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CEO health ☆

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ABSTRACT

Using comprehensive data on 28 cohorts in Sweden, we analyze CEO health and its determinants and outcomes. We find CEOs are in much better health than the population and on par with other high-skill professionals. These results apply in particular to mental health and to CEOs of larger companies. We explore three mechanisms that can account for CEOs' robust health. First, we find health predicts appointment to a CEO position. Second, the CEO position has no discernible impact on the health of its holder. Third, poor health is associated with greater CEO turnover. Here, both contemporaneous health and health at the time of appointment matter. Poor CEO health also predicts poor firm outcomes. We find a statistically significant association between mental health and corporate performance for smaller-firm CEOs, for whom a one standard deviation deterioration in mental health translates into a performance reduction of 6% relative to the mean.

Introduction

Health is a potentially important determinant of CEO productivity and careers. The financial press has reported many examples where the top executive of a large firm has been unable to function due to a health crisis, leading the CEO to take a leave, resign, or even to die (Perryman, Butler, Martin, & Ferris, 2010; Goff & Jenkins, 2011; Hill, 2012). Yet, little evidence exists on executives' health and in particular on their mental health. In a recent review of literature on leaders' mental health, Barling and Cloutier (2017) conclude that "little is known about leaders' physical health" and that "leaders' mental health remains largely unexplored." The dearth of evidence reflects lack of data: health is a personal matter, and the executive may not wish to disclose the details of her condition even if it is value relevant.[1]

In this paper, we study CEO health using a unique combination of career, health, and firm data from 28 cohorts of the Swedish population. Our data include comprehensive and objective health information: we have data on every hospitalization, every open care treatment offered by a specialized doctor, and every filled prescription in the entire country.[2] Of the four million individuals in our data, 40,000 served as CEO during the 2006–15 sample period.

We follow a common practice in the medical literature of measuring health using a comorbidity index. Taking into account the fact that many conditions co-occur in a given patient, comorbidity indices pool various conditions into broader categories—in our case, into 18 physical and four mental condition categories. Of these conditions, mental disorders are of particular interest because of their serious effects on productivity and the stigma associated with them (Bharadwaj, Pai, & Suziedelyte, 2017). Because of this stigma, information on top leaders' mental health is particularly hard to obtain.

Focusing on broad health indicators allows us to get an excellent overview of CEO health, its predictors, and associated outcomes. This strategy is not without costs, however: in most analyses, we inevitably rely on associations rather than causal relations. For example, unexpected health shocks stemming from individual conditions cannot be inferred from aggregated medical information.[3]

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[1] In the recent death of Fiat Chrysler's Sergio Marchionne, the public and the company were not informed of the seriousness of the CEO's health problems until he was on his deathbed (Ball & Eric, 2018; Coppola, Ebhardt, Campbell, 2018). Larcker and Brian (2011) describe the deficiencies in the disclosure of former Apple CEO Steve Jobs's health.

[2] Johnston, Propper, and Shields (2009) find that objective health measures explain economic outcomes better than subjective measures.

[3] The same applies for causal inference from Mendelian randomization (e.g., Lawlor, Harbord, Sterne, Timpson, & Smith, 2008; Davey Smith and Hemani, 2014): the health index spans so many conditions that it is not possible to find a suitable genetic instrument capturing them all.

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We start our analysis by studying how healthy CEOs are. We find they are considerably healthier than other members of their cohort and gender: the population at large has on average 57 % higher predicted number of sick days than CEOs.[4] Compared with the population, CEOs suffer less from mental diseases than physical diseases. Their health also compares favorably with that of lawyers, and it is on par with that of engineers, and finance professionals. CEOs of larger firms have better health than the professionals in any of these high-skill occupations.

These comparisons combine three mechanisms: the role of health in making it to the top, the impact of the CEO job on health, and CEO health problems predicting turnover.[5] We study the first mechanism by estimating the association of health with the number of years it takes for an individual to assume a CEO position for the first time. In these analyses, we estimate the health coefficients controlling for early-life physical condition, traits, and education.[6] We find health and in particular mental health explains CEO appointments. Our estimates imply a one-standard deviation change in the health index is associated with a 19 % change in the hazard of becoming a CEO. This association is almost as large as that of a one-standard deviation change in cognitive ability, and over one-quarter of the association of a one-standard deviation change in non-cognitive ability. Selection of healthier individuals to CEO positions thus appears to be an important contributor to the superior health of CEOs compared to the population.

We next study the second mechanism by asking how the CEO job affects health. Some individuals appointed to the CEO position may find the demands of the job overwhelming, which can have adverse effects on health and narrow the CEO-population health difference. On the other hand, the higher income, higher social standing, and better job control that comes with the CEO job can compensate for some of the adverse health effects and positively contribute to the CEO health premium over the population.[7] We design a quasi-experiment that allows us to investigate the impact of becoming a CEO on health. This analysis takes advantage of CEO promotions in which we can identify two or more executives as potential contenders for the CEO position. Because the contenders come from the same firm and can be followed before and after the CEO promotion, this setting helps to account for firm- and individual-level differences in health.

We find executives appointed to CEO position seem to manage the demands of their new job well: Their health develops in a manner similar to the executives not promoted to the CEO position. In another quasi-experiment focusing on the end of the CEO career, we find that the health of retiring CEOs develops similarly after the typical retirement age as that of the retiring work force in general. We also find no evidence of differential trends in health prior to CEO promotions or retirement, which suggests the effects can be given a causal interpretation. These results are consistent with the executive labor market matching the right people to the right jobs and suggest the CEO-population health difference is not substantially affected by on-the-job effects.

The third and final mechanism contributing to the CEO-population health difference involves the firms' response to the incumbent CEO's health problems. Other things being equal, we would expect CEOs who are mentally or physically less fit to run the firm to be more inclined to lose their job, either because they are fired by the board or because they think it is in their own best interest to step down. We find that poor health—in particular, poor mental health—is highly significantly associated with greater CEO turnover, even after controlling for public performance signals observable to the board. Here, both contemporaneous health and health at the time of appointment matter. Thus, even if an individual's poor health goes unnoticed at the time of appointment, she continues to face a greater turnover risk while on the job.

The above three mechanisms produce a pool of CEOs in good health. Nevertheless, we find CEOs are not superhumans. They are treated for cancer, hyperlipidemia, rheumatoid arthritis, and gout about as often as the age-gender equivalent member of the population. Some of these conditions also expose them to other health shocks.[8] Although their mental health is considerably better than that of the population, each year 6 % of them receive treatment for anxiety and tension, and 4 % for depression.

We assess whether these CEO health problems correlate with corporate performance by regressing operating performance on the CEO's health index, firm and CEO fixed effects, and controls for firm and CEO characteristics. We find a statistically significant association between mental health and performance for smaller-firm CEOs, for whom a one standard deviation deterioration in mental health translates into a performance reduction of 6 % relative to the mean. The relationship between physical health and performance in all firms regardless of size, and mental health and performance among larger-firm CEOs, are of the expected sign but not statistically significant at conventional levels. Our result of the CEO mental health coefficient being larger for smaller than larger firms is consistent with the basic tenets of the upper echelons theory (Hambrick & Mason, 1984).

Data

The sample consists of individuals born between 1951 and 1978 who lived in Sweden in 2006–15. Our data set combines information on individuals and firms from three sources.

Statistics Sweden. The bulk of these data come from the LISA database that covers the whole Swedish population of individuals who are at least 16 years old and reside in Sweden at the end of each year. This database integrates information from registers held by various government authorities and covers for most variables the years 1990–2015. We extract information on labor and total income, wealth, field and level of education, profession, career, family relationships, and mortality, complementing the LISA database with data from the Multigenerational Register and the Wealth Register. The family records allow us to map each individual to their partners, children, parents, and siblings. We identify the executives other than CEOs based on their international ISCO-88 (COM) classification of occupations (codes 122 and 123).[9]

The Swedish Companies Registration Office

The Swedish Companies Registration Office keeps track of all companies, both public and private, and their CEOs and directors. The firm data are available for all corporate entities that have a limited liability structure ("aktiebolag") and report having appointed a CEO ("verkställande direktör"), excluding financial firms that operate as banks or

[4] Note that these results (and our results in general) use predicted number of sick days based on prescriptions and diagnoses. In other words, we do not base our assessment of an individual's health on the actual number of sick days, which might be affected by cultural, social, or attitudinal factors (Hausknecht, Hiller, & Vance, 2008).

[5] We consider each of these mechanisms causal in nature, even though our empirical tests of the first and third of these mechanisms only document associations.

[6] See, for example, Cutler and Lleras-Muney (2008) for a review of the literature on early-life origins of health.

[7] See, for example, Viscusi (1993) for a review on the literature on the value of health, and Frydman and Jenter (2010) and Murphy (2013) for reviews on CEO pay.

[8] For example, the *meta*-analysis of Zhang et al. (2020) finds that underlying conditions such as heart disease, respiratory diseases, and diabetes significantly increase the mortality of Covid-19. Booth et al. (2003), Badawi and Ryoo (2016), and Mertz et al. (2013) report similar evidence for severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), and influenza, respectively.

[9] The ISCO-88 (COM) code 122 corresponds to "production and operations managers" and the code 123 to "other specialist managers." The occupation data available from the LISA database come mainly from the official wage-statistics survey (Lönestrukturstatistiken). Statistics Sweden also undertakes surveys of smaller firms that are not included in the official wage survey. The sampling design in the supplementary surveys is a rolling panel and all eligible firms are surveyed at least once every-five years. Occupation information is available for each year, but the information may not be accurate for each year. To ensure we have accurate occupation information for every year, we require that the information be collected in the relevant year or earlier and for the correct employer-employee link.

insurance companies. These data record various financial-statement items, including sales and the number of employees. By law, each firm must supply this information to the registration office within seven months from the end of the fiscal year. Financial penalties and the threat of forced liquidation discourage late filing.

The data reports the starting and ending dates for CEOs in each firm. When the starting date is missing, we assume the CEO was appointed in 1990. (Our results do not change qualitatively if we relax this assumption by trimming the sample so that all observations have all the data from the whole sample period.) To map starting dates to annual data, we use the first of November each year, the date when the individual firm-workers links are recorded in the Statistics Sweden data. When CEO spells are overlapping in a given year for a given individual, we only keep the spell in the firm with the highest total assets during the spell. To confine our analysis to large enough firms, we only keep CEO spells that at least one point during our sample period (2006–15) fulfill the following two criteria simultaneously: the firm a) reports information on total assets exceeding 1 M SEK, and b) has 5 or more employees. These sample criteria avoid starting CEO spells only due to a firm growing beyond a certain threshold.

The National Board of Health and Welfare

Our health data come from the National Board of Health and Welfare, which maintains comprehensive records of hospital visits, open care offered by specialized doctors (from here on, specialized care), and prescriptions in Sweden. The hospital and specialized care data include primary and secondary diagnoses along with the associated four-digit International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10) codes for each diagnosis. The prescription data include all prescriptions along with the associated Anatomical Therapeutic Chemical (ATC) Classification System code with at least four digits. These ATC codes are further translated into diagnoses using established medical literature. All three data sets cover the years 2006–15. Appendix 1 offers a short description of the health care system in Sweden.

Military Archives

The Military Archives stores information on the cognitive, non-cognitive, and physical characteristics of all conscripts. The purpose of the data collection is to assess whether conscripts are physically and mentally fit to serve in the military and suitable for training for leadership or specialist positions. The examination spans two days and takes place at age 18. Lindqvist and Vestman (2011) offer a comprehensive description of the testing procedure. These data are available for Swedish males drafted in 1970–1996. Military service was mandatory in Sweden during this period, so the test pool includes virtually all Swedish men born between 1951 and 1978.

Due to the sensitive nature of the data, Military Archives, Statistics Sweden and the National Board of Health and Welfare do not allow us to share the data directly. Any researcher interested in obtaining access to the data can, however, apply for access to all the data used in this paper from Military Archives, Statistics Sweden and the National Board of Health and Welfare (after a separate application to the Ethical Review Board). Applications can be submitted by researchers who are affiliated with Swedish institutions or by researchers outside of Sweden who collaborate with researchers affiliated with these institutions.

Overview of the empirical analyses

Our paper has an ambitious empirical agenda including a multitude of analyses. Before describing these analyses in detail, we summarize them in Table 1. This table illustrates the key result of our analyses, potential mechanisms driving this result, and firm outcomes. In each analysis, we describe the outcome variable(s), key covariate(s), the causal nature of their relationship, method, and sample.

CEO health compared to the population and high-skill professionals

Descriptive statistics

Table 2 Panel A reports descriptive statistics on the sample individuals. We are primarily interested is CEOs, which we divide into two groups: those running companies with less than SEK 100 million of total assets (small-firm CEOs, about 90 % of the CEO observations; SEK 1 ≈ USD 0.09) and those above (larger-firm CEOs, about 10 % of the CEO observations). For benchmarking purposes, we also report on the results for three other high-skill professional categories: lawyers, engineers, and finance professionals. Here, we have defined finance professionals as professionals who work in the finance industry and have a university degree.

Our analysis focuses on individuals who were 28–64 years old during our sample period 2006–15. CEOs are on average in their late forties, i.e., 1–3 years older than the population average of 46 years. They are also much more likely to be men, better educated, and earn three to nine times as much as the population on average.

Table 2 Panel B reports on a subsample of men for which we have additional trait information from the military enlistment at age 18. Consistent with Adams, Keloharju, and Knüpfer (2018), CEOs have higher cognitive and non-cognitive ability and are taller than the population. They also possess better cardiovascular fitness and muscle strength and are slightly slimmer than the population. All of these traits improve in firm size. Larger-firm CEOs compare favorably with the other high-skill professions in almost all traits.

Table IA1 in the Internet Appendix reports on descriptive statistics on the sample firms. Their mean total assets are SEK 200 million, i.e. about USD 18 million. Just 0.7 % of the firms are publicly traded. Government owned firms account for less than 3 % of the firms.

Differences in health between CEOs and the population

Table 3 studies the health outcomes of the sample individuals. This analysis reports on 22 conditions that can be expected to have a significant and persistent impact on productivity, are sufficiently different from one another to be considered independently, and can be tracked using prescription and diagnosis data. The conditions are a subset of the 26 constituents of the Rx-Risk Comorbidity Index, a chronic disease index designed to assess the health of a patient on the basis of the ATC codes in prescription data. The index, used e.g. in Fishman et al. (2003) and Katon et al. (2009), takes into account the fact that many conditions co-occur in a given patient, pooling various conditions into broader categories. The composite nature of the index means it does not inform on any specific health component. Each comorbidity category is dichotomous—it is either present or it is not.

Apart from prescriptions, Table 3 uses the diagnosis information embedded in the hospitalization data to assess health outcomes. We assign a condition to an individual in a year if she has that condition in that year either according to prescription or hospitalization data.

The first column of Table 3 Panel A reports on the yearly prevalence of the 22 conditions in the population, separated to four mental and 18 physical health diagnoses. The remaining five columns report on the age- and gender-adjusted prevalence of these conditions relative to the population in the high-skill professional groups.[10] Age and gender adjusting is important because the groups vary in age and

[10] Table IA3 reports the prevalence of these conditions in the high-skill professional groups without age and gender adjustment.

Table 1

Roadmap of analyses, This table illustrates the flow of the analyses in the paper. We highlight the key result in the paper, potential mechanisms behind this result, and firm outcomes. In each analysis, we describe the outcome variable(s), key covariate(s), the causal nature of their relationship, method, and sample.

Analysis	Findings	Outcome variable (s)	Key covariate(s)	Nature of relationship	Method	Sample
Table 2	None: descriptive statistics	Many	Professional status	Association	Group averages	Population, highly skilled professionals
	Key result					
Table 3	CEOs have better health than peers	Incidence of diagnoses, health indices	Professional status	Association	Group averages	Population, highly skilled professionals
Fig. 1	CEOs have better health than peers	Health indices	Professional status	Association	Group averages	Population, highly skilled professionals
Fig. 2	Larger firm CEOs have better health	Health indices	Total assets bins	Association	Group averages	CEOs
	Potential mechanisms					
Table 4	Mechanism 1: Good health predicts CEO appointment	Future CEO appointment	Health indices, past health measures	Association	Cox regression	Population, past conscripts
Table 5	Mechanism 2: Appointment to CEO job affects future health	Health indices	Future CEO status	Causal	Diff-in-diff	Potential contenders for CEO position
Table 6	Mechanism 2: Retiring from CEO job affects future health	Health indices	Current CEO status	Causal	Diff-in-diff	Population of retiring individuals
Table 7	Mechanism 3: Poor CEO health predicts turnover	CEO turnover	Past health indices	Association	Cox regression	CEOs
	Firm outcomes					
Table 8	Poor CEO health harms firm performance	OROA	Past health indices, CEO and firm fixed effects	Association	OLS regression	CEOs

gender, which again are associated with the prevalence of the conditions.

Our results show the high-skill professional groups have a lower prevalence of almost all conditions than the population on average. For example, the age- and gender-adjusted prevalence of depression among larger-firm CEOs is 49.7 % of the population average, while the corresponding prevalence among lawyers is 75.6 %. The few conditions whose prevalence among CEOs is comparable to the population include hyperlipidemia, rheumatoid arthritis, cancer, and gout.

To get a more holistic idea of the health of CEOs, we aggregate the data on individual conditions to a health index, computed separately for the population and for each high-skill professional group. Given that the conditions vary in severity, we wish to avoid using unweighted metrics such as the number of prescriptions or hospitalizations, and rather weigh the conditions according to how taxing they are for the individual. We achieve this by calibrating a health index following established medical literature. Because our data is richer in outcomes and represents a different population than those of readily available indices, we calibrate the index weights ourselves rather than use the weights estimated in previous studies. Appendix 2 reports additional details on how we generate the health indices.

Table 3 Panel B reports on the health index for each group, adjusted for age and gender. The average member of the population takes 6.9 days of sick leave every year, of which 3.6 days are due to mental health and 3.3 days due to physical health. CEOs and in particular larger-firm CEOs exhibit better health than the other high-skill professional groups or the population. For larger-firm CEOs, the predicted number of sick leave days is 56 % of that of the population. This compares favorably with the other high-skill professional groups, for whom the predicted number of sick days is 62.4–73.3 % of that of the population. In other words, smaller health index numbers translate into better health.

Decomposing the health index into its mental and physical health components suggests that CEOs differ from the population and from the other high-skill categories more in their mental health. For larger-firm CEOs, for example, the mental health index is 50.2 % of the population whereas the physical health index is 62.2 % of that of the population. Larger-firm CEOs have a 7-percentage point lower mental health index value than any of the other professional categories, whereas the corresponding difference for physical health is 5 percentage points. The health of small-firm CEOs echoes this result. Their mental health is about the same or better than that of the other professional categories, whereas their physical health is less good than that of engineers and finance professionals. Fig. 1 summarizes the results of Table 3 Panel B. Table IA5 reports a correlation table including the health indices and the variables reported in Table 2.

Are there gender differences in CEO health? We study this matter in Table 3 Panel C which tabulates Table 3 Panel B without gender adjustment, separately for men and women. We find that males of all professional groups and of the population have better age-adjusted physical and in particular mental health than their female benchmarks. This result, also reflected in the correlation table in Table IA5, likely is a manifestation of the male–female health-mortality paradox (see, e.g., di Lego, Lazarević, & Luy, 2020). This paradox finds women experience more medical conditions and disability during their lives even though they live longer than men. The mental health result probably emanates from the two most common mental

Table 2
Descriptive statistics on population, high-skill professionals, and CEOs. This table reports descriptive statistics on the 3.6 million individuals born in 1951–78 over the 2006–15 observation period. The statistics are calculated separately for all individuals in the population, for high-skill professionals in law, engineering, and finance, and for CEOs by firm size (measured by total assets in SEK). Panel A reports on age, gender, education, and income for the full sample. Panel B reports also on cardiovascular fitness, muscle strength, body mass index, cognitive and non-cognitive ability, and height available from the military enlistment on a subsample of males. Cardiovascular fitness is measured in a cycle ergometry test and muscle strength in a combination of knee extension, elbow flexion, and hand grip tests. Body mass index is weight divided by squared height. The cognitive-ability test consists of four subtests designed to measure inductive reasoning (instruction test), verbal comprehension (synonym test), spatial ability (metal folding test), and technical comprehension (technical comprehension test). The subscores are aggregated into a composite score. The non-cognitive-ability score is based on psychologist's evaluation of social maturity, intensity, psychological energy, and emotional stability. All the personal traits are standardized to have zero mean and standard deviation of one in the population. The unit of observation is an individual in a year. The number of distinct individuals in each group has been calculated by grouping individuals into high-skill professional or CEO categories. A given individual can potentially belong to more than one category if her type has changed during the observation period.

Panel A: Descriptive statistics on full sample

	Population	High-skill professional			CEO by firm size	
		Law	Engineering	Finance	< 100 million	≥100 million
Age, years	45.9	43.8	43.1	43.7	47.0	48.8
Female, %	49.4	51.0	27.5	32.4	13.0	9.4
Level of education, %						
Basic	13.3	0.0	0.0	0.0	9.1	2.7
High school	47.9	0.0	0.0	0.0	42.4	20.3
Vocational	15.0	0.0	0.0	0.0	22.0	22.2
University	23.8	100.0	100.0	100.0	26.6	54.8
Income, SEK thousand	298	672	532	1,202	858	2,561
Number of observations	33,866,790	101,869	348,856	33,687	212,742	29,956
N. of distinct individuals	3,569,095	16,234	68,559	10,565	35,632	5,698

Panel B: Subsample of men with data on early-life traits

	Population	High-skill professional			CEO by firm size	
		Law	Engineering	Finance	< 100 million	≥100 million
Age, years	46.2	45.4	43.4	43.6	46.9	48.8
Level of education, %						
Basic	12.8	0.0	0.0	0.0	9.5	2.5
High school	51.7	0.0	0.0	0.0	44.0	20.4
Vocational	16.1	0.0	0.0	0.0	22.2	21.8
University	19.4	100.0	100.0	100.0	24.4	55.3
Income, SEK thousand	389	828	570	1,485	844	2,372
Cognitive ability, % sd	−0.3	77.0	105.0	73.2	39.2	72.4
Non-cognitive ability, % sd	0.3	59.4	40.4	68.1	54.7	88.8
Height, % sd	0.2	23.6	20.0	23.7	16.7	37.5
Cardiovascular fitness, % sd	0.3	31.3	34.7	44.3	25.1	49.5
Muscle strength, % sd	0.2	−10.9	−2.0	−2.1	16.6	18.0
Body mass index, % sd	−0.2	−14.6	−18.5	−19.7	−0.3	−1.7
Number of observations	11,952,139	42,873	203,693	19,400	153,343	23,242
N. of distinct individuals	1,217,301	6,728	39,053	5,390	24,971	4,262

conditions, anxiety and depression, being far more common among women than men (e.g., Altemus, Sarvaiya, & Neill Epperson, 2014).[11]

CEOs exhibit a smaller gender gap in health than the other high-skill professionals and in particular the population on average. The gender gap is the smallest for larger-firm CEOs, the only group for which the gender differences in the physical and pooled health indices are not significant at the 5 % level.

The above results are not sensitive to the health outcome measure. In Table IA6 we calculate the health indices using two alternative health-related outcomes—early retirement and mortality—and find at least as strong results as in Table 3. CEOs have better overall health than any of the other high-skill professional categories, and they outperform their peers in particular in mental health. We also consider the possibility that CEOs avoid the use of medical services altogether or in particular in Sweden, minimizing the likelihood they will end up in centralized (though strictly confidential) registers. To address this possibility, Table IA7 studies the association between our health metrics and mortality, an outcome that does not suffer from any reporting bias. As we discuss in Appendix 3, our results suggest CEOs and other high-skill professionals alike are healthier than what is predicted by their health index, perhaps because they have better access to medical care or are more prone to seek help when necessary. This not only speaks against CEOs' and other high-skill professionals' heightened aversion to record-keeping, but also suggests our results based on the health index can be viewed as conservative.

Does the importance of CEO health increase in firm size? Fig. 2 studies assignment by sorting newly appointed CEOs into 50 bins on firm's total assets and reporting the age and gender adjusted average CEO health index value for each bin. Panel A plots for each bin the CEOs' average mental health index value, scaled by the corresponding mental health index value for the population. Panel B plots the same relationship for physical health, and Panel C for the combined mental and physical health index. In each panel, the CEO health index value decreases about linearly in firm size. Consistent with Table 3 Panel B and Fig. 1, CEOs differ more from the population in mental health than in physical health.

The fact that CEO health improves in firm size suggests CEOs may be selected to their positions based on health. This interpretation is consistent with assignment theories in which positive assortative matching of the "best" CEOs to the largest firms maximizes value (Gabaix & Landier, 2008; Terviö, 2008).

[11] The medical literature has reported gender differences in the likelihood to seek treatment, although estimates in their magnitude vary (see Wang et al., 2007, for comprehensive cross-country evidence). These differences can affect the gender gaps in physicians' anxiety and depression diagnoses and prescriptions, but they cannot plausibly affect the large gender gaps in diagnoses inferred from diagnostic surveys on depression and anxiety (see, e.g., GBD, 2019 Mental Disorders Collaborators, 2022, for related evidence around the world, and Johansson, 2013, for evidence in Sweden). With the exception of Table 3 Panel C, our analyses control for gender and therefore are immune to gender differences in the likelihood to seek treatment.

Table 3

CEO health compared to population and high-skill professionals. This table reports on health of the 3.6 million individuals born in 1951–78 over the 2006–15 observation period. The statistics are calculated separately for all individuals in the population, for high-skill professionals in law, engineering, and finance, and for CEOs by the firm's total assets in SEK. The unit of observation is an individual in a year. Panel A reports the annual prevalence of diagnoses, broken down into the Rx-Risk categories detailed in Table IA2. Diagnoses in the hospitalization, specialized care, and drug prescription registers enter the calculation. The panel reports the ratio of the prevalence of diagnoses, adjusted for age (at the accuracy of one year) and gender, among CEOs and high-skill professionals compared with the population. In other words, smaller numbers indicate better health. The ratio is negative for psychotic illness for larger-firm CEOs because these firms have so few CEOs with diagnosed psychotic illness, producing a negative adjusted prevalence after age and gender adjustment. Panel B aggregates the prevalence of diagnoses listed in Panel A into health indices based on sick leave. These indices calculate first the predicted number of days of next-year sick leave for each individual-year observation using information on the diagnoses an individual has in the current year (these regressions are reported in Table IA4). The health indices are then orthogonalized with respect to age, gender, and year. The panel reports the ratio of the predicted sick leave for CEOs and high-skill professionals and the predicted sick leave in the population. The number of distinct individuals in each professional category is the same as in Table 2 Panel A.

Panel A: Annual prevalence of diagnoses in population, and age-gender-adjusted prevalence relative to population

	Prevalence in population, %	Age-gender-adjusted prevalence relative to population, %				
		High-skill professional			CEO by firm size	
		Law	Engi-neering	Finance	< 100 million	≥100 million
Mental health diagnosis	16.1	79.5	66.6	69.1	69.8	64.3
Anxiety and tension	10.4	82.0	62.5	72.3	73.1	73.3
Depression	10.2	75.6	67.2	59.7	62.0	49.7
Psychotic illness	1.6	37.4	30.7	23.3	6.2	−1.7
Bipolar disorder	0.5	56.2	57.5	47.4	38.5	14.6
Physical health diagnosis	32.3	89.0	80.0	86.0	92.8	88.4
Hypertension	8.7	83.4	70.5	69.4	93.2	81.8
Gastric acid disorder	8.1	58.9	61.6	59.9	79.5	64.8
Heart disease, hypertension	6.1	84.5	69.8	76.0	79.8	60.5
Hyperlipidemia	5.3	88.1	68.6	74.5	95.6	91.4
Rheumatoid arthritis	4.3	87.6	78.0	95.2	106.9	107.2
Coronary, peripheral vascular disease	4.1	89.6	67.9	71.8	79.5	65.6
Thyroid disorder	3.9	98.2	99.8	101.1	87.4	78.5
Liver disease	3.8	83.5	78.6	85.8	78.4	74.3
Diabetes	3.1	61.9	55.6	43.1	60.0	13.9
Asthma	5.9	92.4	85.2	89.4	91.7	80.2
Cardiac disease	2.8	71.0	67.8	65.7	70.8	50.5
Epilepsy	2.2	53.3	43.0	38.3	41.7	25.6
Malignancies	1.9	111.0	105.6	110.8	92.3	101.4
Gout	0.5	86.4	50.3	45.7	114.2	72.5
Irritable bowel syndrome	0.5	80.8	78.4	80.7	82.7	80.7
Parkinson's disease	0.4	65.6	71.5	49.3	66.5	38.9
Renal disease	0.2	84.7	63.0	59.9	55.0	40.1
Tuberculosis	0.04	29.7	24.6	29.2	51.5	37.9

Panel B: Aggregating diagnoses to health index based on sick leave

	Index in population, days	Age-gender-adjusted index relative to population, %				
		High-skill professional			CEO by firm size	
		Law	Engi-neering	Finance	< 100 million	≥100 million
Mental health	3.6	71.6	58.7	56.7	56.9	50.2
Physical health	3.3	75.2	67.6	68.5	73.3	62.2
Mental and physical health	6.9	73.3	62.9	62.4	64.8	56.0

Panel C: Health index based on sick leave by gender

	Popu-lation	High-skill professional			CEO by firm size	
		Law	Engi-neering	Finance	< 100 million	≥100 million
Women						
Mental health	125.2	86.9	68.5	60.6	61.5	42.3
Physical health	111.8	85.4	75.3	75.2	75.6	55.3
Mental and physical health	118.8	86.2	71.7	67.6	68.2	48.5
Men						
Mental health	77.0	57.4	40.3	42.3	35.9	29.7
Physical health	89.6	65.6	57.9	59.7	63.6	53.0
Mental and physical health	83.0	61.3	48.7	50.7	49.2	40.9

Predicting CEO health and outcomes of CEO health

Does health predict CEO appointments?

The CEO health advantage documented in Table 3 combines three potential mechanisms: the role of health in making it to the top, the impact of the CEO job on health, and CEO health problems leading to turnover. We study the first mechanism by analyzing in Table 4 the association of health with the number of years it takes for an individual to assume the position as a CEO for the first time. We estimate a Cox proportional hazards model, essentially a regression model commonly used in medical and economic research for investigating the

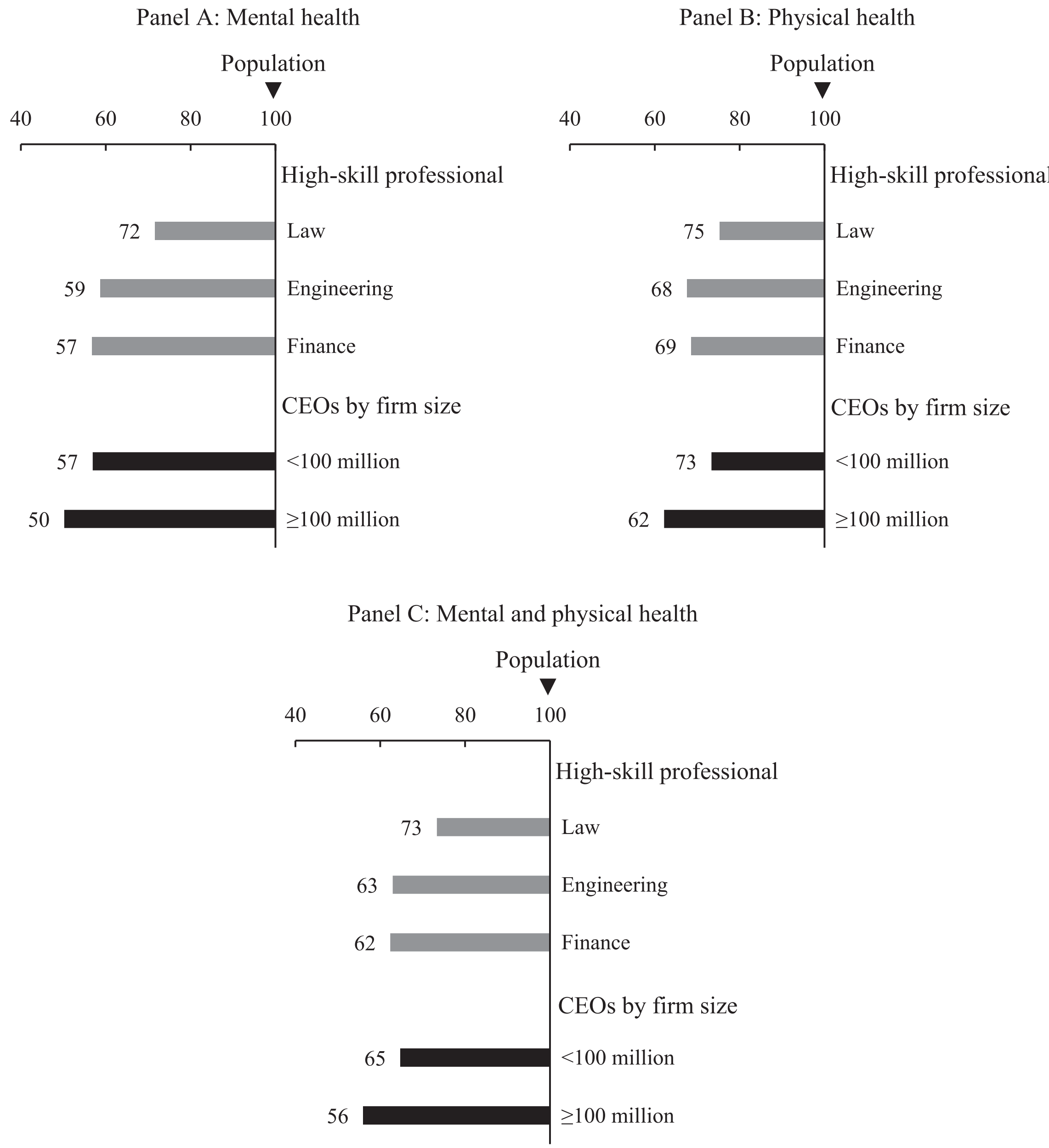

Fig. 1. Health of CEOs and high-skill professionals compared to population, This figure plots indices of mental and physical health tabulated in Table 3 Panel B for CEOs and high-skill professionals in law, engineering, and finance compared to the population. The health indices calculate first the predicted number of days of next-year sick leave for each individual-year observation using information on the diagnoses an individual has each year. The health indices are then orthogonalized with respect to age (at the accuracy of one year), gender, and year to arrive at the final indices. Population retains an index value of 100. Health index values reflect the length of the predicted sick leave, where shorter leave (and smaller health index number) indicates better health. Panels A and B calculate the health indices separately for diagnoses relating to mental health and physical health; Panel C shows the joint results. Unit of reporting is percentage point. The number of distinct individuals in each professional category is the same as in Table 2 Panel A.

association between predictor variables and survival time. The model assumes censoring after the last sample year to account for the fact that some of our sample subjects may assume a CEO position only after the end of the sample period. The three first columns decompose health into mental and physical components, while columns 4–6 study them jointly. The models we estimate are predictive models, so we do not claim they are causal in nature.

Column 1 runs the analysis in the entire population. Apart from indices for mental and physical health in each year, the regressors include indicators for age, gender, and year. Results suggest mental and physical health indices are associated with the hazard to become a CEO (*t*-values –26.9 and –13.6, respectively): the better the health, the sooner the individual becomes a CEO.[12] The coefficient for mental health (–0.036) has a higher absolute value than that for physical health (–0.021, *p*-value for difference is $< 10^{-10}$), suggesting that mental health is an even more important predictor of CEO appointment than physical health.

[12] We generally use *t*-statistics instead of *p*-values to report on statistical significance. When *t*-statistics have large absolute values (and the associated *p*-values are very small), *t*-statistics make it easier to communicate differences in statistical significance. For example, the *t*-values of –26.9 and –13.6 are associated with *p*-values of 2.2×10^{-159} and 1.0×10^{-42}, respectively.

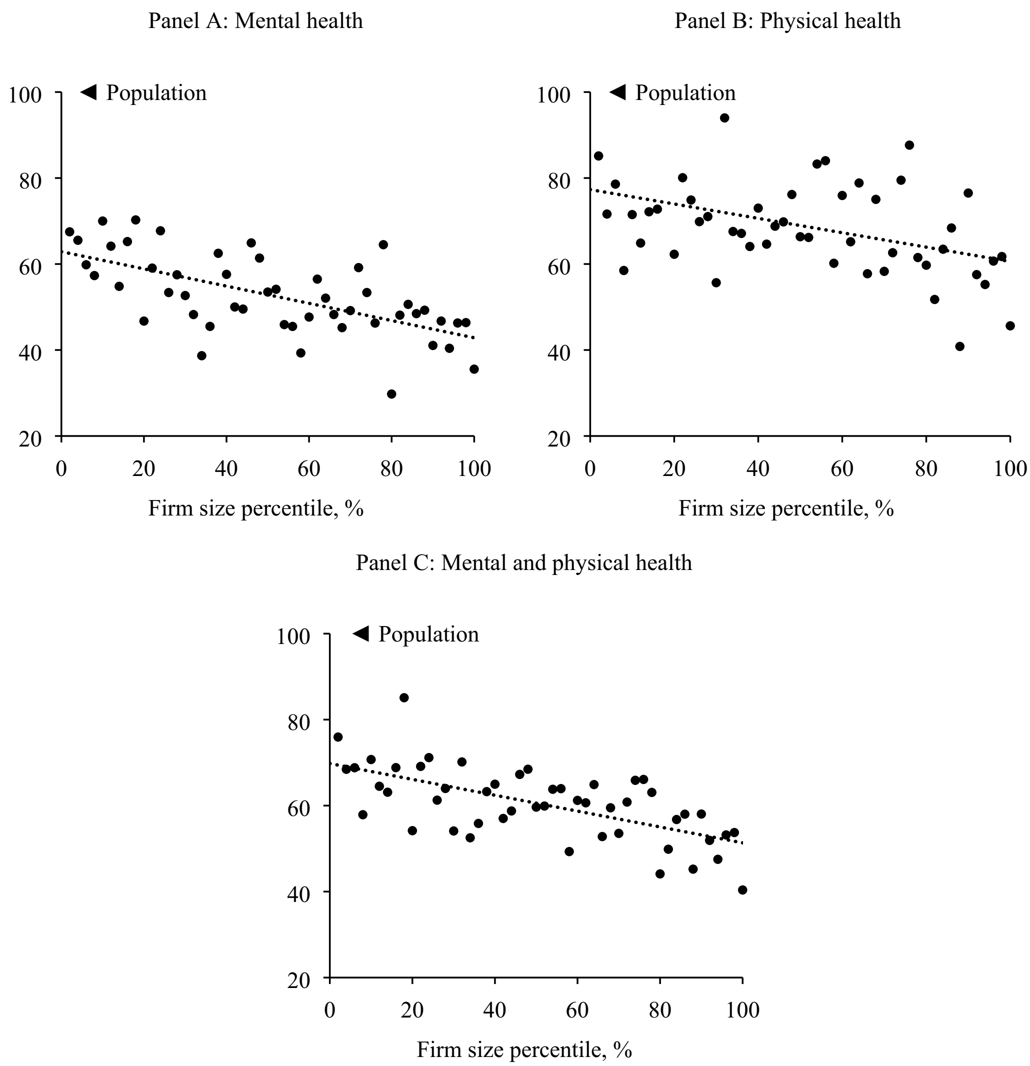

Fig. 2. Health of newly appointed CEOs in firms of different size. This figure plots indices of mental and physical health for newly appointed CEOs in firms of different size. The firms are divided into 2% bins according to their total assets and the averages of health indices, measured one year prior to CEO appointment, are shown in each bin. In these bins, each firm-CEO pair is the unit of observation. The health indices calculate first the predicted number of days of next-year sick leave for each individual-year observation using information on the diagnoses an individual has in a given year. The health indices are then orthogonalized with respect to age (at the accuracy of one year), gender, and year to arrive at the final indices. The figure plots the ratio of the predicted sick leave for CEOs in each firm-size category and the predicted sick leave in the population. In other words, smaller numbers indicate better health. Panels A and B plot the mental and physical health indices separately whereas Panel C combines the mental and physical health diagnoses into one index. The linear regression line accompanies each plot. The unit of reporting is percentage points.

We narrow our sample to individuals for whom we have data on mandatory military enlistment at age 18. This allows us to control for many early-life predictors of CEO appointments: education, cognitive ability, non-cognitive ability, height, cardiovascular fitness, muscle strength, and the body mass index (see Adams et al., 2018, for an analysis of how early-life variables predict CEO appointments). We report the results first without and then with these controls. The comparison of the coefficient estimates allows us to gain insight into the effect of potential omitted variables on our results.

Column 2 in Table 4 reports the results of column 1′s specification in the military subsample. The coefficients in this subsample are statistically highly significant but somewhat smaller than in column 1. They also retain the ranking of the importance of mental health compared to physical health. Column 3 adds early-life controls to the regression equation. All controls are of the expected sign and, except for physical fitness, statistically significant at least at the 5 % level. The mental and physical health coefficient sizes decrease from column 2 by 27 % and 34 %, respectively, but remain highly significant (*t*-values –11.4 and –5.2, respectively). The moderate decrease in the coefficient estimates is consistent with potential omitted variables having a limited effect on our results. These numbers imply a one-standard deviation (15.9 %) change in the mental health index decreases the hazard of becoming a CEO by $(e^{-0.018})^{15.9} - 1 = -24\%$. For the physical health index, this magnitude equals $(\mathrm{e}^{-0.008})^{14.0} - 1 = -11\%$. For comparison, the corresponding one-standard deviation effect sizes range from 1.3 % to 9 % for the measures of early-life physical condition. Cognitive and non-cognitive abilities show effects of 21 % and 68 %, respectively, whereas university education increases the hazard by 42 %.

Columns 4–6 report on the association between pooled physical and mental health and CEO appointments. The results mirror those reported in columns 1–3. In each specification the combined health variable retains a coefficient that is close to the mean of its subcomponents. The combined health variable less noisily associates with the likelihood of appointment than its subcomponents, commanding *t*-

Table 4

Health and CEO appointments.This table reports results on a survival analysis that explains the number of years it takes an individual to become a CEO. Health is measured using the predicted number of days of sick leave, defined in Table 3 Panel B, in the year prior to observing the dependent variable. Health is further divided into mental and physical health conditions following the categorization of the diagnoses in Table 3 Panel A. The table reports a duration regression based on counting the years it takes an individual to become a CEO, estimated using the Cox proportional hazards model and assuming censoring after the last sample year. The sample follows each individual in the sample defined in Table 2 up to the year in which they are first appointed as CEO over the 2007–15 observation period. All specifications include age (at the accuracy of one year) and year indicators; specifications 1 and 4 also include an indicator for gender. Specifications 2, 3, 5, and 6 report on a subsample of males for whom we have data on early-life traits from the military enlistment (see Table 2 for definitions). These early-life traits, and level of education, are added as controls in specifications 3 and 6. The unit of observation is an individual in a year. The table reports the coefficients of the duration model and the *t*-values below coefficients assume clustering at the individual level.

Dependent variable	Years to CEO appointment					
Specification	Mental and physical health separately			Mental and physical health jointly		
	Full sample	Subsample with early-life traits		Full sample	Subsample with early-life traits	
	1	2	3	4	5	6
Mental health	−0.036	−0.024	−0.018			
	(-26.9)	(-15.0)	(-11.4)			
Physical health	−0.021	−0.013	−0.008			
	(-13.6)	(-7.4)	(-5.2)			
Mental and physical health				−0.030	−0.019	−0.013
				(–32.0)	(-17.9)	(-13.1)
High school degree			−0.010			−0.011
			(-0.3)			(-0.3)
Vocational degree			0.243			0.242
			(6.1)			(6.1)
University degree			0.352			0.351
			(9.0)			(8.9)
Cognitive ability			0.194			0.194
			(20.0)			(20.0)
Non-cognitive ability			0.522			0.522
			(52.6)			(52.7)
Height			0.087			0.087
			(10.5)			(10.6)
Physical fitness			0.013			0.013
			(1.5)			(1.4)
Muscle strength			0.039			0.039
			(4.1)			(4.1)
Body mass index			−0.026			−0.025
			(-2.8)			(-2.6)
Mean dependent variable	5.01	4.97	4.97	5.01	4.97	4.97
Number of observations	30,130,805	10,621,616	10,621,616	30,130,805	10,621,616	10,621,616
Number of distinct individuals	3,511,671	1,202,997	1,202,997	3,511,671	1,202,997	1,202,997

values that range from –32.0 in column 1 to –13.1 in column 3 which all indicate meaningful significance. All in all, these results suggest health and in particular mental health is an important predictor of CEO appointments and this relation is difficult to capture with early-life correlates of CEO appointments.

Do promotions and retirement affect CEO health?

The second mechanism that can contribute to the CEO health advantage we document in Table 3 involves the potential causal effect of the CEO job on health. Insufficient screening along the health dimension would result in promotions of executives that struggle with the demands of the CEO job. All else equal, such demands would make an executive promoted to a CEO position more likely to experience health problems (e.g., Schnall, Landsbergis, & Baker, 1994). However, the CEO job is also associated with higher income, higher social standing, and better job control, which can contribute to more robust health (e.g., Karasek, 1979; Marmot et al., 1991; Marmot, Bosma, Hemingway, Brunner, & Stansfeld, 1997). To study these effects, we apply a difference-in-differences framework, where we compare the health of appointed CEOs to that of their peers before and after the appointment. Difference-in-differences strategies study sets of group means in cases when certain groups are exposed to the causing variable of interest (here, appointment to CEO position) and others are not (Angrist & Alan, 1999). To accurately measure the peer group and to control for the work environment, we focus on CEO appointments in which we can identify the most likely contenders for the CEO position. Here, we define this group as the four highest paid executives in the same firm in the year prior to the turnover and the person appointed to the position in case of external appointment. (If there are only two or three individuals in the firm with an executive status, we take the actual number of executives.) Our analysis regresses the health index of each job contender on CEO appointment indicator, an indicator for the period after appointment, and their interaction. Our regressions also control for age, gender, and year, and we include fixed effects for each CEO turnover event. These fixed effects identify the effect of becoming a CEO from within-firm variation and thus keep the firm's working environment and the demands on all of its most important executives constant. We find similar results from regressions that remove these fixed effects in Panel A of Table IA8.

Table 5 reports the results of the analysis. We run six regressions across two dimensions: the length of the post-appointment period (two or four years) and the components of the health index (mental, physical, or both). The analysis produces two kinds of results. First, individuals appointed to the CEO position have similar health as their peers. All the health index differences between the CEO and her peers are insignificant at conventional levels. Second, and more importantly, the health of the individuals who are appointed to the CEO position develops similarly to that of their peers. The interaction term is insignificant at conventional levels for all health components, regard-

Table 5
CEO health before and after appointment. This table reports results of an event study that estimates the impact of becoming a CEO on health. The dependent variable is predicted days of sick leave, defined in Table 3. The independent variables are indicators for years around a CEO turnover event interacted with indicators for an executive appointed to a CEO position. The sample includes the four highest paid executives in the firm in the year prior to the CEO turnover and the person appointed as the CEO in case of an external appointment. We further require that none of these people have been in a CEO position prior to the turnover event. Specifications 1–3 (4–6) include events in which the executives can be followed for two years prior and two (four) years after CEO turnover. All regressions include year, age (at the accuracy of one year), and gender indicators, and fixed effects for each CEO turnover event. The unit of observation is an individual in a year and the *t*-values below coefficients assume clustering at the level of the CEO turnover event. The unit of reporting is days.

Dependent variable	Predicted sick leave, days					
Follow-up period	Two years			Four years		
Specification	Mental health	Physical health	Both	Mental health	Physical health	Both
	1	2	3	4	5	6
After appointment	0.02	0.08	0.11	0.01	0.05	0.05
	(0.3)	(1.0)	(0.8)	(0.1)	(0.5)	(0.4)
Appointed to CEO	−0.06	−0.04	−0.09	−0.09	0.08	−0.01
	(-0.3)	(-0.3)	(-0.4)	(-0.5)	(0.5)	(0.0)
Appointed to CEO × After appointment	0.02	−0.07	−0.05	0.12	−0.09	0.02
	(0.3)	(-0.7)	(-0.4)	(1.2)	(-0.8)	(0.1)
Controls						
Age	Yes	Yes	Yes	Yes	Yes	Yes
Gender	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Turnover event FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean dependent variable	1.28	1.86	3.14	1.31	1.96	3.27
Adjusted R^2	0.150	0.114	0.143	0.163	0.107	0.140
Number of observations	66,210	66,210	66,210	60,416	60,416	60,416
Number of distinct individuals	11,916	11,916	11,916	8,064	8,064	8,064

less of the length of the period in which we measure the health post appointment. The 95 % confidence intervals of the largest health index estimates (for mental health index, in the fourth specification, (−0.07, 0.30); for physical health index, in the fifth specification, (−0.33, 0.14)) allow us to reject effects larger than 3 % of one standard deviation in the mental or physical health index (the standard deviations are 10.4 and 9.2 days, respectively). These results suggest the CEO position has no discernible impact on the health of its holder.

Panel B in Table IA8 confirms we successfully identify events in which an individual becomes a CEO. Replacing the health indices with logged income, it shows the individual appointed to CEO enjoys 10 %–12 % higher pay after the appointment compared to the mean pay in our sample. Figure IA1 plots the raw health indices used in the regressions in Table 5 as a function of event time. Panels A and B show there are no discernible differences in the pre-trends in health prior to the CEO appointment. These figures also corroborate the regression results by showing no clear differences in the development of health of the two groups of individuals.

The job demands-resources model (see, e.g., Bakker & Demerouti, 2007) suggests strain is a response to imbalance between demands on the individual and the resources she has to deal with those demands. Motivated by this model, we study whether the health effect of CEO promotion differs as a function of job demands and available resources. CEOs of larger-size firms plausibly have more responsibility and larger demands than those of small firms. At the same time, they can also be expected to have more organizational and personal resources at their disposal to meet the demands. It is ex ante not obvious whether the additional resources are sufficient to offset the additional demands.

Table IA9 replicates the results of Table 5 for the small- and larger-firm subsamples. The results suggest that for three of the six follow-up period - health index pairings the health of appointed larger-firm CEOs develops less well relative to their peers than the health for small-firm CEOs, while in the remaining three the opposite happens. The difference in the health interaction coefficients is not statistically significant at conventional levels in any of the pairings.

To get a more complete picture of the effect of CEO job on health, we complete our analysis by studying how transitioning out of a leadership position affects CEO health. While this change likely removes much of the pressure CEOs need to be able to sustain to succeed in their jobs, it may also involve a change in their social status, social contacts, time structure, and sense of purpose (Barling & Cloutier, 2017). To better understand the net effect of these forces, Table 6 analyzes what happens to CEOs' health after they leave the CEO position compared with other members of the work force. To minimize the effect of health-related retirements on our analysis, we focus on changes in health around the time when individuals typically retire. More specifically, we narrow our sample to 681,000 individuals (of whom 2,600 are CEOs) who are born in 1942–48. This retirement sample does not overlap with the core sample analyzed in the earlier tables, which consists of cohorts born in 1951–78.

Table 6 Panel A reports on descriptive statistics on the individuals in the retirement sample at the age of 64, i.e. two years before the median retirement age of 66. 92 % of the retiring CEOs are men, and they earn on average about four times as much as retiring non-CEOs do. Panel B reports on difference-in-differences regressions that explain predicted days of sick leave with an indicator for CEOs.[13] This indicator is interacted with a dummy variable for the years after the median retirement age of 66. All regressions additionally include year and gender indicators; the construction of the sample around the age of 66 requires the removal of age indicators.

Consistent with Table 3, the main effects for the CEO indicator are negative and statistically highly significant with *t*-values ranging from –5.4 to –9.9. This suggests that retiring CEOs have on average better health than the average member of the work force. The post-retirement dummy is positive and highly significant, indicating the worsening of health over time. The variable of our primary interest, the interaction between CEOs and post-retirement, takes a positive coefficient for the physical health index, while the sign for the mental

[13] We use predicted (not: actual) sick leave as an indicator of health throughout the paper. Thus, our estimation of an individual's health status does not hinge on whether she actually takes (or even can take) a sick leave.

Table 6
CEO health before and after retirement. This table reports on health before and after retirement, both for CEOs and non-CEOs. The sample consists of individuals who are born in 1942–48. These individuals do not belong to the core sample in Tables 1–4 because they are born before the earliest year an individual can enter the core sample. Panel A reports on descriptive statistics on these individuals. Panel B reports on regressions that explain predicted days of sick leave, defined in Table 3, with an indicator for CEOs. This indicator is interacted with a dummy variable for the years after the median retirement age of 66. All regressions include year and gender indicators (the construction of the sample around the age of 66 requires the removal of age indicators). The unit of observation is an individual in a year, the *t*-values below coefficients assume clustering at the individual level, and the unit of reporting is days.

Panel A: Descriptive statistics on retirement sample

	Non-CEO	CEO
Age, years	64.0	64.0
Female, %	50.6	8.1
Level of education, %		
Basic	29.6	18.1
High school	43.1	42.9
Vocational	6.3	10.5
University	21.1	28.4
Income, SEK thousand	301	1,145
Number of distinct individuals	678,633	2,626

Panel B: Effect of retirement on health

Dependent variable	Predicted sick leave, days					
Follow-up period	Two years			Four years		
Specification	Mental health	Physical health	Both	Mental health	Physical health	Both
	1	2	3	4	5	6
After retirement	0.18	1.69	1.87	0.10	1.27	1.37
	(12.1)	(69.8)	(59.3)	(4.3)	(35.0)	(28.3)
CEO	−1.07	−1.16	−2.23	−0.99	−1.17	−2.16
	(-9.9)	(-5.4)	(-8.7)	(-7.5)	(-4.6)	(-7.1)
CEO × After retirement	0.03	0.26	0.29	−0.11	0.29	0.17
	(0.3)	(1.0)	(1.0)	(-1.1)	(1.1)	(0.6)
Controls						
Gender	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Mean dependent variable	4.19	8.88	13.08	4.21	9.30	13.51
Adjusted R^2	0.015	0.005	0.005	0.017	0.009	0.009
Number of observations	3,405,218	3,405,218	3,405,218	3,021,683	3,021,683	3,021,683
Number of distinct individuals	681,259	681,259	681,259	431,823	431,823	431,823

health index depends on the specification. These results and the results for the overall health index are not statistically significant at conventional levels. These results suggest that the health of individuals who retire from the CEO position develops similarly after retirement as that of the average member of the work force.

Table IA10 takes another look of the job demands-resources model, studying it using data on retiring CEOs. Following the example of Table IA9, we divide the retiring-CEO firms into two groups, small and larger-size firms. We then replicate the analysis of Table 6 Panel B separately for these two subsamples.

Our results suggest that for all of the six follow-up period - health index pairings, the health of retiring larger-firm CEOs develops better relative to the population than the health of small-firm CEOs. The difference is again not statistically significant at conventional levels in any of the pairings. With this caveat in mind, put together, the results of Table IA9 and Table IA10 are consistent with the following story. The demands of appointed larger-firm CEOs increase roughly in pace with the resources compared with small-firm CEOs. When these demands lessen due to retirement, larger-firm CEOs' health develops more favorably due to their larger (plausibly personal) resources.

Panels C and D in Figure IA1 show health of CEOs and other individuals develop in similar ways prior to retirement. These figures also confirm the notion CEOs are in better health prior to retirement. This health advantage also survives in the years after retirement.

Overall, our results suggest CEOs' health advantage survives well into retirement when they are unlikely to retain better access to healthcare due to their work. Maintaining a health advantage in the universal healthcare setting in Sweden makes ours a more informative gauge of the post-retirement health of CEOs in comparison of that in countries where healthcare is not universal.

Does health predict CEO turnover?

The third and final mechanism contributing to the CEO-population health difference involves the firms' response to the incumbent CEO's health problems. We gauge this response by testing whether CEOs leave the company sooner when facing health problems. Our analysis benefits from the fact that each individual appearing in the sample has been selected to run a firm, which makes the individuals more homogenous in terms of potential non-health-related correlates of health. Our analysis is predictive in nature, so it does not allow us to make causal claims.

Table 7 Panel A reports results from a survival analysis that explains the number of years it takes a CEO to leave her current company with her health index and control variables in the previous year. Like in Table 4, and consistent with Campbell, Gallmeyer, Johnson, Rutherford, and Stanley (2011) and Jenter and Kanaan (2015), we estimate a Cox proportional hazards model that assumes right-censoring after the last sample year. Here, we count CEO tenure from the start of the CEO spell; when data on the start of the spell is missing, we assume left-censoring before 1990. (The results do not change if we exclude CEOs with start dates prior to 1990.) Our main variable of interest is the health index, which we decompose into mental and physical health components. The firm-level control variables include firm size, sales growth, operating return on assets, indicators for firms managed or owned by at least two members of the same family, listed

Table 7

CEO health and turnover. Panel A reports results on a survival analysis that explains the number of years it takes for a CEO to leave her current company. The dependent variable is the CEO tenure and it is measured from the year 1990 onwards. The table estimates a Cox proportional hazards model assuming censoring after the last sample year. The mental and physical health indices, lagged by one year, are calculated separately based on the diagnoses listed in Table 3. The unit of observation is a year of a CEO's spell at a firm. Panel B repeats the analysis of Panel A for CEOs appointed after 2006, regressing the number of years to turnover on mental and physical health at the time of appointment. The firm characteristics, lagged by one year, are logged total assets (measured in SEK), operating return on assets, sales growth calculated as relative change from last year, an indicator for firms either managed or owned by at least two members of the same family, and indicators for listed companies and firms fully owned by the national, regional, or local government. OROA and sales growth are winsorized at the 5th and 95th percentiles. All regressions include age (at the accuracy of one year), year, and gender indicators, and indicators for industry based on two-digit SNI codes. The two rightmost specifications additionally control for early-life traits and the level of education, defined in Table 2. The *t*-values below coefficients assume clustering at the CEO level. Coefficients for mental and physical health are multiplied by one hundred whereas the other coefficients enter the table in their natural unit.

Panel A: Contemporaneous health				
Dependent variable	Years to CEO turnover			
Sample	Full sample		Subsample with early-life traits	
Specification	1	2	3	4
Mental health	1.29	1.32	1.47	1.44
	(11.7)	(11.9)	(11.0)	(10.9)
Physical health	0.32	0.39	0.35	0.39
	(3.1)	(3.8)	(2.9)	(3.2)
Logged assets		0.20		0.17
		(45.0)		(31.3)
OROA		−1.28		−1.27
		(-34.3)		(-28.2)
Sales growth		−0.07		−0.06
		(-7.1)		(-5.9)
Family firm, family managed		−0.14		−0.13
		(-4.2)		(-3.5)
Family firm, not family managed		−1.23		−1.27
		(-19.6)		(-16.6)
Listed firm		−0.24		−0.30
		(-3.4)		(-3.7)
Government-owned firm		−0.34		−0.39
		(-7.2)		(-6.9)
Controls				
Age	Yes	Yes	Yes	Yes
Gender	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Early-life traits and education	No	No	Yes	Yes
Mean dependent variable	7.40	7.40	7.68	7.68
Number of observations	183,428	183,428	132,659	132,659
Number of distinct individuals	39,539	39,539	27,836	27,836

Panel B: Health at appointment				
Dependent variable	Years to CEO turnover			
Sample	Full sample		Subsample with early-life traits	
Specification	1	2	3	4
Mental health at appointment	0.76	0.84	1.00	1.01
	(3.4)	(4.0)	(3.7)	(4.0)
Physical health at appointment	0.12	0.22	0.40	0.47
	(0.6)	(1.1)	(1.8)	(2.1)
Logged assets		0.13		0.11
		(20.9)		(14.0)
OROA		−1.18		−1.14
		(−22.8)		(-17.6)
Sales growth		0.00		0.02
		(0.3)		(1.3)
Family firm, family managed		−0.22		−0.23
		(-4.8)		(-4.1)
Family firm, not family managed		−1.23		−1.16
		(-10.3)		(-8.1)
Listed firm		−0.04		−0.10
		(-0.5)		(-1.1)
Government-owned firm		−0.32		−0.44
		(-5.0)		(-5.3)
Controls				
Age	Yes	Yes	Yes	Yes
Gender	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Early-life traits and education	No	No	Yes	Yes
Mean dependent variable	2.74	2.74	2.77	2.77

Table 7 (*continued*)

Panel B: Health at appointment				
Dependent variable	Years to CEO turnover			
Sample	Full sample		Subsample with early-life traits	
Specification	1	2	3	4
Number of observations	58,481	58,481	40,914	40,914
Number of distinct individuals	18,408	18,408	12,715	12,715

and government held firms, and industry. All regressions include tenure and year, age (at the accuracy of one year), and gender indicators. The two rightmost columns additionally control for early-life traits and the level of education by focusing on the subsample for which we have data from the military enlistment. These richer specifications allow us to mitigate omitted variable concerns. Table IA11 reports a correlation table on the variables employed in the turnover analysis.

We find that CEO's health is highly significantly associated with the time it takes for her to leave the company. This association is similar with and without controls, which is consistent with potentially omitted variables having a limited effect on our results. The mental health component retains a larger coefficient in all specifications, and the difference between the mental and physical health components is statistically significant (all the *p*-values are $< 10^{-8}$).

The results are also economically significant. In column 2, for example, a one standard deviation change in mental health is associated with a 7.3 % greater turnover hazard ($t = 11.9$), and a one standard deviation change in physical health is associated with a 2.8 % increase in turnover hazard ($t = 3.8$). Combined, their association with CEO turnover hazard is almost one-half of that of the operating return on assets (−21.4 %), a strong predictor of turnover (e.g., Denis & Denis, 1995). The strength of the turnover-health relation is similar in all four specifications. All in all, these results are consistent with Bennedsen, Pérez-González, and Wolfenzon (2020) and suggestive of firms or CEOs themselves responding to CEO health problems.

How do firms respond to mismatches that occur at the time of appointment? Table 7 Panel B studies this question by regressing the time from appointment to leaving the company on the health index at the time of appointment. To the extent that firms' tastes for CEO health do not vary in a significant way, the health index can be thought of representing mismatch between the CEO and the firm, perhaps because the board did not notice the CEO's true state of health at the time of appointment. The sample is much smaller than that in Table 7 Panel A, because CEO health at appointment is not available prior to 2006. Otherwise, the structure of the test is identical to that of Panel A.

We find that mental health at appointment significantly predicts CEO turnover. In column 2, for example, a one standard deviation change in mental health at appointment is associated with a 4.6 % greater turnover hazard ($t = 4.0$). The results are even stronger in the subsample controlling for early-life traits. In column 4, a one standard deviation change in mental health at appointment is associated with a 5.2 % greater turnover hazard ($t = 4.0$), whereas a one standard deviation change in physical health is associated with 3.0 % greater turnover hazard ($t = 2.1$). The mental health component retains a larger coefficient in all specifications, and the difference between the mental and physical health components is statistically significant at the 5 % level in the first two columns.

Does CEO health predict firm performance?

Our evidence so far shows health is associated with entering and leaving the CEO position. Is it also related to firm performance, as suggested by Bennedsen et al. (2020)? We assess this possibility by studying the association between past CEO health and corporate performance. The analyses we conduct are correlational and not causal in nature. In line with previous literature (e.g., Bertrand & Schoar, 2003, and Bennedsen et al., 2020), we measure corporate performance by the operating return on assets (OROA).

Table 8 reports regressions that explain firm performance in a year with its CEO's health index and control variables in the previous year. The first column only includes year, age (at the accuracy of one year), and gender indicators as controls. Column 2 introduces firm and CEO effects (and drops the gender indicator) to control for any omitted firm or CEO related variables that are invariant in time. Columns 3–5 additionally control for firm related variables that change in time. These variables include firm size and indicators for firms managed or owned by at least two members of the same family, listed firms, and government held firms.

Consistent with Bennedsen et al. (2020), we find a negative association between the health indices and OROA. Column 1 reports deterioration of the mental (physical) health index by one standard deviation is associated with a 0.46 % (0.08 %) decrease in OROA. Given that the average OROA is 8.11 %, these figures translate into a performance reduction of 6 % (1 %) relative to the mean. The coefficient for OROA is statistically significant for mental health ($t = -2.3$) but not for physical health ($t = -0.9$). These results are in line with our earlier results on the relative strength of the mental and physical health components.

Adding firm and CEO fixed effects in Column 2 does not substantially alter the mental health coefficient estimate or its statistical significance (it remains significant at the 5 % level); the physical health estimate switches sign but remains close to zero. Adding time varying firm related variables in Column 3 has likewise very little effect on the results. Collectively, these results are consistent with omitted variables likely having a limited effect on our results. For example, if mental health were to pick up something peculiar about a person's personality, this peculiar feature would need to covary in time together with mental health. Our health measures are lagged by one year, which also makes a reverse causality explanation to our results less plausible.

Columns 4 and 5 divide the sample into two based on firm size: companies with < 100 million SEK of total assets, and those with more. Consistent with the upper echelons theory (Hambrick & Mason, 1984), the coefficients are larger for small than for larger firms: for mental health, for example, the performance effects corresponding to a one standard deviation deterioration in the health index are –0.49 % ($t = -2.0$) and –0.31 % ($t = -0.9$), respectively. The difference between the corresponding regression coefficients ($t = -0.4$) is not significant at conventional levels, an indication that the firm size-health-performance relationship has a low signal-to-noise ratio, i.e. the small- and larger-firm coefficients have relatively modest differences and relatively large standard errors. Table IA12 corroborates this finding by showing that the pairwise correlations between the health indices and OROA are < 0.01 in absolute value, i.e. considerably lower than the corresponding correlations between the health indices and CEO turnover which range from 0.02 to 0.06 in Table IA11 Panel A and B.

What is the economic significance of these performance findings? The statistically significant results apply only to the mental health of

Table 8

CEO health and firm performance. This table reports regressions that explain firm performance in a year with the firm's CEO's predicted sick leave and control variables in the previous year. The firm characteristics are logged total assets (measured in SEK), an indicator for firms either managed or owned by at least two members of the same family, and indicators for listed companies and firms fully owned by the national, regional, or local government. The operating return on assets, OROA, is winsorized at the 5th and 95th percentiles. Specifications 1–3 include all firms whereas the remaining two specifications use a 100-million-cutoff for total assets to split the sample. All regressions include year and age indicators (at the accuracy of one year). Specifications 2–5 add fixed effects for CEOs and firms. The unit of observation is a CEO-firm in a year and the *t*-values below coefficients assume clustering at the CEO level. The number of distinct individuals in the two subsamples exceeds the number of distinct individuals in the full sample, because the same person can belong to both subsamples. The coefficients, mean dependent variable, and change per one standard deviation in health are multiplied by one hundred.

Dependent variable	OROA				
	All firms			Firms by size	
				Total assets < 100 million	Total assets ≥ 100 million
Specification	1	2	3	4	5
Mental health	−0.028	−0.027	−0.029	−0.029	−0.019
	(-2.3)	(-2.0)	(-2.1)	(-2.0)	(-0.9)
Physical health	−0.010	0.002	0.002	0.002	0.0004
	(-0.9)	(0.2)	(0.2)	(0.2)	(0.02)
Logged assets			−3.485	−3.868	−0.972
			(-13.1)	(-13.1)	(-1.8)
Family firm, not family managed			0.608	0.658	0.237
			(1.8)	(1.7)	(0.6)
Family firm, family managed			0.041	0.035	1.532
			(0.1)	(0.1)	(1.4)
Listed firm			−1.254	0.081	−1.517
			(-0.5)	(0.02)	(-1.24)
Government-owned firm			0.363	1.526	−2.567
			(0.2)	(0.7)	(-2.1)
Controls					
Age	Yes	Yes	Yes	Yes	Yes
Gender	Yes	No	No	No	No
Year	Yes	Yes	Yes	Yes	Yes
Firm FE	No	Yes	Yes	Yes	Yes
CEO FE	No	Yes	Yes	Yes	Yes
Change per sd in mental health	−0.46	−0.45	−0.47	−0.49	−0.31
Change per sd in physical health	−0.08	0.02	0.02	0.02	0.003
Mean dependent variable	8.11	8.11	8.11	8.44	5.25
Adjusted R^2	0.003	0.441	0.445	0.437	0.697
Number of observations	183,428	183,428	183,428	164,573	18,855
Number of distinct individuals	39,539	39,539	39,539	35,632	5,695

small-firm CEOs. For the average small firm, a one standard deviation change in the mental health index predicts an operating performance change of –0.49 % × SEK 16 million = SEK –78,000, which corresponds to one month's CEO pay (78,000 / 858,000 * 12 = 1.09). We consider this outcome neither trivial nor dramatic; the fact that physical health issues are more common among CEOs than mental health issues, and that the physical health index is not statistically significantly associated with performance, suggests it is not possible to detect a discernable health-performance effect for the typical firm.

Discussion

Contribution and relation to existing literature

We study the health of CEOs by using a unique combination of data on specialized care, hospitalizations, drug prescriptions, and labor market outcomes of 28 cohorts in Sweden. We find health predicts appointment to a CEO position, even when early-life physical condition, traits, and education are controlled for. Healthier CEOs also run larger corporations and are significantly less likely to leave their position. Despite of the challenges associated with the job, the health of the individuals selected to the CEO job develops similarly as that of their peers. The same applies to CEOs who retire. Health and in particular mental health are significantly associated with turnover, and for smaller firms also with firm performance.

Our paper relates and contributes to four strands of literature. First, it relates to the literature of leader traits (Judge, Piccolo, & Kosalka, 2009) and leader selection. Leaders can either be born (Plato, 2008; Carlyle, 1841; Johnson et al., 1998; Arvey, Rotundo, Johnson, Zhang, & McGue, 2006), or they can be "made", i.e., grow to their roles through experience (e.g., Keloharju, Knüpfer, & Tåg, 2022). Evolutionary approaches to leadership investigate how evolution has selected individuals with certain traits to lead (van Vugt & Grabo, 2015; van Vugt, Hogan, & Kaiser, 2008). Such perspectives can potentially explain, for example, why a leader's appearance is so important to voters (Todorov, Mandisodza, Goren, & Hall, 2005; Antonakis & Dalgas, 2009). While there appear to be fitness benefits from occupying a leadership position (von Rueden, Michael, & Hillard, 2011), empirical evidence on such benefits is sparse (Spisak, 2020). Our paper provides causal evidence on the effect of occupying leadership position on health. Moreover, our results on the association between health and CEO selection hint that the correlation between leadership and facial appearance in the literature may in part be driven by the appearance benefits of good health (e.g., Henderson, Holzleitner, Talamas, & Perrett, 2016).

Second, our paper is related to the literature on executive traits, a subset of the literature of leader traits. The upper echelons theory (Hambrick & Mason, 1984) suggests executives inject a great deal of themselves into their behaviors, making firm outcomes in part predictable from managerial backgrounds. Hambrick and Finkelstein (1987) theorize that executives' ability to affect important organizational outcomes is likewise a function of managerial characteristics (along with other important factors like the task environment). Bertrand and Schoar (2003), Kaplan, Klebanov, and Sorensen (2012), Gow, Steven, David, and Anastasia (2016), and Kaplan and

Sorensen (2021) study the characteristics of CEO candidates and CEOs and their association with corporate performance and policies. Green, Jame, and Lock (2019) find extroverted CEOs to have better career outcomes. Stoker, Garretsen, and Spreeuwers (2016) find CEOs' facial appearance differs from that of the population and professors of the same gender and race; CEO appearance does not predict firm performance, however. Adams et al. (2018) find cognitive ability, noncognitive ability, and height to be associated with the likelihood to become a CEO, assignment of the executive to a larger company, and corporate policies. We expand this literature by showing health is an important trait that makes CEOs different and affects their climb in the corporate ladder.

Third, the paper relates to a small but growing literature on executive health. Holland and Lel (2017) find publicly known CEO health shocks to have a negative effect on firm value, while Limbach and Sonnenburg (2015) find good CEO physical condition, as witnessed by finishing a marathon, to be positively associated with firm value. Borgschulte, Marius, Canyao, and Ulrike (2021) find that CEOs who serve under stricter corporate governance regimes face poorer long-term health outcomes, reflected in an earlier age of death. Outside of the business executive domain, a large literature finds socioeconomic status to be positively associated with health (e.g., Marmot et al., 1991; Kivimäki et al., 2020). Olenski, Abola, and Jena (2015) and Borgschulte and Vogler (2019) compare the mortality of elected political leaders to that of their runners-up.

The study closest to ours is by Bennedsen et al. (2020) who merge register data on hospitalizations with firm data and find CEO hospitalizations to be associated with lower firm performance and investment. Our study differs from theirs in the research questions addressed, in its greater focus on mental health, and more comprehensive assessment of health using drug prescriptions and specialized care. Although the hospitalizations studied in Bennedsen et al. allow analyzing the impact of severe health shocks, they do not lend themselves to characterizing CEO health in general. The wide spectrum of health issues captured by our measures, and the comprehensive data on the population, makes it possible to compare CEOs to the population and its interesting subgroups, and to understand the drivers of these differences. For the first time in the literature, we analyze the selection of individuals in the CEO position based on health, investigate how CEO health develops around promotions and retirement, study how a comprehensive assessment of CEO health at appointment and during tenure is associated with turnover, and how firm performance associates with CEO health issues that do not necessarily lead to hospitalizations.

These analyses reveal most CEOs do not experience severe health problems resulting in hospitalizations. Yet, CEO health issues that do not involve a hospitalization may be quite important: for example, our results are the strongest for mental conditions, which rarely require inpatient care. Taking this wider perspective suggests the aggregate value losses resulting from CEOs' health problems may not be as large as one could perhaps extrapolate from previous work.

Fourth and finally, our paper is related to a vast literature linking long-term stress to various medical conditions, and medical conditions to work performance. Cohen, Janicki-Deverts, and Miller (2007), Thoits (2010), Cesarini, Lindqvist, Östling, and Wallace (2016) and Persson and Rossin-Slater (2018) review the literature on the link between long-term stress and medical conditions. Ford, Cerasoli, Higgins, and Decesare (2011) report the results of a meta analysis on the strength of the link between various medical conditions and work performance; Garcia-Gomez, Ernst, and Stefan (2020) offer a more recent review of the literature from the finance perspective. Given the challenging nature of CEOs' work (Hambrick, Finkelstein, & Mooney, 2005), health could matter more to their productivity than to the productivity of rank-and-file employees.

Implications, limitations, and future research avenues

Our results have the following implications. First, the generally good CEO health and the lack of a discernible effect of CEO promotions and retirement on health suggest the anecdotes on the health crises of individual CEOs (some of which are listed in the first paragraph of the paper) likely are just anecdotes. Thus, there does not appear to be a widespread "CEO health crisis". Second, the association between CEO health and turnover is strong, even when we account for publicly observable performance signals. Despite this relation, CEO health appears to matter for firm performance, at least in smaller firms. These companies may benefit from improvements in corporate wellness plans (Grobart, 2017), and the oft-neglected succession and contingency plans that assign emergency backups for the CEO (Bennedsen et al., 2020; Cheng, 2020).

Relying on broad health indicators allows us to effectively summarize CEO health, its predictors, and associated outcomes. However, this approach comes with a price: we necessarily rely on associations rather than causal relations in most analyses. When our setting does not lend itself to a causal interpretation, we attempt to mitigate problems associated with endogeneity and omitted variables with three different ways: (1) by employing a rich set of covariates, including CEO and firm fixed effects (for the CEO subsample) and early-life predictors (for the population), (2) by estimating our results with alternative specifications which employ both a rich and a scaled-down set of controls, and ascertaining the coefficients of interest do not change much between these specifications, and (3) by using lagged variables.

We admit these fixes are not perfect. Future analyses on CEO health may wish to establish causality by resorting to natural experiment designs (Sieweke & Santoni, 2020) that utilize, e.g., asymmetric, exogenous shocks to different industries. Such shocks could affect demands for CEOs and, indirectly, for their health. Another way to establish causality would be to study the effects of unexpected health shocks to CEOs themselves. Given our evidence on the strong association between mental health and CEO outcomes, exogenous shocks to mental health (such as depression triggered by an unexpected loss of a loved one, Kristensen, Weisæth, & Heir, 2012) would be particularly interesting to study. Because well-defined unexpected health shocks are relatively rare, such analyses would likely need a large sample to reject the null hypothesis of no effect.

Another interesting future research avenue relates to the corporate governance mechanisms associated with CEO health. Borgschulte et al. (2021) find that CEOs who serve under stricter corporate governance regimes face poorer long-term health outcomes. Currently, we do not know enough of the inner workings of firms to take a stand on the mechanisms linking health to CEO appointments, turnover, and performance. These mechanisms could plausibly be different, e.g., for firms representing different governance structures, for family and non-family firms, and for firms representing different levels of CEO ownership. To the extent boards (rather than owner-managers) have a decisive role in firm decision making, it is also not clear whether they view physical and mental conditions in the same way or whether mental conditions carry a stigma that makes CEOs suffering from them particularly vulnerable to board action. The fact that CEO outcomes are more strongly associated with mental health than physical health is consistent with a stigma explanation, but more research is needed to understand the stronger association of mental health with CEO and firm outcomes.

Data availability

The authors do not have permission to share data.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix 1. Institutional details on health care in Sweden

In Sweden, all residents are entitled to publicly funded, affordable health care. County councils are the major financiers and providers of health care. Patient fees only account for about 3 percent of the total revenues; for example, the daily fee for staying at a public hospital is about USD 15 (Grönqvist, Johansson, & Niknami, 2012). Supplemental private health insurance is available, but uncommon. Almost all hospitals are public hospitals (Nilsson & Paul, 2018).

When a patient wishes to visit a health care provider due to a new health problem, she first calls her local health care center. An appointment cannot be made by the patient alone; rather, the nurse answering the phone acts as a gatekeeper and provides advice when needed. The gatekeeper is only able to make an appointment with the local health care center. If the patient needs to see a specialist, she will need to visit a general practitioner at the local health care center and obtain a referral (Nilsson & Paul, 2018). Likewise, the place of residence largely determines the hospital the patient will be admitted to when in need of health care (Avdic, 2016).

Appendix 2. Calculating the health index

Because most of our medical data come from prescriptions, we choose the Rx-Risk comorbidity index to gauge health. This index, used before e.g. in Fishman et al. (2003) and Katon et al. (2009), has been designed to use prescription data. It captures a wide array of conditions that are chronic in nature. It takes into account the fact that many conditions co-occur in a given patient, pooling various conditions into broader categories. Each comorbidity category is dichotomous—it is either present or it is not.

Table IA2 reports the mapping of the Rx-Risk comorbidity categories to ATC data. The mapping follows Quinzler et al. (2019) except when the codes in Quinzler et al. are at a finer level than in our ATC data. In these cases, we use a coarser ATC specification unless this results in an overlap between different comorbidity categories in the index, in which case we omit the codes in question. For four rare conditions (HIV, cystic fibrosis, transplant, and ESRD), the use of coarser ATC data generates an incidence rate that materially differs from that of the population in Sweden. We drop these conditions from the index, which leaves 22 constituents in the index. We further separate these conditions into four mental and 18 physical health diagnoses, which form the mental and physical health subindices.

Apart from prescriptions, we use diagnosis information embedded in the hospitalization data to assess health outcomes. We assign a condition to an individual in a year if she has that condition in that year either according to prescription or hospitalization data. To our knowledge, no direct translation of the Rx-Risk categories to ICD codes is available. We use the medical literature listed in Table IA2 for this translation. Table IA3 reports the annual incidence of diagnoses on each of the Rx-Risk categories for the population and for different high-skill professional groups.

We estimate the weights for the comorbidity categories for all individuals born in 1951–78 who are in the work force by regressing the number of days on sick leave in a year on lagged dummies for the comorbidity categories. Sick leave is a key health outcome, used e.g. in de Vroome et al. (2015) and Zhang, McLeod, and Koehoorn (2016). The convention of using a one-year lag in estimating a health index likewise is common in the medical literature (Gagne, Glynn, Avorn, Levin, & Schneeweiss, 2011, and Lemke, Weiner, & Clark, 2012).

We use the coefficients, listed in Table IA4, to generate predicted health index values for our research subjects. Our use of predicted values, in lieu of actual absences from work, circumvents challenges arising from potential occupational differences in sick leave. Thus, the weighing is immune to CEOs possibly being less likely to take sick leave than the population in general.

For each comorbidity category, the regression includes three mutually exclusive variables that indicate the diagnoses related to whether the category appears in prescription data only, specialized care data but not in hospitalization data, or in hospitalization data. In addition, consistent e.g. with Charlson, Pompei, Ales, and Ronald MacKenzie (1987) and Elixhauser, Claudia Steiner, Harris, and Coffey (1998), the regression includes controls for age (at the accuracy of one year) and gender. Almost all coefficients are positive and highly significant. The most important exception to this rule is hyperlipidemia, which takes a significantly negative coefficient in specialized care and prescriptions data. Pratt et al. (2018) also finds that hyperlipidemia retains a negative coefficient in an index regression similar to ours.

The *R*-squared of the model, 10.5 %, is in the same ballpark as that for similar models in the medical literature (see, e.g., Newhouse, Manning, Keeler, & Sloss, 1989 and Fishman et al., 2003). If we estimated the same regression using hospitalization data alone, the *R*-squared would be less than half of this, 4.1 %. Therefore, having access to more comprehensive health data allows us to gauge the health of the sample individuals much more precisely than would be possible using a narrower set of health indicators.

Appendix 3. Are health records of CEOs comparable to those of the population and other high-skill professionals?

The robust health we report for CEOs in Table 3 could be due to them avoiding the use of medical services altogether or in particular in their home country (see, for example, Babitsch, Daniela, & Thomas Von, 2012, for a review of the evidence on cross-sectional differences in health care use). To analyze whether our results are affected by CEOs' register aversion, we correlate measured health with mortality—an observable outcome intimately related to true health. For benchmarking purposes, we also analyze the register aversion of the other high-skill professionals we analyze in the paper.

We estimate a regression that explains mortality with the health index, CEO dummy, a dummy for other high-skill professionals, and the interaction between the health index and the high-skill professional dummies. If the health index mapped CEOs' health advantage to mortality perfectly, both the CEO main effect and the interaction effect would by construction be zero. Likewise, if CEOs were more likely than the population to refrain from using medical services due to privacy reasons, the health index would return a weaker association for CEOs compared to the population. This weaker correlation would also make the CEOs' mortality appear higher than that predicted by their health index. We test these hypotheses in Table IA7.

For each individual, the dependent variable counts the number of years until death over the 2007–15 period and the independent variables measure health in 2006. We estimate a Cox proportional hazards model that assumes censoring after the last sample year. This model is essentially a regression model and commonly used in medical and economic research for investigating the association between predictor variables and the survival time. We divide the sample into CEOs, other high-skill professionals, and the remainder of the population based on an individual holding a CEO or other high-skill professional position in 2006. The regression also includes age and gender indicators. In the first column mental and physical components enter separately, while in column 2 we use the combined health index.

Column 1 finds that both physical and mental health are highly significantly related to mortality (*t*-values 56 and 52, respectively). Column 2 finds that the combined health index variable retains a *t*-value of 97, making it even more significantly related to mortality than its subcomponents. The most relevant results relate to the coefficients of the CEO and other high-skill professional dummies and their interactions with the health index. Almost all interactions are positive, and two of them statistically significant at the 5 % level. In column 1, the interaction with physical health (0.010; $t = 2.5$) suggests that for high-skill professionals, the health index is 30 % more predictive of mortality than for the population at large. Column 2 documents a similar interaction between the pooled health index and CEO status. The CEOs' and high-skill professionals' stronger predictability of mortality translates into them recording a significantly lower mortality when judged against the prediction emanating from their health index ($t = –8.4$ and –11.6, respectively, in both specifications). With the possible exception of one pair of coefficients (with a *p*-value of 6 %) out of four, the coefficients signifying difference in register aversion between CEOs and other high-skill professionals are not significantly different from one another at conventional levels. In other words, CEOs and other high-skill professionals do not have significant differences in mortality that could not be explained by their health records.

These results speak against the hypothesis that CEOs would be more averse to record keeping than other high-skill professionals or the population. Instead, they are consistent with CEOs and other high-skill professionals having better access to medical care, being medically more literate, or being more prone to seek help when necessary. What all these scenarios have in common is that they make CEOs and other high-skill professionals more likely to enter health registers —and thus appear less healthy. Therefore, our results can be viewed as conservative representations of the true health of CEOs and other high-skill professionals.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.leaqua.2022.101672.

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