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Status and Mortality: Is there a Whitehall Effect in the United States?*

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Abstract

The influential Whitehall studies found top-ranking civil servants in Britain experienced lower mortality than civil servants below them in the organizational hierarchy. I test for a Whitehall effect in the lifespan of a 1930 cohort of white collar employees at a leading American firm—General Electric. All had access to a corporate health and welfare program during a critical period associated with the health transition in the United States. I measure status using position in the managerial hierarchy, attendance at prestigious management training camps, and promotions, none of which is associated with a Whitehall-like rank-mortality gradient. Instead, senior managers and executives experienced a mortality penalty of around 3 to 5 years relative to those lower in the hierarchy. I discuss generalizability and potential explanations for this reversal of the Whitehall phenomenon using additional data on the status and lifespan of top business executives and US senators.

Keywords: Mortality, status, socioeconomic determinants of health.

JEL Classifications: I12, I14, N32

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1 Introduction

Reducing inequalities in health is core to public policy because health and lifespan informs our understanding of how the needs of society are being met (e.g., Cutler, Deaton and Lleras-Muney, 2006; Costa, 2015; Case and Deaton, 2015). In a highly-cited set of studies started in the 1960s, researchers found lower rank in the UK civil service to be detrimental to health, controlling for socioeconomic status (SES) and lifestyle (e.g., Marmot et al., 1978, 1991, 1997). The Whitehall finding—after the area of London in which these civil servants worked—was attributed to a link between mortality risk and the psychological stress of working in subordinate positions.[1]

Recent research, however, has shown that individuals in higher ranks can also be subjected to emotional stress leading to detrimental health outcomes. CEOs who were exposed to more aggressive legal takeover standards in the United States during the late twentieth century experienced premature ageing and reduced life expectancy (Borgschulte et al., 2019). Furthermore, the biology literature suggests the link between social status and health can be mediated by the structure of hierarchies. Studies of baboons find that leaders can be insulated from stress in stable hierarchies, but in unstable hierarchies they must exert stress-inducing effort to prevent displacement (e.g., Sapolsky, 2005; Anderson et al., 2021). Reverse Whitehall effects might therefore be possible.

This paper examines the Whitehall phenomenon in the US using new data on the lifespan and SES characteristics of more than a thousand white collar workers employed at one of America's most prominent early twentieth century corporations—General Electric (GE). While the literature on the health transition in the US has focused on *convergence from below*, namely the impact of rising incomes, better nutrition and medical or public health interventions like efforts to control infectious diseases or provide clean drinking water in reducing inequalities in mortality, white collar variation has not been extensively studied. This paper is concerned with changes in longevity among individuals who would have already experienced secular improvements in life expectancy.

Occupational hierarchies are typically difficult to observe due to lack of data on reporting relationships. I exploit the fact that workers at GE were organized by a clear managerial hierarchy at a time when managerial hierarchies were becoming core to the structure of American business (Chandler, 1977). Using GE's 1930 *Organization Directory*, an internal personnel document, I profile the position of white collar workers in GE's managerial hierarchy focusing on those living in the Schenectady area of New York state, the firm's headquarter city. I sort employees into six hierarchical levels from executives and senior managers at the top, to lower order employees. This approach mimics the ordering of civil servants in Whitehall by their employment grade.

There are several reasons why this setting is ideally suited to an examination of the Whitehall phenomenon. First, just like Whitehall, I study a population of employees that share the same employer, live in the same area, share the same race (white) and lifestyle (comfortable middle-class, at least by the standards of the 1930s). Second, GE in 1930 was so large that it was not unlike the

[1] Cutler, Lleras-Muney and Vogl (2012) cite the Whitehall studies as the "leading examples" of efforts to investigate the health impact of occupational hierarchies, though these findings do remain controversial. For a critical review of these studies see further Case and Paxson (2011) and Chandra and Vogl (2010). For a causal analysis of the Whitehall effect, see Anderson and Marmot (2012).

UK civil service: turnover was low and rank was well-established and stable within the managerial hierarchy. Third, GE was particularly forward-looking from the standpoint of the welfare of its workers (Moriguchi, 2005), so its employees had access to health programs just like civil servants could access the UK national health service. Fourth, although I cannot construct a contemporary measure of health, as was done in the Whitehall studies, I can look further into the future of each employee because all have now died. I can also exploit GE and census data to construct youth and adult SES indicators such as family background and education for each individual. While there are obvious difficulties associated with regression-adjusting for SES characteristics (Adler et al., 1994), the estimates provide a Whitehall-like window into the relationship between rank and lifespan.

Figure 1 illustrates and contextualizes some salient aspects of longevity by rank in the GE hierarchy using broader datasets of business and political elites. Figure 1A shows mean lifespan by birth cohort was comparably high for all GE employees relative to the lifespan of US senators and top executives in US corporations, conditional on survival to the 1930s. For individuals in the upper levels of the GE hierarchy lifespan fluctuated around that of top executives generally (Figure 1B). Yet, Figures 1C and 1D imply a mortality penalty for upper-level executives at GE relative to individuals in lower levels of the hierarchy based on mean and median lifespan respectively. These descriptive plots are inconsistent with a Whitehall-like mortality gradient because they suggest senior executives at the firm from the same birth cohorts lived relatively shorter lives.

There are three main empirical challenges when estimating the relationship between status and mortality in status hierarchies. First, as the Whitehall researchers noted, any misclassification of individuals in an organizational structure will lead to biased estimates. They assumed that the bias would be towards zero (i.e., no effect of status on longevity) given classical measurement error in assigning individuals to ranks.[2] Misclassification using the GE data is unlikely because the boundaries in the hierarchy are codifiable on the basis of the *Organization Directory*. Moreover, I verify the ordering of individuals using independent measures of their social status using data from the 1930 census—the value of an individual's home and the number of servants.

I also define status using additional indicators. GE held extensive management training camps on an isolated island on Lake Ontario in upstate New York (see Figure A1), the most prestigious of which was called "Camp General." I use attendee lists during the 1920s and 1930s from GE's personnel records. Attendance was seen as a significant mark of status and it signalled professional advancement. Employees were organized into management training camp categories through performance appraisal, in line with economic theories of status contests (e.g., Besley and Ghatak, 2008; Moldovanu, Sela and Shi, 2007). Finally, I traced individuals from the 1930 *Organization Directory* to the 1940 directory to observe status changes through promotions. Although I do not exploit exogenous variation in status, an attractive feature of the data is that I can test for consistency of the results using these different measures of status orderings within the same firm.

The second empirical challenge is selection by rank. The analysis relies on observing individ-

[2] I use binary indicators for the six levels of the managerial hierarchy. Any misclassification would lead to non-classical measurement error since flipping a 1 to a 0, or vice versa, would be mechanically correlated with the true value.

uals in census *and* death records. I observe 1,804 individuals in the 1930 *Organization Directory*, matching 1,519 (84 percent) of those to the 1930 census and 1,024 (57 percent) to death records. Notably, individuals in lower level ranks of the managerial hierarchy are less likely to be matched. It is reasonable to assume that these unmatched individuals may have lived shorter lives, for example, if they were fired, had problems with alcohol, or died in poverty. That form of non-randomly missing data would bias estimates of lifespan against individuals in higher ranks, thereby spuriously rejecting the hypothesis of a Whitehall-type rank mortality gradient at GE.

To address the robustness of the results to potential selection biases I use three approaches. First, I simply drop individuals in the lowest levels of the hierarchy from the regression estimates altogether. This excludes levels of the hierarchy where missing individuals may be most likely to experience premature death. Second, I implement Heckman correction methods to adjust for selective sampling on death records. Third, I estimate the probability of near-term survival by tracing individuals across the 1930 and 1940 censuses. Although surviving a decade represents a weaker test of longevity, it avoids selection bias by utilizing a fuller component of the dataset.

The third estimation challenge is that I observe rank in 1930 for each individual rather than maximum rank over the life cycle of a career, so individuals would need to be alive long enough to reach upper levels of management by that year. The relationship between status and mortality is therefore endogenous to individuals entering the data at a specific point in time. As such, those reaching senior positions should mechanically live longer lives. To address this issue empirically, I estimate models using cutoffs above 40 years of age where position in the hierarchy is less likely to change over time. Thus, I capture the relationship between "permanent status" and mortality.

I estimate the relationship between status and lifespan using OLS, median regressions, and Cox Proportional hazard models. I also construct life cycle survival probabilities for the time period each person in the dataset remained alive. I use a vast array of controls, estimating the relationship between lifespan and status with birthplace and age covariates, and controls for youth and adult SES characteristics. I also exploit within GE department variation, comparing the lifespan of observationally similar sets of employees at different ranks in the same area of the firm.

According to the Whitehall studies individuals in senior positions should have lived longer, with monotonically shorter lives further down the hierarchy. None of the measures of status that I use (levels in the management structure, attendance at Camp General and promotions) produce a mortality gradient consistent with the Whitehall studies. In some specifications (Camp General and promotions) I do not find a statistically significant relationship between status and lifespan at all. Where I do find an effect it is in the opposite direction to Whitehall. The core finding is that high-ranked employees lived shorter lives relative to lower-ranked employees with point estimates suggesting a morality penalty for top managers and executives of around 3 to 5 years.

The remainder of the paper is structured as follows. Section 2 covers related literature. Section 3 discusses the relationship between hierarchy, job demands, and health at GE. Section 4 outlines the data and Section 5 presents the results. Section 6 offers potential explanations for the differences between my findings and those of the Whitehall studies. Section 7 concludes.

2 Related Literature on Rank, Health and Mortality

The Whitehall studies are among the most highly cited papers in the epidemiology literature. Whitehall I, starting in 1967, studied a group of male civil servants, whereas a subsequent study—Whitehall II—also included females (see Appendix A.1 for a more detailed description). These studies became widely influential in policy circles because they connected the negative health gradient by rank in the civil service to workplace stress and perceptions of low social standing.

The findings from the Whitehall studies are as controversial as they are influential. Chandra and Vogl (2010) point to several identification issues, especially endogenous selection into occupational categories within the civil service. Case and Paxson (2011) showed that current health status in the Whitehall II data could predict subsequent promotion, so unobserved traits such as tenacity may jointly determine health and position in the hierarchy. On the other hand, Anderson and Marmot (2012) exploit exogenous variation in status through department promotion rates in the Whitehall II data, finding a large causal reduction in heart disease risk for those who were promoted.

As a general rule, coping mechanisms through "fight or flight" responses can lessen adverse health effects in the short run while persistent stress can lead to immune system suppression causing, for example, cardiovascular related diseases or gastrointestinal disorders. The Whitehall studies showed these adverse health effects were strongest in lower levels of the hierarchy but differential health and mortality outcomes by rank in a hierarchy might be observable in other settings given the potentially nuanced impact of job-related stress factors. Research in the biology literature suggests more complex causal channels, highlighting the importance of tests for generalizability.

Sapolsky's famous work on wild baboons in Kenya showed status in the hierarchy was inversely related to health risk. Lower ranked baboons had higher levels of the stress hormone, cortisol. Subsequent studies (discussed in Sapolsky (2005)) showed a mediating role for the structure of the hierarchy: in top-down hierarchies, dominant males can experience high stress hormone levels due to the threat of displacement, whereas in flatter hierarchies the negative health effects of lower rank can be mitigated as subordinates may receive support through kinship or social interactions. The literature remains controversial. Gesquiere et al. (2011) argue that "no consensus exists about the rank-associated stress physiology of individuals in stratified mammal societies" while Petticrew and Smith (2012) caution against generalizing to human hierarchies. In a recent study Anderson et al. (2021) use DNA methylation measurements to capture the "epigenetic clock" of baboons. They link rivalry for status to premature biological ageing for baboons at the top of the hierarchy.

The relationship between rank, health and mortality is especially hard to identify in human populations. As Sapolsky noted primates belong to a single hierarchy whereas humans can belong to multiple hierarchies with potentially offsetting effects. An employee may be subjected to stress in the workplace, but experience social support through clubs, associations or religion. Falk et al. (1992) found in a sample of Swedish men during the early 1980s that social support significantly reduced mortality and morbidity risk arising from job strain. Complicating estimation further, the relationship between stress and lifespan can be determined by early childhood circumstances and be confounded by interactions with morphological characteristics like weight and height. The impact of workplace stress can also be affected by context or the treatment population.

Modern-day studies suggest the relationship between hierarchy in firms, stress and longevity can be complex. Keloharju, Knüpfer and Tåg (2020) find strong selection into high-status corporate positions in Sweden, implying that CEOs should have the physical and mental fortitude to cope with extreme job demands. On the other hand, Borgschulte et al. (2019) show that US-based CEOs lose 1.5 years of life due to exogenous industry shocks whereas less-stressed CEOs gain about 2 years of life due to legislation in their state of operation moderating the threat of hostile takeovers. Their machine learning facial recognition approach shows stressed CEOs even look older than their biological age, consistent with the Anderson et al. (2021) finding for baboons.

The mixed nature of the evidence extends to the relationship between status and lifespan more generally. Rablen and Oswald (2008) find that Nobel Prize winners in physics and chemistry from 1901 to 1950 lived 1 to 2 years longer than nominees. Redelmeier and Singh (2001*b*) show that Oscar winning actors and actresses lived almost 4 years longer than nominees who did not win, but a related study showed Oscar nominated screen writers actually lived *longer* than their counterparts who won (Redelmeier and Singh, 2001*a*). Link, Carpiano and Weden (2013) express general scepticism over a causal link between status and mortality based on their study of celebrities, sports stars and politicians. Leive (2018) shows that silver medal Olympic Track and Field winners between 1896 and 1948 lived about 1 year *longer* than gold medal winners. He attributes this counterintuitive result to the silver medal winners following professional careers in their post Olympic years where they earned higher incomes. The income effect then dominates as a predictor of lifespan.

Historically, wide disparities in mortality rates by social status in the US have been observed back to the middle of the nineteenth century (Ferrie, 2003). Costa (2000, 2015) shows that chronic disease rates fell for men over the twentieth century, while the shift from blue collar to white collar work meant that men were less exposed to occupational hazards. Mortality rates tend to be procyclical (Ruhm, 2000). During the Great Depression when the employees in my sample would have lived, New Deal social welfare programs lowered the infant mortality rate, disease-related deaths and suicides (Fishback, Haines and Kantor, 2007). Most of these policies, however, targeted low income families whereas I observe a sample of mostly higher-earning white collar employees. Finally, in a study of the relationship between promotions and longevity in a novel setting—Second World War US submarine personnel—Suandi (2021) finds sailors who were promoted lived 2.4 years longer, implying economically large effects from status changes.

3 Hierarchy, Health and Job Demands at General Electric

In this section I examine some of the major determinants of job-related stress, and how this may have impacted health and longevity at senior and lower levels of the managerial hierarchy.

Founded in 1892 GE became a pivotal firm in electrical products and intermediate goods. By 1930 GE was one of the largest firms in the US with gross revenues of \$396 million (about \$6 billion today) and a market capitalization based on its 1929 stock market peak of \$2.9 billion (about \$42.5 billion today), second behind only General Motors in market value ranking. It was also one of the largest employers in the country with 78,380 employees in 1930. Hierarchically organized due to the managerial revolution in US business, Chandler (1977) identifies GE as an exemplar case of a modern industrial corporation, characterized by order "imposed from the top." GE had an executive committee where strategy was decided, a group of vice presidents to implement the strategy in functional areas from sales to finance, and a wide array of staff lower in the hierarchy.

Senior executives faced extreme financial pressures throughout the Great Depression. While GE remained profitable during the decade, and it never missed a dividend payment, the level of stock market volatility was high. The annualized standard deviation of GE's stock returns reached 83 percent in 1932 relative to a peak of 75 percent for the US stock market as a whole (Cortes, Vossmeyer and Weidenmier, 2022). Corporate taxes increased significantly in the state of New York leading GE to move a number of its business units to Connecticut, which did not have a business tax. Gerard Swope, president of GE between 1922 and 1940, and Owen D. Young, chairman of GE from 1922 to 1939, faced severe tests managing in this context, eschewing the assertion in Hicks (1935) that the best of all monopoly profits is a "quiet life." Work demands increased into the Second World War. Both Swope and Young returned to GE from retirement in 1942 when the executives hired to replace them—Charles Wilson and Philip Reed—left for Washington DC under the war effort.

Attempts to maintain profits in a mature industry created job pressures for senior leadership. GE had long been a target of anti-trust scrutiny. Between 1940 and 1950 GE was pursued in 13 antitrust cases. In a highly publicized 1961 case, a number of GE executives including Robert Paxton, president of GE and Ralph J. Cordiner, chairman of the GE board, were investigated by the Department of Justice for price fixing with employees from 28 other electrical-equipment manufacturers. Price fixing meetings for products like switchgear devices and transformers had been arranged since the 1930s. Among the seven executives from the colluding firms who received jail terms for violations of the Sherman Antitrust Act, three were GE vice presidents—William S. Ginn, George E. Burens and Lewis J. Burger. As a corporation, GE led fines paid and indictments.

The price-fixing conspiracy revealed longstanding tensions in the hierarchy. Burens explained: "part of the pressure was the will to get ahead and to have the goodwill of the man above you. He had only to get the approval of the man above *him* to replace you, and if you wouldn't cooperate he could find lots of other faults to use to get you out" (Smith, 1963). Top GE executives escaped legal sanction despite the Department of Justice's efforts to pursue convictions. Those lower down who participated in price fixing meetings with rival firms were demoted by GE and had their pay cut (Herling, 1962). All experienced severe job-related stress. According to Fisse and Braithwaite (1983) "Top management suffered the worst obloquy, except of course for the executives who went through the trauma of conviction and sentence." Cordiner lost an honorary degree, was humiliated in a Congressional hearing into the episode, and was forced to resign from a prestigious advisory position he held at the Department of Commerce. Paxton resigned from GE in 1961 at 59 years of age due to "reasons of health" (Smith, 1963). He died of a heart attack in 1980 aged 78.

By contrast, employees lower in the hierarchy may have experienced relatively favorable employment circumstances. In 1940 employment at GE stood at 76,314, not that much different to what it had been in 1930. Moreover, the growing influence of labor unions at GE and elsewhere may have tilted relative incomes, and therefore health, towards lower ranking workers. Under New Deal policies, specifically the Wagner Act and the National War Labor Board, organized labor was strengthened leading to significant aggregate gains in the wage distribution (Farber et al., 2021). Overall, senior executives at GE worked productively with these labor relations changes when most executives of American corporations strongly opposed the strengthening of industrial unions.

Indeed, GE had long adopted a positive approach to human resource management. GE and General Motors were described as "leading welfare capitalists" during the 1920s because of their commitment to employee health and well-being (Moriguchi, 2005). GE had a pension plan, a savings and investment plan, and it offered life insurance through a non-contributory group plan. Employees could receive financial assistance to buy a house; even blue collar workers were entitled to paid vacations. Most welfare benefits were tied to length of service at the firm.

Facilities for health care were extraordinarily forward-looking. Each plant had its own hospital where employees could receive free medical services, including surgery. Moriguchi estimates GE spent between $7-10 million on these programs annually, equivalent to 5-6 percent of payroll. As a result, turnover was low. By the late 1920s 58 percent of employees had been at GE for in excess of five years and a remarkable 26 percent had been with the company for over twenty years. Some of the welfare programs were scaled back during the early years of the Great Depression, but by the end of the decade many had been restored or even expanded. Compared to General Motors, Moriguchi notes, GE was considerably stronger in its commitment to provisions for worker welfare.

Environmentally, most key GE managerial departments were in Schenectady, as was GE's famous R&D facility, established there in 1900. A 1926 GE recruitment guide states of Schenectady: "Its water supply is second to none and equalled by that of few cities. Its health conditions are unusually good. Its schools are among the best in the state." Schenectady was described as having "a broad and well educated middle class, a diverse population and a bustling downtown" (Blackwelder, 2014). The 1935 business census shows Schenectady had 99 industrial establishments employing 12,015 workers. GE was the largest single employer and the city had a low crime rate. For GE employees it was generally a healthy place to live, notwithstanding a history of intense industrial research left a legacy of environmental degradation and toxic waste.

4 Sources and Data

In this section I describe the data, beginning with GE's *Organization Directory* which I use to sort employees into occupational levels. I also describe the construction of the two nested samples of individuals I link to the 1930 census and to death records as well as the multiple indicators of status. The number of observations in each of the samples is given below:

GE Organization Directory	Census Link	Death Records
n=1,804	*n=1,519*	*n=1,024*

4.1 Levels in the Managerial Hierarchy

Following the Whitehall studies, I assume that levels in a hierarchy are correlated with social status. Individuals care about their relative standing in the workplace. Conceptually, economists think about status contests with positional rewards as incentive mechanisms to drive performance (e.g., Besley and Ghatak, 2008; Moldovanu, Sela and Shi, 2007). The inducement of relative standing can be so strong that individuals are even willing to risk death to achieve positional differentiation, as shown by Ager, Bursztyn and Voth (2016) who use evidence from fighter pilot contests during the Second World War. Status-enhancing effects have also been studied extensively in the sociology literature where agents can gain advantages like income and public approbation through hierarchies, prizes and networks (Sauder, Lynn and Podolny, 2012; Reschke, Azoulay and Stuart, 2018).

The managerial hierarchy at GE lends itself particularly well to the contest-like conceptualization of status differences. Managerial hierarchies divide the authority and responsibility in an organization, and the status levels are typically clearly delineated. Inside the firm the principal rewards the agent with a "positional good" associated with a level in the hierarchy. Just as Whitehall had permanent secretaries at the top and administrative workers at the bottom, GE's hierarchy consisted of leading executives all the way down to assistants and clerks. Chandler (1977) describes hierarchies as "self-perpetuating human organizations" hinting at their sociological dimensions.

The 1930 edition of GE's *Organization Directory* lists the job description of each individual in the managerial hierarchy, their rank, and the department in which they worked across GE's US locations. A wide range of departments are included such as sales, accounting, corporate affairs and R&D. This is similar to Whitehall where civil servants are staffed according to various departmental responsibilities. I use information on 1,804 male employees in the directory.[3]

The hierarchy can be identified by the ordering of individuals in the layout of the *Organization Directory*. Each department has its own box on a page with the most important job functions at the top of the box and additional job functions lower down arranged by indents. Figure 2 Panel A shows the box containing Executive Officers where Owen D. Young, the chairman of the board discussed in Section 3 can be identified by his positioning in the directory relative to vice presidents who are listed underneath. Panel B shows the box for the Industrial Services Department. The supervisor of the department is at the top of the box whereas other employees are arranged by indents. The two females working in that department are indented further into the page than most of the males, which is consistent with how gender was used as a status divider in the workplace.

Based on the structure of the *Organization Directory* I sorted individuals into the following sequence of occupational levels, with examples of job titles at each level in parentheses:

[3]There are 36 Schenectady-based females in the *Organization Directory*. Of the 31 I could trace in the 1930 census, the average age at that time was 35 years. Of the 15 I could trace in census and death records the average age at death was 85.9 years, compared to an average age at death of 77.4 years for men. Females are dropped from the analysis because they have different lifespan profiles and because they are not observed in all the layers of the hierarchy.

Level 1: Executives (above Vice President)

Level 2: Vice President

Level 3: Top of box each department (e.g. Manager)

Level 4: Indent 1 (e.g. Assistant Superintendent)

Level 5: Indent 2 (e.g. Assistant General Foreman)

Level 6: Indent 3 (e.g. Inventory Control Clerk)

With multiple departments in the *Organization Directory* an important question is whether status levels are symmetric across these departments. This is not a concern with Levels 1, 2 and 3 because job levels from manager upwards are well defined. While there is some scope for misclassification when comparing lower down levels—e.g., an assistant superintendent with an R&D lab worker or someone in sales or accounting—I use department fixed effects to identify off within-department changes. This approach compares the lifespan of individuals in the same department at GE.

As a check on the robustness of these status orderings to classification errors I compiled data from the 1930 federal census (more details below) on variables that should also reflect status differences between individuals: the value of a home and the number of servants in the household.[4] Census enumerators were instructed to record for all non-farm households the "approximate current market value of the home" or if rented the approximate rental value per month. Enumerators were also instructed to list "all other persons living with the family, whether relatives, boarders, lodgers, or servants." I collected those data even though the counts are debated since the role of servant and housekeeper were often conflated using enumeration procedures (e.g., Stigler, 1946).

Figure 3 illustrates means and confidence intervals for these variables. Panel A shows a distinct ordering associated with occupational levels at GE and the market value of a home. For those in Level 1 occupations the mean home value is \$63,892 (about \$1.0 million today) and for Level 6 occupations it is \$8,788 (about \$135,000 today). The median home values are \$40,000 and \$8,000 respectively. The median value of a home in the 1930 census for native whites living in an urban area was \$5,849 and for foreign born whites it was \$6,076. Hence, individuals I observe working at GE were relatively affluent by comparison. F-tests reject the null of no difference in the means when all levels are included (F=96.91) and the null is also rejected when dropping individuals in Levels 5 and 6 (F=32.88) that may contribute the most to the group differences.

Figure 3 Panel B shows that occupational levels also correspond strongly with the number of servants in the household, although there are few observations of households with more than one servant (n=28). Again, F-tests reject the null of no difference in the means including all levels

[4]The geographic location of a house was also a status differentiator. GE had formed the Schenectady Real Estate company early in the 1900s and sold parcels of land to its employees. Edwin Wilbur Rice, Jr. shown as Honorary Chairman of the Board in Figure 2 Panel A had the best of the land. Accordingly, it was stated that "both the size and the location of Rice's property affirmed his preeminence" at General Electric (Blackwelder, 2014).

(F=107.02) and dropping Levels 5 and 6 (F=32.88). Taking both Panel A and Panel B together, the convexity of wealth and income implied is consistent with theories of "corporate tournaments" where individuals higher up in the corporate structure are remunerated more favorably because they win the race for hierarchy in the internal labor market (e.g., Baker, Gibbs and Holmstrom, 1994; Bognanno, 2001).

4.2 Management Training Camps

As noted in Section 2 individuals can belong to multiple hierarchies, both occupational and social. In the data I can observe hierarchical position in multiple ways *within* GE. I can therefore test for consistency in the results on rank and lifespan to alternative indicators of occupational status.

As a second measure of status, I use lists of attendees at GE management training camps. Regular meetings were held at the GE-owned Association Island in Lake Ontario, about 160 miles north west of Schenectady (see Figure A1). GE's training camps were instrumental to competition for positions in the corporate hierarchy. Each department had its own camp, but "Camp General" was the most prestigious, drawing attendees from all the main departments. The camps were male-only events and participants stayed in tents. Accommodation was arranged typically as two men per tent, although top executives, such as the chairman of the board, got their own individual tent.

Each camp was a 2 to 3 day event. According to the pamphlet for Camp General 1929, participants were provided "opportunity for instruction, recreation and inspiration." The business program started July 14th at 8:00pm and concluded Wednesday 17th at 12:15pm. Reports and plans were presented by each department followed by joint sessions on management practices and business strategy. The 1929 camp focused on "organization" with sessions on functional versus vertical organizational forms. Attendees were instructed to "bring your golf clubs, tennis racket, 12-gauge trap shotgun, bathing suit and fishing tackle." Meals were announced by bugle call.

Nye (1985) describes an invitation to one of these events as "coveted" going on to say that the camps "had the same male aura that pervades college fraternities, exclusive men's social clubs, the Masons and other groups such as the Bohemian Grove."[5] Going to Camp General meant access to top executives at GE. It was a form of socialization that reinforced the hierarchical system of management. An inner group attended Camp General; an outer group attended departmental camps. Further down in the status hierarchy were those who did not attend at all.

Of the 1,024 individuals in the dataset where I can observe a census link and death records, 221 (22 percent) attended Camp General between 1927 and 1939. Of those who did attend 38 percent went only once, 23 percent attended five or more camps, with just 1.4 percent attending all nine camps during this period.

[5] Bohemian Grove is the name of an annual summer retreat for the members of The Bohemian Club, an anachronistic elite male-only club in northern California. The retreat is held in Sonoma county.

4.3 Promotions

As a third measure of status, I traced individuals in the 1930 *Organization Directory* through the 1940 *Organization Directory* to determine if they had been promoted in the hierarchy. Anderson and Marmot (2012) examine promotions as a measure of status in Whitehall II by instrumenting for individual promotion based on predetermined departmental job slot openings. The causal effect of promotions on health remains controversial because of selection into seniority (Suandi, 2021). Promotions can lead to status gains and adverse health effects through increased job stress (Johnston and Lee, 2013). In a sample of British workers, Boyce and Oswald (2012) find healthy individuals are more likely to be promoted but promotions also induce greater mental health fatigue.

Of the 1,024 individuals in the dataset where I can observe a census link and death records, 623 (61 percent) can also be identified in the 1940 directory. 37 of those (6 percent) where employed in 1940 at a higher level.

4.4 Birth and Death Years

The most challenging part of the data collection effort was obtaining birth and death years for each individual in the 1930 *Organization Directory*. I started with collecting birth years by linking individuals in the directory to the 1930 census through name matching. Although some individuals employed by GE had common surnames like "Smith" it was often the case that "General Electric" (or some part of that string) was reported in the occupation field of the census, so the correct match could be identified. The match rate to the census of 84 percent (1,519 out of 1,804) reflects the ease of using the occupation field to identify matches for individuals living in the same general location.

For dates of death I used several sources. GE's archives contain a vast collection of obituaries. Employees maintained a life long attachment to the firm, and sent in obituary notices of friends and colleagues. I also separately searched for obituary notices using digitized newspaper collections and other sources from Ancestry.com, and I accessed about 33,000 archived burial cards recording deaths at the 100 acre Vale Cemetery in Schenectady. Figure A3 shows the burial card for John F. Madgett, who worked in the General Superintendents office at GE, dying in 1947 from a cerebral hemorrhage (few burial cards report the cause of death). Finally, I used the US Social Security Death Index, 1935-2014 for cross-checking. I matched 1,024 individuals to both the census and death records.

4.5 Socioeconomic Status Variables

4.5.1 Youth SES

To measure SES in youth I use place of birth, father's occupation and education. Place of birth can be a key factor determining lifespan because water quality, for example, varied significantly across the US. Troesken and Beeson (2003) report that "70 percent of all cities with populations greater than 30,000 in 1900 used lead service mains exclusively or in combination with some other type of main." Lead exposure or in-utero exposure to pandemics, for example, can affect SES variables such as educational attainment and health outcomes (Almond and Currie, 2011). However, this literature is also highly controversial (Beach et al., 2022).

Father's occupation is commonly used in social mobility studies to identify intergenerational occupational change (Long and Ferrie, 2013). To identify father's occupations I undertook backward census traces for the 1,024 individuals I could observe in both the census and death records, arranging occupations into six categories following the *Dictionary of Occupational Titles* from "professional and managerial occupations" down to "unskilled occupations." I then followed Long and Ferrie (2005) in distinguishing "white collar" occupations (professional, technical, and kindred; managers, officials, and proprietors; clerical; and sales) from other categories. In 77 cases I was unable to find an occupation for a father, so I coded those fathers as non-white collar. In the dataset overall, 284 individuals (28 percent) originated from white collar backgrounds.

GE's archives provide a wealth of personnel documents listing individuals by the colleges and universities they attended. The document "Advanced Course in Engineering, General Electric Company, Schenectady December, 1929", for example, lists an individual in the data, Leon Goldberg an industrial control engineer, as attending MIT. Another individual in the data, Lloyd Shildneck from the A-C engineering department attended the University of Nebraska. 73 individuals (7 percent) in the dataset attended a college or university. In the 1940 census 4.6 percent of the population aged 25 years or over were college graduates.[6] With respect to the causal impact of education on lifespan Lleras-Muney (2005) shows the effect is strongly positive based on US data whereas Clark and Royer (2013) estimate quite small health returns to educational attainment using UK data.

4.5.2 Adult SES

I collected additional SES measures from the 1930 census. As already noted in Section 4.1 I know if an employee owned a home, its approximate market value (or if not owned how much rent was being paid) and the number of servants in the household. The census also reports whether a radio was owned. Although the diffusion of the radio was rapid during the 1920s it was not in all households by the end of the decade (Stromberg, 2004). New York state was among few states where radio ownership was above 50 percent, on average. In my data 78 percent of individuals in the census records reported owning a radio, suggesting affluence relative to the general population.[7]

Finally, I also observe marital status and the number of children in the household (total number and the number under 5 years old). Durkheim (1897) famously conjectured that marriage and family can be "protective" mechanisms which promote psychological well-being and reduce the likelihood that an individual will engage in negative health habits. Marriage has been associated with a longer lifespan empirically in historical and modern datasets (Gove, 1973; Johnson et al., 2000).

In the GE data 82 percent were married, the mean number of children in the household was 1.03 and 0.19 for children under 5. Because the number of children are tabulated "as present" in

[6]The 1940 census contains more comprehensive information on educational attainment.

[7]Whitehall II used car ownership as a measure of SES where it was estimated to be a useful, albeit less strong, predictor of mortality before retirement than employment grade (Marmot and Shipley, 1996) (see Figure A2 Panel B).

the 1930 census this will under-count the children of older individuals at GE if their children had already left the household. Indeed, the probability of having a child in the household exhibits an inverted-U shape as a function of age, increasing to age 47 years and decreasing thereafter.[8]

4.6 Summary Statistics

Table 1 shows descriptive statistics for the variables available in both the census link and the census link plus death records samples. Although most of the mean values across variables, such as surname string length or the number of characters in a person's initials are quite balanced in these samples, I explore the likelihood of selection on these observables in Section 4.7 below.

Summary data show individuals employed at GE were, on average, in their early 40s on entry into the data in 1930 and for those in the death records mean lifespan was 77.4 years. The youngest person died at age 32; the oldest at 104 (see Figure A4 for the overall distribution of lifespan in the dataset). Because entry into the data occurs at a fixed point in time, levels in the managerial hierarchy are correlated with age with older (younger) individuals at higher (lower) levels.

Age at death is highly non-linear by level in the corporation, which contrasts sharply with the strong cross-sectional association between lifespan and job seniority often found in the literature, including in the Whitehall data. Vice presidents (Level 2) at GE experienced a noticeably shorter mean lifespan of 71.3 years, and as discussed in Section 3 these individuals could be exposed to particularly severe circumstances of job-related stress. Their reduced life expectancy is illustrated in Figure 4 which plots the Kaplan-Meier hazard rates for each occupational level.

Lower down the hierarchy individuals were more likely to be born within the state of New York, where Schenectady is located, perhaps because of a reliance on local labor markets. As discussed in Section 4.1, the value of home ownership is correlated with status levels, but mean home ownership and having a radio in the home fluctuates more widely by level and both are quite low for Level 2 vice presidents. These individuals tended to pay more in mean monthly rent compared to their counterparts at lower levels. Purely based on these observations there appears to be something different about vice presidents in the way they organized their lives and how long they lived.

A large share of the individuals tended to be married, even at Level 6. This is interesting because it may imply access to coping mechanisms or social support which have been found to be important mediating influences on stress-related health in the biology literature discussed in Section 2. Lower levels in the occupational hierarchy were associated with more young children being present, which makes sense because individuals at these levels were younger on average. The presence of white-collar backgrounds is reasonably flat across levels with the exception of Level 2 individuals where the mean share is much higher. These individuals also tended to be more likely to have received a higher education, which falls sharply to a low of 4 percent for Level 6 employees.

[8] In a linear probability regression with the dependant variable coded 1 for at least 1 child in the household and 0 otherwise the coefficient on the independent variable age in 1930 is 0.217 (t=13.74) and on age in 1930 squared is -.0023 (t=-12.57). The turning point is then -0.217÷(2×-0.023).

4.7 Selection

I now examine selection when matching individuals from the 1930 *Organization Directory* to the census and the death records samples. Figure 5 Panel A shows the number of individuals in each level of the hierarchy. Panel B shows the percentage of individuals in the 1930 *Organization Directory* matched. Whereas Panel B shows I can match quite evenly from the directory to the census, the share of individuals with a measure of lifespan is lower at Levels 5 and 6. If the unmatched lived shorter lives this would bias any comparison of longevity across groups.

To assess scope for selection bias I use the rich set of variables available in the nested samples. Specifically, Table 2 reports the results of linear probability regressions that test whether being in the data is systematically related to the observable characteristics of individuals. The dependent variable takes on a value of 1 if I observe an individual in a given sample and 0 if an individual is in the reference sample. Thus, I estimate the probability an individual is observed in the census linked sample versus only the 1930 *Organization Directory* and, in turn, in the sample that includes death records versus just the census linked sample. The coefficients on the independent variables (mostly from the census) capture the relationship between selection into each sample and observables.

When analyzing selection from the 1930 *Organization Directory* sample to the 1930 census linked sample, only name diagnostics are available. Nevertheless these variables are still informative. Complex name structures with multiple middle initials, for example, might be correlated with socioeconomic status. Column 1 shows a weak relationship between the probability of selection into the census linked sample and the characteristics of names. The coefficients on surname length and the number of initials are small and they are estimated with large standard errors.

Column 3 examines the probability of an individual being selected into the death records sample from the 1930 census link sample. Hence, I can add a richer array of SES covariates. Few of these variables are strong predictors of selection. There is a 5.1 percent reduction in the probability of selection for home owners, suggesting some bias against more affluent households. The effect of an additional child is associated with a 3.5 percent increase in the probability of being in the death records which would introduce bias since individuals with children generally tend to live longer.

Column 4 reports results from specifications that add two dummy variables: one identifying individuals in both the 1930 and 1940 *Organization Directory*; and another identifying those in both the 1930 and 1940 federal censuses using links to individuals provided by *The Census Linking Project* [9] The effect of being a home owner from column 3 becomes statistically insignificant with these additional controls whereas the effect of an additional child remains robust. While there is no evidence of selection based on presence in the censuses, individuals who stayed at GE are more likely to be selected into the death records sample. The direction of this selection could be positive or negative: delinquent employees may be more likely to leave the firm and die early, or the healthiest ambitious employees might leave to exploit new opportunities.

Finally, the specifications in columns 1 to 4 constraint the effect of the variables on selection to

[9] I use the crosswalk datasets connecting individuals across federal censuses using linking algorithms. I use observations based on the conservative version of the ABE algorithm. See further, Abramitzky, Boustan and Rashid (2020).

be the same at all levels of the managerial hierarchy. In columns 5 and 6 I relax this assumption by splitting the sample by upper (Levels 1, 2 and 3) and lower levels (Levels 4, 5 and 6) of the managerial hierarchy. The point estimates in column 6 suggest stronger selection effects in the lower levels for the number of initials in a name, for home ownership, the number of children, and especially being in the 1940 GE directory where the coefficient is economically large and statistically significant at the 1 percent level. However, it is important to note that Wald tests in column 7 show the regression coefficients in columns 5 and 6 are not significantly different from each other.

Overall, therefore, I cannot rule out that any selection into the death records sample is equivalent for individuals in upper and lower levels of the hierarchy. While these results suggest selection may not be strongly confounding when estimating lifespan differences between these groups, I still run formal checks. Indeed, the regressions in Table 2 reveal a variable that captures the magnitude of selection in the data—specifically being in both the 1930 and 1940 *Organization Directory*. I use this variable in Section 5.4 to estimate selection models as a robustness exercise, under the assumption that individuals in upper and lower levels of the hierarchy were differentially selected.

5 Results

5.1 Baseline Estimates of Status and Lifespan

Equation 1 shows the main OLS estimating equation. In further specifications I estimate using median regressions, as a robustness check against outliers, and Cox proportional-hazards on the uncensored data to quantify differences in survival times. The left hand-side variable is lifespan in years individual i lived, so the estimates are conditional on being observed in the death records. The main right-hand side variable is status, which I capture using all the measures described in Section 4: levels in the hierarchy, attendance at management training camps and promotions.

I use the youth and adult SES variables described in Sections 4.5.1 and 4.5.2, and fixed effects as a full set of binary regressors for birth year, ϕ, birth place, κ, and GE corporate department, ν. In a large organization some departments, such as R&D, may recruit different types of individuals like academic versus administrative staff on a university campus. With department fixed effects identification of lifespan differences comes from intra-departmental variation.

$$\text{Lifespan}_i = \alpha + \beta\textbf{Status Level}_i + \gamma\textbf{Youth SES}_i + \delta\textbf{Adult SES}_i + \phi\mathbf{D}_i^{BIRTH} + \kappa\mathbf{D}_i^{BPLACE} + \nu\mathbf{D}_i^{DEPT} + \epsilon_i \quad (1)$$

Table 3 reports estimates of β using a continuous measure of level in the managerial hierarchy with individuals in Level 1 assigned a value of 1 down to those in Level 6 assigned a value of 6. With an inverse Whitehall mortality gradient by rank, the estimate of the coefficient on status should be negative: individuals lower in the hierarchy should experience monotonically shorter lives.

By contrast, in columns 1 to 5 each of the point estimates is positive. Column 1 implies an *increase* in longevity of around 7 months for every step *down* in the hierarchy, with an estimate of around 9 months in column 4 (which is statistically significant at the 10 percent level) or 10 months in column 5 with a full set of SES controls and birth year, birth place, and GE department fixed effects. Interestingly, the SES variables are not strong predictors of lifespan, though in some cases they do have the expected sign. A higher education, for example, is associated with 1 to 2 years of additional lifespan, although the confidence interval on the point estimate is wide.

Results using a median regression (column 6) are close to the OLS estimate in column 5, suggesting that anomalous values are not influencing the baseline results. The coefficient on status level in column 6 implies an 11 month increase in median longevity further down the hierarchy, or a reversal of the Whitehall phenomenon. A Whitehall effect in a Cox proportional hazards model would produce a hazard ratio on status level above unity; that is an increase in mortality risk over the life cycle. The reported hazard ratio in column 7, while being imprecisely estimated, is less than unity implying a reduced mortality risk lower down in the hierarchy.

5.2 Estimates of Lifespan by Level and External Validity

I now turn to more granular estimates of lifespan using dummy variables to capture level in the hierarchy. Figure 6 Panel A plots OLS and Cox model point estimates and 95 percent confidence intervals for the lifespan of individuals in levels 2, 3, 4, 5 and 6 of the hierarchy relative to individuals in the reference category of Level 1—top executives in the firm. These specification include a full set of SES controls and fixed effects used for the most demanding specifications in Table 3.

A striking result from Figure 6 is the large variation in lifespan by status level. OLS models indicate that individuals in lower levels of the hierarchy (4, 5 and 6) lived between 6 and 8 years longer than individuals in Level 1, with the difference being statistically different from zero for those in Level 4. Hazard ratios from Cox models show a similar pattern, with half of the individuals in Level 4 experiencing a mortality event at any point in time compared to the individuals in Level 1. Of particular note is the mortality penalty at Level 2. These individuals lived around 8 years less than their counterparts in Level 1 (the OLS estimate) with 2.5 times as many experiencing a mortality event at any point in time compared to that reference group (the Cox estimate).

These represent large, but not implausible, mortality differences. Studies of the health effects of cigarette smoking in the US in the 1950s, for example, showed a heavy smoker in their 40s would lose about 7 to 8 years of life relative to a non-smoker (Hammond, 1967). Furthermore, as I show in Figure 6 Panel B, the results pertaining to lifespan differences in the top level of the hierarchy are generalizable to using broader data on business executives active in the US, suggesting the results in Panel A are not being driven by unrepresentative observations in small samples for GE.

Specifically, I traced the birth and death years for top executives in large US firms in the dataset compiled by Frydman and Saks (2010) for their study of managerial pay since 1936. These data include firms like Du Pont, General Motors, and Westinghouse. I obtained a measure of lifespan for 277 of the 289 individuals active from 1936 to 1939 (executives at GE do not enter the data until 1942). For 245 individuals I could identify their position in the hierarchy as chairman of the board, CEO or vice president. I then followed these 245 individuals forwards in time in the data to establish their permanent status, defined as the maximum level they reached in the hierarchy. Frydman and Saks provide comprehensive compensation data for each individual over time. Given that mortality tends to decline with income, I use maximum compensation as a control—the sum of remuneration, long-term pay and option grants, as defined by Frydman and Saks. This exercise produced a dataset containing 86 Chairman of the Board, 47 CEOs and 112 vice presidents.

I also took the additional step of compiling data on a different comparison group of non-business elites, namely US senators where status in the political hierarchy can also be observed. Senators are organized by rank according to the length of their consecutive service in the Senate, with rank being a key determinant of placement on the most prestigious committees (Groseclose and Stewart, 1998). I compiled data on members of the 71st to the 76th Congress, spanning the 1930s in accordance with the GE and top executive data. Since only males are included in the GE data, I dropped the four female senators (Hattie Caraway, Rose Long, Dixie Graves and Gladys Pyle), resulting in a dataset of 214 senators active during these years. For each I obtained birth and death years as well as their party of affiliation and state. I followed these senators forwards in time to establish the maximum rank they ever achieved in the Senate as a measure of their permanent status.

Figure 6 Panels B and C presents point estimates and 95 percent confidence intervals of the relationship between lifespan and status from OLS and Cox specifications. Three findings stand out. First, the mortality penalty associated with being a vice president in the GE data (Panel A) is also evident more broadly. Vice presidents lived around 4 to 5 years less than their counterparts who rose to the position of Chairman of the Board, while the Cox estimates show their hazard of death was around 1.6 times higher over the life cycle (Panel B). For CEO's the confidence intervals overlap with zero (OLS) or unity (Cox). Second, these effects are robust to controlling for variation in income, so income is not confounding the link between position in the hierarchy and lifespan. Third, in Panel C there is no statistically significant mortality penalty by status differences for US senators with below median rank in the Senate relative to those with above median rank, either in bivarite specifications or when controlling for party affiliation and geographic location.

Overall, these comparisons provide suggestive evidence that the morality penalty identified for vice presidents in the GE data can be extrapolated to other corporate settings, and that the relationship between status and lifespan appears to be specific to the structure of managerial hierarchies.

5.3 Upper versus Lower Levels of the Managerial Hierarchy

I now refocus on the GE data to examine differences in lifespan between upper and lower levels of the managerial hierarchy. Table 4 Panel A reproduces all the specifications from Table 3 using an aggregated status indicator coded 1 for upper levels (1 to 3) and 0 for lower levels (4 to 6) of the hierarchy, which preserves an economically meaningful difference in the status ordering.

Since the largest mortality penalty in Figure 6 Panel A is associated with Level 2 vice presidents, I also report results in Table 4 Panel B from regressions dropping these individuals as potential outliers. Panel C reports results dropping individuals in Level 5 and 6 where any effect of selection on lifespan by level would be most pronounced. Panel D restricts the sample to those over 40 years old to capture permanent status, closer to the apex of a career in the hierarchy. To rationalize presentation of the results I report main coefficients only, suppressing the coefficients on the controls.

Across the OLS specifications in Panel A I find a negative lifespan effect of between 3 and 5 years for individuals in upper management positions with the largest mortality penalty being estimated in the most stringent specification in column 5 with SES controls and fixed effects for birth year, birth place and GE department. Results from a median regression produce a slightly larger mortality penalty at around 6 years. In column 6 the hazard ratio from the Cox model indicates that the hazard of death for upper management is 1.3 times that of lower level employees.

In Panel B dropping Level 2 vice presidents does nullify some of the estimates of lifespan differences. The OLS estimates in columns 1 to 4 become statistically insignificant, as does the hazard ratio from the Cox model in column 7. However, in column 5—the most demanding specification—the estimate implies about a 3-year shorter average lifespan for individuals in upper level positions, while the estimate in column 6 implies a 4-year shorter median lifespan. In Panels C and D some precision is lost due to the sample sizes being smaller when dropping Level 5 and 6 individuals and when estimating on a sub-sample of individuals above 40 who would have reached a more permanent position in the hierarchy by 1930. But a statistically significant mortality penalty for upper level leaders at GE is still evident in several specifications, again with a magnitude of 3 to 5 years.

5.4 Heckman Selection Models

As noted in Section 4.7 estimates of lifespan differences in the hierarchy will be biased if individuals with death records are non-randomly selected by status rank. Dropping from the sample the lowest levels in the hierarchy (Level 5 and 6) where the selection effect (premature deaths) might be most evident provides one adjustment (Panel C of Table 4). In this section I present two further approaches: Heckman selection models and ten-year survival probabilities.

Starting with the Heckman approach, I estimate a first stage selection equation where the outcome variable is coded 1 if the observation is only in the death records sample and 0 if it is in the census linked sample. The fitted inverse Mills ratio for each individual from this stage is then used in the second stage main model to correct for any selection bias from observing death years for some individuals but not others. Intuitively, this method removes any bias associated with inference in the main lifespan model due to the non-randomly missing observations in the death records sample.

In the first stage I include all the variables and fixed effects used in Table 3. While the model can be identified off these variables alone due the non-linearity of the Mills ratio, it is preferable to use an exclusion restriction using a variable that predicts selection into the sample but not lifespan. I use being listed in the 1940 GE directory because this variable strongly predicts selection into the death records sample based on the results in Table 2, while the relationship between being listed and lifespan is indeterminate. Although being listed may be associated with career progression—which would violate the exclusion restriction if promotion, in turn, affects lifespan—in the discussion of Table 7 Panel B below, I show promotion does not explain differences in lifespan.

Table 5 reports the results using Heckman's two-step estimator. The first stage selection equations are presented in Appendix Table A1. In these specifications Rho—the correlation coefficient between the error terms in the first and second stage equations—is negative suggesting that the unobservables associated with an individual being in the death records are *negatively* correlated with longevity. Several mechanisms could drive this result. Individuals with more tenacity, for example, might be healthier, more likely to live longer and leave the firm in the long-run, lessening the likelihood of being traced. Equally, less-healthy risk-averse individuals with a higher mortality risk may have stayed over the long-run to exploit GE's favorable worker welfare provisions (see Section 3).

The effect of selection means the OLS estimates in Table 4 will produce *downward* (towards zero) biased estimates of the relationship between status and lifespan. The estimates in columns 1 to 4 of Table 5, which correct for selection, imply that upper level managers experienced about 7 to 8 fewer years of life relative to those in lower level positions. As an additional robustness check I also re-estimated the model in column 4 dropping vice presidents in Level 2 of the hierarchy, leading to an estimate of the coefficient on the upper level dummy variable of -6.54 (z-statistic=2.25), or a shorter lifespan of about 7 years. Overall these results are consistent with a large mortality penalty for upper level managers and executives relative to those lower in the hierarchy.

5.5 Ten-Year Survival to 1940

To further address selection I maximize use of the census link data. For this component of the dataset I observe close matching rates by status level in the hierarchy (see Figure 5 Panel B), indicating this sample of data will be immune to selection bias. I estimate linear probability models for survival to 1940 using a proxy for survival: being traced between the 1930 and 1940 census. An individual is coded as surviving if they can be linked across time, or if they appear in the death records having died post-1940. An advantage of this method is that it measures death independently of the death records, which is the main cause of concern over selection. A disadvantage is the assumption that those who could not be traced experienced death during the 1930 to 1940 interval.

The mean of the dependent variable in columns 1 to 4 of Table 6 shows a baseline probability of survival of 0.77. That is, 77 percent of the 1,519 individuals in the 1930 *Organization Directory* who could be traced in the 1930 census "survived" until 1940. The probability of survival for individuals in upper level positions is lower—by about 10 to 13 percent in columns 1 to 4 with various specifications of controls. These results also show the probability of ten-year survival is significantly higher for individuals in the death records—which is indicative of selection. However, a negative mortality effect concentrated in the upper echelons of the organizational hierarchy at GE is consistent with the main findings on lifespan differences reported in Tables 4 and 5.

5.6 Life Cycle Estimates

I now use the aggregated status indicator to estimate survival probabilities over the life cycle. The Whitehall studies found that the status mortality gradient flattened from pre- to post-retirement, suggesting work-based factors like self-esteem—which would impact individuals more during their working age—were driving adverse health outcomes for lower ranked employees. Marmot and Shipley (1996) documented that the mortality rate for the lowest grade employees was 3.12 times the rate for the highest grade in the civil service between 40 and 64 years of age but this rate fell to 1.86 in post-retirement years (see Figure A2 Panel A). Studies have generally found that health disparities by SES flatten after age 50 or 60 years (Galama and van Kippersluis, 2019).

I estimate linear probability models of survival to age **x** following an estimation approach from the labor literature (e.g., Clark and Royer, 2013). Specifically, I set **x** in Equation 2 to be between ages 50 and 100 and restructure the dataset into a panel so that each individual is associated with 51 observations, one for each age-year inclusive. I then cluster the standard errors by person. Survival for individual i is coded 1 for survival to age **x** and 0 after. I use the same covariates and fixed effects from Equation 1. If those higher up experience greater longevity, a graph of the λ's for upper relative to lower level employees should produce an inverted-U shape over the life cycle of ages starting at zero and finishing at zero. With a mortality penalty at upper levels of the hierarchy, as suggested by the results discussed above, the estimates will be U-shaped.

$$\text{Survival}_i = \eta + \lambda_{\mathbf{x}}\textbf{Upper Level}_i + \gamma\textbf{Youth SES}_i + \delta\textbf{Adult SES}_i + \phi\mathbf{D}_i^{BIRTH} + \kappa\mathbf{D}_i^{BPLACE} + \nu\mathbf{D}_i^{DEPT} + \epsilon_i \quad (2)$$

Figure 7 plots the coefficients and 95 percent confidence intervals of survival probabilities using the variables in the specifications in column 5 Table 4. That is, the survival probabilities are estimated conditional on a full set of SES controls and fixed effects (Panel A) and are estimated dropping vice presidents in Level 2 (Panel B) and individuals at Level 5 and 6 (Panel C). All display a U-shape over the life cycle. These plots show that the main effect driving the negative lifespan effects already identified occur largely in post-retirement years.

5.7 Management Training Camps and Promotions

I now turn to results using alternative measures of status based on the data from GE's camps and promotions. Camp General attendees are coded 1 and those who did not attend are coded 0 with promotions also specified as a categorical variable with advancement in the hierarchy coded 1 and 0 otherwise. Interestingly, the correlation between these variables and the categorical variable measuring upper versus lower level positions is 0.40 and 0.07 for the camp and promotions variables respectively, confirming the multi-dimensional nature of status noted in the sociology literature.

In Table 7 Panel A I find a weak and statistically insignificant relationship between attendance at these prestigious networking and management training events and lifespan across the same set of specifications as used in Table 4 Panel A. Although the OLS and median regression point estimates are negative and the Cox model implies a higher hazard of death for camp attendees relative to non-attendees, the confidence intervals are wide including positive and negative mortality effects.

I also exploit further variation in the Camp General data because employees could attend multiple camps as a symbol of their status at the firm; those with particularly high status, who attended the most camps, may have lived longer. Figure 8 Panel A plots OLS point estimates and 95 percent confidence intervals at variable frequencies of attendance. All the confidence intervals overlap with zero. Panel B illustrates the same substantive finding using Cox models. Both sets of estimates indicate statistically insignificant lifespan differences by frequency of Camp General attendance.

Panel B shows the relationship between promotions and lifespan is also statistically insignificant across these specifications. Although these regressions are estimated using all observations in the dataset—so they do not account for employment attrition—estimating only on the sample of individuals who stayed at GE does not lead to substantively different results. For example, replicating the specification in column 5 of Panel B including only those who could be observed in both the 1930 and 1940 *Organization Directory* (n=623) produces a point estimate for the change in lifespan of those promoted of -1.72 years with a 95 percent confidence interval of -5.42 to 1.98 years.

Finally, Panel C uses all three status measures–upper versus lower positions in the managerial hierarchy, Camp General attendance, and promotions–in the same "horse race" regression. Both the Camp General and promotion effects remain imprecisely estimated, as would be expected based on the results in Panels A and B. The estimated mortality penalties associated with being in the upper echelons of GE management are of a similar magnitude to those estimated in Table 4 Panel A. The persistence of this mortality penalty, when controlling for alternative measures of status, suggests the factors driving the relationship between mortality and rank operated principally through the nature of the managerial hierarchy.

6 Discussion and Potential Explanations

Across a wide range of specifications I find top-level managers in the hierarchy at GE lived relatively shorter lives than their counterparts in lower ranking positions. This contrasts with the famous Whitehall studies where mortality risk declined with higher status. I focus on three potential explanations for these counter-intuitive results: country-specific differences in the gradient in health; occupational sorting and the structure of hierarchies; and stress-related theories of lifespan.

One explanation for these contrasting findings is that different country contexts drive differences in mortality outcomes. Yet, both the US and UK have experienced common trends in the social gradient in health over the long run, so it is unlikely that country-specific differences would matter. The coronary heart disease epidemic, driven by smoking and dietary shifts towards foods high in processed carbohydrates and sugars, peaked in both countries between 1960 and 1970. Although professional workers in the US by the mid-twentieth century had relatively low mortality rates compared to their UK counterparts, in other ways overall mortality profiles were strikingly similar across these two countries (Kitagawa and Hauser, 1973). Rates of occupational mobility in the US had also converged on UK rates around this time (Long and Ferrie, 2013).

Another explanation would be differences in occupational sorting and the structure of the respective hierarchies. Bureaucracies tend to be characterised by different career incentives to private organizations (Bertrand et al., 2020). As such, the recruitment of top civil servants in the UK was rife with patronage and privilege, whereas it is a reasonable assumption that a private firm like GE would have operated more as a meritocracy. Following controversial insights in the biology literature discussed in Section 2, stable dominant hierarchies—like the civil service—tend to place less strain on those at the top as their positions are less likely to be under threat from those lower down. Corporate hierarchies, by contrast, are inherently more unstable as individuals face intense competition for positional rewards. In that sense, we may not expect the Whitehall effect to generalize to this setting because the structure of the hierarchies was so fundamentally different.

Indeed, the changing mortality penalty by type of hierarchy—business versus political—shown in Figure 6 is particularly informative in this regard. There is no evidence of lifespan differences by status orderings for US senators (Panel C), but strong evidence of differences by rank for top executives in corporate hierarchies (Panel B). Unlike in the GE data I do not observe individuals lower down in the hierarchy in this broader corporate data, but the large dip in estimated longevity for vice presidents is suggestive about the non-monotonic psychosocial drivers of lifespan differences among top-level executives. Furthermore, research on the psychology of emotional response by Medvec, Madey and Gilovich (1995) using evidence from Olympic contests illuminates potential mechanisms, showing that bronze medalists are much happier than silver medalists. For a bronze medalist the reference point is no medal at all whereas for a silver medalist the emotional burden is much higher as the cost of a gold medal foregone. By the same token, vice presidents lost out in the contest for career progression, being situated in the hierarchy a layer below the top.

Modern-day studies suggest that senior executives face taxing work schedules (e.g., Bandiera et al., 2019). Furthermore, stress loads can significantly curtail lifespan (Borgschulte et al., 2019). The findings are consistent with stress-related theories of lifespan in corporations where high status is associated with earlier mortality. While hierarchies allow able managers at the top to conserve effort on routine tasks by exploiting the time of less able agents lower down (Garicano and Rossi-Hansberg, 2006), at GE upper level managers occupied particularly testing positions. Executives were said to "put in all kinds of hours... come in at night, come in in the morning, come in at the weekends... in their attempt to climb the hierarchy of GE management" (Schatz, 1983). Notwithstanding social connectedness, family support, or membership of alternative social hierarchies can provide protection from stress-related diseases, opportunities for avoidance strategies were limited because the corporate hierarchy was so instrumental to societal rank at this time. In William Whyte's influential 1956 book on life and the demands of American firms—*The Organization Man*—managers and executives are so dedicated they sell their souls to the corporation.

Top executives at GE faced managerial stress caused by factors such as stock market volatility and uncertainty associated with the Great Depression, union demands, antitrust, and dislocations due to the Second World War. The health literature indicates that psychological stress can have detrimental causal effects on cardiovascular and immune-system health, so it would be natural to expect a correlation between job stress and mortality at GE in this context. In the influential Karasek (1979) model of "job demand-control" in the organizational behaviour literature, workers face negative wellbeing consequences if their tasks are demanding but they lack decision authority. Vice presidents at GE were exposed to severe occupational stress and diminished control. I estimate the largest mortality penalty for these individuals in Table 3, and Figure 6 shows the mortality penalty at this level of the hierarchy generalizes to a broader sample of US business executives.

7 Conclusion

This paper has investigated the link between status and mortality using novel data that can replicate in a leading American corporation many of the characteristics of the famous Whitehall studies of mortality risk by rank. Managerial hierarchies had diffused widely in the US during the early twentieth century. Consequently, I can group white collar workers at GE by a clearly defined set of occupational positions. Despite similarities with Whitehall civil servants in terms of race, lifestyle, education, work environments, low employment turnover rates, and access to health care, I find results that contrast with the Whitehall social gradient in mortality. Higher ranked employees at GE were more susceptible to a shorter lifespan. The effects are large in magnitude with a mortality penalty of around 3 to 5 years for senior executives relative to those lower in the hierarchy.

The findings are consistent with explanations linking mortality to the concentration of stress-levels in layers of the managerial hierarchy. Limitations of the analysis include a lack of information on health and behavioral indicators such as differences in smoking rates, for example, that may interact with occupational stress and influence mortality. Socioeconomic status tended be inversely associated with smoking at this time, but with a moderated gradient for heavy smokers (Haenszel, Shimkin and Miller, 1956). Unobservables like genetics and the presence, or absence, of coping mechanisms may also be correlated with selection into rank and health outcomes.

The results therefore provide a basis for further research in the wider arena of overall mortality reductions in the US during the twentieth century. Individuals well above the poverty threshold, but lower down in the organizational structure of GE, experienced surprisingly positive trends in their life expectancy relative to the mortality penalty experienced by those higher up. Given the growing availability of digitized personnel records and historical census data, it would be interesting to explore the way in which social status affects health in other corporate hierarchies, and the extent to which Whitehall-like gradients might be more likely to be observed in bureaucracies.

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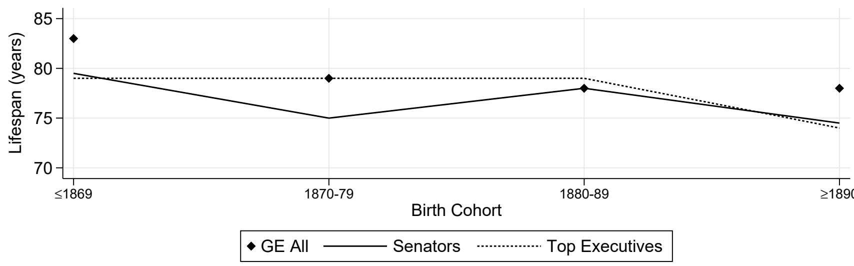
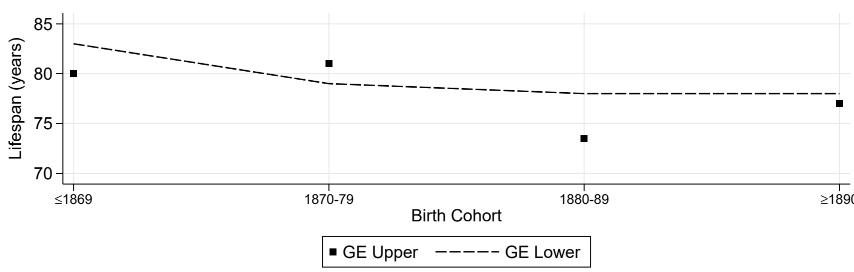
FIGURE 1: BENCHMARKING THE LIFESPAN OF GE EMPLOYEES

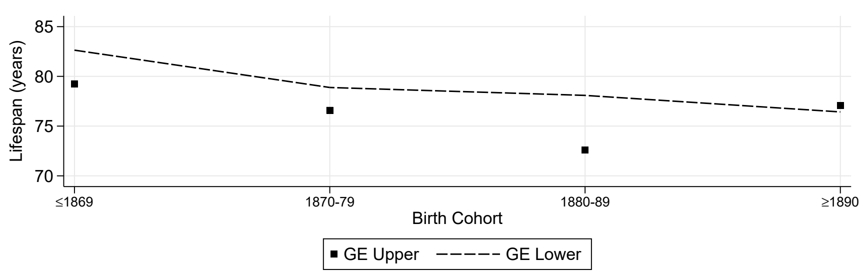


A: MEAN LIFESPAN

B: MEAN LIFESPAN



C: MEAN LIFESPAN



D: MEDIAN LIFESPAN

Notes: These figures show the mean or median lifespan of GE employees by birth cohort compared to the lifespan of top US business executives (n=245) active between 1936 and 1939 in the dataset compiled by Frydman and Saks (2010) and the lifespan of US senators in political office during the 1930s (n=214). GE Upper refers to individuals in Level 1, 2 and 3 of the hierarchy and GE Lower to individuals lower dow in Level 4, 5 and 6. Section 5.2 provides additional details on the construction of these datasets.

FIGURE 2: STATUS LEVELS AND GENERAL ELECTRIC'S *Organization Directory*

OFFICERS

E. WILBUR RICE, Jr.	Honorary Chairman of the Board
OWEN D. YOUNG	Chairman of the Board
GERARD SWOPE	President

JESSE R. LOVEJOY, Honorary Vice President — GEORGE F. MORRISON, Honorary Vice President

BURTON G. TREMAINE, Honorary Vice President

EDWIN W. ALLEN, Vice President
CHARLES W. APPLETON, Vice President
GEORGE P. BALDWIN, Vice President
JOHN G. BARRY, Vice President
WILLIAM R. BURROWS, Vice President
CUMMINGS C. CHESNEY, Vice President
ALBERT G. DAVIS, Vice President
CHARLES E. EVELETH, Vice President
CHARLES E. PATTERSON, Vice President
DARIUS E. PECK, Vice President
WILLIS R. WHITNEY, Vice President

JAMES A. CRANSTON, Commercial Vice President
WILLIAM J. HANLEY, Commercial Vice President
CHARLES K. WEST, Commercial Vice President

DANA R. BULLEN, Assistant Vice President
EARL O. SHREVE, Assistant Vice President

SAMUEL L. WHITESTONE, Comptroller
ROBERT S. MURRAY, Treasurer
WILLIAM W. TRENCH, Secretary

A: EXECUTIVE OFFICERS

INDUSTRIAL SERVICE DEPARTMENT

G. H. PFEIF, SUPERVISOR

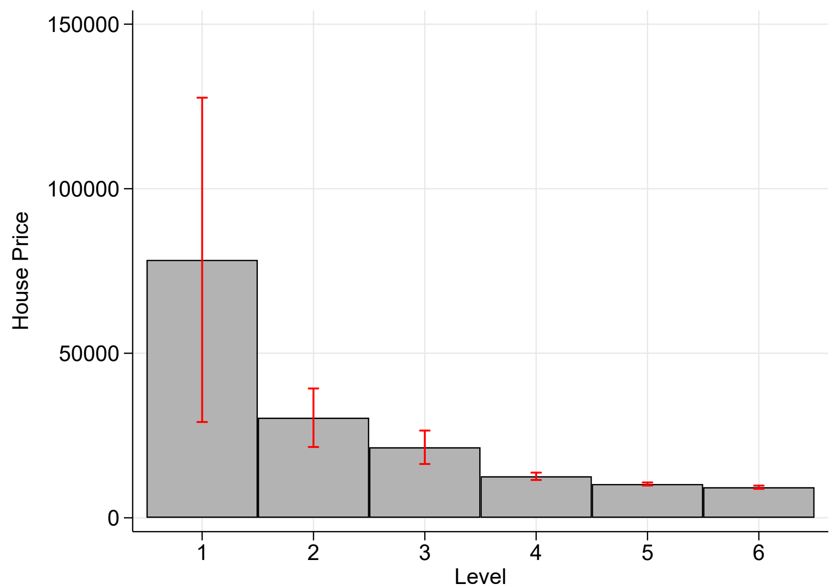
EMPLOYMENT AND EDUCATION

W. M. NELSON	Executive Assistant
C. G. MARCY	Asst. to Supervisor—Welfare
R. T. VIETS	Educational Work—Office Training and Instruction
W. J. E. SMITH, B. H. FRISS	Employment—Factory Help
R. E. RUGEN	Employment—Office Help—Supervision of Substitute Force—Employees' Service—Information Bureau, No. 44
MRS. A. HARDWIG	Employment—Office Help
MRS. M. R. HOLMES	Bureau of Instruction—Office Help
R. G. DAVIDSON	Employees' Records and Statistical Reports
R. S. ROSS	Factory Training
	Americanization Secretary, No. 44
M. M. BORING, L. MEANS	Employment and Training of Technical Students
J. O. WARREN	Employees Tests

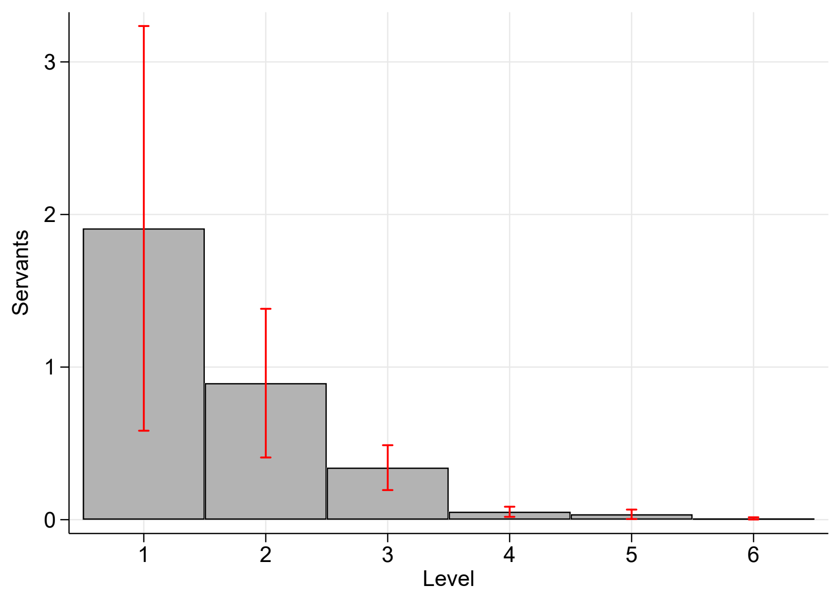
B: INDUSTRIAL SERVICES DEPARTMENT

Notes: These figures show sections of the 1930 edition of General Electric's *Organization Directory* pertaining to executive officers at the firm and the Industrial Services Department of the main Schenectady plant.

FIGURE 3: STATUS LEVELS AND SOCIOECONOMIC CHARACTERISTICS



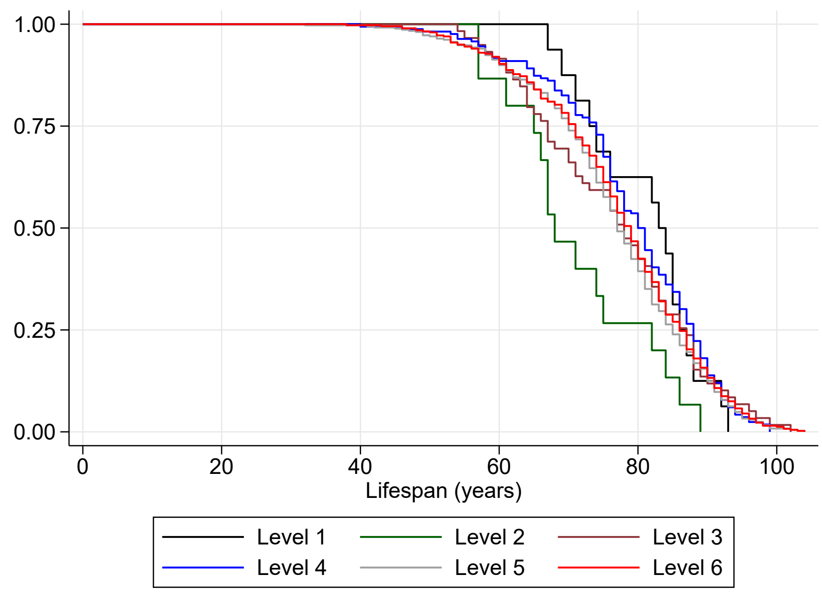
A: HOUSE VALUE



B: SERVANTS

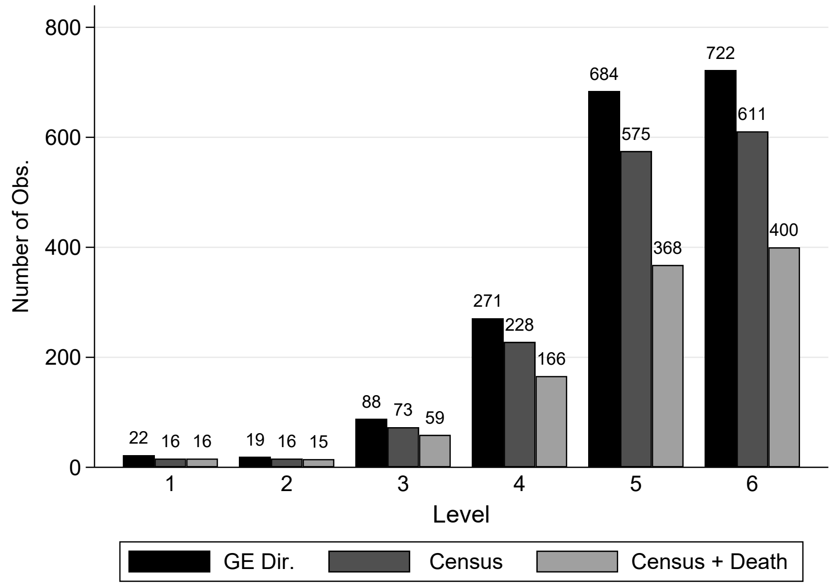
Notes: These figures shows mean household characteristics and 95 percent confidence intervals for employees in Levels 1 to 6 of the General Electric managerial hierarchy. Both variables are from the 1930 census. Level 1 is the highest level. Level 6 is the lowest.

FIGURE 4: KAPLAN-MEIR CURVES BY STATUS LEVEL

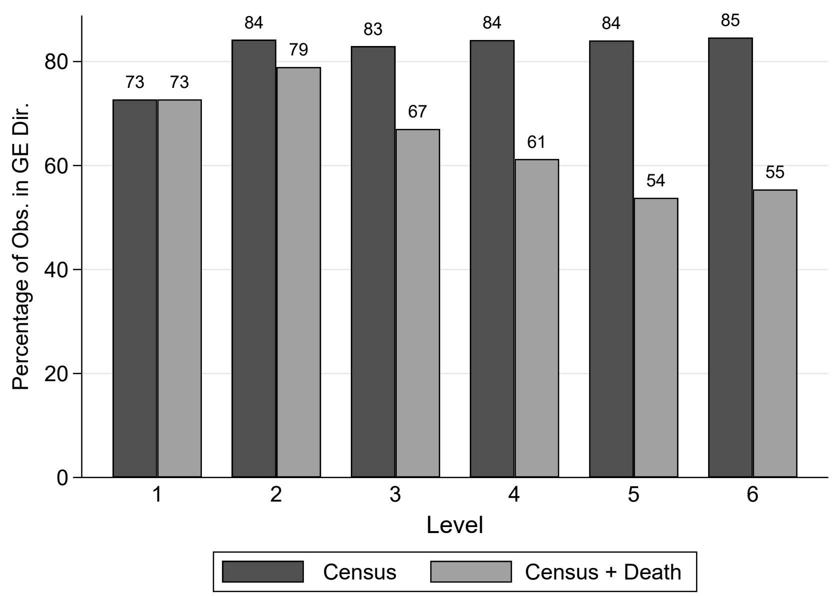


Notes: This figure shows the Kaplan-Meir curves for employees in Levels 1 to 6 of the General Electric managerial hierarchy. Level 1 is the highest level. Level 6 is the lowest.

FIGURE 5: MATCHING TO CENSUS AND DEATH RECORDS BY STATUS LEVEL



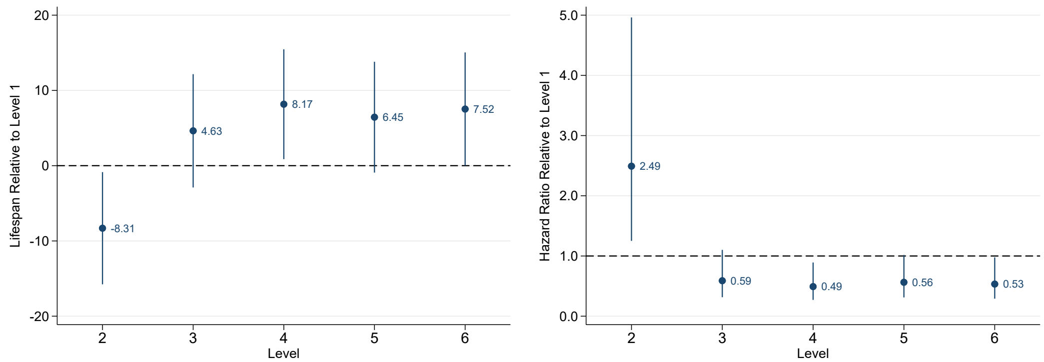
PANEL A: NUMBER OF OBSERVATIONS IN EACH SAMPLE



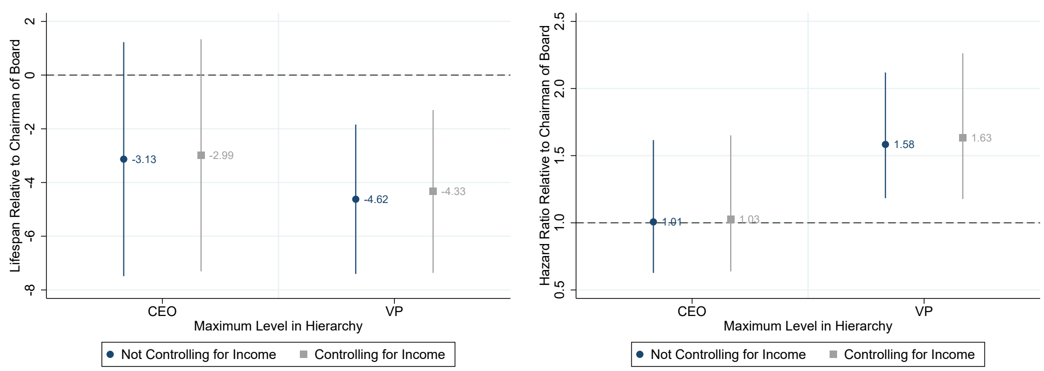
PANEL B: PERCENT OF OBSERVATIONS

Notes: Panel A shows the number of individuals in the General Electric *Organization Directory* and those matched to the 1930 federal census and to death records. Panel B shows the number of observations in the census and death records samples as a percent of those in the *Organization Directory*. For example 85 percent of individuals in the *Organization Directory* at Level 6 can be matched to the 1930 census and 55 percent to both the census and death records.

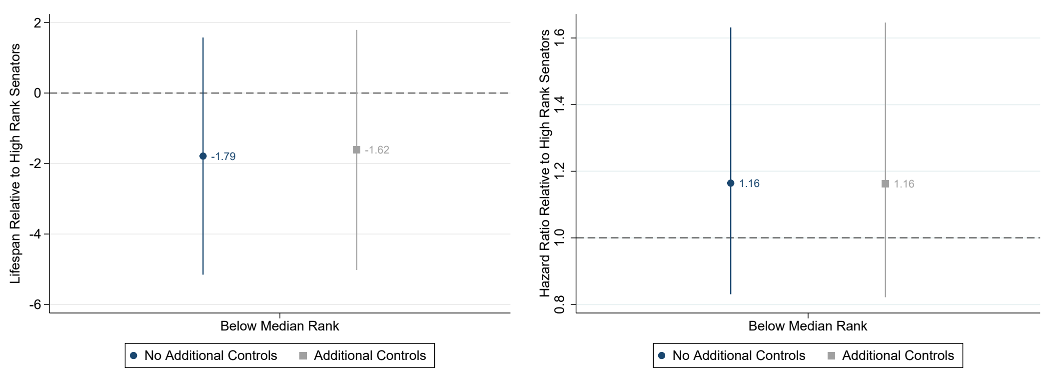
FIGURE 6: ESTIMATES OF LIFESPAN DIFFERENCES BY STATUS



PANEL A: GE DATA



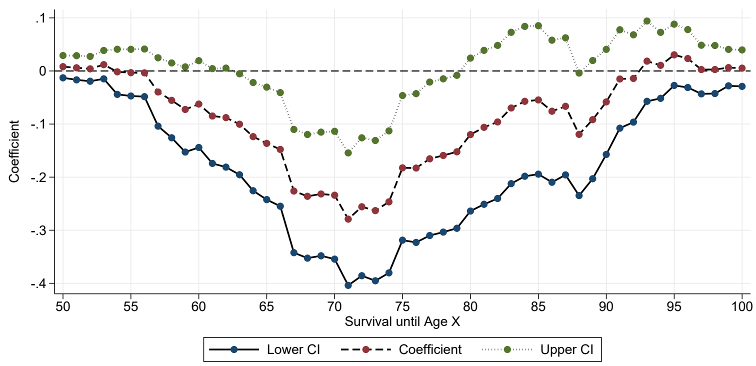
PANEL B: BUSINESS EXECUTIVES DATA



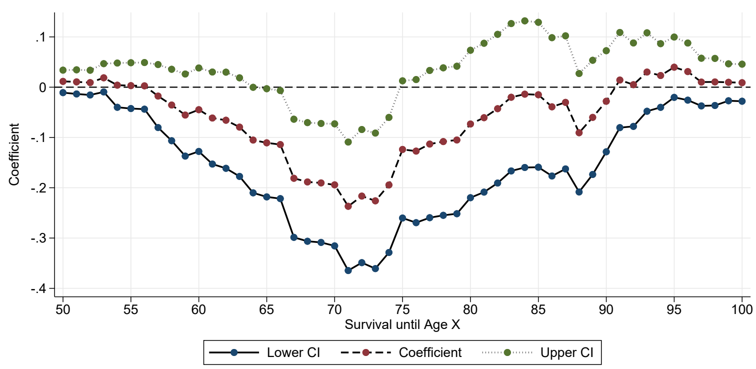
PANEL C: SENATORS DATA

Notes: These figures show point estimates and 95 percent confidence intervals from regressions of lifespan on status (OLS left column, Cox right column). Panel A uses the form in Equation 1. Status is measured by indicators for level in the hierarchy (e.g., vice presidents are Level 2) with Level 1 as the reference group. In Panel B status is measured using indicators for CEO's and vice presidents. The reference group is Chairman of the Board. In Panel C status is measured as an indicator for senator rank based on length of tenure in the US Senate. The indicator is coded 1 for senators with below median rank so the reference group is high ranking senators. The specifications in Panels B and C use birth year fixed effects. Additional controls are maximum income from Frydman and Saks (2010) in Panel B and indicators for political party and geographic region in Panel C.

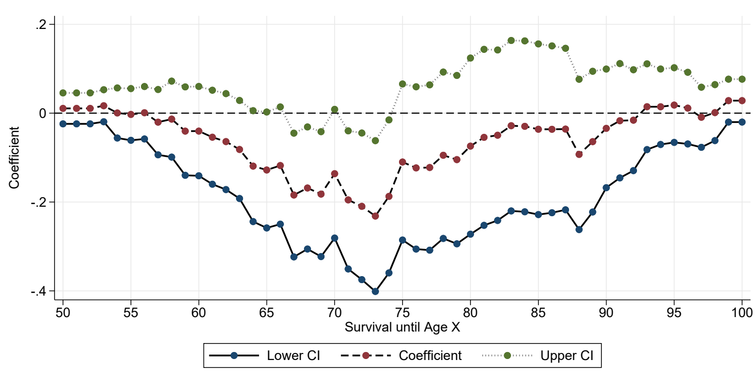
FIGURE 7: SURVIVAL PROBABILITIES - UPPER RELATIVE TO LOWER LEVELS OF THE HIERARCHY



PANEL A: ALL LEVELS INCLUDED



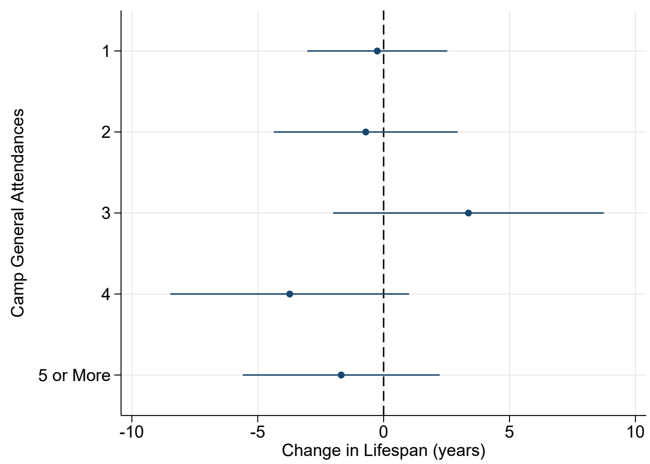
PANEL B: DROPPING LEVEL 2



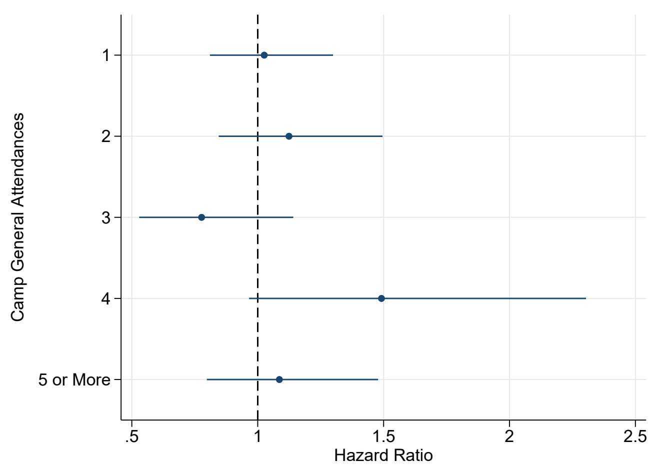
PANEL C: DROPPING LEVELS 5 AND 6

Notes: These figures show the relationship between status and the probability of survival to a given age in a panel where each individual is associated with 51 observations, one for each age-year. Status is measured as a dichotomous variable for upper (Level 1, 2 and 3) relative to lower (Levels 4, 5 and 6) positions in the hierarchy. Specifications use SES controls and fixed effects for birth year, birth place and GE department. Standard errors are clustered by individual.

Figure 8: Attendance at Camp General and Lifespan



Panel A: OLS Estimates



Panel B: Cox Estimates

Notes: These figures show the relationship between attendance at General Electric's Camp General and lifespan. The coefficients are estimated using indicators for attendance with the same set of controls as used in the specification in Table 7 columns 5 and 6. The baseline is the lifespan of non-attendees. The OLS estimates show the relationship between attendance and lifespan, whereas the Cox model estimates the relationship through the hazard of death over the life cycle.

Table 1: Summary Statistics

	Census Link	Obs.	Census and Death Records	Obs.	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Surname Length	6.47	1,519	6.46	1,024	6.56	6.27	6.44	6.52	6.40	6.49
	(1.73)		(1.69)		(1.79)	(1.44)	(1.80)	(1.66)	(1.73)	(1.67)
Initials (#)	1.91	1,519	1.90	1,024	2.00	2.00	2.05	1.96	1.88	1.86
	(0.40)		(0.41)		(0.52)	(0.00)	(0.51)	(0.45)	(0.36)	(0.41)
Age in 1930	41.74	1,519	41.77	1,024	63.38	59.20	50.68	45.00	40.46	38.81
	(11.26)		(11.03)		(8.89)	(8.67)	(11.00)	(10.09)	(9.36)	(10.46)
Age at Death			77.43	1,024	80.94	71.27	76.92	79.05	76.78	77.54
			(11.79)		(8.16)	(10.20)	(12.11)	(11.34)	(11.93)	(11.89)
Birth Year	1888.26	1,519	1888.23	1,024	1866.63	1870.80	1879.32	1885.00	1889.54	1891.20
	(11.26)		(11.03)		(8.89)	(8.67)	(11.00)	(10.09)	(9.36)	(10.46)
Born New York State	0.43	1,519	0.45	1,024	0.00	0.27	0.27	0.35	0.49	0.50
	(0.50)		(0.50)		(0.00)	(0.46)	(0.45)	(0.48)	(0.50)	(0.50)
Home Owner	0.63	1,519	0.62	1,024	0.81	0.67	0.86	0.66	0.64	0.55
	(0.48)		(0.49)		(0.40)	(0.49)	(0.35)	(0.47)	(0.48)	(0.50)
Value of Home	$11,953	1,067	$12,466	666	$78,385	$32,100	$22,025	$12,761	$10,021	$9,160
	($14,550)		($16,822)		($90,632)	($14,708)	($21,273)	($7,112)	($4,452)	($5,331)
Monthly Rent	49.93	520	49.71	259	.	63.33	60.42	56.12	46.54	46.99
	($30.56)		($33.83)		.	($22.55)	($25.94)	($28.94)	($15.44)	($34.87)
Servants (#)	0.09	1,519	0.13	1,024	2.63	1.13	0.51	0.08	0.07	0.02
	(0.53)		(0.64)		(2.87)	(0.99)	(0.73)	(0.32)	(0.51)	(0.12)
Radio in Home	0.80	1,519	0.81	1,024	0.81	0.73	0.92	0.78	0.83	0.79
	(0.40)		(0.39)		(0.40)	(0.46)	(0.28)	(0.41)	(0.38)	(0.41)
Married	0.84	1,519	0.85	1,024	1.00	0.93	0.93	0.88	0.86	0.81
	(0.37)		(0.36)		(0.00)	(0.26)	(0.25)	(0.33)	(0.35)	(0.39)
Children (#)	1.03	1,519	1.10	1,024	0.88	0.87	1.36	1.30	1.16	0.94
	(1.18)		(1.21)		(1.15)	(1.13)	(1.45)	(1.32)	(1.20)	(1.11)
Children Under 5 (#)	0.19	1,519	0.20	1,024	0.00	0.07	0.12	0.17	0.23	0.20
	(0.47)		(0.49)		(0.00)	(0.26)	(0.42)	(0.47)	(0.53)	(0.49)
White Collar			0.30	947	0.23	0.57	0.34	0.31	0.31	0.26
			(0.46)		(0.44)	(0.51)	(0.48)	(0.46)	(0.46)	(0.44)
Higher Education			0.07	1,024	0.31	0.60	0.17	0.08	0.05	0.04
			(0.26)		(0.48)	(0.51)	(0.38)	(0.27)	(0.22)	(0.20)
In 1940 GE Directory	0.53	1,519	0.61	1,024	0.63	0.40	0.59	0.70	0.66	0.53
	(0.50)		(0.49)		(0.50)	(0.51)	(0.50)	(0.46)	(0.47)	(0.50)
In 1940 Census	0.40	1,519	0.39	1,024	0.19	0.13	0.27	0.40	0.42	0.41
	(0.49)		(0.49)		(0.40)	(0.35)	(0.45)	(0.49)	(0.49)	(0.49)

Notes: Means with standard deviations in parentheses. The Census Link sample refers to individuals I can match from GE's *Organization Directory* to the 1930 census. The Census and Death Records sample refers to individuals I observe in both the census and in the death records. The description of each of these variables is given in Appendix A.2.

TABLE 2: SELECTION

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	Census v. GE Dir.	Death Records v. Census Link					
		All Levels			Upper	Lower	
Surname Length	-0.006	-0.000	0.001	0.000	0.008	0.002	[0.725]
	(0.005)	(0.007)	(0.007)	(0.007)	(0.023)	(0.007)	
Initials (#)	-0.030	-0.033	-0.036	-0.061**	0.004	-0.082**	[0.301]
	(0.022)	(0.030)	(0.030)	(0.030)	(0.106)	(0.032)	
Home Owner			-0.051*	-0.046	0.100	-0.057*	[0.139]
			(0.029)	(0.028)	(0.140)	(0.029)	
Radio in Home			0.020	0.023	0.063	0.018	[0.673]
			(0.033)	(0.032)	(0.141)	(0.033)	
Married			0.018	0.018	-0.044	0.012	[0.820]
			(0.040)	(0.040)	(0.332)	(0.040)	
Children (#)			0.035***	0.032***	0.040	0.030**	[0.756]
			(0.011)	(0.011)	(0.044)	(0.012)	
In 1940 GE Dir.				0.201***	0.106	0.200***	[0.300]
				(0.026)	(0.119)	(0.027)	
In 1940 Census				-0.021	-0.146	-0.012	[0.185]
				(0.025)	(0.136)	(0.026)	
Birth Year FE	Y	Y	Y	Y	Y	Y	
Observations	1,806	1,519	1,519	1,519	105	1,414	
R-sq	0.002	0.045	0.054	0.094	0.520	0.098	
Mean of Dep. Var.	0.841	0.674	0.674	0.674	0.857	0.661	

Notes: This table reports coefficients from linear probability regressions. In column 1 the dependent variable is coded 1 if an individual is in the census linked sample and 0 for only in the *Organization Directory*. In columns 2 to 6 the dependent variable is coded 1 if an individual is in the census linked sample and 0 for only in the death records sample. Columns 1 to 4 include all levels of the managerial hierarchy. Columns 5 and 6 split the sample by upper levels (1, 2 and 3) and lower levels (4, 5 and 6) respectively. Column 7 reports the p-value from a Wald test under the null of no difference between the coefficients. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

TABLE 3: LEVELS IN THE MANAGERIAL HIERARCHY

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	OLS	OLS	OLS	OLS	OLS	Median	Cox
Level	0.58	0.52	0.66	0.78*	0.82	0.93*	0.96
	(0.39)	(0.39)	(0.41)	(0.41)	(0.51)	(0.51)	[-1.01]
Home Owner		-0.35	-0.39	-0.35	-0.39	-0.62	1.01
		(0.95)	(0.95)	(0.95)	(0.95)	(0.80)	[0.14]
Radio in Home		0.44	0.52	0.40	0.84	0.16	0.93
		(1.06)	(1.06)	(1.08)	(1.07)	(0.77)	[-0.86]
Married		-0.90	-0.86	-1.22	-1.22	-1.52	1.09
		(1.41)	(1.41)	(1.44)	(1.42)	(1.48)	[0.81]
Children (#)		-0.38	-0.39	-0.38	-0.38	-0.64**	1.04
		(0.34)	(0.34)	(0.34)	(0.34)	(0.28)	[1.40]
White Collar			-0.00	-0.29	-0.42	-0.85	1.03
			(0.87)	(0.88)	(0.88)	(0.70)	[0.41]
Higher Education			2.36	1.94	1.14	2.11	0.76*
			(1.84)	(1.83)	(1.88)	(2.46)	[-1.95]
Birth Year FE	Y	Y	Y	Y	Y	Y	Y
Birth Place FE	N	N	N	Y	Y	Y	Y
Dept. FE	N	N	N	N	Y	Y	Y
Observations	1,024	1,024	1,024	1,024	1,024	1,024	1,024
R-sq	0.05	0.05	0.05	0.06	0.08		
Mean of Dep. Var.	77.43	77.43	77.43	77.43	77.43		

Notes: Columns 1 to 5 are OLS estimates and column 6 is an estimate from a median regression with robust standard errors in parentheses where the dependent variable is lifespan in years. Column 7 reports hazard ratios from a Cox model with z-statistics in square brackets. The Level variable is a continuous measure with a value of 1 for Level 1 individuals down to 6 for Level 6 individuals (the lowest rank in the hierarchy). * p<0.1, ** p<0.05, *** p<0.01.

TABLE 4: UPPER MANAGEMENT RELATIVE TO LOWER LEVELS

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	OLS	OLS	OLS	OLS	OLS	Median	Cox
	Panel A: All Levels Included						
Upper Levels	-3.19**	-3.04**	-3.62**	-3.96***	-4.53***	-5.84***	1.32*
	(1.46)	(1.47)	(1.54)	(1.53)	(1.70)	(2.00)	[1.94]
Observations	1,024	1,024	1,024	1,024	1,024	1,024	1,024
R-sq	0.05	0.05	0.06	0.06	0.08		
Mean of Dep. Var.	77.43	77.43	77.43	77.43	77.43		
	Panel B: Dropping Level 2						
Upper Levels	-1.83	-1.62	-2.19	-2.55	-3.08*	-3.60**	1.18
	(1.53)	(1.54)	(1.59)	(1.57)	(1.71)	(1.78)	[1.13]
Observations	1,009	1,009	1,009	1,009	1,009	1,009	1,009
R-sq	0.05	0.05	0.06	0.06	0.09		
Mean of Dep. Var.	77.53	77.53	77.53	77.53	77.53		
	Panel C: Dropping Level 5 and 6						
Upper Levels	-2.72	-3.29*	-2.95*	-3.15*	-2.97	-2.41	1.19
	(1.72)	(1.75)	(1.72)	(1.71)	(2.09)	(3.33)	[0.81]
Observations	256	256	256	256	256	256	256
R-sq	0.23	0.24	0.24	0.25	0.34		
Mean of Dep. Var.	78.22	78.22	78.22	78.22	78.22		
	Panel D: Over 40 years in 1930						
Upper Levels	-4.02**	-4.01**	-2.73	-2.70	-3.11	-4.53**	1.26
	(1.65)	(1.67)	(1.74)	(1.77)	(1.92)	(2.27)	[1.23]
Observations	533	533	533	533	533	533	533
R-sq	0.07	0.08	0.09	0.10	0.13		
Mean of Dep. Var.	78.35	78.35	78.35	78.35	78.35		
Birth Year FE	Y	Y	Y	Y	Y	Y	Y
Adult SES Controls	N	Y	Y	Y	Y	Y	Y
Youth SES Controls	N	N	Y	Y	Y	Y	Y
Birth Place FE	N	N	N	Y	Y	Y	Y
Dept. FE	N	N	N	N	Y	Y	Y

Notes: Columns 1 to 5 are OLS estimates and column 6 is an estimate from a median regression with robust standard errors in parentheses where the dependent variable is lifespan in years. Column 7 reports hazard ratios from a Cox model with z-statistics in square brackets. Upper Levels is a dummy variable coded 1 for Levels 1, 2 and 3 in the managerial hierarchy and 0 for Levels 4, 5 and 6. Columns 7 and 8 restrict the sample to those above 30 and 40 years of age respectively. Panel A uses the full sample. Panel B drops individuals in Level 2 of the hierarchy. Panel C drops individuals in Level 5 and 6 of the hierarchy. Panel D restricts the sample to those over 40 years of age in 1930 as a measure of permanent status in the hierarchy. * p<0.1, ** p<0.05, *** p<0.01.

TABLE 5: SELECTION MODELS

	[1]	[2]	[3]	[4]
Upper Levels	-7.58***	-7.43***	-8.12***	-8.42***
	(2.07)	(2.08)	(2.08)	(2.23)
Birth Year FE	Y	Y	Y	Y
Adult SES Controls	N	Y	Y	Y
Birth Place FE	N	N	Y	Y
Dept. FE	N	N	N	Y
Observations	1,519	1,519	1,519	1,519
Mean of Dep. Var.	77.43	77.43	77.43	77.43
Rho	-0.948	-0.952	-0.956	-0.917

Notes: This table reports Heckman two-step selection models where the dependent variable in the second stage is lifespan in years. Upper Levels is a dummy variable coded 1 for Levels 1, 2 and 3 in the managerial hierarchy and 0 for Levels 4, 5 and 6. The first stage selection equation models selection into the death records sample (n=1,024) from the census link sample (n=1,519) (see Appendix Table A1 for the first stage estimates). A dummy variable coded 1 for being in the 1940 GE directory and 0 otherwise is the excludable from the second stage regression in all columns. Rho is the estimated correlation coefficient between the error terms in the first and second stage. * p<0.1, ** p<0.05, *** p<0.01.

TABLE 6: SURVIVAL TO 1940

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Upper Levels	-0.13***	-0.13***	-0.10**	-0.14***	-0.11**	-0.11**	-0.14**
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)
In Death Records	0.54***	0.54***	0.55***	0.54***	0.54***	0.51***	0.56***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.07)	(0.03)
Birth Year FE	Y	Y	Y	Y	Y	Y	Y
Adult SES Controls	N	Y	Y	Y	Y	Y	Y
Birth Place FE	N	N	Y	Y	Y	Y	Y
Dept. FE	N	N	N	Y	Y	Y	Y
Observations	1,519	1,519	1,519	1,519	1,503	333	791
R-sq	0.41	0.41	0.47	0.42	0.42	0.43	0.41
Mean of Dep. Var.	0.768	0.768	0.768	0.768	0.770	0.748	0.716

Notes: This table reports coefficients from linear probability regressions where the dependent variable is coded 1 if an individual could be traced across the 1930 and 1940 censuses or had a date of death later than 1940, and 0 otherwise. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

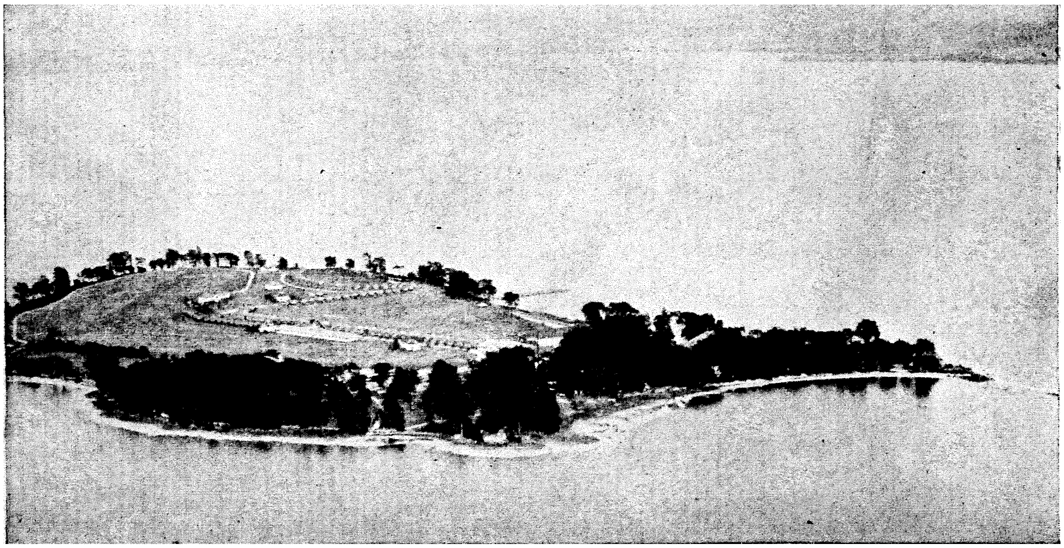
TABLE 7: CAMP GENERAL AND PROMOTIONS

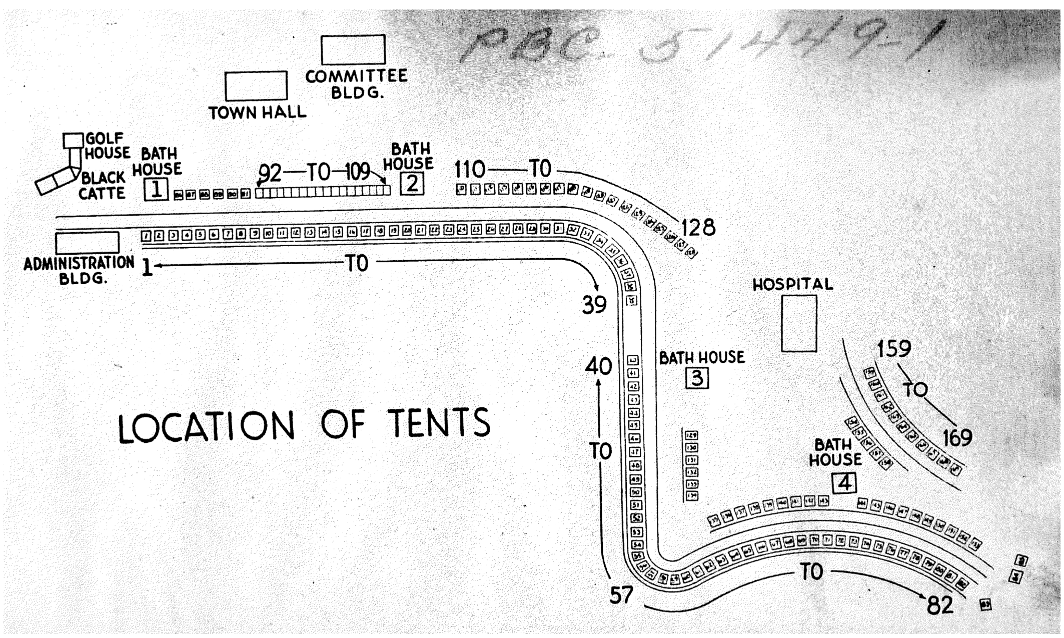
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	OLS	OLS	OLS	OLS	OLS	Median	Cox
	Panel A: Camp General						
Camp General	-0.37	-0.24	-0.54	-1.07	-0.58	-0.58	1.05
	(0.91)	(0.92)	(0.93)	(0.97)	(1.03)	(1.01)	[0.60]
R-sq	0.05	0.05	0.05	0.06	0.08		
	Panel B: Promotions						
Promotion	0.35	0.41	0.35	0.17	0.70	-0.63	1.02
	(1.75)	(1.74)	(1.74)	(1.77)	(1.81)	(2.41)	[0.15]
R-sq	0.05	0.05	0.05	0.06	0.08		
	Panel C: All Status Variables						
Upper Levels	-3.72**	-3.63**	-3.99**	-3.96**	-4.71***	-5.60***	1.32*
	(1.64)	(1.65)	(1.71)	(1.68)	(1.79)	(2.13)	[1.83]
Camp General	0.67	0.76	0.48	-0.06	0.28	1.14	1.00
	(1.02)	(1.03)	(1.02)	(1.06)	(1.08)	(1.12)	[-0.02]
Promotions	0.80	0.85	0.80	0.58	1.02	-0.12	1.01
	(1.78)	(1.78)	(1.77)	(1.81)	(1.80)	(2.61)	[0.09]
R-sq	0.05	0.05	0.06	0.06	0.08		
Birth Year FE	Y	Y	Y	Y	Y	Y	Y
Adult SES Controls	N	Y	Y	Y	Y	Y	Y
Youth SES Controls	N	N	Y	Y	Y	Y	Y
Birth Place FE	N	N	N	Y	Y	Y	Y
Dept. FE	N	N	N	N	Y	Y	Y
Observations	1,024	1,024	1,024	1,024	1,024	1,024	1,024
Mean of Dep. Var.	77.43	77.43	77.43	77.43	77.43		

Notes: Columns 1 to 5 are OLS estimates and column 6 is an estimate from a median regression with robust standard errors in parentheses where the dependent variable is lifespan in years. Column 7 reports hazard ratios from a Cox model with z-statistics in square brackets. The Camp General variable is coded 1 if an employee attended one of General Electric's management training camps and 0 otherwise. The 'Promotion' variable is coded 1 if an employee was promoted to a higher level at General Electric between 1930 and 1940. Upper Levels is a dummy variable coded 1 for Levels 1, 2 and 3 in the managerial hierarchy and 0 for Levels 4, 5 and 6. * p<0.1, ** p<0.05, *** p<0.01.

APPENDIX

FIGURE A1: CAMP GENERAL





Notes: The top image shows the location of General Electric's management training camp on Association Island, Lake Ontario. It is taken from the 1929 Camp General directory held at the firm's archives. The bottom image shows the layout of the tents where the attendees stayed. The Chairman of the Board stayed in tent number 28.

A.1 Description of the Whitehall Studies

The original Whitehall study (Whitehall I) began in 1967 to understand the social gradient in health and its causes. Researchers interviewed and followed the career and health histories of 17,530 civil servants working in Whitehall, London the locus of the UK's governmental bureaucracy. Each individual was also tagged in the Central Registry of the National Health Service so mortality events were recorded. All of the individuals involved in Whitehall I were male. At the time, males were considered to be more prone to coronary heart disease. Whitehall II, started in 1985 as a follow-on to Whitehall I studied 10,314 individuals including 6,900 men and 3,414 women.

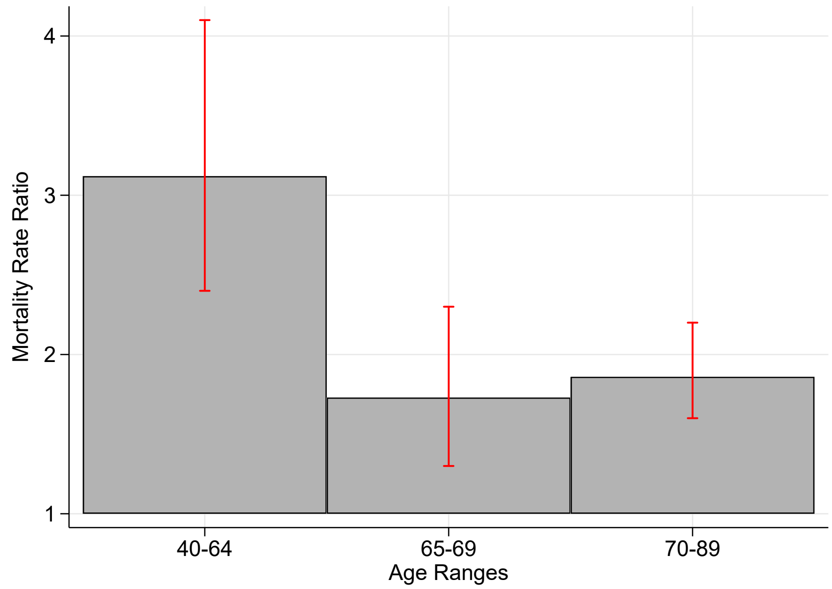
The civil service is highly stratified. Whitehall I and Whitehall II organized civil servants into occupational categories by their civil service grade. Civil servants tend to be socially homogenous by rank. As Marmot (2005) argued, "An executive officer is quite like another executive officer and quite different from an administrator." At the top of the civil service are high status positions like permanent secretaries—the Whitehall mandarins who control the levers of government. At the bottom are support staff such as porters and messengers who would typically be drawn from lower social classes. Job security is high in the civil service so the sample had limited attrition.

Whitehall I found that men between the ages of 40 and 64 in the lowest rank of the civil service had 3.6 times the coronary heart disease mortality rate of equivalently aged men in the highest rank. The effects, though smaller, could also be seen both through retirement, as shown in Figure A2 Panel A, and when controlling for a measure of socioeconomic characteristics, as shown in Figure A2 Panel B. Mortality rates were found to be starkly linear in grade. Level two employees, for instance, had a higher mortality rate than individuals above them even when controlling for contemporaneous health characteristics like blood pressure and cholesterol (Marmot et al., 1978).

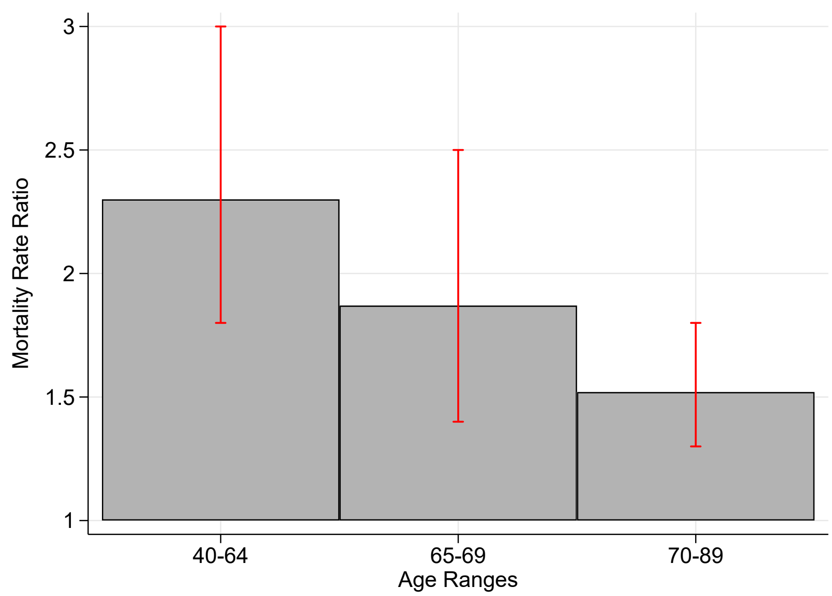
Notably, the status-mortality gradient was shown to be much steeper than in the population as a whole. National statistics showed individuals in the lowest social class had 1.8 times the coronary heart disease mortality rate of individuals in the top social class. Given that people with widely different incomes could be in the same class in the national classification, but not in layers of the civil service, the Whitehall study produced a more robust estimate of the status-mortality gradient.

The finding that employment status was a key predictor of health and mortality created strong momentum for research into mechanisms. Importantly, differential access to health care could be ruled out in this setting given access to the National Health Service. Whitehall II, as well as confirming the main findings from Whitehall I—and showing that females in lower status positions also suffered worse health—concluded that psychological factors and the stress of work were important drivers of the rank-mortality effect (Marmot and Shipley, 1996). Such factors had traditionally been overlooked by policy makers attempting to address health inequalities.

Figure A2: Mortality Rates in the Whitehall Studies



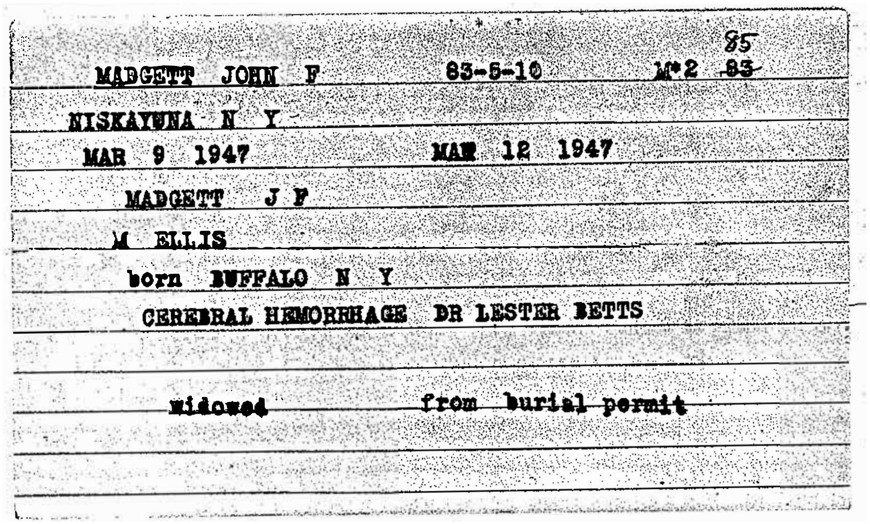
Panel A: Basic Controls



Panel B: Basic Controls + Car Ownership

Notes: These figure plots the results reported in Marmot and Shipley (1996) showing the mortality rate of the lowest grade of employment in the civil service relative to the highest grade. Panel A controls for age and length of follow up in the study. Panel B controls additionally for car ownership as a measure of socioeconomic status.

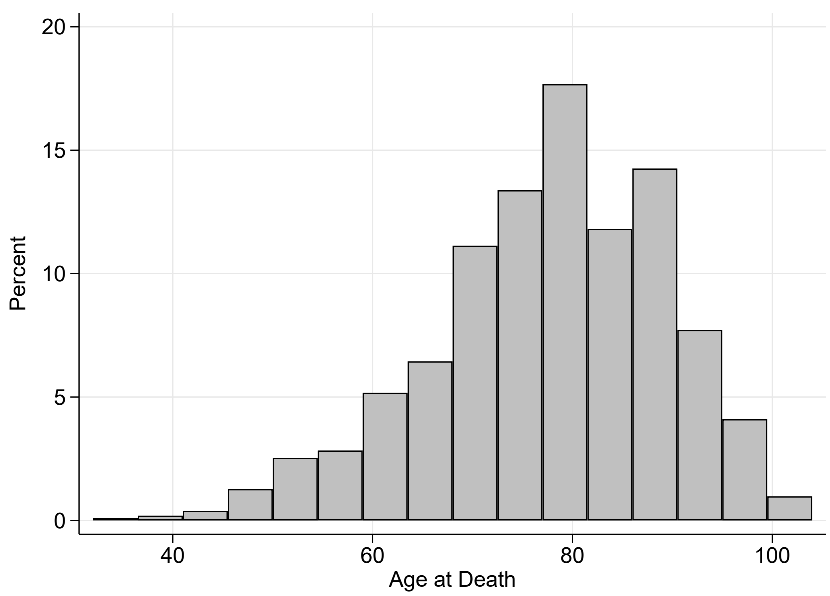
FIGURE A3: A BURIAL CARD FOR AN INDIVIDUAL IN THE DATASET



85
MADGETT JOHN F 83-5-10 M*2 83
NISKAYUNA N Y
MAR 9 1947 MAR 12 1947
MADGETT J F
M ELLIS
born BUFFALO N Y
CEREBRAL HEMORRHAGE DR LESTER BETTS
widowed from burial permit

Notes: This image is of a burial card for John F. Madgett who died in 1947, courtesy of the Vale Cemetery, Schenectady. Madgett was assistant to the General Superintendent at General Electric's main Schenectady plant.

FIGURE A4: THE DISTRIBUTION OF AGE AT DEATH



Notes: This figure plots the distribution of age at death for all individuals in the dataset, which consists of employees listed in General Electric's 1930 *Organization Directory*. The mean age at death is 77.43 years. The median age at death is 78 years.

TABLE A1: HECKMAN MODELS: FIRST STAGE

	[1]	[2]	[3]	[4]
	First-Stage			
Upper Levels	0.63***	0.63***	0.68***	0.71***
	(0.17)	(0.17)	(0.17)	(0.19)
Home Owner		-0.15*	-0.15*	-0.15*
		(0.08)	(0.08)	(0.08)
Radio in Home		0.05	0.08	0.08
		(0.09)	(0.09)	(0.09)
Married		0.05	0.11	0.09
		(0.11)	(0.11)	(0.11)
Children (#)		0.09***	0.09***	0.09***
		(0.03)	(0.03)	(0.03)
In 1940 GE Dir.	0.56***	0.55***	0.57***	0.57***
	(0.07)	(0.07)	(0.07)	(0.08)
Birth Year FE	Y	Y	Y	Y
Birth Place FE	N	N	Y	Y
Dept. FE	N	N	N	Y
Observations	1,519	1,519	1,519	1,519
Selected	1,024	1,024	1,024	1,024
Nonselected	495	495	495	495

Notes: This table reports first stage coefficients and standard errors from the corresponding Heckman selection models from Table 5. The first stage selection equation models selection into the death records sample (n=1,024) from the census link sample (n=1,519). * p<0.1, ** p<0.05, *** p<0.01.

A.2 Description of Variables

- **Level**: Occupational status level indicators Level 1 is the highest position in the managerial hierarchy. Level 6 is the lowest.
- **Upper Level**: Occupational status level indicator coded 1 for employees in Levels 1, 2 and 3 and 0 for employees in Levels 4, 5 and 6.
- **Surname**: String length of an individual's surname.
- **Initials**: Number of initials in an individual's name.
- **Birth** and **Death**: Birth years from matches to the 1930 federal census. Death years were collected from multiple sources as described in Section 4.4.
- **Born New York State**: Coded 1 for employees born in the state of New York and 0 otherwise, from the 1930 federal census.
- **Birth Place**: Specified as four birth place categories: born in the state of New York; born in any US state other than New York; born outside the US; and birth place missing in the 1930 census.
- **Home Owner**: Coded 1 for individuals who owned a home and 0 otherwise, as defined in the 1930 census.
- **Value of Home**: Dollar value of a home, as defined in the 1930 census.
- **Monthly Rent**: Dollar value of monthly rent, as defined in the 1930 census.
- **Servants**: The number of servants in the home, as defined in the 1930 census.
- **Radio**: Coded 1 for individuals who owned a radio, 0 otherwise from the 1930 census.
- **Married**: Coded 1 for individuals who were married as of the 1930 census.
- **Children**: The number of children in the household at the time of the 1930 census.
- **White Collar**: Coded 1 for individuals from white collar backgrounds and 0 otherwise. The construction of this variable is described in Section 4.5.
- **Higher Education**: Coded 1 for individuals who received a higher education and 0 otherwise. The construction of this variable is described in Section 4.5.
- **Camp General**: Coded 1 for individuals who attended General Electric's management training camps between 1927 and 1939. The construction of this variable is described in Section 4.2.

- **Promotion**: Coded 1 for individuals observed in General Electric's 1930 *Organization Directory* who were promoted to a higher level in the corporation in the 1940 *Organization Directory*. The construction of this variable is described in Section 4.3.
- **In 1940 GE Directory**: Coded 1 for individuals observed in General Electric's 1930 *Organization Directory* who could also be observed in the 1940 *Organization Directory* regardless of rank, and 0 otherwise.
- **In 1940 Census**: Coded 1 for individuals traced across the 1930 and 1940 census, 0 otherwise.
- **In Death Records**: Coded 1 for individuals with a date of death observation and 0 otherwise.
- **Adult SES Controls**: Home Owner; Radio in Home; Married. Children (#).
- **Youth SES Controls**: White Collar; Higher Education.