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THE ANTEBELLUM "SURGE" IN SKILL DIFFERENTIALS ONE MORE TIME: NEW EVIDENCE

Robert A. Margo

Georgia C. Villaflor

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ABSTRACT

Changes in the skill differential are often used by economic historians to proxy changes in income inequality. According to Jeffrey Williamson and Peter Lindert, American skill differentials rose sharply between 1820 and 1860, which they interpret as increasing income inequality. Using a large, new sample of wage rates drawn from military records, we find no evidence of an aggregate "surge" in antebellum skill differentials. We do find, however, that skill differentials on the frontier rose relative to levels in settled areas. We show how a reduction in the costs of migrating from old to new regions can explain this finding.

Robert A. Margo
Department of Economics
University of Pennsylvania
3718 Locust Walk
Philadelphia, PA 19104

Georgia C. Villaflor
Department of Economics
San Diego State University
San Diego, CA

1. INTRODUCTION

The process of economic development often changes the relative returns to different types of labor. The initial expansion of industry through capital deepening may raise the premium attached to certain skills, if capital and skilled labor are relative complements in manufacturing.[1] Jobs in the tertiary sector, which tend to have high wages in the early stages of development, may lose their pay advantage with widespread education, with technological advances that permit the substitution of general for specific human capital, and with the gradual "homogenization" and subdivision of tasks through division of labor.[2] The most important implications of these changes concern the income distribution: under certain conditions, the "stretching" or "compression" of the occupational wage structure leads to increasing or decreasing inequality. If growth follows the typical pattern, the development-inequality nexus looks like an inverted "U": rising inequality followed by decreasing inequality as development progresses.[3] The shape of the inverted-U depends on, among other factors, the supply elasticities of the various types of labor. If, as is generally believed, these elasticities are small initially, the rising portion of the inverted-U may be quite steep and prolonged.

It is no surprise, then, that economic historians have expended much effort in the quest for historical income distribution data. American economic historians, however, are faced with a basic dilemma: there are no income distribution data for the nineteenth century. Lacking such data, scholars have looked for direct evi-

dence on the occupational wage structure, in particular, on skill differentials.

Although its meaning varies greatly across studies, the skill differential is often defined to be the ratio of an index of average "skilled" (e.g. in manufacturing, artisans in the building trades, machinists) to average "unskilled" (e.g. common laborers) daily or monthly wage rates. A rising (or falling) skill differential is then interpreted as evidence of increasing (or decreasing) income inequality.[4] Jeffrey Williamson and Peter Lindert provide the most extensive compilation and analysis of American skill differentials. Based on wage data from the Northeast, they conclude that a "surge" in the skill differential took place between 1820 and 1860. They assert "there is no reason to believe that things were different," elsewhere in the country, so "by inference the economy-wide pay structure must have followed closely the northeastern pay structure during the antebellum episode of "wage-stretching."[5] Since 1820 to 1860 corresponds to the beginnings of U.S. industrial expansion Williamson andLindertidentify these years as theinitially rising portion of the American inverted-U.

Although recent scholarship has mainly questioned Williamson and Lindert's conceptualization of early industrialization as a capital deepening process and their related assumption of capital-skill complementarity, their empirical analysis has not gone unchallenged.[6] Using the same data as Williamson and Lindert, Scott Grosse finds no evidence of antebellum "wage-stretching."[7] He claims that the alleged increase in the skill differential is highly sensitive to the choice of occupations and wage series,

sample composition, temporal level of aggregation, and the base period. Williamson and Lindert reject Grosse's criticisms, and conclude that "[o]nly fresh data from the archives can advance debate on this issue."8

This paper presents new evidence on antebellum skill differentials, based on an extensive micro-level sample of the civilian payroll records of the U.S. Army. The portion of the sample examined in this paper is made up of common laborers, teamsters, and artisans in the building trades hired at various military posts between 1820 and 1856.

The analysis of the payroll records is complicated by their extensive heterogeneity. We use the hedonic regression approach to control for changes in sample composition across space and time. We test for rising skill differentials by seeing if the rate of growth of skilled wages is significantly greater than of unskilled wages. The regression results are discussed in part in Section 3 and reported in full in the appendix.

Our major finding may be stated simply: we find no evidence of an aggregate increase in the skill differential between 1820 and 1856. At a disaggregate level, the skill differential fell over time at Southern forts and in the Northeast. In contrast, the skill differential in the North Central states increased sharply after 1830.

The proximate cause of the rising skill differential on the Northern frontier is a narrowing of interregional differences in unskilled wage rates. As a way of interpreting this finding, Section 4 presents a simple equilibrium model of regional labor markets

with the following characteristic: a reduction in the costs of migrating from old to new areas causes the frontier skill differential to rise relative to the skill differential in settled areas. Biases in our sample and the generalization of our findings to the antebellum population are explored in Section 5. Concluding remarks and suggestions for further research are presented in Section 6.

2. DATA

Civilians were employed at U.S. Army posts throughout the nineteenth century. Quartermasters at the posts were required to file monthly reports documenting civilian pay. An extensive collection of these reports covering the period 1820 to 1856 has been sampled.[9] Aside from size, the distinguishing chararcteristics of this data set are its wide coverage of occupations and locations, and the detail in provides on individual workers. The following information is generally available: date of hire; nominal contract rate of pay (monthly or daily); number of rations, if any; legal status (slave or free, South only); an occupational title, or brief description of the task performed; and occasional supplementary remarks.[10]

All extant reports prior to 1845 are included in the sample. After 1845 the number of posts greatly increased, and retrieval of every report is impossible. Our post-1845 sample design is partly judgmental, emphasizing reports from urban areas, and from parts of the country where total collection is feasible, and simple ran-

dom sampling where it is not. The sample stops at 1856, although we plan to extend it beyond this date. The data base presently contains over 40,000 daily and monthly wage observations.

The number of occupations is well over 1,000. Most had well-defined counterparts in the civilian economy and can be easily classified into a smaller number of broadly defined occupational categories. We restrict our attention in this paper to civilians classified as common laborers, teamsters, and artisans in the building trades (carpenters, masons, painters, and plasterers). We also exclude observations from forts in Florida and Georgia during the Seminole War and from the Southwest and Far Western territories.

Table 1 gives the distribution of the skilled-unskilled subsample by occupational category, fort location, and time period. Slightly more than half of the civilians were hired as common laborers or teamsters. Much of the army's demand for civilian labor involved the construction and repairing of forts, producing the relatively large percentage of skilled artisans. The spatial and temporal distribution of the sample reflects the army's role in pushing the frontier westward, and the expansion of that role after 1830. Thus the sample's geographical distribution differs from that of the antebellum population: the South and frontier areas are over-represented relative to the Northeast. Further, the great majority of hires took place after 1830, although the number of pre-1830 observations is still large.

3. EMPIRICAL ANALYSIS

Earlier research on antebellum skill differentials has relied on simple measures of the central tendency of wage distributions--mean, mode, or mid-range point.[11] Such an approach may work well if the data refer to a single location, or if worker and job characteristics in the sample do not change over time. But these conditions are rarely met (if ever), and thus the earlier research is plauged by a basic difficulty: do the changes in the skill differential over time represent changes in the occupational wage structure, or in the composition of the sample under study?

Our solution to this problem is to base inferences on a series of hedonic wage regressions.[12] The principal advantage of the hedonic approach is that it systematically controls for the variation in sample composition across space and time, within the limits of the information at our disposal on the potential determinants of wage rates at the forts. We estimate separate regressions for laborers and teamsters, and the skilled building trades, grouping the data at the census region level. The dependent variable is the log of the daily contract wage; monthly wages are converted to daily wages by dividing by 26 days per month.[13] The independent variables are dummy variables indicating the fort's location; occupation (e.g. teamster, mason); season of the year; whether the worker was hired on a monthly basis; worker or job characteristics associated with especially high (e.g. master carpenter, "cleaning privies") or low (e.g. apprentice mason, porter) wages; legal status (slave, South only); and the time period to which the observation

refers. The time period dummies are asymmetric in length, and are meant to capture business cycle effects.[14]

The regressions fit the data quite well, judging by the R2 (they range from 0.53 to 0.73). Extensive sensitivity analyses have also been performed. The results appear to be quite robust with respect to the regression specification, sample composition, and the presence of outliers, with one exception: the number of unskilled observations at North Central forts during the 1820s is too small to reliably estimate unskilled wage growth from the 1820s to the early 1830s.15 The following discussion is based on the coefficients of the time period dummies. The full set of regression coefficients is reported in the appendix.

The key findings are shown in Table 2. The figures in Table 2 are based on the coefficients of the time period dummies. They can be interpreted as the percentage change in the skill differential between successive decades.[16] A positive change indicates that nominal wages grew faster among the skilled than the unskilled, and the reverse for a negative change. Because the figures are based on the regression coefficients, we are, in effect, comparing the "same" skilled and unskilled workers over time. Our conclusions therefore are not subject to the "index-number" problem alluded to above. The rows in Table 2 labelled "North," "South," and "National" aggregate the census region figures using 1850 occupational weights.[17]

The skill differential in the Northeast fell between the 1820s and 1840s, before rising slightly in the early 1850s. The skill differential at North Central forts, however, rose sharply (20.4

percent) from 1830 to 1856. Aggregating within the North yields a slight increase in the skill differential (3.5 percent) from 1830 to 1856. The skill differential in the South Atlantic states increased slightly in the 1830s, and then fell continuously. An opposite pattern is first observed at South Central forts, but the skill differential decline there as well in the 1850s. The overall decrease was not as large as in the South Atlantic states, however, so the skill differential at South Central forts rose relative to South Atlantic levels. With the exception of the increase in the North Central states, none of the percentage changes is statistically significant at the 5 percent level. Clearly, our sample provides no evidence of an aggregate surge in antebellum skill differentials.

What explains the increased skill differential at North Central forts? The proximate cause was a reduction in interregional differences in nominal unskilled pay within the North. Common laborteamster rates in the 1830s were approximately 28 percent higher on average at North Central forts than in the Northeast, but this nominal pay advantage disappeared by the early 1850s (see Appendix Table 5).[18] A similar pay advantage existed for North Central skilled artisans, but the percentage reduction over time in spatial wage differences was somewhat less. Consequently, the skill differential rose at North Central forts. In the next section we develop a simple model of regional labor markets to show how such a result could arise from a reduction in the costs of migrating from old to new regions.

4. A MODEL OF REGIONAL LABOR MARKETS

This section presents a model capable of rationalizing the relative rise in the skill differential that we observe at frontier locations. Our goal is to isolate the effects of migration costs on spatial wage differentials for workers with different skills. The basic insight of the model is that higher wages compensate for the direct and indirect costs of moving to the frontier. As these costs fall, for example, because of improvements in internal transportation and information flows, spatial wage differences decline. We show that a reduction in migration costs causes the frontier skill differential to rise relative to the level in settled areas.

Consider an economy with two occupations, one skilled (S), the other unskilled (U); and two regions, one old (O), the other a frontier (F). Individuals live for two periods of unit length. Initially homogenous, they enter the economy ("are born") in the O-region. In period one, they decide whether to invest in skills and whether to migrate to the frontier (return migration is not allowed). Investment in skills can take place in either region. If workers invest in skills, income is foregone during the first period (there are no other investment costs). In period two there is only the decision to migrate, because there are no other periods to reap the benefits of skills. Migration takes place at the beginning of a period and does not reduce the time available for labor market activity during the period. Migration costs are $\underline{c}$, and are incurred at the beginning of the period.[19] Second period income net of

migration costs is discounted at the rate ϕ . Wage rates per unit of time are denoted w_{ij} , i=S,U, and j=O,F. The w's are constant within and across periods, although they will clearly differ across occupations and regions. Individuals select a migration and human capital investment strategy that maximizes the net present value of their earnings (in period one).[20] There is no uncertainty in the model.

The model is obviously highly stylized. It omits certain features of nineteenth century labor markets that many American economic historians would regard as crucial. For example, Lebergott shows that the demand for farm land on the frontier was heavily influenced by the prospect of rising land values.[21] There are no capital gains in our model, so it can hardly apply to farmers. By adding new workers only in the O-region, we ignore abundant evidence of higher fertility on the frontier.[22] The constant wage assumption is also dubious. Nor are we suggesting that changes in interregional skill differentials can be traced to a single cause. Nevertheless, the sparse structure has its advantages. By focusing sharply on migration costs, we identify a critical factor linking wage rates (and thus skill differentials) in the two labor markets.

Let P_{ik} be the present value of the ik-th occupation-migration strategy. For those who invest in skills there are three possibilities:

$$PV_{s1}(\text{remain in O-region}) = w_{so}/1+\phi \qquad [4.1]$$

$$PV_{s2}(\text{migrate period one}) = w_{sf}/1+\phi - c \qquad [4.2]$$

$$PV_{s3}(\text{migrate period two}) = w_{sf}/1+\phi - c/1+\phi \qquad [4.3]$$

Clearly PV_{s3} is superior to PV_{s2}, so those who invest in skills do so before they arrive on the frontier. Given that investment in skills must take place in period one, it is better to postpose the costs of migrating rather than incur them upfront.

In equilibrium, the present value of strategies that are followed must be equal. Thus if skilled migration takes place, $PV_{s1} = PV_{s3}$, or:

$$w_{sf} - w_{so} = c \qquad [4.4]$$

The spatial difference in skilled wages amortizes the costs of migration over the second period. Since $c>0$, skilled wages on the frontier exceed skilled wages in the 0-region.

For the unskilled, there are likewise three strategies:

$$PV_{u1}(\text{remain in 0-region}) = w_{uo} + w_{uo}/1+\phi \qquad [4.5]$$

$$PV_{u2}(\text{migrate period one}) = w_{uf} + w_{uf}/1+\phi - c \qquad [4.6]$$

$$PV_{u3}(\text{migrate period two}) = w_{uo} + w_{uf}/1+\phi - c/1+\phi \qquad [4.7]$$

We argue that PV_{u3} will never be chosen. Suppose that it were. As long as some unskilled labor remains in the 0-region, $PV_{u1} = PV_{u3}$ in equilibrium. This implies $w_{uf} - w_{uo} = c$. But then $PV_{u2} > PV_{u3}$, as long as $\phi > 0.23$ Since this cannot be an equilibrium, the unskilled migrate young or not at all.[24] Thus spatial equilibrium in the unskilled market requires:

$$w_{uf} - w_{uo} = c(1+\phi/2+\phi) \qquad [4.8]$$

The spatial differential in unskilled wages amortizes the costs of migration over two periods, and thus depends on the discount rate.

The model is closed by equating present values across occupations in the 0-region:

$$w_{so}/1+\phi = w_{uo} + w_{uo}/1+\phi \qquad [4.9]$$

which implies:

$$s_o = w_{so}/w_{uo} = 2 + \phi \qquad [4.10]$$

where s_o is the skill differential in the 0-region.[25] Let s_f be the skill differential on the frontier region. It follows that:

$$s_f = [w_{so} + c]/[w_{uo} + c(1+\phi/2+\phi)] \qquad [4.11]$$

Let $c = \lambda w_{uo}$ and $\beta = (1+\phi)/(2+\phi)$. Then equation [4.11] can be rewritten:

$$s_f = (s_o + \lambda)/(1 + \lambda\beta) \qquad [4.12]$$

Differentiating s_f with respect to λ :

$$ds_f/d\lambda = -\phi/(1 + \lambda\beta)^2 < 0 \qquad [4.13]$$

A fall in migration costs ($d\lambda < 0$) results in an increase in the frontier skill differential.[26]

The economic logic of equation 4.13 is straightforward. Unskilled and skilled labor are "produced" in the 0-region, and then "transported" to the frontier. A fall in migration costs reduces the compensating differential necessary to attract workers to the frontier. But the effect is greater in the unskilled market because migration costs are a larger percentage of the unskilled wage in the 0-region than of the skilled wage. In percentage terms, w_{uf}/w_{uo} falls more than does w_{sf}/w_{so}. Consequently, the frontier

skill differential (w_{sf}/w_{uf}) rises relative to the the skill differential in the O-region (w_{so}/w_{uo}).

This "supply side" explanation of rising skill differentials contrasts sharply with the "demand-side" (i.e. capital deepening, capital-skill complementarity) explanation favored by Williamson and Lindert. Our model is closer in spirit to Habakkuk's analysis of the effects of immigration on the skill differential in America vis-a-vis England. "There was much more international mobility of skill than of general labour, and a high proportion of English migrants to the U.S.A. before the start of mass migration were skilled workers ... In the early decades of the century therefore immigration did more to alleviate the shortages of artisan skills than of unskilled labour."[27] According to Habbauk, American skill differentials rose relative to English levels as international transport costs fell and unskilled immigration increased.[28]

For our model to be applicable to interregional changes in the skill differential during the antebellum period, we must show that the costs of migrating to the frontier were falling. Although precise quantitative measures are unavailable, the indirect evidence is very strong. The last four decades of the antebellum period witnessed dramatic and unprecedented improvements in internal transportation; migration to the frontier clearly accelerated after 1820, although cyclical fluctuations were often considerable.[29] The gradual settling of the frontier lowered migration costs by reducing the threat of Indian attack, and through the increased economic opportunities associated with higher population density and eventual integration into national markets.

5. BIASES AND GENERALIZATIONS

Historical records are often biased in various ways, and ours are no exception. And living in a world of five hundred dollar screwdrivers and thousand dollar ashtrays would make any reader suspicious of the military origins of our data. Survival in the archives is the first issue. Forts with surviving reports are far outnumbered by known army installations. Unfortunately, we have no way of knowing if the absence of a report means that no civilians were hired at a fort in a given month, or no report survives. But many occupations and locations are represented in our sample, and no reason why significant wage differences should exist between forts with and without complete records.

Worker and job characteristics at the forts may have differed significantly from those in the civilian population. Many army jobs were arduous or dangerous, and as Lebergott has shown, physically demanding work commanded a wage premium throughout the nineteenth century.[30] Some of the forts were isolated, and the army almost certainly paid civilian workers at such posts in more than money wages. Other than rations, non-wage compensation, such as housing, is not reported. We do not know if skilled artisans brought their own tools, or were provided with them by the army; a related problem is the frequency that teamsters came "with team."[31] The threat of Indian attack may have affected wages, although large-scale hiring of civilians generally took place <u>after</u> the army had driven the Indians out. To the extent that these factors are controlled for in

our regressions--for example, fort location, and some worker and job characteristics--our findings should not be affected. But other potentially important variables--for example, the worker's age, ethnicity, and literacy--cannot be included in the regressions, and we simply do not know if the army's civil personnel were younger, less educated, or more often foreign-born than the population at large.

We do know that Congress never attempted to fix the pay of civilian workers in the nineteenth century.[32] There are scattered comments throughout the reports indicating that the wages paid were the "going rates." The regressions certainly show that local market conditions--for example, the season of the year and fort location--and worker and job characteristics affected wage rates, so it is hard to argue that the quartermasters functioned outside of local labor markets. The army's avowed goal was to make the posts as self-sufficient as possible, especially on the frontier, and rare was the officer with funds to squander.[33] The hiring of civilians was often done through contractors, who were in a better position to capture any rents than a lowly teamster or carpenter. But the forts were hardly competitive firms: the same incentives to search for the best workers at the lowest cost were not there.

Did the army "overpay" its civilian workers? This question can only be answered indirectly, by comparing wage rates at the forts with independent antebellum sources for the same location and time period. The most extensive comparisons we can make are between upstate New York forts and the Erie Canal from 1838 to 1843 (our New York sample is largest in this five year period). These are shown in Table 3. Wages on the Erie Canal fall within the range observed at the forts

(with one exception), and there is no evidence of a systematic, upward bias in our data.

Other, much more limited comparisons are possible. Nathan Rosenberg's data for New England carpenters, masons and laborers in the 1820s imply a skill differential of 50 percent; using our hedonic wage regressions, we predict a skill differential of 56 percent at Southern New England forts (Boston and New London) in the 1820s. Donald Adams' data for Philadelphia artisans and laborers imply a skill differential of 38 percent during the 1820s; we predict a skill differential of 35 percent at New York and Philadelphia forts in the 1820s.[34]

Our analysis of this important issue is at an early stage, and we may yet uncover serious biases.[35] Nevertheless, we are confident that, used with care, the reports do yield valid inferences about the antebellum population.

5. CONCLUDING REMARKS

Was there an aggregate "surge" in antebellum skill differentials? Using a much larger and more comprehensive sample of antebellum wage rates than previous available, and more refined statistical techniques, our answer is "no." Biases in our data, especially its military character, do not appear to lessen the force of this conclusion. On a disaggregated level, we observe an increase in the skill differential at frontier locations relative to the skill differential in settled areas, especially in the North. We show how a reduction in the costs of migrating to the frontier--in other words, an im-

provement in spatial efficiency--can explain this finding.

The results of this paper are limited to the skilled building trades, common laborers, and teamsters. Another group of "skilled" workers at the forts were clerks. Many clerks were hired for long stretches of time, however, and a distinct experience-earnings profile is evident in the raw data. Factoring out the effects of labor market experience is the major problem to be faced in analyzing the evolution of clerk-laborer's pay ratios.

Throughout this paper we have maintained--or rather, not investigated--Williamson and Lindert's assumed positive relationship between skill differentials and inequality. A convenient indicator of wage dispersion is the log variance of the combined distribution of skilled and unskilled daily wages, because it depends on the skill differential is a simple, analytically tractable way.[36] Figure 1 plots the change in the log variance across decades on the change in skill differentials, at the census region level; because the log variance is quite sensitive to sample size and outliers, we have omitted census regions and decades where the estimated variances are implausibly high or low.[37] If Williamson and Lindert's assumption holds, all of the X's should lie in the (+,+) or (-,-) quadrants. Five of seven do, but the pattern is much weaker at the census region level: only in the Northeast are both sets of points in the correct quadrants. The plot also reveals increasing wage dispersion in the Northeast after 1830, and decreasing wage dispersion in the South, and in the North Central states from 1840 to 1850. Whether these inequality trends can be generalized to the antebellum population is a subject for future research.[38]

FOOTNOTES

1. Jeffrey Williamson and Peter Lindert, American Inequality: A Macroeconomic History (New York, 1980).

2. See Paul Keat, "Long Run Changes in Occupational Wage Structure," Journal of Political Economy (December, 1960); Claudia Goldin, "The Earnings Gap in Historical Perspective," mimeo, University of Pennsylvania, 1985; Elyce Rotella, "The Transformation of the American Office," Journal of Economic History (March, 1981); Peter Phillips, "Gender-Based Wage Differentials in Pennsylvania and New Jersey Manufacturing," Journal of Economic History (March, 1982).

3. Simon Kuznets, "Economic Growth and Income Inequality," American Economic Review (March, 1955).

4. The conditions under which this statement holds are quite stringent; see footnote 36. Williamson and Lindert base their acceptance of the statement on a set of time-series regressions showing a significant positive relationship between various inequality measures and the skill differential during the twentieth century. The relevance of these regressions to the nineteenth century is open to question. Our own data are inconclusive on this matter; see the text, p. 17.

5. Williamson and Lindert, American Inequality, p. 71.

6. See Claudia Goldin and Kenneth Sokoloff, "Women, Children, and Industrialization in the Early Republic: Evidence from Manufacturing Censuses," Journal of Economic History (December, 1982); Kenneth Sokoloff, "Was the Transition from the Artisanal Shop to the Non-Mechanized Factory Associated With Gains in Efficiency? Evidence

from the U.S. Manufacturing Censuses of 1820 and 1850," Explorations in Economic History (October, 1984) and "Productivity Growth in Manufacturing During Early Industrialization: Evidence from the American Northeast, 1820-1860," UCLA Department of Economics Working Paper No. 373 (June, 1985); John James and Jonathan Skinner, "The Resolution of the Labor Scarcity Paradox," Journal of Economic History (September, 1985).

7. Scott Grosse, "On the Alleged Antebellum Surge in Wage Differentials: A Critique of Williamson and Lindert," Journal of Economic History (June, 1982).

8. Jeffrey Williamson and Peter Lindert, "Antebellum Wage Widening Once Again," Journal of Economic History (June, 1982), p. 422.

9. The records are known as the Reports of Persons and Articles Hired. They are deposited at the National Archives in Record Group 92.

10. For approximately half the sample we have names, and the number of days worked per month. We are often able to link individuals from month to month (particularly clerks) but have not exploited the panel structure of the data.

11. See, for example, Donald Adams, "Wage Rates in the Early National Period: Philadelphia, 1785-1830," Journal of Economic History (September, 1968); Jeffrey Zabler, "Further Evidence on Antebellum Wage Differentials," Explorations in Economic History (Fall, 1972); Williamson and Lindert, American Inequality and "Antebellum Wage Widening"; Nathan Rosenberg, "Anglo-American Wage Differences in the 1820s," Journal of Economic History (June, 1967).

12. For a discussion of hedonic pricing models, see Sherwin Rosen,

"Hedonic Prices and Implicit Markets," Journal of Political Economy (1972).

13. This is the standard figure used by other scholars; see, for example, Stanley Lebergott, Manpower in Economic Growth (New York, 1964), p. 245.

14. The purpose of the "monthly" dummy is to control for unemployment risk; see Lebergott, Manpower, pp. 241-250. Where rations are indicated we inflate the reported wage by 10 percent of the daily laborer's rate; this adjustment was derived from a separate set of regressions. Because we are interested in the evolution of skilled-unskilled wage ratios, we have not deflated the reported wages (which are nominal) by a price index; it would be difficult to do so in general, since there are no consumer price indices for the South and frontier areas during the antebellum period. The time period dummies are: 1820-29, 1830-36, 1837-39, 1840-43, 1844-49, and 1850-56. The results are unaltered if decadal dummies (e.g. 1830-39) or a time trend are used instead.

15. The time period dummies in the unskilled North Central regression are very sensitive to observations from Detroit in the 1820s. Including these observations yields a 30 percent increase in common rates from the 1820s to 1830-36; the overall increase from the 1820s to the 1850s is 25 percent. If these observations are excluded, however, the overall increase is 8 percent. Thus the Detroit observations basically determine whether or not skill differentials at North Central forts rise from the 1820s to the 1850s. Because of this lack of robustness we deleted all 1820s observations from the skilled and unskilled North Central regressions (a full set

of skilled time dummies is reported in brackets in Appendix Table 2.) The left-out time dummy for the North Central region is "1830-36"; for the other regions it is "1820-29."

16. We first construct weighted averages of the time period dummies to produce a set of decadal time dummies. The weights are equal to the proportion of the decade covered by the time period dummies. For example, the decadal dummy $d_{1830-39}$ is:

$$d_{1830-39} = 0.7 \times t_{1830-36} + 0.3 \times t_{1837-39}$$

where the t's are the time period dummies. Let $\dot{s}^{k}_{j+1,j}$ be the percentage change in skill differentials from decade j to decade j+1 in the kth census region. Then $\dot{s}^{k}_{j+1,j}$ is defined:

$$\dot{s}^{k}_{j+1,j} = \exp\left[(d^{k}_{s,j+1} - d^{k}_{s,j}) - (d^{k}_{u,j+1} - d^{k}_{u,j})\right] - 1$$

where d^{k}_{ij} (i=s(skilled), u(unskilled)) is the ij-th decadal dummy in the kth census region.

17. We first calculate the census region shares of common laborers and teamsters, and the building trades (carpenters, masons, painters, and plasterers) from the 1850 Census. Let p_{ik} be the ik-th occupational share (i=occupation, k=census region). The aggregate estimate of $\dot{s}_{j+1,j}$, say for the North (N), is:

$$\dot{s}^{N}_{j+1,j} = \exp\left[\Sigma p_{sk}(d^{k}_{s,j+1} - d^{k}_{s,j}) - p_{uk}(d^{k}_{u,j+1} - d^{k}_{u,j})\right] - 1$$

Use of 1850 occupational weights biases upward the North and South aggregate trends since greater weight is attached to the change in frontier skill differentials, which increase relative to skill differentials in settled areas.

18. This figure is based on the hedonic wage regressions. We first predict wage rates at each fort for each time period. The predicted wages refer to ordinary free skilled and unskilled workers, hired on a daily basis without rations, averaged across seasons of the year. We then construct weighted average wages rates at the census region level; the weights are based on the fort's sample sizes, and are available from the author's on request. Although the absolute percentage differences in predicted wage rates between census regions are sensitive to the weighting scheme, the time trends are not. The predicted wage rates are **not** adjusted for regional differences in cost-of-living, since there are no cost-of-living indices for the South and frontier states during the antebellum period. Thomas Berry (Western Prices Before 1861 (Cambridge, 1943)) shows, however, that prices of agricultural goods in the Midwest rose relative to the price of manufactured goods imported from the east. Because non-farm workers on the frontier consumed midwestern farm products and competed with northeastern manufactured goods, the decline in relative wages on the frontier that we observe is probably understated. Regional (South Central/South Atlantic) differences in unskilled wage rates also narrowed in the South, but in contrast to the North, regional differences in skilled wages increased (see Appendix Table 5). Thus our model can explain only part of the relative rise in the skill differential at South Central forts. The increased regional disparity in skilled wages in the South may reflect shifts in the local demand for skilled artisans, but a full explanation must await further research.

19. The substance of the model would not change if migration costs

differed across occupations, although the formula relating skill differentials in the two regions (eq. 4.12) would be different.

20. Underlying this description of optimal behavior is an assumption of perfect capital markets. Alternatively, one can think of the discount rate ϕ as arising from a consumption loan between new entrants and skilled workers in the old region in a pure apprenticeship, although we do not model this process explicitly.

21. Stanley Lebergott, "The Demand for Land: The United States, 1820-1860," Journal of Economic History (June, 1985); see also Richard Steckel, "The Economic Foundations of East-West Migration During the Nineteenth Century," Explorations in Economic History (January, 1983).

22. See Richard Easterlin, "Population Change and Farm Settlement in the Northern United States," Journal of Economic History (March, 1976); Morton Shapiro, "Land Availability and Fertility in the United States, 1760-1870," Journal of Economic History (September, 1982).

23. The proof is as follows. $PV_{u2} > PV_{u3}$ if $w_{uf} - w_{uo} = c > c(\phi/1+\phi)$. This inequality holds since $\phi > 0$ and migration costs are positive.

24. Evidence from colonial muster rolls supports a flat age-migration profile for the unskilled and a rising profile for the skilled; see Georgia C. Villafor and Kenneth L. Sokoloff, "Migration in Colonial America: Evidence from Militia Muster Rolls," Social Science History (Fall, 1982), p. 556. Preliminary analysis of similar data for the late antebellum period is also consistent with the model's predictions. Among skilled civilians enlisting in the Union Army and born in the Northeast, 35 percent had migrated to

the frontier (i.e. the North Central states) by age 50, compared to 24 percent by age 30. Among the unskilled, the percent migrating to the frontier was flat at 12 percent. The data from which these figures were derived is described in Robert Margo and Richard Steckel, "Heights of Northern Whites During the Antebellum Period," Journal of Economic History (March, 1983). Some caution should be exercised in interpreting these results since the data are cross-sectional and not longitudinal.

25. In a multiperiod (n>2) model, the equilibrium skill differential would be smaller, as long as the number of periods necessary to acquire skills were less than half the total number of periods. In particular, if n(s) is the number of periods needed to acquire skills, and N is the total number of periods, the equilibrium skill differential is $(N/N-n(s)) + \phi$.

26. It can be shown that $s_f < s_o$. To see this, note that $s_f < s_o$ if:

$$[w_{so}+c/(w_{uo}+ c(1+\phi/2+\phi))] \quad < \quad w_{so}/w_{uo}$$

This inequality holds if $s_o = w_{so}/w_{uo} > (2 + \phi)/(1 + \phi)$. But $s_o = 2 + \phi$ in equlibrium, hence $s_f > s_o$. Thus a fall in λ causes s_f to rise relative to s_o, but s_f will never reach s_o except asymptotically as λ approaches 0. Of course, other factors could cause s_f to rise relative to s_o. If individuals were "born" in the F-region (i.e. an indigenous labor supply develops) unskilled rates in the F-region would fall, and skill differentials in the two regions would equalize; interregional trade in goods would have similar effects.

27. H.J. Habbakuk, American and British Technology in the Nineteenth Century: The Search for Labor-Saving Inventions (Cambridge,

England, 1962), p. 24.

28. There is a long and contentious literature debating Habakkuk's analysis; see, for example, Adams, "Wage Rates,"; Zabler, "Further Evidence,"; and Williamson and Lindert, American Inequality. All we wish to point out is the similarity of our model to Habakkuk's informal discussion. Our data (see Appendix Table 5) imply that skill differentials in the South were lower on the frontier than in settled areas; in the North, skill differentials were relatively lower at North Central forts in the 1830s but were actually higher than levels in the Northeast by the 1850s. The range of skill differentials observed in our sample (roughly 50 to 130 percent) is equal to or higher than contemporaneous British levels, which contradicts Habakkuk.

29. See George R. Taylor, The Transportation Revolution (New York, 1962); Lebergott, Manpower, and "The Demand for Land."

30. Lebergott, Manpower, pp. 250-253.

31. Teamsters "with team" are easy to spot, however, since the common practice was to double the teamster wage.

32. Francis J. Heppner and Harry W. John, "Wage Data Among 19th-Century Military and Naval Records," Reference Information Paper No. 54, National Archives and Record Service (Washington, 1973), p. 1.

33. See Francis Prucha, Army Life on the Western Frontier (Norman, Oklahoma, 1958).

34. Rosenberg, "Anglo-American Wage Differences"; Adams, "Wage Rates"; The skill differentials from Rosenberg's and Adams' data make use of our sample occupational shares to aggregate the wages of the various building trades; see Table 1.

35. If our data mimic wage trends outside the army, why do our results

differ so radically from Williamson and Lindert's? In their reply to Grosse, Williamson and Lindert ("Antebellum Wage Widening") shift attention from the earlier series of skill differentials reported in their 1980 book to the decadal average wages computed by Caroll Wright (Massachusetts, Sixteenth Annual Report of the Bureau of Statistics of Labor (Boston, 1885)) which, they claim, support the "surge" hypothesis. Unfortunately, the overlap between our sample and Wright's is too small to make detailed comparisons as in Table 3. Neither Grosse nor Williamson and Lindert have used the disaggregated data underlying Wright's calculations, which are reported in an appendix to the 1885 volume. Grosse's critique suggests that changes in the composition of Wright's sample over time may explain Williamson and Lindert's findings; even Wright (p. 433) cautioned that "an average wage presented for a certain occupation, for any particular period, might be influenced either by the fact that wages obtained for the years included in that period were generally very high or very low price labor, or that wages for that period were given for but one or two years only." Wright's data are not as detailed as ours, but at least a subset are suitable for hedonic analyses. We are currently computerizing Wright's sample and hope to report on such an analysis in a forthcoming monograph.

36. Let V_i, i=s(skilled), u(unskilled) be the log variance of the ith daily wage distribution, and p_i the proportion of the ith occupation. The overall log variance (V) is:

$$V = p_s V_s + p_u V_u + p_s p_u (m_s - m_u)^2$$

where m_i is the geometric mean wage. Thus $s = m_s - m_u$ is

the log of the skill differential, and $dV/ds = 2p_s p_u s > 0$. But this inequality holds only if the variance within occupations and the p's are held fixed; the unconditional relationship between V and s could easily be negative.

37. The V's are calculated following the formula in footnote 15. V_s and V_u are decade-specific, p_s and p_u are derived from the 1850 census (see footnote 17) and m_s and m_u are derived from the hedonic wage regressions (they are weighted averages of predicted fort-specific daily wage rates for each decade, without rations and seasonally adjusted; the weights are based on each fort's sample size, and are available from the author's on request). The results do not change if Gini coefficients (or Lorenz curves) are used instead.

38. The major difficulty is showing whether or not the distribution of civilian wages (as opposed to wage rates for specific types of workers or jobs) accurately describes the population distribution.

Table 1

DISTRIBUTION OF SKILLED-UNSKILLED SAMPLE:
FORT LOCATION, OCCUPATION, DECADE

Fort Location:	N	% x 100
Northeast	6,941 obs.	31.0
North Central	4,728	21.1
South Atlantic	3,266	14.6
South Central	7,443	33.3
Occupation:		
Common Laborer	7,139	31.9
Teamsters	5,454	24.4
Carpenters	6,878	30.7
Masons	2,336	10.4
Painters	571	2.6
Decade:		
1820-29	2,552	11.4
1830-39	7,150	32.0
1840-49	8,101	36.2
1850-56	4,575	20.4

N=22,378

NOTES: "Painters" includes plasterers. Each occurence of a wage is counted as a separate observation.
SOURCE: Margo-Villaflor sample of Reports of Persons and Articles Hired, National Archives, Record Group 92.

Table 2

CHANGES IN SKILL DIFFERENTIALS: CIVILIAN WORKERS, U.S. ARMY INSTALLATIONS, 1820-1856

Location:	1820-30	1830-40	1840-50	1820-50	1830-50
Northeast	-4.8%	-3.0%	2.0%	-5.8%	-1.0%
North Central	na	+3.0%	17.4%	na	+20.4%
North:	na	-2.4%	6.1%	na	3.7%
South Atlantic	3.0%	-6.7%	-11.3%	-14.8%	-18.0%
South Central	-10.4%	12.7%	-11.3%	-10.4%	-1.4%
South	-3.2%	2.6%	-11.3%	-12.4%	-8.9%
National:	na	-2.3%	2.8%	na	0.5%

SOURCE: see Table 1 and text.
NOTES: Figures are percentage change in skill differentials between decades; see text, p. 7 and footnote 16. na: not available; see text, p. 7 .

Table 3

DAILY WAGE RATES, 1838-1843: NEW YORK FORTS AND ERIE CANAL

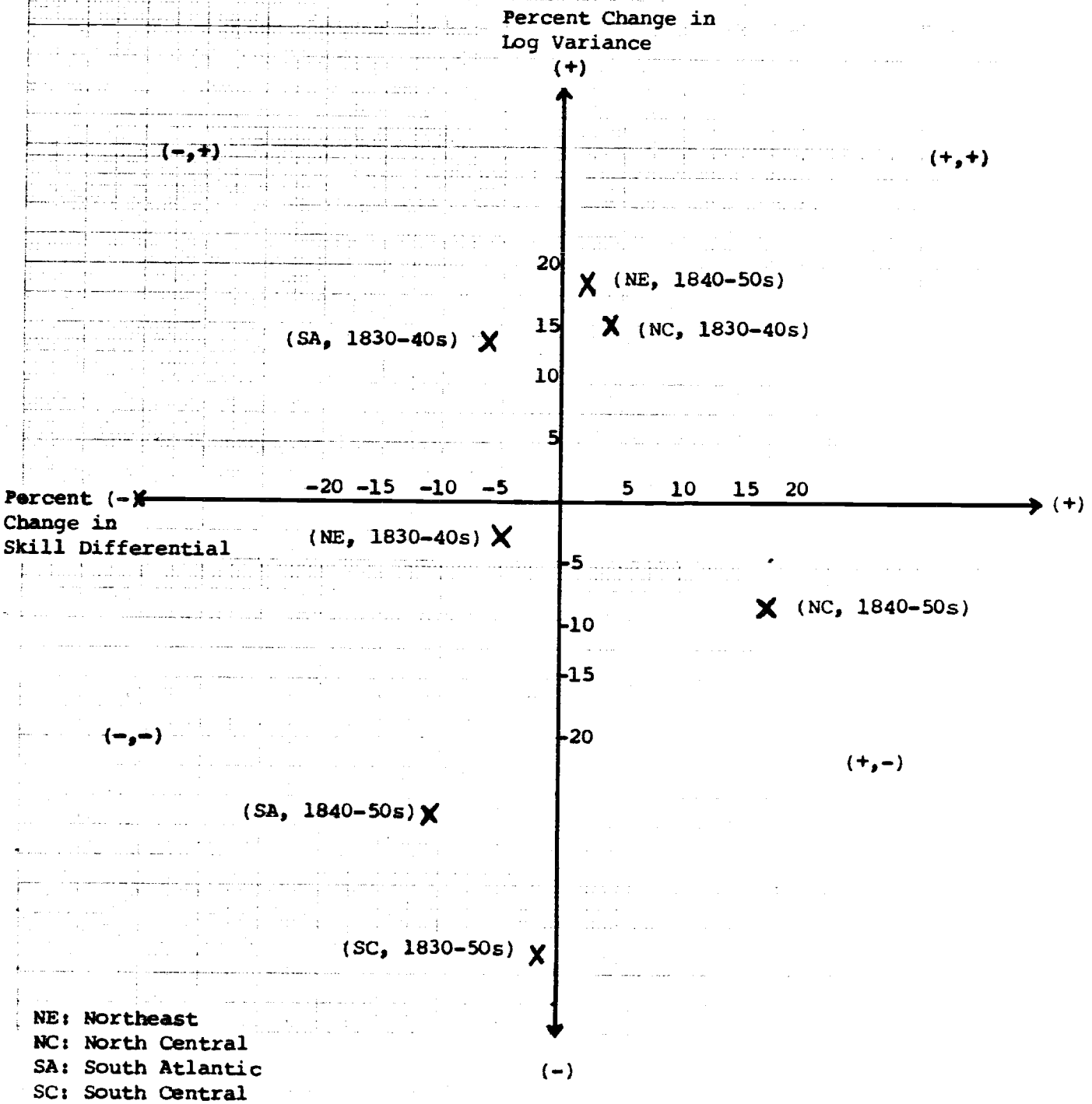
	1838	1839	1840	1841	1842	1843
Laborers-Teamsters:						
N.Y. Forts:						
Range	0.75-1.00	0.75-1.00	0.75-0.88	0.50-1.25	0.75-0.88	0.65-0.88
Mean	0.85 (31)	0.93 (44)	0.77 (26)	0.86 (71)	0.81 (71)	0.75 (13)
Mode	0.75	1.00	0.75	0.90	0.88	0.75
Erie Canal:	0.90	1.00	0.88	0.88	0.88	0.75
Carpenters:						
N.Y. Forts:						
Range	0.75-1.75	1.25-1.75	1.25-1.75	0.75-2.00	1.00-1.75	1.00-1.50
Mean	1.49 (299)	1.51 (89)	1.47 (115)	1.45 (116)	1.34 (78)	1.45 (23)
Mode	1.50	1.50	1.50	1.63	1.38	1.50
Erie Canal:	1.25	1.50	1.50	1.50	1.50	1.25
Masons:						
N.Y. Forts:						
Range	1.25-1.88	1.25-1.75	1.38-1.75	1.20-1.81	1.35	1.38-1.50
Mean	1.66 (94)	1.65 (24)	1.72 (60)	1.41 (109)	1.35 (4)	1.40 (9)
Mode	1.50	1.75	1.75	1.50	1.35	1.38
Erie Canal:	na	na	1.75	1.75	1.50	1.25

NOTES: New York forts: Ft. Niagra (Buffalo); Madison Barracks (Sackett's Harbor); Plattsburgh Barracks (Plattsburgh); West Point; Ft. Ontario (near Syracuse); Ft. Hamilton, Ft. Columbus, Ft. Lafayette (New York City); sample sizes in parentheses.
Erie Canal figures are modes, unweighted across months.
"na", not available.

SOURCE: Margo-Villaflor sample (see Table 1); Walter B. Smith, "Wage Rates on the Erie Canal," Journal of Economic History (Sepember, 1963).

FIGURE 1

The Percentage Change in Skill Differentials Versus the Percentage Change in Log Variances: By Decade and Census Region



APPENDIX

The log wage regressions underlying Table 2 are shown in Appendix Tables 1-4. We briefly discuss the regression coefficients.

Fort Location. Factors associated with fort location that may have affected wage rates include variations in the cost-of-living (recall that our wage data are nominal, and we do not deflate by a regional or temporal price index), unreported worker or job characteristics, the threat of Indian attack, and local labor market conditions. A general finding: the spatial variation in unskilled pay is greater, percentage-wise, than in skilled pay. This suggests that skilled labor markets were geographically more efficient than unskilled labor markets during the antebellum period.

A. **Northeast.** Relative to New York forts, unskilled wages were significantly higher in Maine, the District of Columbia, and Philadelphia; and significantly lower at Upstate New York forts, Carlisle Barracks (near Harrisburg), and Pittsburgh. The especially low common wage at Pittsburgh may reflect a lower-quality work force, but nothing unusual is indicated in the raw data. Excluding the Pittsburgh observations, however, would not affect the substantive results. Relative to New York, skilled pay was significantly higher at Baltimore and in New England, and significantly lower at Carlisle Barracks.

B. **North Central States.** Relative to St. Louis, unskilled pay was lower at Detroit and at forts in Iowa, Wisconsin, and Minnesota, but were higher in Kansas, rural parts of Michigan, and at Cin-

cinatti. Skilled pay was significantly higher at St. Louis than at forts in Michigan or Kansas.

C. **South Atlantic States.** Unskilled pay was much lower at Ft. Monroe, Virginia than at other South Atlantic forts. Slaves were often employed at Ft. Monroe, and most workers received rations. Both factors are controlled for in the regressions, but the adjustments may be inadequate. Relative to Virginia, skilled wages were lower in North Carolina and higher in Georgia.

D. **South Central States.** Relative to Arkansas, common rates were lower in rural Louisiana, and significantly higher at forts in Alabama, Tennessee, Kentucky, and in New Orleans. Skilled pay was highest in New Orleans and lowest in Alabama, Tennessee, and Kentucky. The higher wages at New Orleans probably reflect cost-of-living differences. Many of the carpenters hired at forts in Alabama, Tennessee, and Kentucky were described as "building quarters"; such workers generally received a lower wage than ordinary carpenters (but higher than apprentices). A lower average skill level, then, may explain the lower skilled wage at these forts.

Occupation: Teamsters' wages were higher than common rates in the Northeast, and lower in the South Atlantic states. Masons and painters were generally better paid than carpenters, especially in the Northeast. The premium for masons and carpenters probably reflects a compensating differential for the lack of employment during the winter months.

High-Low. The purpose of these variables is to adjust for job or worker characteristics associated with especially high or low wages. Examples are master artisans, apprentices, strenuous

or distateful unskilled jobs, or very low paying occupations like "porter." Observations are classified as "High" or "Low" only if there is a clear indication for doing so (as in an occupational title or description), or if the absence of such information seems to be an error by the quartermaster preparing the report. Both variables are highly significant in every equation, indicating the importance of controlling for such worker and job characteristics in analyzing wage variation across forts and over time.

Monthy: Unskilled workers hired on a monthly basis received significantly lower daily wages (monthly wage divided by 26 days) than workers hired on a daily basis, which we interpret as a premium for bearing unemployment risk; see footnote 14. In light of this explanation, the positive coefficients in three of the skilled regressions are puzzling. Except for a small number of supervisors and master artisans, skilled workers were almost always hired on a daily basis. Thus the monthly dummy in the skilled regressions may capture some aspect of human capital not fully reflected in the "High" dummy.

Race: Unskilled slaves received lower wages than their free counterparts, but the differences were statistically significant only at South Central forts. Slave artisans, however, received significantly lower wages than free artisans. The source of this differential is unclear. Although the lower wage is consistent with a lower average skill level, the army may have customarily furnished tools to slave artisans, or the costs of supervising slaves may have been higher.

Season: In general, unskilled pay was lower in the winter and

highest in the summer. Seasonal fluctuations in wages were typical in agricultural wage rates, so the presence of seasonality in non-farm wages suggests that the two types of labor markets were closely integrated. Skilled wages were sometimes lower in the winter, but the effect was not universal across the country.

Time Period: Unskilled pay generally rose during the 1830s, and then fell during the depression years of the early 1840s. Common wages increased at forts in the Northeast and the South Atlantic states in the late 1840s, but fell sharply on the frontier. Wages increased throughout the country in the early 1850s. The temporal patterns in skilled wages are less easily generalized, but the fluctuations were similar to unskilled pay movements in each census region, although not as large in magnitude.

Appendix Table 1

LOG WAGE REGRESSIONS: NORTHEAST FORTS

Variable	Common-Teamster	Skilled
Constant	-0.33	0.23
	(9.18)	(10.00)
Fort Location:		
Upstate New York	-0.18	0.003
	(6.06)	(0.18)
Philadelphia	0.17	-0.04
	(9.62)	(1.73)
Pittsburgh	-0.44	-0.10
	(19.43)	(1.83)
Carlisle Barracks	-0.07	-0.16
	(2.06)	(8.12)
Washington, D.C.	0.37	-
	(5.19)	
Baltimore	-0.05	0.09
	(1.70)	(4.33)
Southern New England	-0.007	0.10
	(0.22)	(4.67)
Northern New England	0.25	0.29
	(6.51)	(16.00)
Occupation:		
Teamster	0.15	
	(9.12)	
Mason		0.12
		(13.52)
Painter		0.11
		(6.92)
Job Characteristics:		
High	0.35	0.37
	(8.05)	(22.27)
Low	-0.56	-0.48
	(12.71)	(28.91)
Monthly	-0.09	-0.25
	(5.15)	(10.47)
Spring	0.07	0.06
	(1.62)	(2.43)
Summer	0.06	0.04
	(1.81)	(2.71)
Fall	0.16	0.05
	(4.42)	(2.10)
Time Period:		
1830-1836	0.01	-0.03
	(0.54)	(2.03)

	Common-Teamster	Skilled
1837-1839	0.21	0.12
	(7.87)	(7.12)
1840-1843	0.14	0.07
	(5.55)	(4.21)
1844-1849	0.21	0.10
	(9.71)	(5.06)
1850-1856	0.31	0.24
	(14.69)	(9.50)
N	3246	3695
R	0.73	0.65

NOTES: "Painters" includes plasterers; Monthly=1 if worker hired on a monthly basis, 0 otherwise; see text for definition of "High" and "Low". The intercept represents an ordinary laborer or carpenter hired on a daily basis without rations during the winter months in the 1820s at a fort in New York City (Ft. Columbus, Ft. Lafayette, Ft. Hamilton). Absolute value of t-statistics in parentheses. Dependent variable: log of daily nominal contract wage.

Appendix Table 2

LOG WAGE REGRESSIONS: NORTH CENTRAL FORTS

Variable	Common-Teamster	Skilled	
Constant	-0.21	0.54	
	(4.84)	(12.70)	
Fort Location:			
Detroit	-0.24	-0.26	
	(10.43)	(7.14)	
Other Michigan	0.08	-0.15	
	(2.82)	(5.73)	
Iowa-Wisconsin-Minnesota	-0.32	-0.44	
	(8.34)	(1.72)	
Kansas	0.08	-0.06	
	(5.23)	(2.45)	
Cincinnati	0.10	-0.04	
	(2.82)	(0.90)	
Occupation:			
Teamster	0.01		
	(0.99)		
Mason		0.07	
		(4.29)	
Painter		0.02	
		(0.68)	
Job Characteristics:			
High	0.45	0.43	
	(10.56)	(18.39)	
Low	-0.65	-0.46	
	(14.32)	(16.56)	
Monthly	-0.22	0.09	
	(13.70)	(3.04)	
Spring	0.05	-0.04	
	(1.40)	(0.97)	
Summer	0.06	0.005	
	(2.15)	(0.15)	
Fall	0.005	0.02	
	(0.16)	(0.43)	
Time Period:			
1830-1836	-	-	[0.09]
			(2.77)
1837-1839	0.16	0.03	[0.12]
	(6.96)	(1.11)	(3.43)
1840-1843	-0.002	-0.10	[-0.01]
	(0.08)	(2.98)	(0.22)
1844-1849	-0.12	-0.10	[-0.01]
	(5.74)	(3.40)	(0.37)
1850-1856	0.004	0.15	[0.25]
	(0.17)	(6.46)	(5.18)

	Common-Teamster	Skilled
N	3525	2163
R	0.54	0.69

NOTES: Absolute value of t-statistics in parentheses. The intercept represents an ordinary laborer or carpenter hired on a daily basis without rations during the winter months at St. Louis in the 1830s. Regressions exclude observations from the 1820s; see the text. Figures in brackets are coefficients of time dummies if skilled 1820s subsample is included; left out dummy is "1820-1829." Dependent variable: log of daily nominal contract wage.

Appendix Table 3

LOG WAGE REGRESSIONS: SOUTH ATLANTIC FORTS

Variable	Common-Teamster	Skilled
Constant	-0.48	0.36
	(10.51)	(11.56)
Fort Location:		
North Carolina	0.47	-0.09
	(8.08)	(2.22)
South Carolina	0.16	0.03
	(3.50)	(1.05)
Georgia	0.28	0.17
	(13.83)	(6.93)
Occupation:		
Teamster	-0.12	
	(4.32)	
Mason		-0.07
		(2.61)
Painter		0.03
		(0.82)
Job Characteristics:		
High	0.75	0.46
	(5.15)	(13.98)
Low	-0.64	-0.91
	(10.95)	(23.51)
Monthly	-0.30	0.08
	(8.15)	(1.43)
Spring	-0.06	0.12
	(1.08)	(3.27)
Summer	0.07	0.07
	(1.40)	(1.94)
Fall	0.08	-0.007
	(1.53)	(0.18)
Race	-0.03	-0.25
	(1.56)	(10.39)
Time Period:		
1830-1836	0.04	0.04
	(1.34)	(1.79)
1837-1839	0.19	-0.13
	(5.58)	(1.51)
1840-1843	-0.01	0.04
	(0.22)	(1.43)
1850-1856	0.24	0.08
	(5.27)	(1.92)
N	1839	1427
R	0.62	0.66

NOTES: The intercept represents an ordinary laborer or carpenter

hired on a daily basis without rations at Fort Monroe, Virginia, in the 1820s. Absolute value of t-statistics in parentheses. Dependent variable: log of daily nominal contract wage. Race=1 if slave, 0 otherwise.

Appendix Table 4

LOG WAGE REGRESSIONS: SOUTH CENTRAL FORTS

Variable	Common-Teamster	Skilled
Constant	-0.15	0.53
	(5.14)	(17.32)
Fort Location:		
Alabama-Tennessee	0.13	-0.21
	(6.44)	(10.15)
New Orleans	0.29	0.29
	(20.18)	(14.00)
Other Louisiana	-0.07	-0.02
	(3.85)	(0.26)
Mississippi	0.04	0.08
	(0.42)	(2.21)
Occupation:		
Teamster	0.005	
	(0.42)	
Mason		0.04
		(2.59)
Painter		0.03
		(1.16)
Job Characteristics:		
High	0.18	0.36
	(3.98)	(15.86)
Low	-0.29	-0.62
	(11.80)	(24.99)
Monthly	-0.19	0.04
	(15.76)	(2.10)
Spring	0.04	-0.03
	(1.83)	(1.31)
Summer	0.13	0.02
	(6.67)	(1.03)
Fall	0.08	-0.006
	(4.01)	(0.25)
Race	-0.08	-0.20
	(4.18)	(4.95)
Time Period:		
1830-1836	0.13	0.05
	(5.20)	(2.15)
1837-1839	0.14	-0.01
	(5.13)	(0.31)
1840-1843	0.15	-0.006
	(6.11)	(0.22)
1844-1849	-0.11	0.01
	(4.01)	(0.34)
1850-1856	0.24	0.13
	(10.63)	(4.49)

	Common-Teamster	Skilled
N	4828	2615
R	0.53	0.69

NOTES: The intercept refers to an ordinary laborer or carpenter hired on a daily basis without rations at a fort in Arkansas during the 1820s. Absolute value of t-statistics in parentheses. Dependent variable is log of daily nominal contract wage.

Appendix Table 5

REGIONAL DIFFERENCES IN WAGE RATES: 1830-1850

	1830-39	1850-56
North Central/ Northeast:		
Skilled:	22.1%	12.7%
Unskilled:	28.4%	-3.0%
South Central/ South Atlantic:		
Skilled:	9.4%	24.6%
Unskilled:	58.4%	49.2%

NOTE: Figures give the percentage difference in skilled and unskilled nominal daily wage rates between census regions (e.g. during the 1830s, unskilled daily wage rates at North Central forts were, on average, 28.4% higher than at forts in the Northeast). The figures are based on the hedonic regressions; see footnote 7 and Appendix tables 1-4.
SOURCE: see Table 1.