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ABSTRACT

This paper uses newly collected archival evidence to examine various aspects of the geographic performance of American labor markets before the Civil War. Much of the paper addresses the evolution of regional differences in real wages, of interest to economic historians because they speak to the formation of a "national labor market." In the North, real wages followed a pattern of convergence: wages were highest initially on the frontier -- the Midwest -- but tended to decline relative to real wages in settled regions -- the Northeast -- as labor migrated to the frontier. In the South, regional wage gaps were generally smaller than in the North, but real wages in the South fell significantly below Northern levels beginning in the 1830's.

In addition to regional differences, I also examine wage convergence at the level of local labor markets, proxied by counties, using manuscript census data for 1850 and 1860. I find strong evidence of regression to the mean: high wage counties in 1850 were far less likely to be high wage in 1860. Such evidence is consistent with the view that antebellum local labor markets were spatially integrated.

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For economic historians, a set of spatially distinct, but "integrated" labor markets has two characteristics: first, a tendency for wages to equalize across locations, net of cost of living differences or locational amenities or disamenties, for otherwise identical labor (the "law of one price"); and second, adjustment to economic disparities that appears sensible -- for example, migration in response to wage differentials or to geographic shifts in labor demand. If the size of the set of integrated labor markets within a country expands geographically over time, a "national" labor market is said to be emerging; or, if the set crosses national boundaries, a "global" labor market (Williamson 1995).

For the most part, the story of a national labor market in the United States begins after the Civil War (Lebergott 1964; Wright 1986; Rosenbloom 1996). Regional labor markets in the North allegedly became integrated as early as the 1870s or 1880s, as evidenced by the absence of economically significant wage differentials between the Midwest and the Northeast (Rosenbloom 1996). Inter-regional integration was aided both by falling interregional transport costs (for example, the diffusion of railroads); improved information flows (for example, the telegraph); and falling costs of international transport, which helped integrate Northern labor markets into an Atlantic-based labor market (Wright 1986; Williamson 1995).

The process of regional integration was evidently quite different in the South. "The defining economic feature of the South prior to World War Two was not poor performance or failure," according to Gavin Wright (1986, 64) but the "isolation ... of the southern labor market from national and international flows". The South was left out of the process because of bad timing. After the Civil War, the region was "consumed by the turbulence ... of Reconstruction" precisely when "mass immigration was becoming an established part of the northern social fabric" (Wright 1986, 74). The

"isolation" of Southern labor markets left its imprint in the form of persistently low real wages, particularly in the South Atlantic region, which did not begin to increase appreciably relative to other regions until after World War Two (Wright 1986; Rosenbloom 1996).

Finally, labor markets in the West were initially "balkanized" from the rest of the United States by culture, low population densities, and distance. Only after the "closing of the frontier" in the 1890s did the Western labor markets join in the process of the formation of a national market (Rosenbloom 1990).

With the exception of Lebergott (1964; and Margo 1992), little work has been done on labor market integration before the Civil War.[1] Using state-level data on farm wages, Lebergott made comparisons of coefficients of variation between paired census dates (for example, 1830 to 1850, and 1850 to 1860). The implicit assumption was movement towards the "law of one price" as evidenced by a decline in the coefficient of variation. This movement might be slow, Lebergott observed, because (1964, 134) "in a dynamic economy relatively short run changes in production and demand forces can readily overlay any longer-run tendency" towards wage equalization. "Regions with lively, growing demands for labor offer rising wage rates," he noted, citing early industrialization in the Northeast, and settlement in the Midwest and South Central states in response to growing demands for wheat and cotton (1964, 136). Despite such demand shifts, there was a tendency towards equalization: all pairwise comparisons before the Civil War show a decline in the coefficient of variation of farm wages. Lebergott (1964, 78-85) also showed (graphically) that population growth between census dates (for example, 1850 to 1860) was positively correlated with initial level of wages, which he interpreted as a labor supply response. Despite these findings, he cautioned against the notion that antebellum labor markets were well-integrated. Information on

wage differentials between markets was often unavailable (or available with a lag), with the result being "occasional marked differentials in wage rates between markets ... largely explicable in terms of the simple imperfections in the labor market of the time" (1964, 131-132).

This paper uses newly collected archival evidence to examine various aspects of the geographic performance of antebellum labor markets (Margo 1998, ch. 3). Most of the paper addresses the evolution of regional differences in real wages -- for example, whether real wages were initially higher in the Midwest than in the Northeast, whether the gap narrowed over time, and why. Economists have long been interested in such differentials because they speak to the formation of a "national labor market", as described above.

In addition to regional evolutions, I also examine patterns of "wage convergence" at the level of local labor markets, here proxied by counties. By "wage convergence" I mean a tendency for high (low) wage counties in 1850 to experience low (high) wage growth between 1850 and 1860. Such convergence is suggestive evidence that local labor markets before the Civil War were linked to one another via an arbitrage process.

1.0 The Westward Movement of Population, 1800-1860

The United States underwent a massive redistribution of population from East to West before the Civil War. Although this redistribution can be readily traced from census data, its labor force implications have only become fully apparent with the recent publication of Weiss's (1992) state level labor force estimates. Panel A of Table 1 shows the regional distribution of the total labor force for the census years from 1800 to 1860 for the Northeast, Midwest, and South

Central and South Atlantic regions. In the case of the Midwest and South Central regions, also shown are their labor forces shares within, respectively, the North and South (in brackets). The data refer to both men and women, and include slaves, but none of the fundamental trends revealed by the data would be substantially altered if the figures referred solely to (free) adult males. Panel B shows the change in logs of the labor force shares for the Midwest and South Central regions, both frontiers at the start of the nineteenth century; thus, for example, in log terms the Midwest's share of the labor force grew by 0.32 (about 38 percent) from 1820 to 1860.

At the beginning of the nineteenth century, virtually the entire labor force -- 93 percent of it -- lived in the Northeast or South Atlantic regions, both long settled. But, following 1800, a process of "westward movement" began.

In the case of the Midwest, the growth rate of its labor force share was very rapid between 1800 and 1810, but then decelerated for the next two decades. During the 1830s, however, the Midwest experienced a 60 percent increase (= 0.51/0.32) in the growth rate of its labor force share. Growth in the share declined in the 1840s, but then stabilized in the 1850s. By 1860, the Midwest claimed 41 percent of the Northern labor force; and, while the share continued to increase after the Civil War, the increases were far smaller than those that took place before 1860.

The South followed a broadly similar "east-west" pattern early in the nineteenth century. Growth in the South Central's share of the Southern labor force was rapid between 1800 and 1810, but declined monotonically during the 1810s and 1820s. The growth rate during the 1830s was virtually identical (0.14 in logs) to the growth rate for the 1820s (0.15 in logs). However, measured relative to the Southern labor force, growth in the South Central's share accelerated in the 1830s. The growth rate declined sharply in the 1840s, and continued to remain very low in the 1850s. By

1860, 52 percent of the Southern labor force resided in the South Central region.

Panels C and D repeat the calculations for the nonfarm labor force. The westward movement is still evident: the share of the nonfarm labor force in the Northeast or South Atlantic regions declined from 0.956 in 1800 to 0.669 in 1860. The Midwestern share of the nonfarm labor force increased from 0.004 in 1800 to 0.177 in 1860; the South Central share also increased, although not as dramatically (from 0.040 in 1800 to 0.138 in 1860). Growth in both shares decelerated from 1800 to 1830, but then increased in the 1830s, again consistent with a relative demand shock. However, in contrast to the total labor force, only the South Atlantic share underwent a pronounced decline; the Northeastern share fluctuated between 50 and 53 percent over the 1800 to 1860 period. The jump in the Northeastern share between 1820 and 1830 represents the onset of industrialization in the United States, which was concentrated in the Northeast, whereas the jump in the 1840s reflects the first great wave of European immigration (Goldin and Sokoloff 1982; Ferrie 1998).

Why "Go West"? Explaining the Geographic Redistribution of the Labor Force

Why should labor have moved west before the Civil War? The simplest answer is that, agriculture being a dominant economic activity, locations in the Midwest and South Central regions were perceived to have economic value, provided the costs of moving factors of production to both regions did not exceed the benefits. The benefit/cost ratio presumably increased, as well, with improvements in transportation, such as canals and railroads, which lowered the cost of shipping western goods east (and vice versa), raising economic growth through a process of regional specialization (Taylor 1951; North 1961).

Movement to the frontier generally followed a "due West" direction, partly because this minimized transport costs, but also because human capital in farming tended to be latitude-specific (Steckel 1983). For slave labor, migration from South to North was obviously impeded by the Peculiar Institution, but slave owners showed no general reluctance to move their chattel from east to west within the South. Immigrants who arrived in the Northeast tended to avoid further migration to the South but otherwise had no reluctance to move to the Midwest (Ferrie 1998).

The simple answer, however, runs into an empirical puzzle. Estimates of per capita income show substantially lower values in the Midwest relative to the Northeast in 1840 and 1860, while in the South, per capita incomes in the East South Central region were virtually identical to those in the South Atlantic.[2] Economic theory suggests that individuals generally move from low income to high income locations, not the other way around.

Aside from questioning Easterlin's original data, the puzzle can be resolved in various ways. Perhaps migration west was "selective", in an income sense -- that is, individuals who moved west came from the lower half of the eastern income distribution. This is the so-called "safety-valve" hypothesis of Frederick Jackson Turner (1920) -- the idea that the frontier was a respite for the dispossessed, and economically downtrodden. Although historians have not been kind to the safety-valve doctrine, a recent paper by Ferrie (1997), using sophisticated econometric techniques, find some evidence of "selectivity bias" in migration that is consistent with the Turner hypothesis.

Another explanation is that migration to the frontier was prompted by the possibility of capital gains.[3] It is well-established that "precedence" had economic value on the frontier -- early settlers got the best land, and emerged (on average) with greater capital gains than latecomers (Galenson and Pope 1992). The capital gains were especially great in the Midwest in the 1850s, with

the widespread coming of the railroad (Craig, Palmquist, and Weiss 1998; Coffman and Gregson 1998).

A third explanation, originally suggested by Coehlo and Shepherd (1976) and explored in depth in this chapter, is that the value of the marginal product of labor -- the real wage -- was initially higher on the frontier than in settled areas of the East Coast. The existence of a real wage gap provided the economic incentive to migrate. However, because "assimilation" into the frontier economy takes time, current output per capita can be lower on the frontier than in the settled region of origin. Migration from east to west is spread out over time -- that is, it does not happen instantaneously -- but, eventually, the frontier becomes settled.

Appendix 1 develops a "dynamic programming" model of regional settlement along the lines of this third explanation. In the primary version of the model, there are two regions -- A, a settled region, and B, a frontier region. Initially, most of the economies labor force is concentrated in region A. I assume that labor is more productive on the frontier, but that migration to the frontier incurs two costs -- a direct cost, such as transport costs, plus an assimilation cost. The assimilation cost is modelled as a delay in productivity -- that is, labor must wait for some time before it can be economically productive on the frontier.

The assimilation cost reflects the fact that the American frontier was not productive simply because the land-to-labor ratio was high. Land-clearing and farm-making had to take place first, both capital and time intensive activities, along with some "infrastructure" investment (North 1961; Atack and Bateman 1987).

The assumption that migration includes an assimilation cost implies that, at the margin, aggregate costs of migration are rising, or convex (see Appendix 1). With convex migration costs,

it will not be optimal for all the labor to be moved at once. Migration will be spread out over time -- as in fact, it was historically (recall Table 1). In the model, the pace of migration is quickest initially, but then declines over time. Depending on the initial distribution of the labor force between regions, the pace of migration, and the initial regional gap in labor productivity, output per capita may be lower on the frontier, but eventually overtakes output per capita in the settled area.

The pattern of spreading migration over time has implications for regional gaps in wages. In the model, wages are initially higher in region B (the frontier) than in region A (the settled region). Over time, however, as the share of the labor force in region B increases, the gap in wages diminishes. As is true of migration, the pace at which the wage gap diminishes is greatest initially, but declines over time.

The movement westward in response to an initial regional imbalance in factor proportions can be thought of as a "supply-side" response. The dynamic path of migration can be altered in the model by allowing the costs of migration to change. For example, a fall in the direct (transport) costs of migration will quicken the pace of migration, as well as quicken the pace at which the regional wage gap erodes.

Migration in response to "demand-side" shocks can also be modelled, by allowing the productivity of labor in one region relative to the other to change. An unexpected rise in relative productivity on the frontier -- prompted, for example, by rising demand for frontier-produced goods -- can accelerate both the pace of migration and cause the regional wage gap to temporarily increase.[4]

Appendix 1 also briefly consider a "multiple regions" version of the model -- that is, a model with many regions of destination. In one version of the multiple regions model, regional development takes place in a sequential manner -- for example, in a direct path from east to west.

However, some areas along the direct path might be bypassed for more distant regions, if labor productivity in a more distant region were suddenly increased. I call this process "leapfrogging". The most spectacular example of leapfrogging before the Civil War is the California Gold Rush (see Margo 1998, ch. 6). The discovery of gold in California can be thought of as a very large positive shock to labor productivity in a region very distant from, and thus extremely costly to migrate to, from the rest of the United States. As a result of the gold discovery California became part of the United States considerably sooner than pre-Gold Rush migration patterns would have predicted.

2.0 Regional Wage Differentials Before the Civil War

This section examines the evolution of regional differences in real wages between 1820 and 1860. Margo (1998, ch. 3) uses wage data pertaining to civilian employees of the US army to construct regional nominal wage series for common labor, artisans, and white collar workers for the antebellum period. Nominal wages are converted to real wages by dividing by region-specific price deflators, but these are unadjusted for regional differences in the level of the cost of living. In order to use these series to study the evolution of regional differentials in real wages, it is necessary to benchmark the series. The procedure I follow has several steps.

The first step is to select a benchmark year. Because the nominal wage series are benchmarked to 1850, 1850 is a natural year to choose. The second step is to compute a regional price deflator for 1850; once this price deflator is calculated, it is straightforward to compute relative real wage series.

To fix ideas, let w_j be the nominal wage in region j in 1850, p_j be the price level in region j

in 1850, and let the base region be the Northeast (region N). For region j, the relative real wage in 1850, expressed in index number form, is

$$rw_j\,(1850) = (w_j/w_N)/(p_j/p_N) \times 100$$

Note that for the Northeast, $rw_N(1850) = 100$, by definition. The relative real wage can be computed for any year t:

$$rw_j(t) = rw_j(1850)*w_{rj}(t)$$

where $w_{rj}(t)$ is the region- specific real wage index number in year t ($w_{rj}(1850) = 100$ for each region).

I also define the aggregate real wage, rw, to be:

$$rw(t) = \Sigma\, \alpha_j(t) \times rw_j\,(t)$$

where $\Sigma\, \alpha_i = 1$, and the α_i's are regional occupation-specific labor force shares (see below). Note that, if $rw_j/rw < 1$, the region has lower than average real wages; and conversely, if $rw_j/rw > 1$.

In computing the 1850 regional price deflators, an ideal solution is to choose a set of identically-defined goods that are common to all regions. Unfortunately, the set of such goods for which existing price data -- even wholesale prices from the Cole (1938) collection -- is too small, in my opinion, for the purpose at hand.

To compute the relative price deflators, I use census data at the state level on the average

weekly cost of board, as published in the 1850 census (see Margo 1998, ch. 4). I calculate regional averages of the weekly cost of board, in which each state's figure is weighted by population (see Appendix 2). Let b_j be the average cost of board in region j, with "N" again indicating the Northeast. The regional relative price deflator is $p_j = b_j/b_N$.

Use of board -- the cost of food -- as the sole component in the relative price index obviously ignores other sources of regional price variation. But similar work for the post-bellum period by Rosenbloom (1990, 1996) also uses food prices to construct the regional deflator, so there is an element of consistency in doing so for the antebellum period.

The α weights are derived from the 1850 census of occupations and Weiss's (1992) regional figures on the total and non-farm labor force. First, using the 1850 census, I calculate regional totals of individuals in specific occupations. In the case of common labor, the occupations are "farmer" and "laborer", as reported in the census.[5] In the case of artisans, I sum the number of blacksmiths, carpenters, machinists, masons, and painters. In the case of white collar workers, the occupation is "clerk".

Next, I compute occupation-participation ratios by region, where the numerator is the occupation total and the denominator is the region's labor force. In the case of common labor, "labor force" means total (that is, including farm); for artisans and clerk, "labor force" refers to non-farm. For example, the participation ratio for clerks in the Northeast is 0.034 (=57,908 clerks/ 1,701,400 non-farm workers). I then assume that the ratios are constant for each of the census years from 1820 to 1860. Using Weiss' figures, it is straightforward to compute, for each census year, estimates of each region's share of the aggregate number of common laborers, artisans, and so on. Finally, I linearly interpolate the weights (the regional occupation shares) between census dates. The

weights are shown in Appendix Tables 8-10.

Panel A of Tables 2-4 shows occupation-specific decadal averages of log real wages in the Midwest relative to the Northeast, and South Central relative to the South Atlantic. In the North, the dominant long-run pattern was regional equalization. In the 1820s, real wages in the Midwest exceeded real wages in the Northeast by 0.24 in log terms for common labor, and by considerably more for skilled artisans and clerks. By the 1850s these wage gaps had undergone a pronounced decline; for example, in the case of artisans, the wage gap fell by -0.303 in logs. The declines were not monotonic, however. The regional wage gap for common labor rose slightly in the 1830s and 1850s, as did the gap for clerks in the 1840s and skilled labor in the 1850s.[6]

In the South, the regional gaps were smaller than in the North, and there were no clear trends towards regional equalization. For common labor, the initial wage gap between the South Central and South Atlantic states was small and negative. The gap rose in the 1830s, but then fell back in the 1840s.. In the case of artisans, the wage gaps were small, and fluctuated between the 1820s and 1840s, before rising in the 1850s. For clerks, the gaps were somewhat larger, but showed no signs of a decline.

Panel B of Tables 2-4 shows occupation-specific decadal averages of the ln (rw_j/rw) -- that is, the log of the region's real wage relative to the national average. Also shown is the weighted "mean absolute deviation", which is the weighted average of the absolute values of ln (rw_j/rw). The mean absolute deviation can be interpreted as a summary statistic of regional wage differentials -- if it declines, regional wage differentials, on average, were falling.

Consistent with the findings in Panel A, wages in the Midwest in the 1820s exceeded the national average, but converged on it from the 1820s to the 1850s. Convergence, however, was not

monotonic -- for example, common wages in the Midwest rose relative to the national average in the 1830s. Real wages in the Northeast in the 1820s were below average but also converged by the 1850s, although again not monotonically.

Perhaps the most interesting finding in Panel B, however, is the emergence of a North-South unskilled wage gap. Evidently by the 1830s, real wages of common labor in the South Atlantic region fell below common wages in the Northeast (by about 8 percent). They fell further behind in the 1840s, before rebounding in the 1850s. Because of the divergent trend in the South Atlantic region, the mean absolute deviation for common labor in the 1850s fell only 6 percent below the level for the 1820s. For both artisans and clerks, however, the mean absolute deviation fell almost in half from the 1820s to the 1850s.

Panel C of Tables 2-4 report the slope coefficients from regressions of ln (rw_j/rw) on ln α_j. The idea behind the regression is straightforward. If the slope coefficient is negative, then increases in the region's relative share of the labor force are associated with declines in the region's relative real wage, which is consistent with shifts in labor supply as the dominant factor behind shifts in relative wages in the region. However, if the coefficient is positive, then increases (or decreases) in the region's labor force share were associated with increases (decreases) in the region's relative wage, a signal that demand shifts occurred.

The clearest evidence that shifts in supply were important appears in the regression for the Midwest. For all three occupations the coefficient was negative and statistically significant, with elasticities ranging from -0.13 (common labor) to -0.26 (clerks). The coefficients were also negative for the Northeast. However, for the South Atlantic states -- and in two of three occupations for the South Central -- the coefficients were positive for all three occupations. Given that the South

Atlantic region experienced declines in its share of the labor force between 1820 and 1860, the positive coefficient is suggestive evidence that relative labor demand must have decreased in the South Atlantic.

Finally, Panel D of Tables 2-4 shows calculations of $\Delta\, rw_j \cdot \Delta\, \alpha_j$ for each region based on decadal averages of rw_j and α_j, and also the weighted average value, or average "inner product", across regions. A positive value means that the region's relative real wage increased (decreased) at the same time that its share of the labor force was increasing (decreasing); a negative value means that changes in real wages and labor forces shares were opposite in sign. The value of $\Delta\, rw_j \cdot \Delta\, \alpha_j$ is, again, a summary statistic, and its sign can be taken as indicating whether shifts in relative supply (a negative sign) could potentially explain overall shifts in relative wages or whether shifts in relative demand (a positive sign) must have occurred (Katz and Murphy 1992).

Most of the inner products are negative (or indistinguishable from zero), suggesting that shifts in relative labor supply across regions were the dominant factor influencing relative wages. However, the positive inner product for common labor comparing the 1820s and 1830s indicates that shifts in relative demand influenced relative wages in the 1830s.

Summary

Broadly speaking, the results of this section support a "labor markets" explanation of the westward movement of population before the Civil War, at least in the North. Real wages were initially higher in the Midwest, but converged on the national average as the Midwest's share of the labor force increased. Convergence in the North was rapid in the 1840s, which witnessed the first

full-scale immigration wave to the U.S and the initial "globalization" of labor markets (Williamson 1995). As economically significant as the convergence was, however, it was not completed before the Civil War. In the 1850s real wages were still 11 to 26 percent higher in the Midwest than in the Northeast, depending on the occupation. In the South, regional gaps were apparently quite small, consistent with the claims of some scholars that the operation of well-functioned regional slave markets may have enhananced the general efficiency of the east-west reallocation of labor before the Civil War (Fleisig 1976; Field 1978; Wright 1986).

Labor force redistribution, however, cannot fully rationalize all of the shifts in relative wages that occurred across regions before the Civil War. At least two demand shifts seem to have been important. Beginning in the late 1820s and continuing through the 1830s, improvements in internal transportation, rising demand for cotton, and various federal land policies that subsidized frontier development helped fuel a land boom in Midwest and South Central regions (Temin 1969: Lebergott 1985). This demand shock evidently left its imprint in the labor market in the form of rising real wages for common labor in both frontier regions. Based on relative wage movements, a analogous demand shock in favor of the two frontier regions place in the 1850s, which also witnessed rising wheat and cotton prices, and improvements in internal transportation that raised land values in the Midwest and South Central regions (North 1961; Fogel 1989).

Shifts in demand in favor of the frontier were not the only demand shifts altering relative wages across regions. The South Atlantic's share of the labor consistently declined over the period while its relative wages were falling, a pattern that is difficult to rationalize except by a shift in relative demand. With relative demand moving in favor of the frontier, the most plausible candidate for the remaining demand shift is early industrialization. Manufacturing first took hold in the 1820s

and began to grow rapidly in the 1830s. However, the early growth of manufacturing was not distributed uniformly across the ante-bellum landscape; it was concentrated in the Northeast (Goldin and Sokoloff 1982). Although manufacturing did not completely bypass the South, the region did not industrialize to any appreciable extent before 1860. The combination of demand shocks favoring the Midwest and the Northeast may explain why real wages of common labor in the South Atlantic fell below the national average by the 1830s, and those in the South Central states, by the 1840s. The origins of the post-bellum North-South gap in unskilled wages, it would appear, predate the Civil War (Wright 1986; Rosenbloom 1996).

Aggregate Wage Growth

It is evident that real wages differed in level across regions, and that growth rates of real wages varied across regions. It follows, therefore, that the growth rates of the national aggregate series -- that is, the weighted average of the regional series -- will differ from the region-specific rates of real wage growth.

Appendix Table 11 shows annual values of national aggregates of nominal wages, computed by weighting the the regional series produced in Margo (1998, ch. 3) by the region-occupation shares (the α's). National aggregates of real wages, constructed in the manner described earlier, are shown in Appendix Table 12. Long run growth rates of the aggregate real wage series, calculated as the coefficients on a linear trend, are shown in Table 5. According to my estimates, aggregate real wages of unskilled labor grew at 0.99 percent per annum; those of skilled artisans increased at 0.66 percent per annum; and of clerks, 1.5 percent per annum, between 1821 and 1860.

How important was labor force redistribution in affecting the aggregate growth rates? One way to answer this question is to recompute the aggregate series under the assumption that the weights are fixed at their 1820 values. Estimates of trend growth derived from these series are shown in Table 5. Redistribution had a modest effect on the aggregate growth rates. The largest impact occurred in the case of common labor; for this occupation, redistribution increased the growth rate from about 0.95 percent per annum to 0.99 percent per annum, or by about 4 percent. The results for artisans and clerks suggest that labor force redistribution also boosted aggregate growth rates by similar magnitudes (about 4-5 percent).

3.0 Wage Convergence, 1850-1860: Evidence from the Censuses of Social Statistics

Section 2 presented evidence that real wages differed in level across regions, but that (most) regions shared in a process of convergence before the Civil War. Can the same be said for real wages measured at the level of smaller geographic areas ("local" labor markets)?

Certainly differences in real wage levels were, in a quantitative sense, significant across local labor markets during the antebellum period. These differences can be documented at the county level using data from a sample drawn from the 1850 and 1860 mansucript censuses of social statistics, which collected data on wages for a variety of occuapations as well as the cost of board (recall the discussion in section 2). Table 6 shows the 10-90 spread in the log of the real wage of common labor, for various states in this sample, in 1850 and 1860. (The 10-90 spread is the difference between the log real wage at the 10th percentile versus the 90th percentile, across counties in a given state.) Here, the real wage is defined similarly as in Section 2, namely the nominal wage

deflated by the cost of board. On the face of evidence in Table 6, it would appear that a common laborers could potentially increase their living standards by moving from low-wage to high-wage counties within states -- typically, a shorter distance move than a move across regions.

One should be cautious, however, in accepting this conclusion without reservation. Certain locations might have inherent characteristics that cause wages to be high or low due to locational amenities or disamenities. Prospective indentured servants in the 18th century, for example, were disinclined to enter into contracts in the Caribbean, because the region was known to be unhealthy. To encourage their acceptance, employers had to offer shorter lengths of indenture, effectively a higher wage (Galenson 1981). In nineteenth century England, wages were higher in towns that were more unhealthy, as indicated by higher infant mortality rates (Williamson 1985). However, geographic mobility was quite high before the Civil War, suggesting the possibility that relatively high or low wages might not persist for very long at the local level -- that is, wage convergence would take place.

To measure the extent of wage convergence at the county level, I estimate the following econometric model using the sample data from the censuses of social statistics:

$$w_{it} = -el_{it} + d_{it} + \epsilon_{it}$$

$$\Delta\, l_{it} = l_{it} - l_{it-1} = a + s(w_{it-1}/b_{it-1})$$

The first equation is a labor demand curve, where w = occupation-specific nominal wage, l = occupation-specific quantity of labor demanded, d is a demand shift term, i indexes location (i.e. county), e is the wage elasticity of labor demand (all variables are measured in logs), ϵ is a random

error, and t is the time period. The second equation is a labor supply curve: the change in labor supplied to location i between periods t-1 and t is a positive function of the real wage in period t-1, where "real" means the nominal wage divided by the cost of board. Because I am using the census data, t = 1860 and, therefore, t-1 = 1850.

Taking first differences and solving for Δl_{it}

$$\Delta w_{it} = a + \Delta d_{it} - \beta(w_{it-1}/b_{it-1}) + \epsilon_{it}$$

where $\beta = es$. At issue is whether $\beta > 0$. On the assumption that e is non-zero (that is, labor demand is not perfectly elastic), $\beta > 0$ implies a labor supply response ($s > 0$) and thus wage convergence (Lebergott 1964).

To estimate the model requires a specification for Δd. Included in Δd are some or all of the following variables: Δb, the change in the cost of board between 1850 and 1860; Δw_s, the change in the occupation-specific nominal wage between 1850 and 1860 in the state in which county i was located; the percent foreign born in county i in 1850; a dummy for urban counties in 1850; and dummies for census region.

Separate regressions are estimated by occupation. Because Margo (1998, ch. 4) found essential equivalence in wages of farm and common labor within counties, I group the data for these two occupations together. Thus, there are three sets of regressions: farm/common labor, carpenters, and female domestics. Results are shown in Table 7.

Strong evidence of wage convergence is found: the estimated values of β are all significant and economically meaningful. Holding constant other factors, a 10 percent higher than average real

wage in 1850 implied approximately a five percent reduction in nominal wage growth for common and farm labor. The extent of wage convergence among differed very little across occupations. In additional regressions I experimented with allowing β to vary between the South and North, but found little evidence of such variation.

The remaining variables suggest that shifts in labor demand also influenced wages at the county level. Ideally, Δd should include changes in output prices, but such are not available at the county level. The change in the cost of board was included on the theory that it might be correlated with such price changes. This makes some sense in the case of farm labor, but it less clear-cut for the other occupations. In any case, the change in the cost of board did influence nominal wage growth; the coefficient was always positive and, generally, quantitatively large.

To the extent that changes in labor demand were correlated across counties within states (as they would be, for instance, for state or region-wide increases in output prices) I expected to find positive coeffiences for Δw_s, the change in the (occupation-specific) mean state wage. Except for carpenters the coefficients were positive, but not significant at conventional levels.

Although one might expect somewhat higher wage growth in urban counties (due to more rapid population growth), no such urban effect was found; indeed, the urban coefficients were generally negative and statistically insignificant. Wage growth tended to be lower in counties with a large percentage of foreign born in 1850; the effects range (in log terms) from -0.14 to -0.23, depending on the occupation and regression, and are of marginal statistical significance. The negative coefficients are consistent with lower productivity growth in counties dominated by the foreign born, leading to reduced wage growth (see also Lebergott 1964, 77).

4.0 Conclusion

This paper has presented new evidence on the geographic "efficiency" of labor markets before the Civil War. In the North real wages followed a pattern of convergence: real wages were highest initially on the frontier, and tended to decline over time relative to real wages in settled regions. The South Atlantic region was an exception to this pattern: real wages in the South Atlantic evidently fell over time relative to other regions, at the same time that the region's share of the national labor force was declining.

I also found evidence of wage convergence at the county level: wage growth between 1850 and 1860 was significantly slower in counties that began the decade with relatively high wage levels. The evidence of wage convergence across regions and at the level of local labor markets strongly suggests that antebellum labor markets were integrated spatially.

5.0 Appendix 1: A Dynamic Model of Regional Integration

This appendix presents a mathematical model of regional integration. As a point of departure, imagine an economy consisting of two regions, A and B. Region A is initially endowed with a fixed factor T_A and most of the economy's labor force, $\underline{L} = L_A + L_B$ and $L_A > L_B$. Region B is also endowed with the fixed factor, T_B, plus any labor not initially allocated to A (L_B). The assumption that region A is initially endowed with most of the economy's labor reflects the historical reality of the ante-bellum U.S. (see Table 1).

A single good, X, can be produced in either region. The production function for X in region

A is $F(L_A,T_A)$, and in region B is $\beta F(L_B, T_B)$. The term β can be thought of as capturing a transport cost before X_B can be consumed (in which case $\beta < 1$); or, alternatively, as a region-specific productivity index.[7] I assume that F is concave, so that there are diminishing returns to labor in both regions. Although the fixed factors, by definition, cannot be moved, labor can be re-allocated across regions, albeit at a cost.

To motivate the costs of migration, I assume, first, that migrants take one period to become productive in the region of destination (or, equivalently, that migration takes one period to complete) so that labor that leaves region A in period t does not become part of the labor force in region B until period t+1. The assumption that labor takes one period to become productive in the new region is the assimilation cost referred to earlier in the chapter.

Because F is concave, these assimilation costs of migration are, by definition, convex. In addition, I assume that each migration incurs a fixed cost, C. These fixed costs can be thought of as direct travel costs, "set-up" (relocation) costs upon arrival in the region of destination, or consumption while undergoing the process of assimilation. There is no uncertainty about costs or production.

The economic issue is the optimal dynamic allocation of labor between regions. Because there is no uncertainty and because the initial endowment of labor favors region A, moving labor from B to A is never optimal. Moving labor from A to B, however, may raise total output, depending on migration costs, and differences in productivity between regions. If, for example, C is very large or β is very small, migration might never be optimal, and region B remains forever undeveloped. Assuming that the costs of migration are not too high relative to differences in productivity, some migration will be optimal. However, because the (variable) costs of migration

are convex, it will be not be optimal to move all the labor at once; adjustment will be gradual.

To make these and other points transparent, I consider the "social planner's" problem associated with this model.[8] The solution to the planner's problem defines the efficient dynamic general equilibrium allocation of labor between A and B.[9]

For simplicity, I assume that the social planner seeks to maximize the present discounted value of production. In terms of the "state" variables m_j (migration at time i, i = 0,..,) the planner's problem can be written:

$$\text{Max } V_0 = F(L_A - m_0) + \beta F(L_B) + \sum_{i=1}^{\infty} \delta^i \{F(L_A - \sum_{j=0}^{i} m_j) + \beta F(L_B + \sum_{j=0}^{i-1} m_j)\} - \sum_{i=0}^{\infty} \delta^i C m_i$$

where $0<\delta<1$ is the discount rate, and where I have suppressed fixed factors for notational convenience. This is an infinite horizon dynamic programming problem -- however, because there are diminishing returns to labor and because there are fixed costs to migration, if migration is ever optimal, there will exist a date N such that, for t = N and all subsequent dates, $m_t = 0$ -- that is, current migration at date N and all subsequent dates is no longer optimal. The existence of a date N transforms the infinite horizon problem into a finite horizon problem which, because of its recursive nature, can be solved by backward induction.

For period N - 1, the problem simplifies to a single period optimization

$$\underset{m_{N-1}}{\text{Max}}\ V_{N-1}=F\left(L_A - m_{N-1} - \sum_{i=0}^{N-2} m_j\right) + \beta F\left(L_B+\sum_{i=0}^{N-2} m_j\right) + \delta V^*(m_{N-1}) - Cm_{N-1}$$

where $V^*(m_{N-1})$ is the maximized value of V (the value function) at t = N. However, because migration is no longer optimal in period N or beyond, V* takes on a very simple form. The first order conditions can be written:

$$\delta\left\{\sum_{j=0}^{N-1} \beta F_L\left(L_B+\sum_{j=0}^{N-1} m_j\right) - F_L\left(L_A-\sum_{j=0}^{N-1} m_j\right)\right\} = F_L\left(L_A-m_{N-1} - \sum_{j=0}^{N-2} m_j\right) + C$$

The solution to the first order condition is a function m_{N-1}, which itself is a function of, among other variables, m_{N-2}. Substituting this function into V and stepping back one period gives a new optimization problem

$$\underset{m_{N-2}}{\text{Max}}\ V_{N-2} = F\left(L_A - m_{N-2} - \sum_{j=0}^{N-3} m_j\right) + \beta F\left(L_{B+} \sum_{j=0}^{N-3} m_j\right)$$

$$+ \delta V^{*}(m_{N-2}) - Cm_{N-2}$$

where $V^{*}(m_{N-2})$ is the maximized value of V at t = N-1. This process is repeated until the initial period is reached. In general, the first order condition for period i looks like

$$\sum_{t=i+1}^{i-1} \delta^{t-i}[\beta G_L - F_L] = F_L(L_A - m_i - \sum_{j=0} m_j) + C$$

This first order condition has a straightforward economic interpretation -- namely, the social planner should re-allocate labor in period t to the point where the present value of the differences in future marginal products between regions A and B (the marginal benefits of migration) are just equal to foregone output that the marginal migrant would have produced in region A had the migrant stayed plus the fixed cost of migration.

Although this model is extremely simple, several useful insights can be gleaned from it. First, as noted earlier, because migration costs are convex, it will be optimal to spread migration out over time. Hence, as long as current migration is still optimal, $\beta G_L > F_L$ -- that is, wages must be higher in region B than in A if m_t is positive.[10]

Second, even though wages must be higher in region B than in region A, output per capita need not be higher. Initially, output per capita can be lower in region B, simply because period t migrants make up a relatively large share of region B's labor force; and, by assumption, migrants are not productive until period t + 1. However, over time, the migrant share of region B's labor force declines, and output per capita in region B will eventually exceed output per capita in region A.[11]

Third, the narrowing of regional wage differentials over time is a characteristic of the dynamic equilibrium.[12] Solving the social planner's problem yields an allocation of labor between regions that is always efficient, for any given specification of production or costs of migration. It terms of the model, therefore, the narrowing of wage differentials is not a signal that labor market "efficiency" is "improving" .[13]

Fourth, because the gap in marginal products is greatest at the initial date, and because return migration is never optimal, the pace of migration is greatest initially but decelerates over time. Similarly, wage differentials between A and B diminish over time, but at an ever-slowing pace up to, but not beyond, period N.

The model presented above makes very strong predictions about the evolution of regional labor force shares and wages. These predictions may be altered in revealing ways by varying the parameters in the model, such as C, the fixed costs of migration; β, the regional productivity index; or by exogenously changing aggregate factor endowments.

Consider, for example, a reduction in C starting at date $t = 0$. A decline in migration costs will increase the cumulative amount of migration that occurs as of any date t, causing date N to move closer to the initial time period. Declining migration costs imply that wages will converge more quickly and that, ceteris paribus, wage differentials are smaller at all dates prior to date N.[14] If,

instead, C is constant up until period j, and then declines, migration will accelerate as of period j, and the pace at which wage differentials narrow will quicken after period j. Hence, a sudden decline in wage differentials coupled with an increase in the pace at which B's share of the labor force increases, is a sign that migration costs have fallen.

Shifts in labor demand can be represented by shifts in the parameter β. Imagine a time path for ß such that, for t = 0 until t = k, ß is fixed, but for t = k+1 and all future dates, ß increases. Depending on when k occurs, migration might not be optimal at t = 0 but as date k approaches, migration becomes optimal. Because it is not optimal to move all the necessary labor in advance of date k, wage differentials between A and B may increase as of date k, at the same time that migration picks up.[15] An acceleration in migration, therefore, coupled with rising wage differentials, suggests that regional shifts in labor demand have occurred.

Increases in T_B -- for example, accession of new land on the frontier -- function similarly to increases in β, because they drive up the marginal product of labor in region B. The impact of changes in aggregate labor supply depend in which region they occur. For example, an exogenous increase in factor supply in region A that occurs at date t will cause wage differentials to rise and migration to increase. However, if additional labor were to be added to region B -- for example, through immigration directly to B from outside the country -- wage differentials would erode, possibly to the point where migration from A to B would cease.

Multiple Regions

The model developed above is useful in thinking about the labor market process by which

a "frontier" is integrated into a settled economy and, as such, requires only two regions. For some purposes, however -- and to be realistic empirically -- it is useful to consider a model with multiple regions. Suppose, instead, there are R regions, i = 1, ..., R, and let region 1 be the "base" region -- that is, the region that is relatively well-endowed with labor initially. Also, let C_{ij} be the fixed cost of migration between regions i and j.

The implications of a multiple region model depend on the precise assumptions made about costs of migration and the regional productivity index parameter. For the sake of illustration, I consider the following assumptions. First, I assume that

$$C_{1k} <= C_{1j} + C_{jk},\ 1<j<k<=R$$

and

$$C_{1j} < C_{1k},\ 1<j<k<=R$$

The first assumption means that the fixed cost of migrating directly from region 1 to region k is less than or equal to the cost of sequentially migrating from region 1 to region j, and then from region j to region k. The second assumption implies that, as the region index moves closer to R, the region is more "distant" from the base region.

I also assume that

$$\beta_i > \beta_j\ ,\ 1<i<j<=R$$

Regions closer to the base region, in other words, have higher levels of relative productivity.

Keeping the other assumptions of the two-region model, these additional assumption imply three new results. First, migration flows from the base region -- there is no sequential migration (movement from region 1 to region j, then from region j to region k). Second, if migration takes place in any period to all regions (it may not), the flow will satisfy a first order condition similar to the one developed earlier:

$$PV_i - C_{1i} = PV_j - C_{1j} = F_L + PV_1$$

where PV_i, say, is the present discounted value of a unit of labor moved from region i to region j -- which, as in the model developed earlier, only becomes productive the period after the migration takes place. Because of the assumptions made about migration and transport costs, the implication of this first order condition is that there will be a "frontier" wage gradient -- the wage differential between region 1 and region k will rise monotonically as the region index moves towards R. However, just as in the simpler two-region model, the slope of this gradient (the equivalent of the wage difference in the two region case) will diminish over time; there will be wage convergence between regions.

The most interesting result implied by the above multiple-region model is the possibility of "leapfrogging". Through leapfrogging, a region distant from the base region develops more quickly than a closer region. Leapfrogging can occur, for example, if a distant region experiences a dramatic increase in labor productivity. If productivity increases, additional migration to the region

will have to take place to the region experiencing the productivity shock, if the above first order condition is to hold.

6.0 Appendix 2: Computation of Regional Price Deflators, 1850

As noted in the text, the regional price deflators are constructed from the published statistics on the weekly cost of board in the 1850 census. Let b_j be the published state average and $b = \Sigma \delta_j b_j$ be the regional average formed from the published state averages by weighting by each state's share of the regional population. Because the published averages were unweighted across counties I make a further adjusted to the regional estimates by multiplying each by a regional adjustment factor (see Margo 1998, ch. 5) The adjustment factors generally exceed unity, indicating that properly weighted, the average cost of board within states exceeded the state averages published in the 1850 census. Setting the estimate for the Northeast equal to an index number of 100, the results are:

Northeast	100.0
Midwest	77.4
South Atlantic	84.2
South Central	107.3

Thus the cost of living was relatively low in the Midwest, compared with the Northeast, while the reverse was true in the South Central states compared with the South Atlantic. To construct the regional relative real wage indices discussed in the chapter, follow the procedure in the text using

these cost of living figures, the benchmark wage estimates for 1850, and the regional real wage indices from Margo (1998, ch. 3).

Notes

1.Coehlo and Shepherd (1976) examine regional differences in real wages during the antebellum period, but their series begin in the 1850s.

2. U.S. Department of Commerce (1975, 242). Per capita incomes in the East South Central region, however, were nearly twice as high as in the South Atlantic or West South Central regions.

3. A related explanation involves liberal policies towards the disposal of public lands, which effectively subsidized western movement; see, for example, Fogel and Rutner (1972), Temin (1969) or Lebergott (1985).

4. Other "comparative dynamics", such as the impact of an increase in the stock of land on the frontier, or an exogenous increase in the economy's labor force endowment, are considered in Appendix 1.

5. I use farmers as well as laborers, because Margo (1998, ch. 4) found that wages of farm and common labor were similar. The implicit assumption is that the ratio of farm laborers to total farmers in each region were similar.

6. The timing of the convergence in relative wages in the North contrasts somewhat with Ross (1985, 43) who asserted that migration "in the late 1820s and 1830s brought the artificially high wages of the labor scarce frontier ... more in line with lower eastern wage levels." As is apparent from the tables, this timing appears to be incorrect in the case of common labor and (to a lesser

extent) artisans.

7. As is well known, nominal wages can be equalized across regions through a process of factor price equalization -- that is, through trade. There is no question that costs of interregional transport fell during the antebellum period, as evidenced by dramatic declines in regional gaps in wholesale prices, and that interregional trade expanded (Berry 1943; Taylor 1951). However, these declines in transport cost did not take place in the context of a set of regional economies with fixed endowments of resources (as in the classic Heckscher-Ohlin model; see also O'Rourke and Williamson 1994; and Slaughter 1995). As Table 1 shows, labor was re-distributed, and it is this regional re-distribution that is the primary focus of the model. Factor price equalization enters in indirectly through changes in the parameter β; a fall in transport costs between regions A and B is equivalent to an increase in β.

8. See Townsend (1993, ch. 1) for an excellent discussion of the use of social planner's problems in economic history. As stated in the text, the dynamic programming problem is a transparent way to demonstrate why a social planner would find it optimal to spread migration over time. Migration, however, is an individual decision. Convex aggregate adjustment costs in a model of individual migration can be motivated in the following manner. Imagine that individuals choose the optimal date to migrate from region A to region B. The benefits of migration are independent of time, but the costs are not; specifically suppose that there exists a date t^* at which point the costs fall below the benefits. As in the model in the text, there is no uncertainty about costs or benefits. Then, if migration is optimal (in the sense that the present discounted value of benefits exceed the costs of migration) it will occur at date t^*. Suppose further there is a distribution of costs across individuals. In such a set-up, some individuals will migrate early, and others later,

until the marginal migrant is reached in the migration cost distribution (the individual for whom there exists no date t*, at the margin, for which the present discounted value of benefits exceeds the costs of migration). Then migration will be spread out over time, as in the model in the text.

9. The values of the marginal products of labor would correspond to region-specific real wages.

10. To see this, suppose instead that $(1-ß)F_L(L_B+\Sigma m) = F_L(L_A -\Sigma m)$ However, if this is true for period i, it must also be true for all subsequent periods, and therefore, the expression in brackets is identically zero. But if the expression in brackets is identically zero, m must be zero. The same type of argument can be used to demonstrate that, in this model, m can never be negative -- that is, migration flows in one direction only. Also note that, as long as C is positive, wage differentials between A and B are never driven to zero.

11. Per capita output in region B must eventually exceed per capita output in region A because labor productivity is asymptotically higher in region B than in region A.

12. See Rockoff and Bodenhorn (1992) for a similar, albeit non-technical, argument in the case of capital markets.

13. The issue is the same as in the proper interpretation of the "intertemporal elasticity of substitution" in life-cycle models of labor supply. In such models individuals are supposed to supply more labor when wages are high, but the increase in labor supply is associated with a move along given dynamic equilibrium, not a different dynamic path.

14. Efficiency improves, therefore; the permanent reduction in transport costs acts like a reduction in taxes. Another way for efficiency to improve would be to assume, initially, that migration takes M periods to complete (instead of one period), and let M fall. Indeed, as frontier areas become developed the idea that M would fall is a natural one to make. "Infrastructure

investment", such as cities and towns, transportation facilities, and so forth, surely lower the costs of migration. In a perfect foresight or no-uncertainty model as in the text, it would pay to shift some migration to the future if M is expected to fall. In turn, this would delay convergence in wages for some time, but subsequently wages would converge more quickly than if M were fixed.

15. In a stochastic model, in which shocks are unforseen, there would be no "building in advance" (that is, migration in advance) of the shock.

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Table 1

The Regional Distribution of the Labor Force, 1800-1860

A. Total Labor Force

	Northeast	Midwest	South Atlantic	South Central
1800	0.431	0.008 [0.017]	0.503	0.059 [0.116]
1810	0.416	0.028 [0.063]	0.441	0.114 [0.205]
1820	0.398	0.070 [0.149]	0.381	0.152 [0.284]
1830	0.388	0.096 [0.199]	0.339	0.177 [0.344]
1840	0.366	0.160 [0.304]	0.270	0.204 [0.431]
1850	0.352	0.192 [0.349]	0.232	0.211 [0.477]
1860	0.321	0.230 [0.405]	0.197	0.214 [0.521]

B. Growth Rates (Log Differences)

1800-10	1.253	0.659
1810-20	0.916	0.288
1820-30	0.316	0.153
1830-40	0.511	0.142
1840-50	0.182	0.034
1850-60	0.181	0.014

C. Nonfarm Labor Force

1800	0.506	0.004 [0.008]	0.450	0.040 [0.082]
1810	0.521	0.016 [0.030]	0.378	0.086 [0.185]
1820	0.514	0.053 [0.093]	0.324	0.106 [0.247]
1830	0.546	0.061 [0.100]	0.270	0.123 [0.313]
1840	0.503	0.115 [0.186]	0.237	0.145 [0.380]
1850	0.531	0.163 [0.235]	0.170	0.136 [0.444]
1860	0.531	0.177 [0.249]	0.154	0.138 [0.473]

D. Growth Rates (Log Differences)

1800-10	1.386	0.765
1810-20	1.198	0.209
1820-30	0.141	0.149
1830-40	0.634	0.165
1840-50	0.349	-0.064
1850-60	0.082	0.015

Source: computed from Weiss (1992, 37, 51)

Table 2

Regional Log Real Wage Differences: Common Labor

	1821-30	1831-40	1841-50	1851-60
A. Within North and South (Decadal Averages)				
Midwest-Northeast	0.237	0.266	0.096	0.108
South Central-South Atlantic	-0.020	0.087	0.024	0.029
B. Relative to National Average (Decadal Averages)				
Northeast	-0.075	-0.054	0.015	-0.021
Midwest	0.162	0.212	0.110	0.087
South Atlantic	0.019	-0.132	-0.152	-0.097
South Central	-0.001	-0.045	-0.128	-0.068
Mean Absolute Deviation	0.064	0.101	0.080	0.060

Note: Mean Absolute Deviation is $\Sigma\ (\alpha_j|rw_j/rw|)/4)$; α_j is decadal average.

C. Regression of $\ln (rw_j/rw) = \delta + \beta \ln (\alpha_j)$

	β	t-stat
Northeast	-0.275	-1.965
Midwest	-0.128	-2.740
South Atlantic	0.092	1.080
South Central	-0.727	-2.244

D. Calculation of $\Delta\ rw_j \cdot \Delta\ \alpha_j$ (Decadal Averages)

	1821/30-1831/40	1831/40-1841/50	1841/50-1851/60
Northeast	-0.00078	-0.00242	0.00094
Midwest	0.00335	-0.00694	-0.00108
South Atlantic	0.00680	0.00082	-0.00132
South Central	-0.00006	-0.00066	0.00024
Weighted Average	0.00165	-0.00247	-0.00012

Note: Weight is α_j (decadal average) for initial decade. For example, the 1821-30 weight is used for 1821/30-1831/40, and so forth.

Source: see text

Table 3

Regional Log Real Wage Differences: Artisans

	1821-30	1831-40	1841-50	1851-60
A. Within North and South (Decadal Averages)				
Midwest-Northeast	0.521	0.421	0.191	0.218
South Central-South Atlantic	-0.017	-0.008	0.027	0.084
B. Relative to National Average (Decadal Averages)				
Northeast	-0.204	-0.194	-0.136	-0.114
Midwest	0.317	0.227	0.055	0.104
South Atlantic	0.251	0.223	0.211	0.109
South Central	0.234	0.231	0.238	0.193
Mean Absolute Deviation	0.226	0.207	0.138	0.118

Note: Mean Absolute Deviation is $\Sigma\ (\alpha_j|rw_j/rw|)/4)$

C. Regression of $\ln (rw_j/rw) = \delta + \beta \ln (\alpha_j)$

	β	t-stat
Northeast	-0.909	-5.599
Midwest	-0.263	-7.546
South Atlantic	0.198	4.450
South Central	0.001	0.004

D. Calculation of $\Delta\ rw_j \cdot \Delta\ \alpha_j$ (Decadal Averages)

	1821/30-1831/40	1831/40-1841/50	1841/50-1851/60
Northeast	-0.00029	-0.00242	-0.00098
Midwest	-0.00450	-0.00694	0.00176
South Atlantic	0.00087	0.00082	0.00286
South Central	-0.00003	-0.00066	0.00020
Weighted Average	-0.00043	-0.00236	0.00026

Note: Weight is α_j (decadal average)

Source: see text

Table 4

Regional Log Real Wage Differences: Clerks

	1821-30	1831-40	1841-50	1851-60
A. Within North and South (Decadal Averages)				
Midwest-Northeast	0.519	0.316	0.393	0.229
South Central-South Atlantic	0.115	0.114	0.131	0.186
B. Relative to National Average (Decadal Averages)				
Northeast	-0.151	-0.136	-0.137	-0.092
Midwest	0.368	0.180	0.256	0.137
South Atlantic	0.108	0.106	0.113	-0.016
South Central	0.223	0.220	0.244	0.170
Mean Absolute Deviation	0.163	0.146	0.163	0.101

Note: Mean Absolute Deviation is $\Sigma\ (\alpha_j|rw_j/rw|)/4)$

C. Regression of $\ln (rw_j/rw) = \delta + \beta \ln (\alpha_j)$

	β	t-stat
Northeast	-0.221	-0.786
Midwest	-0.171	-4.518
South Atlantic	0.122	2.853
South Central	0.259	1.323

D. Calculation of $\Delta\ rw_j \cdot \Delta\ \alpha_j$ (Decadal Averages)

	1821/30-1831/40	1831/40-1841/50	1841/50-1851/60
Northeast	-0.00029	0.00001	0.00027
Midwest	-0.00658	0.00388	-0.00345
South Atlantic	0.00006	-0.00046	0.00090
South Central	-0.00005	0.00007	0.00022
Weighted Average	-0.00057	0.00030	-0.00021

Note: Weight is α_j (decadal average)

Source: see text

Table 5

Aggregate Growth Rates: Real Wages, 1821-1860

	Common	Artisan	Clerk
Variable Weight	0.0099	0.0066	0.0150
t-stat	4.496	4.068	6.580
Fixed Weight	0.0095	0.0062	0.0142
t-stat	4.399	3.646	6.066

Figures are coefficients (β) of trend in regression of aggregate real wage: $\ln rw = \alpha + \beta t + \epsilon$
Variable Weight: allows α_j to vary over time; Fixed weight: α_j is fixed at initial (1821) value; see text.

Table 6

10-90 Spread: Log of Real Daily Wage of Common Labor, Across Counties, 1850

Massachusetts	0.17
Pennsylvania	0.31
Michigan	0.48
Iowa	0.46
North Carolina	0.81
Virginia	0.69
Kentucky	0.55
Tennessee	0.63

10-90 Spread: difference in log wage at 10th and 90th percentiles of real wage distribution across counties within state. Real wage: estimated nominal weekly wage (daily wage *6/weekly cost of board).
Source: sample from 1850 and 1860 manuscript censuses of social statistics; see text and Margo (1998, ch. 2).

Table 7

Wage Convergence Regressions, 1850-60

A. Common and Farm Labor

	Sample Mean	β	t-stat	β	t-stat
Constant					
Δ d		0.667	19.297	0.600	14.108
Δ w_s	0.274			0.213	1.657
Δ b	0.315	0.532	24.932	0.528	24.523
% $Foreign_{1850}$	0.038	-0.141	-1.460		
$Urban_{1850}$	0.054	-0.022	-0.859		
Region:					
Midwest	0.136	0.017	0.867	0.012	0.593
South Atlantic	0.378	0.028	1.550	0.019	0.855
South Central	0.320	0.120	6.669	0.100	3.765
ln $(w/b)_{1850}$	1.137	-0.540	-19.009	-0.528	-18.290
N	902				
Mean value-dep.var.	0.265				
R^2		0.495		0.495	

B. Carpenters

Constant		0.852	11.885	0.699	6.524
Δ d					
Δ w_s	0.240			0.620	1.195
Δ b	0.315	0.257	6.484	0.254	6.399
% $Foreign_{1850}$	0.037	-0.203	-1.111		
$Urban_{1850}$	0.055	-0.054	-1.163		
Region:					
Midwest	0.133	0.026	0.690	0.026	0.685
South Atlantic	0.379	0.099	3.024	0.078	1.647
South Central	0.322	0.256	7.348	0.173	1.865
ln $(w/b)_{1850}$	1.841	-0.449	-10.873	-0.432	-10.637
N	451				
Mean value of dep. var.	0.220				
R^2		0.225			0.273

C. Female Domestics

Constant		0.309	11.205	0.333	6.263
Δ d					
Δ w_s	0.277			-0.137	-0.850
Δ b	0.314	0.797	33.673	0.801	33.649
% $Foreign_{1850}$	0.039	-0.178	-1.742		
$Urban_{1850}$	0.058	0.014	0.553		
Region:					
Midwest	0.140	0.049	2.323	0.047	2.243
South Atlantic	0.378	0.038	2.026	0.049	2.921
South Central	0.308	0.106	5.288	0.123	6.404
ln $(w/b)_{1850}$	0.524	-0.615	-11.410	-0.620	-11.392
N	429				
Mean value-dep.var.	0.284				
R^2		0.744		0.743	

Dependent variable is difference in log of nominal (estimated) weekly wage between 1850 and 1860. Weekly wage of common labor and carpenters is 7 x daily wage; weekly wage of farm labor is 7*(monthly wage/26 days).
b: weekly cost of board
Δ: indicates difference between 1850 and 1860
Urban =1 if town or city > 10,000 in county in 1850.
w_s: average wage in occupation in state (from published census volumes)
% Foreign: percent foreign born in county in 1850
Source: see text.

Appendix Table 8

Regional Occupation Weights: Common Labor

	Northeast	Midwest	South Atlantic	South Central
1821	0.499	0.124	0.258	0.120
1822	0.496	0.128	0.254	0.122
1823	0.494	0.133	0.251	0.123
1824	0.491	0.137	0.248	0.125
1825	0.489	0.141	0.244	0.127
1826	0.487	0.145	0.241	0.129
1827	0.484	0.149	0.237	0.130
1828	0.482	0.154	0.233	0.132
1829	0.480	0.158	0.230	0.134
1830	0.477	0.162	0.226	0.135
1831	0.472	0.171	0.221	0.136
1832	0.467	0.180	0.215	0.137
1833	0.462	0.190	0.210	0.139
1834	0.457	0.199	0.204	0.140
1835	0.452	0.208	0.199	0.141
1836	0.447	0.217	0.194	0.142
1837	0.442	0.226	0.188	0.143
1838	0.437	0.236	0.183	0.145
1839	0.432	0.245	0.177	0.146
1840	0.427	0.254	0.172	0.147
1841	0.425	0.258	0.169	0.147
1842	0.423	0.263	0.166	0.148
1843	0.421	0.267	0.163	0.148
1844	0.419	0.272	0.161	0.149
1845	0.417	0.276	0.158	0.149
1846	0.415	0.280	0.155	0.149
1847	0.413	0.285	0.152	0.150
1848	0.411	0.289	0.149	0.150
1849	0.409	0.294	0.147	0.151
1850	0.407	0.298	0.144	0.151
1851	0.404	0.303	0.142	0.151
1852	0.400	0.308	0.140	0.152
1853	0.397	0.313	0.138	0.152
1854	0.394	0.318	0.136	0.152
1855	0.391	0.323	0.134	0.153
1856	0.387	0.327	0.132	0.153
1857	0.384	0.332	0.130	0.153
1858	0.381	0.337	0.128	0.153

1859	0.377	0.342	0.126	0.154
1860	0.374	0.347	0.124	0.154

Source: see text

Appendix Table 9

Regional Occupation Weights: Artisans

	Northeast	Midwest	South Atlantic	South Central
1821	0.608	0.087	0.224	0.079
1822	0.610	0.088	0.220	0.081
1823	0.613	0.090	0.215	0.082
1824	0.615	0.091	0.210	0.083
1825	0.617	0.092	0.206	0.085
1826	0.619	0.093	0.201	0.086
1827	0.621	0.094	0.196	0.087
1828	0.624	0.096	0.191	0.088
1829	0.626	0.097	0.187	0.090
1830	0.628	0.098	0.182	0.091
1831	0.621	0.106	0.179	0.092
1832	0.615	0.115	0.177	0.093
1833	0.608	0.123	0.174	0.093
1834	0.601	0.131	0.171	0.096
1835	0.595	0.140	0.169	0.097
1836	0.588	0.148	0.166	0.098
1837	0.581	0.156	0.163	0.100
1838	0.574	0.164	0.160	0.101
1839	0.568	0.173	0.158	0.102
1840	0.561	0.181	0.155	0.103
1841	0.561	0.187	0.150	0.102
1842	0.561	0.193	0.145	0.101
1843	0.561	0.199	0.140	0.100
1844	0.561	0.205	0.135	0.099
1845	0.561	0.212	0.131	0.098
1846	0.560	0.218	0.126	0.097
1847	0.560	0.224	0.121	0.095
1848	0.560	0.230	0.116	0.094
1849	0.560	0.236	0.111	0.093
1850	0.560	0.242	0.106	0.092
1851	0.559	0.244	0.105	0.092
1852	0.559	0.245	0.104	0.092
1853	0.558	0.247	0.103	0.092
1854	0.557	0.249	0.102	0.092
1855	0.557	0.251	0.101	0.093
1856	0.556	0.252	0.099	0.093
1857	0.555	0.254	0.098	0.093
1858	0.554	0.256	0.097	0.093

1859	0.554	0.257	0.096	0.093
1860	0.553	0.259	0.095	0.093

Source: see text

Appendix Table 10

Regional Occupation Weights: White Collar Workers

	Northeast	Midwest	South Atlantic	South Central
1821	0.587	0.058	0.249	0.106
1822	0.589	0.059	0.244	0.107
1823	0.592	0.060	0.239	0.104
1824	0.595	0.061	0.234	0.111
1825	0.597	0.062	0.229	0.113
1826	0.599	0.062	0.224	0.114
1827	0.602	0.063	0.219	0.116
1828	0.604	0.064	0.214	0.118
1829	0.607	0.065	0.209	0.119
1830	0.609	0.066	0.204	0.121
1831	0.604	0.072	0.201	0.123
1832	0.599	0.078	0.199	0.125
1833	0.593	0.083	0.196	0.127
1834	0.588	0.089	0.194	0.129
1835	0.583	0.095	0.191	0.131
1836	0.578	0.101	0.188	0.133
1837	0.573	0.107	0.186	0.135
1838	0.567	0.112	0.183	0.137
1839	0.562	0.118	0.181	0.139
1840	0.557	0.124	0.178	0.141
1841	0.559	0.129	0.124	0.140
1842	0.561	0.133	0.125	0.138
1843	0.563	0.138	0.125	0.137
1844	0.565	0.142	0.125	0.136
1845	0.567	0.147	0.126	0.135
1846	0.568	0.152	0.126	0.133
1847	0.570	0.156	0.126	0.132
1848	0.572	0.161	0.126	0.131
1849	0.574	0.165	0.127	0.129
1850	0.576	0.170	0.127	0.128
1851	0.575	0.171	0.126	0.128
1852	0.575	0.173	0.124	0.129
1853	0.575	0.174	0.123	0.129
1854	0.575	0.176	0.121	0.130
1855	0.574	0.177	0.120	0.130
1856	0.574	0.178	0.119	0.130
1857	0.573	0.180	0.117	0.131
1858	0.573	0.181	0.116	0.131

1859	0.572	0.183	0.114	0.132
1860	0.572	0.184	0.113	0.132

Source: see text

Appendix Table 11

Aggregate Nominal Wage Estimates

	Common Labor (Daily)	Artisans (Daily)	White Collar (Monthly)
1821	NA	NA	NA
1822	NA	NA	$32.67
1823	NA	$1.40	32.76
1824	NA	1.26	32.85
1825	0.72	1.30	36.14
1826	0.72	1.39	34.07
1827	0.70	1.48	34.41
1828	0.70	1.38	34.37
1829	0.70	1.37	37.71
1830	0.69	1.33	35.74
1831	0.66	1.36	33.36
1832	0.69	1.40	35.09
1833	0.70	1.41	35.76
1834	0.78	1.51	36.38
1835	0.77	1.55	35.52
1836	0.81	1.62	37.00
1837	0.94	1.64	44.35
1838	0.80	1.49	43.22
1839	0.84	1.54	48.55
1840	0.72	1.52	44.19
1841	0.76	1.51	40.24
1842	0.78	1.41	40.81
1843	0.80	1.35	44.44
1844	0.80	1.28	42.58
1845	0.78	1.44	43.98
1846	0.77	1.35	43.09
1847	0.71	1.41	42.53
1848	0.86	1.38	45.06
1849	0.84	1.47	44.74
1850	0.85	1.44	45.54
1851	0.83	1.46	51.91
1852	0.88	1.50	51.63
1853	0.87	1.57	49.15
1854	0.92	1.63	50.86
1855	0.95	1.71	51.38
1856	0.97	1.76	52.83
1857	1.01	1.84	55.25

1858	0.96	1.87	54.01
1859	1.05	1.87	48.39
1860	1.03	1.83	52.00
Five-Year Averages			
1821-25	0.72	1.32	33.61
1826-30	0.70	1.39	35.26
1831-35	0.72	1.45	35.22
1836-40	0.82	1.56	43.46
1841-45	0.78	1.40	42.41
1846-50	0.81	1.41	44.79
1851-55	0.89	1.57	50.99
1856-60	1.00	1.83	52.50
Decadal Averages			
1821-30	0.70	1.36	34.53
1831-40	0.77	1.51	39.34
1841-50	0.80	1.41	43.60
1851-60	0.95	1.70	51.75

Note: Covers Northeast, Midwest, South Atlantic, and South Central regions only.

Appendix Table 12

Aggregate Real Wage Series (1860=100)

	Common Labor	Artisans	White Collar
1821	NA	NA	NA
1822	NA	NA	54.9
1823	NA	73.7	61.0
1824	NA	69.3	63.3
1825	67.6	69.5	67.8
1826	76.0	84.0	71.7
1827	76.2	90.2	73.0
1828	77.0	85.5	74.1
1829	76.9	85.2	81.2
1830	78.0	85.1	79.2
1831	74.7	87.4	73.3
1832	73.9	84.9	73.8
1833	71.7	80.9	71.4
1834	82.6	89.7	75.7
1835	70.7	79.9	64.2
1836	62.1	70.8	56.7
1837	80.0	78.7	73.4
1838	71.5	74.9	75.4
1839	73.3	74.4	82.2
1840	80.1	95.6	93.7
1841	89.6	103.3	90.5
1842	108.4	115.9	109.8
1843	118.1	118.1	130.2
1844	114.7	110.3	122.7
1845	105.4	113.6	117.2
1846	102.6	103.3	112.9
1847	77.7	89.6	97.7
1848	101.9	107.9	120.2
1849	103.1	104.0	112.1
1850	93.5	97.7	103.6
1851	97.4	99.7	121.1
1852	101.1	98.5	115.8
1853	92.0	95.4	101.4
1854	92.0	93.1	98.7
1855	85.8	89.4	91.2
1856	85.5	89.4	91.4
1857	82.0	88.3	89.3
1858	93.8	106.2	104.5

1859	98.2	100.4	90.0
1860	100.0	100.0	100.0
Five-Year Averages (1856-60 = 100)			
1821-25	73.0	75.0	65.0
1826-30	82.9	91.1	79.8
1831-35	80.7	89.6	75.5
1836-40	79.0	82.9	80.3
1841-45	116.6	113.7	120.1
1846-50	108.3	103.2	115.1
1851-55	100.5	97.5	111.2
1856-60	100.0	100.0	100.0
Decadal Averages (1851-60 = 100)			
1821-30	77.9	86.2	69.4
1831-40	79.7	87.3	73.8
1841-50	112.2	109.9	111.4
1851-60	100.0	100.0	100.0

Source: see text

Note: Covers Northeast, Midwest, South Atlantic, and South Central regions only.