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RISK SHARING, CREW QUALITY, LABOR SHARES AND WAGES IN THE NINETEENTH CENTURY AMERICAN WHALING INDUSTRY

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ABSTRACT

This paper examines 36,640 labor contracts signed between whalemen and the agents who organized 1,258 whaling voyages that departed from New Bedford, Massachusetts between January 1, 1840 and December 31, 1858 and between January 1 and December 31, 1866. The contracts contain information on the whaleman's station (occupation) and on his lay (the fraction of output of the voyage that he was entitled to receive upon completion). The paper investigates the benefits associated with this unique contract, examines the occupational and spatial distribution of lays, and compares wages in whaling with those available in the merchant marine and those earned in shore based pursuits. It also attempts to assess the efficiency of this early labor market and to explore the relationship between the labor contract, crew quality, technical change, and productivity.

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1. Introduction

Many Americans have read *Moby Dick* and could, if called upon, identify "Call me Ishmael" as the opening sentence of that novel. Fewer have read Elmo Hohman's "Wages, Risk and Profits in the Whaling Industry;" an even smaller number remember his opening words: "The method of payment in the whaling industry was a singular one."[1] It is, however, to the spirit of Hohman rather than Melville that this paper is dedicated.

As Hohman has pointed out, a whaleman, were he a captain or a greenhand, was "not paid by the day, week, or month, nor was he allowed a certain sum for every barrel of oil or every pound of bone captured. Instead, his earnings consisted of a specified fractional share, known as the lay, of the total net proceeds of a voyage.... The earnings of a whaleman thus constituted a reward not only for the performance of labor under peculiarly trying conditions, but also for the assumption of both business and physical risks. For the size of his lay, representing his wages, was directly dependent upon the business risks centering about price fluctuations, as well as upon the physical risks of storm, fire, stranding, and poor luck on the whaling grounds."[2] The effect of risks on the earnings of whalemen is illustrated by the experience of the captains who directed the vessels that sailed from New Bedford between New Year's day 1840 and the end of 1858. The monthly earnings of the men who guided the more than 1200 successful voyages (voyages from which a vessel returned with some product) averaged $95.54, but their rewards ranged from a low of $1.20 to a high of $621.39. If the experience of the 146 captains whose vessels either returned clean or not at all were included in the calculations, both the average and minimum values would be lower still.

Hohman wrote more than fifty years ago. Although his work was based on an examination

of the records of a large number of whaling voyages, it is not clear which voyages were included nor how he analyzed the data that he found in the accounts of those voyages. On these questions, Hohman merely reports: "The detailed figures serving as a warrant for these statements were secured through an analysis of hundreds of individual accounts found in the collection of scores of original manuscript whaling account-books now in the New Bedford Library."[3]

In part this article parallels Hohman's; but it expands his work in some new directions; it modifies some of his findings; and it directly disputes others. The core of the study is based on a systematic examination of 36,640 labor contracts drawn between ships' agents and the whalemen who signed on to 1258 vessels that sailed from New Bedford between January 1, 1840 and December 30, 1858 and between January 1 and December 30 of 1866 (see Appendix Table 1). The 1258 represent three-quarters of the voyages that, according to Alexander Starbuck, departed New Bedford during the years in question .[4] The labor data have been linked with information on the voyages themselves -- information drawn chiefly from Starbuck, Hegarty, and Dias -- and the links permit the labor contracts to be examined in light of the vessels and equipment used, the grounds hunted, and the results of the hunt.[5] These records have been supplemented by account books of whaling voyages and agents' letter books that are on deposit at the Baker Library of Harvard University.

In the 19th century sperm whales were hunted for sperm oil and spermaceti -- the former used for high quality lighting and to lubricate fast-moving machinery, the latter for very high-quality candles. Baleen whales (the rights, humpbacks, grays, and bowheads), were valued for both their oil and their bone. Whale oil was a less expensive (and lower quality) illuminant than sperm oil. It was also used as a lubricant for heavy machinery. Whale bone (or baleen) was made into corset stays, buggy whips, window shades and other products that demanded both strength and flexibility.

Although at one time or another during the nineteenth century British, Australian, and Norwegian vessels constituted a not insignificant share of the world's whaling fleet, the American component was the largest by far -- between 1820 and 1880, it accounted for more than seventy-five percent of the total vessels.[6] Of the coastal cities that served as home for the American fleet (there were twenty-two such cities in 1850), New Bedford was the most important. Between 1840 and 1860 its vessels accounted for just less than fifty percent of all American whaling tonnage and an equal fraction of the nation's total catch.

The fleets of some American ports specialized in sperm or in baleen whales or focused their search in some particular geographic area, but the vessels that sailed from New Bedford were much more catholic -- they accounted for almost sixty percent of all sperm oil and more than forty percent of all whale oil returned by the American fleet -- and they hunted throughout the world. New Bedford ships' logs list visits to fifty-five separate hunting grounds, including such exotic and geographically disparate places as Patagonia, Delago Bay, the Okhotsk Sea, Desolation Island, and Altaho. For purposes of this study, however, the fifty-five have been aggregated into just four grounds: The Atlantic, Pacific, Indian, and Western Arctic.

In the 1840's and '50's, the New Bedford component, like the entire American fleet, was heavily weighted toward ships; but it contained a substantial and growing proportion of barks and a few brigs, sloops, and schooners as well (of the 1258 voyages, 854 were made by ships, 393 by barks, but only eleven by brigs, sloops and schooners combined). Both ships and barks were three masted. The former were square rigged; the latter, square rigged on the fore and main masts, and fore-and-aft rigged on the mizzen. Ships were usually, but not always, larger than barks (the average tonnage of the ships was 354 and of the barks, 277). Although on average barks employed fewer workers, they used about one-sixth more labor per ton than ships.[7]

The twenty-nine men who manned a typical ship and the twenty-six that constituted a bark's crew were organized very similarly. What differences there were appear to have reflected

size of vessel, the date of sailing, the projected length of the voyage, and the vessel's destination, rather than any difference in rigging. Each vessel had: (1) a captain and some number of mates -- always one, usually three, but sometimes as many as five; (2) a set of skilled professional mariners -- their ranks always included between two and six boatsteerers, sometimes a shipkeeper, and occasionally, a navigator or a head-a-boat; (3) a number of artisans -- almost always a cooper and a carpenter, often a blacksmith, and occasionally a boat builder, a painter, a sail maker, a mechanic, a machinist, a caulker, a coppersmith, and, on rare occasions, a surgeon, or a doctor; (4) some service personnel -- almost no vessel sailed without a cook and a steward, and these two were sometimes supplemented by a second cook or steward, a steerage steward, or a steerage master; (5) a number of seamen -- some skilled, some semiskilled, some "greenhands"; and (6) often a boy or two. Table 1 provides a fairly accurate picture of the occupational structure of the crew of a typical vessel. It does not, however, capture the changes in the structure that occurred over the two and a half decades in question.

2. The Whaleman's Lay

As Hohman has pointed out, each member of the crew from the captain to the cabin boy received a predetermined fraction of his vessel's net catch. Even in this day of sophisticated businessmen-actors and their high powered lawyers, the experience of the motion picture and television industries has shown that there is many a slip between gross and net. That is, it is easy to cheat on expenses; therefore, it is preferable to draw contracts that depend upon a percentage of the final income in gross rather than net terms. Even today, however, as a reading of *Variety* or the *Los Angeles Times* makes apparent, famous actors, including those who employ high priced legal talent, still sign net contracts. In 19th century New Bedford, the whalemen, if not the agents and captains, were no more sophisticated, and the lay was calculated on the "net" value of the catch.[8] In the whaling case, the difference between gross and net was a standard set of charges incurred *during*

the voyage. The nature (but not the amount) of these charges was specified in advance, and the labor contract was written to guarantee that the whaleman (along with the agent and owner) bore his share. The charges always included payments for pilotage, gauging, wharfing, cooperage, watching, cleaning, loading, and unloading. Toward mid-century, when the industry's organizational structure became more complex, the list was expanded to include commissions and insurance on oil and bone shipped home during the course of the voyage.

The contract, however, does not appear to have presented the problems that have plagued the entertainment industry. The expenditures were all made by the captain, and the value of his lay depended on the size of the net. Moreover, his behavior was monitored on the spot by the other ship's officers whose income also depended inversely on the size of the charges, and, at a distance, by the agent, who had the same incentive.

Crew members were usually paid in cash or in a bill of exchange that could be converted to cash, but the agent could, if he chose, give them their share in kind. A crewman was entitled to a full share if he returned on the ship on which he sailed and a prorated share (based on the catch to date) if he died or was discharged for illness or other good cause. Until the 1860's, however, he was not legally entitled to any renumeration if he deserted before the voyage was completed.

It is difficult to determine the effect of the agent's right to pay in kind. Hohman suggests two reasons for the apparent frequent use of such payments when a crewman was discharged for "good reason" during the voyage. First, since there was often a lack of current information about the price of whale products, agreement about the correct level of remuneration was difficult to achieve. Second, in cases where the payment was substantial, the captain often wished to preserve his limited cash reserves. The accounts of the ship *Canton*, for example, show that over the course of eight mid-century years a number of whalemen were paid off with amounts of oil that ranged from 74 to 393 gallons.[9]

At the end of the voyage, however, payment in kind was usually invoked only if there was a dispute between crewmen and an agent over the value of the catch. While it was rarely mentioned either in contemporary accounts or in the whaling literature, a letter from the agent and ship owner Charles Morgan to his Boston lawyer suggests that it may have been a more common practice than a reading of the standard literature would lead one to believe.

> "...the universal custom is for the owner to make up the voyage at a certain price after which it is optional with him to take it, or deliver to the crew as they may elect and it is always the right of the crew to demand the oil but they cannot demand money if the owner is unwilling to pay it. The *Condor's* cargo has in part remained on the wharf & in store since its arrival & I have never yet settled with all concerned. I have this day been delivering to the Capt and one boatsteerer their parts or share of the oil and coffee as we never could agree upon a price & I have after several weeks delay declined purchasing much of the oil of another crew arrived since the *Condor* and many of them have taken away their oil & some have yet left it on the wharf....
> .... P.S. You will understand that voyages are always made up at a certain price whether the crew intends to purchase their shares or not. They [the agents] often decline purchasing & on the other hand the crew often declines selling."[10]

Whatever the importance of the right to pay in kind, all the evidence indicates that the rules governing the earnings of men who failed to complete a voyage became steadily more important as the duration of voyages lengthened -- first as the fleet moved to more distant grounds and then as the captains and agents found that they could keep their vessels at sea for much longer periods, if they used Pacific cities (Honolulu, Lahaina, and Panama, to cite three) as transshipment points. Between 1840-41 and 1857-58, average voyage length increased from thirty-four to forty-five months. In the Atlantic the length of an average voyage rose from twenty-two to thirty-six months, in the Indian Ocean the increase was from twenty-nine to forty, and in the Pacific it went from thirty-eight to forty-seven. Among the 1258 voyages, there were six that lasted more than five years, and two vessels did not return until sixty- nine months after their departure from New Bedford.[11]

The evidence indicates that there was a high and increasing level of labor turnover in a typical crew. The *George Howland*, for example, a New Bedford ship that normally carried a crew

of twenty-eight to thirty men, sailed six times between 1840 and 1866. Over the six voyages, the number of whalemen who died, were discharged, or deserted, ranged from twelve to twenty-four, averaging sixty-three percent of the original crew.[12]

As Hohman has pointed out, the form of the labor contract was idiosyncratic. Each crewman negotiated a lay -- the fraction of the net proceeds realized from the sale of the catch that he would receive at the end of the voyage.[13] The flavor of those negotiations is captured in a letter from Charles Morgan to his captain, Thomas A. Norton, discussing the staffing of the ship *Hector*. After first spelling out the range of lays that he was "accustomed to give in a four boat ship" (3rd Mate 1/70 to 1/75, Boatsteerers 1/90 to 1/95, Seamen 1/125 to 1/130, ordinary seamen 1/135 to 1/150, green hands 1/150 to 1/180, boys green 1/185 to 1/200, and boys not green 1/150 to 1/175) he continues, "Mr Mayhew (a third mate) had a 1/65 last voyage but that was higher than I have before given. I think 1/70 a fair lay for Mr. Wimfrenn but would give 1/67 rather than not have him..."[14]

According to Hohman, the officers, the cooper, and the boatsteerers received so-called "short lays" -- lays less than 1/100. While this conclusion is, in general, correct, there is a record of one boatsteerer on the *Sappho* who, on an 1866 voyage, received only 1/150, and there were a number whose lays fell between 1/125 and 1/140. Moreover, there are numerous examples of shipkeepers, cooks, stewards, and even a few (twenty-nine) able (to say nothing of eleven ordinary) seamen who received lays "shorter" than the magic 100. An examination of the contracts in question indicates that the "outliers" fall into two quite different categories. First, most seem to stem from the perceived *ex ante* competence of the individual whaleman -- that is, in the agent's and the whaleman's recognition that there were substantial differences between the potential productivity of whalemen, differences that existed even among seamen applying for the same job. In the case of the "underpaid" boatsteerers, each of the twelve who received lays longer than 120 was a crewmen on a vessel whose agent had signed his peers at wages in the "usual" range. The

three other boatsteerers on the *Sappho*, for example, received lays of 75, 75, and 100 respectively. The "well paid" seamen on vessels hunting in the Indian, Pacific, and Arctic grounds were often characterized as "able" or "extra skilled", and their not-so-designated shipmates received lays more closely in line with tradition. Since vessels seldom had more than a single steward, such intra vessel comparisons are difficult. It is, however, true that the stewards on vessels hunting the three distant grounds who received abnormally short lays tended to have signed on vessels that were larger (in tonnage) and more heavily crewed than the average vessel of the same rig working those oceans. It seems likely that the larger vessels demanded stewards with higher skills, and that the potentially highly skilled applicants were rewarded.

Skill differences do not, however, explain all of the outliers. Small vessels making relatively short cruises in the Atlantic tended to pay all their hands more (that is to give shorter lays) than those same crewmen would have demanded had they signed on larger vessels for longer voyages to the more distant grounds. The voyages by the one ship, eight barks, and ten brigs, sloops, and schooners, some of whose cooks, stewards, and skilled and semi-skilled seamen received "short" (less than 100) lays, accounted for only four percent of the ships and twelve percent of the barks but seventy-seven percent of the smaller vessels that hunted the Atlantic. Moreover, in each case the vessels were, on average, smaller and at sea for shorter periods of time than their peers hunting the same ground. Overall, while there is a significant positive relationship between the total labor share and vessel size for vessels hunting in the three distant grounds, the relationship is negative and significant for those operating in the Atlantic.[15]

Hohman goes on to argue, "the able and ordinary seamen, stewards, cooks, and blacksmiths were entitled to shares which varied from 1/100 to 1/160; the green hands and boys had to be content with long lays which fluctuated from 1/160 to 1/200; while instances of fractions as small as 1/200 to 1/250 were occasionally encountered."[16] Again Hohman's conclusions are generally, but not exactly, correct. The cases of the well paid stewards, cooks, and seamen have already been

noted, but there were many ordinary seamen and blacksmiths, to say nothing of carpenters, whose earnings fell into the "long lay" range. In addition there are contracts for boys that called for payments as low as 1/3500, one that worked out to be 1/8500, several who signed on for "clothes" and one boy who received no lay whatever (he signed on for "food").

In terms of the trend in the lays, Hohman argues that, with the exception of the shares of captains and first and second mates, the lays were becoming longer as time passed. "That is, the wage bargain entitled him [the whaleman], as time went on, to a smaller fractional share of the voyages on which he shipped..."[17] This degradation he attributes to three factors: (1) the gradually deteriorating character and efficiency of the crew, (2) the increasing temptation to exploit the inferior crews, and (3) the substitution of capital for labor.[18]

As far as the time period covered by this study is concerned, Hohman's generalizations concerning trends in lays are only partly correct. In addition, Hohman's estimates capture both the time trend and the effect of shifts in the grounds hunted; given the nature of his sources, he is unable to recognize, let alone disentangle, the two.

Table 2 displays average lays by ground for the twelve occupations for which there are sufficient numbers of contracts to provide a basis for an annual ground-by-ground comparisons. Table 3 provides all ground averages for an additional seven occupations that appeared too infrequently to permit a more detailed breakdown. Both sets of averages include only those whalemen who had a single occupation. The All Grounds estimates include the sixty-one miscellaneous voyages -- voyages that Hohman may have included in his analysis, on which the captains hunted so widely that they could not be assigned to any single ground. The All Grounds averages are not, then, the averages of the four enumerated grounds.

Between 1840 and 1866 some lays rose and others fell. As a result, while the all year averages in Table 4 do provide an accurate picture of the average shares earned by officers, artisans,

cooks, and deck hands across the entire period, they do not describe the earnings hierarchy either at the beginning or end of the period. If the standard is unskilled seamen, captains did very well, first mates quite well, and the other officers not badly (captains earned more than twelve times, first mates almost eight times, and the second, third, and fourth mates from two and a half to five times as much as a typical greenhand).[19] Among the skilled maritime professionals, boatsteerers earned about twice as much and the "others" about two-thirds again as much as an unskilled crewman. Artisans, coopers aside, did not fare so well. Barrel makers earned more than three times as much as an unskilled hand (about as much as a third mate), but a carpenter's margin was a bare thirteen percent, and blacksmiths and the other skilled workers received only slightly more than half that differential. Cooks and stewards did somewhat better; they earned about a third more than their shipmates who had never been to sea.[20] Finally, a skilled seamen could claim a premium of about twenty-five percent over a greenhand, but his semi-skilled confrere was entitled to only about half that bounty.

Much of Hohman's discussion is focused not on relative lays but on their redistribution -- and particularly the lengthening of all but those of the captains and mates.[21] Starting at the top of the income hierarchy, the data show a continuous shortening (that is, increases) of officers' lays from 1840 to at least 1857. Between 1840-43 and 1855-58, captains' lays shortened by seventeen percent, first mates' by twenty-four, second mates' by twenty-two, third mates' by nineteen and fourth mates' by twelve.

In the case of skilled workers, the picture is less clear. On the one hand, for coopers, shipkeepers, and boatsteerers, comparisons of the years 1840-43 with 1855 -- 58 show small (eight, four, and one percent) shortenings; a similar exercise suggests no significant change in a steward's share. On the other hand, comparisons for cooks, carpenters, blacksmiths, and miscellaneous artisans indicate a lengthening of three, fourteen, seventeen, and fourteen percent. For seamen, Hohman is unambiguously correct. The lays of skilled seamen lengthened by fifteen percent and

semi-skilled and unskilled seamen by nine.

Given the materials with which he worked, Hohman was unable to distinguish ground- to-ground differences in lays. In fact, there were significant and systematic differentials -- differentials that did not erode over time and that were responsible for a significant fraction of the lengthening that Hohman observed. Table 5 captures the general outline of these differentials. The late entry into the Arctic somewhat distorts the pattern for officers, but when the focus is narrowed to the years after 1849, the entire pattern is very clear (see Table 6). Lays were shortest in the Atlantic, they were about eight percent longer in the Indian Ocean, and they were about twelve percent above the eastern baseline in the Pacific and Arctic grounds. Moreover, the differentials persisted throughout the period, despite the longer voyages to the western grounds and the greater loss rates experienced by barks in the Pacific and by all vessels in the Arctic. The explanation of these persistent inter ground differentials is far from obvious, but an attempt is made to provide one in section 4, below. Here, however, the issue is limited to the effects of the observed differentials on the trends in lays that were captured in Hohman's analysis. Because of those differentials, a part of the lengthening in the average seamen's lay can be traced to the redistribution of the fleet from the short lay Atlantic and Indian grounds to the long lay Pacific and Arctic ones. Between 1840 and 1843 ten percent of the labor contracts were for voyages to the Atlantic and an additional twenty-nine percent for vessels sailing to the Indian Ocean. By the years 1855 to 1858, however, the Atlantic's share had declined to five and the Indian's to ten percent of the total. Thus, between 1840 and 1858 about one-fifth of the observed change in the average lay of a skilled seamen can be attributed to the geographic redistribution. In view of that redistribution, the shortening in officers' lays is truly remarkable.

3. The Wages of Whalemen

The lay was only a means to an end: the real wage. The whaleman's interest centered on

the dollars that the lay commanded. Any attempt to estimate the whaleman's wage, however, raises two sets of problems -- neither trivial. First, although the main component of a whaleman's compensation package came from the sale of his share of the catch, the value of the lay was not usually identical to his total income. There were both charges and supplements. There are also significant issues raised by questions of the timing of the payment and of income in kind. Second, even if adjustments can be made to compensate for these aspects of the wage bargain, there are questions of the appropriate definition of the wage.

In terms of the charges traditionally levied against the crewman's account, aside from the repayment of cash and clothing advanced before and during the voyage and a small charge for the Doctor's Box, crewmen's wages, as previously noted, were routinely docked for their share of certain expenses incurred by the vessel during the voyage. In the decades before mid-century the standard charges were small. Hohman to the contrary notwithstanding, they did not significantly affect the final settlement. For example, on nine voyages made by four vessels between 1827 and 1850, these standard charges reduced an average crewman's final payment by a less than six-tenths of one percent.[22]

By the 1850's, however, the industry's structure had become more complex. Destinations were farther from New Bedford, and the time lost reaching and returning from those more distant grounds was costly. In an attempt to overcome their vessels' capacity constraints and to use their capital more efficiently, agents began to order their captains to transship a part of the catch through ports like Lahaina and, if their vessel was not full when it began the homeward trek, to attempt to purchase or to agree to transport enough cargo to fill the hold on the return voyage. Transshipments involved commissions and freight charges and the crew was required to bear their share (they were, however, credited with the interest earned on the income generated by the sale of the transshipped products from the date of their sale to the time of the vessel's return). Similarly, the oil and bone purchased to top off the cargo was not costless, but it produced a net gain for both owner and crew.

Because of these institutional changes, by the 1850's the charges against the gross revenues had increased. On four voyages returning after that date, for example, the average crewman's earnings were reduced by about three percent.[23]

Later, during the Civil War, the threat of Confederate raiders drove insurance and freight charges to new heights. On a voyage of the *George Howland* that departed New Bedford in 1862 and returned four years later, the charges totaled $28,316 (including $13,263 for freight, $9,143 for insurance, and $5,032 in commissions), or more than fifteen percent of gross revenues. It should, perhaps, be noted that, from the point of view of both the agent and the crew, the wartime voyage was still a financial success. Despite the record charges, the monthly net revenues (in constant dollars) were more than half again as high as the average earned on the ship's previous seven voyages and almost ten percent greater than on the most successful of the seven.[24] Not all vessels that put to sea during the War were faced by such heavy charges. On the bark *Callao's* 1093 day voyage from September 1862 to August 1865, for example, after adjustments for the interest accrued on transhipped products, the net charges amounted to only about 1.6 percent of revenues.

After the War charges appear to have settled back into the range that had characterized the 1850's. On one voyage of the bark *Callao* and four of the ship *Milton*, such offsets against wages averaged 4.4 percent. They rose significantly above that level only when a misadventure near the end of a voyage forced the owners to pay freight charges on cargo that would otherwise have been brought back by the vessel itself. In the case of the *Callao* -- condemned in Mauritius in 1877 -- the charges totaled 28.6 percent; in the case of the *Milton* -- "arrived Panama in distress" in 1889 -- they amounted to 12.9 percent. In the latter case, however, if the Panama freight charges had not been incurred, the total would have been only 5.1 percent.[25]

In partial offset to these charges, some whalemen earned supplements to their contracted lays. Captains, of course, usually received some fraction of the profits from the sales of clothing and tobacco from the slop chest, sometimes a share of the slush, and they often carried on

subsidiary commercial enterprises on their own account .[26] Similarly, the cook was normally entitled to some fraction of the slush fund. In addition, although there are questions as to the importance of the practice, seamen did, from time to time, receive not insubstantial bonuses for particularly good performances in sighting and catching whales.[27] On the 1834 voyage of the *George Howland*, for example, four seamen received cash bonuses ranging from $30 to $50 -- sums equal to between 7.5 and 12.5 percent of their lay income.[28] Also, a crew member might be the recipient of some of the traditional charges that provided the wedge between gross and net value. A seamen might well add $25 to $100 to his earnings by helping load the vessel before it set to sea, by helping unload or clean the vessel when it returned to port, or by foregoing shore leave on some exotic South Sea island to remain aboard ship as a watchman.

Finally, although it is impossible to assess the importance of the practice, the evidence indicates that lays were sometimes renegotiated during the voyage. In 1860 the agent Matthew Howland wrote to Valentine Lewis, one of his captains, who had reported that his crew were asking to have their lays increased. Howland told Lewis to resist, if he could, but to accede, if necessary, "...because we are satisfied that a good crew is cheaper at high lays than a miserable crew is for nothing..."[29] On the *George Howland's* eighth voyage (1862-66), seven crewmen (the third mate, the cooper, the steward, three boatsteerers and a seaman) received increased lays whose value ranged from $140.39 to $1936.90 and totaled $5557.98.[30].

Two other characteristics of the wage bargain acted to temper the amount of risk transferred from owner to seaman. Although the custom had no direct effect on the final payment, the seaman received room (or at least a bunk or a place to hang his hammock) and board (such as it was). An analysis of the cost of outfitting a vessel indicates that, in terms of dollars of 1880, the value of a seaman's food probably ranged between $4.05 and $6.94 a month and averaged, perhaps, $5.50.[31]

Second, with the exception of the captain and sometimes a mate or two, crewmen normally received an advance before their vessel left port. Usually the advance was equal to between a quarter and a third of their projected earnings. The funds were used, and were usually sufficient, to support wives and families through the duration of the voyage, although they occasionally were supplemented by further advances, if the voyage proved unusually long or an emergency arose. The crewmen were charged interest on the advance (usually six percent), but most importantly, the advances were almost never repaid if the ship sank or returned clean (that is, without oil or bone). Moreover, if, at the end of a successful voyage, a seaman's account was still in deficit, an agent had little recourse other than to try to convince the whaleman to sign on for another of his -- the agent's -- voyages. Since the seaman could sign with another agent and have a clean slate, the attempts were seldom successful.

Over eight voyages of the *George Howland* (1834-1866), five of the *Milton*, (1869-1885) and two of the *Callao* (1871-1877), advances were taken by 413 of the 459 newly signed crewmen. The advances ranged (in dollars of 1880) from the $1003.25 ($1043.38 nominal) received by the Second Mate of the *George Howland* in 1862 to $1.32 ($1.45 nominal) taken by Joseph Howland -- a Howland family member sailing as an able seaman -- of the same ship in 1838. The average advance was $121.66. Over the fifteen voyages, the advances amounted to just less than ten percent of net revenues (gross returns less charges) or about thirty percent of the crew's share. Moreover, on the three voyages that yielded their owners less than $700 a month, the advances averaged twenty-five percent of the *total revenue*. Finally, although the evidence is very sketchy, it appears that in the post-bellum period individual advances were somewhat smaller ($115 as opposed to $127), but, as a fraction of net revenues, the proportion was probably higher.[32]

The advances were a cause of some concern among the agents and, to a lesser extent, among the seamen as well. Although the agents were prepared to accept the losses associated with truly disasterous voyages, they were less prepared to accept those resulting from desertion. In

September 1834, Charles Morgan warned one of his Captains, Cornelius Howland, Jr., "The crew are generally indebted to the owners about $110 to $120 each. You will therefore be especially careful of them until you get enough oil to secure that and over it."[33] Two months later in a letter to another of his captains he was even more explicit: "I think you have a good crew but they mostly are all in debt to the ship from $70 to $100 -- so please take care they don't run away before you get some sperm oil."[34]

Clearly, on the outbound voyage the crewmen had a strong incentive to desert -- the evidence indicates that some whalemen managed to run even before their vessel left New Bedford. On the return voyage, however, the incentives shifted. It was then that the Captain, and perhaps the agent, found it in their interest to convince a crewman that he should make an early departure. In November 1836, eleven months after the *Condor* had left New Bedford and three months before she was scheduled to return, Morgan wrote his captain, George H. Dexter, that "the carpenter has come and tells a queer tale of his being left purposely, of the whole crew being without bread nine days, and some other things equally probable. I did not pay much attention to him."[35] That captains and agents tended to ease the path to desertion when the seamen's account stood in surplus was certainly the view of Navy Lt. Charles Wilkes, who commanded an expedition to the Pacific in the late 1830's and early 40's. He wrote: "Many Americans are found on the different islands, who have been turned ashore from whale-ships, or left behind because they have broken their liberty a single time near the end of a voyage. Such treatment leaves too much ground not to believe that they are purposely left, in order to increase the profits of the ship-master or owner."[36] For example, in the course of the *Montreal's* third voyage (1857-62), the vessel left five crewmen, and the evidence strongly indicates that it was the ship that deserted the crew not the crew who deserted the ship.[37] In a similar vein, the historian A.B.C. Whipple charges that obstreperous men were often marooned on uninhabited islands and left to die. He describes in some detail the problems that U.S. consuls had adjudicating between captain and men -- did the men desert or were they marooned?

In one instance, however, Whipple describes a case where the consul was faced with an obvious answer. On a four year voyage in the early 1830s, Captain Brown of the Warren R.I. ship *Magnet* wrote this message to the consul at Callao, Peru, concerning crewmen whom the consul was to return to the ship: "I should be happy if you will have the goodness to git the men down as soon as convenient. I have no one I can trust out of my ship or I would send someone up."[38] It is interesting to note that Brown remained the captain on the next voyage of the *Magnet.* Clearly the agent, Joseph Smith Jr. (his father had been the agent for the previous voyage), was not displeased with the captain's contribution to his crew's desertion.

Although it is probably impossible to discover precisely who won and who lost in this game, Hohman concludes that, on average, it was probably the whalemen who won and the agents and owners who lost.[39] Some support for that view can be found in the eight successive voyages that the *George Howland* made between December 1834 and April 1886. In dollars of 1880, over the eight, average advances ranged from $77 to $157 (the mean was $112). Over the same voyages the average income that accrued to the agents and owners from the crewmen who had run or were discharged for cause (i.e. their share less their advance) ranged from a loss of $3732 to a gain of $7966 and averaged $747 -- a figure that amounts to just less than one-fourth of the total amount advanced. That result, however, depends entirely on the results of the seventh voyage (October 1857 to July 1861). For the other seven the average *loss* to the agents and owners was $284, or about eight percent of the money loaned. The exceptional voyage began during the depression of 1857, and it was marked by an average advance of only $77 -- well below the typical $112, and $21 less than that for *any* of the seven other voyages.

Since there is no systematic evidence on supplements, charges, advances, or renegotiations, the hypothetical lay payment (the lay times the value of the catch) will be taken as an approximation to, and , thus, as an index of, the earnings of the mid-nineteenth century whaleman. That figure will, however, be adjusted by an estimate of the value of board in certain wage

comparisons. Even if one is willing to accept these estimates, questions still remain about an appropriate definition of *the* wage. Voyages were not short. They ranged in length from the three months venture into the Atlantic by the *Petrel* in 1866 to the sixty- nine months spent in the Pacific by the *George* in 1847 and the *Courier* in 1850. Contracts were signed before the voyage began, and payment was not due until the vessel had returned to New Bedford. Moreover, a substantial fraction of the original crew did not return with the vessel on which they sailed. How then should the wage be calculated? The answer, of course, is that the measure should depend on the question to be asked. Table 7 provides one such schedule. It reflects the earnings that the whaleman would have received from his lay had he returned on the vessel on which he departed. It is probably the best available *ex post* measure. Although it does not include the charges against, nor the supplements to, the whaleman's lay, it does represent the bulk of his earnings. (Two alternative wage estimates are discussed in the Appendix.)

4. The Relative Wages of Whalemen

While the absolute level of wages was certainly a major concern of the whalemen and of social historians interested in questions of welfare, it was relative wages that dictated career choices and governed the flow of men into the industry. It is, therefore, the latter measure that is of most relevance to economic historians involved in analyzing the efficiency of 19th century labor markets. While the wage ashore furnishes one standard against which to measure whalemen's earnings, it is the merchant marine that, at least at first glance, appears to provide the most direct comparisons. Although the maritime data are spotty, the work of Stanley Lebergott provides a basis, although not an ideal one, for a comparison of six of the twelve major whalemen's occupations.[40]

During the 1840's and '50's, at least, the officers who manned the whaling fleet were well rewarded, if their alternative was service in the merchant marine. Over comparable years, whaling

captains received, on average, $91.55 a month, while their counterparts in the merchant service earned only $29.54 (see Table 8). Although the contrast is less marked for second and third mates, whalers still earned more than twice as much as merchant men. A part of the whaling premium almost certainly reflected the uncertainty of rewards in whaling. For merchant captains the range of salaries was from $20 to $35 per month, while the lucky whaling captains who returned with some catch, earned salaries that varied between $1.20 and $621. For first mates the mercantile range was $45 ($15 to $60) in contrast to $394 for whalers, and for second mates the ranges were $36 and $231 respectively.[41]

In whaling, officers were not only required to assume a larger risk, but also to bear heavier responsibilities. Since they often were hunting in unexplored and uncharted waters, it was necessary that they possess even greater maritime skills than typical officers in the merchant fleet. In addition, the whaling captain had to understand the whale's habits and migration patterns and to be prepared to command one of the New Bedford sleighs -- as the small whaleboats were sometimes called. Although it was the Captain who had the final word, the other officers were also required to possess skills beyond those asked of a mate in the sister service. On August 8, 1834, for example, Charles W. Morgan, the agent, wrote one of his captains, "...I have been thinking about officers, who are however aplenty -- There is Mr. Plaskitt who was 3rd mate on the *Russell* -- if you [were going on] a sperm whale voyage I don't think you could get a better man. I don't know how he would answer for right whaling."[42]

It is clear from a reading of their letters that the agents believed that the choice of the captain (and probably the first and second mates as well) was immensely important to the success of a voyage. Evidence that the agents were not mistaken in this belief can be found in a systematic quantitative analysis of the records of the voyages.[43] A comprehensive multiple regression model -- the dependent variable is a Caves, Christensen, Diewert superlative productivity index and the independent variables are designed to capture decision, technological, and environmental factors

that theory or contemporary accounts suggest might have been important determinants of productivity -- fit to the data on individual voyages shows that productivity was positively associated (large coefficient, high significance level) with the captain's share of output (See Table 15b).[44] In addition, the large lays accruing to captains and other officers certainly add support to the imputation of high productivity to them.

If the greater risk and the increased knowledge and skill requirements led to the relatively high wages earned by officers, they cannot explain the wages of cooks and seamen (neither skilled nor semi-skilled). In none of those cases is it possible to argue that wages in whaling were higher than those paid by the merchant service, and it is most likely that they were, in fact, lower. Over comparable periods, the ratio of earnings in whaling to earnings in the merchant marine ranged from .7 for cooks and skilled seamen to .9 for semi- skilled seamen. Moreover, in only nine of the forty-four occupation years over which there are comparable data was the ratio equal to or in excess of one.

Moreover, these relatively low wages were coupled with variances as high as those of the much more highly paid officers. While the ranges in the merchant marine fell between 1 to 3 and 1 to 6 ($10 to $30 for skilled seamen, $5 to $20 for semi-skilled seamen, and $7 to $40 for cooks), the ranges for the comparable whalers were many times as wide. For cooks, monthly wages ranged from $0.53 to $60.00 (1 to 113), for semi-skilled seamen from $0.27 to $41.00 (1 to 153), and for skilled seamen from $0.29 to $71.00 (1 to 246).

It is generally recognized that merchant seamen "professed great contempt for 'spouters' and 'blubber-hunters'; and a real whaleman never thought of shifting his allegiance." Each industry drew from its own pool of labor, and only when both industries were working to capacity, "was there competition for those hands who were willing to ship in either service."[45] Moreover, neither the whaling nor the merchant marine agents were forced to confine their search to the domestic labor market; they were able to draw from an international labor pool. Stanley Lebergott, for

example, citing contemporary sources, concludes that by the 1840's, officers and mates aside, the vast majority of seamen on American vessels were foreigners.[46]

The flavor of the typical whaling crew (and the question of the appropriate yardstick against which to measure their wages) is neatly captured in Charles Nordhoff's account of the thirty-six man crew of his whaler. "The captain, two mates, and three of the boatsteerers were American. The third mate and one of the boatsteerers were Portuguese, natives of Fayal, as were four of our crew.... The rest of the crew I find enumerated in my log as follows: two lawyers' clerks, one professional gambler, one runaway from his father's counting house in New York (this was also an amateur gambler), one New York "butcher-boy" -- his name was *Mose* -- six factory hands, from some small New England towns, one Boston school boy, six farm boys -- from various parts of New England and western New York, the four Portuguese before mentioned, who were whalemen, and the writer hereof, who wrote himself *seaman*."[47] Nordhoff wrote about a time late in the period when the whaling industry had shrunk substantially. In the 1840's and 1850's, when the industry was at its peak, the fraction of foreigners in a typical crew would probably have been even larger.

The comparison of the wages of whalemen (but not officers) with those for merchant seamen produces results that, if they do not confirm the view that there were two separate labor markets, imply behavior that lies outside the normal bounds of economists' assumptions. If, however, the positions in whaling and in the merchant service were really comparable, and if both industries had access to the same workers, the whalemen's willingness to accept both lower average and much more variable returns would suggest either that they were drawn from a *truly* unique pool of labor -- a group made up of individuals who believed that a small probability of a big win was a goal worth sacrificing for -- or that they were paying their apprenticeship dues on the way to a remunerative position as a boatsteerer or officer. More likely, however, they were being hired for different jobs: merchant seamen as seamen, whalers as oarsmen. It is also possible that they were

doing the same job, but the whalemen were just not very good at it. In fact, the evidence indicates that there is an element of truth in all four explanations, but at this stage it is still not possible to assign relative weights to each.

While the merchant marine may have represented the closest maritime alternative for a whaleman, it appears that it was shore-based opportunities that more than anything else forced captains and agents to look to foreign ports for their crews. Tables 9 and 10 display the trends in absolute and relative whaling-to-onshore wage rates for nine professional and skilled classes of whalemen and for the three classes of seamen.[48] Table 11 provides a comparison of nominal and real wages for whalemen at selected years at the beginning and end of the two decades. A comparison of the years 1840 to 1843 with 1853 to 1856 indicates that the relative position of all officers *vis-à-vis* shore-based artisans improved by fifteen or more percent. Captains and first and second mates earned more than the skilled Department of the Army civilians, although their position, eroded somewhat between 1857 and 1866. For the other skilled whalemen, the story is less favorable. While their relative position did not deteriorate (in fact, it may have improved somewhat), carpenters, cooks, and stewards all earned less than half, boatsteerers only three-fifths and even coopers less than nine-tenths as much as Margo and Villaflor's artisans.

The situation of seamen was no better. Although a comparison with the unskilled Army employees in the Northeast suggests no deterioration in their relative position, the wages of skilled, semi-skilled, and unskilled seamen were only about forty percent of the level of the wates of workers ashore. If the basis of comparison is shifted either to Edith Abbott's estimates of unskilled factory workers or to her figures for all urban unskilled, the relative position of the whalemen improves, but even able seamen received significantly less than the shore-based workers. Moreover, over time, there appears to have been a not insubstantial degradation in the relative position of all three classes of whalemen. The whaling seamen did, however, earn about as much as Massachusetts textile workers, chiefly female employees.[49]

It is unfortunate that the estimates of whaling earnings cannot be extended backward into the 1820's and '30's. The secondary literature indicates that, in those early decades, the workforce was largely native American (i.e. seamen whose fathers had been born on this side of the Atlantic -- including a not insubstantial number of blacks), the majority of whom were trained seamen.[50] Although a precise answer depends on the wage series and the price deflator chosen, it appears that between 1840-43 and 1855-58 the real wages of unskilled workers in the United States may have risen by twenty percent or they may have fallen by as much as five percent. No matter what price index is chosen, the real wages of all "enlisted" whalemen, appear to have declined by more than the most pessimistic of the onshore estimates. Officers, on the other hand, clearly gained.[51] It is, however, difficult to see how, given the wage differentials, the whaling industry could have continued to recruit trained Americans for enlisted jobs over the two ante bellum decades. The most probable explanation, of course, is that they did not. Instead the agents appear to have turned more and more to unskilled Americans and to both skilled and unskilled foreign workers. It appears that even black sailors -- whose onshore opportunities must have been severely constrained -- deserted the whaling fleet. Although her data are somewhat difficult to interpret, Martha Putney's survey of whaling crew lists appears to indicate that there were, on average, 2.8 black Americans on each New Bedford vessel sailing between 1803 and 1840, but only 1.5 in the years 1841-1843 and 1846-1860.[52]

It could, of course, have been otherwise. The industry might have represented such an unusual opportunity for risk lovers that wages shrank as increased numbers of gamblers competed for the limited number of jobs. After all, the presence of both professional and amateur gamblers among Nordhoff's shipmates might indicate something about the degree of risk aversion shared by at least the American component of that crew, and Hohman does argue that, "the device of the lay with its tantalizing possibility of a lucky voyage, served to obscure the average earnings."[53]

In a general sense, the data on wages indicate that, at least within the industry, the labor market appears to have worked quite well (see Table 12). Some clues as to the actual efficiency of the market -- at least the market internal to the industry -- may be gleaned from an analysis of 10,730 unskilled seamen who departed New Bedford over the twenty years 1840-1858 and 1866. Greenhands were chosen because there seemed less chance for bias introduced by differences in skill. For those neophyte whalemen, the real monthly wage averaged $8.34 in dollars of 1860, but there were inter ground differentials. While lays in the Atlantic ground averaged 1/158 (.00633), those in the Indian 1/179 (.00559), those in the Pacific 1/189 (.00530), and those in the Arctic 1/197 (.00509), differences in productivity meant that the ordering of wages received was quite different. Greenhands who signed on for the Atlantic ground earned, on average, only $7.84. Thanks to the banner catches by the *Carnela*, *Mary Ann*, and the *Tropic Bird* in 1853, that figure is more than the $7.44 average for the Indian, but it is below the $8.49 earned in the Pacific and only five-sixths of the $9.30 reward for service in the Arctic.[54]

To aid in reaching an understanding of the workings of the whaling labor market, an attempt was made to model the wage bargain. Each agent and potential crewman was assumed to be aware of: (1) the ground to which the voyage was to be primarily directed (external evidence indicates that the choice of ground was one of the agent's first decisions, and his labor recruitment decisions were made in light of that choice; moreover, the labor contract frequently spelled out the projected destination of the voyage)[55]; (2) the average catch and length of voyage of all vessels returning to New Bedford from the designated ground during the previous year (that information was readily available in the *Whalemen's Shipping List and Merchant's Transcript*, a local newspaper); (3) the average probability of a vessel returning safely from that ground over the previous five years -- again information well documented in the local press. The model rests on the assumption that, although it was the lay that was the actual focus of the negotiation between agent and prospective crewman, it was the expected real wage (or real cost) that was at the heart of the

bargain.

Table 13 reports the results of two alternative, but not independent, specifications of the model. The dependent variable of Model 1 is the real value of the average catch of vessels that had returned from the designated ground in the previous year, multiplied by the lay negotiated by a greenhand in the present year -- it is, in short, a proxy for the expected real wage.[56] The dependent variable in Model 2 is the expected real wage variable of Model 1 multiplied by the average probability (calculated over the previous five years) of a vessel that set out for the designated ground actually returning safely to New Bedford.

There are seven independent variables. Four are suggested by theory or by contemporary accounts, while the remainder are included to test the completeness of the model. In the first set, in addition to "the common wage ashore" (included to get at the competitive pressures emanating from other labor markets) are variables designed to capture financial risk, time at sea, and the risk of spending more time at sea than expected.[57] In the second set are the three ground dummies--the Pacific was chosen as the base, and it is the implicit fourth ground. If the model captures the essence of the wage bargain, the coefficients on the ground dummies should be close to zero.

The results are mixed. The adjusted r^2s are very good, given the element of luck in the industry, and the F values are both very high and significant. Moreover, if attention is focused on the first set of variables, the model appears to have captured the principle elements of the wage negotiation that both theory and the personal tastes and biases implied by the qualitative literature suggest should have dominated the bargain. On the other hand, the ground coefficients indicate that, even after the effects of the first set of variables have been factored out, there still remain substantial differences between expected earnings in the Atlantic and Indian grounds, on the one hand, and in the Pacific and Arctic, on the other.

Theory suggests that workers usually prefer lesser to greater financial risk, and this

conjecture is borne out by the analysis. The coefficient on "financial risk" is positive, large, and very significant. Even in the least compelling case (Model 2), given a dependent mean of $7.37, it appears that a greenhand required a bonus of 35 per cent to compensate him for signing in the year preceded by the maximum as compared with the one marked by the minimum variance.

The variable "time at sea" is intended to be an index of the expected duration of the voyage for which the greenhand signed on. It is measured by the average duration of the voyages--by hunting ground--of vessels returning to New Bedford in the previous year. The industry's historians point out that the desertion rate rose as the length of the voyage increased, and so they infer that whalemen preferred short voyages. It is likely, however, that the observed association reflects not a preference for short voyages, but a perfectly reasonable preference for successful ones. Exceptionally long voyages tended to be unsuccessful. Strong-minded captains, unwilling to return with empty cargo space, would remain at sea, despite the grumblings of the crew. Leaving these cases aside, however, many men must have preferred the security of employment offered by longer voyages--a three year voyage rather than one planned to end in two years, for example. If men with these preferences dominated the market, one could expect the sign on the coefficient of the variable "time at sea" to be negative, as it is: men required a premium for a short voyage.

On the other hand, the sign on the variable "risk of spending more time at sea than anticipated"-- a measure of the variance of the "time at sea" variable-- might very well be positive, since the variable is intended to pick up anticipations of chances of success. In fact, the sign is negative and the coefficient, highly significant, results very difficult to rationalize.

With this exception, the first set of variables seem to capture the essence of the negotiation and indicate that the market was working fairly efficiently. The ground dummies are less successful. If the model were correct and complete, one could expect the coefficients on the dummies to be insignificantly different from zero, but such is not the case. On the positive side, in Model 1, recruitment for voyages to the Arctic ground required a premium of about 8 or 9 percent,

a reasonable result in view of the dangers encountered in the Arctic. Adjustment for physical risk converts the premium into a small discount--less than 4 percent.[58]

Problems arise, however, in the cases of both the Atlantic and the Indian grounds. After adjusting for "physical," "financial," and "at sea" risk and for the length of the voyage, a prospective hand appears to have been willing to sacrifice $2.20 a month to serve in the Indian and an incredible $5.80 a month to serve in the Atlantic, rather than the Pacific. While the differences may reflect very strong tastes and biases, it is more likely that the model is simply incomplete, and the dummies are picking up the effects of the missing variables. After all, apart from the variable "common wage ashore"--which, incidentally, has the right sign-- the model leaves out of account the behavior of those people and institutions on the other side of the market from the seamen. Despite this shortcoming, the model provides quite helpful hints about the nature of the market.

5. Deterioration in Productivity and Crew Quality

Although the exact connections remain somewhat speculative, the years from 1840 through 1858 were characterized by a decline in vessel productivity, on the one hand, and a gradually increasing proportion of unskilled workers and of illiterates among the vessels' crews, on the other (See Table 13). Between 1840-43 and 1856-58, for example, the average productivity index declined by more than a third, illiteracy rose by nearly thirty percent, and the proportion of unskilled seamen in the crew, by more than a quarter. In the early 1840's less than a fifth of the crew were illiterate and nine out of every twenty whaleman could claim at least some maritime experience. On the eve of the Civil War, however, more than a quarter of the crew could not sign their names, and almost three-fourths of the deckhands had never been to sea.

As Table 14 indicates, between 1840 and 1858 both measures of crew quality (literacy and the proportion of seamen who were *at least* semi-skilled) declined, as did the index of average voyage productivity. These common changes need not bespeak causal connections. In order to

pursue that topic further, a model designed to explain productivity change in general is required. The effects of changes in crew quality and the movements of other relevant independent variables can then be systematically assessed. To complete the explanation it is, of course, also necessary to consider how and why crew quality declined and how the managers of whaling voyages dealt with this development. The place to begin is with the model.

The same model used to examine the contributions of the captain to a voyage's productivity can also be employed as part of the effort to deal with the problem of the changing quality of labor.[59] It has been argued in the whaling literature that, because of improving opportunities ashore, the quality of labor available to the whaling industry declined as time passed. An attempt was made to capture this development by introducing indexes of real wage rates ashore as independent variables. Increases in wages ashore, if the best whalers were bid away from the fleet, would, it is assumed, lead to a deterioration of the quality of the whaling labor force and, thus, reduce productivity.[60]

The results of fitting the model to the data from the full period (1820 to 1896) are reported in the first column of Table 15a. It is obvious that the model appears to explain the data, at least from a statistical point of view. The F statistic, the adjusted R^2, the signs and values of the coefficients, and the significance levels are excellent. The issue of current moment has to do with the quality of labor, and the variable of interest is the common wage index. The sign on the index is negative, the coefficient large, and the significance level high: there would appear to be some support for the "bidding away: hypothesis.

Column 2 reports the results of fitting almost the same model to data from the more restricted time period 1840-1858 and 1866 -- years for which direct measures of labor quality exist. Between the specification of the model reported in column 1 and the one reported in column 2, there is just one minor difference: the technology dummy employed in the first is irrelevant for the shorter time period. Despite this difference, the results of the two models are very similar -- a fact

that is reassuring: the relationships depicted in the equation are very stable. Indeed, the degree of stability across the four regressions is striking.

The results of fitting a third specification for the more restricted period are reported in column 3. In this instance, direct measures of labor quality are substituted for the indexes of real wage rates. The coefficients on the quality variables are very small, indeed, and they are not significantly different from zero. There are other small changes between the results of the second and third specifications, but these are not important. The results obtained from the third model are important in one respect: the quality indexes do not appear to have been related to productivity changes.

This apparent paradox may be resolved by noting that there may very well have been two processes at work, both involving crew quality. First, the pull of onshore wages -- taken together with the agents' attempts to lessen labor turnover by substituting unskilled for skilled whalemen -- tended to reduce the quality of workers and, therefor, productivity. Second, new techniques that permitted lower quality seamen to function acceptably were introduced. Agents who accepted these technical changes were able to employ lower quality seamen with some significant success. Across time, then, one might expect to find that the quality factor forces productivity down, but in the cross section (once allowance is made for the cross-time deterioration) vessels that adopted the new technology could employ lower quality crews and were, therefore, more productive than the vessels that did not. The last specification (see Column 4) attempts to separate these two phenomena. The results are plausible. Across time, the decline in quality (i.e. the loss of good crewmen to shore jobs) hurt productivity. In the cross section, however, vessels that employed fewer skilled workers were more productive than those that did not.

The evidence, then, suggests that the argument may be correct, but whether or not it is persuasive depends upon an analysis of the nature of the decline in labor quality and the kinds of adjustments to it that were made by agents and captains.

The rise in the proportion of illiterate and unskilled seamen in the crew of a typical vessel does appear to have been the product, at least in part, of the agents' attempts to recruit crew members who would be less likely to desert. A reading of the contemporary sources suggests that the agents, increasingly concerned with the very high rates of labor turnover, sought to employ unskilled workers who, because of their lack of information and skills, would find it difficult to leave their vessel and sign on another. Nordhoff, for example, reports that despite the almost constant demand for whaling crews, "to a sailor this avenue to a whaleship is hermatically sealed. Neither here [New York] nor in New Bedford is he likely to be shipped -- for experience has taught the captains and owners of whaling vessels that your real tar is too uneasy a creature to be kept in good order for so long a cruise as whalemen now-a-days generally make."[61] The same policy was also noted by Hohman who reports, "The shipping agent preferred to deal with men ignorant of the actual conditions of the industry because they were more easily imposed upon, and also because they were more dependable in observing their contracts."[62]

As voyage length increased, so did desertions -- Herman Melville deserted twice during the heady 1840's--and, if the agents' letters and the remaining account books are to be believed, labor turnover emerged as an increasingly important problem. Not only did desertion reduce profits directly through the losses associated with unrepaid advances, but also indirectly through its effects on productivity. Since a vessel's complement usually consisted of only a few more crewmen (the shipkeepers) than the number required to provide six men for each whaleboat, an unreplaced seaman could mean the loss of an entire boat. Probably more important was the effect on productivity of the replacement of a member of one of the "closely linked whaleboat crews, where the loss of a single cool and expert oarsman often cut down materially the captures made by a certain boat."[63]

Although technological change was not the driving force, it did act to relax certain production constraints. Thus it permitted the captains and agents to adjust their workforce in a way

that they thought would reduce turnover. Historians of technology long argued that there was little improvement in the design of sailing ships over the course of the nineteenth century and virtually none before 1850. More recent work has shown that they were wrong. As early as the 1830's iron rod rigging and turnbuckles had begun to replace the traditional hemp lines, and, it took less skill to work aloft.[64] Between 1820 and 1845 a wide range of new equipment - capstans and windlasses, iron strapped blocks, geared steering, hold ventilators, and geared winches--came on the market.[65] Again, as in the manufacturing sector, these changes meant the work could be done by unskilled workers. Finally, after 1850 there was a near revolution aloft. Sails and rigging were almost totally redesigned. Naval architects recognized that increasing the number of sails made handling easier, and, heretofore conventional wisdom aside, they concluded that flat sails were more efficient than baggy ones. Ship owners responded by "subdividing the larger sails, abolishing the studding sails and other expensive 'kites,' and radically altering the sail's design -- baggy sails were replaced by much flatter ones."[66] In addition, building on the improvements in the 1820's and '30's, iron fittings became common, chains replaced rope, and mast design was greatly simplified.[67] The result was again greater speed, and more importantly for whaling, the need for fewer skilled seamen.

For whaling vessels the gain in speed was of marginal importance. There may have been some reduction in the time of outbound and inbound voyages and in the time necessary to shift from one ground to another, but speed was never of primary concern, and it was of almost no importance during the period of active hunting. Similarly there was probably little gain from the labor-saving dimensions of the technical changes. The size of whaling crews was established chiefly by hunting demands and always included many more men than those required to sail the vessel. In fact, for whaling, the innovation of the new technology probably resulted in an increase in total crew size. The changes did, however, make it possible to alter dramatically the skill profile of the crew. The changes aloft, by greatly easing and simplifying the tasks of setting, changing,

and furling the sails, made it possible for unskilled crewmen to handle most of the above deck work that previously had required trained hands. The technical innovations thus made it possible to substitute greenhands for able and ordinary seamen.

The evidence, both quantitative and qualitative, conclusively demonstrates that, by any traditional definition, the quality of whaling crews deteriorated over at least the two decades preceding the Civil War. The qualitative sources suggest that the decline was the result of a conscious decision by the agents -- a decision aimed at reducing labor turnover and, thus, increasing profits. It is, however, probably impossible to prove that the new *de facto* labor policies were the product of an innovative attempt to reduce labor turnover rather than a reaction to the increasing difficulty of recruiting native Yankee whalemen -- a difficulty rooted in the rising competition for onshore labor.

It may be only coincidental, but the developing manufacturing sector also appears to have undergone a similar substitution of unskilled for skilled labor under the aegis of new technical opportunities at about the same period of time. Although it appears unlikely that labor turnover played a significant role in that case, labor historians have recently recognized that the development of new technologies made it possible for managers to deskill their labor force. Goldin and Sokoloff, for example, note, "the relationship between firm size and the employment of women and children within industries indicates that the diffusion of new large scale technologies was associated with the substitution of women and children for men."[68]

In whaling, however, the policy was not costless to either agent or crewman. It greatly increased the twin problems of supervision and discipline, and the direct cost of the necessary discipline was borne in the first instance by the crew. As one chronicler of the industry reports, "Examination of the crews' account books gives an insight into the changes taking place in the kind of men who shipped aboard whalers and the measures taken by agents and captains to compensate for the increasingly poor quality of the crews. Whether the decrease in quality of personnel led to

harsh measures or whether the methods of the captains, agents, and landsharks led to the poor quality was a question probably debated endlessly by the owners and agents..."[69] There is, however, general agreement, "that the owners were content to ship such [untrained] hands .... because capable and brutally aggressive mates could train them during their long months at sea."[70]

The stories of brutality on whaling vessels are legion, but they are neatly encapsulated in the report of the U.S. revenue cutter *Thetes* on its return from a trip to the Arctic whaling fleet in September 1906. On board were 14 sick whalers, 30 who had been picked up shipwrecked, and two whaling captains, H.E. Bodfish of the *William Bayless* and E.W. Newth, of the *Jeannette*, in irons. Both captains were charged with manslaughter in the deaths of seamen. Bodfish was, in fact, accused of kicking a seamen to death.[71]

The need for increased supervision and discipline meant that a vessel required more "capable and brutally aggressive mates," and they were not costless. The new labor policy, although ridding the industry of some of those skilled seamen who knew when and how to desert, forced the agents to hire more supervisory personnel. The result was a change in size and composition of the crew that led directly to a significant increase in total direct labor costs.

Tables 16 and 17 compare average crews in the two four year periods 1840-43 and 1855-58. Between those dates, despite the substitution of smaller barks for larger ships-- a substitution that should have reduced crew size by three percent -- the size of a typical crew actually increased by 2.3 men or about nine percent (from just less than twenty-six to just over twenty-eight men). Of equal interest, however, are the changes that occurred within the crew. The increase of 2.3 was the result of an increase of 3.5 in the number of unskilled seamen, a reduction of about 2.0 in the number of skilled and semi skilled seamen, and an *increase* of .8 in the number of "professionals." Not surprisingly the number of artisans and service personnel did not change. By the end of the period a typical vessel carried somewhat more than an extra four-tenths of an officer and three tenths of a skilled maritime professional. Those additions constitute a ten percent increase in the

number of crewmen in each of those two job categories.

Assuming that the extra officers were most likely third mates and that skilled maritime workers were paid as much as boatsteerers, the substitution of greenhands *and* skilled officers and boatsteerers for skilled and semi-skilled seamen meant that labor costs rose on average by about $24.40 a month or about $1050 for a typical forty-three month voyage. That estimate, of course, does not reflect the fraction of the increasing wages of existing officers that can be attributed to *their* increased supervisory duties.

The effects of the change can be seen in Table 18. The Table displays, by year, the fraction of the catch that accrued to labor through their lay shares (i.e. excluding charges, supplements, and the value of room and board). Despite the traditional views -- views subscribed to by Hohman and others before him -- that: (1) on every vessel the sum of the lays contracted for by the officers and men was very close to thirty percent of the value of the catch, and (2) that the total was invariant over time -- these figures tell a quite different story.[72] Over the two decades in question, the average labor lay share rose from about thirty-one percent to about thirty-six percent -- an increase of about one-seventh.

It should be recognized that the increase in the crew's share came in the face of a shift in the geographic distribution of the fleet -- a shift that saw a reduction in the proportion of vessels hunting in the short lay Atlantic and Indian grounds and an increase in the fraction working the long lay grounds in the Pacific and Arctic. While in 1840-43 the average total lay was higher in the Atlantic and Indian grounds (.319 as opposed to .310 in the Pacific), by 1855-58, despite the continuing interground differences in whaler's lays, both the Atlantic-Indian and the Pacific-Arctic grounds displayed the same average figure (.359). This apparent anomaly reflects the fact that, although the average crew size had increased in both, it had risen by less than eight percent in the Atlantic-Indian ground in contrast to the twelve percent increase in the Pacific-Arctic theater.

The change in labor policies, whether initially innovative or merely reactive, did apparently result in higher total factor productivity. The question remains: did the increase in productivity offset the transfer of four and a half percent of output from owners to workers? What was the effect of the agents' "labor market innovation" on profits?

6. Conclusion

The system of labor payments based on contracted lays was adopted by whaling agents and owners as early as the seventeenth century. Although it bears some superficial resemblance to payment schemes adopted in certain agricultural activities and some branches of fishing, the structure, as it evolved in the whaling industry, was unique. The economist Henry George greatly approved of the system of payment; however, it has been almost universally condemned by historians who have attempted to chronicle the development of the whaling industry.[73] Both Samuel Morison and Elmo Hohman, for example, complained about the negative impact that the institution had on the wages of seamen. [74] Although Hohman was somewhat more temperate, Morison referred to the lay contract as "a foul system of exploitation." Nor has more recent historiography served to improve the reputation of the lay. In a recent article, the labor historian Gerald O. Williams blames the existence of the "Yankee Hellships" ("...legs and arms broken are considered nothing, ribs stamped in by heavy sea boots had to mend as best they could, faces smashed like rotten apples by iron belaying pins had to get well or fear worse treatment, eyes closed by a brawny mate's fist had to see...") on the system of wage payment.[75]

Williams goes on to argue that, toward the end of the nineteenth century, the agents and owners reaped yet another boon from the system -- a boon that could not have been anticipated at the industry's peak. Because of the judicial interpretation of the lay contract, the owners found themselves almost entirely exempt from the strictures imposed by the federal laws designed to improve the life of American seamen. These acts included the Shipping Commissioner Act of 1872

that, together with it amendments, made it more difficult to Shanghai sailors and guaranteed mariners a minimum level of rations, space, and medical treatment, the White Act (1898) that abolished both criminal penalties for desertion and corporal punishment, and the Seamen's Act of 1915 that provided for the minimum safety standards (e.g. lifeboats).[76]

Despite its critics, the system did have many interesting, and some undoubtedly useful, attributes. Certainly owners benefitted from the transfer of a portion of the risk of the voyage to the crew. However, given the regularized system of advances, the payment of room and board, and the occasional renegotiations of lays, the transfer was certainly not complete. Moreover, even some of the critics of the lay contract (Hohman, for example) admit that at least some crew members reveled in a chance to participate in the "big lottery."

Without question, given the well-documented need for cooperation among the members of a vessel's crew and the difficulties of designing an effective monitoring structure, the lay contract provided an incentive system that rewarded cooperation, and it should have encouraged such behavior. In fact, every contemporary account of the hunt and the subsequent rendering underscores the level of cooperation among the crewmen. Finally, the system appears to have been flexible enough to permit agents to adjust rapidly to emerging inter-ground differences in productivity and to the reduced skill demands of the new sailing technologies.

ENDNOTES

1. Elmo Hohman, "Wages, Risk, and Profits in the Whaling Industry," *Quarterly Journal of Economics*, 40: Aug. 1926, pp. 644 - 671. See also Elmo P. Hohman, *The American Whaleman: A Study of Life and Labor in the Whaling Industry*, (New York: Longmans, Green & Company, 1928) reprinted Augustus M. Kelly, 1972 especially Chapters IX & X, pp. 183-243.
2. Hohman, "Wages, Risk and Profits" pp. 644 & 653.
3. Hohman, "Wages, Risk and Profits" p.651.
4. The 1258 include all but the nine unreadable lists among the crew lists on deposit at the New Bedford Public Library that (1) include information on the whaleman's station and his lay, and (2) that overlap the voyages included in a recent study of whaling productivity. New Bedford Public Library, *Whalemen's Shipping Papers*. L. Davis, R. Gallman, and T. Hutchins, "Productivity in American Whaling: The New Bedford Fleet in the Nineteenth Century," in David Galenson (ed.), *Markets in History: Economic Studies of the Past*, (Cambridge & New York: Cambridge University Press, 1989).
5. Alexander Starbuck, "History of the Whale Fishery," *Report of the United States Commission on Fish and Fisheries, 1874* part 4. Reginald Hegarty, *Returns of the American Whaling Vessels Sailing from American Ports: A Continuation of Alexander Starbuck History of the American Whale Fishery, 1876-1928*, (New Bedford, Massachusetts: Old Dartmouth Historical Society and Whaling Museum, 1959). J. Dias, "The New Bedford Whaling Fleet 1790- 1906," manuscript on deposit at Baker Library, Graduate School of Business, Harvard University (cited here after as Baker Library). For a discussion of the manuscript see Anonymous, "The New Bedford Whaling Fleet 1790-1906" *Bulletin of the Business History Society*, 6 (Dec. 1931), pp. 9-14.

6. In 1846, for example, when the American whaling fleet numbered 706 vessels, there were 230 registered whalers in the rest of the world. Starbuck, "History of the Whale Fishery"; Edward A. Stackpole, *The Sea Hunters: The New England Whalemen During Two Centuries 1635 - 1835* (1853), p. 473.

7. The average of the brigs, sloops, and schooners (brought together in this discussion as a single class, "other") was 112 tons, and they employed more labor per ton than either ships or barks.

8. In regards to the sophistication of the captains and agents, A.B.C. Whipple relates the following true story. Captain Thomas Scullum of the *Cape Horn Pigeon* was stopped up by a Russian naval vessel in the Okhotsk Sea in September of 1892. The Russians charged that he had been hunting in Russian territorial waters, and he (and his vessel) were forcibly taken to a Russian port. Scullun denied the charges and insisted that he had been in international waters. After a time the Russians decided to let him go; but, by the time that decision had been reached, it was too late to hunt that Arctic that year. Therefore, Scullun billed the Russians for the costs he had incurred while in Vladivostok harbor *plus* the opportunity cost of missing the hunting season - a cost he put at $45,000.

   The controversy went on for ten years. The Russians finally gave in and agreed to abide by the decision of an arbitrator; the arbitration to take place in the Netherlands. Scullun amended his charges to include interest for the ten years, and he ended up collecting $56,675.63. Of that sum, $45,000 represented opportunity costs and most of the rest interest. A.B.C. Whipple, *Yankee Whalers in the South Seas,* (Garden City, N.J.: Doubleday, 1954), pp. 126-129.

9. Homan, *The American Whaleman*, p. 226.

10. Charles Morgan to S. Bartlett (Boston), May 5, 1837, *Charles W. Morgan Letter Book*, mss 252, 1820-1865, m 847 v. 4, Baker Library. It should be noted that the *Condor* had arrived

seventeen days before Morgan put his pen to paper.

11. Starbuck reports that the 1844 voyage of the Fairhaven-based ship *Albion* to the Indian Ocean lasted 93 months (7 years and 9 months).

12. Original *Account Book of the Ship George Howland 1834 - 1866*, Baker Library, Business Manuscript Number 76 (microfilm). Desertion was not, however, an entirely new phenomenon, as a report from 1763 indicates. The sloop *Dolan* put in to Cape Cod to take on water "prior to its departure for the whaling grounds, and four men who had signed for the voyage silently jumped ship and disappeared, 'Like Roges they are and we must go to the Vineyard [Martha's] for more hands.' Although the vessel eventually managed to put to sea, 'with a fool crew', the delay cost them four days." Darrie Vickers, "Nantucket Whalemen in the Deep-Sea Fishery: The Changing Anatomy of an early American Labor Force," *Journal of American History*, 72, September 1985, p.287.

13. Although the lay was a fraction, it was often referred to as the reciprocal i.e. a lay of 1/175 was often called "a 175".

14. Charles W. Morgan to Thomas A Norton, November 11, 1834, *Charles W. Morgan Letter Book.*

15. In the Atlantic, the single ship making a "short" lay voyage was registered at 191 tons, compared with a ground average of 301. The average size of the eight barks was 200 tons, compared with a ground average of 225; for the three smaller classes, the ten averaged 97, compared with the ground average of 112 tons. In terms of time at sea, the same comparisons show 16 to 27 months for ships, 23 to 27 months for barks, and 12 to 13 months for the smaller vessels.

A regression of labor share on size and sail year shows:

SUMLAY =	-4.62	+	.00005 TONS	+	.00267 SAILYEAR
	(.0001)		(.0001)		(.0001)

for the Indian, Pacific, and Arctic grounds, but

SUMLAY =	-3.56	-	.00010 TONS	+	.00210 SAILYEAR
	(.0001)		(.0354)		(.0001)

for the Atlantic.

16. Hohman, "Wages, Risk, and Profits," pp. 644-645.

17. Hohman, *Ibid.* p. 652.

18. Hohman, *Ibid.*

19. These figures almost certainly understate the actual lay shares received by captains. In 121 cases (9.6 percent of the total) the captain signed a special contract that was not reported with the normal contracts (special contracts were also signed by 22 first mates, 4 second mates, 1 third mate, 2 fourth mates and 1 boatsteerer). When these contracts could be found they usually involved some bonus payment over and above the lay. In this study missing values were assigned the average value for the position in the ground in question. Substituting the maximum lay in the ground made no significant difference to the results.

20. In the case of the cook the value of the lay was almost always less than his total income from the voyage. In addition to his lay, he was typically entitled to between one-third to one-half of the slush, as the money received from the sale of slush (refuse grease and fat from cooking) and other ship's refuse, was called. On the voyage of the *George Howland* that began on 25 June 1846, for example, Andrew Lewis, the cook, earned $357.73 from his 1/140 lay and an additional $124.00 from his one-half of the slush. Thus his effective lay was 1/104. *Account Book of the Ship George Howland.* Captains also frequently shared in the slush.

21. The terms lengthening and shortening are somewhat confusing. Since the lay was often referred to by its reciprocal, a change from a 150 to a 170 was called a lengthening despite the fact that it involved a reduction of the workers share from 0.67 to 0.56 percent. Similarly a change from a 19 to a 16.5 was termed a shortening despite the implied increase from 5.3 to 6.1 percent.

22. The average encompasses two voyages of the *Stephania* (1828-29 and 1829-30), four voyages of the *George Howland* (1834-38, 1838-41, 1842-45, 1846-50), two voyages of the *Midas* (1827-29 and 1829-30), and one voyage of the *William Rotch* (1830-31). See *Account Book of the Ship George Howland*, and *J & H Coggeshall Papers*, Vol. 2, No. 252, 1809-1847, c 676. Baker Library.

23. The average encompasses one voyage of the *Benjamin Tucker* (returned 1851) and three voyages of the *George Howland* (1850-52, 1852-57, and 1857-61). See *Account Book of the Ship George Howland* and *J & H Coggeshall Papers*.

24. *Account Book of the Ship George Howland*

25. See *Account Books: Ship Milton and Bark Callao*, Mss 252, 1862 - 1889, w 552, Baker Library.

26. On seven of the eight voyages made by the *George Howland* between 1834 and 1866 -- voyages on which we have information (the relevant page on the 1857-61 voyage is missing) -- the captains extra income was, in order, $600.62, $168.45, $1222.65, $0.00, $621.75, $2686.10, and $775.02, an average of $867.80 per voyage or $20.91 per month. *Account Book of the Ship George Howland*

27. Hohman, *The American Whaleman*, p. 219.

28. *Account Book of the Ship George Howland*

29. Howland to Valentine Lewis, July 18, 1860, *Matthew Howland, Letter Book*, mss. 252, 1858-79, H864, Baker Library.

30. *Account Book of the Ship George Howland*

31. These rough estimates are derived from Hohman, *The American Whaleman*, p. 315 and p. 325. Real prices of 1880 are from the Warren and Pearson food price index (*Historical Statistics of the United States Colonial Times to 1957*, p. 115).

32. See *Account Books, George Howland, Milton* and *Callao*.

33. *Letter Book: Charles W. Morgan*, Morgan to Cornelius Howland Jr, September 24, 1834.

34. *Letter Book: Charles W. Morgan*, Morgan to Reuben Russell, November 1, 1834.

35. *Letter Book: Charles W. Morgan*, Morgan to Dexter, Novemeber 21, 1836.

36. Charles Wilkes, *Narrative of the United States Exploring Expedition During the Years 1838, 1839, 1840, 1841, and 1842*, Five Volumes, (London & Philadelphia: 1845), Vol.5, p. 498.

37. Hohman, *The American Whaleman*, p. 65.

38. A.B.C. Whipple, *Yankee Whalers in the South Seas*, p. 132.

39. Hohman, *The American Whaleman*, p. 67.

40. The merchant marine wages are taken from Lebergott *Manpower in Economic Growth: The American Record Since 1800* (New York:McGraw-Hill, 1964), *Appendix* Tables A21, AA22a, and AA22b, pp. 530-538. Lebergott's data are drawn from the manuscript collections of the Baker Library and of the Essex Institute in Salem, Mass. The records do not, however, provide a complete enumeration of the wages of all the seaman on the voyages included. Thus, for the years 1840 through 1858 and 1866, there are records of 83 voyages, but while there are wage data for able seaman for 82 of those voyages, there are captains' wages for only 34, first mates' wages for 59, and cooks' wages for 63.

41. The fact that the highest first mate's wage is $60 while the best paid captain received only $35 does not imply that on a given voyage the first mate earned more than the captain. The apparent anomaly can be traced to the spotty nature of the data. The voyage data that yielded the highly paid mates did not include the wages of the captains. In fact there are no captain's wages reported for any voyage after 1854.

42 Letter from Charles W. Morgan to Reuben Russell, August 27, 1834. *Charles Morgan Letter Book*. Mss 252. 1820-1865, M847 v. 4. Baker Library.

43. L. Davis, R. Gallman, and T. Hutchins, "Managerial Decisions and Productivity Change: The New Bedford Whaling Fleet in the Nineteenth Century." Paper presented at the Second World Congress of Cliometrics, Santander, Spain, June 24-27, 1989.

44. For more thorough discussion of the model see below pages 28 and 29 and footnotes 59 and 60.

45. The quotation is from E. Hohman, *The American Whaleman*,, p. 239. fn. 12. See Charles Enderby, *Proposal for Re-establishing the British Southern Whale Fishery, Through the Medium of a Chartered Company, and in Combination with the Colonization of the Auckland Islands—Revision and Enlargement of a Letter Written to a Mr. T. R. Preston on October 31, 1846*, (London: 1847).

46. Captain Frederick Murry observed in 1838 that, exclusive of officers, seven out of every ten men aboard U.S. ships coasting to and from American ports were British, with some mixture of Swedes and Danes and that one-third of the whalers were probably British. In 1845, Congressman Reed, the Chairman of the Committee on Naval affairs, asserted that 100,000 of the 109,000 men in the Navy and merchant marine were foreigners. Again, in 1845 *Hunts Merchant Magazine* reported that "many believed that two-thirds of our sailors were not native." Stanley Lebergott, *Manpower in Economic Growth: The American Record Since 1800*, (New York: McGraw-Hill, 1964), p. 26.

47. Charles Nordhoff, *Whaling and Fishing*, (New York: Dodd Mean and Company, 1895), p.46.

48. Robert Margo and Georgia Villaflor, "The Growth of Wages in Antebellum America: New Evidence," *The Journal of Economic History*, Vol. XLVII, No. 4, Dec. 1987, pp. 893-895. Paul A. David and Peter Solar, "A Bicentenary Contribution to the History of the Cost of Living in America," *Research in Economic History*, vol. 2, 1977. The whaling wages have been adjusted to include an allowance for room and board. The data on unskilled labor are from Edith Abbott, "The Wages of Unskilled Workers in the US 1850 - 1900," *Journal of*

Political Economy, v.13, 1905, pp. 321-367; those for Massachusetts cotton textile mill operatives are from Robert C. Layer, *The Earnings of Cotton Mill Operatives, 1825 - 1914*, Committee on Research in Economic History, (Cambridge, Mass.: Harvard University Press, 1955).

49. Although in that industry it appears that women workers probably did not receive substantially lower wages than the men.

50. Between 1803 and 1840, 2023 blacks sailed from New Bedford on the 729 vessels surveyed by Martha Putney. She finds that at least thirty-three boat steerers and mates were black as were two whaling captains, Absolm F. Baston (from Nantucket) and Pardon Cook (from New Bedford). See Martha S. Putney *Black Sailors: Afro American Merchant Seamen and Whalemen Prior to the Civil War* Contributions in Afro-American Studies No. 103, (New York: Greenwood Press, 1987), pp. 50-51, pp.54-55, p. 125. Also in one case of a mixed crew, the captain and first mate were killed and the ship was brought back home by the black second mate. Moreover, according to the R.G. Dun records at least one New Bedford agency was composed of black men.

51. The change in real unskilled wages (1840-1843 to 1855-1858) using the Warren-Pearson wholesale price index as a deflator was +1.5% for Margo and Villaflor's unskilled workers and -3.6% for Abbott's "All Urban Unskilled." The changes for the same two series using the Williamson-Lindert consumer price deflator were 0% and -3.6% respectively; and using the implied David-Solar deflator +22.2% and +11.2%. The skill ratios are drawn from Williamson and Lindert. Jeffrey G. Williamson and Peter H. Lindert, *American Inequalilty*, (New York: 1980), p.307.

52. Putney *Black Sailors*, p. 125.

53. Nordhoff, *Whaling and Fishing*, p 46 and Hohman, *The American Whaleman*, p. 239 fn.12.

54. These averages are the estimated earnings of a greenhand who returned on the vessel on which he sailed (Own Vessel). They are not comparable with the dependent means in the regressions reported in Table 13. Those figures are based on the year of sailing (Own Year). See the Appendix for a discussion of these measures.

55. Charles Morgan's letter book contains a broad sample of such instructions to his captains. For example, he wrote George H. Dexter, "The ship Condor being now ready for sea, the owners wish you to proceed at once for sea and as the season is late, make the best of your way to the false Bank off the coast of Brazil when we dispatch the ship for a cargo of Right Whale Oil." The following month he wrote Captain Cornelius Howland, Jr. "The ship Magnolia under your command being now ready for sea -- I proceed to give you such general instructions for the voyage as are required. The ship is bound for the Pacific Ocean for a cargo of sperm oil and is amply fitted for a cruise of four years..." Or again to Reuben Russell 2nd, "The bark being now ready for sea as agent I have to advise you that she is bound on a whaling voyage to the Pacific Ocean -- that she is fitted for thirty months -- and that we wish you to cruise for sperm oil for 20 to 24 months and if you are not then full, fill up with whale oil. We leave to your judgement the cruising ground in the Pacific though we would recommend the neighborhood of New Zealand..." Morgan to Dexter, August 26, 1834, Morgan to Cornelius Howland, Jr., September 24, 1834, Morgan to Russell, November 1, 1834, *Letter Book Charles W. Morgan.* Nor does the passage of time seem to have changed the nature of the instructions. Similar orders can be found in the letters written by Matthew Howland to his captains thirty years later. *Matthew Howland Letter Book,* passim.

56. The deflator employed was the David-Solar Index of Consumer Prices. See P. David and P. Solar, "A Bicentennial Contribution," pp. 16-17. The wage is Own Year (see Appendix).

57. The financial risk variable is the standard deviation of the value of the catch of vessels returning from the designated ground in year (t-1). The measure of voyage length is the

average interval for vessels returning from the designated ground in (t-1). The measure of "at sea" risk is the standard deviation of the interval.

58. A coefficient that had been positive and amounted to a premium of $.65 a month becomes slightly negative in the second model ($.28 a month).

59. For a more complete discussion see Davis, Gallman, and Hutchins, "Productivity in American Whaling." The index of total factor productivity is a translog multilateral index. Labor and capital inputs were measured in man-months and ton-months. Land (the stock of whales) was not entered into the index, but was used in the form of lagged independent variables in the regression analysis. See Douglas W. Caves, Laurits R. Christensen, and W. Erwin Diewert, "Multilateral Comparisons of Output, Input, and Productivity Using Superlative Index Numbers," *The Economic Journal*, 92 (March 1982), pp. 73 - 86 for a discussion of superlative indexes.

60. It may appear that the wage rates of other sea-going occupations would be preferable, but, in fact, that is not the case. As the evidence has indicated, merchant seamen and whalers were different breeds of cat, and the markets for the two were quite different. In any case, it is opportunities ashore not opportunities elsewhere afloat that figure in the hypothesis in the literature.

It may also appear that the proper variable should be, not the real wage rate ashore, but the ratio of the wage rate ashore to the wage rate in whaling. We could not use this ratio because we do not have the necessary data on the wage rate in whaling for all years, but there are reasons why the loss is not a great one. The whaling labor market was a very small tail on a very big dog, the labor market ashore. When the dog twitched, the tail surely moved, but the mere fact that it perhaps moved in the same direction as the twitching dog does not mean that it was unaffected by the twitch. It is change in the wage rate ashore that must have put pressure on the whaling labor market, with effects on labor quality.

61. Nordhoff, *Whaling and Fishing*, p. 12.

62. Hohman, *The American Whaleman*, p.62. "The question was even injected into the original shipping of the crew in the home port; for one of the reasons for preferring green hands lay in the fact that they were less resourceful in matters relating to desertion." Hohman, *Op. Cit.*, p.66.

63. Hohman, *The American Whaleman*, p. 65.

64. H.I. Chapelle, *The Search for Speed Under Sail*, (New York: W.W. Norton & Co., 1967), p.279.

65. *Ibid*, p. 279.

66. E. K. Chatterton, *Sailing Ships: The Story of Their Development from the Earliest Times to the Present Day*, (London: Sidgwick & Jackson Ltd., 1909), p. 266.

67. R. C. McKay, *Some Famous Sailing Ships and Their Builder Donald McKay* (New York & London: G.P. Putnam & Sons, 1928), pp. 213-215 and H.I. Chapelle, *The History of American Sailing Ships*, (New York: W.W.Norton, 1935), p. 290.

68. C. Goldin and K. Sokoloff, "Women, Children, and Industrialization in the Early Republic: Evidence from the Manufacturing Census," *Journal of Economic History*, December 1982, Vol. XLII, no. 4, p. 755. For a complete discussion of the evidence see Goldin and Sokoloff, *Op. Cit.* pp. 741 - 744 *passim* and C. Goldin and K. Sokoloff, "The Relative Productivity Hypothesis of Industrialization." *Quarterly Journal of Economics*, August 1984, Vol. XCIX, pp. 461 - 468.

69. David Moment, "The Business of Whaling in America in the 1850's." *Business History Review* vol. 31, Autumn 1957, pp. 261-291.

70. Hohman, *The American Whaleman* p. 62.

71. Gerald O. Williams, "Share Croppers at Sea: The Whalers 'Lay' and Events in the Arctic, 1905-1907," *Labor History*, Winter 1987, p.32, 46,47, and 48.

72. The thirty percent figure assumed by Hohman has a long history. The figure was first given in an article written by J.R. Williams entitled "The Whale Fishery" (*The North American Review*, January 1834, Vol. xxxviii, p. 105). It was repeated by Joseph Grinnell, *Speech on the Tariff, with Statistical Tables of the Whale Fishery*, (1844), p.9. Hohman himself found a similar figure (30.3 percent) in his compilation of a chance sampling of seven voyages "for which suitable and accurate figures were available." Those voyages were "scattered over the period 1805 to 1850." Hohman, "Wages, Risk, and Profit" p.669.

    It should be noted that neither Hohman nor others who have argued for the thirty percent figure have included the value of room and board in their determination of the labor share. The estimates that have been made in conjunction with these studies suggest that an adjustment for board alone would have increased individual earnings by about $3.90 per month in 1840-43 and $5.60 in 1855-58. Given the average length of voyage and catch, the board adjustment should add almost 8 percent to the labor share in 1840-43 and almost 12 percent in 1855-58.

73. Henry George, *Progress and Poverty: An Inquiry into the Cause of Industrial Depression and of Want with Increase of Wealth . . . The Remedy*, (New York: The Robert Schalkenbach Foundation, 1962), p.54 (Book I, Chapter 3).

74. Samuel Eliot Morison, *The Maritime History of Massachusetts 1783-1860* (Boston and New York: Houghton-Mifflin Co., 1921) pp.320-321. Elmo Hohman, *American Whaleman*, p.224.

75. Gerald O. Williams, "Share Cropper of the Sea," *passim*. The description of a "Hell Ship" is from Robert Luddock, *Round the Horn Before the Mast*, (London: 1893), p. 197.

76. 18 U.S.C.A. 544 still exempts whaling seamen. It provides for protection "except in any case the seamen are by custom or agreement entitled to participate in the profits or results of a cruise or voyage." Interpreted in *Johnson* v. *Standard Oil of New Jersey* (D.C. Md 1940), 33 F. S. 982.

TABLE 1.
THE AVERAGE NUMBER OF CREWMEN IN EACH OCCUPATION CATEGORY ON A VOYAGE, NEW BEDFORD VESSELS, 1840-58, 1866

Captains	1.0
Mates	3.2
Boatsteerers	3.5
Misc. Skilled Maritime	0.2
Coopers	0.9
Blacksmiths	0.5
Carpenters	0.8
Misc. Artisans	0.1
Cooks	1.0
Stewards	1.0
Misc. Service	0.0*
Skilled Seamen	2.2
Semi-Skilled Seamen	2.5
Unskilled Seamen	10.2
Boys	0.6

* less than .05

Source: see text.

TABLE 2
AVERAGE LAY BY GROUND
(Single Occupations Only)
New Bedford Vessels,
1840-58, 1866

PANEL A

	CAPTAINS					FIRST MATES				
YEAR	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC
1840	16.5	16.5	16.5	16.5		27.7	24.0	27.5	28.4	
1841	16.5	15.6	17.0	16.6		25.6	22.1	24.8	26.8	
1842	16.5	15.3	16.5	16.9		25.4	21.2	25.6	26.7	
1843	16.5	17.0	15.4	16.9		26.5	23.5	26.0	26.7	
1844	16.1	15.0	15.7	16.3		26.2	30.0	25.2	26.8	
1845	16.5	14.0	16.7	16.6		25.6	22.3	26.4	25.9	
1846	16.1	13.5	15.9	16.2		25.0	20.8	24.7	25.5	
1847	16.0		15.7	16.1		25.5		24.5	26.0	
1848	16.2	15.0	15.6	16.2		25.3	22.0	24.2	25.4	
1849	15.7	15.0	15.5	15.8	17.0	24.4	22.5	23.5	25.0	23.0
1850	15.1	15.5	15.0	15.0	15.2	22.2	18.5	20.6	22.2	22.9
1851	14.8	14.3	13.0	15.2	14.8	21.4	19.4	20.5	21.7	22.0
1852	14.6	14.7	14.4	14.6	14.5	21.0	19.4	19.9	23.2	20.9
1853	14.5	14.0	14.7	14.6	14.3	20.9	19.3	19.9	21.2	20.7
1854	14.1	12.7	13.8	14.1	15.0	20.3	16.2	20.5	20.4	21.3
1855	13.6	13.2	12.2	13.9	13.9	20.1	19.4	19.2	20.1	20.4
1856	13.3	12.7	12.5	13.4	13.6	19.6	16.5	19.8	19.6	19.8
1857	13.8	12.0	14.4	13.7	14.0	19.4	17.0	19.3	19.8	19.2
1858	13.9	14.0	13.9	14.0	13.8	20.7	19.3	20.0	20.7	21.4
1866	14.0	12.9	15.0	15.0	16.0	21.7	21.2	20.8	22.5	22.5
AVG.	15.2	14.4	15.0	15.4	14.7	23.2	20.8	22.6	23.7	21.3

Note: A lay of 16.5 is really 1/16.5 or .0606

PANEL B

	SECOND MATES					THIRD MATES				
YEAR	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC
1840	46.3	42.5	49.0	46.5		65.3		63.8	65.6	
1841	42.1	38.0	41.2	43.1		64.2	67.5	63.0	64.2	
1842	41.7	36.4	41.0	43.9		61.6	49.0	62.2	62.4	
1843	43.3	48.5	41.4	44.0		65.8	70.0	64.6	65.4	
1844	40.8	36.0	37.9	42.7		60.9	65.0	57.0	63.4	
1845	43.1	37.5	42.9	44.1		62.3	53.0	60.2	64.6	
1846	41.1	37.0	38.7	42.7		53.5		62.9	63.6	
1847	39.6		39.9	42.3		61.1		58.5	61.9	
1848	40.3	35.0	40.2	39.2		61.7		65.5	61.5	
1849	39.4	37.5	38.1	39.9	42.8	58.8	57.0	57.6	59.4	57.5
1850	36.9	26.0	37.4	37.4	37.1	58.6			57.7	60.6
1851	37.2	34.0	38.3	37.9	36.7	55.0	48.7	51.9	55.7	55.2
1852	35.6	30.6	37.0	36.0	38.5	54.5	52.7	52.2	54.9	55.2
1853	36.1	29.9	32.3	36.7	37.6	52.7	45.7	54.6	52.2	54.4
1854	34.8	28.3	34.5	35.3	35.8	52.3	48.3	51.4	52.7	52.8
1855	34.7	32.2	32.6	35.3	34.1	50.9	53.4	51.0	50.2	50.5
1856	33.6	32.0	35.2	33.8	34.2	50.8	65.0	54.5	51.3	47.3
1857	32.7	29.3	32.0	33.5	32.7	49.6	40.0	44.5	50.8	51.4
1858	34.8	29.3	31.0	35.7	35.1	54.3	50.0	52.6	54.0	56.2
1866	34.5	33.4	32.0	35.6	38.0	53.9	53.3	55.0	56.0	51.6
AVG.	38.4	34.4	37.6	39.3	36.6	57.4	54.6	57.0	58.4	53.9

PANEL C

	BOATSTEERERS					COOPERS				
YEAR	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC
1840	91.0	85.8	94.2	91.4		59.0	54.0	55.0	60.0	
1841	84.9	73.1	81.7	88.8		56.4	59.0	54.7	56.5	
1842	83.8	68.2	84.6	87.5		61.3	68.3	59.5	62.6	
1843	90.3	90.0	86.1	91.9		60.6	47.1	59.6	62.0	
1844	86.9	77.5	79.8	91.4		59.5	55.0	62.0	58.4	
1845	90.0	64.3	89.7	91.1		54.1	68.0	54.2	52.9	
1846	88.8	58.3	83.5	92.2		59.0	60.0	59.8	59.1	
1847	88.4		78.8	91.5		56.7		57.6	56.4	
1848	91.4	62.5	86.5	92.3		56.7		52.5	57.4	
1849	86.0	84.2	82.4	87.3	92.0	57.8	75.0	56.5	58.0	60.0
1850	87.7	45.0	71.5	88.4	91.4	52.3		50.0	51.6	54.2
1851	89.3	69.1	81.6	91.5	93.4	54.4	52.0	59.5	54.0	53.0
1852	86.3	64.6	83.8	88.9	91.7	56.4	58.7	61.4	54.0	61.9
1853	83.4	65.3	78.7	84.0	87.5	56.6	70.8	48.8	55.8	56.1
1854	83.7	57.9	74.4	85.0	89.7	58.8	64.0	58.6	57.2	60.0
1855	86.0	75.4	83.0	87.1	88.2	54.3	52.0	54.2	54.8	54.9
1856	84.6	74.2	75.8	86.5	87.0	52.8	50.0	52.6	52.5	56.0
1857	87.3	67.8	83.2	88.6	89.7	55.5	50.0	60.0	54.2	55.5
1858	88.4	82.5	82.2	89.2	90.6	55.4	53.3	49.0	56.7	54.2
1866	89.3	81.3	88.6	94.9	96.7	66.1	65.0	61.0	70.3	65.0
AVG.	87.4	70.9	82.5	89.5	90.7	57.2	59.0	56.3	57.3	57.3

PANEL D

	CARPENTERS					COOKS				
YEAR	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC
1840	150.8		150.0	151.2		141.9	140.0	147.5	141.0	
1841	150.3	130.0	145.0	154.2		135.1	120.4	135.8	137.9	
1842	150.9	138.3	149.2	155.4		133.0	109.4	134.4	139.2	
1843	151.5	140.0	161.7	149.8		139.9	158.5	135.0	141.7	
1844	153.3	140.0	145.4	158.9		139.7	100.0	133.0	144.9	
1845	161.9	100.0	162.9	162.2		141.2	103.3	141.7	143.3	
1846	160.8	135.0	160.0	161.6		138.4	128.3	135.6	140.8	
1847	163.5		155.6	166.1		138.3		134.3	140.2	
1848	165.2		200.0	162.7		145.0	130.0	138.0	146.6	
1849	158.2	152.5	155.7	161.6	157.5	134.8	135.0	136.0	134.7	140.0
1850	165.6		145.0	165.8	170.4	139.2	82.5	127.0	140.9	146.2
1851	169.2	143.6	163.0	171.6	175.2	142.9	128.2	144.5	143.5	147.8
1852	167.9	151.7	164.3	171.9	165.7	138.1	121.7	144.0	139.1	143.3
1853	168.4	140.0	165.0	167.6	175.4	139.0	130.6	126.7	141.4	139.1
1854	168.4	159.6	166.7	170.0	177.5	140.8	136.2	138.3	143.7	148.3
1855	172.0	159.6	170.0	171.5	177.5	136.7	136.0	140.0	143.1	152.1
1856	170.7	170.0	160.0	175.5	159.2	143.2	135.0	135.8	143.7	148.3
1857	171.6	132.5	170.6	175.4	170.0	142.3	123.3	132.2	145.6	143.3
1858	172.7	160.0	177.0	170.9	177.5	146.6	138.8	143.3	147.3	148.8
1866	184.5	173.1	180.0	198.0	175.0	149.4	149.1	144.0	150.0	152.0
AVG.	163.9	145.4	162.4	166.1	171.0	140.3	126.6	137.4	142.4	146.3

PANEL E

	STEWARDS					SKILLED SEAMEN*				
YEAR	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC
1840	137.0	130.0	110.0	141.7		142.5	131.6	150.0	145.2	
1841	133.3	125.0	130.0	135.8		138.0	120.3	134.0	144.4	
1842	132.7	123.1	130.2	140.2		135.0	112.5	134.9	145.4	
1843	137.0	150.0	137.6	136.4		143.9	155.0	141.0	144.8	
1844	136.7	160.0	135.0	138.5		147.1	134.2	130.9	154.2	
1845	137.3	105.0	137.0	138.1		150.9	95.0	148.3	152.6	
1846	139.0	125.0	137.5	141.2		146.1	105.0	138.0	151.4	
1847	137.6		131.2	140.1		147.9		143.7	151.6	
1848	141.6	160.0	139.2	141.3		150.4	135.0	150.5	150.3	
1849	136.4	127.5	140.4	135.0	145.0	148.5	148.0	146.5	148.9	162.5
1850	138.7		116.7	138.1	145.6	151.6	97.1	140.6	152.9	160.4
1851	136.8	118.9	132.0	139.9	138.2	156.0	139.0	154.1	157.7	164.8
1852	131.3	105.8	139.8	131.9	136.2	153.0	133.2	150.8	155.1	160.8
1853	133.4	125.7	130.8	134.1	135.9	150.6	131.6	140.0	150.8	158.7
1854	134.1	118.3	129.5	136.0	136.0	151.3	125.0	134.6	153.6	161.8
1855	132.8	120.0	127.9	133.6	139.5	156.6	143.0	160.7	157.1	157.6
1856	134.0	136.2	135.0	135.1	137.6	156.7	143.0	152.0	158.4	157.8
1857	131.6	123.3	120.5	131.8	138.8	160.8	145.0	153.6	163.6	159.7
1858	141.6	133.3	137.0	142.1	142.9	167.5	150.0	145.0	169.8	169.3
1866	134.4	125.3	145.0	139.3	142.0	163.3	151.0	159.4	175.3	174.2
AVG.	135.9	128.5	132.1	137.5	139.8	150.9	131.3	145.4	154.2	162.5

* Skilled Seamen include Seaman, Able Seaman, Whaling Seaman, Extra Prepared Seaman, Bow Hand, Lead, and Lookout.

PANEL F

	SEMI-SKILLED SEAMEN*					UNSKILLED SEAMEN**				
YEAR	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC
1840	160.1	144.2	165.0	161.9		178.0	153.9	185.5	178.1	
1841	153.0	137.8	141.8	163.2		171.0	149.0	170.1	181.6	
1842	155.3	119.1	151.9	166.2		179.8	151.4	186.1	180.6	
1843	164.2	176.2	155.9	166.1		178.1	189.2	172.7	180.5	
1844	161.5	160.0	142.2	168.4		179.3	170.5	168.1	185.9	
1845	165.8	127.9	167.5	170.2		187.8	132.7	188.2	189.6	
1846	162.2	137.5	149.7	166.4		179.2	124.5	173.5	183.3	
1847	165.7		148.6	169.8		184.2		172.2	187.1	
1848	171.3	150.0	174.5	170.9		187.2	160.0	177.1	189.1	
1849	157.6	146.8	148.8	160.8	168.3	181.8	164.4	174.5	185.9	193.2
1850	169.0	173.8	166.6	171.8	170.0	185.1	103.4	166.5	186.6	193.7
1851	170.4	165.0	170.1	173.2	173.9	189.5	171.6	184.9	191.4	196.7
1852	172.3	143.6	157.4	177.4	168.9	186.1	151.7	180.2	191.9	194.3
1853	168.3	136.0	174.0	168.1	176.1	185.3	160.4	175.5	187.3	188.6
1854	166.4	134.6	153.8	167.2	177.8	184.8	150.1	174.5	186.7	193.7
1855	166.7	164.8	150.6	166.5	176.4	189.0	172.5	183.9	190.7	195.2
1856	167.4	165.3	166.9	171.8	168.9	190.4	163.7	178.9	194.4	192.9
1857	175.2	148.8	163.7	171.2	191.4	196.2	166.1	187.4	194.4	212.7
1858	178.1	150.4	182.6	177.7	185.1	192.9	178.5	183.0	194.3	197.3
1866	185.3	169.5	182.9	196.8	188.0	201.1	189.6	193.1	215.2	203.2
AVG.	166.79	150.1	160.7	170.3	176.8	185.3	158.1	178.8	188.7	196.5

* Semi-Skilled Seamen include Ordinary Seamen, Oarsman, Mariner, "One Voyage", "Has been coasting", Past Green Hand", "Used to Boat", "5 Years Crawling", "Has been to Sea", "Extra Green Hand", Boatman, "in the Boats".

** Unskilled Seamen include Greenhand, Landsman, Green Oarsman, Green Portugese, Green Canaka, Green Malay, Spanish Islands, Green Black, Green Colored.

Sources: see text.

TABLE 3

AVERAGE LAYS: CATEGORY 2 OCCUPATIONS

(All Grounds and Single Occupation Only)

New Bedford Vessels, 1840-58, 1866

YEAR	4TH MATE	SHIP KEEPER	MISC. SKILLED SEAMEN[1]	BLACKSMITHS	MISC. ARTISANS[2]	MISC. SERVICE[3]	BOYS
1840	82.5	113.3		146.2	151.7		223.8
1841	75.9	90.0	100.0	156.3	155.0		313.4
1842	73.1	117.0	11.0	158.1	148.8		227.7
1843	74.0	121.3	98.3	163.1	159.2		404.2
1844	73.1	125.0	72.5	158.6	166.2		531.8
1845	78.1	105.0		175.0	163.8		632.6
1846	76.8	119.0		164.2	181.0		909.7
1847	73.2	135.0		165.4	171.4		499.7
1848	75.3	112.5		171.7	175.7		368.6
1849	68.0	111.7		167.2	160.5		255.9
1850	70.6	133.3	75.0	175.3	161.8		335.1
1851	73.1	100.0	120.0	176.9	175.2	175.0	538.8
1852	70.1	126.2		178.2	168.8		603.3
1853	72.5	160.0	55.0	177.2	185.0		477.5
1854	70.8	116.4	145.0	171.6	171.9		252.3
1855	67.5	92.5	90.0	182.2	155.0		249.3
1856	64.0	108.0		181.9	180.6	180.0	475.1
1857	67.7	110.0		179.2	177.5		471.5
1858	70.2	115.0	162.5	184.8	190.0		250.5
1866	68.8	96.7	175.0	193.7	224.0		282.0
AVG.	72.3	115.4	109.4	171.3	171.2	177.5	415.1

1. Misc. Skilled Seamen includes: 5th Mate, 2nd Boatsteerer, Preventive Boatsteerer, Extra Prepared Boatsteerer, Head-a-Boat, Asst. Boat Steerer, and Navigator.
2. Misc. Artisan includes: 2nd Cooper, 2nd Carpenter, Sailmaker, Boat Builder, 2nd Blacksmith, Painter, Surgeon Doctor, Mechanic, Machinist, Caulker, and Coppersmith.
3. Misc. Service includes: Steerage Steward, 2nd Steward, 2nd Cook, and Steerage Master.

Sources: see text.

TABLE 4
AVERAGE LAYS: ALL YEARS BY OCCUPATION,
New Bedford Voyages, 1840-58, 1866
(ALL GROUNDS)

OCCUPATION	AVERAGE LAY	PERCENT OF VALUE OF CATCH	RELATIVE SHARES: UNSKILLED SEAMEN EQUAL 100	% CHANGE IN LAY 1840-43 TO 1855-58
CAPTAIN	15.2	6.58	1219	-17.3
FIRST MATES	23.2	4.31	799	-24.1
SECOND MATES	38.4	2.60	483	-21.7
THIRD MATES	53.9	1.86	344	-19.2
FOURTH MATES	72.3	1.38	256	-11.8
BOATSTEERERS	87.4	1.14	212	-1.1
SHIP KEEPERS	115.4	0.87	161	-3.6
MISC. SKILLED MARITIME	109.4	0.91	169	22.8
COOPERS	57.2	1.75	324	-8.1
CARPENTERS	163.9	0.61	113	13.8
BLACKSMITHS	171.3	0.58	108	16.7
MISC. ARTISANS	171.2	0.58	108	14.4
COOKS	140.3	0.71	132	3.4
STEWARDS	135.9	0.74	136	0
SKILLED SEAMEN	150.9	0.66	123	14.7
SEMI SKILLED SEAMEN	166.8	0.60	111	8.7
UNSKILLED SEAMEN	185.3	0.54	100	8.7
BOYS	415.1	0.24	45	33.5

Sources: see text.

TABLE 5

RELATIVE LAYS BY GROUND, ALL YEARS

New Bedford Voyages, 1840-58, 1866

(Atlantic = 100)

	GROUND			
OCCUPATION	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC
OFFICERS				
CAPTAINS	100	104	107	106
FIRST MATES	100	109	114	106
SECOND MATES	100	109	114	109
THIRD MATES	100	104	107	101
SKILLED MARITIME				
BOATSTEERERS	100	116	126	127
ARTISANS				
COOPERS	100	95	97	97
CARPENTERS	100	112	114	116
SERVICE PERSONNEL				
COOKS	100	109	112	116
STEWARDS	100	103	107	107
SEAMEN				
SKILLED SEAMEN	100	111	117	122
SEMI-SKILLED SEAMEN	100	107	113	117
UNSKILLED SEAMEN	100	113	119	123
SIMPLE AVERAGE ALL OCCS.	100	108	112	112

Sources: see text.

TABLE 6
RELATIVE LAYS BY GROUND
New Bedford Vessels, 1849-58, 1866
(Atlantic = 100)

OCCUPATION	GROUND			
	ATLANTIC	INDIAN	PACIFIC	ARCTIC
OFFICERS				
CAPTAINS	100	102	106	107
FIRST MATES	100	107	113	112
SECOND MATES	100	111	116	118
THIRD MATES	100	102	105	105
SKILLED MARITIME				
BOATSTEERERS	100	115	127	130
ARTISANS				
COOPERS	100	94	95	97
CARPENTERS	100	107	112	111
SERVICE PERSONNEL				
COOKS	100	107	111	114
STEWARDS	100	107	110	113
SEAMEN				
SKILLED SEAMEN	100	109	116	119
SEMI-SKILLED SEAMEN	100	107	112	115
UNSKILLED SEAMEN	100	112	120	122
SIMPLE AVERAGE ALL OCCS.	100	107	112	113

Sources: see text.

TABLE 7
MONTHLY EARNINGS, BY OCCUPATION, ALL GROUNDS, OWN VESSEL*
CURRENT PRICES
NEW BEDFORD VESSELS, 1840-58, 1866

PANEL A

YEAR	CAPTAINS	FIRST MATES	SECOND MATES	THIRD MATES	BOATSTEERERS	COOPERS
1840	92.51	54.89	33.05	24.71	17.61	26.77
1841	71.38	45.45	29.18	21.12	14.35	22.52
1842	78.15	51.00	30.98	23.14	16.20	23.75
1843	81.55	50.54	30.98	21.87	15.05	22.56
1844	70.00	42.94	27.71	18.70	13.32	18.90
1845	66.95	42.77	26.09	20.13	12.70	21.08
1846	83.81	53.37	32.81	24.79	15.90	23.60
1847	83.08	50.58	31.88	23.70	15.72	24.14
1848	110.10	69.84	44.91	29.62	19.70	33.00
1849	104.72	68.48	41.71	28.30	19.81	30.11
1850	109.02	73.74	44.35	29.09	18.78	32.94
1851	116.66	79.40	45.82	32.42	19.64	32.79
1852	107.66	73.56	42.00	31.87	18.60	28.82
1853	123.53	85.29	48.49	35.74	21.45	34.51
1854	111.26	77.70	45.21	32.51	19.83	29.94
1855	100.51	68.52	40.08	28.79	16.34	26.37
1856	106.98	72.19	41.16	29.52	16.82	28.09
1857	93.04	65.06	38.65	26.21	14.25	22.08
1858	104.35	69.73	41.77	27.30	16.87	27.07
1866	137.55	87.95	57.30	37.14	22.22	31.39
AVG.	97.64	64.15	38.71	27.33	17.26	27.02

* The estimate assumes the crewman returned on the vessel on which he sailed.

PANEL B

YEAR	CARPENTERS	COOKS	STEWARDS	SKILLED SEAMEN	SEMI-SKILLED SEAMEN	UNSKILLED SEAMEN
1840	10.41	10.86	11.29	10.84	9.55	8.90
1841	7.95	8.88	9.25	8.52	8.11	6.90
1842	7.86	9.64	9.69	9.57	8.43	7.60
1843	8.80	9.17	9.74	9.04	8.34	7.71
1844	7.12	7.91	8.24	7.69	7.30	6.25
1845	7.02	7.72	7.69	7.72	5.84	6.27
1846	8.00	9.78	9.90	9.81	8.45	7.57
1847	7.86	9.49	9.90	8.76	8.08	7.51
1848	11.28	12.44	12.39	12.60	10.13	9.50
1849	11.51	12.26	12.04	11.35	10.46	9.08
1850	10.07	11.50	11.54		11.59	9.24
1851	10.50	11.90	12.62	10.85	9.41	9.20
1852	9.53	11.02	13.72	11.46	8.58	8.44
1853	12.49	13.01	14.30	10.77	10.72	9.80
1854	10.36	11.45	12.71	12.76	8.71	8.76
1855	8.92	9.34	11.19	9.33	8.54	7.37
1856	8.41	9.88	10.77	9.67	7.87	7.33
1857	7.40	9.03	9.59	7.52	7.28	6.58
1858	9.00	9.82	10.40	8.63	9.58	7.41
1866	11.17	12.34	16.15	12.17	10.62	9.73
AVG.	9.28	10.37	11.16	10.03	8.76	8.03

Sources: see text.

TABLE 8
COMPARATIVE WAGES:MERCHANTMEN AND WHALERS
CURRENT $'S PER MONTH*, 1840-58, 1866

PANEL A

	CAPTAINS			FIRST MATES			2ND MATES		
YEAR	MM	W	W/MM	MM	W	W/MM	MM	W	W/MM
1840	30.00	92.50	3.08	26.00	54.90	2.11	19.33	33.00	1.71
1841	30.00	71.40	2.38	21.33	45.50	2.13			
1842	30.00	78.16	2.61	21.00	51.00	2.43	4.00	30.00	7.50
1843	30.00	81.60	2.72	18.67	50.50	2.71			
1844	27.50	70.00	2.55	18.67	42.90	2.30			
1845	26.67	67.00	2.51	19.25	42.80	2.22			
1846	28.00	83.80	2.99	20.33	53.40	2.63	19.00	32.80	1.73
1847	25.00	83.10	3.32	31.00	50.60	1.63	21.00	31.90	1.52
1848	30.00	110.10	3.67	22.00	69.80	3.17	20.00	44.90	2.25
1849				30.00	68.50	2.28			
1850	27.33	109.00	3.99	17.50	73.70	4.21			
1851				32.00	79.40	2.48	20.00	45.80	2.29
1852				28.00	73.60	2.63	20.00	42.00	2.10
1853	35.00	142.60	4.07	25.67	100.00	3.90	20.00	56.20	2.81
1854	35.00	109.40	3.13	46.25	76.40	1.65	33.33	44.50	1.34
1855							37.50	40.00	1.07
1856									
1857				50.00	69.70	1.39	35.00	39.00	1.11
1866				55.00	88.80	1.61	36.00	57.80	1.61
AVG.	29.54	91.55	3.09	28.39	64.21	2.44	23.76	41.49	2.25

NOTES: WHALERS ARE NEW BEDFORD "OWN VESSEL", ALL GROUNDS
MERCHANTMEN FROM LEBERGOTT A21, AA22A, & AA22B
MM = MERCHANT MARINE
W = WHALEMEN

PANEL B

	COOKS			SKILLED SEAMEN			SEMI-SKILLED SEAMEN		
YEAR	MM	W	W/MM	MM	W	W/MM	MM	W	W/MM
1840	13.75	10.90	0.79	14.00	10.80	0.77			
1841	9.80	8.90	0.91	14.00	8.52	0.61			
1842	10.00	9.60	0.96	13.00	9.57	0.74			
1843	8.33	9.20	1.10	13.00	10.11	0.78			
1844	8.43	7.90	0.94	14.00	7.70	0.55			
1845	11.17	7.60	0.68	14.00	7.70	0.55			
1846	12.36	9.80	0.79	14.00	9.80	0.70	8.60	8.50	0.99
1847	20.00	9.50	0.48	14.00	8.80	0.63			
1848	12.17	12.40	1.02	15.00	12.60	0.84	10.25	10.10	0.98
1849	15.00	12.30	0.82	15.00	11.40	0.76			
1850	13.00	11.50	0.88	13.00	11.60	0.89			
1851	16.50	11.90	0.72	15.00	10.90	0.73	9.63	9.40	0.98
1852	17.25	11.00	0.64	15.00	11.50	0.77	9.53	8.60	0.90
1853	15.00	15.00	1.00	15.00	18.10	1.21	12.28	10.70	0.87
1854	27.00	11.20	0.41	15.00	12.50	0.83	9.78	8.50	0.87
1855	26.00	9.30	0.36	15.00	9.30	0.62	8.49	8.50	1.00
1856					9.67				
1857	25.00	9.10	0.36	15.00	7.58	0.51			
1858					8.00				
1866	29.33	12.50	0.43	27.00	12.20	0.45	13.03	10.30	0.79
AVG.	16.12	10.53	0.74	15.00	10.42	0.72	10.20	9.33	0.92

Sources: see text.

TABLE 9

COMPARATIVE WAGES* : WHALING VS. ONSHORE

1840-58, 1866

PANEL A

YEAR	M-V** MONTHLY NOMINAL WAGES ARTISANS NORTHEAST	MONTHLY NOMINAL WAGES INCLUDING BOARD WAGES ARE OWN VESSEL AND ALL GROUND					
		CAPTAINS	1 MATES	2 MATES	3 MATES	STEERERS	COOPERS
1840	37.50	99.29	61.67	39.83	31.49	24.39	33.55
1841	37.50	77.48	51.55	35.28	27.22	20.45	28.62
1842	34.25	83.63	56.48	36.46	28.62	21.68	29.23
1843	36.50	86.70	55.69	36.13	27.02	20.20	27.71
1844	32.50	75.00	47.94	32.71	23.70	18.32	23.90
1845	38.75	72.06	47.88	31.20	25.24	17.81	26.19
1846	37.25	88.89	58.45	37.89	29.87	20.98	28.68
1847	38.00	89.26	56.76	38.06	29.88	21.90	30.32
1848	35.75	115.78	75.52	50.59	35.30	25.38	38.68
1849	36.00	110.42	74.18	47.41	34.00	25.51	35.81
1850	36.25	114.56	79.28	49.89	34.63	24.32	38.48
1851	35.75	122.19	84.93	51.35	37.95	25.17	38.32
1852	37.00	113.76	79.66	48.10	37.97	24.70	34.92
1853	38.25	129.84	91.60	54.80	42.05	27.76	40.82
1854	41.00	118.62	85.06	52.57	39.87	27.19	37.30
1855	43.25	108.34	76.35	47.91	36.62	24.17	34.20
1856	48.25	114.34	79.55	48.52	36.88	24.18	35.45
1857		100.84	72.86	46.45	34.01	22.05	29.88
1858		110.64	76.02	48.06	33.59	23.16	33.36
1866		149.11	99.51	68.86	48.70	33.78	42.95
AVG.							
1840-56	37.87	101.19	68.39	43.45	32.84	23.18	33.07
ALL YRS		104.04	70.55	45.10	33.73	23.65	33.42

* M-V refers to the Margo-Villaflor Series

** Whaleman wages all, all grounds

PANEL B

YEAR	M-V MONTHLY NOMINAL WAGES ARTISANS NORTHEAST	MONTHLY WAGES INCLUDING BOARD WAGES ARE OWN VESSEL AND ALL GROUND CARPENTER	COOKS	STEWARDS
1840	37.50	17.19	17.64	18.07
1841	37.50	14.05	14.98	15.35
1842	34.25	13.34	15.12	15.17
1843	36.50	13.95	14.32	14.89
1844	32.50	12.12	12.91	13.24
1845	38.75	12.13	12.83	12.80
1846	37.25	13.08	14.86	14.98
1847	38.00	14.04	15.67	16.08
1848	35.75	16.96	18.12	18.07
1849	36.00	17.21	17.96	17.74
1850	36.25	15.61	17.04	17.08
1851	35.75	16.03	17.43	18.15
1852	37.00	15.63	17.12	19.82
1853	38.25	18.80	19.32	20.61
1854	41.00	17.72	18.81	20.07
1855	43.25	16.75	17.17	19.02
1856	48.25	15.77	17.24	18.13
1857		15.20	16.83	17.39
1858		15.29	16.11	16.69
1866		22.73	23.90	27.71
AVERAGES:				
1840-56	37.87	15.32	16.38	17.02
ALL YRS		15.68	16.77	17.55

PANEL C

	NOMINAL MONTHLY WAGES				NOMINAL MONTHLY WAGES INCLUDING BOARD WAGES ARE OWN VESSEL AND ALL GROUND		
YEAR	M-V UNSKILLED NORTHEAST	MASS. TEXTILES	UNSKILLED FACTORY WORKERS	ALL URBAN UNSKILLED	SKILLED SEAMEN	SEMI-SKILLED SEAMEN	UNSKILLED SEAMEN
1840	37.50	14.63	16.00	23.74	17.62	16.33	15.68
1841	37.50	14.59	15.75	22.74	14.62	14.21	13.00
1842	35.25	14.81	17.25	21.50	15.05	13.91	13.08
1843	36.50	13.94	16.25	19.75	14.19	13.49	12.86
1844	32.50	14.67	16.00	20.75	12.69	12.30	11.25
1845	38.75	15.09	15.50	21.24	12.83	10.95	11.38
1846	37.25	15.27	19.00	22.74	14.89	13.53	12.65
1847	38.00	15.73	16.88	22.74	14.94	14.26	13.69
1848	35.75	16.15	17.50	22.25	18.28	15.81	15.18
1849	36.00	15.86	18.75	23.25	17.05	16.16	14.78
1850	36.25	16.22	20.00	22.74	17.13	14.78	14.30
1851	35.75	15.95	18.75	22.38	16.38	14.94	14.73
1852	37.00	15.66	18.88	22.74	17.56	14.68	14.54
1853	38.25	15.68	19.25	23.74	17.08	17.03	16.11
1854	41.00	16.06	19.50	25.49	20.12	16.07	16.12
1855	43.25	16.08	19.75	25.00	17.16	16.37	15.20
1856	48.25	16.26	21.25	25.49	17.03	15.23	14.69
1857		15.89	21.25	25.26	15.32	15.08	14.38
1858		14.48	20.38	25.25	14.92	15.87	13.70
1866		27.06	33.50	40.53	23.73	22.18	21.29
AVG.:							
1840-56	37.87	15.45	18.02	22.84	16.15	14.71	14.07
ALL YRS		16.00	19.07	23.97	16.43	15.16	14.43

Sources: see text.

TABLE 10
RELATIVE EARNINGS: SKILLED WHALEMEN TO M-V ARTISANS, 1840-58, 1866
M-V ARTISANS = 100

PANEL A

YEAR	CAPT.	MATE 1	MATE 2	MATE 3	BOAT STEERER	COOPER	CARP'TR	COOK	STEWARD
1840	265	164	106	84	65	89	46	47	48
1841	207	137	94	73	55	76	37	40	41
1842	244	165	106	84	63	85	39	44	44
1843	238	153	99	74	55	76	38	39	41
1844	231	148	101	73	56	74	37	40	41
1845	186	124	81	65	46	68	31	33	33
1846	239	157	102	80	56	77	35	40	40
1847	235	149	100	79	58	80	37	41	42
1848	324	211	142	99	71	108	47	51	51
1849	307	206	132	94	71	99	48	50	49
1850	316	219	138	96	67	106	43	47	47
1851	342	238	144	106	70	107	45	49	51
1852	307	215	130	103	67	94	42	46	54
1853	339	239	143	110	73	107	49	50	54
1854	289	207	128	97	66	91	43	46	49
1855	251	177	111	85	56	79	39	40	44
1856	237	165	101	76	50	73	33	36	38
AVG.	268	181	115	87	61	88	41	43	45
RATIO OF RELATIVE EARNINGS: 1840-43 TO 1853-56									
RATIO	0.85	0.79	0.84	0.85	0.97	0.93	0.98	0.99	0.94

PANEL B

	SKILLED SEAMEN TO:				SEMI-SKILLED SEAMEN TO:			
YEAR	M-V UNSKLD NO'EAST	MASS. TEXTILE	UNSKLD FACTORY	ALL URBAN UNSKLD	M-V UNSKLD NO'EAST	MASS. TEXTILE	UNSKLD FACTORY	ALL URBAN UNSKLD
1840	47	120	110	74	44	112	102	69
1841	39	100	93	64	38	97	90	62
1842	44	102	87	70	41	94	81	65
1843	39	102	87	72	37	97	83	68
1844	39	87	79	61	38	84	77	59
1845	33	85	83	60	28	73	71	52
1846	40	98	78	65	36	89	71	60
1847	39	95	89	66	38	91	84	63
1848	51	113	104	82	44	98	90	71
1849	47	108	91	73	45	102	86	70
1850	47	106	86	75	41	91	74	65
1851	46	103	87	73	42	94	80	67
1852	47	112	93	77	40	94	78	65
1853	45	109	89	72	45	109	88	72
1854	49	125	103	79	39	100	82	63
1855	40	107	87	69	38	102	83	65
1856	35	105	80	67	32	94	72	60
1857		96	72	61		95	71	60
1858		103	73	59		110	78	63
1866		88	71	59		82	66	55
AVG.								
1840-56	43	104	90	71	39	95	82	64
ALL YRS		103	87	69		95	80	64
RATIO OF RELATIVE WAGES: (1) 1840-43 TO 1853-56 & (2) 1840-43 TO 1855-58								
(1):								
(2):		1.03	1.21	1.10		1.00	1.17	1.07

* whaling wages are all ground

PANEL C

	UNSKILLED SEAMEN TO:			
YEAR	M-V UNSKLD NO'EAST	MASS. TEX	UNSKLD FAC'RY	ALL URBAN UNSKLD
1840	42	107	98	66
1841	35	89	83	57
1842	38	88	76	61
1843	35	92	79	65
1844	35	77	70	54
1845	29	75	73	54
1846	34	83	67	56
1847	36	87	81	60
1848	42	94	87	68
1849	41	93	79	64
1850	39	88	71	63
1851	41	92	79	66
1852	39	93	77	64
1853	42	103	84	68
1854	39	100	83	63
1855	35	95	77	61
1856	30	90	69	58
1857		91	68	57
1858		95	67	54
1866		79	64	53
AVG.	37	91	78	62
1840-56		91	77	61
ALL YRS				
RATIO OF RELATIVE WAGES: (1) 1840-43 TO 1853-56 & (2) 1840-43 TO 1				
(1):	1.02	0.97	1.07	1.00
(2):		1.02	1.19	1.09

Sources: see text.

TABLE 11
CHANGE IN WAGES 1840-43 TO 1855-58, BY OCCUPATION

OCCUPATIONS	NOMINAL DOLLARS	W-P REAL* DOLLARS	W-L REAL*	D-S REAL*
1. CAPTAINS				
1840-43 TO 1855-58	25.1	3.5	-1.8	6.6
1840-43 TO 1847-51	25.8	11.7	9.2	23.6
1847-51 TO 1855-58	-0.5	-8.3	-10.0	-11.9
2. FIRST MATES				
1840-43 TO 1855-58	36.5	11.9	7.2	16.4
1840-43 TO 1847-51	30.1	15.3	12.7	28.8
1847-51 TO 1855-58	4.9	-3.0	-4.9	-7.1
3. SECOND MATES				
1840-43 TO 1855-58	30.2	6.7	2.2	10.9
1840-43 TO 1847-51	31.1	16.4	13.8	29.1
1847-51 TO 1855-58	-0.7	-8.4	-10.2	-12.1
4. THIRD MATES				
1840-43 TO 1855-58	23.1	0.9	-3.3	5.1
1840-43 TO 1847-51	21.9	8.3	5.9	19.9
1847-51 TO 1855-58	1.0	-6.8	-8.6	-10.3
5. BOATSTEERERS				
1840-43 TO 1855-58	1.7	-16.9	-20.2	-13.4
1840-43 TO 1847-51	17.1	4.1	1.7	16.1
1847-51 TO 1855-58	-13.2	-20.1	-21.5	-23.1
6. COOPERS				
1840-43 TO 1855-58	8.4	-11.5	-15.0	-7.6
1840-43 TO 1847-51	25.7	11.5	9.1	22.5
1847-51 TO 1855-58	-13.8	-20.6	-22.1	-23.6
7. CARPENTERS				
1840-43 TO 1855-58	-3.7	-21.3	-24.4	-18.0
1840-43 TO 1847-51	16.3	3.4	1.0	11.6
1847-51 TO 1855-58	-17.2	-23.8	-25.1	-26.7
8. COOKS				
1840-43 TO 1855-58	-1.3	-19.2	-22.5	-15.9
1840-43 TO 1847-51	18.5	5.4	3.0	16.3
1847-51 TO 1855-58	-16.7	-23.3	-24.7	-26.2
9. STEWARDS				
1840-43 TO 1855-58	5.0	-14.0	-17.5	-10.4
1840-43 TO 1847-51	14.8	2.1	-0.2	11.6
1847-51 TO 1855-58	-8.6	-15.8	-17.3	-18.8
10. SKILLED SEAMEN				
1840-43 TO 1855-58	-7.4	-24.2	-27.2	-20.9
1840-43 TO 1847-51	16.7	3.6	1.4	15.4
1847-51 TO 1855-58	-20.7	-26.9	-28.2	-29.5
11. SEMI-SKILLED SEAMEN				
1840-43 TO 1855-58	-3.4	-21.2	-24.3	-18.1
1840-43 TO 1847-51	10.1	-2.0	-4.3	6.9
1847-51 TO 1855-58	-12.2	-19.5	-20.9	-22.7
12. UNSKILLED SEAMEN				
1840-43 TO 1855-58	-7.8	-24.5	-27.6	-21.4
1840-43 TO 1847-51	12.0	-0.3	-2.6	10.3
1847-51 TO 1855-58	-17.7	-24.3	-25.7	-27.1

* W-P= Warren-Pearson, W-C=Williamson-Lindert, P-S= David- Solar

Sources: see text.

TABLE 12
RELATIVE MONTHLY WAGES BY GROUND*
NEW BEDFORD VESSELS, 1840-58, 1866
(ATLANTIC = 100)

OCCUPATION	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC
CAPTAIN	100	98	111	134
FIRST MATE	100	91	103	131
SECOND MATE	100	90	102	128
THIRD MATE	100	107	119	143
BOATSTEERER	100	88	92	108
COOPER	100	104	113	132
CARPENTER	100	65	74	86
COOK	100	97	108	129
STEWARD	100	74	82	102
SKILLED SEAMAN	100	72	82	93
SEMI-SKILLED SEAMAN	100	110	113	133
UNSKILLED SEAMAN	100	99	89	114
AVERAGE ALL OCCUPATIONS	100	91	99	119

Wages are own vessel, all years

Sources: see text.

Table 13
LABOR MARKET EFFICIENCY
NEW BEDFORD VESSELS, 1840-58, 1866

	Model 1 Non Physical Risk Adjusted (Dependent Variable is expected monthly wage of an Unskilled Seaman)		Model 2 Physical Risk Adjusted (Dependent Variable is Risk Adjusted Monthly Wage of an Unskilled Seaman)	
Observations	10,723		10,390	
F	1434.0		1447.2	
Adj r^2	.483		.494	
Dep. mean	$7.95		$7.33	
Intercept	+10.237	*	+11.038	*
Time	+.0847	*	+.0538	*
Financial Risk	+.00247	*	+.00230	*
(Voyage Length)^2	-.00348	*	-.00383	*
"Time At Sea" Risk	-.00433		-.0471	*
Hunting Ground				
Atlantic	-5.747	*	-5.860	*
Indian	-1.867	*	-2.111	*
W. Arctic	+.811	*	+.00876	

* significant at the .0001 level

Sources: see text.

TABLE 14
CREW & VOYAGE CHARACTERISTICS, ALL GROUNDS
NEW BEDFORD VESSELS, 1840-58, 1866

	----FRACTION-----				----RELATIVES: 1840 = 1.000----			
		--IN CREW--		AMONG SEAMEN		--IN CREW--		AMONG SEAMEN
Year	Productivity Index	Who Are Illiterate	Who Are Unskilled	Who Are Unskilled	Productivity Index	Who Are Illiterate	Who Are Unskilled	Who Are Unskilled
1840	0.976	0.211	0.292	0.528	1.000	1.000	1.000	1.000
1841	0.914	0.192	0.308	0.565	0.936	0.910	1.055	1.070
1842	1.101	0.201	0.324	0.607	1.128	0.953	1.110	1.150
1843	0.924	0.190	0.292	0.546	0.947	0.900	1.000	1.034
1844	0.899	0.220	0.335	0.631	0.921	1.043	1.147	1.195
1845	0.818	0.217	0.355	0.660	0.838	1.028	1.216	1.250
1846	0.874	0.226	0.354	0.661	0.895	1.071	1.212	1.252
1847	0.716	0.236	0.355	0.658	0.734	1.118	1.216	1.246
1848	0.916	0.253	0.343	0.654	0.939	1.199	1.175	1.239
1849	0.789	0.235	0.360	0.674	0.808	1.114	1.233	1.277
1850	0.864	0.233	0.387	0.725	0.885	1.104	1.325	1.373
1851	0.698	0.235	0.390	0.710	0.715	1.114	1.336	1.345
1852	0.413	0.223	0.396	0.726	0.423	1.057	1.356	1.375
1853	0.622	0.221	0.394	0.730	0.637	1.047	1.349	1.383
1854	0.639	0.275	0.406	0.751	0.655	1.303	1.390	1.422
1855	0.512	0.247	0.430	0.779	0.525	1.171	1.473	1.475
1856	0.603	0.265	0.426	0.773	0.618	1.256	1.459	1.464
1857	0.635	0.280	0.359	0.664	0.651	1.327	1.229	1.258
1858	0.416	0.238	0.381	0.692	0.426	1.128	1.305	1.311
1866	0.557	0.277	0.312	0.559	0.571	1.313	1.068	1.059
AVG.	0.744	0.234	0.360	0.665	0.763	1.108	1.233	1.259
AVERAGE (1) IS 1840 TO 1843 AND AVERAGE (2) IS 1855 TO 1858								
AVG.(1)	0.979	0.199	0.304	0.562	1.003	0.941	1.041	1.063
AVG.(2)	0.542	0.258	0.399	0.727	0.555	1.220	1.366	1.377
PERCENT CHANGE	-0.447	0.297	0.313	0.295	-0.447	0.297	0.313	0.295

Sources: see text.

TABLE 15a
ANALYSIS OF PRODUCTIVITY IN NEW BEDFORD WHALING

Obs.:	2,343 voyages	991 voyages	991 voyages	991 voyages
F	103.1	64.7	62.2	59.4
Adj. R^2	.478	.562	.553	.565
Dep Mean	.733	.690	.691	.691
	(1)	(2)	(3)	(4)

Variable	Para	Prob	Para	Prob	Para	Prob	Para	Prob
Intercept	2.2	*	2.4	*	1.3*	2.4*		
Vessel type:								
ships vs. all other:	0.11	*	0.06		0.07	***	0.06	
Hunting Ground								
Atlantic	-0.15	*	-0.40	*	-0.35	*	-0.39	*
Indian	-0.06	*	-0.12	**	-0.12	**	-0.13	**
W. Arctic	0.17	*	0.15	***	0.09		0.13	**
Time	-0.0004		0.002		-0.007		0.002	
Blt for fit	-0.30		0.03		0.04		0.02	
Re-rigged	0.09	*	-0.19	***	-0.19	***	-0.19	***
Whale stocks:								
Baleen	0.11	*	0.05		0.004	0.04		
Sperm	0.05		0.25		0.50		0.23	
Crowding on Hunting Ground	-0.004		-0.01	***	-0.02	**	-0.02	**
Technology	0.31	*						
Vessel size	0.000002	*	0.000002	*	0.000002	*	0.000002:*	
Voyage Length	-0.0003	*	-0.0003	*	-0.0003	*	-0.0003	*
Vessel Age	0.004	*	0.006		0.007		0.004	
Vessel Age Sq.	-0.00009	*	-0.0001		-0.0001		-0.00008	
Last Voyage	-0.08	*	-0.06	***	-0.05		-0.05	
Real Common Wage:	-0.006	*	-0.012	*			-0.013	*
Ratio, Skilled Wage to Unskilled Wage	-0.57	*	-0.27				-0.38	
% Illiterate					0.001		0.002	
% Unskilled					0.001		0.002	**
Spec:								
in Baleens	-0.095	*	-0.05		-0.047		-0.05	
in Sperms	-0.70	*	-0.71	*	-0.74	*	-0.74	*
Measure Dummy	-0.03		0.14		-0.11		0.17	

Notes:
*: significant at the 1% level
**: significant at the 5% level
***: significant at the 10% level

TABLE 15b
ANALYSIS OF PRODUCTIVITY IN NEW BEDFORD WHALING

Obs.:	2,343 voyages	991 voyages	991 voyages	991 voyages
F	103.1	61.9	59.3	57.1
Adj. R^2	.478	.563	.553	.566
Dep Mean	.733	.691	.691	.691
	(1)	(2)	(3)	(4)

Variable	Para	Prob	Para	Prob	Para	Prob	Para	Prob
Intercept	2.2	*	2.3	*	1.2*	2.3*		
Vessel type:								
ships vs. all other:	0.11	*	0.07	***	0.07	***	0.07	***
Hunting Ground								
Atlantic	-0.15	*	-0.41	*	-0.36	*	-0.41	*
Indian	-0.06	*	-0.13	**	-0.12	**	-0.13	**
W. Arctic	0.17	*	0.12	***	0.09		0.13	**
Time	-0.0004		0.0005		-0.008	***	0.00004	
Blt for fit	-0.30		0.03		0.04		0.02	
Re-rigged	0.09	*	-0.20	***	-0.19	***	-0.19	***
Whale stocks:								
Baleen	0.11	*	0.05		0.004	0.04		
Sperm	0.05		0.19		0.50		0.21	
Crowding on Hunting Ground	-0.004		-0.01	***	-0.02	*	-0.01	**
Technology	0.31	*						
Vessel size	0.000002	*	0.000002	*	0.000002	*	0.000002:*	
Voyage Length	-0.0003	*	-0.0003	*	-0.0003	*	-0.0003	*
Vessel Age	0.004	*	0.006		0.008	***	0.005	
Vessel Age Sq.	-0.00009	*	-0.0001		-0.0001	***	-0.00009	
Last Voyage	-0.08	*	-0.06	***	-0.05		-0.06	***
Real Common Wage:	-0.006	*	-0.013	*			-0.014	*
Ratio, Skilled Wage to Unskilled Wage	-0.57	*	-0.31				-0.43	
% Illiterate					0.002		0.002	***
% Unskilled					0.001		0.001	*
Spec:								
in Baleens	-0.095	*	-0.048		-0.048		-0.047	
in Sperms	-0.70	*	-0.75	*	-0.74	*	-0.74	*
Captain's Lay			3.17	***	1.75		3.49	***
Measure Dummy	-0.03		0.14		-0.11		0.17	

Notes: *: significant at the 1% level
**: significant at the 5% level
***: significant at the 10% level

TABLE 16
AVERAGE NUMBER OF CREWMEN PER VOYAGE, BY OCCUPATION
NEW BEDFORD VESSELS, 1840 THRU 1843 VS. 1855 THRU 1858

		PROFESSIONALS					SEMI-	UN-			
		SKILLED			TOTAL	SKILLED	SKILLED	SKILLED			TOTAL
YEAR	OFFICERS	MARITIME	ARTISANS	SERVICE	PROF.	SEAMEN	SEAMEN	SEAMEN	BOYS	UNKNOWN	CREW
1840	4.00	3.60	1.87	1.93	11.40	3.13	3.80	8.20	0.80	0.07	27.40
1841	3.71	3.04	1.84	1.84	10.42	2.38	3.69	7.76	0.56	0.02	24.84
1842	3.69	3.00	1.91	1.91	10.52	2.74	2.55	8.55	0.52	0.14	25.02
1843	3.96	3.46	2.08	2.04	11.54	3.31	3.50	8.04	0.62	0.00	27.00
AVG.	3.80	3.19	1.93	1.93	10.86	2.83	3.28	8.13	0.58	0.06	25.73
1855	4.12	3.38	2.04	1.88	11.42	1.68	1.78	12.39	0.59	0.00	27.86
1856	4.21	3.47	1.88	2.05	11.60	1.82	1.59	12.44	0.70	0.01	28.16
1857	4.26	3.68	2.19	2.01	12.15	2.39	2.76	10.38	0.56	0.00	28.24
1858	4.16	3.60	1.70	2.00	11.46	1.60	3.20	10.98	0.68	0.00	27.92
AVG.	4.19	3.52	1.97	1.99	11.67	1.89	2.26	11.60	0.63	0.00	28.06
CHNG.	0.39	0.33	0.04	0.06	0.82	-0.94	-1.02	3.47	0.04	-0.05	2.32
%CHNG.	0.103	0.103	0.021	0.030	0.075	-0.331	-0.312	0.427	0.077	-0.933	0.090

Sources: see text.

TABLE 17
SKILL COMPOSITION OF A TYPICAL CREW, NEW BEDFORD VESSELS
1840 THRU 1843 VS. 1855 THRU 1858

		FRACTION OF CREW WHO ARE									
		SKILLED			TOTAL	SKILLED	SEMI-SKILLED	UN-SKILLED			TOTAL ALL
YEAR	OFFICERS	MARITIME	ARTISANS	SERVICE	PROF.	SEAMEN	SEAMEN	SEAMEN	BOYS	UNKNOWN	CREW
1840	0.146	0.131	0.068	0.070	0.416	0.114	0.139	0.299	0.029	0.002	1.000
1841	0.149	0.122	0.074	0.074	0.419	0.096	0.149	0.313	0.023	0.001	1.000
1842	0.147	0.120	0.076	0.076	0.420	0.110	0.102	0.342	0.021	0.006	1.000
1843	0.147	0.128	0.077	0.076	0.427	0.123	0.130	0.298	0.023	0.000	1.000
AVG.	0.147	0.125	0.074	0.074	0.422	0.110	0.127	0.316	0.023	0.002	1.000
1855	0.148	0.121	0.73	0.67	0.410	0.060	0.064	0.445	0.021	0.000	1.000
1856	0.150	0.123	0.067	0.073	0.412	0.065	0.056	0.442	0.025	0.000	1.000
1857	0.151	0.130	0.076	0.071	0.430	0.085	0.098	0.367	0.020	0.000	1.000
1858	0.149	0.129	0.061	0.072	0.410	0.057	0.115	0.393	0.024	0.000	1.000
AVG.	0.150	0.126	0.069	0.071	0.416	0.067	0.080	0.414	0.022	0.000	1.000
CHNG.	0.003	0.001	-0.005	-0.003	-0.006	-0.042	-0.047	0.097	-0.000	-0.002	0.000
%CHNG.	0.020	0.008	-0.068	-0.041	-0.014	-0.0386	-0.369	0.308	-0.012	-0.939	0.000

Sources: see text.

TABLE 18
LABOR'S SHARE OF THE NET VALUE OF THE CATCH, ALL GROUNDS
NEW BEDFORD VOYAGES, 1840-58, 1866

	PERCENTAGE			RELATIVES: 1840 = 100 -		
	AVERAGE LABOR	MAXIMUM LABOR	MINIMUM LABOR	AVERAGE LABOR	MAXIMUM LABOR	MINIMUM LABOR
YEAR	SHARE	SHARE	SHARE	SHARE	SHARE	SHARE
1840	0.309	0.340	0.281	1.000	1.000	1.000
1841	0.309	0.380	0.269	1.000	1.118	0.957
1842	0.315	0.375	0.261	1.019	1.103	0.929
1843	0.317	0.359	0.287	1.026	1.056	1.021
1844	0.317	0.388	0.265	1.026	1.141	0.943
1845	0.320	0.372	0.283	1.036	1.094	1.007
1846	0.318	0.371	0.282	1.029	1.091	1.004
1847	0.317	0.363	0.270	1.026	1.068	0.961
1848	0.317	0.352	0.263	1.026	1.035	0.936
1849	0.318	0.363	0.278	1.029	1.068	0.989
1850	0.333	0.383	0.290	1.078	1.126	1.032
1851	0.344	0.423	0.287	1.113	1.244	1.021
1852	0.344	0.386	0.299	1.113	1.135	1.064
1853	0.345	0.422	0.286	1.117	1.241	1.018
1854	0.347	0.427	0.296	1.123	1.256	1.053
1855	0.359	0.461	0.301	1.162	1.356	1.071
1856	0.362	0.433	0.309	1.172	1.274	1.100
1857	0.362	0.429	0.306	1.172	1.262	1.089
1858	0.350	0.383	0.295	1.133	1.126	1.050
1866	0.344	0.383	0.282	1.113	1.126	1.004
AVERAGE	0.332	0.390	0.285	1.076	1.146	1.012
MAXIMUM	0.362	0.461	0.309	1.172	1.356	1.100
MINIMUM	0.309	0.340	0.261	1.000	1.000	0.929
AVERAGE (1) IS 1840-1843 AND AVERAGE (2) IS 1855-1858						
AVG. (1)	0.313	0.364	0.275	1.011	1.069	0.977
AVG. (2)	0.358	0.427	0.303	1.159	1.254	1.077
%CHANGE	0.146	0.173	0.103	0.146	0.173	0.103

Sources: see text.

APPENDIX: ALTERNATIVE WAGE MEASURES

The wage estimates reported in Table 7 (Own Vessel) reflect the earnings that the whaleman would have received from his lay share had he returned on the vessel on which he departed. An alternative measure, Own Ground, is based on the average catch of all vessels sailing to a particular ground in the year that the crewman put to sea, and it provides another measure of realized expectations. Although orders were sometimes changed, most agents had chosen the general area to be hunted before the crew was signed. Moreover, from the agent's point of view, the Own Ground figure might be viewed as an estimate of the potential labor cost of a voyage.

While there is evidence to support the belief that New Bedford residents knew something about the current productivity of each of the various grounds, to the extent that these wage estimates can be viewed as relevant information for *ex ante* decisions, the Own Vessel *and* the Own Ground estimates implicitly assume that both agent and crewman were able to accurately assess the potential future productivity of each ground. For agents, who appear to have been continually in contact with their captains and with merchants throughout the world, this assumption may not overly distort reality; but for crewmen that conclusion is much less obviously correct. In an attempt to capture the information that would have been available to a seaman (or to an agent) before the 'signing,' a third estimate, Own Year, was calculated. It is based on the average catch of vessels *returning to* New Bedford from the marked ground in the year the crewman sailed to that ground. It appears reasonable to assume that this evidence must have formed a substantial part of the basis for the expectations of crewmen and agents, and, therefore, a wage estimate based on it may be the best *ex ante* estimate available. The interground wage regressions reported in Table 13 are based on the Own Year estimates.

APPENDIX TABLE 1A
DESCRIPTION OF DATA, NEW BEDFORD VESSELS
1840-58, 1866

NUMBER OF VOYAGES

YEAR	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W.ARCTIC	MIXED
1840	15	2	2	11	0	0
1841	55	8	13	34	0	0
1842	58	8	25	25	0	0
1843	52	2	15	31	0	4
1844	70	1	22	42	0	5
1845	53	3	14	28	0	8
1846	59	2	15	35	0	7
1847	59	0	14	38	0	7
1848	56	1	8	43	0	4
1849	57	2	15	37	2	1
1850	67	2	5	41	18	1
1851	117	11	10	63	30	3
1852	63	8	8	38	8	1
1853	86	7	7	54	17	1
1854	84	6	12	44	20	2
1855	74	9	8	43	10	4
1856	73	4	5	44	12	8
1857	73	3	9	42	16	3
1858	50	3	6	28	12	1
1866	37	15	3	13	5	1
Average:	63	5	11	37	8	3
Total:	1258	97	216	734	150	61

Sources: see text.

APPENDIX TABLE 1B
DESCRIPTION OF DATA, NEW BEDFORD VESSELS
1840-58, 1866

NUMBER OF CREW CONTRACTS

YEAR	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W.ARCTIC	MIXED
1840	413	48	60	305	0	0
1841	1428	182	329	917	0	0
1842	1520	175	664	681	0	0
1843	1476	58	409	903	0	106
1844	1958	29	560	1229	0	140
1845	1590	60	429	838	0	263
1846	1699	38	388	1076	0	197
1847	1715	0	365	1150	0	200
1848	1655	24	214	1289	0	128
1849	1601	52	403	1062	60	24
1850	1920	39	117	1206	535	23
1851	3558	264	278	1958	976	82
1852	1825	186	231	1144	241	23
1853	2548	164	180	1631	533	40
1854	2393	140	296	1275	623	59
1855	2251	252	232	1302	337	128
1856	2231	102	144	1388	380	217
1857	2219	77	269	1291	494	88
1858	1521	87	162	847	394	31
1866	1119	413	87	419	167	33
Average:	1832	120	291	1096	237	89
Total:	36640	2390	5817	21911	4740	1782

Sources: see text.

APPENDIX TABLE 1C
DESCRIPTION OF DATA, NEW BEDFORD VESSELS, 1840-58, 1866

	Average Value of Catch Per Voyage *Current $'s*					Average Voyage Length *Months*				
YEAR	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC	ALL GROUNDS	ATLANTIC	INDIAN	PACIFIC	W. ARCTIC
1840	47984	22596	45659	53023		33	20	28	36	
1841	39640	19752	29733	48107		34	22	29	39	
1842	35327	12015	36023	42090		29	16	25	37	
1843	42487	36778	34435	47268		33	20	29	37	
1844	38201	17713	30098	42809		35	29	30	38	
1845	38089	14452	37310	41177		34	33	33	34	
1846	46316	14824	36253	53764		34	19	35	36	
1847	50145		38780	53928		39		39	39	
1848	57930	58587	42690	60652		34	17	27	36	
1849	53326	37124	46066	55849	60080	36	24	37	36	21
1850	56260	6160	38825	58323	62904	36	18	29	38	36
1851	61138	22028	55502	65952	71179	36	27	35	39	36
1852	58581	17569	66300	63813	69038	37	20	36	41	38
1853	67246	27058	30653	75633	69567	39	30	39	41	37
1854	55834	22897	40942	58953	66073	37	22	36	39	40
1855	54577	41330	49013	57150	69760	41	31	36	43	42
1856	55287	13434	51260	62693	58356	41	17	43	44	40
1857	53833	22077	39254	57611	61522	44	30	38	46	46
1858	67767	51534	38276	67892	89832	46	41	44	48	46
1866	65047	40229	57540	83514	85324	37	22	44	47	49

Sources: see text.