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THE DECLINE OF NON-COMPETING GROUPS: CHANGES IN THE PREMIUM TO EDUCATION, 1890 TO 1940

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ABSTRACT

Between 1890 and the late 1920s the premium to high school education declined substantially for both men and women. In 1890 ordinary office workers, whose positions generally required a high school diploma, earned almost twice what production workers did. But by the late 1920s they earned about one and one-half times as much. The premium earned by female office workers, male office workers, and male office workers plus supervisors fell by about 30%. Several factors operated in tandem to narrow differentials to education. The supply of high school graduates relative to those without high school degrees increased by 16% from 1890 to 1910, but by 40% from 1910 to 1920 and by 50% from 1920 to 1930. Immigration restriction is another factor, but is dwarfed by the expansion of high schools; reduced immigrant flows explain just 1/8th of the relative supply increase of educated workers. The impact of rapidly increasing supplies of high school educated workers was reinforced by technological changes in the office that enabled the substitution of educated workers and machines for the exceptionally able. The premium to high school graduation, rather than declining further in the 1930s, levelled off as the demand for high school educated workers expanded in the manufacturing sector. We make comparisons between this historical period of narrowing wage differentials in the face of technological progress in the office and ours of widening differentials.

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The wage structure in the United States has been widening for at least the past 15 years but, as yet, there is no definitive answer why. Technological advances are regarded by many as causing much of the increase in wage inequality.[1] It has recently been asserted that technological progress almost always increases wage inequality and that additional educational resources, already large and fairly well distributed across youths, cannot provide an ameliorating force.[2] Others see a less bleak future. According to them, the lower skilled are falling behind because high schools inadequately train youths to be productive members of a technologically complex work place. Education, then, can alleviate the impact of technological advance but only if educational quality improves.

Lessons about the wage structure can be gleaned from the past for ours is not the only era to witness technological advance, educational change, and large shifts in the wage structure. A big difference between ours and the previous episode we explore is the direction of change in the wage structure. From 1890 to 1950 the wage structure narrowed, the return to education plummeted, and the premium to many types of white-collar work fell substantially. Changes in the wage structure were not distributed evenly across the entire 60-year interval. Most happened quickly at particular junctures during the longer period, often during and after wartime. The premium to white-collar office workers, our focus here, fell sharply from 1914 to the early 1920s, never again to recover.[3] It was, in the words of Paul Douglas, the demise of

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[1] See Krueger (1993) and Autor, Katz, and Krueger (1995) on personal computers and the wage structure. Berman, Bound, and Griliches (1994) present evidence consistent with the view that skill-biased technological change is the primary explanation for the shift in demand toward skilled labor by U.S. manufacturing concerns in the 1980s; see Mishel and Bernstein (1994) for an alternative interpretation.

[2] Herrnstein and Murray (1994); also Kaus (1992). The advances referred to are those in information technology that have created a "cognitive elite." Reich (1991) also argues that technological change has widened the income distribution but views education and training as capable of offsetting its effects.

[3] In Table 5 we present evidence on the decline in the ratio of office worker earnings to those in manufacturing from 1914 to the 1939. The same ratio, for both males and females, declines only slightly from 1930 to 1970 (see Goldin 1990, table 3.2).

a "non-competing group."[4]

Educational and Technological Advances of the Early Twentieth Century

The educational attainment of young Americans rose rapidly in the first few decades of the twentieth century. In 1910 a small fraction of American youths graduated from high school. Just 15% did in New England which had long led the nation in education and less than 30% of New England's youths were attending high school in 1910. The fraction attending high school was considerably less in other regions, particularly the South, but it was also low in the industrial North. Barely 10% of the youths in the Middle Atlantic states graduated high school in 1910 and just 20% attended high school.[5]

By 1920 a transformation was apparent in many states that was to blossom fully in the 1920s and 1930s and was, even then, termed the "high school movement." The graduation rate in New England rose to 25% by 1920 and the enrollment rate to 43%.[6] The increase in the Pacific region was more impressive. The enrollment rate doubled in the 1910s, increasing from 29% to 60%; the graduation rate more than doubled, rising from 12% to 27% (see Figure 1).

The fraction of young Americans who graduated high school in 1910, it should be emphasized, was considerably smaller than the fraction who graduate college today. But by the mid-1930s the fraction graduating high school was larger than the fraction completing four-year college today. High schools at the turn of the century were elite institutions that prepared the children of the wealthy and the fortunate for occupations in offices and for those that required a college degree. The restricted number of individuals who could potentially enter office jobs

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[4] "[D]uring the nineties, the clerical class constituted something of a non-competing group ..." (Douglas 1930, p. 367).

[5] See Goldin (1994, 1994a) for data and Goldin and Katz (1995) for further justification.

[6] By the enrollment rate we mean the percentage of 14 to 17 year olds currently attending public or private secondary school.

around the turn of this century gave rise to the notion that they were members of a "non-competing" group. The implied rate of return to years of high school far exceeded the return to other investments at the time and to years of education in the post-1940 period.

The fraction of high school graduates who continued to college was 50% in 1910 but fell to 25% by 1932 (Goldin 1994). It never again reached its 1910 level until the boom in college enrollments in the 1970s. When high school was primarily for the elites, the majority of youths who persisted for the four years went on to college. But when high schools were opened to the masses, the fraction continuing fell.

High schools became open to the masses because schools were built closer to the homes of potential students and embraced a more relevant curriculum for the non-college bound youth. The internal combustion engine, paved roads, and consolidated school districts brought secondary education to rural communities. Within cities, changes in school curricula, an acknowledgment that high schools were more than college preparatory institutions, attracted more students. And a propaganda campaign throughout the nation touted the financial benefits of a high school diploma and may have served to spread the gospel of education (Goldin 1994).

Coinciding with the high school movement was the "first industrial revolution in the office." Although the typewriter was invented earlier, Christopher Sholes commercially developed it in the late 1860s and it was not extensively used until the early twentieth century. But once mechanization entered the office it spread swiftly. Typewriters were first, followed in rapid succession by adding machines, calculators, address machines, dictaphones, mimeo machines, and, yes, even the precursor of the computer -- the keypunch (Beniger 1986, Cortada 1993). By the 1920s the office was transformed as the artisanal shop had been a century before. Machines replaced labor, made some jobs simpler, and fostered an extensive division of labor. Most importantly, they greatly cheapened the cost of office and information services.

The increased supply of educated youths and the technological revolution in the office were associated with a sharp reduction in the premium earned by office and managerial personnel relative to production workers. Among our most important findings is that the wage of office workers, relative to that for production workers in manufacturing, plummeted from 1914 to the 1920s and then remained relatively constant to 1939. Although the ratio probably declined slightly in the 1940s, the decrease from 1939 to 1949 and beyond is small compared with the initial decline. A male office worker in 1914 earned 1.7 times what a male production worker did, but a mere 1.1 in 1926; a female office worker had earnings 2.1 times those of a female production worker in 1914, but 1.5 in 1926. The reduction in the premium to education and skill was enormous. Three factors were apparently at work: the increased supply of educated workers, technological change, and the slowdown of immigration flows.

The expanded supply of educated workers, we will claim, was the crucial though not sole factor in the decreased wage premium to office workers by sex. By shifting out the supply of workers who were capable of entering these occupations, the high school movement created competition where there had previously been little. Although the mix of office occupations changed, the premium declined for each clerical occupation. The reduction in the relative wages of office workers did not result solely from a change in the occupational distribution. The premium for typists declined along with that for bookkeepers and the decrease occurred for men in male-dominated occupations and for women in the newly-feminized occupations.

The introduction of the new technology, in most cases, interacted with increased education to enhance the demand for office workers. Office machines lowered the cost of information services and increased the demand for the complementary factor -- high-school educated office workers. In only a few occupations did advances in technology foster the substitution of educated labor and capital (e.g., a trained machine operator and a comptometer)

for the remarkably gifted (e.g., the human calculator). If the decrease in the wage premium was the simple result of deskilling, we would expect to encounter it in occupations, such as bookkeeper, which experienced a reduction in skill required, but not for typists, which did not. But that is not what we find. In general, therefore, the reduction in the premium to office workers by sex, that we have uncovered, is not largely due to deskilling or compositional differences. The same workers received relatively lower earnings because of enhanced competition from a growing cadre of high-school educated workers.

Many office jobs were rapidly feminized during the early twentieth century and feminization may appear to have reduced the premium to office work. But male occupations that were not feminized, such as managers (also termed supervisory personnel), also experienced a sharp decrease in relative earnings. Without more high-school educated women there would not have been the increased use of females as office workers. Educational change, and not an exogenous increase in the employment of young women, was the factor of greatest importance.[7]

Immigration was another cause of the decrease in the premium to educated labor, but was quantitatively minor in comparison with educational change. The decline in immigration and the increase in high-school educated workers acted in tandem to decrease the relative wages of the more educated. But the increased supply of educated workers was by far the greater in magnitude, exceeding the impact of immigration restriction by a factor of five to ten.

The factors just mentioned are all on the supply side of the equation. We look, as well, at demand shifts but can only measure the between, not within, industry (and occupation) movements. From 1890 to 1920 the demand for high-school educated workers increased at a moderate pace. But, starting in the 1920s, demand must have sharply expanded because the

[7] Countries in which women are poorly educated compared with men have clerical positions dominated by men, even though the technologies used are the same as in countries having highly feminized office work. Education, not technology, is the critical factor (see Goldin 1995).

wage premium stabilized in the face of a rapid increase in the supply of high-school educated youths.

Given the fundamental changes in the office and the decline in the premium paid to its workers the revolution that ensued was remarkably quiet. The absence of comment was even more exceptional because real wages for office workers declined, recovering their pre-World War I level some fifteen years later. The decrease in the relative and real wages of office workers, whose numbers were soaring, may have received little comment (see, however, Douglas 1926, 1930) because of several factors.[8] The nation enjoyed a productivity boost in the 1920s, particularly in the manufacturing sector, after a period of only moderate increase.[9] Real wages for most Americans increased substantially in the 1914 to 1929 period. At the same time, the office sector grew enormously. Whereas office workers (clericals only) were barely 5% of the U.S. (non-agricultural) labor force in 1900 they were 11.0% by 1920 (Table 1, col. 10). But the real wage of most clerical workers actually fell during the late 1910s, recovering to pre-World War

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[8] Douglas (1926) is a popular version and elaboration of Douglas (1930). For various reasons few economic historians and economists have paid much attention to Douglas's clerical data and have, instead, claimed that the skill premium during the 1920s returned to its pre-World War I level (e.g., Williamson and Lindert 1980). The premium to skilled workers in the building trades and to other skilled workers in manufacturing was much reduced during World War I. But it returned to its pre-war level by the mid-1920s. Douglas's data have also been ignored because they group together males and females as well as ordinary office workers with managers. Our data separate the various groups. C. Wright Mills (1953), in his classic work on white-collar workers, did note the phenomenon. "In 1890, the average income of white-collar occupational groups was about double that of wage-workers. Before World War I, salaries were not so adversely affected by slumps as wages were but, on the contrary, they rather steadily advanced. Since World War I, however, salaries have been reacting to turns in the economic cycles more and more like wages, although still to a lesser extent. ... Yet after each war era, salaries have never regained their previous advantage over wages" (p. 72). Mills must have been relying on Douglas's data, although he does not reference Douglas. He also does not acknowledge that educational advances, not simply changed cyclical sensitivity, may have altered the white-collar differential after both world wars.

[9] The productivity boost is apparent in the Kendrick manufacturing data. Kendrick's total factor productivity estimates for manufacturing are: 0.3% average annually for 1909 to 1919, 5.3% for 1919 to 1929, and 1.9% for 1929 to 1937 (Kendrick 1961, table 34). Woolf's revisions, which include electricity as an input, yield 0.6% for 1909 to 1919 and 3.6% for 1919 to 1929 showing that electricity may have been a factor in the productivity surge of the 1920s (Woolf 1984; data computed using 1909 weights for 1909 to 1919 and 1919 weights for 1919 to 1929).

I real levels some fifteen years later in 1929 (Table 2). The substantial change in both the relative and real earnings for office workers may not have attracted attention because office workers were among the more highly paid workers, their numbers were growing rapidly, and the economy was doing rather well. All of this is in sharp contrast to the current situation.

We concentrate in this paper on the white-collar labor market, particularly that of office workers. During the early period of the high school movement, offices were major employers of high-school educated workers, particularly of those who did not continue to college. But by the 1920s, another, much larger employer of male high school students, emerged. The newer manufacturing industries, such as petroleum refining, certain chemicals, and electrical and transportation machinery, were just beginning to hire high-school educated males in production-line jobs. As the premium to educated workers in white-collar jobs collapsed, that in blue-collar jobs probably emerged, as managers in the growing and technologically complex industries took advantage of the bargain prices for high-school educated youths. The premium to high- school educated workers within manufacturing declined during the 1940s.

Occupations and Wages: Measurement Issues

Data on income and education are generally needed to measure the earnings premium to educated workers. The requirement poses problems for much of American history. The 1940 federal population census was the first to ask Americans about their earnings and the highest grade they completed. Only one state census queried residents about both subjects before 1940 and only two asked grade completed.[10] Several proprietary data sets contain information on

[10] There are reasons to doubt the validity of the responses to the question on highest grade completed in the 1940 census, particularly among older Americans (see Goldin 1994a; Goldin and Katz, 1995). The only state to include information on both education and income prior to 1940 is Iowa. The Iowa census included questions on education in both 1915 and 1925 and income in 1915. South Dakota had a question on education in 1915. See Friedberger (1973) or Jensen and Friedberger (1976) on the Iowa data.

earnings and education for the period but the samples are small and idiosyncratic.[11] The standard data with which to estimate the returns to education are almost entirely lacking for the period of the high school movement.

Wage data for occupations that required particular levels of education can be used in place of micro-level cross-section data. We take this route and compute the ratio of the wage of office workers (or office workers plus supervisory personnel) to that for production workers in manufacturing as a proxy for the return to high school education. Occupational wage data of this sort have the obvious advantage that they enable a computation of the premium to education, but they also have drawbacks. One potential problem is that occupations often group beginners with more experienced workers and the average wage for the occupation will be a mixture of the two. The problem is of particular relevance when the occupation requiring the higher level of education is growing and has more beginners than the less-educated one. The ratio will then understate the premium to high school and the decrease in the premium will be overstated. We recognize this bias but demonstrate that even for entry-level positions, the ratio of office worker earnings to those of production workers decreased from 1914 to the 1920s.

Despite potential biases in both directions, evidence for more recent time periods, when data on wages by occupation and education are available, indicates that changes in occupational premia closely track those in educational wage differentials (see, for example, Juhn 1994, table 1; Murphy and Welch 1993, table 1). According to Murphy and Welch, "virtually all of the fluctuations in education returns [for the 1940 to 1990 period] have come from relative wage changes *across* occupations" (1993, p. 123; italics in original).

This study focuses on the "office" or "clerical" trades. Included in the group are various types of clerks (but not sales clerks), typists, stenographers, secretaries, bookkeepers, cashiers,

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[11] See, for example, Gorseline (1932), and Griliches and Chamberlain (1975) on Gorseline.

(although not in retail trade), and, later, machine operators of various types (e.g., comptometer operators). Office occupations often included managers, but we have treated managers as a separate category. It was an occupation to which one was promoted and not generally an entry-level position.

An abundant literature, on educational requirements for jobs, emerged in the early twentieth century to guide personnel managers, among others. These guides reveal that most manufacturing positions, even if skilled, did not require high school diplomas although they often required some high school or the completion of junior (intermediate) high (Edgerton and Cunliffe 1924). Die-makers, for example, were generally not required to have schooling beyond eighth grade, but it took about four years to learn the trade. Carpentry generally required an intermediate school education and four years for mastery of the trade. Even those in the printing trades, known for their ability to typeset from illegible scrawls, required "good elementary or high school education" and four to five years of on-the-job training.

In contrast, most of the office trades -- stenographer, dictating machine operator, bookkeeper, ledger clerk, cashier, typist -- required a high school diploma (Nichols 1927). And others -- secretarial stenographer, correspondent, statistical clerk -- often demanded college. Although some -- file clerk, multigraph operator, stock clerk, mail clerk, timekeeper -- required only a junior high education, the vast majority of office workers were in the group requiring a high school degree. Even though the formal education component was high, the on-the-job training required to master the job was generally considered minimal.

Many occupations of the period also required schooling beyond eighth grade but other than those already mentioned, the only ones that can be studied for the entire 1890 to 1940 period are teachers, college professors, and members of the clergy.[12] With some exceptions,

[12] We examine the data for teachers but not that for the clergy. Systematic data on the earnings of

these occupations required education beyond high school. We present wage data for these occupations showing that college professors also suffered a decreased premium during the period but that teachers, a much larger fraction of the labor force, did not.

Office and Production Worker Wages: Sources and Data

The wage data come from a diverse set of sources that include various censuses of manufacturing, a report of the U.S. Commissioner of Labor, a National Industrial Conference Board (NICB) study on the wages of production workers, another on clerical workers, three state-level reports of office workers (Massachusetts, New York State and Ohio), the Interstate Commerce Commission (ICC) reports on Class I steam railroads, a Personnel Classification Board report for 1928, and a Women's Bureau study for 1939. The manufacturing censuses and the U.S. Commissioner of Labor report are relied on for the 1890 to 1919 period; the state reports plus the ICC data are used for the 1920s. The sources, therefore, divide chronologically with one set covering the period through World War I and the other, the period after. There is some overlap allowing us to ensure comparability and consistency from 1914 to the 1920s.

Information on the earnings of office workers exists in the censuses of manufacturing for 1890 to 1919 but the detail and definitions change over time. In 1909, 1914, and 1919 ordinary office workers (termed clerks) in manufacturing firms were enumerated separately from salaried officers, superintendents, and managers.[13] In 1900 and 1904, however, salaried officials were grouped with clerks and these data have not been used for that reason. In 1890 clerks were enumerated separately from officers and "firm members actively engaged in the industry or in

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engineers, lawyers, and physicians exist for only the post-1929 period (see Historical Statistics, 1975, series D 913-926). Sales personnel is white-collar group that can be studied, but earnings vary widely between retail and wholesale trade and often involved commissions.

[13] The office work category also included "other subordinate salaried employees" (U.S. Bureau of the Census 1923a, p. 10), such as salespersons in manufacturing establishments.

supervision." But the census subsequently claimed that many supervisors and shop-floor managers, who would ordinarily have been included in production workers, were grouped with office workers. The data for 1895 come from the Eleventh Annual Report of the Commissioner of Labor, a survey of female and child-intensive industries containing data listed by firm and, within firm, by detailed occupation. There is also a data point for 1902 which comes from a Massachusetts survey of mercantile establishments although office workers in the mercantile sector were paid considerably less than they were in manufacturing (see notes to Table 2).

After 1919, neither the decennial nor the biennial manufacturing censuses contains separate statistics on production and non-production workers.[14] Rather, all wage earners are grouped together. Fortunately, other data exist. For 1921 to 1929 office worker wages are obtained from state reports for New York State and Ohio (Ohio's contains data for female office workers starting in 1914).[15] The ICC reports on Class I steam railroads contain data for male clerks.[16] The New York State reports enumerate workers separately by sex, but include "office clerks, stenographers, bookkeepers, accountants, cashiers, stock clerks, office managers, superintendents, etc." (New York State, various years). For males, these data are comparable to those from the manufacturing censuses in 1890, 1909, 1914, and 1919 which include superintendents and managers.[17] The Class I steam railroad data used here exclude the upper end of the occupational spectrum (supervisors and chief clerks) as well as the lower end

[14] The biennials group together all wage earners as does the decennial for 1930 although it has a separate heading for salaried officers and employees.

[15] The Ohio office worker wage data for males has different properties from those in all other data sets we know. The wages greatly increase during the 1920s when all others increase only slightly. Paul Douglas (1930, p. 366, fn. 1) also noted the discrepancy and added, "Why there should be this difference between the two indexes merits further analysis." We know of none.

[16] See U.S. Department of Labor (1932) on the Ohio data, and Goldin and Margo (1992) on the New York State and the Class I steam railroad data.

[17] There are too few female managers and superintendents for their inclusion to matter.

(typists). These data are comparable with those from the manufacturing census for clerical workers only.

The office worker wage data are given in Table 2 for males and females separately and for ordinary clerks and clerks plus supervisors for males. Detailed derivations are given in the notes and an appendix to the table. Wage data for production workers in the same years as for office workers are given in Table 3. The data for production workers are more easily found in conventional sources and require less comment. Both series are deflated by a price index denominated in 1914 dollars.

From 1900 to 1920 the clerical work force grew at two and one-half times the rate in the non-agricultural sectors (Table 1, col. 10) and was altered by mechanization and an extensive division of labor. Women were 15% of all (non-managerial) office workers in 1890 but 48% in 1920 (Table 1, col. 4). One may rightly question whether tracing the wages of all office workers, even divided by sex, is a valid procedure for obtaining the premium to high school graduates. We are fortunate that data exist for 1895, 1926, and 1939 containing detailed information for specific office occupations (see Table 4).

Changes in occupational distribution, as can be seen in Table 4, are more pronounced for females than for males, although in both cases the percentage of bookkeepers drops and the percentage of typists, stenographers, and machine operators (a category that did not exist in 1895) rises. The average wage for the occupations listed is given in row (1) and that for the whole sample or from an independent source is given in row (2). There is close agreement in all cases. Row (3) gives the average wage using the 1895 weights. Despite change in the occupational distribution, the average wage by sex is virtually unaffected by the weights used.

The Premium to High-School Educated Workers, 1890 to 1940

We construct a ratio of the wages of office workers to those of production workers (simply dividing the numbers in Table 2 by those in Table 3) to produce our estimate of the high-school education premium by sex for 1890 to 1939. The premium is given in Table 5 for the clerks and the clerks plus supervisors (for males only).

The premium for all three groups begins quite high in 1890 and 1895. It rises slightly to 1914, after which it plummets. The sharp decrease in the ratio of the wages of office to production workers from 1914 to 1919 should not be surprising. The inflation of the World War I period combined with the stickiness of the earnings of the salaried and certain other workers caused relative wages for many occupations to fall temporarily. It has also been claimed that the demand for less-skilled workers soared during the World War I period, resulting in an increase in their wages relative to those for more-skilled production workers. An index of the ratio of the wages of craftsmen (either in the building trades or manufacturing) to those of the unskilled (either laborers or the lower-skilled in manufacturing), for example, fell during the 1914 to 1919 period, dropping from 1.99 in 1914 to 1.72 in 1919 (Williamson and Lindert 1980, p. 307). But by 1923 the ratio regained ground at 1.92 and in 1926 it stood at 1.95.[18]

The premium to education, however, did not fall temporarily during the war. Rather, it plummeted and remained at that level for another decade. Even by 1929 the ratio we construct (given in Table 5) is 1.13 for men and 1.53 for women. Thus from 1914 to 1929 the premium to high school fell by 31% for females, 41% for male clerks, and 37% for male clerks

[18] The Ober-Miller series, however, does show the decline to persist after World War I (Goldin and Margo 1992). The decline, though, is not as large as the one we produce for office work relative to production workers. The apparent reason for the differences in the Williamson-Lindert and Ober-Miller series is that Ober-Miller use the very lowest-skilled group in the denominator in contrast to Williamson-Lindert who often use a more encompassing group. The lowest-skilled group (e.g., laborers, helpers, haulers) appears to have received a windfall gain after 1914.

plus supervisors.[19]

The sources we have used for office worker wages change around World War I but this is not what produces the large decrease in the premium to white-collar work. For both males and females there is sufficient overlap across the data sets from 1914 to the 1926 to ensure comparability of the series and when they differ, the differences are not sufficient to overturn the findings. For females, the Ohio number for 1921 is almost identical to that for New York State in 1923 which is, in turn, close to that for the U.S. census figure in 1919. The Ohio wage in 1914 and 1919 is lower than that from the U.S. census by 15%. But even if the Ohio data are used, the ratio of clerical to production worker wages falls from 1.81 in 1914 to 1.42 in 1921. We also have independent evidence for 1926 from an NICB report and that figure is nearly identical to the New York State wage in that year (see Table 4). For the men, both the railroad (clerks) and New York State (clerks plus supervisors) series are somewhat lower than the figure for 1919 from the U.S. census, but the differences are not large and we again have the 1926 figure as a benchmark. Of greatest importance though is that all series yield an impressive decline and many, such as those for 1895 and 1926, involve evidence quite independent of the major sources such as the U.S. census and the state surveys.

Regional differences in wages persisted across the United States into the early twentieth century and one may wonder how the premium to education varied by region.[20] The high school movement differed in its spread, taking off rapidly in the states of the West, parts of New England, and the West North Central and lagging in the South even for whites. Not all the data sets allow a study of regional differentials, but the census data reveal that the premium in 1910 was highest in the South and lowest in the West. Almost all the variation comes from the

[19] The percentage change is given by the difference in the logs of the wage ratios.

[20] On regional differences in manufacturing earnings see Rosenbloom (1994).

production worker series; wages for clerical workers varied far less by region.

Most of the wage data refer to full-time employment, meaning that weekly wages were multiplied by 52 or, as in the case of the census, that there was an implicit adjustment in the number of persons reported as working. None of the sources adjusts for hours of work. From 1914 to 1919 hours were reduced considerably in manufacturing for production workers but there is no evidence of as significant a decline in the white-collar trades (Whaples 1990). If correct, this implies that the relative decrease in the earnings per hour for office workers was even greater than we have measured.

Several factors may have caused the premium earned by office workers to decline so steeply. One, which we have already seriously discredited, is the changing composition of the occupational group. The wage premium could not have decreased solely because the office worker group became less skilled, shifting from mainly bookkeepers to typists. As Table 4 showed, the mean office wage is not much affected by changing the distribution of occupations. And as Table 6 shows, there were large declines from 1895 to 1926 in the premium earned by various types of office workers. The only case of a possible increase is for female bookkeepers from 1895 to 1926. But by 1926 the definition of a bookkeeper, particularly for women, was clearer. The 1895 data may have labelled ordinary clerks who did some bookkeeping as bookkeepers. There is also the issue of the feminization of the office work force. But even though the fraction of all office workers who were women increased from 19% to 53% from 1890 to 1930, many occupations remained highly segregated just above entry-level positions. The premium, moveover, declined for women to about the same extent that it declined for men.

Even though we can be certain that changes in occupational mix are not driving the results, another issue is whether the skill of the average typist, stenographer, clerk, and bookkeeper fell over the period. Although we do not know the precise skill content of all office

jobs, the age of ordinary office workers, relative to production workers in manufacturing, actually rose as the premium fell.[21] Machines, to be certain, replaced skill in certain office activities. The bookkeeper of 1890 was an extraordinary individual, literally a human calculator. The bookkeeper of 1920 was no more than a high-school educated individual trained in the use of comptometers. Many stenographers of the 1920s typed from the recently-invented Ediphone, an early version of the dictaphone machine. But in most office occupations, skill requirements were virtually unaffected by the new technology. The major advance in the typewriter design was the ability to see what one was typing, but that came in 1895 (Cortada 1993, p. 19). Thus the decrease in the premium to office workers resulted from a combination of technological change and an increased supply of educated workers. But for most office workers it was the increase supply that appears to have mattered most.

Earnings in several other white-collar occupations can be studied for the 1910 to 1940 period. Some experienced a large decrease in the wage premium during the 1914 to 1920s period, whereas others did not. College professors watched their earnings decrease from more than 4 times that of a production worker to about 3 times (see Table 7). One possible reason is that the number of M.A.s and Ph.D.s increased greatly during the late 1910s and 1920s.[22] But the earnings of public school teachers relative to those of production workers (also given in Table 7) did not decrease during the first few decades of this century. The ratio fell sharply during the World War I period but rebounded quickly and completely. By 1926 the ratio was exactly

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[21] For all men older than 17 years, the difference in mean age between office workers and manufacturing production workers was -1.3 years in 1910 but -0.7 years in 1940 (calculated from the 1910 PUMS and 1940 PUMS).

[22] From 1900 to 1910 there were about 1,800 M.A. degrees conferred each year. But from 1911 to 1920 the number increased to 4,000 and from 1921 to 1930 it increased to 15,000. The Ph.D. was not yet a universal requirement for college teaching. From 1900 to 1910 there were between 350 and 450 Ph.D.s conferred each year. From 1911 to 1920 about 600 were granted each year and from 1921 to 1930 the number rapidly increased to 2,300 (U.S. Department of Education 1993, table 28).

what it had been before the war. Thus the decline in the premium to education was not universal. There was no long-lived reduction in the earnings premium for elementary and secondary school teachers, the demand for whom increased along with the supply of educated Americans.

From 1890 to 1914 the ratio of female office worker to female production worker earnings was between 1.85 and 2.07. If, as we contend, a high school diploma was required for many office jobs, the return to a year of high school for females was quite high -- 15% to 18%.[23] Some office occupations, to be sure, did not require all four years. But for the one pre-World War I year when we have the occupational breakdown, 1895, there is little variation among female earnings by occupation (see either Table 4 or Table 6). The ratio is about 2 for bookkeepers and typist-stenographers, both of which ordinarily required a high school degree.

The data for men are a bit more complicated because the return depends on whether ordinary office workers or clerks plus supervisors are considered. About a quarter of all office workers in manufacturing were in management, and managerial positions were those to which men were promoted. By excluding managers, one is biasing the office occupations toward entry-level positions, whereas the production-worker occupations include both entry-level and higher-level positions. Using the male clerk data the ratio was 1.7 from 1890 to 1914 but was 2.4 for male clerks plus supervisors. If one needed a high school diploma for these positions but no more than eighth grade for the production jobs, the return would be between 13% and 22% per high school year. However one treats these data, the return to secondary school before World War I was substantial.

By the 1920s the return to high school had declined substantially. The ratio of office

[23] We measure the return to a year of high school as log(office-worker wage/production-worker wage) divided by four. Carter and Hammaker (1995), using evidence on school years and earnings by occupation-city cells in 1894 Kansas, find somewhat lower returns (7% per year), but they do not separate secondary from elementary school years nor do they test for the impact of a high school diploma.

worker wages to production worker wages was about 1.5 for females. It was 1.6 for male clerks plus supervisors, although only 1.1 for male clerks. Assuming, as we did above, that access to these positions was gained with four additional years of school, the annual return was 10% for females and 12% for males, although just 2.4% if the upper-level positions for males are excluded. The return, therefore, was halved during the period. The implied return before World War I was substantial but by the end of the 1920s it was just slightly higher than the returns to education calculated for the 1960s and 1970s.[24]

We have alluded to the fact that we are not the first to comment on the sharp decrease in the returns to high school in the 1910 to 1930 period. Paul Douglas (1930) constructed an estimate of the wage of salaried and clerical workers and compared it with his estimates for other workers over the 1890 to 1926 period.[25] Douglas's series grouped men and women, as well as managers and ordinary office workers. We have already noted that the share of women among all office workers increased during the period and women earned substantially less than did men. Douglas knew the limitations of his data but was convinced that the return to each group had substantially decreased, and our data show that he was right.

Even though Douglas's data, like ours, point to a sharp break with World War I, Douglas emphasized long-run factors in his explanation for the decline in the premium. The most important single explanation, to Douglas, was the rise of publicly-funded high schools:

> "The truth of the matter seems to be that, during the nineties, the clerical class constituted something of a non-competing group, into which it was somewhat difficult for the children of the manual workers to penetrate. The members of this class were in consequence enabled to secure real differences in wages beyond those necessitated by the extra skill involved. But these differences have been

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[24] Mincer (1974) for example calculates the rate of return to a year of school as 7% in 1960. Similarly, Goldin and Margo (1992) estimate a 7% return to a year of high school for young males in 1960 in contrast to a return of 9% in 1940.

[25] See also Burns (1954) which extends the data in Douglas and continues his theme of the decline of non-competing groups into the post-World War II era.

> greatly lessened, not only by the reduction in the amount of skill required, but also by the extension of free public education." (Douglas 1930, p. 367).

Douglas hypothesized that the premium to education would have declined further had the demand for office workers not increased so greatly. And he speculated that the driving force behind the high school movement was "the business interests of the country [who] were willing to have so much of the resources of the country, and incidentally of their own, devoted to furthering secondary education" (Douglas 1930, p. 368).

Why the Premium Fell

Our explanation for why the premium to office workers fell, like Douglas's, emphasizes both education and technology but also considers the change in immigration and other shifts in the demand for educated workers. To recapitulate our findings on the wage structure: the proxy for the relative wage of high school workers shows little change from 1890 to 1910, declines substantially (by approximately 35 log points) from 1910 to 1920, and changes slightly from 1920 to 1930.[26] The central questions for supply and demand analysis are why the relative wage of the high school educated declined from 1914 to the mid-1920s and what accounts for its subsequent stability. The major difference between the 1910s and the previous two decades, we find, was a marked acceleration in the rate of growth of the relative supply of high-school educated workers. The increase in relative supply of high school graduates (measured either as a percent of the labor force or as the log ratio of high school graduates to those without high school degrees) was approximately three times more rapid from 1910 to 1920 than from 1890 to 1910. The expansion in the share of the work force with a high school education was due to the high school movement and the sharp curtailment of immigration in 1915. But the increase in

[26] Our recapitulation uses census years because our measures of the relative supply and demand for high school workers generally pertain to them.

new high school graduates was by far the more important factor.

If supply factors alone were the driving force in the relative wage of high school workers, the premium to office work would have continued its decline in the 1920s and 1930s. The rate of growth of educated labor accelerated in the 1920s and the 1930s. Because the wage differential for office workers stabilized in the 1920s, one has to look to the demand side for an explanation. The rate of growth of relative demand for high school graduates must have increased substantially in the 1920s relative to the 1910s. We construct proxies for between-occupation and between-industry demand shifts for high school graduates using information on changes in the occupational and industrial structures from 1900 to 1940 and information on the relative usage of high school graduates by occupation and industry in 1940. The indices suggest that between-sector demand shifts for high school graduates decelerated in the 1910 to 1920 period and then accelerated from 1920 to 1930. Although the measured between-occupation and between-industry demand shifts are consistent with our explanation, they are not large enough to provide the entire story. Within-sector demand shifts favoring high school graduates must have accelerated substantially in the 1920s to make the observed movements in relative wages and relative quantities consistent with a market-clearing framework.

We recognize that there are other, reinforcing explanations for the substantial decrease in the premium to high-school educated workers. Technological changes in the office, as we have already mentioned, facilitated the substitution of machines and educated labor for the extraordinary worker, as in our bookkeeper example. The quality of high school graduates may have declined as high schools expanded and became more for the masses. And as they expanded, they may have taught less demanding courses. But high schools were elite institutions prior to the high school movement and did not necessarily draw from the upper tail of the ability distribution. Rather than a decline in standards for those who did not continue

to college, it is more likely that the non-college track expanded.

Finally, there is possibility that the market for blue-collar workers was substantially altered in the World War I period and that the threat of unionization and a desire to decrease turnover increased wages for blue-collar workers (see, for example, Slichter 1929). According to this view, the labor market should have returned to its previous wage structure after World War I but did not because of a fundamental change in labor market institutions. What the proponents of this theory did not realize is that the aberrant circumstances of the war were reinforced by supply and demand shifts that continued after. We turn now to those shifts.

Relative supply shifts

To measure how the relative supply of high school graduates changed we construct estimates of the stock of high school graduates from 1890 to 1940. Rather than use data on school attainment of the older population from the 1940 census, we construct the stock using flow data. We do so because the high school graduation data in the 1940 census are highly suspect and appear to overstate substantially the human capital stock of Americans (see Goldin 1994; Goldin and Katz, 1995).[27] We combine our estimates of the stock of high school graduates with information on the relative labor force participation rates of high school graduates and those with less than 12 years of schooling in the 1940 PUMS to estimate the high school graduate share of the labor force.

Our estimates of high school graduates as a share of the adult population and the labor force are given in Table 8. The stock of high school graduates is computed in each year by assuming that 4 percent of the adult population in 1890 were high school graduates. The stock of high school graduates is updated each year by adding in the flow of new high school

[27] The 1940 census was the first to ask years of schooling.

graduates by sex (U.S. Department of Education 1993, table 29; see also Goldin 1994, 1994a).[28]

A modest increase in the fraction of high school graduates in the population and labor force during the 1890 to 1910 period is shown in Table 8. But beginning in the 1910s and continuing to the 1920s and 1930s, the growth in the proportion graduating high school accelerates rapidly. The time patterns of change are similar for men and women.

A useful measure of the relative supply of high school graduates is the logarithm of the ratio of high school graduates (S^h) to those without high school degrees (S^n) in the labor force: $\log(S^h/S^n)$, termed here the "log relative supply of high school graduates."[29] The log relative supply of high school graduates increased by just 0.11 from 1890 to 1900 and by 0.22 from 1900 to 1910. But from 1910 to 1920 the log relative supply increased by 0.40 and it increased further to 0.50 from 1920 to 1930.[30] The rate of growth of the (log) relative supply of high school graduates tripled in the decade of the 1910s and was more than twice as rapid in the period of the collapse in the office worker wage premium as it was in the previous two decades, when the premium was stable. The increase in relative supply could fully explain the collapse of the wage premium even if the rate of growth in relative demand had stayed constant from 1890 to 1920.

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[28] See the notes to Table 8 for a detailed description of the procedure. The procedure probably overestimates the stock of high school graduates from 1890 to 1940, due to two assumptions. The first is that we explicitly choose an upper-bound estimate for the initial stock in 1890. The second is that we update the stock each year by the gross flow of new high school graduates and do not estimate a net flow by subtracting deaths of existing high school graduates. The low high school graduation rate of older cohorts (educated prior to 1890) suggests that deaths probably were small relative to the number of new graduates in this period. We ignore additions to high school graduates from the net immigration of adults, but we suspect that few adult immigrants arrived with high school degrees prior to the 1930s. Our conclusions regarding the growth of high school graduates in the population are not sensitive to reasonable changes in these assumptions.

[29] This is the appropriate measure of relative supply for examining relative wage changes in a two factor model (high school graduates and those without a high school degree) with CES technology.

[30] These numbers can be generated from Table 8 which expresses the number of high school graduates as a share of the total labor force. When the share was 0.054 in 1910, for example, the ratio of high school graduates to all others was, then, 0.058. In 1920 the fraction was 0.085 (= 0.079/0.921). Thus the decadal rate of growth in (S^h/S^n) from 1910 to 1920 was 40% (= ln 0.085/0.058).

But the further acceleration of relative supply growth in the 1920s, in the absence of a continuing decline in the wage premium, implies an acceleration in the rate of growth of relative demand for high school workers. It also leaves open the possibility that a demand slowdown (possibly a shift in relative demand favoring production workers during World War I) could also have contributed to the different behavior of relative wages in the 1910s than previously.

Paul Douglas (1930) argued that both the expansion of high school education and the reduction in immigration reduced the relative supply of less-educated labor and eroded the wage premium paid to office workers. Sumner Slichter (1929) and other observers of his day emphasized the decline of immigration after 1914 as the key factor in increasing relative wages of less-skilled workers. Table 9 shows the evolution of male immigrants (foreign born) as a fraction of the U.S. adult population (≥ 19 years) from 1890 to 1950. Large scale immigration (combined with rapid native population growth and some out-migration) kept the foreign-born share of the adult male population relatively constant from 1890 to 1910. The immigrant share then declined steadily from 1910 to 1950.

But the decrease in the foreign-born share of the population cannot account for all but a small fraction of the increase in the relative supply of high school graduates after 1910, even if all immigrants were unskilled (i.e., none had a high school degree). If the immigrant share of the male population remained at 24.3% from 1910 to 1920 and if none of the additional immigrants arrived with high school degrees, male high school graduates as a share of the male adult population would have increased from 4.5% to 6.28% (1910 to 1920) rather than to 6.5% (the observed change in Table 8). Thus the immigration slowdown could not have raised the male high school share by more than 0.2 to 0.3 percentage points during the period. The growth of new high school graduates, on the other hand, contributed at least 1.75 percentage points. Thus the high school movement was approximately 8 times as important as the reduction in

immigration in explaining changes in the relative supply of more-educated workers.

Relative demand shifts

Changes in the relative supply of high school graduates can explain the collapse of the office worker wage premium in the 1910s. But supply changes alone would lead one to predict a continuing decline through the 1920s and 1930s. Substantial shifts in relative labor demand favoring high school workers are needed to explain differences in the behavior of the wage premium across the decades.

Relative labor demand shifts may come from two types of changes: those that occur within sectors (i.e., shifts that change relative factor intensities within sectors at fixed relative wages) and those that occur between sectors (i.e., shifts that change the allocation of labor demand across sectors at fixed relative wages). Between-sector shifts are driven by changes in product demand and differences in rates of factor-neutral technological change. Major sources of within-sector shifts include skill-biased technological change and changes in prices of non-labor inputs. Observed changes in the sectoral composition of employment (occupational and industrial employment distributions) and information on differences in sectoral factor intensities can be used to estimate proxies for between-sector demand shifts. Within-sector shifts are more difficult to measure and are typically viewed as a residual after accounting for relative supply shifts and between-sector demand shifts. We will follow this approach.

One widely used measure of the effect of between-sector demand shifts on relative labor demands is the fixed-coefficient "manpower requirements" index (Freeman 1980). This proxy for the percentage change in demand for demographic group k can be written as:

$$\Delta D_k = \Sigma_j \lambda_{jk}(\Delta E_j/E_j)$$

where j indexes sector, E_j is total employment of all demographic groups in sector j, $\lambda_{jk} = E_{jk}/(\Sigma_j E_{jk})$ in a base year, and E_{jk} is the employment of group k in sector j.

The index measures the percentage change in the demand for a demographic group as the weighted average of percentage employment growth by sector, where the weights are the industrial employment distribution for the demographic group in a base period.[31] When relative wages are changing (as from 1910 to 1920), the index will tend to overstate demand shifts favoring groups with declining relative wages.

The employment distribution of different education groups cannot be obtained prior to 1940, but we do have the employment distribution of education groups from the 1940 PUMS. The occupational distribution of employment for 1900 to 1940 is easily obtained (see Kaplan and Casey 1958) although that for the industrial distribution had to be adjusted for consistency across the entire period (see Fabricant 1949 for the base data). Thus we can calculate demand shift measures, that are essentially standard fixed-coefficient manpower requirement indices, by combining information on changes in the occupational (or industrial) distribution with information on factor intensities of the occupations (industries) in 1940.

We specify our index of the between-sector change in demand for group k measured relative to base year employment of group k, E_k, as:

$$\Delta D_k = \Sigma_j \lambda_{jk}(\Delta E_j/E_j) = \Sigma_j (E_{jk}/E_k)(\Delta E_j/E_j) = \Sigma_j (E_{jk}/E_j)(\Delta E_j/E_k) = [\Sigma_j \alpha_{jk}\Delta E_j]/E_k$$

where j indexes sector, E_j is total employment in sector j, and $\alpha_{jk} = (E_{jk}/E_j)$ is group k's share of total employment in sector j in the base year, $\lambda_{jk} = E_{jk}/(\Sigma_j E_{jk})$ in the base year.[32] ΔD_k provides an estimate of the change in demand for demographic group k measured as a percentage of the

[31] Katz and Murphy (1992) provide a formal justification for the use of such an index and show that it provides an unbiased measure of between-sector demand shifts when employment is measured in efficiency units (rather than simple bodies) and when relative wages are constant. As a practical matter, experimentation with data from the 1960s to the 1980s suggests that measuring sectoral labor inputs in employment levels rather than efficiency units (where the relative weight of different demographic groups depends on their relative wages in a base year) makes little difference in estimates of trends in between-industry and between-occupation demand shifts.

[32] Employment levels are the share of total employment in the year: $\Sigma_k E_k = 1$; $\Sigma_j E_j = 1$; and $\Sigma_j \Sigma_k E_{jk} = 1$.

employment of demographic group k in the base year (i.e., 1940). We use this approach for occupational employment shifts from 1900 to 1940 (using an 11 occupation decomposition) and for industry employment shifts for 1910 to 1940 (breaking the economy into 37 industries).

Table 10 provides the key information used to create the between-occupation demand shift measures: the occupational distributions and high school intensity by occupation.[33] The table shows the large gap in the share of high school workers between clerical and sales jobs on the one hand and blue-collar jobs on the other hand even in 1940. White collar employment (professional, managerial, clerical, and sales) increased from 17.6% of the total in 1900 to 31.1% in 1940. The growth in clerical employment was particularly rapid from 1900 to 1920; sales growth expanded in the 1920s. Industry employment shifts show similar patterns from 1910 to 1940 with sectors employing disproportionately more high-school workers growing more rapidly. Much of the shift towards high school occupations and industries arose from the decline in agriculture, but large shifts are apparent even within the non-farm economy.

The between-occupation and between-industry demand shifts for high-school educated workers are shown in Table 11. The stability of the high school relative wage from 1900 to 1910 and from 1920 to 1940 implies that the indices in Table 11 provide unbiased estimates of between-sector demand shifts over these periods. But changing relative wages from 1910 to 1920 mean that the indices overstate the between-sector demand shifts towards high school workers during the 1910s. The magnitude of the between-occupation demand shift index declines slightly from the 1900 to 1910 to the 1910 to 1920 period. A substantial slowdown in the shift in relative demand towards high school workers may have occurred in the 1910s. The collapse in the relative wage of high school workers should have increased the demand shift measure for high school graduates even if actual demand behavior had not changed. The between-occupation and

[33] Similar information for industries is presented in Appendix Table A4.

between-industry measures both show some acceleration from the 1910s to the 1920s. The movement here is in a direction opposite to that of the expected bias, implying an increase in the rate of growth of the relative demand for high school workers in the 1920s. The bottom panel of Table 11 shows somewhat similar results when one treats male and female high school workers as distinct labor inputs. The time patterns of between-sector demand shifts displayed in Table 11 for those with 12 or more years of schooling are quite similar when we compare those with exactly 12 years of schooling to those with less than high school education.

Putting supply and demand shifts together

Figure 2 summarizes the estimated shifts in the relative supply of and demand for higher- and lower-educated labor from 1890 to 1940. The horizontal axis is the decadal rate of change in the (log) quantity of higher-educated labor (L^h) relative to that for lesser-educated labor (L^n). The vertical axis gives the decadal rate of change in the (log) ratio of the wages for the two types of labor, higher (w^h) and lesser (w^n). Asterisks (*) denote the (log) rate of change in a variable.

The supply of high school graduates increased modestly from 1890 to 1910 relative to the subsequent decades. Measured between-occupation demand shifts can account for much of the demand shift necessary to keep the relative high school wage stable given such a modest supply shift. Relative supply growth accelerated starting in the 1910s. Between-sector relative demand growth slowed somewhat from 1910 to 1920. These two changes can account for the collapse of the white-collar wage premium during the period. Supply growth continued to accelerate in the 1920s and the 1930s. Between-sector demand shifts also accelerated but not by enough to fully offset the growth in the supply of high school graduates. Thus within sector demand shifts from changes in technology and the organization of work are necessary to explain the stability of the differential after the early 1920s.

Evidence in the 1940 PUMS reveals where some of the increased demand for high-school

educated workers is to be found. The proportion of blue-collar workers, by industry, who were high school graduates is given in Table 12. Particular industries hired disproportionate fractions of high school graduates among their young (18 to 34 years old), male blue-collar workers (operatives, craftsmen, service workers, and laborers). The new high-technology sectors of the era -- electrical machinery, petroleum refining, certain chemicals, transportation equipment, utilities, and communications, to mention a few -- were in the forefront hiring high-school graduates as blue-collar workers. The older industries of America -- textiles, lumber, iron and steel, tobacco -- hired very few as a fraction of their labor forces.

We do not yet know when industry began hiring educated blue-collar workers in large numbers. It is our sense that the conversion began in the 1920s among the newer and growing industries. The work spaces of growing, high-technology industries could be designed for the educated worker who was suddenly available at bargain prices. The response of this large sector to the decreased relative cost of educated labor implies that some part of the occupations we have assumed required no high school education, eventually did.

Conclusion

The premium to high-school educated workers plummeted sometime from 1890 to the late 1920s, declining 30 to 40 log points most likely in the World War I period. Our best estimate of the rate of return to a year of high school for males was 22% before the decline and 12% after; for females it was between 15% and 18% before but 10% after. We attribute much of the decline to the increased supply of high school graduates during the initial period of the high school movement.[34] But even though the premium to education declined substantially, it was still

[34] This evidence supports Becker's (1993) speculation that the relative position of high school graduates deteriorated sometime prior to 1940 because of pressure from increased supplies of high school students.

relatively high in 1939 when it underwent another decrease.

The long-run change in relative wages was briefly strengthened by the heightened demand for blue-collar workers during World War I. Other factors reinforced the increased relative supply of educated workers but their impacts were smaller. The sharp curtailment of immigration, due first to war in Europe and then to U.S. legislation, was one. But immigration restriction was between one-fifth and one-tenth as large as the increase in high school graduation in affecting the relative supply of more educated labor. Compositional changes in office occupations and a reduction in the innate ability of educated workers are other factors that our evidence downplays in importance.

The fact that the premium to educated workers declined rapidly during a war-time period may be meaningful. Another compression in the wage structure occurred in the 1940s, although it differed in extent and causes (Goldin and Margo 1992). Both episodes, though, support the notion that wars enable the erosion of customary wage differentials (Phelps Brown 1977). The precise timing of the decreased premium to education may have been due to the special circumstances of World War I, but the fact that it remained in place supports our contention that it was driven by market forces, mainly the increased supply of educated workers.

Also supporting our story is that the wage of British office workers relative to those in manual trades remained high until sometime between the late-1930s and the mid-1950s, long after the great narrowing in the United States. The premium to British secondary school education then collapsed just as it had in the United States some thirty years before. The key variable here, as in the American case, is education. British secondary schooling was substantially altered with the passage of a 1944 act mandating its public funding, and high school enrollments and graduation rates soared in the post-World War II period.[35]

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[35] See Phelps Brown (1977, table 3.6). The ratio of white-collar to manual worker earnings drops, from

Prior to 1910, when only the elite and the fortunate could attend secondary school, office workers were a non-competing group. The substantial earnings premium to high school graduation before World War I must have provided a strong enticement to attend secondary school and formed the basis of an effective propaganda campaign for their spread. Even though the premium to high school declined as schools were built and more youths were educated, the returns to high school were still substantial in 1940. We do not mean to imply that the high school premium was eliminated during the period we explore. On the contrary, it decreased again, in the 1940s along with that to college education (see Goldin and Margo 1992).

Parallels exist between the episode we describe and that of today. Both contain major technological changes in information services and increased demands placed on the educational system. In both there were large changes in the wage structure, although opposite in direction. History shows that technological change in the information sector does not always widen the wage structure. Rather than be an ability-enhancer, technological change can enable the substitution of machines for particular innate skills and be an ability-equalizer. Another important lesson is that education, particularly publicly-provided education, is often ameliorative. It enabled those from less fortunate circumstances to enter the higher-paying occupations of the early twentieth century. And education together with technology provided the means for those who were less intellectually gifted to become workers in the modern office.

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the late-1930s to the mid-1950s, for men in higher and lower professional occupations, and for women in lower professional jobs. It also falls for men in clerical jobs but remains stable for women in those occupations.

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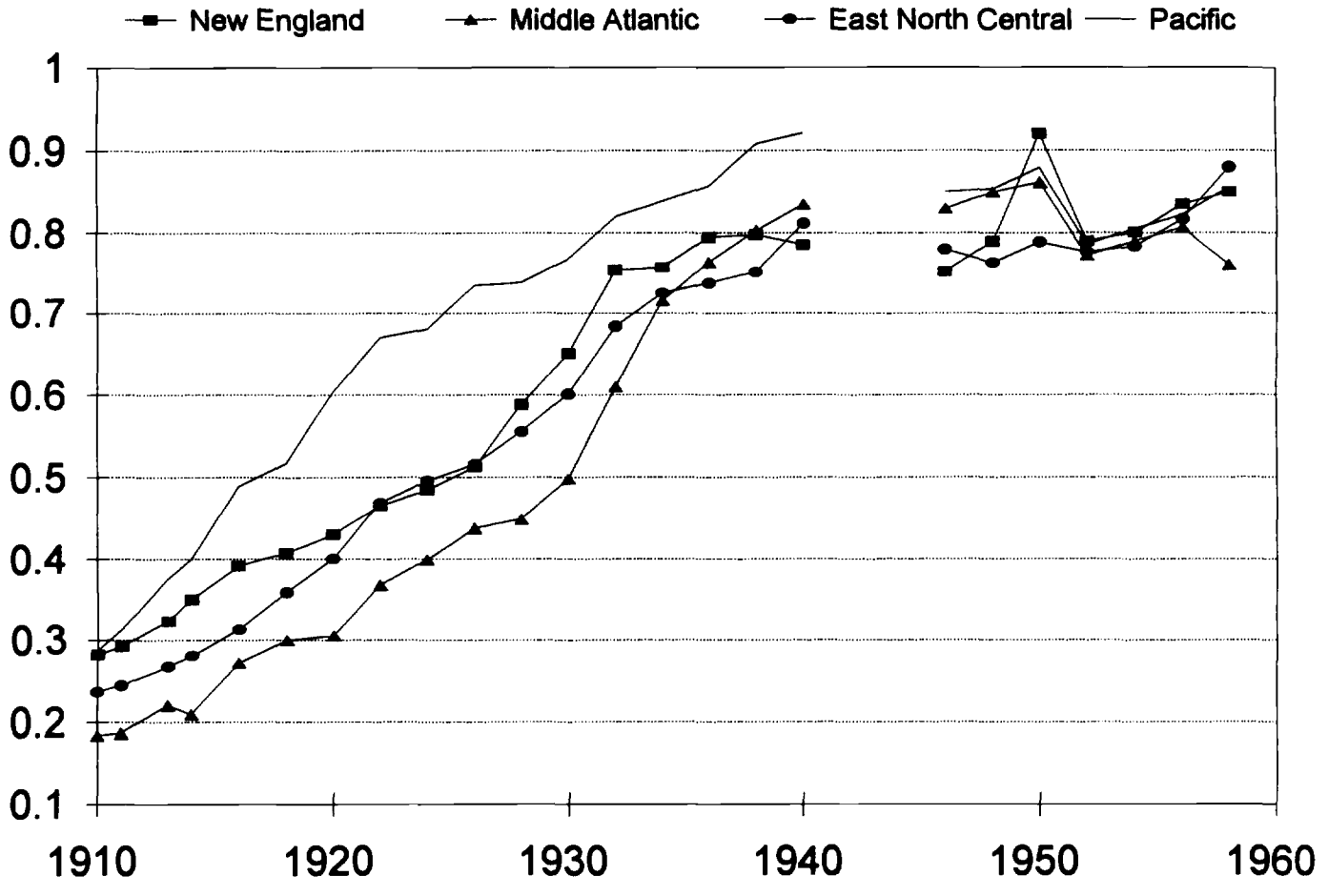
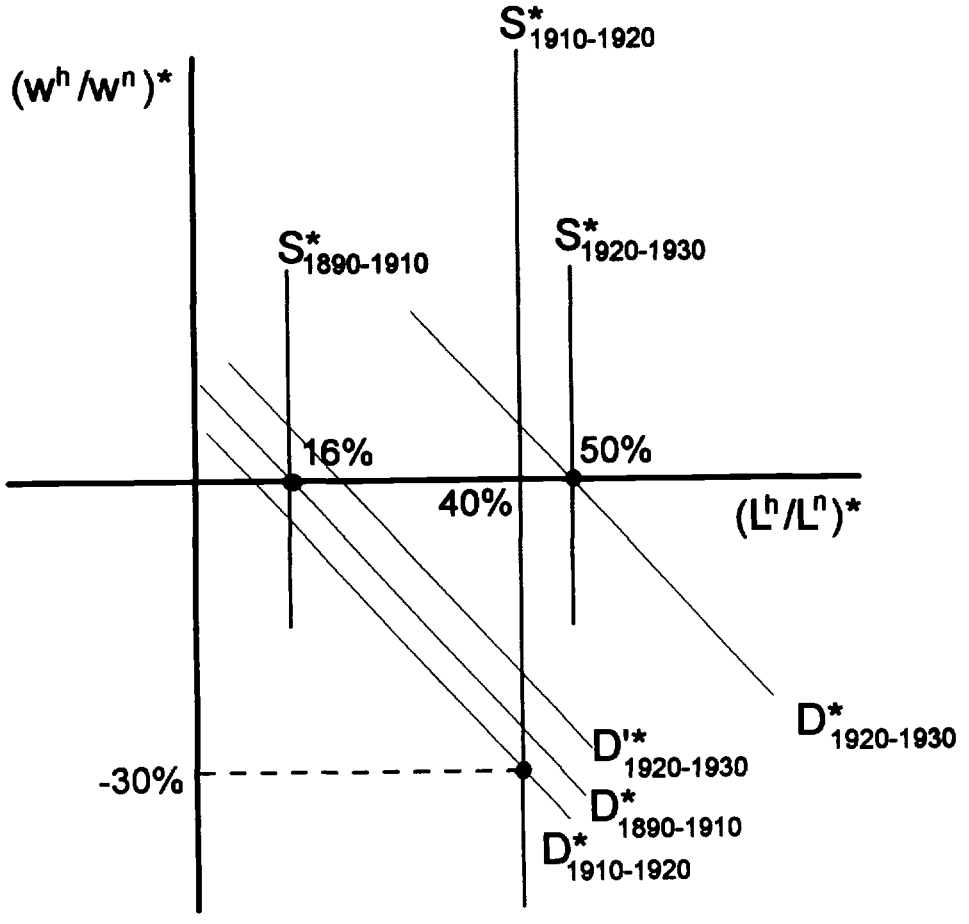


Figure 1: Public and Private Secondary School Enrollment Rates for Four Regions

Sources: See Goldin (1994, 1994a)

Notes: Males and females are combined. Enrollment is divided by the approximate number of 14 to 17-year olds in the state. Interpolations to the population figures are made between census years. There are no private school data for 1940 to 1946.

Figure 2: A Schematic Representation of Supply and Demand Shifts for Higher-Educated (L^h) and Lower-Educated (L^n) Labor



Notes: We have drawn this figure to be consistent with the facts presented in the paper regarding the shifts in the relative supplies of higher- and lower-educated labor, taken here to have a zero-elasticity with respect to relative wages of the two types of labor. From 1890 to 1910 the supply of higher-educated (versus lower-educated) labor grew at 16% per decade. As high schools expanded, the relative supply of educated labor shifted to the right, growing at 40% from 1910 to 1920 and 50% from 1920 to 1930. From 1890 to 1910 the relative wages of the two types of labor did not change and thus the demand function (in rate of change form) is given by $D^*_{1890-1910}$. Because we find that the relative demand for educated labor decreased from 1910 to 1920, we draw it to the left of that for 1890 to 1910. The premium to high school graduation fell by 30% from 1910 to 1920. But despite the further increase in relative supplies, the relative wage was constant from 1920 to 1930 implying that the demand for higher-educated workers increased faster than that for lower-educated workers. The $D'^*_{1920-1930}$ function indicates that using the between industry shifts we are only able to track a small part of the increase in demand. The difference between $D'^*_{1920-1930}$ and $D^*_{1920-1930}$ is the within industry increase in the relative demand for more educated workers.

Table 1
Office and Other White Collar Employment: 1890 to 1940

Year	(1) Office Workers: 3 Clerical Groups: Males (000)	(2) Office Workers: 3 Clerical Groups: Females (000)	(3) Office Workers: 3 Clerical Groups: % Female	(4) % Female in Sector: All Office	(5) % Female in Sector: Entire Labor Force	(6) White Collar Workers: Profess. (000)	(7) White Collar Workers: Manag. (000)	(8) White Collar Workers: Clerical (000)	(9) White Collar Workers: Sales (000)	(10) (8)/Non agr. Labor Force	(11) (6)+(7)+(8)+(9)/ Nonagr. Labor Force
1890	307.4	73.3	19.4	14.6	18.3						
1900	494.0	214.2	30.2	24.0	20.0	1234	1697	877	1307	4.8	28.2
1910	950.8	573.1	37.6	36.2	20.4	1758	2462	1987	1755	7.7	30.9
1920	1441.7	1396.0	49.2	47.7	22.1	2283	2803	3385	2058	11.0	34.2
1930	1774.4	1964.4	52.5	51.5	24.3	3311	3614	4336	3059	11.3	37.3
1940				51.5	27.9	3879	3770	4982	3450	11.7	37.6

Notes:
Three clerical groups are: (1) bookkeepers, cashiers, accountants; (2) clerks (except clerks in stores); (3) stenographers, typists, secretaries.
In the white collar worker category: managerial group excludes retail dealers; clerical excludes messengers, office boys, office girls, baggagemen; sales excludes hucksters, peddlers, newsboys.
The All Office category used to compute % Female in Sector includes all those in office employment, not just those in the three clerical groups.

Sources:
Office Workers, 3 Clerical Groups: Rotella (1977, table 5.11) from U.S. Bureau of the Census (1943).
% Female in Sector: Goldin (1984)
White Collar Workers, non-agricultural labor force: Historical Statistics, series D182-232 (1975)

Table 2
Office Worker Real Annual Earnings (1914 Dollars): Males and Females, 1890 to 1939

Year	Males				Females		
	Clerks		Clerks & Supervisors		Clerks		
	Urban U.S.	RR U.S.	Urban U.S.	NYS	Urban U.S.	NYS	Ohio
1890			1080[a] 1320[b]		520		
1895[c]	924				539		
1902[d]	852 (910)				526 (553)		
1909	1058		1491		688		
1914	1099		1537		740		645
1919	888		1346		620		541
1921							611
1922		907					
1923	893	892		1303	632	642	
1924	924	908		1347	648	658	
1925	917	892		1337	672	682	
1926	937	898		1366	685	695	685
1927	964	924		1407	700	711	690
1928	977	964		1425	723	734	716
1929	1009	976		1472	733	744	716
1939	1199			1727	890	890	

[a] Includes clerical staff and some managerial personnel.

[b] Includes clerical staff, managerial personnel, salaried officers, and some proprietors.

[c] The 1895 figure is from U.S. Commissioner of Labor (1897).

[d] The 1902 figure is for Massachusetts office workers in mercantile establishments. Because a higher fraction of mercantile clerical workers were bookkeepers, wages by occupation have been reweighted using the occupational distributions for 1895. The unweighted average is given in parentheses and excludes sales personnel, buyers, managers, and executives.

Sources and Notes to Table 2:
Real values were obtained by dividing nominal values by a spliced price index consisting of that due to Rees (1890 to 1914), Douglas (1919 to 1926), and the B.L.S. (1927 to 1939). See Historical Statistics series E 135, 185-186. Appendix Table A2 contains the nominal values.

Annual earnings figures for some of the series were obtained by multiplying weekly rates by 52 or monthly rates by 12.

1890: U.S. Census Office (1895)
The 1890 census was the first to list separate information on office or firm members and clerks. It appears that some managers may have been inadvertently included in the clerk group. Only the city-level data separated "clerks" from "officers, firm members, and clerks." The latter group included officers, firm members, superintendents, managers, and clerks. The data come from a sample of the 20 largest manufacturing industries (although in this particular tabulation, some important large industries such as iron and steel were excluded) in the 165 principal cities listed in table 6 of part II (Statistics of Cities). We have included males > 16 years and females > 15 years old. The North consists of the New England, Middle Atlantic, East North Central, and West North Central regions. We have assumed that very few of the female "clerks" were managers. City-industry cells are weighted by the number of workers. "Average weekly earnings per employee" have been multiplied by 52 weeks to obtain annual earnings.

1895: U.S. Commissioner of Labor (1897)
This survey lists average weekly wages at the firm level by occupation for female-intensive and mixed industries (e.g., textiles, clothing) and for some firms in the trade and service sectors. We recorded the wages of all office workers (e.g., typists, stenographers, bookkeepers, clerks) listed but omitted managers, supervisors, and firm owners. Only adults (≥ 18 years) are included in the wage averages. One large Massachusetts firm with very low-wage male stock clerks was omitted. The North consists of the New England, Middle Atlantic, East North Central, and West North Central regions. Because of the omission of male-intensive industries, we adjusted the male wage by the ratio of male "clerk" earnings for all 20 industries in 1890 to that in female-intensive industries (viz, $14.714 \times [18.912/18.653]$). There are 1358 males and 974 females in the sample for the North. See Table 4 for occupational data on all regions.

1902: Massachusetts Bureau of Statistics of Labor (1903)
The survey by the Commonwealth of Massachusetts was of mercantile wages and salaries. Sales workers are excluded here and only regular office workers are included. There are 410 males and 665 females in the sample (excluding managers and buyers). Bookkeepers (and kindred occupations) were 47% of male office workers, whereas they were 31% in the 1895 sample of mainly manufacturing concerns. We have reweighted the Massachusetts sample using the occupational distribution for 1895 given in Table 4. Mercantile wages for office workers still appear to be lower than those for office workers in other sectors. Various surveys in the 1930s show that wages for office workers in mercantile establishments were lower than those in other sectors (see U.S. Bureau of Labor, Women's Bureau 1934, 1942). On average, the earnings of female (male) office workers in mercantile establishments were 28% (46%) lower in Philadelphia in 1939. Individual occupations show somewhat lower penalties for mercantile work (e.g., female typists earned 21% less; male stock clerks earned 44% less than in other establishments).

1909: U.S. Bureau of the Census (1912), see Appendix Table A1 for construction of clerk (office worker) wages. The wage for clerks and supervisors is a weighted average of the clerk wage and that for supervisors. Supervisor earnings and numbers employed were listed separately but no breakdowns by sex were given. All supervisors are assumed to be male. The proportion of male clerks among male clerks and supervisors was 0.6892 and nominal annual earnings for supervisors was $2229.

1914: U.S. Bureau of the Census (1918), see Appendix Table A1 for construction of clerk (office worker) wages. The wage for clerks and supervisors is a weighted average of the clerk wage and that for supervisors. Supervisor earnings and numbers employed were listed separately but no breakdowns by sex were given. All supervisors are assumed to be male. The proportion of male clerks among male

clerks and supervisors was 0.7112 and nominal annual earnings for supervisors was $2582.

1919: U.S. Bureau of the Census (1923), see Appendix Table A1 for construction of clerk (office worker) wages. The wage for clerks and supervisors is a weighted average of the clerk wage and that for supervisors. Supervisor earnings and numbers employed were listed separately but no breakdowns by sex were given. All supervisors are assumed to be male. The proportion of male clerks among male clerks and supervisors was 0.6256 and nominal annual earnings for supervisors was $3750.

1922 to 1929:
Urban U.S.:
1923-1929 (except 1926): Extrapolated on the NYS series using 1.458 for males (1.015 for females) as the ratio of the NYS annual wage to that for all office workers in the urban U.S. The ratio uses the 1926 data for office workers and is very close to that computed for 1939. It is higher for males than females because the NYS data include supervisors, a large fraction of whom were probably men.
1926: National Industrial Conference Board (1926). The 1926 NICB survey included firms in the 18 largest U.S. cities and covered 25,879 workers. See Table 4.

RR: U.S. Interstate Commerce Commission, Wage Statistics of Class I Railroads in the United States (1922 to 1952). Only clerks (A, B, and C) in Reporting Division II: Professional, Clerical, and General are included. End of year summaries have been used in all cases. Monthly earnings are: (total compensation)/(average number of employees, middle of month). There is no breakdown by sex, and women may have been employed in some clerical positions, although it is likely that there were very few. Typists, stenographers, and secretaries comprised a completely different group and women were probably more common in those occupations. See also Goldin and Margo (1992).

NYS: U.S. Department of Labor (various dates). These data, which come from surveys of office personnel working in New York State factories, were initially collected by the New York State Department of Labor and published in The Industrial Bulletin (Albany, New York). For all years but 1923, the data were reprinted in the Monthly Labor Review. The wages series after 1922 was separated by sex and whether the factory was located in upstate New York or New York City. Office workers included managers for this survey.

Ohio: U.S. Department of Labor, Women's Bureau (1932, table 6, p. 13). The survey of Ohio clerical workers that produced these data was reprinted by the Women's Bureau as Bulletin no. 95. Clerical workers included only the three major occupations: bookkeepers, stenographers, and office clerks. Only those in offices (as opposed to manufacturing and trade) are used and only medians are given. The wage in manufacturing establishments in Ohio for 1914 is $563 or only 78% of the census figure for that year and 87% of that for offices in Ohio. See also Goldin (1984, p. 14).

1939: U.S. Department of Labor, Women's Bureau (1942). The data come from a survey of firms hiring office workers in Houston, Kansas City, Los Angeles, Philadelphia, and Richmond. The survey included data on 34,048 women and 21,959 men. All office occupations, except supervisors, are included.

Table 3
Annual Real Earnings for Production Workers (1914 Dollars), 1890 to 1939

Year	(1) Douglas, 3-year moving average	(2) Males, NICB all production workers	(3) Males, derived from cols. (1) & (2)	(4) Females, NICB all production workers	(5) Females, derived from cols. (1) & (4)
1890	484		552		281
1895	480		546		279
1902	549		626		319
1909	568		641		352
1914	575		648		357
1919	656		739		406
1921	694		782		431
1922	725		817		449
1923	721		813		447
1924	747	873	842	517	463
1925	739	873	833	517	458
1926	745	885	842	518	463
1927		891	853	523	467
1928		914	874	523	468
1929		935	895	537	480
1939		1090	1043	640	572

Notes and Sources:
Nominal wages are deflated using the procedure described in the notes to Table 2.
col. (1): Douglas (1926), 3-year moving average for all production workers.
cols. (2), (4): Beney (1936, see also Historical Statistics 1975, series D 835, 838), weekly wage × 52 weeks for all production workers.
col. (3): Derived from col. (1) using values for the percentage of all production workers who were females (α) and the ratio of female to male weekly wages (λ), $w = [\alpha\lambda + (1-\alpha)]\, w_m$, where w = average weekly wage for all adult production workers and w_m is that for adult males. For 1890 to 1902 $\lambda = 0.25$ and $\alpha = 0.51$ and for 1909 to 1926 $\lambda = 0.25$ and $\alpha = 0.55$. U.S. Census Office (1895) sample of 165 principal cities (> 20,000 population) yields $\alpha = 0.241$ and $\lambda = 0.51$; the urban North sample for 1909, 1914, and 1919 (see Table 2) gives $\alpha = 0.255$ in 1909, 0.254 in 1914, and 0.241 in 1919 and $\lambda = 0.55$ on average over the years. The ratio of the NICB data for 1924 to 1926 to those of Douglas are 0.957 for males and 0.893 for females. The figures for 1927 to 1929 are adjusted accordingly. The wages for 1890 to 1919 derived by using this procedure are very close to those we have produced for production workers from samples similar to those from which we derived the clerical wages in Table 2.

Table 4
Occupational Distribution and Real Weekly Wages (1914 Dollars) by Occupation for Office Workers by Sex: 1895, 1926, and 1939

	Males						Females					
	Percentage			Weekly Wage			Percentage			Weekly Wage		
	1895	1926	1939	1895	1926	1939	1895	1926	1939	1895	1926	1939
Clerks[a]	61	57	65	14.58	14.93	21.65	44	31	38	9.63	10.47	16.02
Other clericals[b]	2	7	(3)	8.27	9.67	(18.07)	4	12	(8)	7.39	11.41	(14.30)
Bookkeepers, cashiers[c]	35	29	18	23.94	25.95	25.43	30	11	7	10.75	19.61	17.73
Typists, stenographers[d]	2	3	6	17.21	21.34	22.05	22	31	42	11.24	14.60	18.16
Machine operators[e]	0	5	6	n.a.	13.21	19.25	0	15	13	n.a.	12.49	16.40
Special office staff	0	0	6	n.a.	n.a.	35.96	0	0	1	n.a.	n.a.	24.70
(1) Average wage				17.79	18.02	23.06				10.22	13.17	17.12
(2) Average wage from other sources[f]				17.76	17.46					10.37	13.17 13.36	
(3) Average wage using 1895 weights				17.79	18.21	22.65				10.23	14.10	16.95

[a] All clerks except chief and senior clerks, file clerks, and mail clerks for 1895 and 1926.

[b] Includes office boys and girls, telegraph and telephone operators, and mail clerks in 1895; switchboard operators, file clerks, and mail clerks in 1926. For 1939 these occupations are included in all clerks although the percentage for the occupations is given in parentheses.

[c] Also includes chief and senior clerks, accountants, and assistant bookkeepers for 1895 and 1926. Includes tellers in 1939.

[d] Includes secretaries, typists, and stenographers in 1895, but excludes male secretaries with very high earnings. For females in 1926 uses a weighted average of the wages of typists and stenographers.

[e] Includes punchcard, duplicating, addressing, and adding (calculating) machine operators in 1926. Adds billing, bookkeeping, and tabulating machine operators in 1939. There were no machine operators in 1895.

[f] The 1895 figure is from Table 2 divided by 52; that for males in 1926 is the monthly figure for railroads divided by 4.286. For females, the top figure is from Ohio and the bottom for New York State. See Table 2.

Notes and Sources to Table 4:

Nominal wages are deflated using the procedure described in the notes to Table 2.

1895: U.S. Commissioner of Labor (1897), see notes to Table 2.
1926: National Industrial Conference Board (1926)
1939: U.S. Department of Labor, Women's Bureau (1939)

The 1895 and 1926 surveys were samples of various types of firms hiring office workers and included mainly manufacturing firms but also some insurance companies and publishing firms.

The 1895 data given here include 1573 male adults and 1058 female adults. The 1895 earnings data in Table 2 are slightly different from those in this table because Table 2 includes all non-supervisory personnel in the sample but is only for the 4 northern regions. Individuals with "bi-occupations"(e.g., bookkeeper-salesman) were excluded here unless the two occupations were similar (e.g., typist-stenographer). The male weekly wages have been adjusted for the exclusion of male-intensive industries, as per the notes to Table 2.

The 1926 NICB survey included firms in the 18 largest U.S. cities and covered 25,879 workers. Banks and railroads were a separate category in 1926 and have been excluded. The 1939 survey sampled all types of firms hiring office workers. The sample size in 1939 is 34,048 women and 21,959 men and excludes supervisory personnel.

Table 5
Education-Skill Premium, 1890 to 1939: Clerical and Supervisory Workers

Year	(Clerk/Production Worker) Wage		(Clerk & Supervisor/ Production Worker) Wage
	Males	Females	Males
1890	n.a.	1.848	2.392[a] 1.958[b]
1895	1.691	1.936	n.a.
1909	1.652	1.956	2.326
1914	1.696	2.073	2.372
1919	1.202	1.525	1.821
1922	n.a.	n.a.	n.a.
1923	1.099	1.413	1.603
1924	1.097	1.399	1.600
1925	1.101	1.466	1.605
1926	1.113	1.480	1.623
1927	1.131	1.501	1.650
1928	1.117	1.546	1.630
1929	1.128	1.527	1.645
1939	1.150	1.557	1.656

Notes and Sources:
Clerk (clerk and supervisor) wages: Table 2, urban U.S.
Production worker wages: Table 3.
The figure for 1902 is omitted because it includes just mercantile wages which were lower than those for clerical workers in manufacturing and other offices.

[a] Clerks and supervisors include clerical staff, managerial personnel, salaried officers, and some proprietors.

[b] Clerks and supervisors include clerical staff and some managerial personnel.

Table 6
Education-Skill Premia by Occupation: 1895, 1926, and 1939

Sex, Occupation	(Clerk/Production Worker) Wage 1895	1926	1939
Male clerks	1.388	1.084	1.088
Female clerks	1.798	1.177	1.499
Male bookkeepers	2.278	1.604	1.268
Female bookkeepers	2.001	2.205	1.613
Male typists, stenographers	1.638	1.319	1.100
Female typists, stenographers	2.099	1.641	1.652
Male machine operators		0.816	0.960
Female machine operators		1.404	1.492

Notes and Sources:
Tables 3 and 4. The weekly wage for clerks in 1939 has been adjusted for consistency with the other years by calculating the implied figure for clerks other than those in the "other" category (e.g., mail and file clerks). The figures are $30.16 for males and $22.77 for females. In all years the annual figures for production workers are divided by 52 to obtain the weekly wage. There were no machine operators listed in 1895.

Table 7
Education-Skill Premium, 1909 to 1939: College Professors and Public School Teachers

Year	(College Professor/Male Production Worker) Wage			(Public School Teacher/ Male Production Worker) Wage
	Full	Associate	Assistant	Urban Schools
1909	4.142	2.864	2.451	1.256[a]
1914	3.904	2.873	2.418	
1919	2.142	1.663	1.345	0.812[b]
1921	2.613	1.983	1.686	
1922	2.849	2.234	1.734	1.148
1923	2.889	2.229	1.863	
1924	2.829	2.176	1.798	1.204
1926	2.818	2.166	1.803	1.225
1927	2.872	2.170	1.816	
1928	2.904	2.213	1.838	1.252
1929	2.851	2.203	1.765	
1939				1.356[c]

Notes:
Male production worker wages are used as the denominator because most college professors during this period were men and the public school data do not yet separate males and females.

Sources:
College professor earnings are from Stigler (1950, p. 42) who relied on Booth (1932) for 1914 to 1932. Booth gives the average of the median earnings among 27 state universities and colleges. Stigler's data for additional years are medians. Public school teacher salaries are from Stigler (1950, p. 21). They are averages, but group together males and females, and elementary school teachers with secondary school teachers. They do separate rural from urban schools. Production worker wages are from Table 3.

[a] Teachers' salaries for 1910.

[b] Teachers' salaries are an average of 1918 and 1920.

[c] Teachers' salaries are an average of 1938 and 1940.

Table 8
High School Graduates as a Share of the Adult Population and Labor Force

	Adult Population (≥ 14 years)			Labor Force		
Year	Total	Males	Females	Total	Males	Females
1890	0.040	0.035	0.046	0.040	0.035	0.064
1900	0.045	0.038	0.052	0.044	0.038	0.072
1910	0.055	0.045	0.066	0.054	0.045	0.092
1920	0.080	0.065	0.095	0.079	0.065	0.132
1930	0.122	0.102	0.142	0.123	0.102	0.197
1940	0.203	0.181	0.226	0.213	0.181	0.314

Notes: We created the stock of high school graduates in each year by assuming the stock was 4% of the adult population in 1890. That is likely to be an overestimate of the actual figure because the rate of graduation among 17 year olds in 1890 was approximately 4%. We also assumed that the ratio of female to male high school graduates in the initial 1890 stock was 1.25 because this was approximately the ratio of new female to male graduates around 1890. We update the stock of high school graduates each year by adding in the flow of new high school graduates. Missing years from the high school graduate series were interpolated by regressing the log of high school graduates on a local time trend, allowing the trend to differ in each interval containing missing observations. We then divided by the relevant population numbers to get the fraction of high school graduates in the adult population. To get the share of the labor force that consisted of high school graduates we had to compute the fraction of high school graduates who were in the labor force by sex. We assumed the ratio of the labor force participation rate of high school graduates to that in the entire population was the same in all years as it was in 1940 and used the 1940 PUMS to estimate the labor force participation rates by schooling and sex. For males the ratio was 1.0 but it was 1.39 for females. More educated females were disproportionately in the labor force in 1939. Therefore the high school share of the labor force is the same as that in the population for males, which is why the population and the labor force numbers in the table are the same.

Sources: High school graduates by sex: U.S. Department of Education (1993), table 19 for 1890-1909, 1939-40; Goldin (1994a) for 1910-1938. Population and labor force data: Historical Statistics (1975), series A 119-134, D 75-84.

Table 9
Male Immigrants as a Fraction of the Adult Total and Male Populations

Year	Male Immigrants as a Fraction of the	
	Adult Total Population	Adult Male Population
1890	0.128	0.247
1900	0.118	0.228
1910	0.127	0.243
1920	0.112	0.217
1930	0.095	0.187
1940	0.068	0.136
1950	0.050	0.101

Source: Historical Statistics (1975), series A 119-134.

Table 10
Occupational Distribution, 1900 to 1940
and Fraction High School Graduate and ≥ 10th Grade by Occupational Group, 1940

	Occupational Distribution, Males and Females					Fraction H.S. Graduate	Fraction ≥ 10th Grade
Occupational Group	1900	1910	1920	1930	1940	1940	1940
Professional	0.043	0.047	0.054	0.068	0.075	0.852	0.903
Managerial	0.058	0.066	0.066	0.074	0.073	0.443	0.561
Clerical	0.030	0.053	0.080	0.089	0.096	0.633	0.771
Sales	0.045	0.047	0.049	0.063	0.067	0.518	0.673
Craft	0.105	0.116	0.130	0.128	0.120	0.202	0.332
Operative	0.128	0.146	0.156	0.158	0.184	0.184	0.320
Laborer	0.125	0.120	0.116	0.110	0.094	0.108	0.198
Service, private household	0.054	0.050	0.033	0.041	0.047	0.145	0.240
Service, other	0.036	0.046	0.045	0.057	0.071	0.244	0.389
Farmer	0.199	0.165	0.153	0.124	0.104	0.104	0.170
Farm laborer	0.177	0.144	0.117	0.088	0.070	0.107	0.177
All occupations						0.300	0.412
Nonagricultural occupations						0.338	0.459

Note: The fraction high school graduate is that with 12 or more years of schooling in the 1940 PUMS; ≥ 10th grade is fraction with 10 or more years of schooling in the 1940 PUMS.

Sources: Occupational shares, Kaplan and Casey (1958); percentage of high school graduate (or ≥ 10th grade) workers in each occupation, 1940 PUMS.

Table 11
Demand Shifts Between Occupation and Between Industry for High School Educated Workers

A. Demand shifts for high school graduates

	Occupation		Industry	
	Share of Labor Force	% of 1940 Share	Share of Labor Force	% of 1940 Share
Males and Females				
1900-1910	2.2	7.4	--	--
1910-1920	2.1	7.2	2.2	7.4
1920-1930	2.5	8.5	2.5	8.5
1930-1940	1.3	4.5	1.5	5.2

B. Demand shifts for high school graduates and those with less than high school graduation by sex as a % of the 1940 share

	Occupation				Industry			
	Male		Female		Male		Female	
	≥ HS	< HS	≥ HS	< HS	≥ HS	< HS	≥ HS	< HS
1900-1910	5.4	-4.5	11.2	2.4	--	--	--	--
1910-1920	5.6	-2.1	10.2	-7.0	7.7	-2.6	6.9	-5.5
1920-1930	6.3	-6.3	12.6	7.2	5.3	-5.8	14.8	5.0
1930-1940	2.3	-4.6	8.6	9.1	3.2	-3.8	9.0	4.2

Notes: High school graduates (≥ HS) are those with ≥ 12 years of school.
We proxy the level of demand for group k in year t (e.g., high school graduates in 1930) as a share of the total labor force as:

$$d_{kt} = \Sigma_j \alpha_{jk,1940} E_{jt}$$

where $\alpha_{jk,1940} = E_{jk,1940}/E_{j,1940}$ = share of employment in sector j of group k in the 1940 PUMS; and E_{jt} equals sector j's share of total employment in year t. (A sector is an occupation for between-occupation demand shifts and an industry for between-industry demand shifts. We decompose the economy into 11 occupations and 37 industries.) The change in the demand for group k from t to τ as a share of the labor force is given by $d_{k\tau} - d_{kt}$.

We measure the change in demand for group k from t to τ as a percent of employment of group k in 1940 (the base year) as:

$$\Delta D_{k,t\tau} = [\Sigma_j \alpha_{jk,1940} \Delta E_{j,t\tau}]/E_{k,1940} = (d_{k\tau} - d_{kt})/E_{k,1940}$$

where $\Delta E_{j,t\tau}$ = change in employment share of industry j from t to τ; and $E_{k,1940}$ = employment share of group k in 1940.

Sources: Occupational distribution of employment, 1900 to 1940: Kaplan and Casey (1958), table 2.
$\alpha_{jk,1940}$ and E_{jt} (for occupations), $E_{k,1940}$: Table 10.
$\alpha_{jk,1940}$ and E_{jt} (for industries): Table A3.
Industrial distribution of employment, 1910-1940: Authors' calculations from Fabricant (1949) and Carson (1949). Demographic shares of occupations and industries in 1940: 1940 PUMS.

Table 12
High School Graduates as a Percentage of Blue-Collar Workers
in Selected Industries
White Males, 18 to 34 Years: 1940

Industry, % HS grad. ≥ 0.30	Industry, % HS grad. < 0.30	%	Number
	mining	19.5	4270
	building trades	18.7	12958
food		30.8	3524
	tobacco	13.8	116
	textiles	16.8	3550
	clothing	25.5	780
	lumber & furniture	19.6	3634
	paper	27.1	1109
printing & publishing		44.3	1380
chemicals		32.2	1169
petroleum		40.0	557
	rubber	29.0	445
	leather	23.7	1065
	stone, clay, glass	26.1	1227
	iron & steel	28.6	4610
nonferrous metals		31.2	1015
machinery, non-electric		34.1	2260
machinery, electric		39.7	1086
transportation equipment		33.4	3421
scientific & photographic equipment		40.0	235
	transportation services	26.5	6105
communication services		57.1	389
utilities		38.7	1162
trade		35.7	10230
	financial, insurance, real estate	27.9	542
business and repair services		31.7	2955

Notes: The percentage of high school graduates among all white 18 to 34 year old men with blue-collar occupations in 1940 = 26.5. High school graduates = those with ≥ 12 years school. Blue collar = craft workers, operatives, service workers, and laborers. "Number" is the number of observations in the 1940 PUMS.

Source: 1940 PUMS

Appendix Table A1
Construction of Office Worker Nominal Earnings for 1909, 1914, and 1919

Year	Female/Male Office Worker Wage		Mean Wage, Urban North	Female Employment Share	Method I		Method II	
	Actual	Assuming trend, 1895 to 1926			Male wage	Female wage	Male wage	Female wage
1895	0.5838							
1909		0.6502	875.25	0.2599	963	626	956	650
1914		0.6740	999.03	0.2778	1099	740	1097	736
1919		0.6977	1400.35	0.3722	1578	1101	1591	1098
1926	0.7309							

Sources: Female/male office worker wage, 1895: U.S. Commissioner of Labor (1897), see Table 2.
Female/male office worker wage, 1926: National Industrial Conference Board (1926), see Table 2.
Mean wage, urban North: 1909, U.S. Bureau of the Census (1912); 1914, U.S. Bureau of the Census (1918); 1919, U.S. Bureau of the Census (1923).
Female employment share: see notes to Table 2 for construction of 1909, 1914, and 1919 office wages.

Notes: The manufacturing censuses of 1909, 1914, and 1919 list "clerks (including other subordinate salaried employees)" separately from "salaried officers of corporations." Although the numbers of male and female clerks (adults, ≥ 16 years old) are given separately, the wages of both sexes are combined. Two methods are used to separate the wages of male and female office workers. The urban North is used because the 1895 and 1926 data are primarily for the urban North.

Method I: The following identity was fit with the above data, $w = [(1 - \alpha) + \alpha\cdot\lambda]\cdot w_m$, where w = mean office worker wage for the urban North (males and females combined), α = female share of office employment, and $\lambda = w_f/w_m$. Values for λ for 1895 and 1926 come from independent sources. Those for 1909, 1914, and 1919 are extrapolated using the assumption of linear trend increase. Values for λ during the 1920s from the railroad (male) and NYS (female) data in Table 2 show the procedure is probably quite accurate.

Method II: All cities in the four regions of the North (New England, Middle Atlantic, East North Central, and West North Central) having populations > 20,000 in 1910 were used as the sample. The log of the average wage for clerks was regressed on the proportion female among all office workers (α) in the occupation-city (the regression was weighted by the number of office workers in each city). Only cities containing < 5000 clerks were used (this excluded a few large cities and several smaller cities having large insurance companies). The regression equation can be derived by assuming that the average office worker's wage in each city (w) was a geometric average of that for males and females: $w = w_f^{\alpha} \cdot w_m^{(1-\alpha)}$. Then $\ln(w) = \ln(w_m) + \alpha\ln(w_f/w_m)$.

The regression produced an estimate of the ratio of female to male office-worker earnings in each year (1909, 0.6806; 1914, 0.6710; 1919, 0.6900). This estimate was then used to obtain the wages of male and female clerical workers by using the actual mean wage and the percentage female in the occupational group, both for the entire sample of cities (not just those with < 5000 office workers in the manufacturing sector). The regression procedure was checked for accuracy against the data for 1890, which contain wages of male and female office workers separately. The method produced estimates in 1890 that were within a few percentage points of the actual data.

Table A2
Office Worker Nominal Annual Earnings: Males and Females, 1890 to 1939

Year	Males				Females		
	Clerks		Clerks & Supervisors		Clerks		
	Urban U.S.	RR U.S.	Urban U.S.	NYS	Urban U.S.	NYS	Ohio
1890			983[a] 1201[b]		473		
1895[c]	776				453		
1902[d]	733 (783)				452 (476)		
1909	963		1357		626		
1914	1099		1537		740		645
1919	1578		2391		1101		961
1921							1081
1922		1494					
1923	1504	1502		2193	1064	1080	
1924	1555	1529		2267	1091	1107	
1925	1583	1540		2308	1160	1177	
1926	1624	1557		2368	1187	1205	1188
1927	1666	1596		2430	1210	1228	1192
1928	1665	1643		2428	1232	1251	1220
1929	1720	1664		2508	1249	1268	1220
1939	1657			2387	1230	1195	

Notes: See Table 2.

[a] Includes clerical staff and some managerial personnel.

[b] Includes clerical staff, managerial personnel, salaried officers, and some proprietors.

[c] The 1895 figure is from U.S. Commissioner of Labor (1897).

[d] The 1902 figure is for Massachusetts office workers in mercantile establishments. Because a higher fraction of mercantile clerical workers were bookkeepers, wages by occupation have been reweighted using the occupational distributions for 1895. The unweighted average is given in parentheses and excludes sales personnel, buyers, managers, and executives.

Table A3
Nominal Annual Earnings for Production Workers, 1890 to 1939

Year	(1) Douglas, 3-year moving average	(2) Males, NICB all production workers	(3) Males, derived from cols. (1) & (2)	(4) Females, NICB all production workers	(5) Females, derived from cols. (1) & (4)
1890	441		502		256
1895	403		459		234
1902	472		538		274
1909	517		583		320
1914	575		648		357
1919	1165		1313		722
1921	1229		1384		762
1922	1194		1346		740
1923	1214		1368		753
1924	1258	1470	1417	871	780
1925	1276	1508	1438	893	791
1926	1295	1535	1459	898	802
1927		1539	1473	903	806
1928		1557	1490	892	797
1929		1593	1525	916	818
1939		1506	1441	885	790

Notes and Sources: See Table 3.

Table A4

Industrial Employment Distribution, 1910-1940
and Fraction High School Graduate and ≥ 10th Grade by Industry Group, 1940

Code	Industry	Industrial Distribution Males and Females 1910	1920	1930	1940	Fraction HS Grad	Fraction ≥ 10th Grade
2	Mining	.029	.030	.024	.021	.155	.240
3	Construction	.063	.052	.062	.066	.147	.247
5	Food	.015	.019	.019	.023	.286	.424
6	Tobacco	.005	.005	.003	.002	.150	.239
7	Textiles	.025	.028	.024	.024	.165	.279
8	Apparel	.019	.017	.016	.017	.187	.321
9	Lumber	.022	.020	.018	.020	.163	.261
10	Paper	.003	.004	.005	.007	.277	.412
11	Printing	.011	.011	.012	.013	.471	.624
12	Chemicals	.004	.007	.007	.009	.357	.480
13	Petroleum	.001	.003	.004	.004	.381	.505
14	Rubber	.002	.005	.003	.003	.321	.477
15	Leather	.009	.010	.008	.008	.222	.347
16	Stone,clay,glass	.010	.008	.008	.007	.234	.346
17	Iron	.026	.025	.025	.026	.243	.369
18	Nonferrous	.007	.008	.007	.006	.294	.421
19	Machinery	.011	.024	.013	.014	.328	.482
20	Elec. Machinery	.003	.006	.008	.008	.396	.551
21	Trans. Equip.	.011	.025	.020	.018	.284	.431
22	Scientific Inst	.001	.001	.001	.002	.415	.556
23	Misc Manuf	.017	.025	.017	.010	.298	.443
24	Transportation	.064	.066	.053	.042	.220	.345
25	Communication	.006	.008	.010	.008	.504	.670
26	Utilities	.014	.016	.020	.018	.411	.546
27	Whole & retail	.092	.098	.122	.133	.399	.545
28	FIRE	.014	.019	.029	.029	.574	.686
29	Bus & repair ser	.000	.000	.015	.012	.327	.472
31	Amusement	.004	.005	.006	.007	.428	.577
33	Government	.015	.022	.022	.032	.504	.632
34	Ind not reported	.016	.009	.028	.062	.337	.452
101	Agriculture	.309	.268	.215	.169	.109	.177
102	For and Fish	.007	.007	.006	.003	.163	.251
301	Domestic Ser	.059	.041	.048	.049	.158	.254
302	Personal Ser	.043	.048	.051	.058	.286	.422
321	Educ Services	.025	.028	.034	.032	.808	.856
322	Prof Services	.017	.021	.030	.036	.698	.775
402	Hand Trades	.024	.012	.007	.004	.107	.179
	All Industries					.300	.412
	Nonagric. Ind.					.338	.459

Note: The fraction high school graduates is that with 12 or more years of schooling in the 1940 PUMS; ≥10th grade is the fraction with 10 or more years of schooling in the 1940 PUMS.

Sources: Industrial shares, Author's calculations from Fabricant (1949) and Carson (1949); percentaged of high school graduates (or ≥ 10th grade) workers in each industry from 1940 PUMS.