

# Are Rich Earners Time-Privileged in Taiwan? The Evidence from 1981 to 2006

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**Abstract** This paper investigates how the relationship between income and working hours in Taiwan has changed over time. By using the official individual sample in the Manpower Utilization Surveys from DGBAS during 1981–2006, this study concludes that higher earners worked fewer hours as the economy is expanding and the price level increases in Taiwan; however, higher earners lose their time privileges as the economy relies on the service sector more than before. Furthermore, with regard to gender differences, it is found that higher earners still have time advantages relative to lower earners over time for male, but not so for female.

**Keywords** Taiwan · Time-privileged · Working hours

## Introduction

The relationship between earnings and working hours has been a prominent issue in labor economics for quite a while. Most of the research on earnings and working hours conducted by economists has focused on explanations for cross-sectional differences among individuals in terms of their working hours. Special attention has also been directed to measuring the effect of wages and nonwage income on working hours. However, there has been little analysis of changes in working hours over time.

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Over the twentieth century, working hours have declined by almost half, mostly because of rising wages brought about by a renewed economic growth, as well as the supporting role played by trade unions and collective bargaining, in addition to progressive legislation. Lee et al. (2007) found that working hours per week in most of the industrialized countries dropped steadily to about 40 hours after World War II. The decline has continued at a slower pace in Europe. For example, France has adopted a 35-hour workweek since 2000. Working hours in industrialized economies such as South Korea, however, are still much higher than in the leading industrialized countries, although they are also declining steadily.

In addition, according to Costa (2000), the relationship between income and working hours has been reversed over the past century in the United States. Costa (2000) showed that the distribution of working hours was very egalitarian in the 1890s when the most highly paid worked 2 hours less per day than the lowest paid. By 1973 differences in working hours between the top and bottom deciles were small and by 1991 workers in the top wage decile worked the longest day. This changing wage–hours relationship has implications for earnings inequality. In other words, in the past the highest earners used to work the longest hours, but this is not the case nowadays. Fuess (2006) also found that high income workers in Japan were time-privileged during 1976–1989, meaning that the highest earners worked the fewest hours; however, as working hours fell in the 1990s, the time privileges of the highest earners changed as well. Specifically speaking, although the highest earners still gained time advantages relative to the lowest earners, the highest earners lost some advantages relative to the median earners.

It is observed that Taiwan’s society has encountered a significant change within the last 50 years. The Taiwan economy has developed rapidly, and the political progress, on the other hand, has led to political freedom and the lifting of prohibitions that has unlocked a society that has been restrained over a long period of time. Therefore, changes in the political and economic environment and valuation have shaped a new relationship between work and leisure. According to Costa (2000) and Fuess (2006), as an economy develops, at first the lowest earners work the longest hours, and then the rich earners eventually come to work the longest hours. By using the official individual sample in the Manpower Utilization Surveys in Taiwan during the period 1981–2006, it is shown in Fig. 1 that the average income per month increased from roughly NTD 10,000 to NTD 30,000, while the

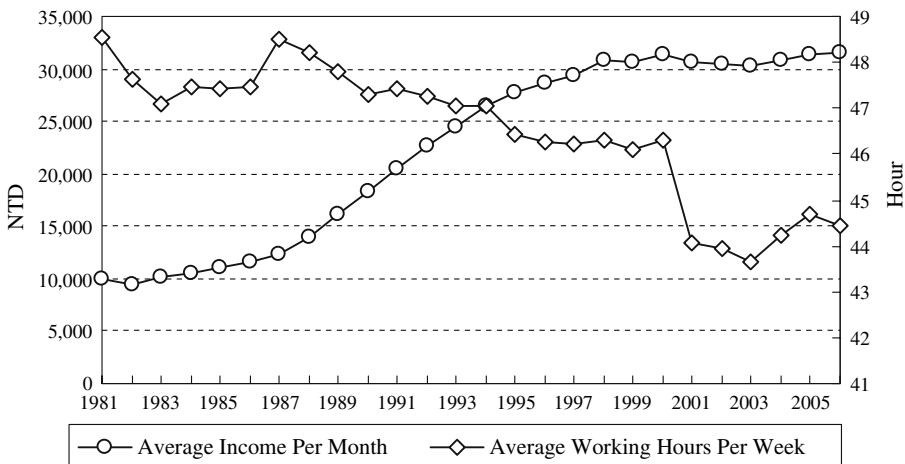


Fig. 1 Income and working hours in Taiwan: 1981–2006

average working hours per week decreased from 48 to 44. In fact, the Taiwan government implemented its 2 days of holiday every week in 2000, and hence working hours declined in 2001. Therefore, this study attempted to investigate whether rich earners work the longest hours in Taiwan, and also seeks to analyze the determinants of the decline in the average working hours since 1981.

The primary purpose of this study was to investigate the issue of whether or not rich earners have eventually come to work the longest hours in Taiwan. The remainder of this study is organized as follows. Section “Literature Review” provides a review of the literature on working hours followed by section “Changes in Working Hours in Taiwan” that provides a description of working hours during the research period in Taiwan. Section “Methodology and Data Description” introduces the empirical model, and section “Empirical Results” analyzes the estimation results. Finally, the concluding remarks are discussed in “Concluding Remarks” section.

## Literature Review

The length of the working period, together with income, has been a central issue in the field of industrial relations. Blyton (1989) indicated that labor has typically been purchased in temporal units (hours, days, weeks, years), there being an emphasis on time rather than task as the primary concern. Throughout this century, working time has been altered through reductions in the length of the workweek, increased holiday entitlement and a reduction in the working lifetime (by way of late entry to and/or early exit from the labor market), while the incidence of part-time work has increased significantly. In addition, Hinrichs et al. (1991) contended that in the initial stages of industrialization, employees were concerned about having sufficient time for recuperation from work. However, in the Golden Age of European economic growth in the 1950s and 1960s, the focus turned to the pursuit of leisure, followed more recently, as preferences for more individualized lifestyles emerged in the 1970s, by greater flexibility in working time.

Employers, from their own part, have attempted to move from a system of standardized working hours: (a) first, because of the requirement, arising from the intensive use of capital, that employees working hours outside the normal, socially-established time structure; (b) second, because of volatile demand patterns (particularly in the growing service sector); and (c) third, to attract workers whose preferred hours exactly meet those of the job. For this reason, Hill and Blyton (1987) indicated that employees’ preferences for flexibility are based on the concept of time sovereignty, while management’s desire for flexibility is founded on the increased uncertainty surrounding input prices, production possibilities, and product demand, which are largely driven by the coincidence of economic recession and the development of new and flexible manufacturing technology.

In the case of the UK, Fagan (2000) noted that working hour arrangements are determined to some degree by personal preferences. However, other factors are also important, such as the level of social security and taxation. For example, certain income and hours thresholds within the social security system create incentives for employers to design part-time jobs and to shorten hours of work. In addition, the availability of childcare facilities and the prominence of work-life balance policies can affect working hours.

Income may also affect the levels of working hours. In some cases higher income may induce people to offer extra hours of labor. However, this result is not clear cut as this relationship depends on the relative magnitudes of the income effect and the substitution effect. That is to say, there are two effects of a wage increase. First, the individual has a

higher income and so is more able to afford leisure time. In economics this is known as the income effect and may lead the individual to increase his or her consumption of leisure. However, the wage increase also means that the cost of consuming leisure has risen in terms of forgone income. This may lead the individual to switch his or her activity from leisure to work, and is known as the substitution effect. As Juster and Stafford (1991) pointed out, if income is high enough, the income effect will generally dominate and workers will consume more leisure as opposed to supplying labor. On the other hand, they also provide the example of the former Soviet Union to illustrate the income effect; whereby, low wages led workers to supply more of their labor to the market.

In addition to the change in income, the education level might play a role in working hours. Robinson and Godbey (1997) noted that Americans with a college education work longer hours than Americans with a less formal education, and, to a lesser extent, those with larger incomes or in professional occupations work the longest hours.

It is generally accepted that labor market variables are affected by movements in the business cycle. In particular, Millard et al. (1997) found that growth in total working hours is positive in times of economic expansion and negative during recessions. Handy (1997) also indicated that general changes in the structure of the economy, such as the move from an industrial to a postindustrial knowledge-based economy, can also have an impact on working hours. For example, industrial jobs tend to have set patterns of working time, while jobs in the knowledge-based economy tend to be more flexible with varied working hours.

Moreover, the labor union is also a factor that affects the number of working hours. In the case of the UK, Haskel et al. (1997) examined the impact of demand shocks on UK firms' responses, by using data from the Workplace Employee Relations Survey for 1990, and they found that, first, labor input is aligned to the business cycle. Second, firms with more flexibility are more likely to adjust employment or working hours than price or capacity, and third, manufacturing firms with a high proportion of part-time workers are most likely to adjust working hours. Haskel et al. (1997) also noted that the presence of trade unions may affect the level of working hours, as trade unions encourage the adjustment of hours, rather than employment, in order to protect the insider power of existing workers. In addition, Green (1988) adopted the General Household Survey and found that union presence was associated with a reduction in hours worked in the UK.

Drolet and Morissette (1997) attempted to establish a profile of Canadian workers who would have liked to change their working hours. Differences in preferences towards work time depend on both observed and unobserved individual and job characteristics. Most Canadians who would like a change in their workweek would prefer to work longer rather than shorter hours. In fact, Drolet and Morissette (1997) found that workers who want a shorter workweek are (a) professionals, managers and natural and social science workers, (b) have high earnings, (c) have high levels of education, (d) have long job tenure, (e) are employed in permanent jobs and (f) already work longer hours. These individuals can generally afford a reduction in working time without jeopardizing their standard of living.

Regarding the cross-national studies, Bell and Freeman (2001) argued that workers choose current hours of work to gain promotions and advance in the distribution of earnings. Since U.S. earnings are more unequally distributed than German earnings, the same extra work pays more in the U.S.; thereby, generating more hours worked. Bell and Freeman (2001) sought to explain the greater number of hours worked by Americans compared to Germans in terms of forward-looking labor supply responses to differences in earnings inequality between the countries. Supporting this inequality-hours hypothesis, Bell and Freeman (2001) showed that in both countries hours worked is positively related to earnings inequality in cross-section occupational contracts, and that hours worked raises

future wages and promotional prospects based on longitudinal data. On the other hand, Perrucci et al. (2007) provided another viewpoint that the 8-hour, 5-day work week has given way to longer workdays and workweeks, resulting in U.S. workers having significantly more hours at work than their counterparts in other industrialized economies. Moreover, Isgut et al. (2006) found that high-income Canadians take considerably more weeks of vacation per year than their American counterparts and are less likely to work long workweeks.

Other studies concerned with changes in working hours take into consideration the race, gender and marital status differences. Ciscel et al. (2000) indicated that the number of hours women spend in the labor force is increasing, but the number of hours women spend in the labor force is still less than the number of hours men spend in the labor force. Ciscel et al. (2000) also pointed out that while the families in the longitudinal analysis have been able to maintain fairly stable work and income patterns, the cross-sectional data indicate that families need to devote an increasing number of hours to the labor market to maintain economic stability. Abroms and Goldscheider (2002) indicated that married mothers appear to be more able to call on the earnings of their partners to reduce their working hours than mothers in other household situations. Christie-Mizell (2006) used the National Longitudinal Survey of Youth (NLSY) to show that African-American men, African-American women, and White women benefited more from the hours spent at work than White males. No other considerable differences emerge with regard to working hours.

Finally, Lin and Chen (2006) used the March and April match files of the 1992 Current Population Survey (CPS) conducted by the U.S. Bureau of Census to examine the effect of custody status on working hours by fathers. They found that, on average, custodial fathers relative to all other fathers are more likely to hold a full-time job and that they work more hours. In addition, a custodial father's marital status is closely correlated with his working hours and full-time working decision. Among custodial fathers, unmarried fathers are more likely to work full-time and for longer hours while married fathers are less likely to work full-time and will work fewer hours.

### Changes in Working Hours in Taiwan

Following the trend of globalization, and in order to cope with the economic development and globalization, an institutional change in employees' working hours referred to as *one week with 2 days off* has become an inevitable trend in Taiwan. However, the Taiwan government decided to implement this policy in phases to avoid the huge economic impact that might be felt. The Taiwan government thus first of all implemented a *2 days off every other week* policy in 1998. That is to say, the first and third weeks have 2-day weekends and the second and fourth weeks have 1.5-day weekends. This course of action was based on recognizing the importance of leisure, and on associating leisure with normality. However, in view of the opposition from some employers, this policy was not implemented by all private enterprises and thus gave rise to the weird situation of *one country two systems*. In fact, the officials or white-collar workers work 40 hours each week, but blue-collar laborers still have to work 48 hours each week. This reflects an unequal treatment of labor.

This study used an individual sample drawn from the official individual sample in the *Manpower Utilization Surveys* conducted by the Directorate-General of Budget, Accounting and Statistics (DGBAS), Executive Yuan, Taiwan (1986–2001) in order to calculate the average working hours per week of the 90th, 50th, and 10th income

**Table 1** Distribution of entire sample of working hours by income percentiles in Taiwan: 1981–2006

	Average working hours per week by income percentiles		
	1981	2001	2006
<i>Entire sample</i>	48.82	44.09	44.63
10th Percentile sample	41.88	36.94	38.42
50th Percentile sample	49.44	45.06	44.61
90th Percentile sample	51.56	45.99	46.71
	Ratio of working hours by income percentiles		
	1981–2000	2001–2006	
90th/10th Percentile	1.25 (0.02)	1.22 (0.03)	
90th/50th Percentile	1.04 (0.01)	1.03 (0.01)	
50th/10th Percentile	1.19 (0.02)	1.19 (0.04)	

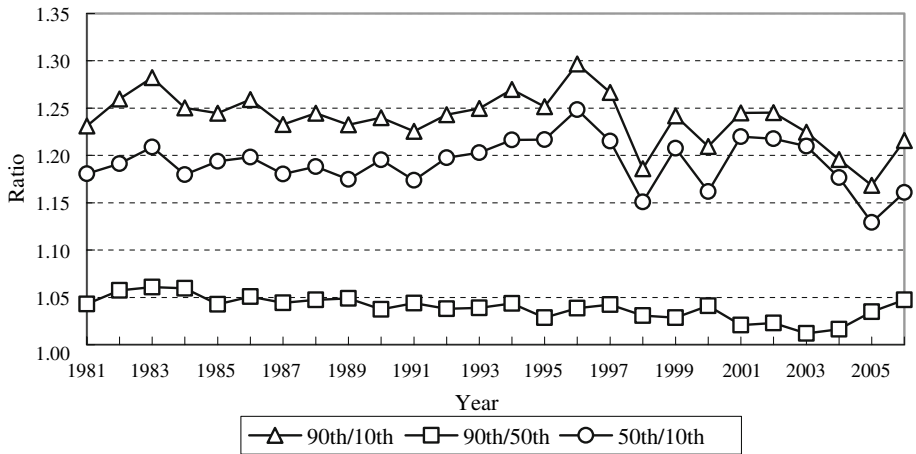
*Note:* Numbers in parentheses are standard deviations. From “Manpower Utilization Surveys,” by Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan, 1981–2006

percentiles in each year, and the ratio of average working hours of any two income percentiles as shown in Table 1.

In 1981, the rich earners exhibited the longest working hours (51.56). By contrast, the poor earners exhibited the shortest hours (41.88). During the 1981–2000 period, working hours decreased across all earnings deciles. If we consider the ratio of working hours for the 90th earnings percentile relative to the 10th earnings percentile, for the period 1981–2000, the ratio was 1.25, meaning that top earners worked roughly 3% more hours than bottom earners, and so low-income workers seemed to be time-privileged compared to the high-income workers. Moreover, median earners were also time-privileged compared to top earning workers. That is, if we also consider the ratio of working hours for the 90th earnings percentile relative to the 50th percentile, this ratio was 1.04 during 1981–2000. That is to say, median earners seemed to be time-privileged compared to high-income workers. Low-income workers, in turn, were time-privileged compared to the 50th percentile. The 50th/10th hour ratio was 1.19. When Taiwan implemented a 2-day holiday each week in 2000, the number of working hours for blue-collar workers declined in 2001. The changing social structure resulted in social morals and the value attached to working being switched to equilibrium work and leisure at the same level.

In 2001 the 90th earnings percentile still experienced the longest working hours (45.99, down from 51.56 in 1981); the 10th earnings percentile still exhibited the shortest working hours (36.94, down from 41.88 in 1981) worked. During 2001–2006, the 90th/10th hour ratio fell to 1.22. After the Taiwan government pressed for shorter working hours, rich earners were now scheduled to work roughly 2% more hours than poor earners. Compared to the 90th/10th hour ratio during 1981–2000, low-income employees now seemed to become less time-privileged than before.

The 90th/50th hour ratio, in turn, also fell to 1.03. By contrast, the 50th/10th hour ratio remained steady at 1.19. During the 2001–2006 period, working hours continued to increase across all earnings deciles, but the highest income employees seemed to gain some of their time advantages. This means that rich earners were willing to pay more and more attention to leisure, both in value and conceptual terms. As leisure behavior became recognized by social institutions and received economic support, the individual time



**Fig. 2** Ratios of total working hours in Taiwan: 1981–2006

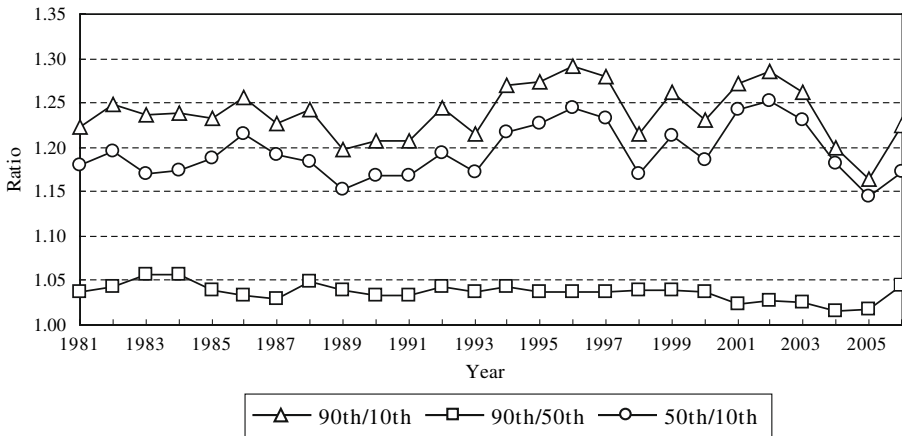
**Table 2** Distribution of male working hours by income percentiles in Taiwan: 1981–2006

	Average working hours per week by income percentiles		
	1981	2001	2006
<i>Male sample</i>	49.08	44.24	45.21
10th Percentile sample	42.44	36.51	38.86
50th Percentile sample	50.05	45.35	45.53
90th Percentile sample	51.90	46.42	47.57
	Ratio of working hours by income percentiles		
	1981–2000	2001–2006	
90th/10th Percentile	1.24 (0.03)	1.22 (0.05)	
90th/50th Percentile	1.04 (0.01)	1.03 (0.01)	
50th/10th Percentile	1.09 (0.03)	1.19 (0.04)	

*Note:* Numbers in parentheses are standard deviations. From “Manpower Utilization Surveys,” by Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan, 1981–2006

distribution was redistributed by leisure time, especially for upper income earners. As shown in Fig. 2, in the early-to-mid 1990s the time advantages of higher income workers were not pronounced. However, the figure also shows that in the late 1990s and early 2000s, top earners seemed to gain some of their time advantages.

With regard to gender differences, the figures are reported in Table 2. In 1981 the rich male earners exhibited the longest working hours (51.90); by contrast, poor male earners exhibited the shortest hours (42.44). During the 1981–2000 period, male working hours decreased across all earnings deciles. Again, if we consider the ratio of male working hours for the 90th earnings percentile relative to the 10th earnings percentile, during 1981–2000, this ratio averaged 1.24, meaning that rich male earners worked roughly 3% more hours than poor male earners; therefore, low-income male workers seemed to be time-privileged



**Fig. 3** Ratios of male working hours in Taiwan: 1981–2006

when compared with high-income male workers. Similarly, median male earners were also time-privileged compared to rich male earners because the ratio of working hours for the 90th earnings percentile relative to the 50th percentile was 1.04. Poor male earners, in turn, were time-privileged compared to those for the 50th percentile. The 50th/10th hour ratio averaged 1.09.

In 2001 the 90th earnings percentile still experienced the longest working hours (46.42, down from 51.90 in 1981); the 10th percentile still worked the shortest hours (36.51, down from 42.44 in 1981). For 2001–2006, the 90th/10th hour ratio fell to 1.22. With the Taiwan government pressing for shorter working hours, rich male earners were now scheduled to work roughly 2% more hours than poor male earners. Compared to the 90th/10th hour ratio during the 1981–2000 period, high-income male employees seemed to become more time-privileged than before.

The 90th/50th hour ratio, in turn, also fell to 1.03. By contrast, the 50th/10th hour ratio increased to 1.19, with the result that the time advantages of median male earners were eroded. During the 2001–2006 period, working hours continued to increase across all earnings deciles, but rich male earners seemed to gain some of their time advantages, relative to median male and poor male earners. As shown in Fig. 3, in the early-to-mid 1990s the time advantages of male higher income workers were not pronounced. However, the figure also shows that in the late 1990s and early 2000s, rich male earners also seemed to gain some of their time advantages.

On the other hand, Table 3 is the distribution of female working hours based on income percentiles. In 1981, the median female earners exhibited the longest working hours (47.93); by contrast, the lowest female earners exhibited the shortest hours (39.49). During the 1981–2000 period, female working hours decreased across all earnings deciles. The 90th/10th hour ratio was 1.20 during 1981–2000, meaning that rich female earners worked roughly 2% more hours than poor female earners, so that low-income female workers seemed to be time-privileged compared to high-income female workers.

By contrast, the rich female earners were time-privileged compared to median female earners because the ratio of working hours for the 90th earnings percentile relative to the 50th percentile was only 0.98. Low-income female workers, in turn, were time-privileged compared to the 50th percentile. The 50th/10th hour ratio averaged 1.22.



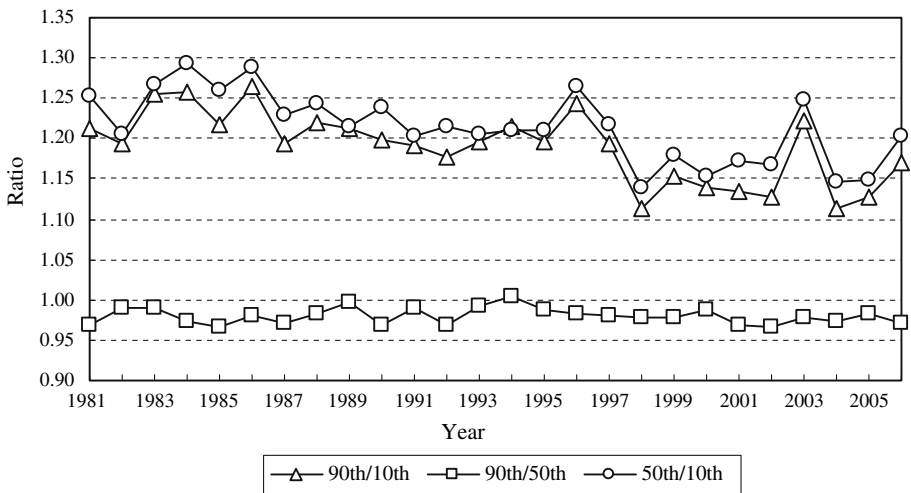
**Table 3** Distribution of female working hours by income percentiles in Taiwan: 1981–2006

	Average working hours per week by income percentiles		
	1981	2001	2006
<i>Female sample</i>	48.03	43.42	43.70
10th Percentile sample	39.49	38.31	37.29
50th Percentile sample	49.51	44.87	44.89
90th Percentile sample	47.93	43.42	43.60

	Ratio of working hours by income percentiles	
	1981–2001	2001–2006
90th/10th Percentile	1.20 (0.04)	1.15 (0.04)
90th/50th Percentile	0.98 (0.01)	0.97 (0.01)
50th/10th Percentile	1.22 (0.04)	1.18 (0.04)

*Note:* Numbers in parentheses are standard deviations. From “Manpower Utilization Surveys,” by Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan, 1981–2006



**Fig. 4** Ratios of female working hours in Taiwan: 1981–2006

In 2001 the 50th earnings percentile still experienced the longest working hours (44.87, down from 49.51 in 1981), while the 10th percentile still worked the shortest hours (38.31, down from 39.49 in 1981). For 2001–2006, the 90th/10th hour ratio fell to 1.15. Rich female earners were now scheduled to work roughly 2% more than poor female earners. Compared to the 90th/10th hour ratio during the 1981–2000 period, high-income female employees seemed to become more time-privileged.

The 90th/50th hour ratio, in turn, also fell to 0.97, and the 50th/10th hour ratio fell to 1.18. During the 2001–2006 period, working hours continued to increase in the 50th and 90th earnings deciles, but rich female earners seemed to gain some of their time advantages. This means that rich earners were willing to pay more and more attention to leisure. As shown in Fig. 4, in the early-to-mid 1990s the time advantages of female higher income

workers were not pronounced. However, the figure also shows that in the late 1990s and early 2000s, rich female earners also seemed to gain some of their time advantages.

## Methodology and Data Description

In order to explore how the relationship between income and working hours in Taiwan has changed, this study calculated the primary variable, the ratio of average working hours of the rich and poor income percentiles for each year, by using the official individual sample in the *Manpower Utilization Surveys* conducted by Directorate-General of Budget, Accounting and Statistics (DGBAS), Executive Yuan, Taiwan (1986–2001). However, the *Statistical Yearbook of the Republic of China (DGBAS 1986–2001)* was also needed to supplement some related variables. Because some variables are not available before 1981, such as the annual real output per employed person, the research period covered in this study ranged from 1981 to 2006.

According to the literature, we specified that the ratio of average working hours of the rich and poor income percentiles ( $WH$ ) is a function of the unemployment rate ( $UNEMP$ ), consumer price index ( $CPI$ ), the ratio of the service industry's output value to industrial output value ( $SERIND$ ), output per employed person ( $OPEP$ ), age ( $AGE$ ) and a time trend ( $TIME$ ). Therefore, this study established an empirical model which may be presented as follows:

$$WH_{i,j,t} = \alpha_0 + \beta_1 UNEMP_{t-1} + \beta_2 CPI_{t-1} + \beta_3 SERIND_{t-1} + \beta_4 \log(OPEP_{t-1}) + \beta_5 AGE_{t-1} + \beta_6 TIME_t + \varepsilon_t \quad (1)$$

In Eq. 1,  $\alpha_0$  represents the constant term of the equation,  $\varepsilon_t$  represents the error term with zero mean and variance  $\sigma^2$ , and  $t = 1981, 1982, \dots, 2006$ .  $WH_{i,j,t}$  denotes the ratio of average working hours of the  $i$ th and  $j$ th income percentiles in year  $t$ , where  $(i, j) = (90, 10), (90, 50),$  and  $(50, 10)$ , implying that there are three specifications of the regression model with different types of ratios of working hours used in this study, where the 90th/10th hour ratio is the top 10% income decile relative to the lowest 10% income decile, the 90th/50th hour ratio is the top 10% income decile relative to the median income decile, and the 50th/10th hour ratio is the median income decile relative to the lowest 10% income decile. In addition, to consider gender differences, all specifications of the regression were also estimated for the male and female samples, respectively. Therefore, nine regressions were estimated in this study.

The ratio of average working hours of the rich and poor income percentiles may be affected by macroeconomic variables, including the unemployment rate and consumer price index (CPI), reflecting changes in Taiwan's economy. Therefore, the variable  $UNEMP$  denotes the annual unemployment rate, and  $CPI$  represents the consumer price level. With regard to  $UNEMP$  representing economic conditions, Millard et al. (1997) found that the growth in total workings hours is positive in times of economic expansion and negative during recessions. Fuess (2006) further indicated that a growing economy means more work overall, especially for the lowest earners. That is to say, a lower unemployment rate implying a growing economy might lower the ratio of working hours of the rich and poor income percentiles. Therefore, this study expects that the influence of  $UNEMP$  on the ratio of working hours of the rich and poor income percentiles should be positive.

Another macroeconomic variable is the  $CPI$ . A higher level of the  $CPI$  implies a lower purchasing power of salary. In order to maintain a certain level of living, employees will work more hours with a high  $CPI$  than with a low  $CPI$ , particularly low income employees.

Therefore, this study predicts that the influence of the *CPI* on the ratio of working hours of the rich and poor income percentiles should be negative.

Regarding the economic structure, *SERIND* denotes the ratio of the services sector's output value to the industrial output value. According to Handy (1997), general changes in the structure of the economy such as the move from an industrial to a postindustrial knowledge-based economy, can also have an impact on working hours. As a matter of fact, industrial jobs tend to have set patterns of working time according to the *Labor Standard Act*, and, therefore, the difference in working hours between rich and poor workers should be small. However, in the service economy rich employees seem to work more hours than before, and poor earners' working hours do not change according to the *Labor Standard Act*. Thus, the ratio of average working hours of rich and poor employees will increase as the economy changes from an industrial to a service economy. It is thus hypothesized that the ratio of the services sector's output value to industrial output value might have a positive influence on the ratio of the average working hours of the rich and poor income percentiles.

In addition, *OPEP* is monthly real output per employed person, and represents the employee's productivity. According to Fuess (2006), any improvement in productivity should bolster labor demand. Such boosts, evidently, are concentrated among the highest earners. Therefore, this study expects that the influence of *OPEP* on the ratio of working hours of the rich and poor income percentiles should be positive.

Finally, *AGE* represents the ratio of age by income percentiles, with the same definition for the dependent variable. It has been proved by Craypo (1991) that working hours will decrease as employees get old and their health deteriorates. This study proposes that the influence of *AGE* on working hours is negative. However, the influence of *AGE* on the ratio of working hours of the rich and poor income percentiles might be uncertain, for it depends on the decreasing range of working hours of the rich and poor workers.

It is worth noting that all explanatory variables except for the time-trend are lagged one year in order to avoid any potential endogeneity problems between any of the independent variables and the dependent variable. In addition, the *OPEP* are deflated by the CPI deflator (base year = 1981). The definitions, descriptive statistics, and expected signs of the aforementioned variables are listed and described in Table 4.

## Empirical Results

The estimation results of Eq. 1 for the entire sample are presented in Table 5, and those for the male and female samples are in Table 6. The *F*-statistics in the three specifications for all types of sample provided by Tables 5 and 6 reject the null hypothesis which assumes that the coefficients are all zero for the different significance levels. Since some empirical specifications are found to have a heteroskedasticity problem (the  $\chi^2$  statistics of Breusch-Pagan all reject the critical value in  $\alpha = 0.01, 0.05, \text{ or } 0.1$ ), the corrected covariance matrix proposed by White (1980) was also used.<sup>1</sup> Moreover, the pair-wise correlation coefficients and auxiliary regression were adopted to test for the possible problem of multicollinearity. It is shown that none of the pair-wise correlation coefficients were greater than 0.7 and, thus, it was concluded that no multicollinearity exists in the empirical models. With regard to the  $R^2$  of the auxiliary regression, it was found to be less than 0.8, implying that there was no multicollinearity problem among all of the explanatory variables. Based on the

<sup>1</sup> In fact, the usual set of OLS results is given, but with a revised robust covariance matrix.

**Table 4** Descriptive statistics and definitions of variables

Variables	Definitions	Mean (S.D.)	Expected sign
A. Dependent variable			
$WH_{i,j}$	Ratio of average working hours of the $i$ th and $j$ th income percentiles	1.24 (0.03)	
B. Independent variables			
$UNEMP$	Annual unemployment rate (%)	2.65 (1.17)	+
$CPI$	Annual consumer price index (%)	2.43 (3.31)	-
$SERIND$	Ratio of service sector's output value to industrial output value (%)	1.81 (0.60)	+
$OPEP$	Monthly real output per employed person (CPI = 100 in 1981) (NT\$ per month)	39,037.39 (19,972.25)	+
$AGE$	Ratio of average age of two income percentiles (%)	0.98 (0.05)	-
$TIME$	Time trend = 1 in 1981 and increases by 1 for the following each year	13.00 (7.36)	?

Note: Numbers in parentheses are standard deviations. From “Manpower Utilization Surveys,” by Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan, 1981–2006

above tests for econometric issues, such as heteroskedasticity and multicollinearity, it is implied that the conclusions provided by this study are reliable.

For the entire sample, the empirical results presented in Table 5 show that the unemployment rate had a significant and negative impact on the ratio of working hours in Model 2, but a positive impact in Model 3. According to Fuess (2006), a growing economy means more work overall, especially for the lowest earners. However, this study suggests that as

**Table 5** Estimation results: entire sample

Dependent variable			
Average working hours of the $i$ th over the $j$ th income percentiles			
Variables	Model 1: 90th/10th	Model 2: 90th/50th	Model 3: 50th/10th
<i>Constant</i>	0.04 (0.02)	1.85 (3.62)**	-2.73 (-1.82) <sup>†</sup>
<i>UNEMP</i>	$0.82 \times 10^{-2}$ (0.82)	$-0.92 \times 10^{-2}$ (-2.79)*	0.02 (2.38)*
<i>CPI</i>	$-0.26 \times 10^{-2}$ (-2.90)**	$-0.15 \times 10^{-2}$ (-3.98)***	$-0.99 \times 10^{-3}$ (-1.07)
<i>SERIND</i>	0.06 (3.96)***	0.01 (1.47)	0.04 (1.78) <sup>†</sup>
<i>OPEP</i>	0.13 (0.45)	-0.10 (-1.97) <sup>†</sup>	0.38 (2.60)*
<i>AGE</i>	-0.15 (-0.94)	0.16 (3.32)**	0.07 (0.47)
<i>TIME</i>	-0.01 (-1.19)	$0.33 \times 10^{-2}$ (1.28)	-0.02 (-3.18)**
Sample size	26	26	26
Adjusted $R^2$	0.34	0.67	0.22
$F$ -statistic	3.13*	9.29***	2.16 <sup>†</sup>
$B$ - $P$ Statistic: $\chi^2$	13.82*	1.37	12.27 <sup>†</sup>
Auxiliary $R^2$	0.38	0.37	0.39

Note: The numbers in the parentheses are  $t$ -values

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ ; <sup>†</sup>  $p < .10$

**Table 6** Estimation results by gender

Variables	Male working hours			Female working hours		
	Model 1: 90th/10th	Model 2: 90th/50th	Model 3: 50th/10th	Model 1: 90th/10th	Model 2: 90th/50th	Model 3: 50th/10th
<i>Constant</i>	-0.96 (-0.39)	1.35 (2.80)*	0.26 (0.11)	2.00 (0.80)	1.76 (4.04)***	0.09 (0.59)
<i>UNEMP</i>	0.02 (2.01) <sup>†</sup>	-0.83 × 10 <sup>-2</sup> (-2.56)*	0.03 (3.27)**	0.47 × 10 <sup>-2</sup> (0.30)	-0.97 × 10 <sup>-2</sup> (-3.42)**	0.02 (1.54)
<i>CPI</i>	-0.22 × 10 <sup>-2</sup> (-2.05) <sup>†</sup>	-0.14 × 10 <sup>-2</sup> (-3.07)**	0.11 × 10 <sup>-2</sup> (0.92)	-0.24 × 10 <sup>-2</sup> (-1.53)	-0.11 × 10 <sup>-2</sup> (-1.98) <sup>†</sup>	-0.19 × 10 <sup>-2</sup> (-1.48)
<i>SERIND</i>	0.09 (3.24)**	0.02 (1.72) <sup>†</sup>	0.06 (2.09)*	0.01 (0.57)	0.02 (1.92) <sup>†</sup>	-0.12 × 10 <sup>-2</sup> (-0.04)
<i>OPEP</i>	0.23 (0.98)	-0.05 (-0.97)	0.13 (0.57)	-0.49 × 10 <sup>-2</sup> (-0.02)	-0.07 (-1.61)	0.20 (1.24)
<i>AGE</i>	-0.21 (-1.09)	0.15 (2.12)*	-0.51 (-2.09)*	-0.74 (-3.54)**	-0.10 (-1.80) <sup>†</sup>	-1.06 (-5.04)***
<i>TIME</i>	-0.02 (-1.90) <sup>†</sup>	0.56 × 10 <sup>-3</sup> (0.21)	-0.01 (-1.37)	-0.65 × 10 <sup>-2</sup> (-0.55)	0.15 × 10 <sup>-2</sup> (0.84)	-0.01 (-1.44)
Sample size	26	26	26	26	26	26
Adjusted R <sup>2</sup>	0.36	0.48	0.50	0.52	0.17	0.67
F-statistic	3.37*	4.86**	5.12**	5.59**	1.88 <sup>†</sup>	9.57***
B-P Statistic: $\chi^2$	4.76	11.45 <sup>†</sup>	3.72	11.04*	0.94	7.28
Auxiliary R <sup>2</sup>	0.38	0.46	0.44	0.41	0.39	0.43

Note: The numbers in the parentheses are *t*-values

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ ; <sup>†</sup>  $p < .10$

Taiwan's economy becomes better, the median earners decrease their working hours compared to their counterparts in both the highest and lowest percentiles. That is, the median earners gain their time privileges relative to the highest and lowest earners as the Taiwan economy is expanding.<sup>2</sup> Therefore, a decrease in Taiwan's unemployment rate implies that a growing Taiwan economy lifts the ratio of working hours of the 90th over the 50th income percentiles, but lowers the ratio of working hours of the 50th over the 10th income percentiles. However, such a decrease does not significantly affect the ratio of working hours of the 90th over the 10th income percentiles in Taiwan.

In addition, the *CPI* also plays an important role in the employee's working hours. As mentioned before, in order to maintain a certain living standard, employees will work more hours when the *CPI* is high than when it is low, particularly in the case of the median and low income employees. From Table 5, we found that as the price level (*CPI*) increased, both the ratios of working hours of the 90th over the 50th income percentiles and of the 90th over the 10th income percentiles decreased. This implies that the highest earners gain time privileges relative to the median and lowest earners as the price level increases. However, the ratio of working hours of the 50th over the 10th income percentiles was not significantly affected by any changes in the *CPI*.

With respect to the ratio of the services sector's output value to industrial output value, Table 5 indicates that there is a positive and significant impact of *SERIND* on the ratio of working hours in Model 1 and Model 3. As mentioned before, while an economy changes from an industrial to a service economy, rich employees seem to work more hours than before. However, poor earners do not change their working hours primarily based on Taiwan's *Labor Standard Act*. This study concludes that, when compared with poor earners, rich and median earners are losing their time privileges as the Taiwan economy relies on the service sector more than before. Therefore, the ratio of average working hours of the rich over the poor (Model 1) and of the median over the poor (Model 3) employees will increase as the economy changes from an industrial to a service economy in Taiwan.

Although Fuess (2006) indicated that any improvement in productivity (*OPEP*) should bolster labor demand, particularly among the highest earners, this study found that productivity gains erode some of the time privileges of median earners. In other words, an increase in employees' productivity will decrease the ratio of average working hours of rich over median employees (Model 2), but will increase that of median over poor (Model 3) employees.

In addition, the empirical results in Table 5 show that the coefficient of *AGE* was statistically significant and positive only in Model 2, indicating that rich earners will work more hours than their median counterparts as they become older. Finally, the coefficient of *TIME* was statistically significant only in Model 3, implying that as time goes by, the ratio of average working hours of median over poor earners will decrease. That is to say that, when compared with median earners, poor earners will lose their time privileges over time.

With regard to the gender differences, the empirical results for the three specifications of the models for each gender are presented in Table 6. For the male's working hours, Table 6 shows that the unemployment rate has a significant and negative impact on the ratio of male working hours in Model 2, but a positive impact in Models 1 and 3, i.e., median male earners lose their time privileges relative to their rich and poor counterparts as Taiwan's unemployment rate increases. The empirical results also show that the *CPI*

<sup>2</sup> According to the definition of the Phillips' curve, in general there is a trade-off relationship between unemployment and inflation. However, in considering the expected inflation, we can explain why there is no trade-off between inflation and unemployment in the long-run.

plays an important role in male employee's working hours. The coefficient of *CPI* is significant and negative in both Models 1 and 2, but not in Model 3. This implies that rich male earners gain time privileges relative to median and poor male earners as the price level increases.

In addition, the ratio of the service sector's output value to industrial output value (*SERIND*) had a positive and significant influence on the ratio of male working hours in all models in Table 5. That is to say, rich (poor) male earners lose (gain) their time privileges as the Taiwan economy relies on the service sector more than before. Regarding *AGE*, the results indicate that the coefficient of *AGE* is positive and significant in Model 2, but negative in Model 3, implying that median male earners gain more time privileges than their rich and poor counterparts as they are getting old. Moreover, the coefficient of *TIME* is negative and significant only in Model 1, implying that as time goes by, compared to poor male earners, rich male earners gain their time privileges over time. Finally, improvement in productivity (*OPEP*) does not have any significant impact on the ratio of the male's working hours.

As for the female's working hours, Table 6 shows that both the unemployment rate and the *CPI* had a negative and significant impact on the ratio of female working hours only in Model 2, implying that, compared to median female earners, rich female earners gain their time privileges as the Taiwan economy is contracting or has a higher *CPI*. However, the ratio of the service sector's output value to industrial output value (*SERIND*) has a positive and significant influence on the ratio of female working hours only in Model 2. That is to say, compared to median female earners, rich female earners lose their time privileges as the Taiwan economy relies on the service sector more than before. In addition to *AGE*, the results indicate that the coefficient of *AGE* is negative and significant in all models, implying that rich (poor) female earners gain (lose) their time privileges as they are get old. Finally, neither the improvement in productivity (*OPEP*) nor the time trend had any significant impact on the ratio of the female's working hours.

## Concluding Remarks

The primary purpose of this study was to investigate how the relationship between income and working hours in Taiwan has changed. This study therefore calculated the primary variable, ratio of average working hours of rich and poor income percentiles for each year, by using the official individual sample in the *Manpower Utilization Surveys* conducted by the DGBAS during 1981–2006. The findings of this study indicate that median earners gain their time privileges relative to rich and poor earners as the Taiwan economy is expanding. Moreover, rich earners gain time privileges relative to median and poor earners as the price level increases, and rich and median earners lose their time privileges as the Taiwan economy relies on the service sector more than before.

This study also found that productivity gains erode some of the time privileges of median earners, and the empirical results showed that rich earners will work more hours than their median counterparts as they become old. In general, as time goes by, the ratio of average working hours of median over poor earners will decrease. That is to say, when compared with median earners, poor earners lose their time privileges over time.

With regard to gender differences, median male earners lose their time privileges relative to their rich and poor counterparts as Taiwan's unemployment rate increases, and rich male earners gain their time privileges relative to median and poor male earners as the price level increases. In addition, rich (poor) male earners lose (gain) their time privileges

as the Taiwan economy relies on the service sector more than before, and median male earners gain more time privileges than their rich and poor counterparts as they are get older. As time goes by, when compared to poor male earners, rich male earners gain their time privileges over time.

Rich female earners gain their time privileges relative to median female earners as the Taiwan economy contracts or has a higher CPI. However, compared to median female earners, rich female earners lose their time privileges as the Taiwan economy relies on the service sector more than before. Finally, rich (poor) female earners gain (lose) their time privileges as they are get older.

To sum up, compared to lower income earners, higher income earners have become even more time-privileged as the economy is expanding and the price level increases. However, the higher income earners lose their time privileges as the economy relies on the service sector more than before. In other words, if rich earners have become even more time-privileged than poor earners, then a growing income inequality may develop. In fact, Lee (2001) has also demonstrated that changes in the labor market activity of family heads substantially contribute to the increased inequality, accounting for half of the increase in the income gap between families in the top and bottom income deciles. In particular, the sharp relative decline in employment and working hours for the heads in the lowest 10th families is a major source of increased inequality. Furthermore, although relative to the lowest decile, employees in the highest earnings decile are still more time-privileged. However, compared to median earners, the time advantages of rich earners have been eroded. Therefore, as in the U.S. and Japan, there is a trend that the time advantages of rich earners does not remain in Taiwan. It is thus also essential for future research to focus on other countries to see if rich earners are still time-privileged.

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