ANOTHER LOOK AT INDUSTRY AND AGRICULTURAL WAGE DIFFERENTIALS 1800-1830

Jeffrey F. Zabler
Wheaton College

In a recent article Nathan Rosenberg and Don Adams[1] have stressed the importance of wage differences in explaining inter-sectoral and intra-sectoral labor force shifts. The purpose of this study is to delve further into this matter with regard to the American economy and attempt to shed some light on the following questions: (1) What was the magnitude of the skilled-unskilled industrial wage, and how did it vary in the 1800-1930 period? (2) What was the relation of the skilled-unskilled differential to the general industrial wage rate, and how did this vary throughout the period? (3) What was the sectoral wage differential between farm labor and the alternative, unskilled industrial labor, throughout this period? (4) What possible effect would this sectoral wage differential have had on inter-sectoral shifts in the labor force? (5) How did wage differentials in the United States compare with wage differentials in Great Britain?

To accomplish this purpose, I have used manuscript data on wages for a variety of iron producing firms in eastern Pennsylvania for the 1800-1830 period. Also, I have used data on wages paid to farm laborers in this area.[2] This, of course, localizes the industrial wage data to the iron industry, as well as to region. There is no reason to suppose that wages would be significantly different in similar industries, especially since the skilled labor in the task-groups used is of the artisan type and since unskilled and agricultural labor are fairly homogeneous. It also must be noted that, with the possible exception of the clerk (skilled) and housekeeper (unskilled), none of the workers received non-monetary compensation such as free room and board, and none of the workers were party to profit-sharing arrangements, either of which would prejudice the results.[3] In this case the clerk and housekeeper would cancel one another, should it be assumed they did receive such compensation, since one is skilled and the other unskilled.

The tasks in the sample have been chosen for which the best and most complete data are available. They are presented in Tables I and II. As can be seen in Table III column A, the skilled-unskilled wage differential in industry rose fairly

TABLE I

SKILLED MONTHLY WAGE

	Clerk	Keeper	Carpenter	Smith	Miller	Collier
1800	16.70	14.00	14.00	11.85	12.25	18.60
1801	19.40	14.00	9.25	14.65	13.33	18.00
1802	20.00	16.67	18.98	14.65	17.75	18.00
1803	19.40	18.66	14.82	14.45	14.42	18.50
1804	22.20	20.00	13.66	14.45	16.67	19.00
1805	26.20	16.00	15.00	14.45	17.75	20.00
1806	22.20	14.00	16.00	14.45	16.67	20.00
1807	16.70	13.33	16.00	14.45	16.70	20.00
1808	22.20	19.00	(16.90)	13.00	20.00	21.00
1809	22.20	19.00	17.80	14.45	20.00	19.50
1810	22.20	20.00	17.25	14.45	20.00	16.00
1811	22.20	(20.00)	17.75	14.45	17.25	20.00
1812	22.20	20.00	15.30	14.45	14.42	20.33
1813	22.20	(18.75)	16.00	15.00	14.42	(21.10)
1814	19.40	(17.50)	26.00	16.10	14.42	21.90
1815	(17.75)	(16.25)	16.00	16.70	14.42	23.25
1816	(16.08)	15.00	18.00	16.70	14.42	22.65
1817	14.45	16.50	16.70	16.70	14.42	21.00
1818	16.70	15.00	16.70	16.70	14.42	23.00
1819	16.33	(15.75)	16.70	16.70	16.67	(21.80)
1820	16.00	(16.50)	(15.94)	(16.05)	16.08	(20.60)
1821	15.67	(17.25)	(15.17)	(15.50)	15.42	(19.40)
1822	15.33	18.00	14.40	(14.90)	14.83	(18.20)
1823	15.00	(17.33)	15.00	14.45	14.17	17.00
1824	16.70	(16.66)	15.00	14.45	15.00	(17.00)
1825	16.70	16.00	15.00	14.45	15.00	17.00
1826	16.70	17.50	15.00	14.45	15.00	17.00
1827	16.70	19.00	14.50	14.45	15.00	17.20
1828	16.70	(18.25)	14.50	14.45	15.00	17.00
1829	20.83	17.50	14.50	14.45	15.00	17.00
1830	20.83	14.00	15.00	15.00	15.00	17.00

Sources: Hopewell Forge Cashbook 1803-08; Hopewell Forge Daybook 1803-17; Hopewell Forge Cashbook 1808-13; Mount Vernon Furnace Cashbook 1800-01; Hopewell Furnace Daybook 1800-1803, 1804-06; Hopewell Furnace Journal 1806-08; Mount Hope Furnace Journal 1800-1818; Reading Furnace Time Book 1824-29; Reading Furnace Daybooks 1801-03, 1803-06, 1806-08; Reading Furnace Cashbook 1808-13, 1813-22; Colebrook Furnace Blotter 1812; Cornwall Furnace Daybook 1804-22, 1823-30, 1798-1804; Colebrook Furnace Journal 1802-08.

TABLE II

UNSKILLED MONTHLY WAGE

	Filler	Laborer	Housekeeper	Teamster	Woodcutter	Banksman
1800	16.30	9.33	8.90	11.90	17.68	13.33
1801	15.00	10.00	8.90	12.20	17.68	13.33
1802	16.00	8.00	8.90	12.20	18.20	13.33
1803	16.30	10.00	8.90	12.20	17.16	13.33
1804	19.00	10.00	8.90	(12.45)	18.72	9.00
1805	16.30	9.00	8.90	(12.75)	17.16	13.30
1806	17.33	12.50	8.90	13.00	17.68	14.67
1807	17.00	12.25	8.90	13.00	19.24	10.00
1808	16.30	12.00	8.90	13.33	18.20	13.33
1809	17.00	10.00	8.90	13.00	(17.68)	13.33
1810	18.66	(9.75)	8.90	12.00	17.16	(13.33)
1811	18.66	9.50	8.90	12.70	17.16	13.33
1812	17.33	(10.67)	8.90	13.33	18.72	13.33
1813	17.33	(11.94)	8.90	13.00	18.20	14.67
1814	18.66	(13.11)	9.80	12.66	21.84	(15.10)
1815	(18.66)	(14.28)	8.90	15.40	24.44	(15.55)
1816	18.66	15.33	10.56	15.40	24.44	16.00
1817	18.66	11.00	8.90	14.66	20.80	16.00
1818	(18.00)	15.00	10.00	16.00	(20.28)	(16.00)
1819	(17.33)	12.50	8.90	16.00	19.76	16.00
1820	(16.67)	(12.38)	(8.80)	16.00	19.76	(15.33)
1821	16.00	(12.25)	(8.90)	(15.10)	15.60	(14.66)
1822	16.00	(12.12)	(8.90)	(14.20)	15.08	14.00
1823	16.00	12.00	(8.90)	13.33	14.56	(14.00)
1824	16.00	12.00	(8.90)	(13.33)	15.60	14.00
1825	16.00	12.00	(8.90)	(13.33)	14.56	14.00
1826	16.00	12.00	(8.90)	13.33	13.00	14.00
1827	16.00	12.00	(8.90)	13.33	13.00	14.00
1828	14.00	12.00	(8.75)	13.33	13.00	14.00
1829	16.00	13.00	(8.60)	13.33	13.00	14.00
1830	15.50	13.00	(8.50)	13.33	13.00	14.00

Sources: See Sources Table I

consistently from 1800-1805 after a sharp rise, dropped precipitously in 1806, and then nearly doubled in 1808. Between 1808 and 1811 the differential remained quite stable, only to fall rather sharply in 1812, and even more drastically in 1815 with the end of the War of 1812. The wage differences remained low until the sharp rise in 1819, stabilizing for awhile, then gradually tending upward after 1826. The figures in columns B, C, and D follow the same paths.

These movements bear consideration in the light of general trends in the economy as a whole and of the iron industry in this area as well. Until the Embargo of 1808 the general economy experienced a boom, led by the prosperous neutralist trade with the European beligerants.[4] The iron industry, fairly hard-pressed in these years, was relieved of foreign competition by the Embargo which ushered in a period of prosperity.[5] During this period the wage differential rose; unskilled wages did not rise significantly for most of this period (Table II); however, skilled wages registered a sharp gain in 1802 (Table I) and maintained it for these years. This indicates that skilled labor became rather scarce, perhaps attracted to urban areas or other pursuits, thus pushing up the skilled wage to the disadvantage of the common laborer. They certainly did not move into agriculture (Table IV B). The effect of this move on the wage bill as a whole is shown in Table III columns C and D. In any case, they exited the rather hard-pressed and unprotected iron industry.

In 1806-1807 the differential dropped sharply (Table III D); however, skilled wages did not decline as far as unskilled wages rose. Thus unskilled wages caught up in this period indicating the influence of skilled on unskilled wages.

With the Embargo in 1808 the differential jumped sharply as did skilled wages; unskilled wages trailed behind. At this time the general economy entered a decline which lasted until the termination of hostilities in 1814.[6] The iron industry, on the other hand, began to prosper under the protection afforded by the Embargo. To 1811, the jump in the differential is explained wholly by the rise in skilled wages. The drop after that date is due to a combination of moderate declines in the skilled wage and more significant rises in the unskilled wage which last until 1816.

These movements indicate that the labor scarcity and high wages of the earlier period drew increasing numbers into industry, which in the case of iron was prospering, and that

TABLE III
SKILLED-UNSKILLED WAGE MOVEMENTS

	(A) Σ skilled w $-\Sigma$ unskilled w (dollars)	(B) Skilled-Unskilled w Differential (A) as % Unskilled w	(C) Skilled-Unskilled w Differential as % of Wage Bill	(D) % Δ in Col. C	(E) U.S. Skilled margin over Unskilled as % of Unskilled (Adams)	(F) G.B. Skilled margin over Unskilled as % of Unskilled (Adams)
1800	9.96	12.86	6.04	15.06	64	43
1801	11.52	14.94	6.95	131.65	55	--
1802	29.42	38.39	16.10	-22.04	75	--
1803	22.36	28.71	12.55	20.80	91	--
1804	27.91	35.75	15.16	12.93	60	--
1805	31.99	41.33	17.12	-40.01	57	111
1806	19.24	22.88	10.27	-7.89	66	34
1807	16.79	20.89	9.46	63.53	68	--
1808	30.04	36.61	15.47	10.73	91	--
1809	33.04	41.35	17.13	-7.36	56	54
1810	30.10	37.72	15.87	3.09	72	--
1811	31.40	39.13	16.36	-21.03	77	49
1812	24.42	29.68	12.92	-5.34	58	--
1813	23.43	27.88	12.23	-3.19	52	--
1814	24.15	26.49	11.84	-70.10	63	--
1815	7.14	7.34	3.54	-65.82	91	--
1816	2.46	2.45	1.21	324.79	89	--
1817	9.75	10.83	5.14	-28.79	71	56
1818	7.24	7.60	3.66	89.07	86	--
1819	13.46	14.87	6.92	-7.80	63	--
1820	12.13	13.62	6.38	37.77	--	--
1821	15.90	19.27	8.79	-0.68	83	54
1822	15.36	19.13	8.73	-5.50	120	56
1823	14.16	17.97	8.25	4.00	47	--
1824	14.98	18.76	8.58	3.50	55	52
1825	15.36	19.49	8.88	19.93	74	52
1826	18.42	23.85	10.65	5.82	70	--
1827	19.62	25.40	11.27	8.07	73	--
1828	20.82	27.73	12.18	-1.07	74	61
1829	21.35	27.40	12.05	-7.05	80	59
1830	19.50	25.22	11.20		73	58

Sources: Columns A-D based on Tables I and II. Columns E and F: Don Adams, "Some Evidence on English and American Wages, 1790-1830," Journal of Economic History XXX, p. 504.

TABLE IV
SECTORAL WAGE MOVEMENTS

	(A) Mean Unskilled Wage (dollars)	(B) Mean Farm Labor Wage (dollars)*	(C) Unskilled-Farm Wage Differential (Absolute value) (dollars)	(D) Wage Differential as % of Farm w $\frac{A-B}{B}$	(E) Wage Differential as % of Unskilled $\frac{B-A}{A}$	(F) Shift Motivation Factor to move to or stay in Agriculture (E-D)
1800	12.90	17.33	4.42	-25.52	34.26	59.78
1801	12.85	15.00	2.15	-14.32	16.73	31.05
1802	12.77	(14.60)	1.83	-12.52	14.33	26.85
1803	12.98	(14.20)	1.23	-8.57	9.48	18.05
1804	13.01	(13.80)	0.79	-5.71	6.07	11.78
1805	12.90	(13.40)	0.50	-3.72	3.88	7.60
1806	14.01	13.00	1.01	7.79	-7.21	-15.00
1807	13.40	(14.22)	0.82	-5.77	6.12	11.89
1808	13.68	(15.44)	1.76	-11.42	12.87	24.29
1809	13.32	(16.66)	3.34	-20.06	25.08	45.14
1810	13.30	(17.88)	4.58	-25.62	34.44	60.06
1811	13.38	(19.10)	5.73	-29.97	42.83	72.80
1812	13.71	20.33	6.62	-32.55	48.29	80.84
1813	14.00	(18.88)	4.87	-25.81	34.79	60.60
1814	15.20	(17.44)	2.25	-12.87	14.80	27.67
1815	16.20	16.00	0.20	1.28	-1.23	-2.51
1816	16.73	16.00	0.73	4.57	-4.36	-8.93
1817	15.00	16.00	1.00	-6.23	6.66	12.89
1818	15.88	16.00	0.12	-0.75	0.76	1.51
1819	15.08	16.00	0.92	-5.74	6.10	11.84
1820	14.84	(15.38)	0.54	-3.51	3.64	7.15
1821	13.75	(14.74)	0.99	-6.70	7.20	13.09
1822	13.38	(14.12)	0.74	-5.22	5.53	10.75
1823	13.13	13.50	0.37	-2.73	2.82	5.55
1824	13.31	13.50	0.19	-1.44	1.43	2.87
1825	13.13	13.50	0.37	-2.73	2.82	5.55
1826	12.87	13.50	0.63	-4.65	4.90	9.55
1827	12.87	(13.50)	0.63	-4.65	4.90	9.55
1828	12.51	(13.50)	0.99	-7.30	7.91	15.21
1829	12.93	(13.50)	0.56	-4.16	4.33	8.49
1830	12.88	(13.50)	0.61	-4.53	4.74	9.27

* Parenthesized figures are interpolated.

Source: Tables I and II.

the relative over-abundance of unskilled labor was declining, perhaps due to the War, as indicated by rising unskilled wages. This last point seems to be supported by the fact that the iron industry paid premium prices for unskilled labor in 1816, even though it was being pressed harder due to renewed foreign competition; skilled wages already had begun to decline. It is also noteworthy that the rise in unskilled wages at the end of the War coincided with a declining farm labor wage, which previously had been rising, pointing to a probable sectoral shift from industry to agriculture by unskilled labor. Skilled labor, on the other hand, was beginning to trickle back from whence they had gone in the earlier period, thereby depressing skilled wages.

The post-war depression lasted until 1819,[7] and for the iron industry until 1822. The wage differential sharply declined after the War, but doubled in 1819. Skilled wages also dropped significantly in 1815, remaining stable to 1819. Unskilled wages lagged behind and dropped in 1817; their decline continued steadily until 1829. In relative terms the drop for unskilled wages in 1817 was significantly greater (Table III D).

The upturn for the general economy is mirrored in the sharp rise in the differential in 1819 due to slightly upward-tending skilled and more steeply-declining unskilled wages. The relative stability in the skilled wage in the 1815-1820 period and the decline thereafter indicates that unlike earlier periods, skilled workers did not exit from industry when the rest of the economy was booming, except if the depressed state of industry was rather severe. Even in these cases the movement of skilled workers was not significant, if the small wage increases are any indication. This would tend to support the notion that this was the period when a permanent skilled industrial labor force was developing. It should also be noted that the decline in unskilled wages was proceeding at about the same pace as skilled wages, resulting in the fairly stable wage differential of the 1820's. Agricultural wages were even more stable in that decade indicating that there was probably very little movement, if any, from industry to agriculture, except for a brief dip in industrial prosperity at the end of the decade.

The next point to consider concerns the relation of the American experience to that of the British. Don Adams has done work in this area in an effort to re-evaluate the Habakkuk hypothesis that skilled labor was less expensive relative to unskilled labor in the U.S. than in Britain, and this resulted

in lower wage differentials in this country.[8] His figures are presented in Table III columns E and F and he summarizes his findings as follows:

> The figures show that there was little difference between the skilled-unskilled differentials in the two countries. . . Thus, far from supporting the hypothesis that skilled workers in the United States were relatively less expensive than their British counterparts, the series indicate that there was little difference between the two countries in this respect. Indeed, the difference that did exist indicates a higher skilled-unskilled differential in the United States than in Britain.[9]

A comparison of columns B and E of Table III, however, cast some doubt on the intrinsic value of this observation. Not only do the differentials not match closely in magnitude, but they do not move coincidently. The movements of the differentials derived from this study and Adams' estimates for Britain do, however, move quite closely, and the magnitudes support, at least in spirit, Habakkuk's general hypothesis. The arguments which Habakkuk puts forward conveniently support this matching of differentials.[10]

Professor Adams goes on to note that:

> Furthermore, there is no indication that the differential in either country changed over time. The average of column 1 [British] for the decade 1790-1799 is 52 per cent, and for the decade 1820-1829 the ratio is 56 percent. In the United States the differential for the decade 1790-1799 was 69 percent, and for 1820-1829 it was 75 percent.[11]

The data presented in this study, however, show that for the 1800-1810 decade the average differential was 30.13 percent; for the 1811-1820 decade, 17.99 percent; and for the 1821-1830 decade, 22.42 percent. As follows from the wage differential figures, this conflicts significantly with Adams' observations in magnitude as well as in consistency for the entire period in that it shows a sharp decline for the 1811-1820 decade, a moderate rise in the following decade, and a general downward trend for the entire period. The average of Adams' data for the British in the 1800-1810 decade is 60.05 percent. This is quite the opposite of the British case, and in terms of magnitude support Habakkuk's hypothesis. Thus if the

British wage differential was dropping slowly from 1800-1830, the American differential was declining at a relatively much faster rate, specifically at a rate of 26 percent as compared with 8 percent in Britain for the period, not to mention the huge dip in the 1811-1820 decade in the U.S.

The contradictions presented here are not to be taken as an indictment of Adams' findings nor as support of Habakkuk's hypothesis in full; however, they do point to the need for more extensive research in this area before any general conclusions can be accepted with reasonable finality. There are a variety of explanations for the apparent contradictory findings and resulting conclusions. The first undoubtedly lies with imperfections in the data. Neither the figures presented here nor in Adams' analysis are as complete as could be desired, nor are they of general applicability. Indeed, the dearth of usable data for this period is a serious limitation. Secondly, there is the possibility of inter-industry differences due to difference in tasks observed, but this does not appear to be greatly significant in that the types of labor involved are roughly comparable.[12]

There is also the possibility that inter-regional differences could lead to conflicting results; however, this also appears to be insignificant in that much of Adams' data comes from the Philadelphia area as does the foregoing wage data. This would seem to indicate that a probable cause may lie in urban-rural differentials. Adams' notes that the rural-urban wage rate was greater in the U.S. than in Britain and was probably declining.[13] The fact that the preceeding data come exclusively from rural industry, while Adams' figures are more heavily based on urban trades, supports this. Nevertheless, it would appear that the magnitude of this influence is greatly underestimated, as is the speed with which this differential declined in the U.S. as settlement moved westward. The preceeding further indicates that a reconsideration of Habakkuk's hypothesis would be worthwhile as more concrete and generally applicable wage data are made available.

This brings us to a consideration of inter-sectoral shifts between agriculture and industry. From the series for mean unskilled industrial wages and for farm workers' wages presented in Table IV columns A and B, it can be seen that the fluctuations in the agricultural series are more smooth and less frequent than for the industrial series. This could be anticipated in that agriculture typified the economy and labor force at large, and, as was the case with iron, was not an

infant industry. For the pre-Embargo period, farm wages were generally rising, in line with prosperity in the general economy. Unskilled industrial wages, on the other hand, declined slightly echoing the more difficult times in the iron industry, but by 1803 they were dragged upward by the more significant rise in skilled wages. Perhaps this indicates an early sectoral shift by unskilled industrial laborers to suitable alternative pursuits in the similarly skilled agricultural sector. This would account for the drop in agricultural wages and the mid-period rise in industrial wages as their numbers began to decline, as well as for the drop in the farm-industry wage differential, (column C).

In the Embargo-War period unskilled wages were fairly stable which indicates that industry was maintaining its unskilled labor force with relative ease since it did not resort to the payment of premium wages. The specific movement of agricultural wages is not clear in the data as the figures are interpolated; they end in a significantly higher wage in 1812 compared to the 1806 wage, then decline steadily thereafter. The 1812 figure may, of course, be a fluke belying the magnitude of the rise, but in any case the 1815-1819 figures indicate that some rise was taking place over the 1806 level. From the unskilled figures, however, it can be implied that shifts were not taking place in the Embargo period, but rather began to be felt towards the end of the War.

Following the War, some shifting evidently did occur as indicated by the sharp rises in the unskilled data, but this trend diminishes shortly thereafter; both series decline throughout the 1820's. Wage differentials also markedly decline after the War and maintain themselves at a fairly low level, indicating that sectoral shifts were much less likely in this period, compared to the former, as industry began to provide a more viable labor market.

The series in column D of Table IV expresses the relative disadvantage (A-B) to the farm worker, in most cases, of moving into industry, usually at a lower wage when expressed as a percent of farm workers' wages. This can be seen as an indication of the motivation for a farmer to move to industry. He will see the usually negative wage differential in the light of his present wage level. Because the differential is smaller relative to his higher wage, he will be less hesitant to move to industry as the differential drops. This was most probably the case for both farmers in later periods and new workers entering the labor market.

The series in column E shows the relative advantage (B-A), in most cases, to the industrial laborer of moving into agriculture at a higher wage; the differential is expressed as a percent of unskilled industrial wages. This also shows the motivation for an industrial laborer to move to agriculture when he sees the differential as relatively large in comparison to his present wages.

Column F combines these two influences into what I have called the "shift motivation factor" to move-to or stay-in agriculture, defined as E-D. As can be seen, the motivation to move-to or stay-in agriculture declines rather dramatically to 1806, on the eve of the Embargo, when a definite shift to industry is indicated. The interpolated farm wage figures in the Embargo-War years may definitively prejudice the results in column F in that there is the possibility that farm wages might have remained low or risen only gradually in the face of sustained industrial wages. This would be especially true if the 1812 farm figure is in fact a fluke. If this were the case, the high motivation to move-to agriculture in these years would have to be discounted considerably, especially in view of the rising industrial wage and declining differential at the end of the War which leads to another definite shift to industry. This would imply a much smaller, perhaps negligible, motivation to move-to or stay-in agriculture during these years, and this is certainly more consistent with reality in view of the relative prosperity iron experienced during the Embargo-War period.

After the War the motivation remains low, although positive. This supports the fact that the iron industry, and perhaps other industry, was once again struggling to refurbish and strengthen itself in the face of foreign competition and a more prosperous economy. The motivation factor is lower than in previous periods and is fairly stable, which can be taken to indicate that industry was becoming a more viable alternative to agriculture in the 1820's, reducing the motivation to move from sector to sector. Nevertheless, industry was still the junior partner of the two.

In summary, the findings show that there is a definite tendency for skilled wage leadership throughout the period. The results also imply a much heavier emphasis to be given to the urban-rural influence on wage differentials, even greater than to skilled-unskilled differentials. The data also suggest that more thought should be given to the Habakkuk hypothesis and its implications in light of the fact that these

data strongly support the notion that American skilled labor was less expensive than British in comparison to their unskilled counterparts. Obviously, more work needs to be done in this area to broaden the sample since conflicting results can be generated depending on the data used.

With regard to sectoral shifts, it has been shown that the possibilities for shifts to industry were far less in the pre-1815 period than after and that the possibility of such shifts generally conform to movements in the economy.[14] It has also been seen that the skilled-unskilled differential was less than the unskilled industrial wage-farm wage differential in the 1802-1810 period and the post-war period, but greater in 1800-1801 and 1811-1813, lending support to the observation about the importance of the rural-urban influence on wages. Finally, the "shift motivation factor" gives, with possible qualifications as noted, an indication as to the strength and probability of motivations to shift sectorally. The fluctuations in magnitude of these inclinations closely follow actual conditions and add a measurable dimension to them.

While these findings are based on quite complete and revealing data, they are in no way final. It is hoped that they will provoke further thought, new empirical research, and continued interest in this area.

Footnotes

[1]Nathan Rosenberg, "Anglo-American Wage Differences in the 1820's," Journal of Economic History XXVIII, p. 221-229; Don Adams, "Wage Rates in the Early National Period: Philadelphia 1785-1830," Journal of Economic History XXVIII, p. 404-426;---------, "Some Evidence on English and American Wage Rates, 1790-1830," Journal of Economic History XXX, p. 499-520.

[2]Hopewell Forge Cashbook 1803-08; Hopewell Forge Daybook 1803-17; Hopewell Forge Cashbook 1808-13; Mount Vernon Furnace Cashbook 1800-01; Hopewell Furance Daybook 1800-1803, 1804-06; Hopewell Furnace Journal 1806-08; Mount Hope Furnace Journal 1800-1818; Reading Furnace Time Book 1824-29; Reading Furnace Daybooks 1801-03, 1803-06, 1806-08; Reading Furnace Cashbook 1808-13, 1813-22; Colebrook Furnace Blotter 1812; Cornwall Furnace Daybook 1804-22, 1823-30, 1798-1804; Colebrook Furnace Journal 1802-08.

[3]Joseph E. Walker, Hopewell Village: A Social and Economic History of an Iron Making Community (Philadelphia--1966) 178, 209-210; J. F. Zabler, "A Microeconomic Study of Iron Manufacture: 1800-1830," (Unpublished Ph.D. dissertation, University of Pennsylvania, 1970) 102-103.

[4]Paul David, "New Light on a Statistical Dark Age: U.S. Real Product Growth Before 1840," Economic History Review 57: 297.

[5]Zabler, Ibid., 220.

[6]David, Ibid.

[7]Ibid. 298.

[8]H. J. Habakkuk, American and British Technology in the Nineteenth Century (Cambridge 1962); Adams, op. cit. 499-504.

[9]Adams, "...Evidence..." op. cit., 503.

[10]Habakkuk, Ibid. 21.

[11]Adams, Ibid.

[12]Adams, "Wage Rates...," op. cit., passim.

[13]Adams, "...Evidence...," op. cit., 511.

[14]David, Ibid., and "The Growth of Real Product in the United States Before 1840: New Evidence, Controlled Conjectures," Journal of Economic History XXVII: 151-195; Stanley Lebergott, "Labor Force and Employment 1800-1860," Output, Employment and Productivity in the United States After 1800, N.B.E.R., Studies in Income and Wealth, v. 30 (New York, 1966), 119.