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Working hours and job satisfaction in China: A threshold analysis

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ABSTRACT

This study utilizes a threshold model to examine the nonlinear relationship between working hours and job satisfaction, using the open-access data of the 2018 China Family Panel Studies. We address the endogeneity of working hours utilizing an instrumental variable-based two-stage residual inclusion approach. The threshold model shows that the effects are indeed different. Working more than 9 h reduces workers' job satisfaction, and these reductions are even greater among those working more than 12 h. Heterogeneous analysis reveals that working long hours reduces the job satisfaction of female employees more than that of their male counterparts; the job satisfaction of unmarried individuals is unaffected by how long they work, whereas that of married workers declines when they work longer hours. Also, although the job satisfaction of wage-employed workers falls with an increase in the number of hours worked regardless of how long they work, that of self-employed workers falls only when they work more than 12 h. Poor physical health mediates the adverse effects of long working hours on job satisfaction. Finally, working long hours reduces individuals' short-run hedonic well-being but does not affect their perceptions and feelings towards various facets of life in the long run.

1. Introduction

According to the World Health Organization (WHO) and International Labor Organization (ILO), about 36.1% of the global workforce spends more than 48 h/week working (Messenger, 2018). In Europe, this number was 16% in 2015 (Eurofound, 2017). Overwork is endemic in many Asian countries (Yamashita, Bardo, & Liu, 2016). For example, Chinese Labor Law states that the statutory working time is 8 h/day, and the average working time is no more than 44 h/week. Some organizations, especially in the technology sector, expect employees to work from 9 am to 9 pm, six days per week (Dong, Wu, Ni, & Lu, 2021; ILO, 2018); there is a growing backlash against this draconian "996 working system". In Japan, the term *karoshi,* referring to overwork-related death, reflects Japan's culture that exalts overwork. Working long hours is a universal concern with far-reaching implications for society.

Extended working hours are associated with increased fatigue and less productivity (Allison et al., 2022; Collewet & Sauermann, 2017; Elliott et al., 2022; Okazaki et al., 2019). According to the WHO and ILO, long working hours ($\geq$55 h/week) led to more than 0.74 million deaths from stroke and ischemic heart disease in 2016, with a sharp increase of 29% since 2000 (Descatha et al., 2020; Li et al., 2020). The adverse physical health consequences of long working hours, such as headaches and weight gain, have been

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documented in countries like Japan and Australia (Ishikawa, 2022; Nagaya, Hibino, & Kondo, 2018; Virtanen et al., 2020). Excessively long working hours are also linked to adverse psychological health outcomes: stress, somnipathy, fatigue, dissatisfaction with jobs, and low happiness and enjoyment levels (Afonso, Fonseca, & Pires, 2017; Hoang & Knabe, 2021; Piovani & Aydiner-Avsar, 2021; Shin, Kim, Kim, & Kang, 2021). For example, Hoang and Knabe (2021) reported that the longer employees in the United Kingdom worked on a specific day, the less enjoyment they experienced.

Although previous studies have highlighted that long working hours are critical occupational hazards, most have considered a linear association between how long people work and their physical and psychological health (e.g., Afonso et al., 2017; Berniell & Bietenbeck, 2020; Hoang & Knabe, 2021). This view is simplistic and potentially misleading. Excessively long hours beyond specific thresholds may compromise physical and mental health (Chu, 2021), giving rise to a nonlinear association between the number of hours worked and job satisfaction (Dong et al., 2021; Rudolf, 2014).

A prerequisite for evaluating the impacts of working hours is distinguishing between *long* and *normal* working time. Previous studies have defined long working hours based on government regulations (Chu, 2021; Shin et al., 2021) or subjectively (Afonso et al., 2017; Chan, Au-Yeung, Wong, Chung, & Chung, 2021). These ad-hoc and a priori classifications of working time capture only the general linear or nonlinear trends; also, subjective definitions may lead to potential biases. In contrast, the threshold model uses a bootstrapping estimation procedure to identify specific threshold values, obviating the need to a priori characterize long or normal working time (Chiu & Yeh, 2017; Hansen, 2000).

Long working hours have contributed to China's rapid economic growth (Wang, 2020). How much people work affects their financial security, productivity, health, and well-being, and thus their quality of life; it affects the socioeconomic tapestry of nations. Yet, the empirical evidence on the psychological effects of long working hours in China remains sparse. Accordingly, the primary objective of this study is to analyze how the number of hours worked affects job satisfaction, which is integral to living a fulfilling life. Specifically, we ask the following questions: Does job satisfaction decrease progressively with increases in the number of hours worked? If yes, what are the specific thresholds, and how much does job satisfaction change once a threshold is crossed? Do respondents' sex, marital status, employment type, and sectors in which they work have heterogeneous effects on the potential nonlinear relationship? We answer these questions using the open-access 2018 China Family Panel Studies (CFPS) data. In doing so, we contribute to the literature in five important ways.

First, we analyze the nonlinear association between working hours and workers' job satisfaction. More specifically, our focus is on estimating thresholds of the number of hours worked that delineate different levels of job satisfaction. Second, we utilize the instrument-variable-based two-stage residual inclusion approach to address the endogeneity of working hours. Previous studies have revealed that how long one works is endogenous (Collewet & Sauermann, 2017; Cygan-Rehm & Wunder, 2018). Ignoring this endogeneity would generate biased results and misleading policy implications. Third, we investigate whether the nonlinear relationship between the number of hours worked and job satisfaction has heterogeneous effects on workers of different sex, marital status, having different employment types, and working in different sectors. Fourth, we conduct a mediation analysis to explore the potential mechanisms through which working hours affect job satisfaction. In particular, we consider physical health, sleep duration, and time allocated to leisure as mediators. Because individuals allocate their time to different activities, a mediation analysis would help improve our understanding of the nexus between working hours and job satisfaction. Last, we examine how working hours affect individuals' happiness and life satisfaction, two indicators of subjective well-being.

The rest of this paper is structured as follows. We review the relevant literature on long working hours in Section 2. Section 3 describes the methods and data. Section 4 presents and discusses the empirical results, and Section 5 concludes the paper and lays out policy implications.

2. Literature review

The labor laws in countries stipulate normal daily or weekly working time differently. For example, in July 2018, the Korean Labor Standards Act defined a statutory working week of 40 h and allowed 12 h of paid overtime on weekdays (Song & Lee, 2021). Based on this, Shin et al. (2021) classified two long-working-hour levels (52–60 h/week and $\geq$ 60 h/week) for Korea. Some studies have subjectively determined the threshold between a long and normal workweek (Afonso et al., 2017; Chan et al., 2021; Nakata, 2017). For example, Afonso et al. (2017) used a 48 h/week cut-off, whereas Chan et al. (2021) set the thresholds at 36, 60, and 72 h. Establishing thresholds allows researchers to study the associations between working long hours and workers' well-being. This area has been the focus of considerable research that can be broadly classified into three strands.

The first strand analyzes the effects of long working hours on physical health (Berniell & Bietenbeck, 2020; Chu, 2021; Li et al., 2020, 2021; Nagaya et al., 2018; Tucker, 2021; Virtanen et al., 2020; Virtanen & Kivimäki, 2018). For example, Virtanen and Kivimäki (2018) found that long working hours ($\geq$55 h/week) are associated with a 1.12-fold increased risk of coronary heart disease and a 1.21-fold increased risk of stroke. Using data collected from Japan, Nagaya et al. (2018) reported that long working hours lead to headaches by directly and indirectly reducing sleep duration. Virtanen et al. (2020) examined the association between long working hours ($\geq$55 h/week) and body mass index using data from Europe, the United States, and Australia. Their results suggested that long working hours increase the risk of being overweight. A meta-analysis conducted by Li et al. (2021) also found that individuals who worked long hours tended to be obese. On the whole, long working hours are associated with adverse health effects.

The second strand documents how overwork affects mental health (Afonso et al., 2017; Chan et al., 2021; Lee, Kim, Choi, Kim, & Kawachi, 2021; Liu, Wang, Wang, Ji, & Li, 2021; Lu & Chou, 2020; Otterbach, Charlwood, Fok, & Wooden, 2021; Piovani & Aydiner-Avsar, 2021). For example, Afonso et al. (2017) found that people working long hours ($\geq$48 h/week) have significantly more depressive and anxiety symptoms and worse sleep quality than those who do not work long hours. In their investigation of Australian

and German workers, Otterbach et al. (2021) showed that over-employed workers (those who work 50 h/week or more) tend to have worse mental health than those who do not overwork. A study conducted by Lee et al. (2021) revealed that working 52 h/week or more is associated with the highest risk of self-reported depressive and anxiety symptoms in Korea.

The third strand argues that the number of hours worked also determines subjective well-being: job satisfaction, happiness, and life satisfaction. Although evidence on the negative health effects of overwork abounds, whether and to what extent it affects subjective well-being is unclear; the findings are mixed (Bartoll & Ramos, 2020; Hoang & Knabe, 2021; Lee, 2021; Masood, Mugheer, Asma, & Muna, 2021; Rudolf, 2014; Shin et al., 2021; Valente & Berry, 2016; Yamashita et al., 2016). Valente and Berry (2016) found that males in Latin America were happier when working less, while males in the United States were happier when working more. They argued that cultural differences between the two regions help explain the differences—Latin America embraces collectivism, whereas individualism characterizes the United States. To be clear, they did not define long-working hours concretely. Using data from Spain, Bartoll and Ramos (2020) showed that long working hours (41–47 h/week) reduced workers' job satisfaction. Shin et al. (2021) reported a negative relationship between long working hours and subjective well-being among Korean workers.

Most studies mentioned above have focused on the linear association between long working hours and workers' subjective well-being. Studies exploring the nonlinear effects of long working hours on workers' subjective well-being remain scarce. However, there are two exceptions: Rudolf (2014) and Dong et al. (2021). Specifically, Rudolf (2014) reported an insignificant impact of long working hours on workers' well-being by dividing working hours into six categories. In contrast, by including a variable representing long working hours and its quadratic term, Dong et al. (2021) found an inverse U-shaped association between working hours and job satisfaction among Chinese employees. However, they did not report a specific turning point in working hours corresponding to the highest job satisfaction.

The threshold to classify long and normal working hours and the corresponding nonlinear effects of working hours on job satisfaction have not been empirically investigated in the literature. The present study is the first to analyze the nonlinear relationship between long working hours and job satisfaction using a cross-sectional threshold model. This approach is advantageous because it neither relies on ad hoc assumptions about what constitutes long and normal working hours nor defines these hours based on labor laws. Instead, the thresholds are endogenously determined and thus are free of biases inherent in ad hoc definitions of overwork.

3. Methods and data

3.1. Methods

3.1.1. Endogeneity of working hours and how to address it

We assume job satisfaction is a function of working hours and a vector of control variables, specified as follows:

$$Y_i = \alpha_1 H_i + \alpha_2 Z_i + \varepsilon_i \tag{1}$$

where Y_i refers to an individual i's job satisfaction; H_i measures the average working hours for individual i's current or most recent primary job, measured in hours/day; Z_i represents a vector of exogenous control variables (e.g., age, sex, education, marital status, and asset ownership) that may affect job satisfaction; α_1 and α_2 are parameters to be estimated; and ε_i is the error term capturing unobserved heterogeneity.

Individuals' working hours might be positively or negatively influenced by their job satisfaction (Collewet & Sauermann, 2017; Cygan-Rehm & Wunder, 2018; Rudolf, 2014). Workers who are satisfied with their work and derive enjoyment from it might work more of their own volition. Happy workers might be more productive and thus successful (Ma, Vatsa, Zhou, & Zheng, 2022; Oswald, Proto, & Sgroi, 2015); they may have the opportunity to set their work schedules. These bi-directional linkages suggest that how long one works is endogenous. Failure to address this endogeneity would lead to biased estimates of the effect of working hours on job satisfaction.

Both the two-stage residual inclusion (2SRI) and the two-stage predictor substitution (2SPS) models can be applied to address the endogeneity of working hours. However, because the former can provide consistent estimates of structural parameters, average partial effects, and average marginal effects, it is deemed superior to the latter (Liu, Paudel, Li, & Lei, 2019; Terza, 2017; Zhu, Ma, Leng, & Nie, 2021). Therefore, we employ the 2SRI model in this study. In the first stage, we assume that working hours depend upon a vector of exogenous variables and one or more instrumental variables. The empirical specification is as follows:

$$H_i = \beta_1 Z_i + \beta_2 IV_i + \omega_i \tag{2}$$

where H_i and Z_i are as defined earlier; β_1 and β_2 are parameters to be estimated; IV_i are instrumental variables (IV); ω_i is the error term.

Identifying at least one valid IV is critical to estimating the 2SRI model; nevertheless, this task can be challenging. In this study, we could not identify any variables within the CFPS data that met the statistical requirements for valid IVs. Therefore, leaning on the peer effect theory, we constructed two IVs. The first denotes the average working hours of other respondents (except for the sampled respondent) of the same age in the same province, and the second represents the average working hours of other respondents of the same sex in the same province. Theoretically, peers at work can motivate individuals to work longer and accomplish tasks faster (Silver, 2021)—working duration and intensity become embedded in the workplace culture, translating into workers behaving similarly. The two constructed IVs represent the working times of peers, reflecting the potential effects others have on individuals. However, others' working times are not directly associated with respondents' job satisfaction levels.

To confirm the validity of IVs econometrically, we first estimate standard linear regressions, taking job satisfaction and the number

of hours worked as dependent variables and the two IVs and other variables as independent variables. The results presented in Table A1 in the Appendix show that the two IVs are insignificant in the job satisfaction equation, while their coefficients are positive and statistically significant in the working hours equation. Thus, the two IVs satisfy the exogeneity and correlational requirements. Furthermore, we conducted the Sargan test to check for potential overidentification—the test statistic is reported in the lower part of Table A4 in the Appendix. We fail to reject the null hypothesis of orthogonality between the instruments and the errors, as the χ^2 statistics have high *P*-values. These results confirm the validity of the two IVs and thus lend credence to the identification strategy employed in the first stage of the estimation framework.

In the second stage of the 2SRI approach, we estimate the outcome equation, that is, the job satisfaction equation. The residuals derived from the first stage are included as an additional regressor in the second stage. Because we are interested in estimating both the linear and nonlinear relationships between working hours and job satisfaction, we discuss the outcome regression models separately below.

3.1.2. Linear relationship between working hours and job satisfaction

The linear regression model for job satisfaction in the second stage of the 2SRI model is specified as follows:

$$Y_i = \delta_1 H_i + \delta_2 Z_i + \delta_3 Residual_i + \zeta_i \tag{3}$$

where Y_i, H_i, and Z_i are as defined earlier; $Residual_i$ is the residual term derived from Eq. (2); δ_1, δ_2, and δ_3 are parameters to be estimated; ζ_i is the error term. Eq. (3) is estimated using the ordinary least squares (OLS) method.

3.1.3. Nonlinear relationship between working hours and job satisfaction

Different strategies can be used to investigate nonlinear relationships between working hours and job satisfaction. For example, one can simply include the working hour variable and its quadratic term in the regression model (Dong et al., 2021). Still, this approach only provides a partial picture. Ad hoc definitions of thresholds undermine the objectivity of the analyses—the biases and notions of analysts influence these definitions. To overcome these limitations, we employ the threshold model in this paper (Chiu & Yeh, 2017; Hansen, 2000; Huang, Cai, Huang, Tian, & Lei, 2019; Peng, Xiao, Wen, & Zhang, 2019). The threshold model enables us to analyze the changes in the impact that working hours have on job satisfaction at various intervals.

For simplicity, we illustrate the threshold regression model with one threshold. It can be described as follows:

$$\begin{cases} Y_i = \varpi_1^{'} Z_i + \varpi_2 Residual_i + \tau_i, if\ q_i < \gamma \\ Y_i = \phi_1^{'} Z_i + \phi_2 Residual_i + \tau_i, if\ q_i \geq \gamma \end{cases} \tag{4}$$

where q_i is the threshold variable (working hours in this study), and γ is the threshold. Eq. (4) can be regarded as a special case of the threshold model with either $q_i < \gamma$ or $q_i \geq \gamma$ for all $i = 1, \ldots, N$. For compactness, the model can be expressed as follows:

$$Y_i = \theta_1 H_i I(q_i < \gamma) + \theta_2 H_i I(q_i \geq \gamma) + \theta_3 Z_i + \theta_4 Residual_i + \psi_i \tag{5}$$

where Y_i, H_i, Z_i and $Residual_i$ are as defined earlier; $I(\bullet)$ is the indicator function, and the threshold variable q_i divides the observations into two regimes distinguished by different regression slope parameters θ_1 and θ_2; θ_3 and θ_4 are parameters to be estimated; ψ_i is the error term. Based on a specific threshold value γ, derived from the whole distribution of working hours, a standard linear regression is employed to estimate Eq. (5).

We follow the estimation procedure proposed by Hansen (1999) to test for threshold effects and determine the number of thresholds. Specifically, we first estimate Eq. (5) using γ, which is derived from the whole distributions of working hours, and then search the minimum value of the residual sum of squares, $S(H) = \widehat{e}(H)^{'}\widehat{e}(H)$. The specific threshold value is determined based on the formula: $\widehat{\gamma} = argmin S_N(H)$. To verify the significance of the threshold effects under the null hypothesis of no threshold effects, the corresponding probability and confidence intervals of the thresholds are generated using a bootstrapping technique (Hansen, 2000; Huang et al., 2019; Peng et al., 2019). Once the presence of a single threshold value in Eq. (4) is confirmed, the presence of potential double or triple thresholds is tested. Eq. (5) can be extended to scenarios with double or triple thresholds. The estimation procedure with more thresholds naturally includes more intervals of working hours.

3.2. Data source and descriptive statistics

3.2.1. Data source

The analysis in this study relies on the open-access 2018 China Family Panel Studies (CFPS) dataset. The CFPS was conducted by the Institute of Social Science Survey (ISSS) at Peking University (Beijing, China). The survey covered 30 provinces (excluding Tibet) of mainland China (Xie & Hu, 2014). Using a multistage probability proportional to size (PPS) sampling procedure, the 2018 CFPS comprised interviews with 37,354 individuals from 14,218 households in both urban and rural regions and gathered information about the individuals (e.g., education experience, marital experience, and work experience) and their households (e.g., household size, property ownership, and financial investment). In the survey's work module, respondents were asked to report their work types (part-time or full-time), working time, and job satisfaction. Although several waves of the CFPS have been conducted—in 2012, 2014, 2016, and 2018—we did not construct a panel dataset. This is because not all respondents were interviewed in every wave. Furthermore, people may change jobs from one wave to the next, leaving only a small number of people who held the same job at the time of specific

waves of the CFPS. To be clear, different roles are likely to influence job satisfaction, making it difficult to isolate the impact of the number of working hours. Thus, we have used the *cross-sectional* 2018 CFPS to examine the relationship between working hours and job satisfaction.

In this study, our focus is on those with full-time work and who worked for at least one hour the week before the survey was conducted. Thus, first, we removed observations for retired and unemployed individuals. Though retired respondents were also asked about their satisfaction with their most recent work, we did not include these individuals due to potentially imprecise recollections of how they felt while employed. Second, we excluded those who held part-time jobs. This is because people (e.g., graduate students) take on part-time jobs or internship positions to improve their skills and gain experience, and, at the same time, earn money. On the other hand, full-time workers tend to shoulder the responsibility of providing for their families and have markedly different socioeconomic and psychological factors underpinning their motivations to work. Thus, it is difficult to compare the associations between time spent working and job satisfaction for part-time and full-time workers. After dropping observations with missing values and outliers (e.g., working more than 16 h/day), we analyzed data on 15,336 individuals from 9132 households.

The dependent variable, job satisfaction, is based on the question, "*In general, how satisfied are you with this job?*". The corresponding answer is based on a five-point Likert scale, that is, 1 = very unsatisfied, 2 = unsatisfied, 3 = fair, 4 = satisfied, and 5 = very satisfied. The key explanatory variable, working hours, comes from respondents' self-reported working time, including paid and unpaid extra hours except for lunch breaks. So, self-reported working hours may exceed the national standard (8 h/day), which allows us to explore the threshold effects of working long hours on job satisfaction. The control variables were selected based on the literature on working hours and job satisfaction (e.g., Dong et al., 2021; Masood et al., 2021; Rudolf, 2014; Shin et al., 2021; Yamashita et al., 2016). These include individual-level variables (respondents' age, sex, education, and marital status), household-level variables (family size, child ratio, elder ratio, property ownership, and whether the household lives in urban or rural areas), and province-level variables (population size, fixed-asset investment of whole society, and Internet access).

3.2.2. Descriptive statistics

Table 1 presents the definitions and summary statistics of variables used in the empirical analysis. The average job satisfaction of respondents is 3.62 out of five; this is similar to that in Portugal, 3.93 out of six, and in France, 4.32 out of six (Lepinteur, 2019). The

Table 1
Variable definitions and descriptive statistics.

Variables	Definitions	Mean (S.D.)
Dependent variable		
Job satisfaction	Self-reported job satisfaction level from 1 = very unsatisfied to 5 = very satisfied	3.62 (0.95)
Happiness	Self-reported happiness level from 1 = very unhappy to 10 = very happy	7.47 (2.05)
Life satisfaction	Self-reported life satisfaction level from 1 = very unsatisfied to 5 = very satisfied	3.98 (0.95)
Key explanatory variable		
Working hours	Average working hours in current/most recent primary job (hours/day)	6.80 (3.00)
Independent variables		
Age	Age of respondent (years)	43.03 (12.31)
Sex	1 if respondent is male, 0 otherwise	0.56 (0.50)
Education	The educational level of the respondent (years)	7.73 (5.20)
Marital status	1 if respondent is married, 0 otherwise	0.83 (0.37)
Family size	Number of family members (persons)	4.31 (2.04)
Child ratio	Ratio of the number of family members aged 0–14 years to the number of family members aged 15–64 years	0.05 (0.11)
Elder ratio	Ratio of the number of family members aged 65 years and over to the number of family members aged 15–64 years	0.08 (0.16)
Property ownership	1 if household owns house property(s), 0 otherwise	0.86 (0.34)
Urban	1 if respondent lives in the urban area, 0 otherwise	0.48 (0.50)
Population size	Population of the province (100 million)	0.60 (0.30)
Fixed-asset investment	Total provincial fixed-asset investment of the whole society(trillion yuan) [a]	2.18 (1.37)
Internet access	Number of Internet access ports in the province (100 million)	0.33 (0.18)
IV1	Average working hours of other respondents (i.e., except for the sampled respondent) of the same age in the same province	6.80 (1.10)
IV2	Average working hours of other respondents (i.e., except for the sampled respondent) of the same sex in the same province	6.80 (0.59)
Variables used for mediation analysis		
Physical health	Self-reported physical health status from 1 = very unhealth to 5 = very health	3.10 (1.17)
Sleep duration	Average sleeping duration on working days (hours/day)	7.56 (1.39)
Leisure time	Average time spent watching TV and movies (hours/week)	9.34 (8.67)
Sample size		15,336

Note: S.D. refers to the standard deviation.
[a] Yuan is the Chinese currency (1 USD = 6.75 yuan in 2017).

average self-reported happiness is 7.47 out of ten, and the average life satisfaction is 3.98 out of five. Respondents, on average, worked 6.80 h/day in their current or most recent primary job. This is significantly lower than 8 h/day, China's nationally recognized standard workday. On average, the respondents were 43 years old, and 56% were male. Around 83% of the respondents were married. Regarding household-level characteristics, on average, households comprised four members, and about 86% of households owned house properties at the time of the survey.

Fig. 1 illustrates the proportions of males and females working different numbers of hours/day. Overall, the data show that males worked longer hours than their female counterparts. Males who worked 7–8 h/day constituted the most significant proportion of total respondents: 11.46%. Among females, those who worked 5–6 h/day constituted the largest group, at 8.39% of all respondents. Fig. 2 shows the differences in job satisfaction for males and females working for different durations. Males working less than one hour had an average job satisfaction of 3.4; it was 3.74 for those working 5–7 h/day. However, job satisfaction decreased to 2.93 among males working 15–16 h. A similar pattern was evident for females: working 4–5 h was associated with the highest job satisfaction (3.77), and it fell noticeably among those working more than 12 h. Overall, Figs. 1 and 2 suggest that how long people work may have heterogeneous effects on their job satisfaction, which we explore in detail in Section 4.

4. Results and discussions

Recall that how long one works is endogenous. To address this endogeneity, we use a standard linear regression model to regress the number of hours worked on a rich set of control variables and the IVs in the first stage of the 2SRI estimation framework. The results obtained from the first-stage regression are presented in Table A2 in the Appendix. The residual series obtained from this regression is used in the second stage of the model as a regressor to account for the endogeneity of working hours. In this section, we first discuss the determinants of working hours, which are estimated from the first-stage regression of the 2SRI model. Then, we discuss the associations between working hours and job satisfaction. Finally, we present and discuss how working hours affect happiness and life satisfaction.

4.1. Determinants of working hours

Column 2 of Table A2 in the Appendix shows the effects of different factors on working hours estimated from Eq. (2). The coefficient of age is negative and significant, suggesting that the older one gets, the less one works. Specifically, for every 10-year increase in age, the number of hours worked declines, on average, by 0.45 h/day. The coefficient of sex indicates that males work 0.347 h/day more than females, whereas that of marital status suggests that married individuals work 0.499 h/day more than unmarried ones. In contrast, education negatively affects working hours; however, the effect is relatively small. For an additional year of education, the hours worked fall by 0.034 h/day. Property ownership, a measure of wealth, is associated with fewer hours worked. Although it is unsurprising that urban residents work longer hours than their rural counterparts, the difference is not large: urban residents work only 0.318 h/day more than rural residents. The coefficients of both IVs are positive, suggesting that how long people work is influenced by how long their peers work. Peer effects often derive from the social distance between workers (Rosaz, Slonim, & Villeval, 2016).

4.2. How working hours affect job satisfaction

This section discusses the effects of how long people work on how satisfied they feel with their jobs. A linear model ignores potential nonlinearities, presenting a somewhat simplistic and potentially misleading view of the relationship between working hours and job satisfaction. Nevertheless, to facilitate comparison, we estimate a linear regression model using Eq. (3). The results (see the second column of Table A3 in the Appendix) show that working an extra hour/day reduces job satisfaction, on average, by 0.067 points on a five-point Likert scale. To confirm the robustness of these results, we also estimate the impact of working hours on job satisfaction using the two-stage least squares (2SLS) regression model. The results (Table A4 in the Appendix) show that working hours negatively and significantly affect job satisfaction, supporting our findings in Table A3.

We further include the squared term of working hours in the second stage of the 2SRI model to investigate the potential nonlinearities in the association between working hours and job satisfaction. As reported in the third column of Table A3, the coefficient of working hours is positive, and that of its squared term is negative, suggesting an “Inverse-U" relationship between the two. We recognize that the effects are likely to be nonlinear. Consider, for example, two individuals, the first working four hours a day and the second nine hours. An additional hour of work would entail different changes in their job satisfaction. After all, the second has significantly less non-work time at her disposal and, thus, parting with an additional hour of the same would have a higher opportunity cost for the second than the first; the second individual may also feel dissatisfied with her work, whereas the first may experience little or no change in job satisfaction. To account for such nonlinearities, we estimate thresholds delineating the number of hours worked and how it influences job satisfaction.

4.2.1. Threshold effects of working hours on job satisfaction

Before implementing the threshold model to study the nonlinear effects of working hours on job satisfaction, we determine the thresholds delineating the number of hours worked and test whether the threshold effect exists between working hours and job satisfaction (Hansen, 2000; Huang et al., 2019; Peng et al., 2019). The results presented in Table 2 show four thresholds: 8.571 for the single-threshold model; 7.143 and 9.000 for the double-threshold model; and 12.000—in addition to the two threshold values for the double-threshold model—for the triple-threshold model. Then, we test the number of thresholds and calculate the bootstrapped

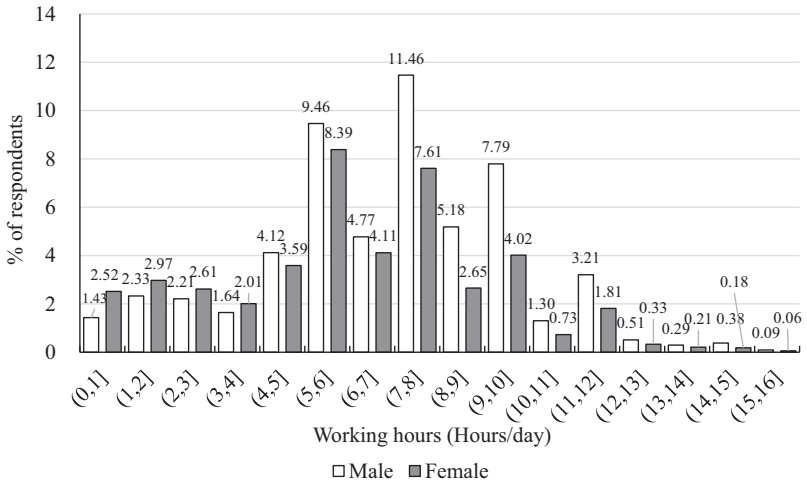

Fig. 1. Sample proportions by working hours and sex.

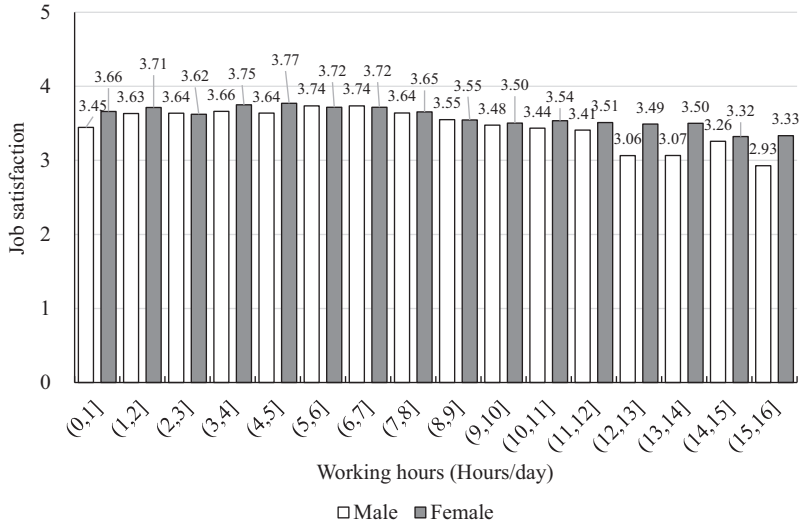

Fig. 2. Job satisfaction by working hours and sex.

confidence intervals. They are presented in Table A5 in the Appendix and validate the thresholds: the null hypothesis is rejected in each of the three cases. The results point to the validity of the single, double, and triple threshold models.

We present the effects of working hours and control variables on job satisfaction corresponding to the three thresholds in Table 3. Column 2 corresponds to the single-threshold model and shows that an additional hour of work does not affect the job satisfaction of those working fewer than 8.571 h/day—this aligns with the labor laws in China, according to which the standard workday is 8 h long. However, for those working more than 8.571 h/day, an extra hour of work reduces job satisfaction by 0.061 points on a five-point Likert scale. The results for the double-threshold model presented in the third column suggest that job satisfaction is insensitive to changes in the number of working hours for individuals working fewer than 9 h/day. Nevertheless, for those working more than 9 h/

Table 2
Threshold-test results and confidence intervals.

Threshold variable	Independent variable	Threshold	Threshold value	95% Confidence interval	
				Lower	Upper
Working hours	Job satisfaction	Single threshold	8.571	8.571	8.571
		Double threshold	7.143	6.000	12.000
			9.000	8.000	9.429
		Triple threshold	12.000	0.286	13.000

Table 3
Threshold impact of working hours on job satisfaction: baseline estimation.

Variables	Threshold model		
	Single	Double	Triple
Working hours (< 8.571 h/day)	−0.039 (0.031)		
Working hours (≥ 8.571 h/day)	−0.061 (0.031)**		
Working hours (< 7.143 h/day)		−0.021 (0.032)	
Working hours (7.143–9 h/day)		−0.038 (0.031)	
Working hours (≥ 9 h/day)		−0.055 (0.031)*	
Working hours (< 7.143 h/day)			−0.019 (0.032)
Working hours (7.143–9 h/day)			−0.038 (0.031)
Working hours (9–12 h/day)			−0.052 (0.031)*
Working hours (≥ 12 h/day)			−0.061 (0.031)*
Age	0.003 (0.002)**	0.004 (0.002)**	0.004 (0.002)**
Sex	−0.004 (0.032)	−0.005 (0.032)	−0.005 (0.032)
Education	−0.004 (0.002)*	−0.004 (0.002)**	−0.004 (0.002)**
Marital status	−0.077 (0.028)***	−0.076 (0.028)***	−0.075 (0.028)***
Family size	0.002 (0.004)	0.003 (0.004)	0.003 (0.004)
Child ratio	−0.209 (0.072)***	−0.204 (0.071)***	−0.202 (0.071)***
Elder ratio	−0.020 (0.051)	−0.026 (0.051)	−0.025 (0.051)
Property ownership	−0.066 (0.027)**	−0.063 (0.027)**	−0.064 (0.027)**
Urban	0.053 (0.019)***	0.046 (0.019)**	0.047 (0.019)**
Population size	−0.328 (0.095)***	−0.317 (0.095)***	−0.316 (0.095)***
Fixed-asset investment	0.021 (0.007)***	0.021 (0.007)***	0.020 (0.007)***
Internet access	0.496 (0.168)***	0.484 (0.168)***	0.480 (0.168)***
Locational fixed effects	Yes	Yes	Yes
Residual	0.046 (0.031)	0.044 (0.031)	0.045 (0.031)
Constant	3.984 (0.274)***	3.903 (0.274)***	3.901 (0.274)***
Sample size	15,336	15,336	15,336

Note: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.
Standard errors are presented in parentheses.

day, an additional hour of work is associated with a reduction of 0.055 points in job satisfaction. The results in the last column are similar to those for the double-threshold model. Individuals working fewer than 9 h/day do not experience a significant decline in job satisfaction due to the increased number of hours worked. In contrast, the job satisfaction of those working more than 9 h/day but fewer than 12 h/day declines by 0.052 points. Furthermore, for those working longer than 12 h/day, an additional hour of work is associated with a larger reduction of 0.061 points in job satisfaction. In summary, the higher the threshold, the more job satisfaction declines with an additional hour of work.

The results confirm the expected nonlinear effects of the number of hours worked on job satisfaction. They also point to the detrimental effects of the so-called 996 work regime, that is, working from 9 am to 9 pm, six days a week. Despite the state denouncing such practices, the confluence of capitalism and Confucian values of obedience and hierarchy perpetuates harsh working conditions (Wang, 2020). However, resentment against overwork is rising in China. Our results reflect the growing discontent and disapprobation of grueling work regimes.

4.2.2. Threshold effects of control variables on job satisfaction

To gain further insights into the potential nonlinear associations of job satisfaction with age and education, we incorporate an age-squared term in our model and replace the continuous education variable with a series of education dummies. Furthermore, because job-related characteristics (e.g., employment type and sector) are also important determinants of job satisfaction,[1] we include variables to capture the employment type and sector in our model. The definitions and descriptive statistics of these variables are presented in the upper part of Table A6 in the Appendix, and the results obtained from modeling them are presented in Table 4.

The magnitudes, signs, and significance of the coefficients of the control variables are similar across the three models (see columns 2–4 of Table 4). In the interest of brevity, we will discuss the coefficients corresponding to the triple-threshold model presented in the last column of Table 4. The coefficients of the age variable and its squared term (age^2) are negative and positive, respectively. The findings suggest that job satisfaction first decreases and then increases as a function of the respondents' age. That is, there is a "U-shaped" relationship between respondents' age and job satisfaction. The education dummies (except those corresponding to PhD degrees) have significant and negative coefficients, suggesting that relative to people with no schooling, those having primary school, middle school, high school, junior school, junior college, bachelor, and masters level education have a lower level of job satisfaction. Education improves employment prospects; at the same, educated individuals are more likely to be employed in roles for which they are overqualified, thus leading to boredom and dissatisfaction (Kim, Park, Sohn, & Lim, 2021; Sanchez-Cardona, Vera, & Martínez-Lugo, 2019).

Although family size does not affect job satisfaction, the elder ratio does. The higher the ratio, the lower the job satisfaction.

[1] We thank an anonymous reviewer for pointing this out.

Table 4
Threshold impact of working hours on job satisfaction: extended estimation.

Variables	Threshold model		
	Single	Double	Triple
Working hours (< 8.571 h/day)	−0.035 (0.033)		
Working hours (≥ 8.571 h/day)	−0.055 (0.033)*		
Working hours (< 7.143 h/day)		−0.029 (0.033)	
Working hours (7.143–9 h/day)		−0.038 (0.033)	
Working hours (≥ 9 h/day)		−0.053 (0.033)	
Working hours (< 7.143 h/day)			−0.028 (0.033)
Working hours (7.143–9 h/day)			−0.037 (0.033)
Working hours (9–12 h/day)			−0.050 (0.033)
Working hours (≥ 12 h/day)			−0.059 (0.033)*
Age	−0.035 (0.005)***	−0.035 (0.005)***	−0.035 (0.005)***
Age^2	0.000 (0.000)***	0.000 (0.000)***	0.000 (0.000)***
Sex	−0.019 (0.026)	−0.022 (0.026)	−0.022 (0.026)
Primary school	−0.186 (0.028)***	−0.186 (0.028)***	−0.186 (0.028)***
Middle school	−0.189 (0.028)***	−0.190 (0.028)***	−0.191 (0.028)***
High school	−0.182 (0.040)***	−0.185 (0.040)***	−0.188 (0.040)***
Junior college	−0.144 (0.059)**	−0.151 (0.059)**	−0.153 (0.059)***
Bachelor	−0.118 (0.073)	−0.126 (0.073)*	−0.130 (0.073)*
Master	−0.195 (0.118)*	−0.201 (0.118)*	−0.204 (0.118)*
PhD degree	0.416 (0.226)*	0.407 (0.228)*	0.418 (0.240)*
Marital status	0.018 (0.026)	0.017 (0.026)	0.017 (0.026)
Family size	0.001 (0.004)	0.002 (0.004)	0.001 (0.004)
Child ratio	−0.112 (0.075)	−0.110 (0.075)	−0.109 (0.075)
Elder ratio	−0.110 (0.050)**	−0.114 (0.050)**	−0.114 (0.050)**
Property ownership	−0.023 (0.024)	−0.021 (0.024)	−0.021 (0.024)
Urban	−0.024 (0.017)	−0.025 (0.017)	−0.024 (0.017)
Population size	−0.167 (0.083)**	−0.166 (0.083)**	−0.166 (0.083)**
Fixed-asset investment	0.013 (0.007)**	0.013 (0.007)**	0.013 (0.007)*
Internet access	0.194 (0.149)	0.193 (0.149)	0.189 (0.149)
Self-employment	0.054 (0.022)**	0.057 (0.022)**	0.062 (0.023)***
Agricultural sector	−0.349 (0.074)***	−0.346 (0.075)***	−0.351 (0.075)***
Locational fixed effects	Yes	Yes	Yes
Residual	0.034 (0.033)	0.033 (0.033)	0.035 (0.033)
Constant	4.838 (0.289)***	4.808 (0.290)***	4.809 (0.290)***
Sample size	15,336	15,336	15,336

Note: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.
Standard errors are presented in parentheses.
The reference education stage is no schooling.

Stressors related to one's family—parental duties, caring for the elderly, completing household chores, and domestic conflict—may trigger psychological and physiological burnout (Mesmer-Magnus & Viswesvaran, 2005). This burnout may lead to productivity loss and spill over into job dissatisfaction. The provincial population is negatively associated with job satisfaction. For an increase of 100 million in the population of a province, job satisfaction of those living in it declines by 0.166 points. Pollution and congestion are commonplace in highly populated areas and may lower job satisfaction among the populace.

The dummy variable denoting self-employment is assigned a value of one if the respondents report being self-employed and zero if they work for others (see Table A6 in the Appendix). The coefficient of self-employment is positive and statistically significant, suggesting that self-employment increases job satisfaction by 0.062 points relative to wage-employment. Self-employment is often associated with greater freedom to choose not only the type of work people take on but also the hours they want to work. This freedom can obviate the anxiety and stress of conforming to norms, schedules, regulations, and ethos of traditional workplaces. As a result, people may feel liberated to exercise their creativity and resourcefulness, instilling a sense of accomplishment. We have also represented the agricultural sector with a dummy variable equal to one if the respondents work in the agricultural sector and zero if they are employed in a non-agricultural sector (see Table A6 in the Appendix). The negative and significant coefficient of this variable (last column of Table 4) suggests that working in the agricultural sector is associated with 0.351 points lower job satisfaction than being employed in a non-agricultural sector. This can be attributed to the toilsome and laborious nature of agricultural activities that can take their toll on one's physical health, leading to exhaustion and, thus, lower job satisfaction.

4.2.3. Heterogeneous analysis

We also investigate the heterogenous effects of working hours on job satisfaction across respondents' sex, marital status, employment type, and employment sector. Table 5 presents the heterogeneous analysis results by sex. The results reveal that males who work fewer than 7.143 h/day experience greater job satisfaction upon increasing the time they spend working; this may reflect the importance of work in providing a sense of purpose, meaning, and accomplishment (Martela & Pessi, 2018; Valente & Berry, 2016). In contrast, for females, the number of hours worked is negatively associated with job satisfaction; this result holds across all the

Table 5
Heterogeneous analysis by sex.

Variables	Threshold model		
	Single	Double	Triple
Male			
Working hours (< 8.571 h/day)	0.062 (0.044)		
Working hours (≥ 8.571 h/day)	0.036 (0.044)		
Working hours (< 7.143 h/day)		0.075 (0.045)*	
Working hours (7.143–9 h/day)		0.061 (0.044)	
Working hours (≥ 9 h/day)		0.041 (0.044)	
Working hours (< 7.143 h/day)			0.076 (0.045)*
Working hours (7.143–9 h/day)			0.060 (0.044)
Working hours (9–12 h/day)			0.044 (0.044)
Working hours (≥ 12 h/day)			0.030 (0.044)
Control variables	Yes	Yes	Yes
Locational fixed effects	Yes	Yes	Yes
Constant	2.983 (0.425)***	2.915 (0.426)***	2.922 (0.426)***
Sample size	8618	8618	8618
Female			
Working hours (< 8.571 h/day)	−0.151 (0.046)***		
Working hours (≥ 8.571 h/day)	−0.168 (0.046)***		
Working hours (< 7.143 h/day)		−0.142 (0.046)***	
Working hours (7.143–9 h/day)		−0.154 (0.046)***	
Working hours (≥ 9 h/day)		−0.165 (0.046)***	
Working hours (< 7.143 h/day)			−0.142 (0.046)***
Working hours (7.143–9 h/day)			−0.154 (0.046)***
Working hours (9–12 h/day)			−0.166 (0.046)***
Working hours (≥ 12 h/day)			−0.163 (0.046)***
Control variables	Yes	Yes	Yes
Locational fixed effects	Yes	Yes	Yes
Constant	5.050 (0.403)***	5.006 (0.403)***	5.008 (0.403)***
Sample size	6718	6718	6718

Note: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.
Standard errors are presented in parentheses.

thresholds identified. China continues to be a patriarchal society where families are male-dominated but male-absent, and women are responsible for domestic work, which can be toilsome and time-intensive (Luo & Chui, 2018). Thus, working long hours may leave women less time to address the demands of domestic work, in turn influencing their job satisfaction.

Table 6 presents the heterogeneous analysis of the associations between working hours and job satisfaction for the married and the unmarried. It shows that working hours also affect the job satisfaction of the married and the unmarried differently. Here, we rely on the results of the triple threshold model to shed light on the association between working hours and job satisfaction. The time spent working does not affect the job satisfaction of married individuals working fewer than 9 h. However, job satisfaction decreases by 0.064 points on a five-point Likert scale for those who work between 9 and 12 h/day. Moreover, the decline is even larger among married individuals working more than 12 h/day: 0.071 points. These results suggest that the time spent working should not exceed 9 h/day for married individuals—time spent in excess of 9 h compromises job satisfaction and may also infringe upon one's work-life balance. In other words, working fewer than 9 h may allow these individuals to meet familial duties, fulfill responsibilities at their workplace, and allocate time to leisure. On the other hand, the time spent working is not significantly associated with the job satisfaction of unmarried workers.

Table 7 presents the heterogeneous analysis considering different employment types. Since the CFPS data have rich information on wage-employed respondents, we include several additional variables pertaining to their employment in the regression model to glean deeper insights into the factors that may affect their job satisfaction. These are the size of the company where the respondents work, the sector in which they are employed, whether they have managerial roles, receive pensions, and own health insurance, work-injury insurance, and maternity insurance. Apropos company size, we consider three categories: small, medium, and large. We also consider 20 sectoral dummies. The corresponding definitions and descriptive statistics are presented in the lower part of Table A6 in the Appendix. The last column of Table 7 reveals that self-employed workers who work more than 12 h/day report lower job satisfaction than those working fewer than 12 h/day. These results are suggestive. We have shown above that self-employment is associated with greater job satisfaction. Nevertheless, long working hours can compromise job satisfaction even among the self-employed. People who work long hours sacrifice time spent with family and friends and are more susceptible to occupational stress. Such factors can lead to ennui and depression. In comparison, among those with wage-employment, working hours have a negative and statistically significant impact on job satisfaction across all the thresholds. Besides, working in a medium-sized company is associated with around 0.048 points higher job satisfaction than working in a small company. Management responsibilities are associated with 0.210–0.212 points higher job satisfaction.

We also investigate the relationship between working hours and job satisfaction for workers employed in the agricultural and non-

Table 6
Heterogeneous analysis by marital status.

Variables	Threshold model		
	Single	Double	Triple
Married			
Working hours (< 8.571 h/day)	−0.049 (0.035)		
Working hours (≥ 8.571 h/day)	−0.071 (0.035)**		
Working hours (< 7.143 h/day)		−0.037 (0.036)	
Working hours (7.143–9 h/day)		−0.049 (0.035)	
Working hours (≥ 9 h/day)		−0.066 (0.035)*	
Working hours (< 7.143 h/day)			−0.036 (0.036)
Working hours (7.143–9 h/day)			−0.049 (0.035)
Working hours (9–12 h/day)			−0.064 (0.035)*
Working hours (≥ 12 h/day)			−0.071 (0.035)**
Control variables	Yes	Yes	Yes
Locational fixed effects	Yes	Yes	Yes
Constant	3.944 (0.330)***	3.879 (0.330)***	3.880 (0.330)***
Sample size	12,746	12,746	12,746
Unmarried			
Working hours (< 8.571 h/day)	−0.003 (0.066)		
Working hours (≥ 8.571 h/day)	−0.025 (0.065)		
Working hours (< 7.143 h/day)		−0.000 (0.067)	
Working hours (7.143–9 h/day)		−0.014 (0.066)	
Working hours (≥ 9 h/day)		−0.025 (0.065)	
Working hours (< 7.143 h/day)			0.002 (0.067)
Working hours (7.143–9 h/day)			−0.013 (0.066)
Working hours (9–12 h/day)			−0.020 (0.065)
Working hours (≥ 12 h/day)			−0.034 (0.066)
Control variables	Yes	Yes	Yes
Locational fixed effects	Yes	Yes	Yes
Constant	3.842 (0.575)***	3.847 (0.577)***	3.835 (0.577)***
Sample size	2590	2590	2590

Note: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.
Standard errors are presented in parentheses.

agricultural sectors. The results are presented in Table A7 in the Appendix. It shows that job satisfaction is negatively associated with working hours regardless of which of the two sectors people work in. Specifically, working an extra hour over and above 8.571 h/day is associated with reductions in job satisfaction of 0.019 and 0.031 points, on a five-point Likert scale, in the agricultural and non-agricultural sectors, respectively. For those working more than 9 h/day, an additional hour of work is associated with a reduction of 0.020 and 0.027 points in job satisfaction for workers in the agricultural and non-agricultural sectors. Furthermore, for people working more than 12 h/day, an additional hour spent on work is associated with a reduction of 0.026 points in job satisfaction for agricultural workers and 0.028 points for non-agricultural workers.

4.2.4. Exploring potential mechanisms

We have confirmed a nonlinear relationship between working hours and job satisfaction. Further, an important question is why working job satisfaction declines among those working more but not fewer than 9 h/day. To answer this, we explore the mechanisms underpinning the association between the time spent working and job satisfaction. To this end, we first create a binary variable that takes the value of one if the respondent works more than 9 h/day and zero otherwise. Then, we employ the 2SRI approach to control for the endogeneity of this binary variable. In the interest of brevity, the first-stage results (from which the residuals are derived) are not reported. These residuals are included as an additional control variable in the second stage of the mediation analysis. In addition, we employ the Sobel test and the bootstrapping-based method to examine the mediation effects of physical health, sleep duration, and leisure time on job satisfaction (Elliott et al., 2022; Preacher & Hayes, 2008; Zhang, Mishra, Zhu, & Li, 2020).

The results (Table A8 in the Appendix) show that the indirect effects of physical health are negative, suggesting that working more than 9 h reduces job satisfaction by compromising physical health. The indirect effects of sleep duration and leisure time are statistically insignificant. These results should be of strong interest to employers and policymakers in charge of public health systems and labor laws, considering that overwork is responsible for the poor physical health of employees and is implicated in reduced productivity at work (Åkerstedt et al., 2002; Nagaya et al., 2018).

4.3. How working hours affect happiness and life satisfaction

We have established the link between the number of hours worked and job satisfaction. Although pivotal to one's quality of life, job satisfaction presents only one aspect of well-being. Thus, to more comprehensively understand the impact of the number of hours worked on the quality of life, we examine how it affects a person's happiness and life satisfaction, two indicators of subjective well-

Table 7
Heterogeneous analysis by employment type.

Variables	Threshold model		
	Single	Double	Triple
Self-employment			
Working hours (< 8.571 h/day)	0.007 (0.006)		
Working hours (≥ 8.571 h/day)	−0.008 (0.004)**		
Working hours (< 7.143 h/day)		0.006 (0.007)	
Working hours (7.143–9 h/day)		0.005 (0.005)	
Working hours (≥ 9 h/day)		−0.008 (0.004)**	
Working hours (< 7.143 h/day)			0.007 (0.007)
Working hours (7.143–9 h/day)			0.006 (0.005)
Working hours (9–12 h/day)			−0.006 (0.004)
Working hours (≥ 12 h/day)			−0.011 (0.005)**
Control variables	Yes	Yes	Yes
Locational fixed effects	Yes	Yes	Yes
Constant	3.470 (0.089)***	3.474 (0.090)***	3.468 (0.091)***
Sample size	7557	7557	7557
Wage-employment			
Working hours (< 8.571 h/day)	−0.027 (0.008)***		
Working hours (≥ 8.571 h/day)	−0.041 (0.005)***		
Working hours (< 7.143 h/day)		−0.024 (0.010)**	
Working hours (7.143–9 h/day)		−0.032 (0.008)***	
Working hours (≥ 9 h/day)		−0.040 (0.006)***	
Working hours (< 7.143 h/day)			−0.019 (0.010)*
Working hours (7.143–9 h/day)			−0.028 (0.008)***
Working hours (9–12 h/day)			−0.035 (0.006)***
Working hours (≥ 12 h/day)			−0.042 (0.006)***
Company size (Medium)	0.049 (0.025)*	0.048 (0.025)*	0.048 (0.025)*
Company size (Large)	0.005 (0.028)	0.004 (0.028)	0.004 (0.028)
Management duty	0.212 (0.029)***	0.210 (0.029)***	0.210 (0.029)***
Pension	−0.018 (0.052)	−0.019 (0.052)	−0.018 (0.052)
Health insurance	0.049 (0.053)	0.047 (0.053)	0.047 (0.053)
Work injury insurance	0.056 (0.036)	0.057 (0.036)	0.057 (0.036)
Maternity insurance	−0.045 (0.042)	−0.048 (0.043)	−0.048 (0.043)
Sectoral dummies	Yes	Yes	Yes
Control variables	Yes	Yes	Yes
Locational fixed effects	Yes	Yes	Yes
Constant	4.116 (0.113)***	4.114 (0.116)***	4.088 (0.117)***
Sample size	6839	6839	6839

Note: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.
Standard errors are presented in parentheses.
The reference company size is small. The reference sector is Sector 1.

being (Nie, Ma, & Sousa-Poza, 2021; Zheng & Ma, 2021). To this end, we estimate the threshold impact of working hours on happiness and life satisfaction.

Table A9 in the Appendix presents the empirical results. It shows a nonlinear relationship between working hours and happiness. Consider, as an example, the triple threshold model, whose results are presented in the last column. For respondents who work between 7.143 and 9 h/day, happiness would fall by 0.261 points on a ten-point Likert scale with an additional hour worked. However, for those working between 9 and 12 h/day, the decline in happiness due to an additional hour of work is 0.271 points. Furthermore, happiness falls by a still larger magnitude of 0.274, with an additional hour worked among people working more than 12 h/day. In contrast, the impact of working hours on life satisfaction (the lower part of Table A9) is insignificant in the three threshold models. The results stand to reason. Happiness captures short-run hedonic well-being and reflects the perceived quality of one's daily experience, while life satisfaction measures long-run perceptions and feelings towards various facets of life (Nie et al., 2021; Zheng & Ma, 2021).

5. Conclusions and policy implications

Working long hours is exalted in developed countries, and developing countries are embracing overwork too. The draconian “996” work regime in China exemplifies this phenomenon. However, there is a growing discontent towards working long hours, and it is rebuked by policymakers, media, and workers themselves, who are becoming dissatisfied with jobs requiring them to work long hours. This paper analyzes the nonlinear effects of working hours on job satisfaction using a threshold model. Considering that job satisfaction is endogenous, we employ the IV-based 2SRI model to address the endogeneity. This is the first paper to examine nonlinearities in the link between the number of hours worked and job satisfaction while endogenously determining the thresholds delineating the work durations associated with changes in job satisfaction.

We find that how long people work indeed affects their job satisfaction. The nonlinear estimates derived from the threshold model

confirm four specific thresholds for the number of hours worked/day signifying changes in job satisfaction: 8.571 for the single-threshold model; 7.143 and 9.000 for the double-threshold model; and 12.000—in addition to the two threshold values for the double-threshold model—for the triple-threshold model. The findings of the threshold model confirm larger reductions in job satisfaction at higher thresholds of the number of hours worked. The effects of working hours on job satisfaction for males and females vary, as do the effects for married and unmarried individuals. Our results show lower job satisfaction from working long hours for males and married individuals but not for females and those who are unmarried. The type of employment people are engaged in also influences their job satisfaction differently—working long hours may lower the job satisfaction of wage-employed people more significantly than of those who are self-employed. Working long hours in both the agricultural and non-agricultural sectors significantly reduces job satisfaction once working hours reach the above thresholds. The mechanism analysis reveals that poor physical health mediates the adverse effects of working long hours on job satisfaction. Furthermore, working hours are negatively associated with people's self-reported happiness.

Balancing work with life is essential for societies and economies to flourish. Our findings confirm the detrimental effects of long working hours on workers' subjective well-being and highlight the importance of attending to the growing concerns regarding overwork. Furthermore, requiring employees to work long hours may not be in the employers' best interests—job dissatisfaction may increase workplace ennui and increase employee churn, leading to loss of productivity and increased hiring and training costs. Given the proven adverse health effects of overwork, policies that discourage grueling work regimes and prioritize workers' well-being would help ease the mounting burden on public healthcare systems, freeing up valuable resources. Our results also suggest that one-size-fits-all policies may lead to sub-optimal outcomes. Job satisfaction depends on several factors: sex, marital status, age, education, and the presence of children and the elderly in the household. Therefore, understanding the specific needs of different employees is important for designing appropriate practices and policies to optimize employees' well-being. For example, females and married workers may prefer a flexible working schedule. Although this can be resource-intensive, especially for larger companies, the approach is likely to deliver targeted interventions leading to better outcomes for employees and companies alike.

Declaration of Competing Interest

There is no conflict of interest.

Data availability

Data will be made available on request. The data that support the findings of this study are available from the leading author, Hongyun Zheng, upon reasonable request.

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Appendix

Table A1
Validity tests for the instrumental variables.

Variables	Coefficients: job satisfaction	Coefficients: working hours
IV1	−0.011 (0.008)	0.064 (0.025)**
IV2	−0.035 (0.023)	0.646 (0.069)***
Control variables	Yes	Yes
Locational fixed effects	Yes	Yes
Sample size	15,336	15,336

Note: ** $p < 0.05$ and *** $p < 0.01$.
Standard errors are presented in parentheses.

Table A2
Determinants of working hours.

Variables	Coefficients
Age	−0.045 (0.003)***
Sex	0.347 (0.076)***
Education	−0.034 (0.005)***
Marital status	0.499 (0.072)***

(*continued on next page*)

Table A2 (*continued*)

Variables	Coefficients
Family size	−0.008 (0.013)
Child ratio	0.117 (0.218)
Elder ratio	−0.225 (0.154)
Property ownership	−0.394 (0.072)***
Urban	0.318 (0.050)***
Population size	−0.183 (0.284)
Fixed-asset investment	0.017 (0.021)
Internet access	0.099 (0.511)
Locational fixed effects	Yes
IV1	0.064 (0.025)**
IV2	0.646 (0.069)***
Constant	3.851 (0.480)***
Sample size	15,336

Note: ** $p < 0.05$ and *** $p < 0.01$.
Standard errors are presented in parentheses.

Table A3
Linear and nonlinear impacts of working hours on job satisfaction: second stage of the 2SRI approach.

Variables	Job satisfaction (Coefficients)	Job satisfaction (Coefficients)
Working hours	−0.067 (0.031)**	0.011 (0.032)
Working hours^2		−0.006 (0.001)***
Age	0.003 (0.002)*	0.003 (0.002)**
Sex	−0.006 (0.032)	−0.007 (0.032)
Education	−0.002 (0.002)	−0.004 (0.002)*
Marital status	−0.081 (0.029)***	−0.074 (0.028)***
Family size	0.003 (0.004)	0.003 (0.004)
Child ratio	−0.208 (0.072)***	−0.202 (0.071)***
Elder ratio	−0.024 (0.051)	−0.025 (0.051)
Property ownership	−0.063 (0.027)**	−0.065 (0.027)**
Urban	0.062 (0.019)***	0.054 (0.019)***
Population size	−0.341 (0.095)***	−0.333 (0.095)***
Fixed-asset investment	0.020 (0.007)***	0.020 (0.007)***
Internet access	0.523 (0.168)***	0.504 (0.168)***
Locational fixed effects	Yes	Yes
Residual	0.047 (0.031)	0.049 (0.031)
Constant	4.107 (0.274)***	3.911 (0.274)***
Sample size	15,336	15,336

Note: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.
Standard errors are presented in parentheses.
The results of the first stage of the 2SRI model are reported in Table A2.

Table A4
Impact of working hours on job satisfaction: 2SLS model estimation.

Variables	Working hours (coefficients)	Job satisfaction (coefficients)
Working hours		−0.067 (0.031)**
Age	−0.045 (0.003)***	0.003 (0.002)**
Sex	0.347 (0.076)***	−0.006 (0.032)
Education	−0.034 (0.005)***	−0.002 (0.002)
Marital status	0.499 (0.072)***	−0.081 (0.028)***
Family size	−0.008 (−0.013)	0.003 (0.004)
Child ratio	0.117 (−0.218)	−0.208 (0.076)***
Elder ratio	−0.225 (−0.154)	−0.024 (0.051)
Property ownership	−0.394 (0.072)***	−0.063 (0.026)**
Urban	0.318 (0.050)***	0.062 (0.019)***
Population size	−0.183 (−0.284)	−0.341 (0.090)***
Fixed-asset investment	0.017 (−0.021)	0.020 (0.007)***
Internet access	0.099 (−0.511)	0.523 (0.157)***
Locational fixed effects	Yes	Yes
IV1	0.064 (0.025)**	
IV2	0.646 (0.069)***	
Constant	3.851 (0.480)***	4.107 (0.270)***
Test for over-identifying restrictions		
Sargan test	χ^2=0.626, Prob = 0.429	
Sample size	15,336	

Note: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.
Standard errors are presented in parentheses.

Table A5
The bootstrapping test of threshold effects.

Threshold variable	Independent variable	Hypothesis test	*F*-statistics	Critical values		
				1%	5%	10%
Working hours	Job satisfaction	Test for single threshold	79.816***	6.115	5.828	3.871
		Test for double threshold	14.085***	−10.593	−12.383	−13.224
		Test for triple threshold	7.708***	4.320	4.308	2.676

Note: *** $p < 0.01$.
Bootstrapped simulation is conducted 3000 times.

Table A6
Variable definitions and descriptive statistics.

Variables	Definitions	Mean (S.D.)
Age^2	Squared term of age	2002.76 (1082.11)
No schooling	1 if respondent has not attended school, 0 otherwise	0.19 (0.39)
Primary school	1 if respondent has attended/completed primary school, 0 otherwise	0.19 (0.39)
Middle school	1 if respondent has attended/completed middle school, 0 otherwise	0.31 (0.46)
High school	1 if respondent has attended/completed high school, 0 otherwise	0.15 (0.36)
Junior college	1 if respondent has attended/completed junior college, 0 otherwise	0.08 (0.28)
Bachelor	1 if respondent has attended/completed bachelor study, 0 other wise	0.07 (0.26)
Master	1 if respondent has attended/completed master study, 0 otherwise	0.01 (0.07)
PhD degree	1 if respondent has attended/completed PhD degree study, 0 otherwise	0.00 (0.02)
Self-employment	1 if respondent is self-employed, 0 if respondent works for others	0.49 (0.50)
Agricultural sector	1 if respondent works in agricultural sector (forestry, stock farming, fishing, and other sideline productions)), 0 if respondent works in non-agricultural sector	0.40 (0.49)
Sample size		15,336
Company size	Number of employees (persons)	780.06 (7273.71)
Company size (Small)	1 if the company has fewer than 20 employees, 0 otherwise	0.38 (0.48)
Company size (Medium)	1 if the company has 21–100 employees0, 0 otherwise	0.30 (0.46)
Company size (Large)	1 if the has more than 100 employees, 0 otherwise	0.32 (0.47)
Management duty	1 if respondent has a managerial role, 0 otherwise	0.14 (0.35)
Pension	1 if the job provides pension, 0 otherwise	0.44 (0.50)
Health insurance	1 if the job provides health insurance, 0 otherwise	0.44 (0.50)
Work injury insurance	1 if the job provides work injury insurance, 0 otherwise	0.43 (0.50)
Maternity insurance	1 if the job provides maternity insurance, 0 otherwise	0.34 (0.47)
Sector1	1 if the job belongs to agriculture, forestry, animal, husbandry, and fishery sector, 0 otherwise	0.02 (0.13)
Sector2	1 if the job belongs to mining sector, 0 otherwise	0.02 (0.13)
Sector3	1 if the job belongs to manufacturing sector, 0 otherwise	0.29 (0.45)
Sector4	1 if the job belongs to electricity and water sector, 0 otherwise	0.02 (0.14)
Sector5	1 if the job belongs to construction sector, 0 otherwise	0.11 (0.32)
Sector6	1 if the job belongs to wholesale and retail trades sector, 0 otherwise	0.06 (0.23)
Sector7	1 if the job belongs to transport, storage, and postal sector, 0 otherwise	0.02 (0.14)
Sector8	1 if the job belongs to hotels and catering services sector, 0 otherwise	0.10 (0.30)
Sector9	1 if the job belongs to information transmission, software, and information technology sector, 0 otherwise	0.05 (0.23)
Sector10	1 if the job belongs to financial intermediation sector, 0 otherwise	0.03 (0.17)
Sector11	1 if the job belongs to real estate sector, 0 otherwise	0.03 (0.16)
Sector12	1 if the job belongs to leasing and business services sector, 0 otherwise	0.03 (0.17)
Sector13	1 if the job belongs to scientific research and technical services sector, 0 otherwise	0.01 (0.08)
Sector14	1 if the job belongs to environmental, water, and public facilities management sector, 0 otherwise	0.02 (0.12)
Sector15	1 if the job belongs to household repairs and household services sector, 0 otherwise	0.03 (0.18)
Sector16	1 if the job belongs to education sector, 0 otherwise	0.06 (0.24)
Sector17	1 if the job belongs to health and social service sector, 0 otherwise	0.03 (0.17)
Sector18	1 if the job belongs to culture, sports, and entertainment sector, 0 otherwise	0.01 (0.11)
Sector19	1 if the job belongs to public management, social security, and social organization sector, 0 otherwise	0.06 (0.25)
Sector20	1 if the job belongs to other sector, 0 otherwise	0.00 (0.02)
Sample size		6839

Note: S.D. refers to the standard deviation.

Table A7
Heterogeneous analysis by employment sector.

Variables	Threshold model

(*continued on next page*)

Table A7 (*continued*)

Variables	Threshold model		
	Single	Double	Triple
	Single	Double	Triple
Agricultural sector			
Working hours (< 8.571 h/day)	−0.003 (0.006)		
Working hours (≥ 8.571 h/day)	−0.019 (0.004)***		
Working hours (< 7.143 h/day)		−0.007 (0.008)	
Working hours (7.143–9 h/day)		−0.005 (0.006)	
Working hours (≥ 9 h/day)		−0.020 (0.005)***	
Working hours (< 7.143 h/day)			−0.006 (0.008)
Working hours (7.143–9 h/day)			−0.004 (0.006)
Working hours (9–12 h/day)			−0.018 (0.005)***
Working hours (≥ 12 h/day)			−0.026 (0.007)***
Control variables	Yes	Yes	Yes
Locational fixed effects	Yes	Yes	Yes
Constant	3.104 (0.107)***	3.117 (0.108)***	3.114 (0.108)***
Sample size	6149	6149	6149
Non-agricultural sector			
Working hours (< 8.571 h/day)	−0.012 (0.006)**		
Working hours (≥ 8.571 h/day)	−0.031 (0.004)***		
Working hours (< 7.143 h/day)		−0.002 (0.008)	
Working hours (7.143–9 h/day)		−0.016 (0.006)***	
Working hours (≥ 9 h/day)		−0.027 (0.004)***	
Working hours (< 7.143 h/day)			0.002 (0.008)
Working hours (7.143–9 h/day)			−0.013 (0.006)**
Working hours (9–12 h/day)			−0.023 (0.005)***
Working hours (≥ 12 h/day)			−0.028 (0.004)***
Control variables	Yes	Yes	Yes
Locational fixed effects	Yes	Yes	Yes
Constant	3.857 (0.067)***	3.812 (0.071)***	3.792 (0.072)***
Sample size	9187	9187	9187

Note: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.
Standard errors are presented in parentheses.

Table A8
Potential channels affecting job satisfaction: a mediation analysis.

Decomposition	Bias-corrected bootstrap		Sobel test
	Coefficient	SE	SE
Mediation path through physical health			
Total effect	−0.331***		0.091
Direct effect	−0.303***	0.091	0.090
Indirect effect	−0.028**	0.015	0.015
Mediation path through sleep duration			
Total effect	−0.331***		0.091
Direct effect	−0.334***	0.085	0.091
Indirect effect	0.003	0.005	0.005
Mediation path through leisure time			
Total effect	−0.331***		0.091
Direct effect	−0.329***	0.087	0.091
Indirect effect	−0.002	0.002	0.002

Note: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$; 500-replications bootstrapped standard errors are reported for bias-corrected bootstrap estimation. The endogeneity of working more than 9 h is also addressed by the 2SRI approach. Direct effects refer to the effects of working more than 9 h on job satisfaction. Indirect effects refer to the effects of working more than 9 h on job satisfaction mediated by the variables in question.

Table A9
Threshold impact of working hours on happiness and life satisfaction: threshold model estimation.

Variables	Threshold model		
	Single	Double	Triple

(*continued on next page*)

Table A9 (*continued*)

Variables	Threshold model		
	Single	Double	Triple
Impact on happiness			
Working hours (< 8.571 h/day)	−0.259 (0.067)***		
Working hours (≥ 8.571 h/day)	−0.278 (0.066)***		
Working hours (< 7.143 h/day)		−0.246 (0.067)***	
Working hours (7.143–9 h/day)		−0.261 (0.067)***	
Working hours (≥ 9 h/day)		−0.272 (0.066)***	
Working hours (< 7.143 h/day)			−0.246 (0.067)***
Working hours (7.143–9 h/day)			−0.261 (0.067)***
Working hours (9–12 h/day)			−0.271 (0.066)***
Working hours (≥ 12 h/day)			−0.274 (0.067)***
Control variables	Yes	Yes	Yes
Locational fixed effects	Yes	Yes	Yes
Constant	9.354 (0.586)***	9.289 (0.588)***	9.289 (0.588)***
Sample size	15,336	15,336	15,336
Impact on life satisfaction			
Working hours (< 8.571 h/day)	−0.036 (0.030)		
Working hours (≥ 8.571 h/day)	−0.046 (0.030)		
Working hours (< 7.143 h/day)		−0.036 (0.031)	
Working hours (7.143–9 h/day)		−0.039 (0.030)	
Working hours (≥ 9 h/day)		−0.046 (0.030)	
Working hours (< 7.143 h/day)			−0.036 (0.031)
Working hours (7.143–9 h/day)			−0.039 (0.030)
Working hours (9–12 h/day)			−0.046 (0.030)
Working hours (≥ 12 h/day)			−0.047 (0.030)
Control variables	Yes	Yes	Yes
Locational fixed effects	Yes	Yes	Yes
Constant	3.924 (0.267)***	3.922 (0.268)***	3.922 (0.268)***
Sample size	15,336	15,336	15,336

Note: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.
Standard errors are presented in parentheses.

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