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Evidence from the maritime sector

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Numeracy and literacy in early modern Europe: Evidence from the maritime sector¹

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Summary

This paper reconstructs comparative levels of numeracy and literacy for seamen of different ranks from 14 countries in the seventeenth and eighteenth centuries using age heaping and signature methods. Results show how skill was rewarded in the maritime labour market, where captains and fishing skippers show higher levels of numeracy and literacy than lesser officers and ordinary sailors. The level of numeracy and literacy among ship masters and Scandinavian sailors are among the highest found anywhere, while Dutch, French and Spanish sailors were a par with the common labour force. This is discussed in light of the migratory and competitive character of the maritime sector.

¹ This work is a contribution to the Census of Marine Life's History of Marine Animal Populations (CoML-HMAP) project, and the EU Network of Excellence (MARBEF), the INCOFISH Specific Targeted Research Project "Integrating Multiple Demands on Coastal Zones with Emphasis on Aquatic ecosystems and Fisheries" funded in the European Community's Sixth Framework Programme (INCO). In addition the research was partly funded by the Economic and Social Research Council (ESRC), and the British Academy. We would like thank Christiaan van Bochove, Jeff Bolster, Lex Heerma van Voss, Danielle van den Heuvel, Anne Dorthe Holm, Jan Lucassen, Richard Smith and David J. Starkey for valuable discussions and suggestions for this paper. An earlier version of this paper was presented in November 2008 at the Institute of Historical Research, London and at the Cambridge Group for the History of Population and Social Structure, University of Cambridge, and we are grateful for insightful comments at both occasions.

‘On Als and in the Duchies (Schleswig-Holstein) in general, especially in places inhabited by seafarers, reckoning is much more appreciated than here in Funen, in the countryside so to say.’²

This remark stems from a schoolmaster, who in the 1770s wrote an account on his experiences with teaching in different parts of Southern Denmark, including the island of Als, which is located off the east coast of the duchy of Schleswig. Literacy became widespread in the Danish territories during the 1700s, but numeracy, expressed in the teaching of arithmetic, seems to have been more prolific in Schleswig.³ The writings of several remarkable 18th century individuals from this area testify to the importance of reckoning in maritime communities. Hark Olufs, a ship captain from the island of Amrum in the Waddensea was seized by Algerian corsairs in 1724 and enslaved, but within a number of years, he managed to build a career culminating with the appointment as minister of finances in the Constantine province of the Algerian state. Much of this we know from Hark Olufs’ autobiography, and surely his extraordinary life illustrates that he was a man of arithmetic skills.⁴

One anecdote on the levels of numeracy in Southern Denmark or the story of Hark Olufs’ spectacular life, do not themselves make a case for striking a strong connection between skills of writing and reckoning on the one hand and the successes of maritime communities of eighteenth century Europe on the other hand. They do however, hint towards the importance of this relationship, which is the topic of this investigation into the levels of numeracy and literacy in the maritime sector of early modern Western Europe.

The maritime sector has been hailed as a highway of commerce, communication and cultural encounters in the buzzing Early Modern Atlantic economy of the early modern era, and the Early Modern maritime labour market was sophisticated and comprehensive, marked by a large degree of internationalization and labour specialization. Reading and writing skills would be of special importance to a ship’s master be it for navigating by use of a reading atlas or filling out a logbook, while most commercially related activities would benefit from handling the various ship’s papers in a swift and efficient way. Numeracy would come handy in use for captains and mates alike, when using a ship charting a course and position at sea, while the counting of barrels and fish catches would be useful for everybody aboard a fishing vessel. In terms of book keeping and accounting, the success of trading and paying or receiving of salaries would all be matters, where numeracy

² Poulsen, B. ‘Thirst for Knowledge’, p. 125-126 and 129.

³ Poulsen, B. ‘Thirst for Knowledge’, p. 125-126 and 129.

⁴ Rheinheimer, M. *Fremde Sohn*.

would be highly beneficial, and similar to the literate skills, this would be most beneficial for the higher ranks aboard a ship.

All of this makes the maritime sector particularly prone to international comparative studies of literacy and numeracy as an indicator of levels of human capital. This paper therefore, examines whether or not, differences in levels of numeracy and literacy did exist between different ranks aboard a ship and in between seamen from different countries. Finally, the objective is to situate the findings from the maritime sector within the wider societal context of the early modern Europe.

I

Within the last three decades investigations into historical levels of human capital have made use mainly of approximations relating to levels of literacy in different societies. For the Early Modern period literacy has been measured using methods ranging from estimating book production per capita and the number of schools in various countries and anecdotal reports to analyses of the frequency with which people have signed legal documents with their own name rather than using a mark, as well as estimates from protestant societies of the percentage of a population that have confirmed their faith through reading of scriptures and catechisms.⁵ Pioneering works in the late 1960s such as Schofield's 'The measurement of literacy in pre-industrial England' and Goody and Watt's 'The consequences of Literacy' were followed by a wealth of regional, national and international comparative studies from most of Europe and North America.⁶ This has greatly increased our knowledge of how Western societies all experienced a process during the period c. 1500-1900, which lead to great increases in overall literacy; but also how different the path of literacy was tread in Western and Eastern Europe, by men and women, Protestants and Catholics and various classes in any society. Distinct maritime oriented studies dealing literacy however have been rare, a good example of such a study is Rediker's *Between the Devil and the Deep Blue Sea*.⁷ Rediker uses the ability to sign a document as his proxy for literacy levels, which makes for direct

⁵Houston, R. A., *Literacy in Early Modern Europe*, p. 125-140. Cressy, D., *Literacy and the social Order*.

⁶ Schofield, R. S., 'literacy in pre-industrial England'; Goody, J. and Watt, I., 'consequences of Literacy'; Bödeker, H. E. and Hinrich, E., *Alphabetisierung*; Cressy, D., *Literacy and the social Order*; Gawthrop, R. and Strauss, G., 'Protestantism and literacy'; Graff, H. J., *The Legacies of Literacy*; Hart, S., *Geschrift en Getal*; Hinrichs, E. and Wiegelmann, G., *Sozialer und Kultureller Wandel*; Hofmeister, A. et al., 'Elementary Education'; Houston, R. A., *Scottish Literacy and the Scottish Identity*; Messerli, A. and Chartier, R., *Lesen und Schreiben*; Stephens, W. B., *History of Literacy*; Tóth, I. G., *Literacy and Written* and Vincent, D., *Literacy and popular culture*.

⁷ Rediker, M. *Between the Devil*. See also Van Royen's work on literacy in the Dutch merchant marine: Van Royen, P.C., *Zeevarenden*, and Hart's analysis of 17th century sailors in Amsterdam, based on the Amsterdam marriage registers: Hart, S., *Geschrift en getal*.

comparison with this study, where the primary analyses are based on frequency of signatures. The advantage of signatures as a proxy is that it is a direct measure of exactly the person, one wants to investigate. This method is limited though, since it is not possible to follow a gradient of literate skills between individuals who all know how to sign their name, but it is useful when dealt with on a population level as in this study.⁸

Numeracy as a proxy for human capital has been viewed as a key factor for economic and societal development already with Max Weber's theory of work ethics, double entry book keeping and the formation of a capitalist spirit in Western Europe.⁹ Studies of early modern numeracy however, have a much shorter historiography than literacy studies. Anecdotes such as the introductory paragraph of this paper and the appearance of books about arithmetic give some indications on the spread of numeracy.¹⁰ One particular study estimates that fewer than 400 men in England could be said to be mathematically minded in the late seventeenth century.¹¹ In the past couple of decades however, several papers have dealt with numeracy levels in various pre-modern societies in Europe, North America and Asia based on the phenomenon of *age heaping*.

Age heaping is defined as the effect of misreporting of age, when a group of people is asked how old they are. When a tendency to give out ages divisible with 5 and 10 occurs, it is sign that not everyone in the group know how old they are. The investigation of samples of men at the age of retirement in seventeenth century New England showed clear signs of age heaping, which is a problem for exact measurements of age of retirement.¹² Similarly a study of Chinese mortality rates found significant errors at very high ages, skewed by an over sympathetic attitude towards the fortunate number 12 and ages divisible therewith.¹³ However, when looked at from a point of view of the people interrogated in can be used fruitfully as in the case of early modern time and age awareness in Russia, where the perceived ages as mentioned in legal documents were compared with birth registers.¹⁴ Recently, attempts have been made to link both literacy and numerical skills with levels of age heaping. For twentieth century data this seems to have been the case in developing countries, and for seventeenth century French census data, negative correlation was found between levels of age heaping and literacy.¹⁵ Most recently, studies on Dutch and Belgian

⁸ Houston, R. A., *Literacy in Early Modern Europe*, p. 134-35.

⁹ A'Hearn, B. Baten, J. and Crayen, D., 'Quantifying quantitative literacy'.

¹⁰ Poulsen, B. 'Thirst for Knowledge'.

¹¹ Houston, R. A., *Literacy in Early Modern Europe*, p. 163.

¹² Demos, J., *Old Age*.

¹³ Coale, A. J., and Li, S., 'Age Misreporting in China'.

¹⁴ Kaiser, D. H. and Engel, P., 'Time- and Age-Awareness'.

¹⁵ Crayen, D. And Baten, J., 'Numeracy, Inequality, Age Heaping'.

census data for the early modern period have found a link between levels of female labour participation and levels of numeracy as evident from findings of age heaping.¹⁶

In this paper we use two different tests for age heaping, the so-called ‘Whipple index’ and the so-called ‘Z-index.’ The Whipple-index measures to which degree age groups ending on 5 and 0 are overrepresented in a population group.¹⁷ The Whipple index gives scores ranging from 0 if the ages ending on 5 and 0 are not represented at all, and up to 500 if all ages mentioned end with 5 or 0. Thus, if the score for the Whipple index is 100 or lower, there is no sign of age heaping of these age groups.

Another technique used in testing for age heaping is the so-called Z-index, which measures the percentage of ages ending with 5 and 0. In this way an estimation of the percentage of a population whose real age is unknown is reached. The formula for Z is: $Z = 5/4 * (X-20)$, where X is the percentage of ages ending with 5 and 0. The Z-index therefore has an evenly distributed range from 0-100.

When used on datasets from modern societies, the percentage figures derived from the Z-index is known to correspond with literacy rates.¹⁸ In the data analyzed in the cases presented in this paper, we also found significant correlation ($r^2 = 0.44$) between Z-indexed numeracy rates and illiteracy rates based on the ability or not to sign a document. In Section VII we will go further into this issue.

It is important to note that in most studies of age heaping data are derived from census material, where people have been asked their age. In these cases their parents are often registering the age of children and youngsters, which means that their age is not a solid proxy for numeracy. Therefore age groups below the age of 23 are often discarded. Similarly the ages mentioned by old people are often discarded as they can have an inordinately tendency to mention round numbers and lack of memory in general. In the material used in this paper everybody has been asked their age, and since they are all professional seamen and fishermen, we have not found reason to discard age groups below 23 and above 62.

Similar to the issues related to signatures as a proxy for literacy, one short coming of using age heaping as an approximation for numeracy levels is that the method only works for groups of people, not for individuals, since usually it is not possible to verify the extent to which a perceived age is the real age of a particular individual, which also makes it difficult to detect improved skills

¹⁶ De Moor, T. and Van Zanden, J. L., ‘Every woman counts.’

¹⁷ De Moor, T. and Van Zanden, J. L., ‘Every woman counts,’ p. 3.

¹⁸ Clark, G., *A Farewell to Alms*, p. 178.

for an individual over time. Moreover, as noted by Van Leeuwen and Foldvari, estimates of age heaping only works as approximations on numeracy and human capital levels as long as there is age heaping in a society, and in for instance Western Europe, populations exhibit perfect knowledge of age sometime into the nineteenth century.¹⁹ With a complete absence of age heaping more recent increases in levels of numerical skills do not therefore become visible. The method is therefore particularly well suited for studies of the early modern period.

Furthermore, age specific information from the early modern period is mainly found in connection to census data, where it is not known if the person attributed a specific age has actually been questioned about it, or whether a parish priest or district bailiff have extracted the information from the local birth registers. The most reliable age specific data therefore arises from situations such as court depositions, where a person being questioned is asked to give their age without being able to double-check with a reference, and this is the type of primary material being examined in this paper.

II

The first of the two main sources we use in this paper are the so-called Prize Papers, kept in the National Archives in London.²⁰ This archive is part of the overarching archive of the High Court of Admiralty and consists of the documents dealing with the privateering activities of the Royal Navy from the middle of the seventeenth century up until the first decades of the nineteenth century. During times of war the British Navy and private men-of-war were instructed to capture as many enemy ships as possible, something that was common practise all over the Atlantic.²¹ Everywhere merchant ships and Navy vessels alike ran the risk of being brought to an enemy port and its cargo or even the ship being confiscated. To establish whether a vessel was a lawful prize or not, the English developed a procedure. They confiscated all ship's papers and questioned the master of the ship as well as a couple of crew members. These interrogations were fully standardised but were extended over time: under the rule of Charles II each had to answer 18 questions, at the end of the eighteenth century the number of questions had risen to 34 questions. Since it was of the utmost importance to determine if a ship or its cargo belonged to an individual from an enemy state, crewmembers were interrogated about all matters dealing with the ownership of the ship and its

¹⁹ Van Leeuwen, B. and Földvári, P., 'How much human capital'.

²⁰ National Archives (NA), High Court of Admiralty (HCA), 'Prize Papers,' 32. For a more extensive description of the sources, see Heerma van Voss, L., Van Lottum, J., and Lucassen, J., 'Labour markets'.

²¹ See archives mentioned in Heerma van Voss, L., Van Lottum, J., and Lucassen, J., 'Labour markets'.

cargo.²² The most relevant information for the purpose of this paper can be found at the beginning of the interrogations where the crew members were asked to reveal personal information; here they were asked for their rank, place of origin and age; another relevant piece of information was given at the end of the interrogation, each was instructed to sign the interrogation at the bottom of the document – thereby revealing information on the level of literacy.

Table 2.1. Nationality of seamen in sample

<i>Country</i>	<i>N</i>
Canada	2
Germany	115
Denmark	83
Spain	140
France	216
Finland	1
Habsburg Netherlands	20
Italy	12
Ireland	13
Norway	22
Netherlands	250
Portugal	2
Sweden	39
United States	51
Total	966

Source: Database Prize Papers

Although there are instances in which the entire crew was interrogated with the help of a sworn-in interpreter, usually three crewmembers were quizzed. The composition of those who were interrogated could vary; nonetheless, the High Court of Admiralty appeared to have aimed to question a cross-section of all ranks on board of a ship, so in most cases the master of the ship, one of the officers or a ship's craftsman, and an ordinary sailor were cross-examined.

²² For other use see Heerma van Voss, L., Van Lottum, J., and Lucassen, J., 'Labour markets'.

Although interrogations exist for the end of the seventeenth century and for different periods of the eighteenth century, in this paper we focus on the part of the archive for that deals with the second half of the eighteenth century, 1756-1783. The choice for this period is based on the fact that for this period the interrogations are available for virtually every ship and, as importantly, they were held in a uniform and standardized way: every interrogated crew member had to answer the same list of questions, something that was not the case in earlier interrogations. Based on the interrogations that were held in the Seven Years' War (1756-1762) and the Revolutionary Wars (1776-1783) we have constructed a database consisting of a sample of some 300 ships, comprising the interrogations of 966 men who were born in 14 countries (Table 2.1).²³ For every individual seaman we have recorded the country of birth, rank, the ability to sign the document, and the age.

It is important to note that our sample from the interrogations is a *non-* random sample; we have opted to create a sample with an as large as possible variety of different nationalities, although countries such as The Dutch Republic, France and Spain frequently at war with England feature most prominently. One country that is lacking is England itself.²⁴ Although there are interrogations of English born crews in the Prize Papers archive, for instance in when the information provided by the crews of the enemy ship were not satisfactory, we have chosen to not include them in our sample since they were not interrogated in a similar way as the crews from foreign ships, and to keep our database as uniform as possible. Unfortunately English sailors hardly entered foreign labour markets and hence do not show up on board ships in our sample. In Table 2.1 below all nationalities and their sample size in our overall sample are listed.

Whereas recording the age, country of birth and signatures was a straightforward exercise, classifying the rank was carried out by allocating every individual into four categories plus a rest-category of seamen for which we do not know their occupation (Table 2.2). First of all we discerned the category of 'masters', which consist of those stating to be the captain or master of the ship. The second, category is titled 'officers', and comprises the senior crewmembers on board of a ship and include occupations such as lieutenant, boatswain or mate. The third category is the most varied, and is called 'others'; this category includes all those on board in a non-maritime occupation like carpenters, surgeons, or cooks. In some instances also passengers were interrogated, but with a main interest in those working in the maritime sector, they have been left out of this analysis. The final category is that of sailors, consisting of everyone stating to be a sailor. The category of 'unknown'

²³ NA, HCA 32/255, 256, 260, 287, 288, 302, 315, 328, 338, 347, 360, 364, 372, 373, 374, 375, 376, 378, 380, 383, 385, 386, 393, 412, 413, 415, 416, 417, 448, 449, 466, 470, 477, 478, 480, 481, 482, 486, 487, 491. In the rest of the paper we will refer to the data derived from the Prize Papers as 'Database Prize Papers'.

²⁴ Cf. Heerma van Voss, L., Van Lottum, J., and Lucassen, J., 'Labour markets'.

were most likely to be common sailors as well,²⁵ but are not included in the ‘sailors’ category in our analysis.

Table 2.2. The number of seamen of different ranks.

Rank category	N
Master	291
Officer	129
Non-maritime	37
Sailor	346
Unknown	163

Source: Database Prize Papers

The main problem of this categorization lies in the differences in the meaning of a particular rank: a certain rank in different countries may translate the same way in English, but can actually imply a completely different occupation. It is highly likely that a 54 year old surgeon on board of large French Navy vessel carrying more than 50 men in reality had different tasks on board of the ship than a 17 year old surgeon on a small Dutch merchant ship sailing with only 5 men. The same goes for the lieutenant on board the same French ship and the boatswain sailing with the teenage surgeon; both end up in the same category, but may have performed completely different activities on board. This could affect the measurement of the human capital stock for the different categories; French and Spanish lieutenants appear more frequently than in the Northern European countries, and since it is likely the former are better educated than the latter, the French officers’ category may show lower innumeracy or illiteracy levels, not as a result of better skills within the same group, but because different groups are being measured. However, in this paper conclusions are drawn mainly on the basis of the groups of masters and sailors, and only to a lesser extent on the basis of the middle ranks.

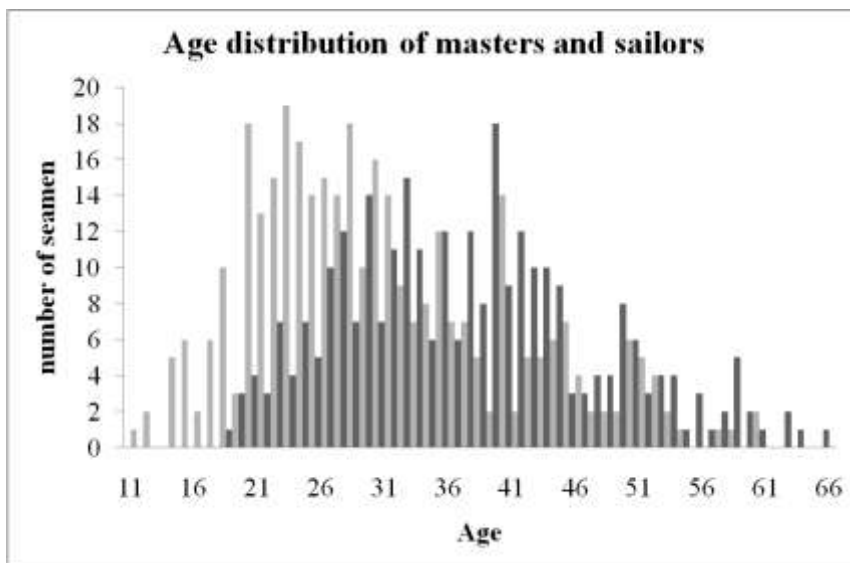
III

In order to be able to interpret the result of the age heaping analysis correctly, it is first necessary to establish whether or not age heaping correlates with age. It is common in populations that levels of

²⁵ Cf. Rediker, *Between the devil*, 307.

age heaping increases with the reported age. Someone in her 50s or 60s is more likely to misreport age than someone in her 20s.²⁶ The question is, however, whether this also applies within the same sector, and within a relatively homogeneous population. As the age distribution in Figure 3.1 shows, masters were – not surprisingly – older than sailors, and if age would be negatively correlated with age heaping, in theory human capital levels of older masters should be lower than their younger colleagues. In order to test the validity of age heaping as a proxy for human capital, we therefore checked for the influence of average age in the different sub-populations used.

Figure. 3.1. Age composition, maritime workforce, 1756-1783



Source: Database Prize Papers

Comparing the Whipple-Index of the younger half of the masters with the older half, and similarly for the sailors, it was found that also in this dataset the tendency to misreport one's age does increase in the older cohorts (Table 3.1.). Even though on average, a sailor is 7.7 years younger than a master, they still exhibit markedly higher levels of age heaping. This result only increases the validity concerning the conclusions drawn below about higher levels of age heaping in the sailors group than in the masters group.

Table 3.1. Age heaping in younger and older halves of population.

²⁶ Coale, A. J., and Li, S., 'Age Misreporting in China'.

<i>Region</i>	<i>Masters 36 and younger</i>		<i>Masters older than 36</i>		<i>Sailors 30 and younger</i>		<i>Sailors older than 30</i>	
	<i>N</i>	<i>Whipple- index</i>	<i>N</i>	<i>Whipple- index</i>	<i>N</i>	<i>Whipple- index</i>	<i>N</i>	<i>Whipple- index</i>
Northern Europe	71	99	93	119	93	118	85	118
Southern Europe	59	112	57	114	89	129	50	230

Source: Database Prize Papers

Table 3.2. Average age per nationality and occupation.

<i>Area</i>	<i>Masters</i>		<i>Sailors</i>		<i>All groups</i>	
	<i>N:</i>	<i>Average age</i>	<i>N:</i>	<i>Average age</i>	<i>N:</i>	<i>Average age</i>
Germany	27	35.6	41	30.0	115	31.8
Denmark	19	37.4	30	32.7	83	33.7
Spain	44	35.8	60	29.0	140	31.0
France	68	37.8	72	30.4	216	32.6
Netherlands	100	39.9	64	31.1	250	35.1
United States	10	29.9	28	26.5	51	28.0
All countries	291	37.9	346	30.2	966	32.8

Source: Database Prize Papers

Nevertheless, the average age of a master and a sailor could differ considerably in between the different nations represented in the sample. We therefore calculated the average age of seamen from the 6 different nations and within the masters and sailors of the same nationality (Table 3.2). The results confirm that differences in average age did not play a part in explaining the differences found in levels of literacy and numeracy. Within the two occupations the average age ranges within 4 years, roughly between 29 and 32,²⁷ except for the United States, which represents the youngest cohort with an average age of nearly 30 in the case of the masters while the average age of sailors

²⁷ Cf. Bruijn, 'Career patterns', 27-28.

was a mere 26.5. This corresponds with the Rediker's findings on American sailors from the period 1700-1750, which shows an average age of 27.6 years.²⁸

IV

Whereas the interrogations of the Admiralty's prize courts provide us with a broad geographical scope of numeracy and literacy levels in the maritime sector, the 50 years of perspective does not really allow for analyses of changes over time. The second main source used in this paper, a unique set of data for the herring skippers from the town of Schiedam in The Netherlands, does provide a long term perspective. By law every Dutch skipper taking part in the herring fisheries was obliged to give testimony and report his catches upon arrival in port. In Schiedam the records of these testimonies have been preserved in an unbroken series covering the period of 1597-1788.²⁹ From this material a sample was constructed using the testimonies from every other year 1604-1698 and from every year 1700-1788. Each testimony provides information on individual skippers' catch, the time spent at sea, skipper's name and for the years 1624-1788 also the age of the skipper.

None of the skippers signed their testimonies, but this was not necessary in order to identify them. Going back to the Middle Ages the skippers of Dutch herring vessels each had a personal, and sometimes quite elaborate mark. The primary purpose of their mark was to be carved into each barrel of salted herring thereby identify the seller of the finished product and thus a mark of quality rather than an indicator of lack of literacy.³⁰

This gives a sample of 4,051 entries for age. Since every skipper was asked to tell his age on the spot, the ages mentioned is a good indicator of the perceived age of the population. These age data forms the background for analysing the levels of age heaping in a very long time period, which is unique compared to previous studies of age heaping. Figure 4.1 illustrates the age distribution reflecting this specific group of fishing skippers with notable heaps around the ages of 30, 36, 40, 50 and 60.

In addition, the recurrent annual sampling of a distinct group of skippers landing in Schiedam provides the unique opportunity to follow the ages mentioned by individual skippers each time they land fish. Following individual skippers over their entire career as skippers, it becomes

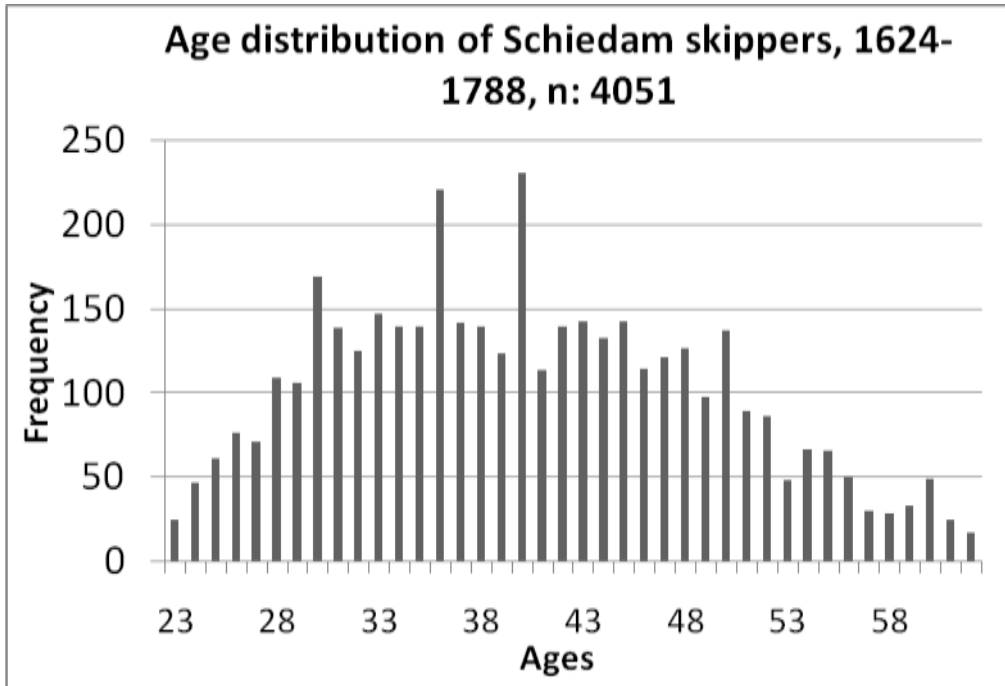
²⁸ Rediker, *Between the devil*, 299, Appendix A. For nation-specific age distribution of seafarers see also: Rodger, *Wooden world*, 360-361; Palmer and Williams, 'British sailors', 108; Ketting, *Oost-Indievaarders*, 52; Hans Chr. Johansen, 'Danish sailors', 246; North, *German sailors* 258; Le Goff, 'labour market for sailors', 321.

²⁹ Gemeentearchief Schiedam, 'Haringcertificaten, 1597-1788'.

³⁰ Poulsen, B., *Dutch Herring*, p. 133-135.

evident how the pattern of perceived ages fluctuates for some individuals and not for others. This was tested for by extracting all individual skippers, who appear in the records ten years or more. 36 skippers meet this requirement.

Figure 4.1 Age composition, Schiedam skippers, 1624-1788



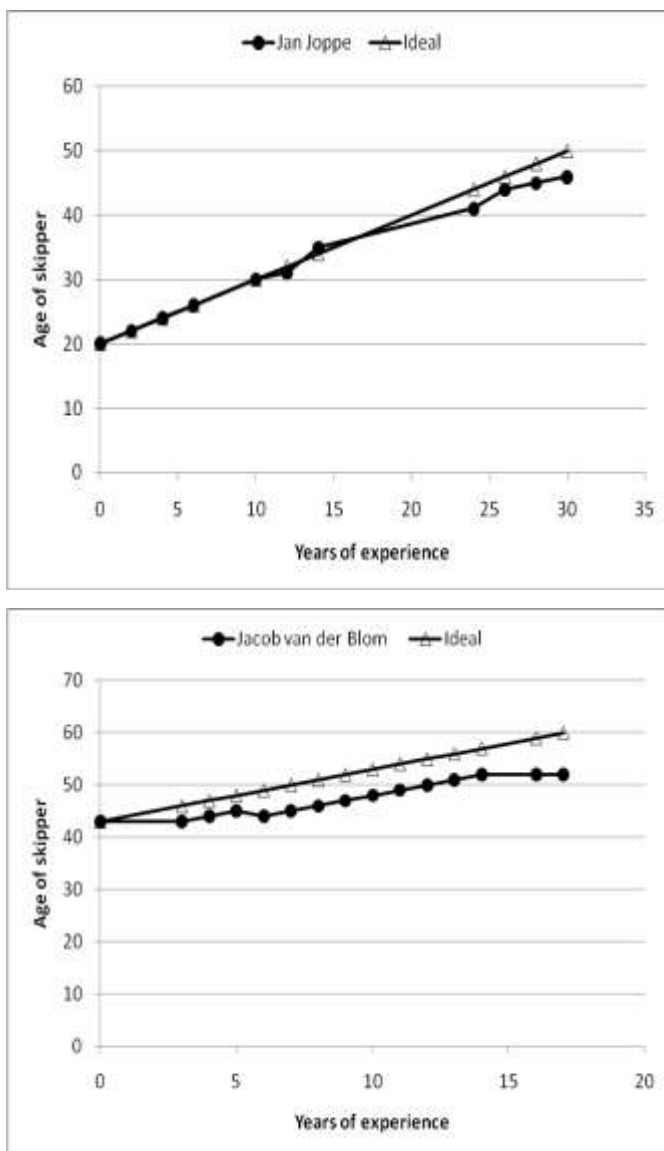
Source: Gemeentearchief Schiedam, ‘Haringcertificaten, 1597-1788’.

For each skipper their noted age in their first season is taken as a starting point, and after x amount of years they should have become x amount of years older. This was not always the case. We cannot expect the skippers to increase their age by exactly one year per year, since the interrogation took place anytime during the herring season from July – 31 January. This means that if a skipper had his birthday during the fishing season his real age can vary between zero and two ages in between two fishing seasons. Therefore, we can only be sure that a skipper does not know his real age, if he reported age display differences of more than two ages from one season to the next. Moreover each skipper usually landed herring in Schiedam once, twice or more rarely three times during a particular fishing season. We therefore present the average of ages reported at each season’s landings.

To illustrate the development of perceived ages during the career of individual skippers, the different ages of skippers Jacob van der Blom (1749-1766) and Jan Joppe (1686-1716) are displayed along with the ideal curve of precise listing of ages (Figure 4.2). Jacob van der Blom

claimed to be 43 years old in his first season as a skipper, but 18 years later in his last year as a skipper he is only 52, or eight years less than expected. Jan Joppe was 20 years old in his first year as a skipper, while 30 years later his reported age was 46. Another way of looking at inconsistent reporting of ages from individual skippers is to look at misreporting from one year to the next, but if the age is back to the normal level after two years this could be an error made by the clerk taking notes. Therefore, the perceived ages over the span of an entire career give a better representation of the knowledge of one's age among the group of Schiedam skippers.

Figure 4.2. The perceived ages of fishermen, Jan Joppe and Jacob van der Blom during their career as Skipper



Source: Gemeentearchief Schiedam, 'Haringcertificaten, 1597-1788'.

Skippers Jan Joppe and Jacob van der Blom were just two out of several Dutch skippers who reported their age in an inconsistent way. Following this technique 8 out of the 36 skippers reporting their age in at least ten different seasons definitely misreported their age.

V

With regards to the analysis of age heaping the Schiedam skipper data was broken down into eight time frames of 20 years each and the Whipple index was measured (table 5.1). From a highpoint of 139 in the period 1624-39 the Whipple index drops to a mere 108 in the period 1660-79 followed by a rise to above 130 in between 1680-1719, while in the latter half of the 18th century age heaping does not appear to be present in the group of skippers in Schiedam. Since the likelihood of people not knowing their exact age increases the older someone is, the average age of a skipper was calculated for each of the eight time frames. In the groups from 1624-1759 the average age varied in between 38.5 and 41.4, while the cohort were on average 45,9 years old in the 1760-88. The latter rise can be explained by the fact that the fishery from Schiedam was in sharp decline during this period, which meant that very few younger men came to replace the aging skippers, but the rising average age of appears irrelevant for age heaping in this time frame.

Table 5.1 Levels of age heaping for Schiedam skippers, during eight periods between 1624-1788 (n: 4,051)

<i>Time:</i>	<i>N:</i>	<i>Whipple-index:</i>	<i>average age:</i>
1624-39	357	139	41,4
1640-59	589	126	38,5
1660-79	590	108	39,8
1680-99	782	132	40,7
1700-19	668	134	39,2
1720-39	600	124	40,2
1740-59	257	93	40,6
1760-88	208	84	45,9
1624-1788	4,051	122	40,3

Source: Gemeentearchief Schiedam, 'Haringcertificatien, 1597-1788'.

When combined, the results of the two different types of analyses concerning the fishing skippers from Schiedam contribute to our knowledge of the level of numeracy. Following the age heaping method the levels were highest in the period 1660-79 and again after 1740, when there was very little or no age heaping detected. However, as revealed through the analysis of the perceived ages during the career of 36 individual skippers, this does not mean that every skipper had precise knowledge of his age. In fact, 3 of the 4 skippers who misreported their age in the 18th century began their career as skippers after 1740, when seemingly no age heaping took place. Thus, the absence of age heaping in a cohort of people as a whole does not indicate perfect knowledge of one's age for every individual in the population. However, when looked at over the entire 165 years in the sample, the tendency to misreport ages was higher in the 17th century than in the 18th century according to both types of analyses, hence the level of numeracy among this group appears to have been growing from 1624 to 1788.

VI

Now we have established that, at least within one segment of the maritime World, levels of numeracy rose during the seventeenth and eighteenth century, while analysis of the eighteenth century interrogations in the prize papers determine whether or not differences occurred within different ranks and countries. Seamen from 14 countries appear in the dataset, but estimates of age heaping were made for 5 nationalities, for which the sample population was larger than 50 individuals (Table 6.1). The sample of Danes was also larger than 50, but we have chosen to include them in a separate category of Scandinavia including also Norwegians, Swedes and Fins, which enabled an analysis of Whipple-index for the group of Scandinavian sailors.

When all ranks of seamen from Germany, Spain, France, The Netherlands and The United States are combined the level of age heaping is lowest in Denmark with Whipple index 106, and in Scandinavia as a whole, age heaping is insignificant. The Netherlands, France and Germany all show clear evidence of age heaping (ranging between 116 and 126), while Spain (140) and the United States (171) have the poorest level of numeracy. In terms of the ability to sign documents Danish and Dutch seamen have the lowest rate of illiteracy (6 percent) and Scandinavia as a whole 12 percent, while the other nationalities have illiteracy levels of 14-19 percent.

When the data are broken into occupations the level of age heaping per nationality could only be accounted for with France and The Netherlands, and in both cases it was insignificant,

suggesting a high level of numeracy. The presumed high rate of numeracy corresponds well with the findings on illiteracy ranging from 0 - 7 percent. We cannot know if the one American master out of ten who did not put his signature to the interrogation is accidental, but Rediker's slightly larger sample of early eighteenth century depositions of North American shipmasters shows no illiteracy rate indicate that in general literacy levels were high in this group as well.³¹

Table 6.1. Numeracy and literacy for masters and sailors.

Country/ Region	Masters				Sailors				All groups			
	N:	whipple-index	Z-index	Illiteracy (%)	N:	whipple-index	Z-index	Illiteracy (%)	N:	whipple-index	Z-index	Illiteracy (%)
Germany	27	-	-	0	41	-	-	29	115	126	4	18
Spain	44	-	-	5	60	171	19	25	60	140	17	14
France	68	92	0	7	72	163	17	31	216	116	5	19
Netherlands	100	100	1	1	64	156	14	13	250	126	7	6
United States	10	-	-	10	28	-	-	21	51	171	17	14
Scandinavia	33	-	-	3	63	71	0	19	145	94	0	12
<i>Total</i>	291	112	4	4	346	137	9	25	966	129	7	15

Source: Database Prize Papers

Note: Whipple index or Z index calculated only when n: >50

The group of sailors is larger, and Whipple and Z Indices could be calculated for Scandinavia, where they surprisingly proved to be insignificant (meaning high levels of numeracy), while Spain (171), France (163) and The Netherlands (156) all demonstrated a very clear tendency for age heaping. Not surprisingly all nationalities in the sailors group have higher rates of illiteracy than any of the nationalities in the masters group. The most illiterate sailors came from France (31 percent of the sample was illiterate), to be followed by Germany (29 percent), Spain (25 percent), United States (21 percent), and Scandinavia (19 percent) while only 13 percent of the Dutch sailors did not write his name on below the testimony.

³¹ Rediker, *Between the Devil*, 307, Appendix D.

From the analysis of the highest resolution of data (the masters and the sailors) it seems that seamen from the Northern European countries were better skilled in terms of both numeracy and literacy levels than their Southern counterparts. When looking at the literacy rates Germany is an exception to the North South pattern of illiteracy rates, which may be attributable to the great east-west dispersion of the group of German seamen ranging from Emden to East Prussian Königsberg. Although catching up, East Prussia at the end of the eighteenth century had still relatively low literacy rates; around 1800 only about 40 percent of the peasants could sign their name.³² The possibility of such patterns of international north-south dichotomies in the population can be further analysed by way of aggregating the nation groups into three regions, Northern and Southern Europe and North America (Table 6.2).³³ This facilitates the inclusion of nationalities such as Portuguese and Italian where the sample was too small for independent analysis.

Table 6.2. Whipple index and literacy levels for masters and sailors in three regions.

Area	Masters				Sailors				All groups			
	N:	Whipple-index	Z-index	Illiteracy (%)	N:	Whipple-index	Z-index	Illiteracy (%)	N:	Whipple-index	Z-index	Illiteracy (%)
Northern Europe	164	110	3	1	178	115	4	20	543	115	4	12
Southern Europe	116	99	1	7	139	169	17	30	370	134	10	18
North America	11	-	-	9	29	-	-	24	53	164	15	15

Source: Database Prize Papers

Note: Whipple index calculated only when n: >50.

The comparison underlines that the shipmasters, regardless of their origin show no signs of significant age heaping, illustrating that a certain threshold of numeracy skill was necessary to sail a

³² Gawthrop and Strauss, 'Protestantism and literacy', p. 53.

³³ 'Northern Europe' consists here of present day territories of Norway, Sweden, Finland, Denmark, The Netherlands, Belgium, Ireland and Germany including the areas along the southern Baltic coast.. Southern Europe consists of present day France, Spain, Portugal and Italy, while North America covers Canada and the US.

ship. With regard to the lowest ranks the comparison between Northern and Southern Europe shows that there is a noticeable difference in numeracy and literacy skills. Sailors from Northern Europe as a whole show a slight tendency of age heaping (115) and illiteracy levels of 20 percent, while sailors from the South have illiteracy levels of 30 percent and a much higher tendency for age heaping with a Whipple index of 169. For North America the Whipple index could only be calculated for the entire group of seamen resulting in the highest overall regional tendency for age heaping (164).

VII

The most obvious relation between numeracy and literacy levels is to determine whether or not trends in numeracy correlate with those in literacy. This correlation is illustrated in a more telling way in Table 7.1, where indeed the literate population has a much higher Whipple Index, both in the case of the Northern European sailors as well as in the population of seamen from the south.

Table 7.1. Whipple indices for literate and illiterate seamen.

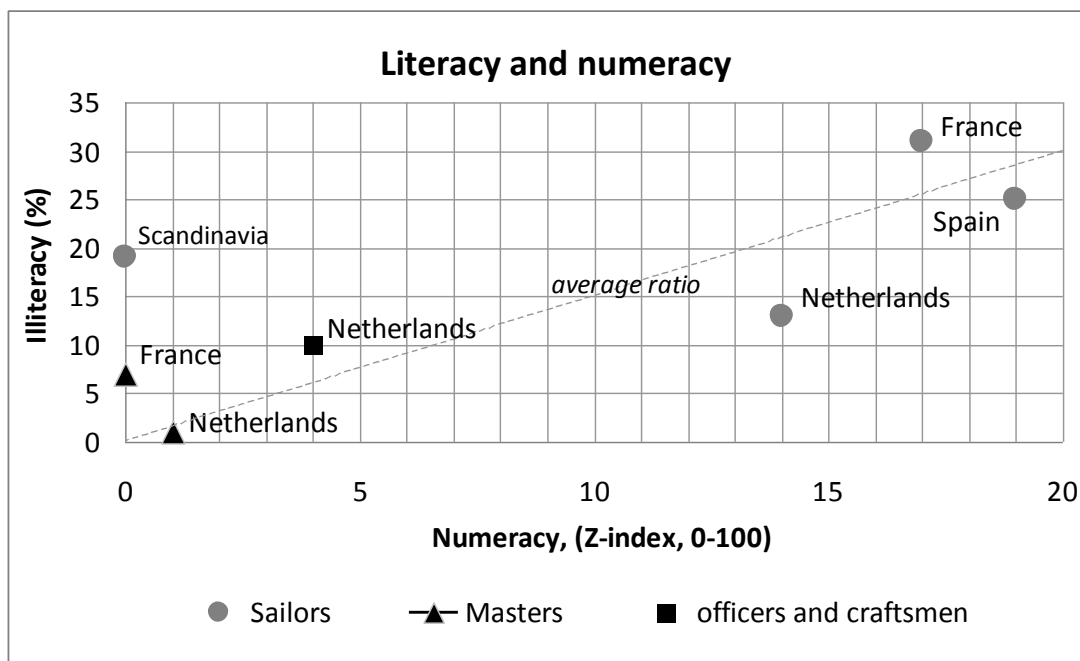
<i>Area</i>	<i>Signed</i>		<i>Non signed</i>	
	<i>N:</i>	<i>Whipple-index</i>	<i>N:</i>	<i>Whipple-index</i>
N. Europe	477	113	66	126
S. Europe	302	135	68	141
All areas	824	127	142	144

Source: Database Prize Papers

Somewhat more refined figure 7.1. illustrates the links between literacy and numeracy, for the various ranks and countries in the prize paper database. The first result from this is that in general skills in literacy follow skills in numeracy. Secondly, each occupation where Z-index have been calculated, the ratio (fluctuating around the 1:1.5) between numeracy and literacy level is quite straight with the exception of the Scandinavian sailors. The masters and sailors from the different countries and the Dutch mid-range ranks for which it is possible to calculate numeracy levels for three occupations, it is demonstrated that skill correlates with rank, in other words, the higher ranks have higher skills. Interesting is, however, that the Dutch seamen show that the

improvement in skill between the sailors and the mid-range ranks is mainly in numeracy levels. The numeracy levels of the mid range ranks (including officers and so-called the non-maritime professions) are comparatively better than their literacy levels. It is likely that this is mainly the effect of specific training relating to the maritime sector, thus a sign that the introductory anecdotes on the esteemed status of reckoning in maritime versus rural Denmark bear a European wide resemblance.

Figure 7.1. Relation between literacy and numeracy in the maritime labour market (1756-1784)



Source: Database Prize Papers

Whether or not it is literacy or numeracy is dominant skill is strongly related to education and education is in turn closely related to where you grew up. Whereas in the case of Dutch sailors since the second half of the seventeenth century, and continuing throughout the eighteenth century, the main pool from which the lowest ranks were drawn shifted from smaller towns and rural villages north of Amsterdam to the larger urban cores such as Amsterdam itself, and thus increasingly consisted of urban dwellers.³⁴

In the case of the Scandinavian countries most sailors came from small rural and strongly maritime oriented villages. The Danish sailors in this sample were for instance without exception all from either the Danish Wadden Islands such as Fanø, Rømø and Amrum, coastal villages in

³⁴ Bruijn and Lucassen, *Op de schepen*, 27; Davids, 'Maritime labour', 57-58.

Western Jutland such as Ringkøbing or from the maritime communities in towns of Aabenraa, Flensburg and Schleswig in the Duchies of Schleswig-Holstein, which all came to harbour both ship building and merchant fleets of substantial size.³⁵ These areas, as were for instance the Norwegian coastal settlements, were all maritime communities in which one can expect all boys to have been trained and educated in the various maritime skills from an early age, either on the job or at schools.³⁶

What may appear surprising is that none of the Danish sailors came from Copenhagen, which in the latter half of the eighteenth century grew to become one of the most important maritime centres in Europe forming what in Danish historiography has been termed the Flourishing Era of Trade.³⁷ Ship owners benefited from this, while auxiliary industries profiting from skilled maritime labour such as instrument making became big business in Copenhagen.³⁸ Due to Danish-Norwegian neutrality during most of the European wars of these decades, hardly any Danish registered ships though, were brought up by British privateers, which explains why the Danish sailors in the sample mainly served on Dutch vessels, and came from the areas closest to the Netherlands.

VIII

Now both the trend over time as well as the differences between numeracy and literacy levels between ranks and countries has been elucidated, we can investigate how the maritime labour market compares to other sectors of the economy. The fishing skipper testimonies showed that the level of numeracy gradually improved over the 165 years we have data for, and although the trend in numeracy is not linear, the numbers are within a credible range of deviation within the twenty-year time frames. Even though the skippers' dataset is unique in its time frame, a number of snapshots of numeracy levels of different economic sectors from The Netherlands are available through the work of Tine de Moor and Jan Luiten van Zanden.³⁹

The De Moor and Van Zanden data differs from our dataset in one important way: it does include women, whereas unfortunately, but understandably our data only comprises men.

Therefore, although the De Moor and Van Zanden datasets differentiate between ratios for men and

³⁵ Klem, K., *Skibsbyggeriet*.

³⁶ Poulsen, B. 'Thirst of Knowledge'; Also in the North of Holland in Friesland, and the Wadden Islands, specifically tailored education for sailors and potential sailors was very common. Very often the teacher was a retired seaman: Van Royen, *Zeevarenden*, 134-135.

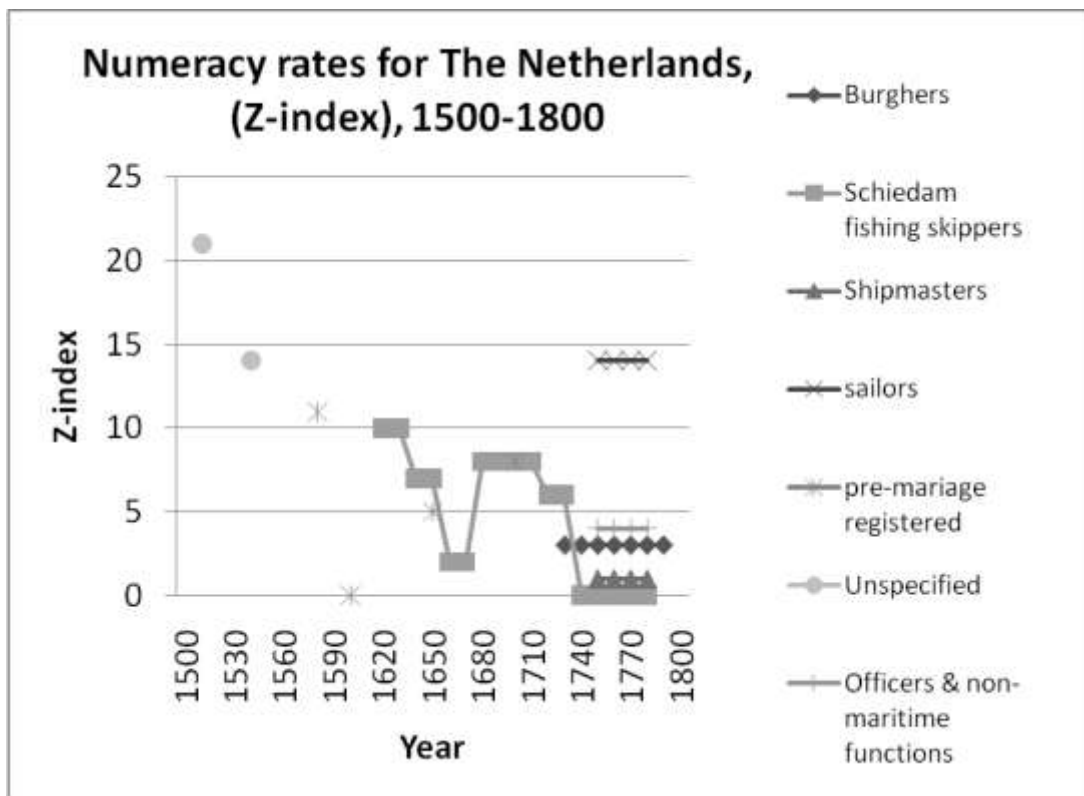
³⁷ Feldbæk, O., *Dansk Søfarts Historie*, p. 133-192.

³⁸ Poulsen, R. T., *Nellebladets kølvand*, p. 9-40.

³⁹ De Moor, T. and Van Zanden, J. L., 'Every woman counts.'; and the revised and adapted Dutch version of this paper: De Moor, T. and Van Zanden, J. L., 'Van fouten kun je leren'.

women, we only compared our data with the level of male population. Using the Z-index, in Figure 8.1 below we grouped the findings on Dutch sailors, shipmasters and fishing skippers with results from early 16th century Dutch census data covering virtually all social strata of society, which is also the case for the pre-marriage registers from Amsterdam. Analysis of the age heaping tendency evident in Amsterdam pre-marriage registers during 4 snapshots between 1585 and 1700 also shows a long term downward slope with certain setbacks in the short term. Finally we included the numeracy levels for the “new burghers” of Amsterdam, which covers people taking up citizenship in the city.⁴⁰ This was relevant for the middle and upper layers of society. In this way the numeracy levels in the maritime sector can be assessed against other sectors in Dutch society, c. 1500-1800.

Figure 8.1. Numeracy rates for The Dutch Republic, c. 1500-1800.



Source: Database Prize Papers; Gemeentearchief Schiedam, ‘Haringcertificaten, 1597-1788’; Clark, G., *A Farewell to Alms*, p. 178; De Moor, T. and Van Zanden, J. L., ‘Every woman counts’; A’Hearn, B. Baten, J. and Crayen, D., ‘Quantifying quantitative literacy’; Crayen, D. And Baten, J., ‘Numeracy, Inequality, Age Heaping’.

⁴⁰ De Moor, T. and Van Zanden, J. L., ‘Every woman counts.’

Most of the data point towards a downward trend in age heaping between 1500 and 1800, which corresponds well with scattered numeracy data extracted from other parts of Early Modern Europe. However, when compared with other numeracy snapshots from the areas of present day Russia, Germany, Belgium, Italy and the United States, the Dutch downward trend seem to have occurred earlier than in other countries.

In any case, the Z-indices for the fishing skippers are within the same range between 0-10 as the figures from Amsterdam marriage registers covering the period until 1700. A real comparison between branches though is possible for the latter half of the 18th century. The numeracy rates are highest for the fishing skippers and the Dutch shipmasters in general both with Z-values around 0, while the middle- and upper class group of burghers of Amsterdam have a Z-value of 3. The group of officers and crew-members with non-maritime functions just above with Z: 4, but towering above these groups the Dutch sailors have a Z-value of 14, which is equivalent to the average Dutch person two centuries earlier. Ship captains and fishing skipper thus appear to have been among the best skilled people in Dutch society, while the fishing skipper clearly exhibit a downward trend, which was also found in Dutch society as a whole.

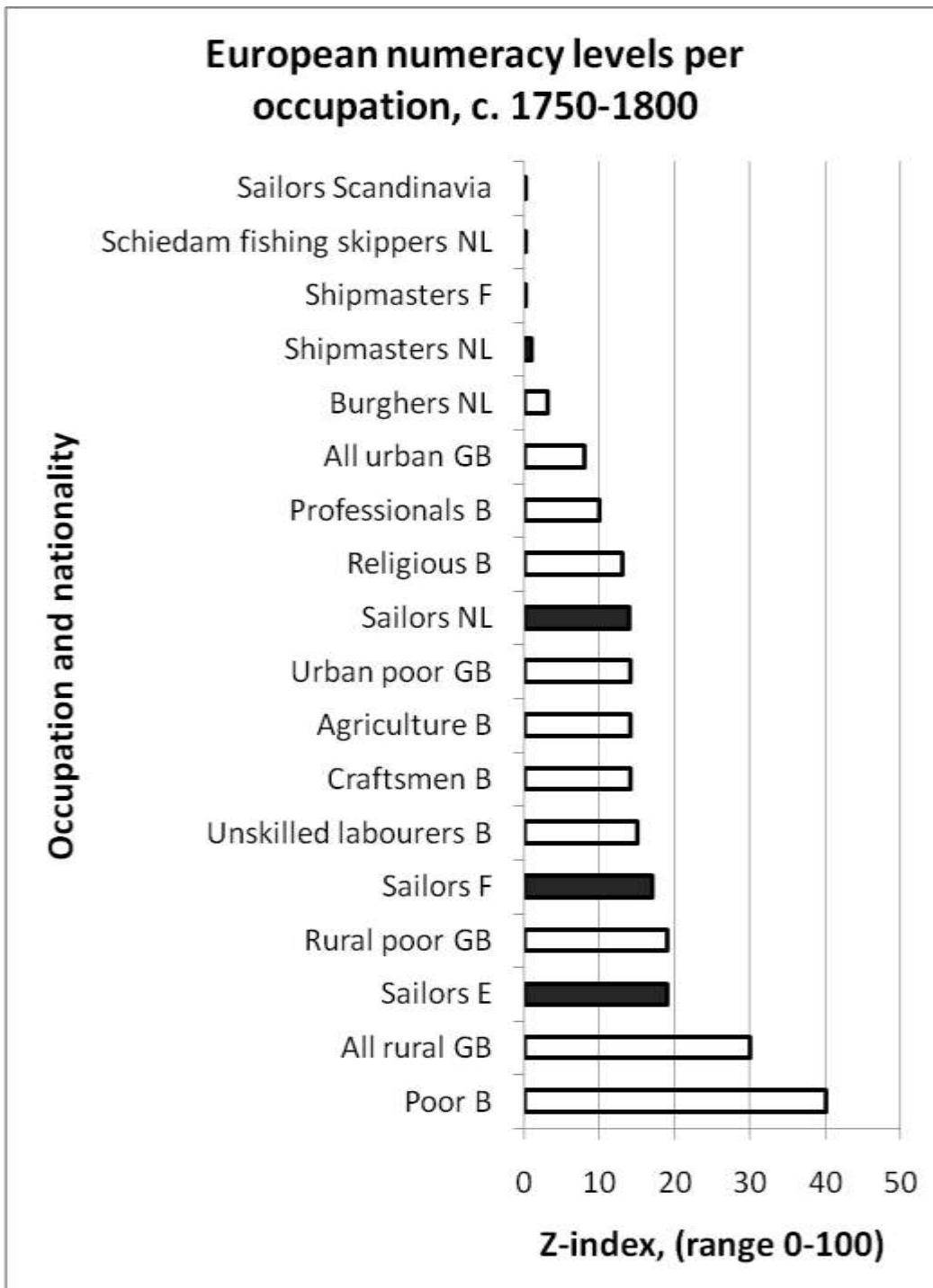
Comparing with the general trends in literacy, this downward trend is echoed in most of the Western world. By the end of the nineteenth century virtually the entire male population of Western Europe was able to read and write, although the rise of literacy in Eastern and Southern Europe had occurred with a delay of fifty – one hundred years compared to Northern Europe. In Sweden the process was by and large completed by the turn of the eighteenth century, while parts of France and most of Spain and Italy were lagging behind.⁴¹ In general, literacy in Early Modern Europe also evolved faster for men than for women, while it was more widespread among protestant communities than catholic groups. Moreover, the higher ranks of urban societies were more literate than poor people in the countryside.⁴²

Within this grid of early modern literacy and numeracy, the analysed prize papers and fishermen's certificates offer a unique transnational window for looking into the performance of a particular branch of society, the maritime sector, in eighteenth century Europe. Large differences in numeracy co-existed between different branches of Dutch society in the latter half of the 18th century. For this period a good number of comparable numeracy reconstructions have been made, which makes it possible to situate the performance of the maritime occupations from a variety of countries and regions with other types of occupations (Figure 8.2).

⁴¹ Schenda, R., *Alphabetisierung*, p. 3-4.

⁴² Houston, R. A., *Literacy in Early Modern Europe*, p. 141-161.

Figure 8.2. European numeracy levels per occupation, c. 1750-1800.



Sources: Database Prize Papers; Gemeentearchief Schiedam, 'Haringcertificaten, 1597-1788'; Clark, G., *A Farewell to Alms*, p. 178 and De Moor, T. and Van Zanden, J. L., 'Every woman counts'.

Taking the Z-values as a proxy for numeracy and human capital the shipmasters from The Netherlands, France and the Schiedam fishing community show the highest level of all by not showing any signs of age heaping. A very low Z-value is maintained even for the aggregated figures for all masters in the North Atlantic. For comparison, the Amsterdam burghers, the urban population in England and the branch of ‘professionals’ in present day Belgium are the only groups which come close to the performance of the masters. Uneducated segments of society such as the poor in Belgium and rural population in England are by far the least numerate group, but the sailors from Spain, France and The Netherlands also reveal relatively low levels of numeracy.

One remarkable exception to this is the group of Scandinavian sailors with numeracy levels comparable to that of the shipmasters and far above the levels of other nations’ sailors. The opening quote to this paper spoke of reckoning as a particular desirable skill in the maritime communities of the Danish territories, where also books of arithmetic were found in notable quantities. Possible reasons for this remarkable exception is discussed in the section below.

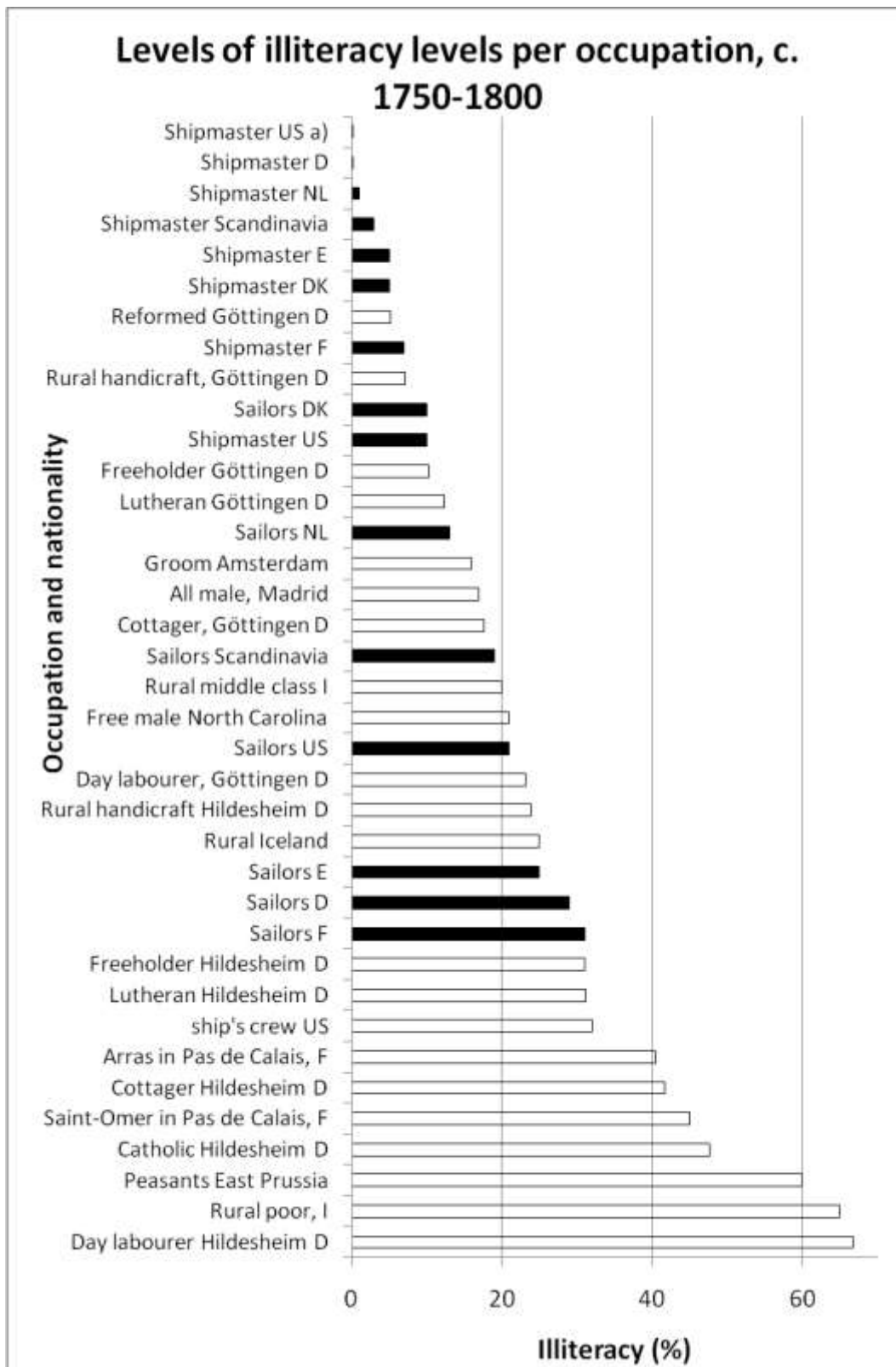
The findings of illiteracy among sailors from the various countries correspond well with compared with available estimates of illiteracy rates for the countries involved (Figure 8.3). Estimates on illiteracy based on the Amsterdam marriage registers for instance show that between 1751-1775 Dutch grooms born in the cities of Holland had an illiteracy rate of 16 percent (against 13 percent in our sample).⁴³ Estimates of the proportion of free males in North Carolina in the second half of the eighteenth century are also close to our estimate, or in fact identical (21 percent).⁴⁴ The 21 percent illiteracy rate of US sailors based on the Prize Papers rate is somewhat better than the rate for common seamen in Rediker’s sample of crews of merchant ships between 1700 and 1750, which was approximately 32%. This also corresponds with Gallman estimate for North Carolina in the first half of the eighteenth century, which was 36 percent.⁴⁵

⁴³ Hart, S., *Geschrift en getal*, p. 178, Table 28.

⁴⁴ Gallman, R. E., ‘Literacy in seventeenth-century England’, p. 574.

⁴⁵ Rediker, *Between the devil*, 307, Appendix D.

Figure 8.3. European literacy levels per occupation, c. 1750-1800.



^{a)}The figures for these North American shipmasters are from first half of the 18th century.

Source: Database Prize Papers; Gallman, R. E., 'Literacy in seventeenth-century England', p. 574; Gawthrop, R. and Strauss, G., 'Protestantism and literacy'; Hart, S., *Geschrift en getal*, p. 178, Table 28; Hofmeister, A. *et al*, 'Elementary Education'; Houston, R. A., *Literacy in Early Modern Europe*, p. 143 and Rediker, *Between the devil*, 307, Appendix D.

German, French and Spanish sailors were on average about as literate as groups such as German day labourers and craftsmen from Lower-Saxony or inhabitants of rural Iceland, but undoubtedly the regional differences in large countries such as France, Spain and the various German territories were immense. In the Oldenburg area of North Western Germany the literacy was very widespread all over society in the 18th century.⁴⁶ As evident from figure 8.3 reformed German groups also had high rates of literacy. On the other hand, nearby Catholic groups had very low literacy rates, just as the East Prussian peasants did.⁴⁷

Since the German sailors came from North western Germany as well as the German territories along the Baltic there is probably a large variation between the different sailors, even if they were all German. Likewise, literacy in France was very unevenly spread over the country. While a majority of the adult population in towns of Arras and Saint-Omer North western France were able to write their signature, and more than ninety percent of males in Normandy and Alsace, less than ten percent of the people in some areas of Southern France possessed this skill.⁴⁸ For Spain it has been difficult to find direct eighteenth century comparisons. For the seventeenth century though, literacy levels from a handful of cities such as Madrid, Toledo, Santiago and provinces such as Andalusia fluctuate around sixty-seventy percent for the urban male population, while in Murcia only 30 percent were literate.⁴⁹ The average eighteenth century sailor from Germany, France or Spain would definitely favour in the job market from literacy, but depending on, which region he came from, his skills would range from average to exceptional.

From the Scandinavian countries the average sailor, often working on board a Dutch vessel would not fair better than the native Dutch sailors in terms of literacy. These is mainly due to modest literacy rates among the Norwegian contingent, while the Danish sailors as a whole, was the most literate national group of sailors with 90 percent literacy. They did not tower above the rest as

⁴⁶ Hinrichs, E., 'Zum Alphabetisierungsstand', p. 28-29; Hofmeister, A. *et al*, 'Elementary Education'.

⁴⁷ Gawthrop, R. and Strauss, G., 'Protestantism and literacy'.

⁴⁸ Siddle, D. J., 'Cultural Prejudice', p. 20.

⁴⁹ Nalle, S. T., 'Early Modern Castile', p. 68.

in the case of numeracy, but the results underline the arithmetical skills associated with the above analysis of numeracy.

The average Danish sailors enjoyed a literacy rate comparable to the American ship masters. Only ten American ships masters though, featured in the sample. More explanatory power rise from the groups of Dutch, German, Scandinavian, French and Spanish masters, who all without exception are amongst the most literate groups in eighteenth century Europe and North America, and only a very few individuals have not signed their names, when giving testimony to the British High Court of Admiralty.

This emphasize that while the rank of sailor in the maritime sector may have reflected the literacy levels in their landlocked societies at large, the ship captains was in a league of their own. The desired skills necessary to navigate a ship in open water, command a vessel with crews of diverse origin, conduct trade with foreign foes and friends, and providing a log book based account of daily events, all point towards the abilities of reading, writing and reckoning. The findings from our analysis suggest that these desired skills were indeed met in this particular line of work in eighteenth century Europe and North America.

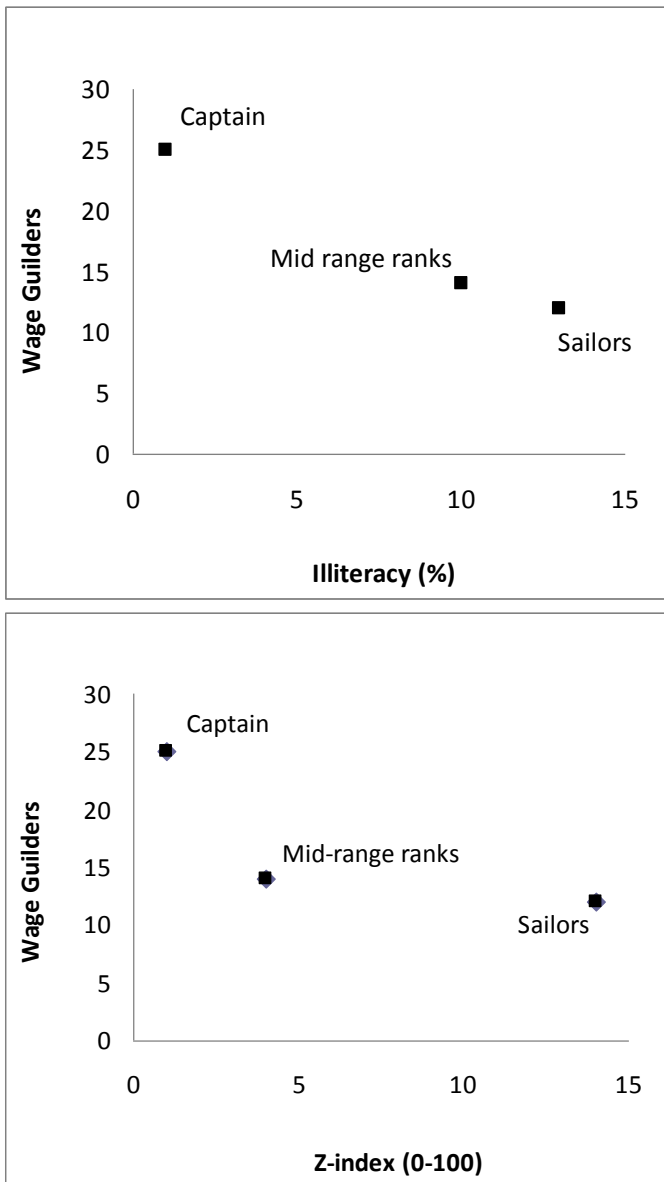
IX

The high numeracy levels of the shipmasters and fishing skippers may not come as a surprise since they needed to be skilled and well educated to perform their profession, the low Z-Index of the Scandinavian sailors on the other hand is more surprising given that their Dutch, German and Southern European colleagues performed the same profession, but showed much higher levels of age heaping. In order to contextualise the significance of these findings, this section looks at the effect of possessing a certain level of skill in relation to one's work or career within the maritime labour market, through comparison between the case of the Scandinavian seamen to the group for which data are most abundant, namely the Dutch seamen. Subsequently this will be linked to what is generally known about the maritime sector and its labour market in the Early Modern period.

The differences in numeracy and literacy levels between the sailors, the mid range ranks and the masters in all but the Scandinavia vessels imply that those who were the most skilled on board were in fact also the most important and well paid people aboard, the skippers. Below the numeracy and illiteracy indices of masters, mid-range ranks such as boatswain and gunner (see note Graph 9.1), and sailors are plotted against the average monthly wages, based on a muster role of the Dutch merchant marine in 1781 (Figure 9.1). The level of both skill indicators, indeed equates with the

level of remuneration; the better the skills, the better the payment. Skippers are by far paid the highest wages, followed by the mid-range group of officers and craftsmen, while the least skilled adult workers on board of the ship, the sailors have the lowest wage. The Z-index of 4 for the Dutch officers mirrors the level of the burghers of Amsterdam, which as a group also consisted of many craftsmen.

Figure 9.1 Wages and skills of Dutch seamen the Dutch merchant marine in the 1780s.



Source: Database Prize Papers; wage data based on a muster role found in the Prize Papers archive, concerning the vessel *De Goede Verwachting*, sailing from Curacao to Amsterdam in 1781, NA, HCA 32, 343.

Notes: the wages in the mid range ranks is based on the average monthly wage (17 guilders) of four mid range ranks (boatswain and his mate (20 and 16 guilders), gunners and his mate (18 and 16 guilders) and the ship's carpenter (14 guilders).

In terms of literacy the mid-range ranks are much closer to the lowest rank than to the rank of masters, while their numeracy levels almost reach that of the skippers. This stresses the fact that in the Dutch maritime labour market the *real* premium is on numeracy skills. This in turn shows that for Dutch workers the Dutch maritime labour market functioned as a relatively open market in which higher numeracy skills were indeed rewarded with a higher rank; in other words there was an inverse relation between wage and numeracy skills. The inequality levels between crew members in terms of numeracy skills and the correlation between numeracy and remuneration in the Dutch maritime labour market can also be found in the French and Spanish labour market. Here the Z and Whipple index differential between skippers and sailors also matches that of the Dutch, suggesting a similar correlation between skill, rank and reward. Further indications of this is brought forward by the illiteracy levels, where the average Dutch and Scandinavian sailor score better than their more Southern and possibly eastern counterparts from Germany, Spain and France, which is mirrored by the levels in these societies in general.

As noted, the Scandinavian sailors and skippers are a notable exception. While there is a large gap between literacy levels of Scandinavian masters and sailors, the difference in numeracy levels in between ranks is almost non-existent.⁵⁰ This would indicate that in comparison to their southern neighbours in The Netherlands, specific maritime training did not necessarily pay off for the Scandinavian seaman; neither in terms of status nor in terms of monetary betterment: higher skills do not equate with higher income. This becomes all the more problematic if one takes in mind that jobs in the lower ranks are obviously more plentiful than those in the higher ranks: even though as a result of growing up in a maritime environment the skills of seamen from the maritime villages may have been high, there were often very few opportunities outside maritime work or sons were simply destined to follow in their fathers' footsteps.⁵¹

At a first glance one can argue that the situation of the Scandinavian sailors resembled that of many (potential) Dutch sailors with an urban background; entering the maritime labour market

⁵⁰ Also in the seventeenth century, immigrants from Northern Europe had lower literacy rates compared to those born in the Dutch Republic. See: Kuipers, E., 'Lezen en schrijven', p. 510-511 and Hart, S., *Geschrift en getal*, p. 204.

⁵¹ Bruijn, J., 'Career patterns', p. 27.

was often the best chance to earn a living. This was especially so during the second half of the eighteenth century when labour opportunities in the maritime labour market still expanded compared to other sectors in Dutch society.⁵²

The main difference between the Scandinavian sailors and their Dutch colleagues were however the level of skill. Most urban dwellers were from a poor background, had a poor education if any, and did not grow up in an environment where they could learn the skills of a mariner from an early age.⁵³ It is likely that most skilled men with an urban background would rather have opted for a better-paid and much safer profession on land, for which the highly urbanized Dutch Republic remained to provide opportunities for native workers.⁵⁴ However, many of the highly specifically skilled Danish sailors did not have such a choice; maritime work was often the only work available in the local labour market, and if they chose to be employed within the national labour market, they needed to take the opportunity regardless of its pay or status. Had the maritime labour market been a closed-off national or local labour market, the chances of social mobility for Scandinavian sailors will have been fairly limited. Thereby making external, non-labour market related factors such as patronage or other personal preferences relatively important in the chance of promotions.

In reality labour opportunities were *not* restricted to the community or even country where one was born, and Scandinavians could (and did so in large numbers) go abroad to make a living there – in other words they had more opportunities than the poorly skilled Dutch urban dwellers.⁵⁵ The obvious destination was one of the largest maritime labour market in Western Europe, that of the Dutch Republic, which possessed the truly first international labour market in Western Europe.⁵⁶ The openness of this maritime labour market meant there were still options for the specifically skilled, but locally ‘under-rewarded’ Scandinavia sailors to ‘capitalize’ on their surplus in skills.⁵⁷ The Dutch mid-range ranks illustrated that high numeracy levels even combined with relatively low literacy rates were sought after.

The fact that Scandinavian sailors were generally better skilled than sailors from other countries is likely to have contributed to their success as maritime immigrants in the Netherlands. By the end of the eighteenth Scandinavian sailors were much more sought after than for instance Germans, who from the 1740s onward increasingly came from inland Germany and less from

⁵² Van Lottum, J., and Lucassen, J., ‘Dutch maritime labour market’; Van Lottum, *Across the North Sea*, Chapter 4.

⁵³ Bruijn, J., ‘Career patterns’, 27

⁵⁴ De Vries, J., ‘Pre-industrial labour markets’, 57-58.

⁵⁵ On Scandinavian migration to the Dutch Republic during the early modern period, see amongst others: Sogner, S., ‘Young in Europe’; Sogner, S., and Van Lottum, J., ‘Immigrant community’; Van Lottum, J., *Across the North Sea*.

⁵⁶ Cf. Van Lottum, J. and Lucassen, J., ‘Dutch maritime labour market’; Lucassen, ‘International maritime labour market’; Van Lottum, *Across the North Sea*.

⁵⁷ Heerma van Voss, L., Van Lottum, J., and Lucassen, J., ‘Labour markets’.

regions in the maritime Northwest of Germany.⁵⁸ It is therefore to be expected that if a master of a vessel needed to make the choice between less skilled German sailor or a highly skilled Dane, he will have opted for the latter.

The popularity of skilled workers in the Dutch maritime labour market provided an opportunity for Scandinavian sailors, not only in terms of employment but also in terms of monetary and career improvement. First of all, Dutch wages were on average higher than those in Scandinavia, giving a clear monetary incentive for moving to the Dutch labour market.⁵⁹ In addition, the Dutch labour market provided relatively good career perspective, although native-born workers were preferred over foreigners.⁶⁰ The demand for seamen kept rising through the eighteenth century thus still providing upward mobility for foreigners mainly as a result of the mortality rates which could be staggeringly high.⁶¹ The argument present here can thus be summed up that in a national or local Scandinavian labour market skill might not necessarily be rewarded, while the chances of this were high for the seaman moving abroad.⁶² Within the framework of the international labour market there was a mutual positive effect: Scandinavia sailors were able to profit from higher wages and career perspectives, while at the same time the Dutch maritime labour market, operating with the highest productivity levels in Europe, profited from the in-migration of skilled migrants.⁶³

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In the diary of Hans Jørgensen Fogt from the island of Als in Denmark an entry from 1772, reveals a list of 25 crafts, which he practised including being a maker of buttons and a schoolmaster, while five of his crafts were maritime related such as first mate, ship's carpenter, maker of tackle, boatswain and instrument maker. The combination of crafts for this jack-off-all-trades may have been unusual, and in his article on literacy historian Bjørn Poulsen asks if indeed Fogt may have been a loner?⁶⁴ We will never for sure, but there is no doubt that as soon as Fogt or any other seaman left the shores of eighteenth century Europe to join the ranks of sailor, officer or master, he would be one many highly skilled numerate and literate individuals and far from exceptional.

⁵⁸ Bruijn, J., 'Personeelsbehoefte', 245-246

⁵⁹ Danish maritime wages were about 20-25 percent lower than those in the Netherlands. See: Johansen, H.Chr., 'Danish-Dutch economic relations', 199.

⁶⁰ Cf. Van Royen, J., *Zeevarenden*, 146-149.

⁶¹ Bruijn, J., 'Career patterns', 31-32.

⁶² Bruijn, J., 'Career patterns', 33.

⁶³ Heerma van Voss, L., Van Lottum, J., and Lucassen, J., 'Labour markets'.

⁶⁴ Poulsen, B., 'Thirst for Knowledge', p. 126.

The above testing for literacy and numeracy have revealed a number of important similarities tapping into previously unexploited archival material from British privateering (1750s-1780s) and Dutch fishing skippers' landings certificates (1624-1788). From the point of view of methodology, both datasets benefited from combining the age heaping methods using the whipple-index with alternative methods. With regards to the skippers, the age reports of 35 individual skippers spanning at least 10 years each is a novel method, which provided a chance to see the actual mistakes made at micro level, supplementing the age heaping method. The 18th century data for different occupational groups and nations in general documented good correlation between the levels of numeracy and literacy.

From an empirical point of view several important signals emerge from the two datasets. First of all, there is a clear pattern throughout Europe showing that skill was rewarded in the maritime labour market, since the rank of ship captains and fishing skippers come out with significantly higher levels of numeracy and literacy than other officers at sea such as boatswains. They in turn score significantly better than ordinary sailors. Secondly, there are a number of regional differences within Europe and North America, while most notably, the Scandinavian sailors, exhibit exceptionally high levels of numeracy comparable only to the rank of captains. Thirdly, in comparison with other branches of society, the ship captains, fishing skippers and Scandinavian sailors have the highest level of human capital found anywhere in the 18th century. Dutch, French and Spanish sailors on the other hand show numerate and literate skills a par with the unskilled labour force in Northern European countries.

The high performance of the Scandinavian sailors is explained as a consequence of the migratory and competitive character of the maritime sector, while the relative high levels of human capital among the ship captains reflects just how much skill was needed for someone in charge of a ship, certainly one of the most demanding jobs in the Early Modern Era.

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