

Christiaan van Bochove, Jan Luiten van Zanden

Two Engines of Early Modern Economic Growth? Herring Fisheries and Whaling during the Dutch Golden Age (1600-1800)

1. Introduction

Since the work of Colin Clark and Simon Kuznets the standard interpretation of the process of economic development is that growth in GDP per capita is usually accompanied by a transformation of the structure of the economy resulting in the long-term decline of the primary sector and the increase of secondary and tertiary activities. It is not very clear which role fisheries are supposed to play in this scheme, however. Because fisheries are part of the primary sector, one would normally expect this 'traditional' industry to show long-term decline in terms of its share in both employment and in GDP. In fact, one can even argue that fisheries (and hunting) are more 'traditional' than agriculture itself, because the latter was the result of the Neolithic Revolution of some 10,000 years ago, whereas hunting and gathering have been the most important sources of subsistence for almost 99 % of the history of humankind. But on the other hand, fisheries (and other gathering activities) are not necessarily governed by the same rules as agricultural activities. Land, during the period before 1800 the primary limiting production factor in agriculture, was not a constraint here (but fishing grounds were, of course). The possibilities for rationalization and labour saving technologies were not constrained by the same factors as in agriculture where the seasonality of much work made it difficult to increase levels of specialization and introduce labour saving devices. Finally, the long-term demand for fish was probably much more income elastic than the demand for the more basic foodstuffs that were the staples of the agricultural sector. Therefore, in theory, fisheries could have been a dynamic and expansive part of the economy, in particular when there existed possibilities for exporting fish and fish products.

In the modern period Iceland is probably the best example of an economy that owed much of its economic progress to the fishing industry. During the early modern period Holland comes to mind. In the economic-historical literature on the western part of the Netherlands the fisheries have traditionally played a large role (see the following paragraph for an outline of the historiography). The question what the contribution of these industries has been to economic growth has been most systematically analysed by Jan de Vries and Ad van der Woude in their seminal work on the Dutch economy in the early modern period. They, amongst others, show that the herring industry of Holland and Zeeland was a large source of employment. Contemporaries even considered it to be one of the keys to the economic success of the Dutch Republic, an assessment that is not fully shared by De Vries and Van der Woude. They question the profitability of the industry, and low profits might of course also point to a low value added per person employed and a relatively low contribution of this industry to GDP. They are also relatively pessimistic about the contribution of the fishing industry to economic growth. In fact they conclude that ‘these scraps of quantitative evidence hint at a long-term tendency for the chief branches of the fisheries to decline both in terms of total revenue and of profitability’ and ‘both of these industries (whaling and herring fisheries – CvB / JLvZ) experienced long-term reductions of output, as their catches declined in size’.¹

We are not completely convinced by this rather negative assessment of the contribution of the fishing industry to growth during the Dutch Golden Age. One of its limitations is that it focuses on the periods of decline (which indeed occurred in both industries) rather than on the expansion that, in both cases, preceded decline. It is somewhat mysterious that in a book that is making such a big point of the economic successes of the Dutch Republic, the fisheries get such a bad press. Moreover, as they stress themselves, their assessment is based on rather patchy quantitative evidence that does not fully cover the long-term performance of both industries. This, again, is rather surprising because both industries are among the best documented of the Republic’s economy.

In this article we hope to present a more balanced assessment of the contribution of herring fisheries and whaling to economic growth during the 1600-1800 period. This is first of all based on a detailed reconstruction of the development of employment and value added in the fisheries in this period. Section 2 presents a short outline of the historiography. The following

¹ J. DE VRIES, A. VAN DER WOUDE, *The first modern economy. Success, failure, and perseverance of the Dutch economy, 1500-1815*, Cambridge 1997, p. 267.

section briefly describes the sources used for that purpose and discusses some of their limitations. Then we will chart the long-term trajectory of employment in the fisheries (section 4), analyze their contributions to growth during the Golden Age (section 5) and briefly deal with the issue of the depletion of the stocks of herrings and whales (section 6). Section 7 puts together our main conclusions.

2. *Historiography*

Although the local and provincial government carefully documented the herring fisheries, most contemporaries were not aware of these figures. Historians only published the data from the late 19th century onwards and even then the most influential works – those by Beaujon and Kranenburg – mainly focused on the size of the fishing fleet instead of the catch figures. The German historian Wätjen was the first to publish a substantial share of the available catch data. Efforts undertaken from the late 1980s onwards by Willemsen, Van Vliet, Poulsen and Van Bochove have resulted in more or less complete catch statistics.²

Because the data were not available until the late 19th century, early modern observers made fantastic estimates about the size of the fleet. John Keymer – the English economic commentator – for example, estimated that during the early 17th century Holland's herring fleet numbered 2,000 busses. But even the Dutch States General in 1610 calculated the number of herring fishers at above 20,000.³ When parts of the catch statistics were published Kranenburg fixed the highpoint of Holland's herring fisheries during the 1630s with a fleet of about 500 busses and a catch of 20,000 lasts. Recent research by Van Bochove, however, has placed the highpoint at the beginning of the 17th century, with c. 500 busses and 31,000 lasts. During the first half of the century a maximum of about 700 busses seems to have been in use.

² A. BEAUJON, *Overzicht der geschiedenis van de Nederlandsche zeevisscherijen*, Leiden 1885; H. KRANENBURG, *De zeevisscherij van Holland in den tijd der Republiek*, Amsterdam 1946; H. WÄTJEN, *Zur Statistik der holländischen Heringsfischerei im 17. und 18. Jahrhundert*, in: "Hansische Geschichtsblätter", 16, 1910, pp. 129-185; R. WILLEMSSEN, *Enkhuizen tijdens de Republiek. Een economisch-historisch onderzoek naar stad en samenleving van de 16e tot de 19e eeuw*, Hilversum 1988; A. VAN VLIET, *Vissers en kapers. De zeevisserij vanuit het Maasmondgebied en de Duinkerker kapers (ca. 1580-1648)*, 's-Gravenhage 1994; B. POULSEN, *Historical exploitation of North Sea herring stocks. An environmental history of the Dutch herring fisheries, c. 1600-1860* (unpublished PhD-dissertation University of Southern Denmark); C. VAN BOCHOVE, *De Hollandse baringvisserij tijdens de vroegmoderne tijd*, in: "Tijdschrift voor sociale en economische geschiedenis", 1, 2004, pp. 3-27.

³ A. VAN VLIET, *Vissers en kapers*, cit., p. 30.

Warfare, privateering, new investment opportunities and labour scarcity are brought forward as major causes of decline.

Historians have also touched upon the economic significance of the herring fisheries. Van Gelder estimated profitability at about 12 % during the period 1590-1604 and Van Vliet calculated c. 17 % (around 1600) and c. 12 % (around 1630).⁴ Kranenburg fixed gross income at more than 3 million guilders annually. He also tried to determine the amount of money that was spent in the Netherlands, but due to double counting this did not result in a value added figure.⁵

With respect to whaling historians initially focused mainly on the period of the chartered company of the 'Noordsche Compagnie'. Later both Van der Woude and De Jong wrote a synthesis on the whole period of early modern Dutch whaling.⁶ The main focus of the early historical research was not on the size of the catch. Fairly accurate catch statistics, however, had survived from 1661 onwards. Contrary to the herring fisheries these were not recorded by the government, but by individuals interested in the fisheries. As with the herring fisheries, the first to make the catch data available to the larger scientific public was Wätjen.⁷

Profits during the first phase of Dutch whaling seem to have been good. Eighteenth century authors, however, compared investing in the whaling fleet to participation in a lottery, but De Jong concluded that when one had enough money to weather out losses, the good years would in the end compensate for the bad years. The average profit ranged somewhere between 5 and 20 %. Van Densen concluded just the opposite: it was interesting to invest in the whaling lottery with small amounts of money in order to wait for the big returns. Just as with the herring fisheries, authors calculated gross in-

⁴ H. VAN GELDER, *Gegevens betreffende de haringvisserij op het einde der 16de eeuw*, in: "Bijdragen en Mededeelingen van het Historisch Genootschap", 32, 1911, pp. 1-62; A. VAN VLIET, *Visseren en kapers*, cit., pp. 57, 171.

⁵ H. KRANENBURG, *De zeevisserij*, cit., p. 212.

⁶ A good historiographical overview is provided by Hacquebord. See: L. HACQUEBORD, *Van Noordse Compagnie tot Maatschappij voor de Walvisvaart. Honderd jaar onderzoek naar de geschiedenis van de Nederlandse walvisvaart*, in: "Tijdschrift voor zeegegeschiedenis", 13, 1994, pp. 19-40.

⁷ H. WÄTJEN, *Zur Geschichte des holländischen Walfischfanges von der zweiten Hälfte des 17. bis zum Beginn des 19. Jahrhunderts*, in: "Hansische Geschichtsblätter", 25, 1919, pp. 247-290; J.R. BRUIJN, C.A. DAVIDS, *Jonas vrij. De Nederlandse walvisvaart, in het bijzonder de Amsterdamse, in de jaren 1640-1664*, in: "Economisch- en sociaal-historisch jaarboek", 38, 1975, pp. 141-178; L. HACQUEBORD, *Smeerenburg. Het verblijf van Nederlandse walvisvaarders op de westkust van Spitsbergen in de 17e eeuw*, 1984. The last two publications greatly improved our knowledge of the pre-1661 situation.

come and estimated the amount of money that stayed in the Republic. No value added calculations have been made.⁸

3. *The data*

The herring fisheries and the whaling industry are among Holland's best-documented industries. One of the reasons for the high quality of the documentation regarding the herring fisheries is that there was a high degree of state involvement in this industry, mainly because of the necessity to protect the fleet at sea, which also led to the introduction of special taxes to fund their defence. Because these taxes (the *lastgeld*) were levied on the landings of the herring at the ports and were recorded there meticulously by officials, they form a good source for the reconstruction of the long-term development of the catch. Some local governments also introduced taxes to repair and improve port facilities. Generally both series match perfectly. Of course there was an incentive for the fishermen to evade taxation, but in order to make this profitable in the long run – the taxation per last was not incredibly high – one had to hide a quite substantial portion of the catch. This will have been difficult to maintain. Evasion will thus probably have made up only a small portion of total landings.

Whaling was even more regulated initially – it was an official monopoly between 1614 and 1642 – and even after the liberalization of the business in 1642 both public and private interest in the industry remained large. As the whaling industry was not subject to taxation the catch was not recorded by the government, but by interested individuals. It was not very difficult to record the size of the whale catch as the size of the fleet never really exceeded 200 vessels and because the catch was a certain – often small – number of whales caught per year. The notes these individuals made were already put together in detailed overviews of the whole industry during the 18th century. These observations seem to have been fairly precise, but they sometimes missed a vessel. De Jong therefore comprised his series using the maximum catch that he could find in these 18th century sources. The pre-1661 data are more problematic, but represent current knowledge about this period.

Information on the structure of income and expenditure was based on historical and archival research on actual accounts. As economic historians have already contributed a lot to the study of these two kinds of fisheries, we

⁸ C. DE JONG, *Geschiedenis van de oude Nederlandse walvisvaart I*, Pretoria 1972, pp. 248-257; C. DE JONG, *Geschiedenis van de oude Nederlandse walvisvaart II*, Johannesburg 1978, pp. 313, 316-321; W. VAN DENSEN, *On the perception of time trends in resource outcome. Its importance in fisheries co-management, agriculture and whaling*, 2001. See the latter for catch variability and profitability.

are relatively well informed about such things as the size of crews, their wages, the prices of the main products and the cost structure. Where necessary, interpolations were made based on price series for relevant goods. It should be mentioned that the Amsterdam wholesale prices were used. This of course, underestimates the income that the fishing companies generated. Especially in a sector as the herring fisheries where probably 80 % of the total catch was exported and where many investors were also involved in trading herring. In this respect our income figures will thus underestimate actual income.

4. The long-term development of employment in both industries

The point of this paper is to bring this information together and analyze the long-term performance of the two industries in detail. Herring fisheries were already quite important during the 15th century, when the centre of gravity of the herring industry moved from Flanders and Zeeland in the south to a number of villages in the delta of the River Meuse (near Rotterdam). According to a detailed reconstruction of the structure and level of GDP in 1510/14, about 5 % of employment was in the herring fisheries (the share in GDP was slightly lower); agriculture, by comparison, contributed about one-quarter of employment.⁹ During the 16th century the industry expanded rapidly – but so did the total population of Holland (it increased from 275,000 in 1514 to about 500,000 in 1600) and total GDP. At about 1600 the herring industry still employed about 2½ to 3 % of the labour force. Figure 1 presents a set of estimates of the share of fisheries in total employment showing the long-term pattern during the 17th and 18th centuries. Already from the first decade of the 17th century did the relative importance of herring decline; until the 1640s this was mainly caused by the fact that employment in herring stabilized at a level of about 7,000 crew members, whereas the population of Holland increased by about one-half in between (from 500,000 to 750,000). After the late 1640s herring became a declining industry and output and employment began a long-term fall that continued into the second half of the 18th century. At the same time whaling became a relatively large source of employment, increasing to about 2 to 3 % of total employment from the 1680s onwards. So employment in fisheries remained more or less stable at the still sizeable level of circa 3 % of the total labour force be-

⁹ J. VAN ZANDEN, *Taking the measure of the early modern economy: historical national accounts for Holland in 1510/14*, in: “European review of economic history”, 6, 2002, pp. 131-163.

tween the 1620s and 1750s; it was only during the second half of the 18th century that the industry as a whole showed definite signs of overall decline.

The contribution of the herring fisheries to growth during the first decades of the Golden Age is not really captured by the employment estimates of Figure 1. There are two estimates of the catch at about 1514 and in 1550, which can be combined with the post 1600 data (see Figure 2). The spectacular expansion of the industry during the second half of the 16th century becomes very clear now; it was in particular the expansion of the fleet of North Holland (Enkhuizen and Graft/De Rijp) that was behind the increase between 1550 and 1600. At about 1600 the herring fisheries were at their peak – the highest recorded catch of 40,000 lasts was in 1602 – and already during the first decades of the 17th century a relative decline set in. Growth between c. 1580 and 1600 must have been spectacular, however, because the industry was badly affected by the civil war that broke out after 1572, and only when Amsterdam joined the Revolt in 1578 was it able to recover a bit from the losses of the previous years. So a fair share of the increase between 1550 and 1600 must have occurred in the final two decades of the 16th century.¹⁰

The rise and decline of whaling was almost entirely a story of the 17th and 18th centuries (although in the 19th and even the 20th century some attempts were made to revive the industry in the Netherlands, which were by and large unsuccessful). During the first thirty years (1614-1642) the industry was dominated by the Noordsche Compagnie, which only slowly expanded its business (Figure 3). After the dissolution of the monopoly growth became more rapid, but it took another twenty years before the golden years of the industry began (but the statistics for the 1640s and 1650s are relatively weak). Between the 1660s and the 1700s output was at its maximum, after about 1705 the trend in output was already negative although employment continued to increase (Figure 1).

Another striking aspect of employment in this branch was its instability. In particular during wars when the risk of becoming prey to the warring parties was large – in spite of the protective measures developed by the two fleets – the industry would almost come to a standstill. This occurred in particular during the Anglo-Dutch wars (except for the first one, when the Dutch navy still dominated the seas), but also conflicts with the French were often quite harmful for the industry. Prior to 1648 Dunkirk privateers formed an enormous threat to Holland's fishing fleet: killing and capturing fishermen and destroying and capturing vessels and nets.¹¹ Holland's fisheries were

¹⁰ A. VAN VLIET, *Visseren en kapers*, cit., pp. 298-299.

¹¹ A. VAN VLIET, *Visseren en kapers*, cit.

therefore an important source of economic instability because employment fluctuated extremely from one year to another. In the most extreme case, during the second Anglo Dutch war, estimated employment fell from about 14,000 in 1663 to 1,000 in 1665 and even less in the next year.

Figure 1. Share of employment in fishing in Holland's labour force, 1600-1795 (in %)

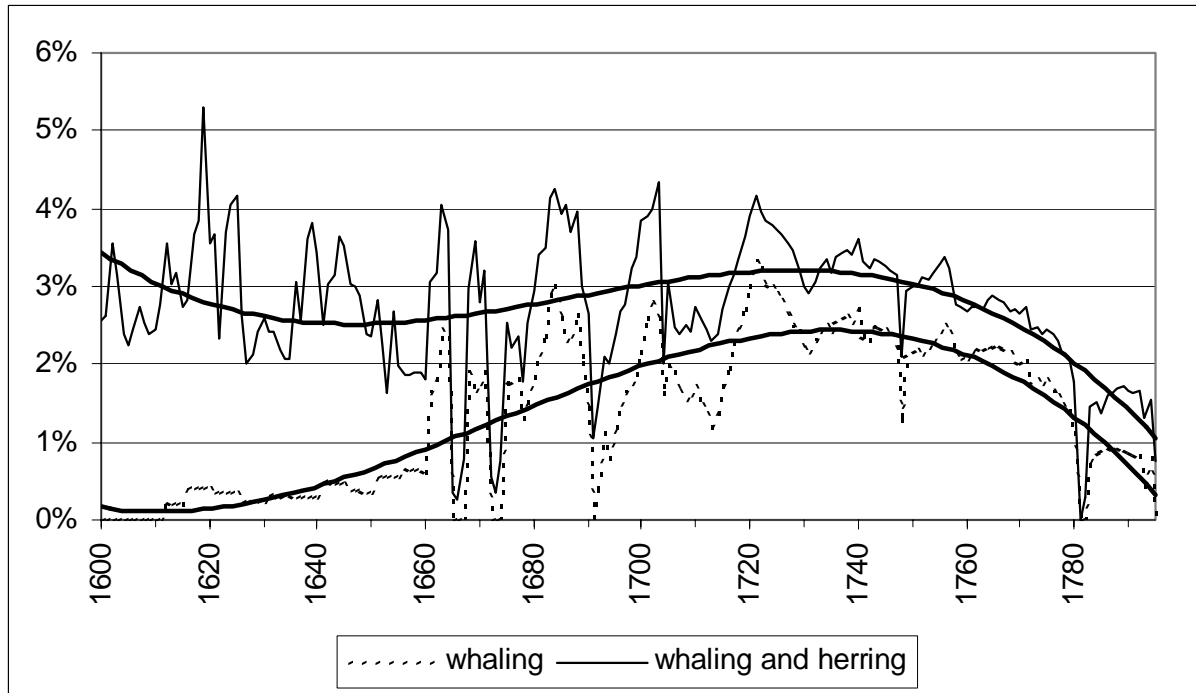


Figure 2. Catch of the herring fisheries, 1512-1795 (in lasts)

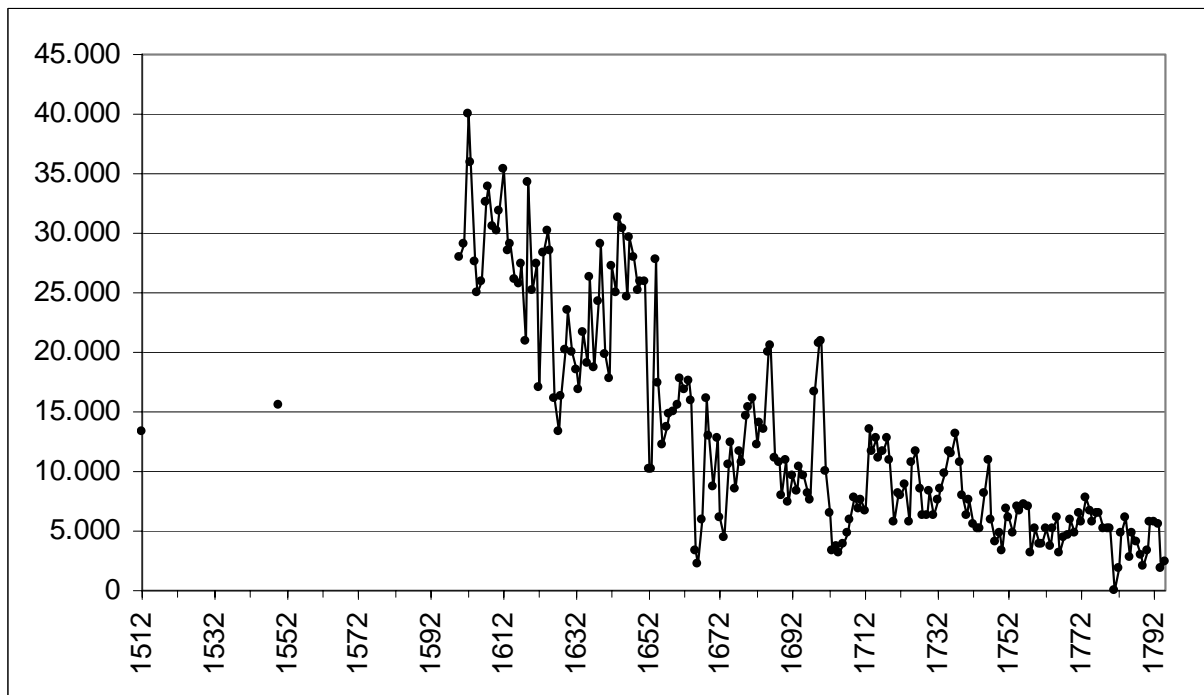
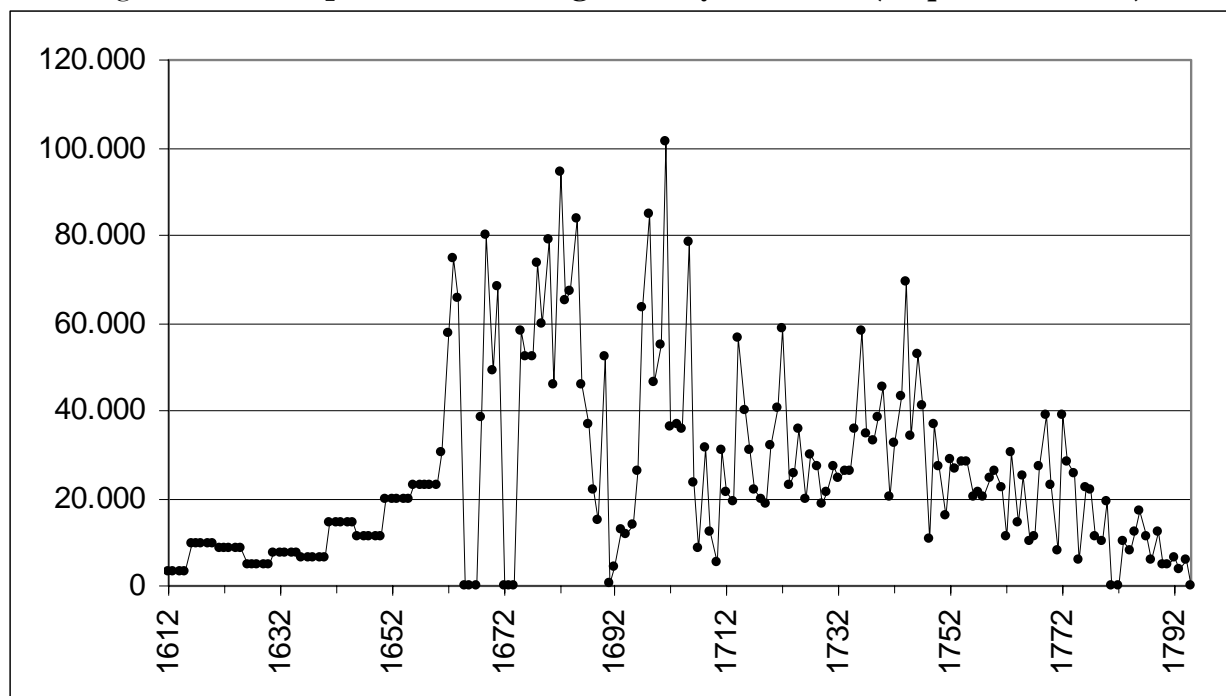


Figure 3. The output of the whaling industry, 1612-1795 (in quarteels of oil)



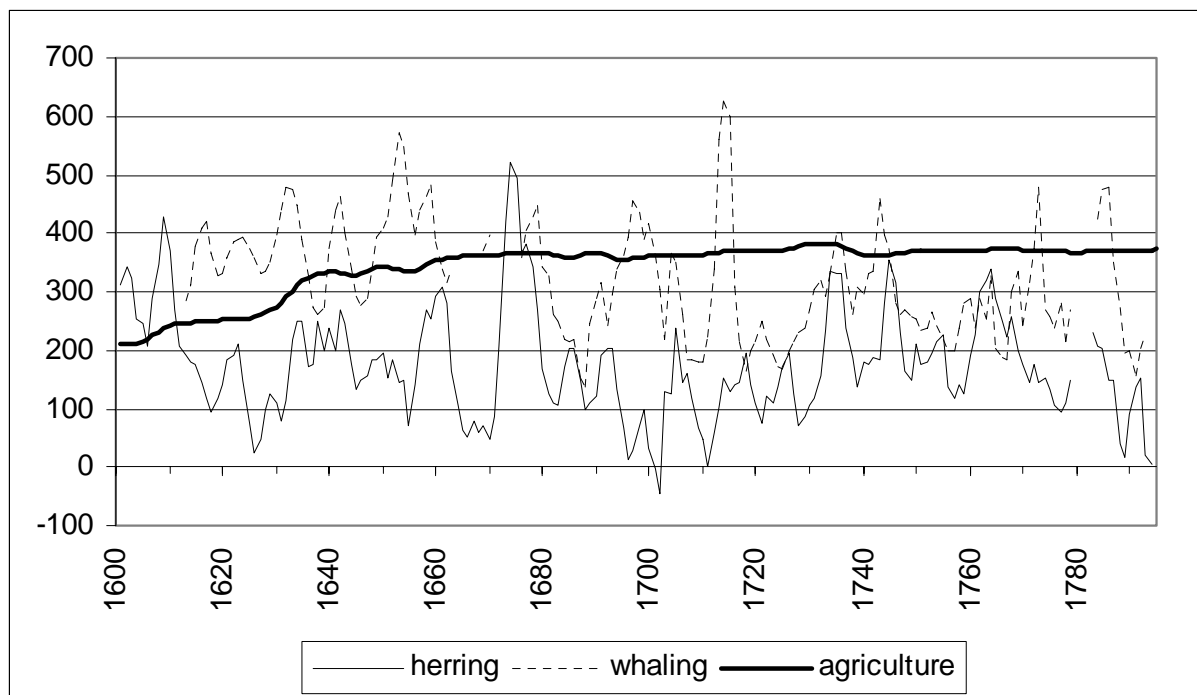
5. The economic contribution of the fisheries

The fishing industry continued to be an important part of the economy of Holland during the Golden Age, and only after about 1760 did its share in employment decline much. But how large was its contribution to GDP? Unfortunately no detailed estimates of Holland's GDP are available for this period (this paper is part of a project that eventually will produce such estimates). The alternative is to compare with the agricultural sector, for which preliminary estimates for value added and employment have been made. In the two benchmark years for which we have overall estimates of GDP – 1510/14 and 1807/08 – the value added per person employed in fisheries was relatively low at about 70-75 % of the value added in the economy as a whole.¹² This also appears to be the case in the 17th and 18th centuries, especially for the herring fisheries. Whereas the value added per worker in agriculture increased from about 200 guilders in 1600 to 350 - 370 guilders between 1660 and 1800, the per worker value added in herring fisheries fluctuated around the 200 guilders mark during much of the 17th century, and still lower during the 18th century. Most striking is perhaps that in a few years (most notably the period around 1700) value added was negative – the result of an ex-

¹² J. VAN ZANDEN, *Taking the measure*, cit.; J. VAN ZANDEN, J. SMITS, E. HORLINGS, *Dutch GNP and its components, 1800-1913*, Groningen 2000.

tremely meagre catch, which did not even compensate for the expenses incurred for inputs such as nets – as a result of which of course also the value added per worker was negative. But the average of 200 guilders per worker is even slightly lower than the annual income of an unskilled labourer in Holland at the time, who earned close to one guilder per day from the 1630s onwards, or perhaps as much as 220 to 250 guilders per annum if he was employed for 250 days. Herring fisheries were a seasonal industry, of course, which employed its labourers for only half the year (but the busiest part of the year – from May to November). The wage per fisher was estimated at about 120 guilders per year, plus 40 guilders for food on board, which meant that during this part of the year they could earn between 50 to 75 % of the income of an unskilled labourer. During the rest of the year most fishermen were employed in agriculture (many inhabitants of small fishing villages had small plots of land), in the maintenance and repair of nets, ships and other inputs, in the processing of the catch (in the oil mills of Zaandam), or in the trade of the fish. So the income earned in these other activities should be included in an overall assessment of the productivity of the seamen active in fisheries.

Figure 4. Estimated gross value added at market prices per worker in fisheries and agriculture, 1600-1795 (centred three-yearly moving averages; in current prices)

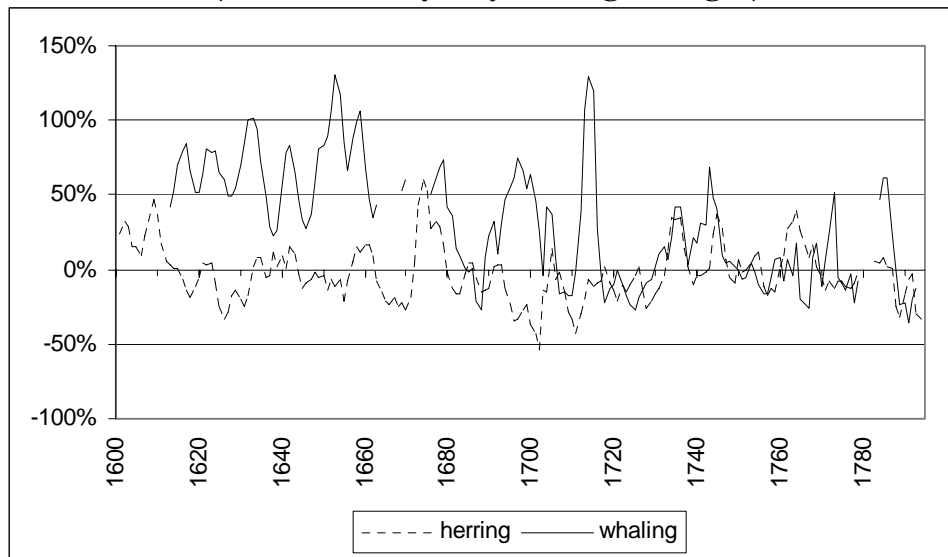


The labour productivity in whaling was much higher than in the herring business (Figure 4), the difference remaining more or less the same during these two centuries. In the first half of the 17th century its level was even higher than that in agriculture, but whaling was still a small and artificially monopolized sector during these years. The stability of value added per worker was the result of two contrasting trends: as we will see in the next section, output per worker declined almost continually in whaling (the result of a gradual overexploitation of the stocks), and also the trend in the catch per person in herring fishing was downward. By contrast, relative prices of the produce went up slowly, as a result of which the decline of value added in current prices was rather limited.

One of the consequences of the low productivity of herring fishing was that profits were very low here. In Figure 5 profitability is estimated in relation to the actual annual expenses (because we do not have data on the capital invested); a profit rate of 100 % in this case means that the net profits for the entrepreneurs are equal to the outlays in terms of wages, the rent of ships, nets, etc. Whaling was, in particular during the first six decades of the 17th century, quite a profitable business.¹³ After 1660 yearly fluctuations in profitability became very large, and years with extremely high profits occur next to years with net losses (these fluctuations are dampened somewhat by the fact that Figure 5 presents three-years moving averages). But the overall picture is still rather favourable until about 1700, after which profits become much less normal, and owning of a whaling ship becomes a very speculative business.

¹³ Note that the rent of ships is already taken into account here, so it concerns the net yield of the investment made by the ship owners.

Figure 5. The 'profitability' of the two branches, 1600-1795
(centred three-yearly moving averages)



The structurally low level of profitability in herring fishing is a bit of a mystery. Pons and Van Bochove have noted this phenomenon before – it was also a feature of the herring industry until the middle of the 19th century.¹⁴ The explanation offered by them is that ship owners made their profits in the (export) trade of their produce, and in the manufacture of inputs such as nets and barrels. Yet it remains puzzling that this activity could persist in spite of the negative long-term profitability. Of course, ship owners did to some extent respond as economists expected them to respond: the herring fleet declined strongly in the long run (but this decline already began during the first decades of the 17th century, when profits were still relatively high). An alternative solution is that our data underestimate gross income or overestimate costs, but although margins of error of these estimates are quite high, we do not think that this is the case in a systematic way. Moreover, when the 19th century actual business accounts of herring busses become available, the same phenomenon (i.e. that ship owners made on balance no net profits on their ships) can be observed in detail.

6. Fisheries and resource depletion

The final question we would like to address is whether the decline of these industries was related to the overexploitation of the resources they were

¹⁴ G. PONS, *De bakens verzet. Een analyse van de Hollandse pekelharingvisserij met kielschepen in de periode 1814-1885* (unpublished PhD-dissertation University of Utrecht).

using. Because overexploitation will lead to declining returns to effort, we can measure this by looking at the yield per ship or per worker.

Figure 6. Labour productivity in herring fisheries and whaling east of Greenland (in average catch per worker; indices 1720-1729=100)

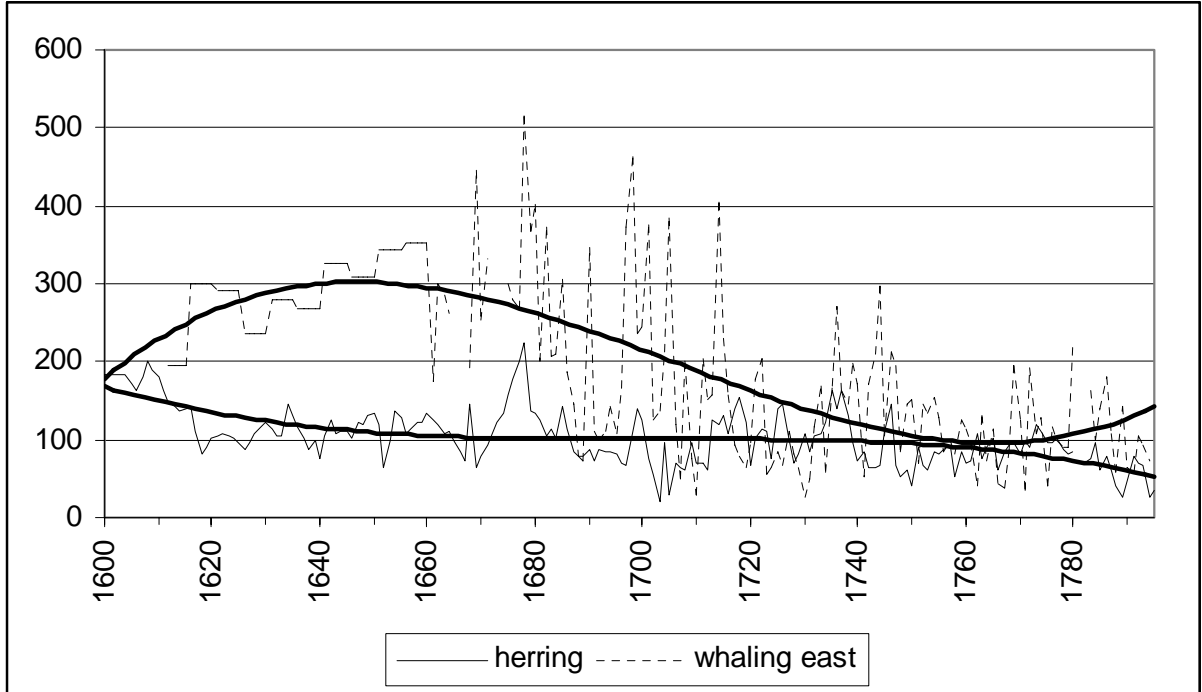
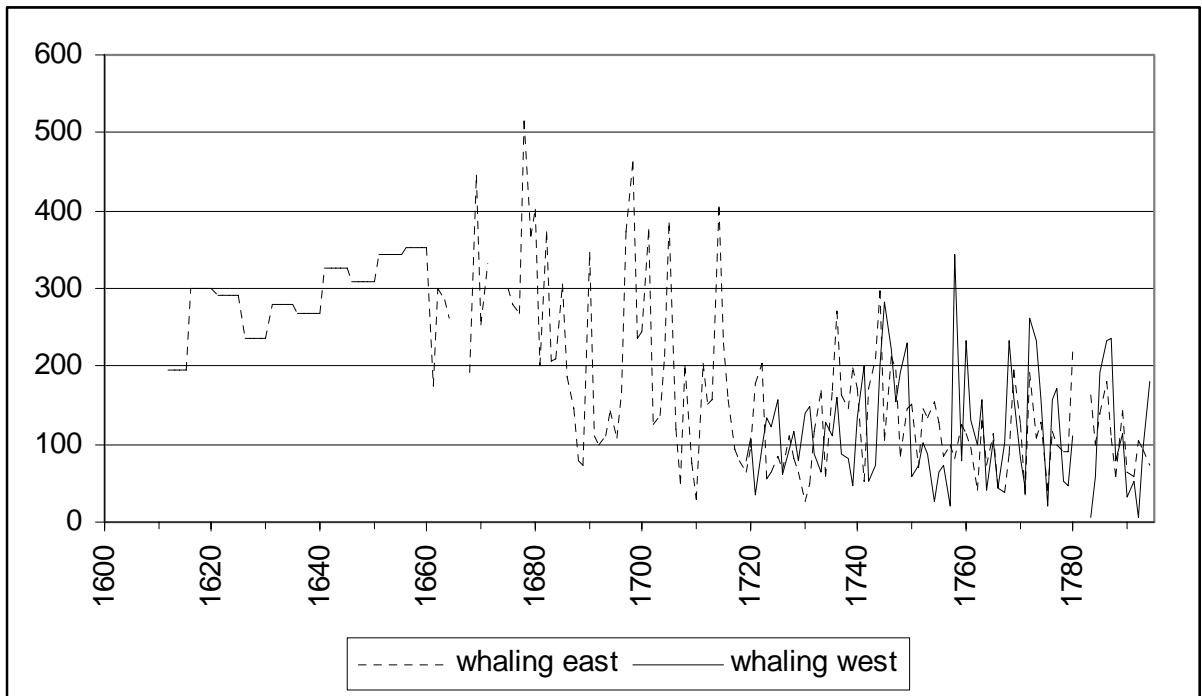


Figure 7. Labour productivity in whaling east and west of Greenland (in average catch per worker; indices 1720-1729=100)



Figures 6 and 7 present the average catch per worker in the two industries – in terms of lasts of herrings or in quarteels of oil. For whaling we have included data about the fisheries on the east and west of Greenland. The latter fisheries took place in the Davis Strait and were only developed after 1720. The estimates for the first decades of the 17th century are relatively weak, in particular those for whaling, so it is not certain that the decline was as big as is suggested by Figures 6 and 7. But that yields in whaling were declining is quite certain, although for contemporaries it was difficult to observe this because of the enormous annual (and ship-by-ship) fluctuations in catches (and nobody of course did the ‘advanced’ calculations of averages and of trends that are now possible).¹⁵ The decline of catches in whaling also led to a search to new whaling grounds.

The herring industry was in this respect more stable, at least until the middle of the 18th century. Here the long-term trend was probably downward, but at the same time the number of trips per buss also declined so the catch per trip was more or less constant. In both industries resource depletion may therefore have played a role in the economic difficulties faced during the 18th century. International competition was also quite important, however; the herring fisheries faced increased competition from Scotland, Denmark and Norway, the whaling business was gradually taken over by the English.¹⁶

7. Conclusion

Fisheries were an important source of employment during Holland’s Golden Age, but the productivity of this sector was not very high, in spite of the new labour saving and rather capital intensive techniques that had been introduced in the herring fisheries (such as the buss) and that were being introduced in the whaling business during the 17th and 18th centuries. Profits in herring fishing were extremely low and instable, and one of the mysteries of the branch is that ship owners continued to invest in their ships in spite of the fact that in the long run profits were extremely small or even negative. The profitability of whaling was much higher, especially before 1680, but the sustainability of this industry was problematic, and the depletion of the fishing stocks became an acute problem already quite soon (i.e. during the early 1700s). This more detailed reconstruction of the economics of the fishing industry therefore confirms the rather mixed assessment by Jan de Vries and

¹⁵ W. VAN DENSEN, *On the perception*, cit.

¹⁶ J. DE VRIES, A. VAN DER WOUDE, *First modern economy*, cit., pp. 253, 265.

Ad van der Woude of the contribution of fishing to the economic expansion during the early modern period.

APPENDIX

Of the three large industrial fisheries of early modern Holland (herring, whale and cod), two have been documented extremely well. Catch data of the herring fisheries have been preserved due to the provincial and local taxes that were levied. Contemporaries meticulously recorded catches of the whaling fleet.

Whaling

Year to year catch records for the period 1612-1660 are not available. The catch, therefore, needed to be based on the number of vessels that were fitted out each year. Hacquebord brought together the available information (De Jong and Bruijn and Davids) and added some unpublished information to it. He assumed that a vessel annually caught an average of 10 whales of 50 quar-teels train each. From 1661 onwards contemporaries meticulously recorded catches of the whaling fleet. Although they were often able to collect complete figures, a comparison of different lists shows that they sometimes missed information on specific ships. In constructing his catch series, De Jong therefore used the largest figure he could find for each year. These lists included the number of vessels and the production of train. The number of whalebones needed to be estimated. De Jong, following Van der Woude, assumed that east of Greenland a quar-teel of train yielded an average of 24 pounds of whalebones. West of Greenland the average was 25 pounds. For the period 1612-1642 De Jong assumed a ratio of 1:20. The ratios for the intermediary years were linearly interpolated.

Hacquebord estimated that during the period 1612-1660 the crew of whaling vessels counted about 40 heads. Land stations had a crew of about 30 men. De Jong estimated that during the period of the Noordsche Compagnie there were on average nine of these land stations each year. From 1661 onwards the size of the crew was put at 42 men.

De Jong took his prices of train and whalebones from Hoboken and Posthumus. In order to estimate the missing Dutch train entries – mainly for the first quarter of the 17th century – we used the English naval stores prices published by Beveridge. Due to incomplete data the price of whalebone had to be put at ten guilders during the entire 1612-1660 period.

Hacquebord presented new information on the costs of fitting out a whaling vessel during the period before 1661. He partly based himself on Bruijn and Davids. Hacquebord differed between the elements (e.g. food,

wages and freight rates) that made up total expenditure. When data for whaling west of Greenland become available it turns out that fitting out a ship was 3,000 guilders more expensive due to the fact that a longer voyage resulted in higher wage and food costs.

From 1661 (east of Greenland) and 1719 (west of Greenland) De Jong only presented the total costs. In order to compose a value added series this total needed to be split up into its original components. For whaling east of Greenland the average shares during the period 1650-1660 were calculated and used for the period 1661-1795: 28.32 % depreciation of the whaling vessel, 19.70 % food, 32.38 % regular wage and 19.15 % for tools. The variable part of the wage, which depended on the size of the catch, was taken to remain constant at 3½ guilders per *quarteel* train. In order to do the same for whaling west of Greenland we assumed that the tools cost the same east and west. This then left us with the depreciation of the vessel, victuals and the standard wage. Their shares were based on the division of shares east of Greenland during the years 1709-1719: 35.03 % depreciation of the vessel, 24.37 % victuals and 40.61 % standard wage. Here, again, the variable pay was 3½ guilders per *quarteel* train. The calculation of profit and value added followed logically from these data.

Sources: J.R. BRUIJN, C.A. DAVIDS, *Jonas vrij*, cit., p. 157; L. HACQUEBORD, *Smeerenburg*, cit., pp. 55, 77, 239-240; DE JONG, *Geschiedenis*, I, pp. 14, 253-256; IDEM, *Geschiedenis*, II, pp. 283-288, 294, 298-300; IDEM, *Geschiedenis van de oude Nederlandse walvisvaart*, III, Johannesburg 1979, p. 149 and tables 1, 2, 7, 8, 11, 12, 15, 17; A. VAN DER WOUDE, *Het Noorderkwartier. Een regionaal historisch onderzoek in de demografische en economische geschiedenis van westelijk Nederland van de late middeleeuwen tot het begin van de negentiende eeuw*, Wageningen 1972; W. BEVERIDGE, *Prices and wages in England from the twelfth to the nineteenth century*, I, London 1965.

Herring

The Dutch herring fisheries probably are the single best-documented fisheries of the early modern period because both the provincial and local government developed an early interest in taxing it. Provincial taxation was mainly used to cover convoy expenses. Local taxes were, among others, used to improve port facilities. Recently Van Bochove collected the available published information and filled the gaps with archival materials.

Historians interested in reconstructing gross income and profitability have published on the cost and income structure. Archival research has yielded the accounts of some fishing companies, which contained valuable information on prices of fishing goods, the cost and income structure, as well as the financial organization of business. The combination of published and archival sources allowed the construction of a number of benchmarks. The

intermediary years were either filled directly (e.g. salt and herring prices) or indirectly (e.g. hemp prices as proxy for nets).

Note: C. VAN BOCHOVE, *The 'gouden mountain': an economic analysis of Holland's early modern herring fisheries* (forthcoming) will publish this information in detail. IDEM, *Database Hollandse haringvisserij 1500-1795* (URL: <http://www.iisg.nl/research/haringvisserij.php>).