related companies in the M4H

N= 90 observations. Sources: M4H Website, Google Maps, Site Observation Tour

5.2.2 Creative related economic activities

Figure 16 presents the creative company overview of the M4H area. Many companies are considered as creative capital in the M4H area. Based on the description of the creative class by Florida (2005), it is determined whether a company is part of the creative capital in the M4H area. Florida (2005) has described many creative occupations, such as artists, entertainers, architects, editors, researchers, and designers. All the occupations are described at the *Methodology* section.

The company *GroupA* in the M4H area is a great example of a creative company, because of the SBI description and About section, which states that they are architects. In the company overview there are more companies that are considered as creative capital due to the architect occupation, such as *De Urbanisten, Felixx* and *Kaw*. Other companies are suggested to also be creative, due to other occupation descriptions of Florida, such as company *OD*. The M4H description and Industry of *OD* states that the main business activity is designing. Considering that a designer is also a creative occupation, *OD* is creative related. The following companies are also considered as creative capital due to the designer occupation: *Spark, Solid Lighting, This is Bouw* and almost every studio presented in the company overview. *Dansvoer* and *Weelde* are examples of entertainment companies, entertainers are also a creative occupation and therefore these companies are also part of the creative capital in the M4H area. The *Erasmus Centre for Entrepreneurship* is part of the Erasmus University and therefore suggested that there are university professors and researchers, which are both seen as creative occupations.

Other companies in the figure are possible contributors to the attraction of creative capital. The creative contributors are split up into the urban service providers and the innovative companies. For instance, *Keilecafé* and *Fruitvis* are places which provides urban services, such as eating and drinking. These services are demanded by the creative class and therefore important in the attraction of creative capital. In addition, the literature review demonstrated that the creative class is attracted to innovative hubs. The Rotterdam Makers District has shown in the literature review that it wants to be an innovative hub, where the circularity and sustainability trend are crucial factors. The company *Floating Farm* in the M4H area might be a great example of an innovative company because circularity and sustainability are important values for their business activities. *Groencollect* is another example of an innovative company because it also focuses on sustainability. Another example of a company that might thrive well between the creative class is *PortXL*. This company is a port and maritime accelerator and therefore seen as port related. And besides port relation, the company states that they are innovation drivers and therefore possible contributors to creative capital.

Figure 16: Creative related company overview of the M4H area presented by the logos of the companies based on this research (Sources: M4H website, Google Maps and Observation Site Tour)

Table 2 presents the numbers regarding the companies which are creative related or not. The table shows that many companies are creative related. Based on table 2, figure 17 present the pie chart of creative companies in the M4H area. 54% of the companies are part of the creative

capital in the M4H area. 5% of the companies are providing urban services, which are demanded by the creative class and 11% are part of the innovative hub. Therefore, this research suggests that 70% (63 out of 90) of the companies in the M4H area are contributors to the attraction of the creative class in the Rotterdam Makers District.

Table 2

Number of creative related companies in the M4H area

Overall Results	Number of companies
Creative Capital	49
Urban Service Provider	4
Part of Innovative Hub	10
Not Creative Related	27
Total	90

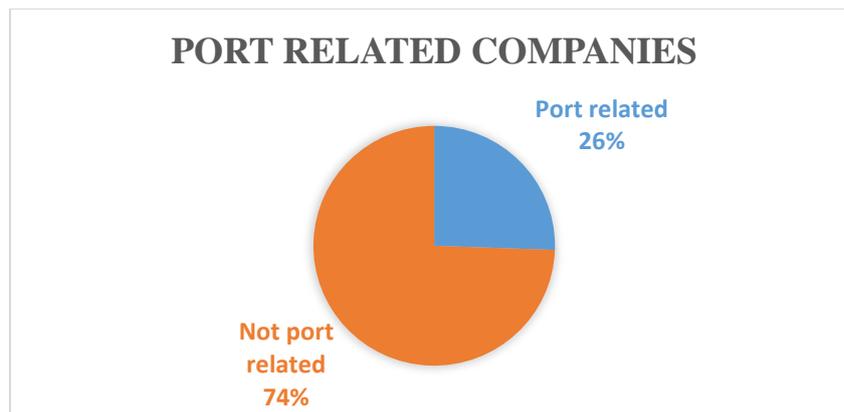Note: N=90. Sources: M4H Website, Google Maps, Site Observation Tour
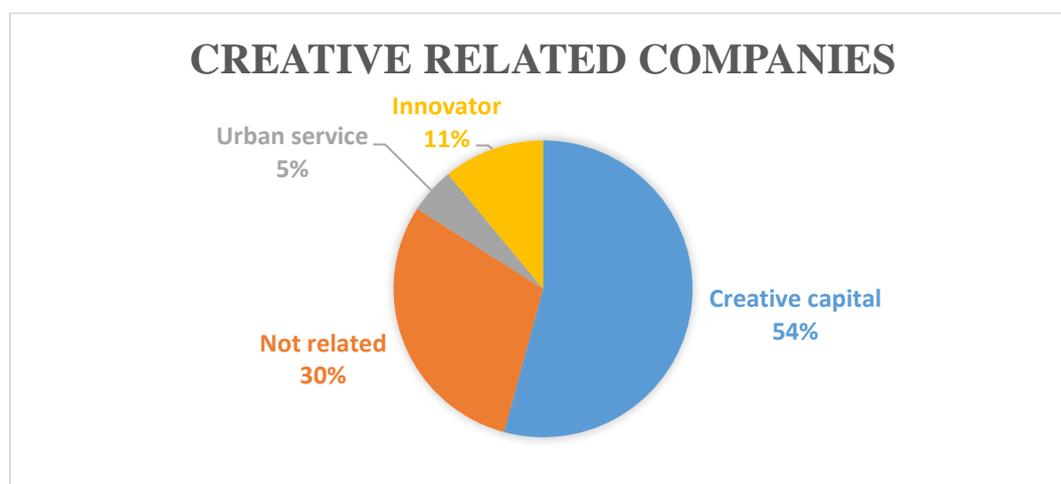
Figure 17: Distribution of port and creative related companies in the M4H

N= 90 observations. Sources: M4H Website, Google Maps, Site Observation Tour

The results have shown that the Rotterdam Makers District has port related economic activities and is attracting creative capital. It is important that the attracted creative capital is also port related regarding the strengthening of the port-city relationship. From the creative companies, which are considered part of the attracted creative capital in the company overview, there are zero companies acknowledged as port related. From the companies that are considered as creative contributors, there are five companies considered as port related. These companies are shown in figure 14. One of these companies is an earlier discussed company, namely *PortXL*. This means that only approximately 7.9% (5 out of 63) of the suggested creative companies

are port related. That is a low score and indicates that the attraction of creative capital in the M4H area is not necessarily port related.

The discussed results are based on all sources together. However, I also investigated the results of the three sources individually. The results from the M4H website only were quite remarkable compared to the results of all three sources taken together. Therefore, table 3 and table 4 are added to this result section. This table presents the number of port related companies in the M4H area based on only the companies that were listed on the M4H website. The table presents that only 5 of the 53 companies are port related on the M4H website. And on the contrary, 41 of the 53 companies are related to the attraction of creative capital. This might imply that the M4H area would rather have a creative character than a maritime character.

Table 3
Number of port related companies in the M4H area

M4H website Results Port	Number of companies
Port related companies	5
Non-port related companies	48
Total	53

Note: N=53. Sources: M4H Website

Table 4
Number of creative related companies in the M4H area

Overall Results Creative	Number of companies
Creative Capital	41
Urban Service Provider	3
Part of Innovative Hub	7
Not Creative Related	2
Total	53

Note: N=53. Sources: M4H Website

5.3 Results: analyzing LISA dataset

5.3.1 Descriptive statistics of port and creative related employment

This section provides insights about the employment and company development related to creative capital and the port sector in the M4H area. The two last sub questions will be discussed together, because they both focus on economic growth. The third sub question states whether the Rotterdam Makers District can generate economic growth through the attraction of creative capital. And the fourth question focuses on whether the Rotterdam Makers District also continues with generating economic growth through their port companies while focusing on attracting creative capital.

Figure 18 demonstrates the number of creative and port related jobs in the M4H area. The graph demonstrates that the number of port jobs have declined in the past years. Table 6 in Appendix B present the exact number of jobs. In the year 2000 there was the highest number of port jobs, namely 662. In the year 2017 there were only 314 port jobs left in the M4H area. This means that there was a decline of port jobs of more than 50% in the past 17 years. The largest drop was from the year 2010 to 2011. In the year 2011 there were 185 less port jobs in comparison to 2010. In that year *Rotterdam Fruit Wharf BV* reduced their employment with 105 jobs. This partly explains the major drop in port jobs. Given this information, the number of port jobs line in the graph substantiates the statement in the literature review that port activities have started to move away from the M4H area, in particular fruit transhipment companies.

On the contrary of the decline of number of port jobs, the number of creative jobs underwent different developments. One of the notable developments is the decline of 305 creative jobs in the 2004. One of the causes was that *the Rotterdam City development department of the municipality* had left the M4H area in 2004 and led to a decrease of 221 jobs. From 2012 there was only an increase in the number of creative jobs. Table 6 in Appendix B shows that in the year 2012 there were only 205 creative jobs and that in year 2017 there were already 636 creative jobs. This means that there was a creative job growth of 210.2% in five years' time. In 2014 creative job line and the port job line crossed each other and afterwards there were more creative jobs than port jobs in the M4H area. The focus of the policy of the M4H on creating an innovative hub seem achievable, because the area already has attracted creative capital to the area.
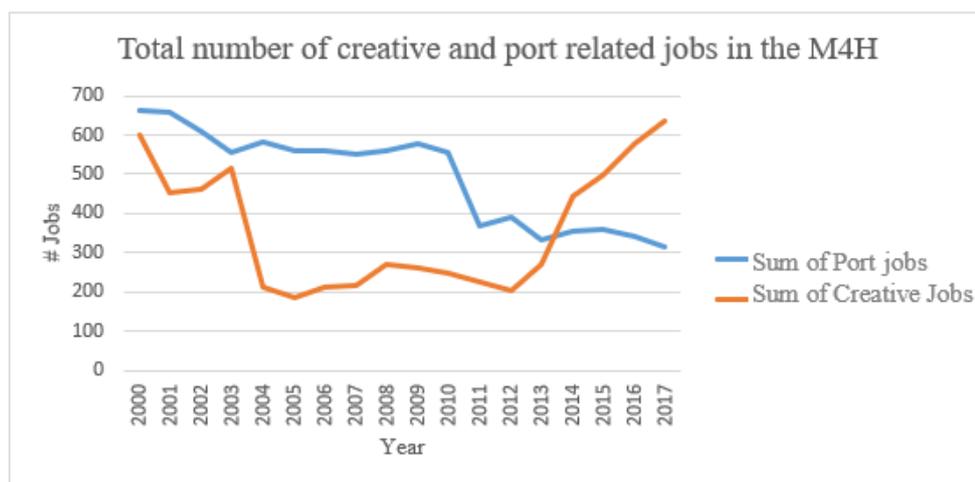
Figure 18: Number of port and creative related jobs in the M4H area from 2000 till 2017 based on the LISA dataset.

Besides discussing the job growth per creative and port sector, figure 19 demonstrates the creative and port company developments from 2000 till 2017. The number of the port related companies stayed between the 20 and 40 companies. In contrast to figure 18 there are no large declines at the end of the graph, there is even an increase in the number of companies in the years 2016 and 2017. From 2012 onwards there was a large increase of creative companies in the M4H area. Table 7 in Appendix B presents that in the year 2012, there were only 54 creative minded companies and in year 2017 there were 132 companies. This is a company growth of almost 144.4%. As shown by figure 13 in the data section, from 2012 onwards the M4H mainly attracted small companies (1 employee or 2-10 employee's companies). This suggests that the growth of the creative sector, mainly exists from small companies.
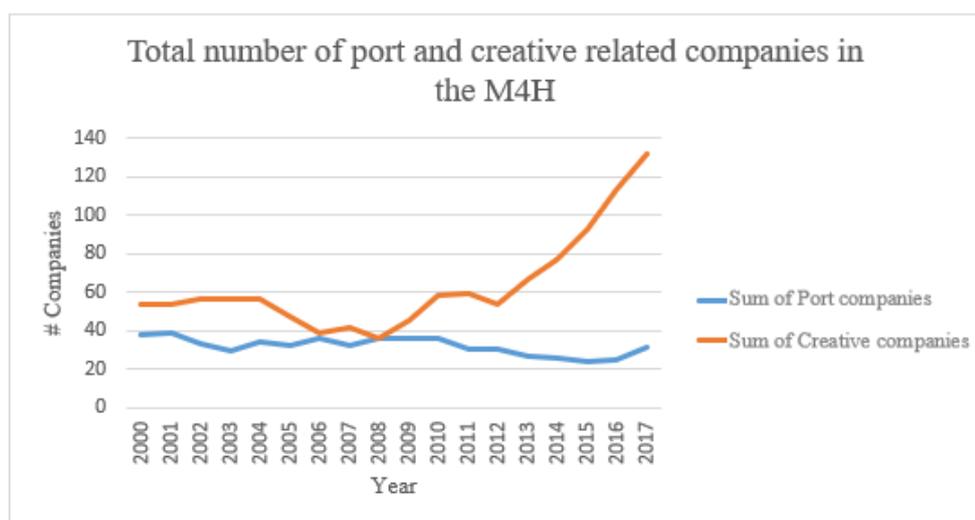
Figure 19: Number of port and creative related companies in the M4H area from 2000 till 2017 based on the LISA dataset.

5.3.2 Economic growth regression: Creative

The regression results for sub question three will be discussed in this section. The corresponding hypothesis and regression were as follows:

Hypothesis 1:   *A creative related company generates more job growth for the M4H area than non-creative companies.*

Short regression: $Job\ Growth = \beta_0 + \beta_1 * Creative + \beta_2 + \varepsilon i$

Long regressions:

Without interaction effect*:* $Job\ Growth = \beta_0 + \beta_1 * Creative + \beta_2 * \#Jobs + \varepsilon i$

With interaction effect: $Job\ Growth = \beta_0 + \beta_1 * Creative + \beta_2 * \#Jobs + \beta_3 * (\#Jobs * Creative) + \varepsilon i$

Added year dummy variables: $\beta_n * Year_{2001} + \beta_{n+1} * Year_{2002} + \cdots + \beta_{n+17} * Year_{2017}$

The results of the short and long regressions of hypothesis one are presented in table 5. As shown by the table, a total of six regressions are provided. The first short regression consists of only one independent variable. However, the regression might be biased, which is caused by omitted variables. This means that the independent variable presents partly the effect of other variables, which are not included. The other regressions try to solve the endogeneity problem by including other variables. The control variable *Number of Jobs* is included in the second regression. This control variable and the *interaction effect* between the independent variables are included in the third regression. The last three regressions present the same regressions, but *time fixed effects* are also added. The coefficients of the year dummy variables are shown in Appendix D table 1.

The first short regression demonstrates that a non-creative company experiences a job decline of 0.389 jobs per year. The second regression shows that a non-creative company experiences a larger job decline, namely 0.572. This means that a non-creative company has in two years approximately a decline of one job. Even though the constant is significant; it is not likely that the total *number of jobs* of a company is zero. A company without any employees does not exist in the LISA dataset. This also holds for the third regression. Moreover, the constants of the regressions with time fixed effects show only the job growth for non-creative companies in the year 2000. Therefore, the constant of the first regression provides better information about non-creative companies. The same applies for hypothesis two, because those regressions try to control for omitted variables the same way.

The coefficient of the control variable *#Jobs* at the second regression (with and without time fixed effects) is positive (0.018 and 0.017). This demonstrates that larger companies have a slightly higher job growth than smaller companies. Once the interaction effect is included at the third regression, the effect of *#Jobs* becomes almost zero. With or without the year dummy variables, the interaction effects are positive (0.056 and 0.053). This suggests that the number of jobs in general does not influence the job growth, but particularly the creative number of jobs does influence the job growth.

The estimate of the effect of the *Creative* characteristic is shown by coefficient β_1. The first regression suggests that a creative company has approximately a 0.470 higher growth of jobs per year than a non-creative company, ceteris paribus. However, as stated before there might be endogeneity in this regression. The last regression of the table has controlled for all the discussed omitted variables. Therefore, the endogeneity level of this might be the lowest. The β_1 of the first regression is larger than the β_1 of the last regression (0.470>0.125). Therefore, the β_1 might be upward biased and therefore tends to overestimate the effect of the creative characteristic of a company on job growth. The estimate of the β_1 of the long regression is 0.125 and is not significant ($p > 0.05$). If the effect would have been significant, then a creative company would have 0.125 more job growth than a non-creative company from 2000 to 2017 in the M4H area.

The regression results have provided meaningful insights in the job growth in the M4H area. The results have suggested that a creative company has more job growth per year than a non-creative company. However, the effects of the *Creative* variable are insignificant for all regressions and therefore the null-hypothesis cannot be rejected, indicating that a creative company does not generate more job growth per year than a non-creative company in the M4H area. In addition, the effects of the other control variables were also insignificant. Therefore, no further conclusions can be drawn regarding the endogeneity problem that is caused by the discussed omitted variables.

Table 5

The linear-regression results for the effect of the creative characteristic of a company on choosing job growth

Dependent variables	Job growth					
	Without Time fixed effects			*With Time fixed effects*		
Constant (β_0)	-0.389	-0.572*	-0.391	0.128	-0.146	-0.061
	(0.269)	(0.274)	(0.281)	(0.272)	(0.394)	(0.406)
Creative (β_1)	0.470	0.563	0.189	0.396	0.482	0.125
	(0.364)	(0.361)	(0.386)	(0.375)	(0.372)	(0.397)
# Jobs (β_2)		0.018	0.000		0.017	0.001
		(0.020)	(0.024)		(0.020)	(0.024)
# Jobs * Creative (β_3)			0.056			0.053
			(0.046)			(0.046)

Coefficients are given. Standard errors are in the brackets below the coefficients. Significance level: * $p<0.05$, ** $p<0.01$. N=2361

5.3.3 Economic growth regression: Port

The results for sub question four will be elaborated in this section. The corresponding hypothesis and regression were as follows:

Hypothesis 2:   *A port related company generates less job growth for the M4H area than non-port related companies.*

Short regression: $Job\ Growth = \beta_0 + \beta_1 * Port + \varepsilon i$

Long regressions:

Without interaction effect*:* $Job\ Growth = \beta_0 + \beta_1 * Port + \beta_2 * \#Jobs + \varepsilon i$

With interaction effect: $Job\ Growth = \beta_0 + \beta_1 * Port + \beta_2 * \#Jobs + \beta_3 * (\#Jobs * Port) + \varepsilon i$

Added year dummy variables: $\beta_n * Year_{2001} + \beta_{n+1} * Year_{2002} + \cdots + \beta_{n+17} * Year_{2017}$

The same with hypothesis one, there are also six regression results provided. As shown by table 6, the regressions have the same set up as table 5. The year dummy variables of this table are presented at Appendix D table 2. As discussed at hypothesis one, the constant of the first regression also provides the best information regarding job growth of non-port related companies. The coefficient β_0 is equal to 0.005, which is a very low outcome. This would imply that companies which are not related to port activities have a yearly job growth of 0.005 in the M4H area.

The coefficient of the control variables *#Jobs* at the second regression (with and without time fixed effects) are positive (0.018 and 0.018). This demonstrates that larger companies have a slightly higher job growth than smaller companies. Once the interaction effect is included, the effect of *#Jobs* on job growth becomes larger. With or without the year dummy variables, the interaction effects are negative (-0.087 and -0.086). This suggests that there is heterogeneity among large and/or small companies. The results imply that the larger the port company, the greater the job decline. And on the contrary, the larger the non-port related company, the greater the job increase, ceteris paribus. The interaction effect is significant, and this made me question whether the effect of port companies on the number of jobs is significantly larger or smaller than the effect non-port related companies. This question will be discussed at the conclusion and discussion section as a suggestion for further research.

The coefficient β_1 presents the estimate of the effect of the port characteristic of a company on job growth. Similar to the results of table 5, the coefficient β_1 of the first regression might be biased. The last regression has controlled for every discussed omitted variable and therefore might have solved the endogeneity problem. In the first regression the effect of the *Port* characteristic of a company on job growth is negative and suggests that a port company has a decrease of half job per year. On the contrary, in the last regression the *Port* effect on job growth is positive (+0.163). However, the LISA dataset does not consist of companies which have zero employees. The results imply that when a port company has more than 10 employees, the yearly job growth is negative. Nevertheless, the coefficient β_1 of the first regression is suggested to be downward biased and shows the effect of other omitted variables. Therefore, interpreting the results of the last regressions would be a better choice. The β_1 in the long regression is 0.163 and not significant ($p > 0.05$). If the effect of *Port* on *Job Growth* would have been significant, then a port related company would have an increase of approximately 0.163 jobs per year in the M4H from 2000 to 2017. Considering that the effect is not significant, the null-hypothesis cannot be rejected, indicating that a port related company does not necessarily experience a job decline.

Table 6

The linear-regression results for the effect of the port characteristic of a company on job growth

Dependent variables	Job growth					
	Without Time fixed effects			*With Time fixed effects*		
Constant (β_0)	0.005	-0.090	-0.353	0.464	0.274	-0.145
	(0.210)	(0.216)	(0.237)	(0.270)	(0.366)	(0.435)
Port (β_1)	-0.509	-0.670	0.089	-0.441	-0.594	0.163
	(0.415)	(0.412)	(0.427)	(0.423)	(0.418)	(0.438)
# Jobs (β_2)		0.018	0.070		0.018	0.069
		(0.020)	(0.037)		(0.020)	(0.037)
# Jobs * Port (β_3)			-0.087*			-0.086*
			(0.044)			(0.044)

Coefficients are given. Standard errors are in the brackets below the coefficients. Significance level: * $p<0.05$, ** $p<0.01$. N=2361

6. Conclusion and Discussion

6.1 Answering the research question

The purpose of this thesis is providing a better understanding about the creation of local benefits by attracting the creative class through waterfront redevelopments. The main research question of this paper is:

> *"Do waterfront redevelopment projects effectively create port related local benefits for the port-city by attracting the creative class and therefore, improve the relationship between the port and the city?"*

To provide an answer to this research question, the question is split into four sub questions, which are specified on the waterfront redevelopment project: The Rotterdam Makers District. An answer can be formulated for the main research question by answering the sub questions Therefore, the answers to the sub questions will be first summarized. First, the answer to sub question one is provided:

Sub question 1: *"To what extent are the economic activities that resulting from the waterfront redevelopment project in the Rotterdam Makers District, port related?"*

In the literature review is stated that the RDM area as part of the Rotterdam Makers District is maritime minded and has connections to the maritime sector, such as the port related businesses in that area. For the M4H is not suggested that the area is maritime minded, therefore an empirical research is provided about the relation between the M4H area and the port. The research demonstrated that 26% of the investigated companies in the M4H area are port related. This shows that economic activities are partly port related and can contribute to the strengthening of the port-city relationship. However, it is notable that from the 53 listed companies on the M4H website, there were only 5 port related. This might suggest that the M4H area does not consider the maritime activities as a high priority. The next sub question investigates whether the Rotterdam Makers District can attract creative capital to the area:

Sub question 2: *"By investigating the economic activities, is the Rotterdam Makers District attracting creative capital and to what extent is this creative capital port related?"*

Based on the three crucial factors (Talent, Tolerance and Technology) is concluded in the literature review that the Rotterdam Makers District can attract creative capital. The literature review showed that there are multiple educational institutions located in the makers district and that the city Rotterdam provides opportunities for high educated entrepreneurial talent, which suggests that *talent* can be attracted. Additionally, it presented that the city Rotterdam is culturally diverse, which indicates *tolerance*. The *technology* level of an area is based on the concentration of innovation and high technology. In the literature review is stated that the Rotterdam Makers District is focussing on becoming an innovative hub and therefore might increase the technology levels in that area. Besides reviewing the literature, more empirical research is provided to confirm whether this is indeed the case for the M4H. According to the description of creative occupations of Florida, the results section shows that 54% companies are considered as creative capital. Besides the creative capital, there are some other companies that contribute to the attraction of the creative class. Companies that provide urban services or support the innovative environment are possible creative contributors. Based on this reasoning, another 16% of the companies in the M4H are contributors to a creative environment. Therefore, the suggestion is made that a total of 70% companies in the M4H area might attract creative capital to the Rotterdam Makers Districts. Based on the literature review and the results it can be suggested that the Rotterdam Makers District can attract creative capital and has already attracted the creative class.

As demonstrated by the literature review, the attraction of creative capital has one major positive effect, which is the creation of economic growth in an area. Economic growth is considered as a local benefit in this thesis. According to the literature review, for strengthening the port-city relationship, it is important that the local benefits are also port related. Therefore, I investigated whether the creative companies are also port related and combined the results of sub questions one and two. However, only approximately 7.9% of the suggested creative companies are port related. This is a very low score and indicates that the attraction of creative capital in the M4H area is not necessarily port related. Therefore, the possible creation of local benefits through attracting creative capital is not necessarily port related. The next sub question focusses on whether the attracted creative capital is indeed creating local benefits:

Sub question 3:   *"Is the Rotterdam Makers district generating economic growth through the attraction of creative capital as a local benefit?"*

In this thesis the indicator for economic growth is job growth, because the M4H is an industrial area with many business activities and less living opportunities. Hence, GDP would not have been a good indicator for the area. Figure 11 at the descriptive statistics at the data section showed that from 2013 till 2017 there was a job growth of approximately 34,8% in four years' time. In addition, from 2012 onward there only had been an increase in the number of companies, which consisted mostly of small companies with one or between two and ten employees. The growth in the number of jobs and companies implies an economic growth from at least from 2013 to 2017. This indicates that the creative class might have been attracted, because economic growth is one of the major positive effects. The descriptive statistics at the result section demonstrated the port and creative related job and company growth. These figures presented that from the year 2012 until the year 2017 there had been a creative related job growth of 210.2% and a company growth of almost 144.4%. This suggest that the generated economic growth in the M4H area is indeed creative related. Additionally, it can be suggested that the attracted capital consists mostly of small companies.

For this research there were also regressions executed to investigate whether a creative company has significantly more job growth than a non-creative company. The regressions showed that from 2000 till 2017 a creative company would has experienced more job growth than a non-creative company. The results demonstrated that the effect of the creative company characteristic on job growth is positive. However, the results were insignificant, and no conclusions can be drawn for these results.

The findings for sub question three suggest that creative capital is attracted to the M4H area. However, while focussing on attracting creative capital, does the M4H area also continue with generating economic growth through port activities? Which is important for the strengthening of the port-city relationship. This leads to answering the last sub question of this thesis:

Sub question 4:   *"While focussing on attracting creative capital, does the Rotterdam Makers district also continue with generating economic growth through their port companies?"*

The answer to sub question one already presented that there are still port activities in the M4H area. The descriptive statistics about the port and creative related job and company growth demonstrated that the number of port jobs declined with more than 50% in the past 17 years. This section substantiated the statement in the literature review that port activities have started to move away from the M4H area, in particular fruit transhipment companies. Additionally,

regressions have been tested for investigating whether a port related company has significantly less job growth than a company that is not port related. The results presented that from 2000 till 2017 a port company with more than 10 employees would have less job growth than a company that is not related to the port. The same with these regressions, the results were not significant, and no further conclusions can be drawn from there results.

Based on the answers to the sub questions, an answer to the main research question can be provided. This research suggests that waterfront redevelopment projects can be successful in attracting creative capital. Additionally, based on the descriptive statistics the attracted creative class is creating job and company growth. This means that local benefits are created in the Rotterdam Makers District. The literature showed that the local benefits should be port related regarding the strengthening the port-city relationship. Nevertheless, the results suggested that the attracted creative capital is not port related. Therefore, the attracted capital does not contribute to the strengthening of the port-city relationship.

6.2 Research limitations

One of the main limitations of this thesis is that the regression results for sub questions three and four are not significant and no conclusions can be drawn from these results. Nonetheless, the descriptive statistics of sub questions three and four at the result section presented interesting insights and substantiated the literature review.

Even when the results would have been significant, omitted variable bias would be a serious problem. There was only one possible omitted variable available in the LISA dataset, which could be included as a control variable. However, there might be other factors that both influences the dependent and independent variables, such as the age of the company or the type of company.

Besides having more control variables, to lower the level of endogeneity in the regression, other research methods could be used, such as the Fixed effects method. This method controls for every time-invariant control variable. The data requirement for fixed effects is that the dataset should consist of panel data. In this thesis the quantitative LISA dataset consists of panel data. However, the dummy variables Port and Creative as independent variables are time invariant. And with fixed effects all the time invariant variables are demeaned and get value zero. Therefore, the method would not present the effect of the independent variables on the dependent variable. Instead of using the Fixed effects method, I have added time fixed effects as year dummy variables to control for yearly time-invariant effects.

One of the strong points of this thesis is the combination of qualitative and quantitative data. The company overview supplements the LISA dataset with information about the SBI-codes. Besides the supplements, both datasets present different insights for answering the main research question. However, there is one downside of combining the two datasets, the datasets do not match perfectly. The company overview is based on the current companies in the M4H areas and only the SBI codes of these companies are used for making the extract of the LISA dataset. Only these current (2020) SBI codes were used, because only for these are determined whether the company is port or creative related. On the contrary, the LISA dataset consists of company information from 2000 till 2017 and therefore there is a high chance that some SBI codes are missing. Even tough, this might be the case, I am confident that most of the activities are covered in this dataset with this method.

Moreover, within the scope of time for this thesis it was not doable to investigate every possible SBI code in the M4H area from 2000 till 2017. Additionally, it would be for some companies impossible to find the information that is needed, because they went bankrupt in the early years for instance.

The last limitation is about determining whether a SBI code is port or creative related based on the information of the company overview. Some SBI codes had quite general descriptions and because the companies in the company overview is creative minded, it does not have to be the case that every company with the same SBI code is also creative mined. Nonetheless, many SBI codes had a clear descriptions. Additionally, I checked for some companies in the LISA dataset whether they could indeed be creative or port related. This did not show very worrying cases.

Considering the limitations, the results and statistics of this thesis should be handled with caution. They provide helpful insights for answering the main research questions, but no rock-solid conclusions can be drawn.

6.3 Future research recommendations

For future research on this topic there are multiple recommendations, which are described in this section. The main research question of this thesis focused on the Rotterdam Makers District. This district consists of two areas, namely the RDM and the M4H. According to the literature review, the RDM was already considered as a successful waterfront redevelopment project, therefore the empirical study focused on the M4H area. However, it would also be interesting to do the same empirical study on the RDM and compare these two areas. A

comparison between these areas might highlight factors that can contribute to successful waterfront redevelopment. Moreover, the Rotterdam Makers District is part of the Cityports of Rotterdam. The Cityports consists of more areas than the RDM and M4H, such as the Eemhaven and Waalhaven. Perhaps these areas do also contribute to the port-city relationship by providing local benefits. Therefore, another recommendation is doing the same research for these areas.

Another recommendation for further research would be doing research about the creation of other local benefits in the Rotterdam Makers District. This thesis focused on the economic related local benefits, such as the creation of economic growth and the economic activities in the M4H area. Another possible local benefit would be making the port culture more essential in that area, such as organising port related events. This might also strengthen the port-city relationship.

According to Florida (2005) one of the local benefits of the attraction of creative capital is economic growth. This thesis looked at the job growth as indicator of economic growth in the M4H area and whether this growth was related to the creative class. As Florida also described in his research, the creative class is drawn to places which possesses three critical factors. Namely, technology, talent and tolerance. According to the literature review, the Rotterdam Makers District possesses these factors. To confirm the presence of these crucial factors, more empirical research could be done about these three critical factors, such as talent. Therefore, a potential recommendation for further research is investigating the amenities that are needed to attract talent, such as living opportunities or educational institutions.

As demonstrated at the result section, the interaction effect between the port characteristic and the number of jobs is significant. This made me question whether port companies have significantly more or less employees than a non-port related company. Due to the descriptive statistics, which demonstrated that there was an increase in small companies and an increase in creative companies, I also questioned whether a creative company has significantly less employees than a non-creative company. I have added Appendix E with OLS regression results regarding these questions for future recommendations. The results in table 2 of Appendix E show that a port company has approximately 8 employees more than a non-port related company (with or without year dummy variables). And the results in table 1 of Appendix show that a creative company has approximately 5 employees less than a non-creative company (with or without year dummy variables). The effects of a company characteristic (Port or creative)

on the number of jobs are both significant. Therefore, it would be a good recommendation to investigate the company sizes of different types of companies in the Rotterdam Makers District. A new research could do an analysis of the trade-off between the creative and port companies that might be happening in the Rotterdam Makers district. The results of Appendix E suggest that a port companies have more employment than creative companies. This means that when one port company leaves the area, multiple creative companies must be attracted to compensate the number of jobs in the area. The research question could focus on whether it would be better to have a few large companies or to have multiple small companies in an area for the employment rate in the long term.

In conclusion, there are multiple recommendations for further research about the Rotterdam Makers District. More in-depth analysis would contribute to the comprehension of the evolution of waterfront development projects.

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Appendix A

The following postcodes occurs in the datasets:

> Addresses company overview (3029): AA, AC, AG, AH, AJ, AK, AL, AM, AP, AR, AS, BE, BG, BH, BM, BP, BR, BS, BT

> Addresses LISA dataset (3029): AA, AB, AC, AD, AE, AG, AH, AJ, AK, AL, AM, AP, AR, AS, AT, AV, AW, AB, BB, BE, BG, BH, BJ, BL, BM, BA, BP, BR BT, BW

The LISA dataset was based on the whole postcode area 3029 (Figure 1A). However, this area is too large to represent only the M4H area. Therefore, some postcodes are deleted from the dataset. Figure 2B shows the M4H area based on the postcodes of the company overview and the map provided in the vision and strategy document of the Rotterdam Makers District.
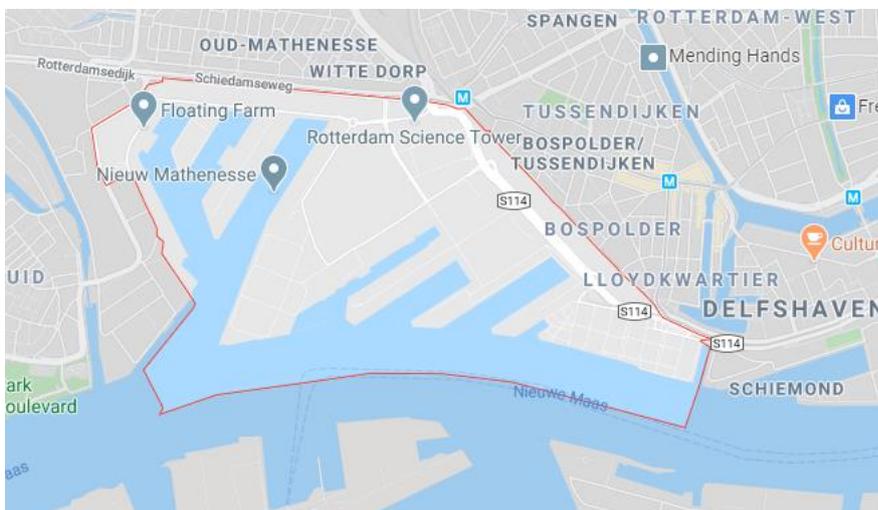
Figure 1A: Postcode area 3029

Figure 2A: M4H area

Appendix B

Table 1
Total jobs in the M4H area based on the LISA dataset

Year	Number of jobs
2000	2137
2001	1994
2002	2014
2003	2098
2004	1796
2005	1644
2006	1737
2007	1831
2008	1886
2009	1941
2010	1931
2011	1740
2012	2259
2013	2119
2014	2509
2015	1296
2016	1003
2017	1033

Table 2:
Number of jobs of the civil engineering's office of Rotterdam in the M4H area based on the LISA dataset

Year	Number of jobs
2000	707
2001	674
2002	716
2003	761
2004	758
2005	776
2006	851
2007	955
2008	944
2009	1024
2010	1044
2011	1062
2012	1581
2013	1446
2014	1637
2015	356
2016	0
2017	0

Table 3
Total jobs in the M4H area based on the LISA dataset, without the data of the civil engineering's office of Rotterdam

Year	Number of jobs
2000	1430
2001	1320
2002	1298
2003	1337
2004	1038
2005	868
2006	886
2007	876
2008	942
2009	917
2010	887
2011	678
2012	678
2013	673
2014	872
2015	940
2016	1003
2017	1033

Table 4
Total number of companies in the M4H area based on the LISA dataset

Year	Number of companies
2000	113
2001	116
2002	113
2003	112
2004	116
2005	102
2006	96
2007	93
2008	91
2009	101
2010	114
2011	109
2012	103
2013	115
2014	125
2015	141
2016	164
2017	185

Table 5
The number of companies per category in the M4H area. Cat. 0 (1 employee), cat. 1 (2-10 employees), cat. 2 (11-50 employees), cat. 3 (51-200 employees), cat. 4 (201-500 employees), cat. 5 (501-1000 employees), cat 6. (>1000 employees).

Year	Cat. 0	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 5	Cat. 6	Grand Total
2000	32	56	19	3	2	1		113
2001	31	63	17	2	2	1		116
2002	33	59	16	2	2	1		113
2003	34	58	13	4	2	1		112
2004	40	55	16	3	1	1		116
2005	36	46	16	2	1	1		102
2006	33	43	15	3	1	1		96
2007	30	44	14	3	1	1		93
2008	24	47	16	3		1		91
2009	27	53	17	3			1	101
2010	43	50	16	4			1	114
2011	45	42	20	1			1	109
2012	37	46	18	1			1	103
2013	49	47	17	1			1	115
2014	54	48	18	4			1	125
2015	60	59	17	4	1			141
2016	75	68	17	4				164
2017	81	81	20	3				185
Total								**2109**

Table 6
Number of port and creative related jobs in the M4H area based on the LISA dataset

Year	Number of Port related jobs	Number of Creative related jobs
2000	662	602
2001	657	455
2002	609	462
2003	557	516
2004	582	211
2005	558	184
2006	562	211
2007	551	215
2008	558	269
2009	578	263
2010	554	246
2011	369	226
2012	391	205
2013	331	269
2014	353	444
2015	360	499
2016	341	577
2017	314	636
Grand Total	**8888**	**6490**

Table 7
Number of port and creative related companies in the M4H area based on the LISA dataset.

Row Labels	Sum of Port related	Sum of Creative related
2000	38	54
2001	39	54
2002	33	56
2003	29	56
2004	34	56
2005	32	47
2006	36	39
2007	32	41
2008	36	36
2009	36	45
2010	36	58
2011	30	59
2012	30	54
2013	27	67
2014	26	77
2015	24	93
2016	25	113
2017	31	132
Grand Total	**574**	**1137**

Appendix C

Company overview M4H area

Company name	Source company	SBI code	SBI code description	Port	Creative
Atelier van Lieshout	M4H website	47.78.3	Winkels in schilderijen, lijsten, prenten, kunstvoorwerpen en religieuze artikelen	No	Yes
Awkward	M4H website	62.01	Ontwikkelen, produceren en uitgeven van software	No	Yes
Bouw Akademie	M4H website	85.59.2	Bedrijfsopleiding en -training	No	Contributor: Innovative
Club Gusto	M4H website	68.32	Beheer van onroerend goed	No	Yes
Conform Cox	M4H website	74.10.1	Communicatie- en grafisch ontwerp	No	Yes
Dansvoer	M4H website	90.02	Dienstverlening voor uitvoerende kunst	No	Yes
De Bende	M4H website	74.10.2	Industrieel en productontwerp	No	Yes
De Urbanisten	M4H website	71.12	Ingenieurs en overig technisch ontwerp en advies	No	Yes
Erasmus Centre for Entrepreneurship	M4H website	70.22.1	Organisatieadviesbureaus	No	Yes
Felixx	M4H website	71.12	Ingenieurs en overig technisch ontwerp en advies	No	Yes
Floating Farm	M4H website	10.89	Vervaardiging van overige voedingsmiddelen (rest)	No	Contributor: Innovative
Fruitvis	M4H website	56.3	Cafés	No	Contributor: Urban Service
Groencollect	M4H website	38.11	Inzameling van onschadelijk afval	No	Contributor: Innovative
GroupA (architects)	M4H website	71.11.1	Architecten (geen interieurarchitecten)	No	Yes
Hatrabbits	M4H website	62.01	Ontwikkelen, produceren en uitgeven van software	No	Yes
Kaw	M4H website	71.11.1	Architecten (geen interieurarchitecten)	No	Yes
Keilecafé	M4H website	56.21	Eventcatering	No	Contributor: Urban Service
Keilewerf I en II	M4H website	74.9	Overige specialistische zakelijke dienstverlening	No	Yes
Krill Architectuur en Onderzoek	M4H website	71.11.1	Architecten (geen interieurarchitecten)	No	Yes
Lab Hotel	M4H website	74.9	Overige specialistische zakelijke dienstverlening	No	Yes
OD Designstudio	M4H website	73.11	Reclamebureaus	No	Yes
Organism Studios	M4H website	62.01	Ontwikkelen, produceren en uitgeven van software	No	Yes
Rotterdams Collectief	M4H website	73.11	Reclamebureaus	No	Yes
Royal Roos	M4H website	46.72.2	Groothandel in ferrometalen en -halffabrikaten	Yes	No
Sabine Marcelis	M4H website	74.10.3	Interieur- en ruimtelijk ontwerp	No	Yes

Sant Interiors	M4H website	78.20.2	Uitleenbureaus	No	Yes
Santas Koffie	M4H website	46.37	Groothandel in koffie, thee, cacao en specerijen (geen ruwe)	Yes	Contributor: Innovative
Shokunin Coffee Collective	M4H website	85.59.2	Bedrijfsopleiding en -training	Yes	Contributor: Innovative
Snijlab	M4H website	22.29	Vervaardiging van overige producten van kunststof	No	Yes
Sober Industries B.V.	M4H website	73.11	Reclamebureaus	No	Yes
Solid Lighting Design	M4H website	27.4	Vervaardiging van elektrische lampen en verlichtingsapparaten	No	Yes
Spark Design & Innovation	M4H website	72.19.2	Technisch speur- en ontwikkelingswerk	No	Yes
Stichting Voedseltuin	M4H website	88.99.3	Lokaal welzijnswerk	No	No
Studio I Focus	M4H website	47.59.1	Winkels in meubels	No	Yes
Studio Buitenom	M4H website	74.10.3	Interieur- en ruimtelijk ontwerp	No	Yes
Studio De Ronners	M4H website	73.11	Reclamebureaus	No	Yes
Studio Faber	M4H website	74.10.3	Interieur- en ruimtelijk ontwerp	No	Yes
Studio Inherent	M4H website	74.10.1	Communicatie- en grafisch ontwerp	No	Yes
Studio Minale-Maeda	M4H website	74.10.2	Industrieel en productontwerp	No	Yes
Studio New West	M4H website	59.11.1	Productie van films (geen televisiefilms)	No	Yes
Studio Roosegaarde	M4H website	90.03	Schrijven en overige scheppende kunst	No	Yes
Studio Wieki Somers	M4H website	74.10.3	Interieur- en ruimtelijk ontwerp	No	Yes
The Talk of the Town - TTOTT	M4H website	46.47.1	Groothandel in huismeubilair	No	Yes
This is Bouw	M4H website	85.59.2	Bedrijfsopleiding en -training	No	Yes
Toettoetfood	M4H website	90.02	Dienstverlening voor uitvoerende kunst	No	Contributor: Urban service
We Umbrella	M4H website	26.2	Vervaardiging van computers en randapparatuur	No	Yes
Weelde	M4H website	90.02	Dienstverlening voor uitvoerende kunst	No	Yes
Widget Brain	M4H website	62.01	Ontwikkelen, produceren en uitgeven van software	No	Yes
Woodwave	M4H website	43.32	Bouwtimmeren	No	Yes
Zero Food Waste	M4H website	94.99.6	Overige ideële organisaties (rest)	Yes	Contributor: Innovative
Zero Latency	M4H website	93.29.9	Overige recreatie (rest, geen jachthavens)	No	Yes
BSR van Uden Stevedoring	Google maps	52.29.1	Expediteurs, cargadoors, bevrachters en andere tussenpersonen in het goederenvervoer	Yes	No

Diva Party Centre	Google maps	90.02	Dienstverlening voor uitvoerende kunst	No	Yes
Rotterdam Fruit Wharf BV	Google maps	52.24.1	Laad-, los- en overslagactiviteiten voor zeevaart	Yes	No
JS Trade B.V.	Google maps	46.18	Handelsbemiddeling gespecialiseerd in overige goederen	Yes	No
RC Inspection	Google maps	49.41	Goederenvervoer over de weg (geen verhuizingen)	Yes	No
Alltrans vdv B.V.	Google maps	52.29.1	Expediteurs, cargadoors, bevrachters en andere tussenpersonen in het goederenvervoer	Yes	No
Soigneur	Google maps	58.11	Uitgeverijen van boeken	No	Yes
Jorden Logisitcs	Google maps	52.29.1	Expediteurs, cargadoors, bevrachters en andere tussenpersonen in het goederenvervoer	Yes	No
Werkplaats de Rijk	Google maps	31.09	Vervaardiging van overige meubels	No	Yes
CDS electronics B.V.	Google maps	26.11	Vervaardiging van elektronische componenten	No	No
Argomerchants Rotterdam	Google maps	82.92	Pakken, sorteren e.d. in loon	Yes	No
Fortuna Frutos International	Google maps	46.31.1	Groothandel in groenten en fruit	Yes	No
HIWA Rotterdam Port Cold Stores B.V.	Google maps	52.29.1	Expediteurs, cargadoors, bevrachters en andere tussenpersonen in het goederenvervoer	Yes	No
Prodalim Holland B.V.	Google maps	72.19.3	Speur- en ontwikkelingswerk op het gebied van gezondheid en voeding (niet biotechnologisch)	No	Contributor: Innovative
Continental Juice	Google maps	46.34	Groothandel in dranken (geen zuivel)	Yes	No
Frabex B.V.	Google maps	52.29.1	Expediteurs, cargadoors, bevrachters en andere tussenpersonen in het goederenvervoer	Yes	No
CINNNAMON	Google maps	91.02.2	Kunstgalerieën en -expositieruimten	No	Yes
Kunst & Complex	Google maps	91.02.2	Kunstgalerieën en -expositieruimten	No	Yes
Bolder Neoliet	Google maps	93.11.2	Sporthallen, sportzalen en gymzalen	No	No
Port XL	M4H website	70.22.2	Advisering op het gebied van management en bedrijfsvoering (geen public relations en organisatie-adviesbureas)	Yes	Contributor: Innovative
Rainmaker	M4H website	71.12	Ingenieurs en overig technisch ontwerp en advies	No	Yes
MoederscheimMoonen Architects	Observation tour	71.11.1	Architecten (geen interieurarchitecten)	No	Yes
Jordy's Bakery (voor horecaklanten)	Observation tour	47.24.1	Winkels in brood en banket	No	No

Conforte	Observation tour	88.99.9	Overig maatschappelijk advies, gemeenschapshuizen en samenwerkingsorganen op het gebied van welzijn	No	No
OBA grandcafe & Restaurant	Observation tour	56.10.1	Restaurants	No	Contributor: Urban service
Stadsgas	Observation tour	46.69.2	Groothandel in machines en apparaten voor de warmte-, koel- en vriestechniek	No	Contributor: Innovative
Kringloopwinkel Keigoed	Observation tour	94.99.3	Steunfondsen (niet op het gebied van welzijnszorg)	No	Contributor: Innovative
Dutoit Europe B.V.	Observation tour	46.31.1	Groothandel in groenten en fruit	Yes	No
Global Fruit Point	Observation tour	72.19.1	Speur- en ontwikkelingswerk op het gebied van landbouw en visserij (niet biotechnologisch)	Yes	No
Sitra Nederland B.V.	Observation tour	77.39.9	Verhuur en lease van overige machines en werktuigen en van overige goederen (geen automaten)	Yes	No
Leo Pels Import	Observation tour	46.31.1	Groothandel in groenten en fruit	Yes	No
Food Forces	Observation tour	46.31.1	Groothandel in groenten en fruit	Yes	No
Men at Work TV produkties	Observation tour	59.11.2	Productie van televisieprogramma's	No	Yes
Gebroeders De Klip	Observation tour	45.11.2	Handel in en reparatie van personenauto's en lichte bedrijfsauto's (geen import van nieuwe)	No	No
Studio Makkink & Bey B.V.	Observation tour	74.10.2	Industrieel en productontwerp	No	Yes
Potipora Fruits B.V.	Observation tour	46.31.1	Groothandel in groenten en fruit	Yes	No
Praxis	Observation tour	70.10.1	Concerndiensten binnen eigen concern	No	No
Leenbakker	Observation tour	46.47.1	Groothandel in huismeubilair	No	No
crossfit 010	Observation tour	85.51.9	Overig sport- en recreatieonderwijs	No	No

Figure 1: Other companies overview of the M4H area presented by the logos of the companies based on this research (Sources: M4H website, Google Maps and Observation Site Tour)

Appendix D

Table 1: *The linear-regression results for the effect of the creative characteristic of a company on choosing job growth*

Dependent variables	Job growth					
	Without Time fixed effects			*With Time fixed effects*		
Constant	-0.389	-0.572*	-0.391	0.128	-0.146	-0.061
	(0.269)	(0.274)	(0.281)	(0.272)	(0.394)	(0.406)
Creative	0.470	0.563	0.189	0.396	0.482	0.125
	(0.364)	(0.361)	(0.386)	(0.375)	(0.372)	(0.397)
# Jobs		0.018	0.000		0.017	0.001
		(0.020)	(0.024)		(0.020)	(0.024)
# Jobs * Creative			0.056			0.053
			(0.046)			(0.046)
Year dummy						
2001				-1.153	-1.095	-1.024
				(0.992)	(0.998)	(1.016)
2002				-0.492	-0.434	-0.366
				(0.369)	(0.370)	(0.409)
2003				0.150	0.197	0.253
				(0.908)	(0.944)	(0.958)
2004				-2.636	-2.545	-2.402
				(1.839)	(1.850)	(1.840)
2005				-1.680	-1.572	-1.441
				(1.282)	(1.281)	(1.295)
2006				-0.257	-0.159	-0.049
				(0.438)	(0.453)	(0.461)
2007				-0.390	-0.287	-0.187
				(0.762)	(0.780)	(0.788)
2008				0.332	0.410	0.496
				(0.693)	(0.727)	(0.712)
2009				-0.140	-0.043	0.036
				(0.625)	(0.639)	(0.650)
2010				-0.578	-0.476	-0.365
				(0.451)	(0.471)	(0.492)
2011				-1.968	-1.831	-1.735
				(1.078)	(1.114)	(1.110)
2012				-0.347	-0.223	-0.106
				(0.835)	(0.857)	(0.867)
2013				-0.401	-0.273	-0.172
				(0.502)	(0.526)	(0.536)
2014				1.042	1.156	1.224
				(0.741)	(0.774)	(0.777)
2015				0.070	0.179	0.256
				(0.339)	(0.366)	(0.377)
2016				-0.063	0.052	0.129
				(0.321)	(0.354)	(0.369)
2017				-0.259	-0.133	-0.053
				(0.475)	(0.497)	(0.506)

Coefficients are given. Standard errors are in the brackets below the coefficients. Significance level: * $p<0.05$, ** $p<0.01$. Base year: 2000. N=2362

Table 2: *The linear-regression results for the effect of the port characteristic of a company on job growth*

Dependent variables	Job growth					
	Without Time fixed effects			*With Time fixed effects*		
Constant	0.005	-0.090	-0.353	0.464	0.274	-0.145
	(0.210)	(0.216)	(0.237)	(0.270)	(0.366)	(0.435)
Port	-0.509	-0.670	0.089	-0.441	-0.594	0.163
	(0.415)	(0.412)	(0.427)	(0.423)	(0.418)	(0.438)
# Jobs		0.018	0.070		0.018	0.069
		(0.020)	(0.037)		(0.020)	(0.037)
# Jobs * Port			-0.087*			-0.086*
			(0.044)			(0.044)
Year dummy						
2001				-1.147	-1.087	-1.006
				(0.992)	(0.998)	(1.018)
2002				-0.495	-0.437	-0.362
				(0.370)	(0.371)	(0.457)
2003				0.141	0.183	0.230
				(0.910)	(0.944)	(0.939)
2004				-2.650	-2.562	-2.373
				(1.840)	(1.851)	(1.852)
2005				-1.695	-1.588	-1.351
				(1.270)	(1.274)	(1.284)
2006				-0.263	-0.164	0.031
				(0.441)	(0.456)	(0.467)
2007				-0.402	-0.298	-0.110
				(0.766)	(0.783)	(0.809)
2008				0.327	0.407	0.559
				(0.694)	(0.729)	(0.712)
2009				-0.152	-0.054	0.127
				(0.629)	(0.644)	(0.673)
2010				-0.577	-0.474	-0.264
				(0.451)	(0.471)	(0.518)
2011				-1.966"	-1.827	-1.653
				(1.082)	(1.114)	(1.118)
2012				-0.340	-0.212	-0.013
				(0.838)	(0.857)	(0.889)
2013				-0.394	-0.264	-0.080
				(0.504)	(0.527)	(0.559)
2014				1.038	1.147	1.311
				(0.747)	(0.777)	(0.791)
2015				0.071	0.176	0.348
				(0.343)	(0.368)	(0.411)
2016				-0.063	0.047	0.224
				(0.324)	(0.356)	(0.405)
2017				-0.247	-0.122	0.042
				(0.477)	(0.498)	(0.530)

Coefficients are given. Standard errors are in the brackets below the coefficients. Significance level: * $p<0.05$, ** $p<0.01$. Base year: 2000. N=2362.

Appendix E

Table 1: *The linear-regression results for the effect of the creative characteristic of a company on the number of jobs*

Dependent variables	Number of jobs	
	Without Time fixed effects	*With Time fixed effects*
Constant	10.386**	15.188**
	(0.816)	(2.111)
Creative	-5.332**	-5.019**
	(0.938)	(0.916)
Year dummy		
2001		-2.754
		(2.807)
2002		-2.732
		(2.817)
2003		-2.091
		(2.832)
2004		-4.655
		(2.817)
2005		-5.678*
		(2.848)
2006		-5.037
		(2.913)
2007		-5.345
		(2.901)
2008		-3.910
		(2.975)
2009		-4.987
		(2.907)
2010		-5.285
		(2.865)
2011		-7.264*
		(2.827)
2012		-6.605*
		(2.889)
2013		-6.806*
		(2.850)
2014		-5.942*
		(2.768)
2015		-5.672*
		(2.729)
2016		-6.020*
		(2.653)
2017		-6.655*
		(2.576)

Coefficients are given. Standard errors are in the brackets below the coefficients. Significance level: * $p<0.05$, ** $p<0.01$. Base year: 2000. N=2362

Table 2: *The linear-regression results for the effect of the port characteristic of a company on the number of jobs*

Dependent variables	Number of jobs	
	Without Time fixed effects	*With Time fixed effects*
Constant	5.112**	9.896**
	(0.393)	(2.076)
Port	8.732**	8.465**
	(1.317)	(1.014)
Year dummy		
2001		-2.782
		(2.783)
2002		-2.581
		(2.793)
2003		-1.768
		(2.809)
2004		-4.255
		(2.794)
2005		-5.285
		(2.825)
2006		-4.902
		(2.889)
2007		-5.149
		(2.876)
2008		-3.850
		(2.950)
2009		-4.822
		(2.883)
2010		-5.154
		(2.841)
2011		-7.112*
		(2.804)
2012		-6.489*
		(2.865)
2013		-6.585*
		(2.826)
2014		-5.452*
		(2.746)
2015		-5.184*
		(2.707)
2016		-5.445*
		(2.631)
2017		-6.284*
		(2.554)

Coefficients are given. Standard errors are in the brackets below the coefficients. Significance level: * $p<0.05$, ** $p<0.01$. Base year: 2000. N=2362