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Do Japanese Work Shorter Hours than before?: Measuring Trends in Market Work and Leisure Using 1976-2006 Japanese Time-Use Survey

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Abstract

Using Japanese time-use data from the *Survey on Time Use and Leisure Activities* (STULA), this paper measures trends in average hours worked (market work) and leisure for Japanese over the past three decades. OECD reports at least a 15 percent decline in market work for Japan since the 1970s. However, holding demographic changes constant, we found that market work per week increased from the 1970s until mid 1980s, and has been relatively stable for the last two decades for both male and female full-time workers. Furthermore, although the market work per week remained relatively constant since the mid 1980s, we found a significant change in the allocation of time to market work within the week during the period. Specifically, when dividing samples into weekdays (Monday through Friday) and weekends (Saturday and Sunday), average hours spent for market work per weekday among full-time males increased by 0.4 hour since the mid 1980s, whereas a significant decline in market work on Saturday was observed. This suggests that people shifted their work time from Saturday to weekdays in response to the reduced work week introduced by the amendment of the Labour Standards Act at the end of 1980s. In the meantime, commuting time and home production had decreased by 3 hours since the mid-1980s for full-time female workers, indicating that the average hours of leisure had increased for females even though market work remained the same. Interestingly, however, hours for sleep declined consistently over the last three decades, resulting in a 3-4 hour reduction per week for both male and female workers. Lastly, a comparison of Japanese and US time use data suggests that Japanese work much longer than their American counterparts. On average, Japanese males work 8.6 hours longer per week, and Japanese females 6.5 hours longer, than Americans, even after adjusting for demographic differences between the countries.

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Micro data used in this paper are data from the *Survey of Time Use and Leisure Activities* (Statistics Bureau, Ministry of Internal Affairs and Communications; MIAC) and the *American Time Use Survey* used in Aguiar and Hurst [2007]. The aAuthor deeply appreciates the MIAC and Professor Aguiar for their providing the preciousthei r valuable data. The aAuthor also would also like to thank Naohito Abe, Reiko Aoki, Akira Kawaguchi, Daiji Kawaguchi, Ryo Kambayashi, Yukinobu Kitamura, Kazuo Koike, Yoko Konishi, Toshiyuki Matsuura, Yuichi Mizumachi, Sadao Nagaoka, Hiroyuki Odagiri, Fumio Ohtake, Yosuke Okada, Hiroyuki Okamuro, Kunio Okina, Hiroko Okudaira, Noriyuki Takayama, Kotaro Tsuru, Yasushi Tsuru, Iichiro Uesugi, Kengo Yasui, Kouzo Yamaguchi, Isamu Yamamoto, Shinji Yamashige and Hiroshi Yokouchi for their valuable comments. Tomiko Noguchi provided excellent research assistance. The remaining errors are solely of my own. This research is supported by the Japanese government's *Grants in aid for young scientists* (Japan Society for the Promotion of Science; Research No.19730167).

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1. Introduction

Using Japanese time-use data from the *Survey on Time Use and Leisure Activities* (hereafter, STULA), this paper aims at measuring trends in hours worked (market work) and leisure for Japanese over the past three decades. STULA is a rich time-use survey that has been taken by the Japanese government (the Ministry of Internal Affairs and Communications; MIAC) every five years since 1976.

According to OECD statistics, there are large differences across countries in trends of hours worked over the past forty years[1]. For example, hours worked since 1970 has declined notably in Germany and France, but has been roughly flat in the US (see Figure 1). For Japan, annual average hours worked fluctuated around 2,100 hours per year from 1970 to the mid 1980s, then began declining rapidly at the end of the 1980s, and stood at about 1,784 in 2006. Japan had long been categorized in the group of OECD countries with the longest hours worked, but in 1998 was overtaken by the US.

Some suggest that this decline in Japan's hours worked is due to the reduction of the (straight-hour) work week, from 48 hours to 40 hours, mandated by the 1988 amendment to the Labor Standards Act. Due to this amendment, many firms introduced a five-day work week (instead of six days) beginning in the late 1980s. Hayashi and Prescott (2002) suggest that Japan's period of low growth in the 1990s, often referred to as Japan's "lost decade," can be

[1] There is a considerable body of research attempting to explain these cross-country differences in hours worked, including Prescott (2004), who argues that the length of hours worked can be explained by country differences in marginal tax rates through a substitution effect, Blanchard (2004), who finds difference among countries in the preference for leisure, and Alesina, Glaesaer, and Sacerdote (2006), who suggest institutional differences such as unions and pension systems, as well as social norms.

explained by two main factors; (1) the more than 10 percent reduction in work hours caused by the Act's amendment and (2) the decline in total factor productivity.[2]

In contrast with the decreasing trend observed in these long-term official statistics, however, an increase in "overworking" by full-time employees (especially males) has recently become a serious issue in Japan. Some claim that hours worked of full-time workers is higher than ever because of globalization, internet usage, the decline in the number of regular employees due to dismissals caused by the lost decade[3]. The Japanese term *karoshi*, often translated as death from overwork (overwork and excessive stress can cause health problems, such as cerebral/heart diseases, mental disorders, and, eventually, death) has been widely used throughout the media, especially since the 1990s.

To our knowledge, however, there has been no analysis that closely examines how average hours worked has evolved in Japan from a relatively long-term perspective. The Japanese data used by the OECD is originally from the *Monthly Labor Survey* (the Ministry of Health, Labor and Welfare; MHLW), which surveys the work hours of employees in establishments with 30 or more employees (including both full-time and part-time). This survey asks establishments the number of hours worked for which wages were paid. It has long been noted that there is a fairly large discrepancy in Japan between work hours for which establishments pay wages and

[2] See Motonoshi and Yoshikawa (1999) and Kobayashi and Inaba (2006) for other explanations for the Japan's prolonged recession during the 1990s. Regarding empirical literature that examines the effect of work hour regulation on the actual work hours for other countries, see Hunt (1999) for Germany, Hamermesh and Trejo (2000) for the United States, and Crepon and Kramarz (2002) for France.

[3] This argument is made in books by Ogura (2007) in his title *Endoress woukazu* (*Endless workers*), and Morioka (2005) in his title Hatarakiguzi no Jidai (*An era of overwork*) (both in Japanese). Those arguments include that because of employment adjustments necessitated by the severe recession, a huge work burden was placed on the employees who remained. Genda (2005) uses the *Employment Status Survey* (the Ministry of Internal Affairs and Communications; MIAC) to point out that the fraction of full-time male workers who work more than 60 hours per week increased from 20% in 1992 to 27.6% by 2002.

hours that workers actually work (so called *unpaid work*).[4] Nevertheless, because the data on actual hours worked collected from individuals are believed to contain measurement errors from differences in both memory and perception, it has long been considered difficult to get an accurate picture of how hours worked has evolved over time.

This paper tries to measure trends in hours worked for Japanese over the past three decades using Japanese time-use survey.[5] STULA is a rich survey which collects time diaries of more than 200,000 Japanese citizens aged above 10 over a two-day period. Like other time-use surveys reported in other countries, STULA asks each interviewee to record his/her activities in 15 minutes increments over a 24-hour period. Therefore it is likely to have less error caused by differences in recollection or perception than those surveys that require individuals to report their hours worked over a period of a week or a month.[6]

In addition, this paper takes into account the three factors. The first is adjusting changes in average hours worked brought about by demographic and lifestyle changes following Aguiar and Hurst (2007). There have been a number of changes in Japan's demographics and lifestyles compared with 30 years ago, including a rising share of elderly, lower fertility rates, an increasing number of years in education, a decline in the marriage rate, and a diversification of types of employment, including an increase in part-time workers and a decline in the proportion

[4] *Unpaid work* exists in countries other than Japan, as well. For example, Bell and Hart (1999) found an average of 1.9 hours of unpaid work per week in the UK. There is a possibility, however, that unpaid work is much longer in Japan. For example, surveys of full-time employees conducted by the Japan Institute for Labor Policy and Training and the Japanese Trade Union Confederation both found that approximately 40% of respondents had worked unpaid overtime, and that the amount of that overtime averaged over 30 hours per month (Ogura and Fujimoto [2005] and the Research Institute for Advancement of Living Standards [2007]).

[5] Time-use surveys have been increasingly used in the field of both sociology and economics over the past two decades. Those literature include, for example, Justor and Stafford (1991), Shor (1991), Robinson and Godbey (1999), Hamermesh (1996), Hamermesh and Pfann (2005), and Ramey and Francis (2006) .

[6] For example, in their analysis of American time-use data, Robinson and Godbey (1999) show that the longer the hours worked, the more it becomes likely for worker's recollection of the actual number of hours worked to generate upward bias.

of self employed. Without controlling for these changes, the trend in average hours worked would paint a different picture. Specifically, if on average, people work long hours while young, and gradually reduce their hours worked as they age, a rising elderly population would create a downward bias in hours worked even though each individual's hours worked had not changed over time. Meanwhile, assuming people who are single or who have less children tend to work somewhat longer hours than those who have a larger family, since they have relatively less need to do nonmarket work (such as home production and child care), the recent trend of more individuals marrying later in life and having less children may produce an upward bias in average hours worked. A measurement of changes in average hours worked without taking account of these compositional changes would generate a change in the trend on the macro level, even without any changes in the distribution of hours on the individual (micro) level. This paper takes this into account by measuring hours while holding the above demographic changes constant.

Second is the measurement of leisure separate from the time spent for market work. In recent years, home production has increasingly been substituted with either capital (from the development and improvement of household appliances) or the growing number of outsourcing services. If these changes have brought about a decline in hours in home production, there is a possibility that leisure increases even when an increase in market work is observed. Aguiar and Hurst (2007) found a secular increase in market work by US females since 1965, but also found an increase in leisure during the same period as a result of a decline in home production. This paper also focuses on measuring leisure and its changes over time.

Third, we focus not only trends in people's time allocation per week, but also time allocation within a week. As noted above, Japan had experienced a reduction of work week from

six-days to five-days in the end of 1980s. We look how this institutional change had affected people's time allocation overtime.

The results of this paper can be summarized as follows. First, holding demographic changes constant, the average hours worked per worker increased from 1976 until 1986 by about two hours, and remained relatively stable over the two decades since then. This implies that the downward trend observed in Figure 1 can be explained mainly by demographic/compositional changes. Second, when further dividing samples into weekday respondents (Monday through Friday) and weekend respondents (Saturday and Sunday), hours worked per weekday for full-time male employees increased 0.68 per day from 1976 to 1986, and increased another 0.42 hours per day from 1986 to 2006, which comes to a total increase of 1.1 hours per day over the 30 years ended 2006. In contrast, hours worked on Saturday decreased 1.62 hours from 1986 to 2006. These observations suggest that people shifted their hours worked from Saturday to weekdays after the legal work week was shortened at the end of the 1980s. In other words, even though the total hours worked per week remains unchanged, time allocation within the week has changed drastically over the last two decades. Third, although weekly hours worked remained relatively constant for those two decades, commuting time and home production for female full-time workers had decreased by 3 hours since 1986. This means that the average hours of leisure increased for females even though hours worked remained the same. In the mean time, however, time spent for sleep had declined since 1976, by almost 3 hours per week for full-time female employees, despite the gain in leisure. The decreasing trend in sleep is also observed among full-time male workers, for whom the data shows a decline of more than 4 hours per week over the 30-year period. Lastly, comparison of the Japanese and US time use data suggests that male

Japanese full-time workers work about 8.6 hours longer per week, and the females about 6.5 hours longer, than American workers, even after adjusting for demographic differences between the countries.

This paper is organized as follows. We start in the next section by observing trend in hours worked without adjusting for demographic changes, and then compare this with other official data, including those used in OECD statistics. In section III, we measure hours worked after adjusting for demographic and lifestyle changes. In section IV, we limit the sample to full-time male employees and observe the trend in hours worked by weekday and weekends as well as years of education and age. In Section V we measure trends in leisure, and in Section VI we make some comparisons between Japan and the US using both countries' time-use data. Section VII concludes.

2. Hours worked -- unadjusted for demographic changes

We start by observing trends in weekly hours worked per employee (excluding the self-employeed), prior to adjusting for demographic changes. Hereafter, we define time spent on market work to earn income as *market work* to distinguish from time spent on nonmarket work such as home production, which we look at further in another section.

In Figure 2, we plot weekly *market work* per employee from three different official statistics: (1) the *Monthly Labor Survey* (MHLW) used in OECD statistics (solid line), (2) the *Labor Force Survey* (MIAC; thick line) and (3) STULA (dots with numbers).[7] In STULA[8], we

[7] Since STULA is taken during October, we also use the October surveys for other two statistics. As noted earlier, the *Monthly Labor Survey* is a survey of establishments with at least 30 employees, and therefore the data does not include the hours worked by employees at establishments with less than 30 employees. The

use the category called *work*, to measure *market work* per week.[9] This excludes break or meals between work hours. The survey covers every day of the week (from Monday through Sunday), such that, assuming a sufficient number of samples, the averages can be interpreted as the hours spent on *market work* per week.

As noted earlier, the *Monthly Labor Survey* asks establishments their paid work hours. The *Labor Force Survey* and STULA both asks individuals actual hours worked. The main difference between the latter two is that the former asks the approximate hours worked during the last week of the previous month, whereas the latter asks the kind of activities done every 15 minutes for 24 hours.

It is interesting to see in Figure 2 that the *Labor Force Survey* and STULA almost coincide. It had long been considered difficult to get an accurate assessment of *market work* from data such as the *Labor Force Survey* due to measurement errors. At the same time, time-use surveys are often criticized as having a downward bias on *market work*, since they require respondents to record their activities every 15 minutes, and this supposedly makes it more difficult to collect answers from busy people. However, on average, Figure 2 shows no such bias between the *Labor Force Survey* and STULA[10].

Another characteristic shown in Figure 2 is that hours of *market work* reported by individual surveys are considerably longer than paid work hours reported by firms, by

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Labor Force Survey and STULA both cover all workers, regardless of firm size. This makes it important to keep in mind the limitations on any strict comparisons among the three.

[8] For details on STULA, see the appendix.

[9] Unless noted otherwise, all analysis from this point forward is based on calculations using weights provided by the Statistics Bureau of the MIAC.

[10] One may think that if the *Labor Force Survey* and STULA almost coincide, there is no need to look at STULA. However, the lack of any detailed information regarding individuals' characteristics as well as other time allocations in the *Labor Force Survey*, make it still worthwhile to use STULA to study allocation of time.

approximately six to seven hours per week. It has been said that there is a certain amount of *unpaid work* in Japan – and the discrepancy in the figure corresponds to the unpaid time. If one calculates annual hours worked by simply multiplying the *market work* in STULA by 52 weeks, it becomes 2,262 hours per year in 2006, which is more than 400 hours higher than the data reported in OECD[11]. In this regard, it is also conceivable that the per hour productivity calculated in OECD statistics may be overestimating Japan's productivity.

Overall, the common feature observed in this figure is the downward trend in all three statistics over the past several decades. That is, average *market work* per employee is actually decreasing, regardless of the type of statistics used[12]. In the next section, we look further at whether there is still a downward trend in *market work* after controlling for compositional changes in demography and lifestyle.

3. Hours worked -- adjusted for demographic changes

3.1 Quick overview of demographic changes

In this section, we measure weekly hours of *market work* after adjusting for demographic changes. Tables 1(1) and 1(2) show demographic changes for the past three decades for male and female workers aged 22 to 65 (excluding students), based on micro data from STULA.[13] The

[11] Nickell (2006) showed that the increase in vacation days in European countries was one factor pushing down annual hours of *market work*. According to the *Employment Conditions Survey* (MHLW), however, the average number of vacation days taken annually by Japanese over the past 30 years has been fairly constant at around eight days, which suggests there has been no impact from an increase in vacation days.

[12] In Figure A-1, I decomposed the change in hours worked by employee into (1) change in hours worked by full-time, (2) change in hours worked by part-time and (3) full-time / part-time ratio. As can be seen in the figure, full-time/ part-time ratio is the main cause of pushing down the average hours worked.

[13] From this point forward, we limit the sample to workers aged 22 to 65 (excluding students) in order to omit such factors as rising matriculation rates and changes in the proportion of students working part-time.

shares shown in Tables 1(1) and 1(2) are roughly the same as the values in the *Population Census* (MIAC) taken the year prior to each survey year.

Tables 1(1) and 1(2) show the following common trends for both males and females over the past 30 years: (1) declines in the marriage ratio, (2) increases in the elderly, (3) increases in individuals with higher education, (4) declines in the ratio of those with a child less than six years old, (5) increases in part-time workers[14], and (6) declines in the percentage of self-employed.

3.2 Method for adjusting for demographic changes

We look at per-capita trends in time allocation for three groups: (A) workers (including the self-employed), (B) employees (excluding the self-employed) and, (C) full-time employees (with at least a 35-hour work week). The adjustment for demographic changes is done as follows.

(1) For each survey year, place samples from (A) to (C) into each classification (hereafter, "cell") as shown below.

(A) Sex x Age (10-year increments) x Marital status x Having a child under age six x Education level (college or more, high school, up to junior high) x Work status (full-time or part-time) x Self-employed

(B) Sex x Age (10-year increments) x Marital status x Having a child under age six x Education level (college or more, high school, up to junior high) x Work status (full-time or part-time)

(C) Sex x Age (10-year increments) x Marital status x Having a child under age six x Education level (college or more, high school, up to junior high)

Nevertheless, the inclusion of persons under age 22 and students in the sample has almost no impact on the results of this paper.

[14] We treat as full-time employees those who answered that they usually work at least 35 hours, and treat as part-time employees those who answered they usually work less than 35 hours per week. .

(2) Pool the cells from each year and calculate the sum of total samples in each cell for all survey years combined.

(3) Divide the number of samples for each cell found in (2) by the sum of total samples for all survey years to calculate each cell's share. We use these shares as the constant weight from 1976 to 2006.

By using these weights, we observe changes in *market work* over time that would have occurred had there been no demographic change. In case the number of samples was too small, cells were combined. Specifically, since most people with a child less than six years old are married in Japan, that distinction was eliminated for singles. It was also eliminated for the categories of aged 50-59 or 60-64. After these adjustments, the number of cells for each year wound up being 312 for (A), 156 for (B), 78 for (C).

3.3 Market work after adjusting for demographic changes

Table 2 shows *market work* per week when holding demographic and lifestyle changes constant. The first three rows show *market work* per worker, per employee and per full-time employee by combining male and female samples. We find that without adjusting for demographic and lifestyle changes, a completely different picture can be observed for the evolution of hours spent on *market work* in Japan. The right column of the table tells us that without adjusting demographic changes, *market work* per week has declined by 1.48 hours per worker and 1.75 hours per employee from 1976 to 2006. However, when holding demographics and lifestyles constant (the middle column of the table), *market work* has increased by 1.39 hours per worker, and 2.51 hours per employee, for the last three decades. The largest differences occurred with employees, suggesting the increase in number of part-time workers has pushed the average

market work hours down significantly. For full-time employees, the increase in *market work* is revised upward from 1.94 to 3.33 hours when holding demographic changes constant. For all groups, we can see that the largest increase in *market work* for the last three decades occurred in the first decade from 1976 to 1986, and that it has not changed much since 1986. The results of significance tests for the differences in two years are reported in the parenthesis. Although a modest decline in *market work* was observed during the *lost decade* in the 1990s, *market work* had picked up again by 2006 after the economic recovery, close to the 1986 level. This would suggest that the modest decline in the 1990s is due in part to the prolonged recession, rather than a reduction in the work week following the amendment of the Labor Standards Act in the late 1980s.

Similar trends can be observed for males. The fourth to sixth rows show the average *market work* for males. *Market work* increased by 3 to 4 hours for the first decade and then remained constant from 1986. On the other hand, female's *market work* (seventh to ninth rows) has not changed much for the last 30 years when holding demography constant, except for a 1.4 hour increase from 1976 to 1986 for full-time employees. Notable differences can be seen for females, both workers and employees, between the figures with demographic adjustment and those without. This comes from the fact that the fraction of female part-time workers nearly doubled from 1976 to 2006 (see Table 1(2)).

In summary, we can conclude that when controlling for demographic changes, *market work* per week in Japan has not decreased, but rather increased significantly from 1976 to 1986 and remained relatively constant for the subsequent 20 years. This trend can be observed even when limiting the samples to full-time male employees (see Figure 3).

In Figure 4, we plot histograms of weekly *market work* for full-time male employees for 1976, 1986, 2001 and 2006 using 78 cells used to control for demographic changes. This is to check whether there was any observable diversification in the average *market work* among those cells for the past two decades. We can see that the histogram seems to shift to the right from 1976 to 1986 along with a slightly increasing dispersion. The histogram shifted back to the left in 2001, with some widening dispersion, when the Japanese economy hit the bottom of a severe recession. However, following a mild economic recovery after 2002, the histogram shifted back to the right again in 2006, when the distribution's position and shape were quite similar to those observed in 1986. In Table 3, we calculate the trend in demography adjusted *market work* by disaggregating the samples into different educational levels or age groups. Table 3 shows substantial differences in the change in *market work* depending on educational level and age group. For those with a college degree or higher, *market work* increased almost six hours from 1976 to 1986, and remained unchanged for the subsequent 20 years. On the other hand, the *market work* of those with a high school diploma or less increased two to four hours from 1976 to 1986, followed by a 2 to 2.5 hour decrease from 1986 to 2001 during the recession, and returned to similar level of 1986 in 2006. Our finding is somewhat similar to that of Aguiar and Hurst (2007), which suggests an increasing in leisure among the less educated using the American time-use survey. In Japan, however, the dispersion narrowed again after the recovery[15]. All age groups except those in their sixties have shown an increase in *market work* since 1976, although the level of increase differs across age groups, with the largest increases coming from those in their twenties and thirties. From 1986 to 2001, however, the *market work* of all age groups except

[15] Since Japanese full-time males do not spend much time on home production (their average hours spent on home production <housework + childcare + caring or nursing> was only 1.58 hours per week in 2001), hours worked (*market work*) can be regarded as the mirror image of leisure.

those in their thirties decreased about 1.5 to 2.5 hours per week, whereas the *market work* of those in their 30s, after a 4.5 hour increase from 1976 to 1986, remained unchanged for the subsequent 20 years. This suggests the widening discrepancy in the 1990s is due to differences in not only education but also age. In 2006, almost all age groups increased *market work* to near their 1986 level, with the exception being those in their 40s, who increased their market work by an additional 1.69 hours over 1986 by 2006, recording the longest *market work* for this age group in the past 30 years. Overall, while there was a widening gap among educational level and age groups during the *lost decade*, there was no significant change in weekly *market work* between 1986 and 2006 for most groups.

If this is a fact, there remains a puzzle as to why the prevailing sentiment in Japan is that full-time males' *market work* hours are longer now than they used to be, as stated in the Introduction. To find out, we will take a more detailed look at full-time male employees in the next section.

4. Market work for full-time male employees -- adjusted for demographic changes

4.1 Distribution of weekly hours worked

For a closer look, we divide the samples into three groups: weekday (Monday through Friday), Saturday and Sunday respondents. This is because after the amendment of the Labour Standards Act reduced the legal work week from 48 to 40 hours in the late 1980s, many firms moved from a six-day work week to a five-day work week. The ratio of those in our samples who take two days off every week increased from 14 percent in 1976 to 49 percent in 2006.

Figures 4 (1) to (3) show histograms of *market work* per day by weekday, Saturday, and Sunday using raw samples (without adjusting for demographic changes). For weekdays, the histogram shifted to the right from 1976 to 1986. In 2006, the distribution shifted further to the right and became more dispersed, suggesting an increasing discrepancy among hours for weekday *market work*. For Saturday, the histogram shifts to the right somewhat from 1976 to 1986. In 2006, the mean of the histogram declined significantly due to a large spike around zero. This reflects the reduction of the legal work week in the late 1980s. There was also an increasing discrepancy in the 2006 Saturday samples. For Sunday, the shape of the distribution has not changed drastically, although the zero spike increased slightly in 2006.

Taking these observations into account, in Table 4, we calculate the fraction of *market work* per day by weekday, Saturday, and Sunday. In 1976, 17.1 percent of workers worked more than 10 hours on weekdays, and this ratio increased consistently over the last 30 years, reaching 42.7 percent in 2006. On the other hand, as suggested in the histograms in Figures 4(2), the fraction of zero hours on Saturday increased drastically, especially after 1986. These observations suggest that even though weekly *market work* remained relatively constant for the last two decades, time allocation within the week may have changed significantly. We will see whether such implication remains robust after controlling for demographic changes.

In Tables 5(1) to (3), we calculate *market work* per weekday, Saturday and Sunday by holding demographic changes constant. These tables show that *market work* per weekday increased 0.68 per day from 1976 to 1986, and increased additional 0.42 hours per day from 1986 to 2006, a total increase of 1.1 hours per day over 30 years. In contrast, *market work* on Saturday increased 0.54 hours from 1976 to 1986, but decreased 1.62 hours from 1986 to 2006. This

suggests that people may have shifted their hours worked from Saturday to weekdays after the legal work week was reduced at the end of 1980s. Concentrating *market work* into shorter work week may have generated a feeling of exhaustion and the misperception of hours worked having increased in total.

In the same tables, we also calculated *market work* by education and age group. It is interesting to note that while the increase in weekday *market work* was large in the most educated group, that group's decrease in Saturday *market work* was also large.

4.2 The relationship between market work and income for full-time male employees

In the previous section, we observed that although there was a notable change in time allocation within the week, total time spent on *market work* per week has not changed in the last 20 years. We check below whether the relationship between *market work* and income may also not have changed since 1986.[16]

STULA only had a single question related to income, a discrete choice question on total annual income for the household, and thus provides no information on the annual incomes of individuals.[17] Because of this, we first narrow the sample to full-time male employees who answered that their wives do not work, and then look at whether average hours worked systematically correlates with annual income level. To address the possibility of the sample being biased by a tendency for males whose wife is a homemaker to work longer hours, we first divide our full-time male samples into groups based on whether their wives are working or not, and then

[16] For the Unites States, Aguiar and Hurst (2007) suggest the trend that individuals with higher incomes become to work longer hours.
[17] It is also important to note the annual income in STULA also includes income other than wage income.

test to see if there is a significant difference between the two groups in the husbands' average *market work*. We focus on the thirties age group, since that is the only group for which weekly *market work* has not changed since 1986, as noted in the previous section. Test results are shown in Table 6. The left column for each sample year is the simple difference in average *market work* between husbands whose wives are not working (treatment group) and husbands whose wives are working (control group). The table shows that in the 1986, 1991, and 1996 surveys, it was actually the husbands whose wives were working who worked longer hours. When calculating a matching function, however, by matching each worker's characteristics (educational attainment, having a child less than 6 years old, prefecture of residence, and number of employees at workplace) between the treatment and control groups, the difference between the two groups becomes insignificant for most survey years (except the 2001 survey).

Figures 6(1) to (4) show average *market work* by annual income divided into quartiles for each year from 1986 through 2006, using thirties samples whose wives are not working.[18] Figure 6(1) shows significant decreases in *market work* in the two highest income quartiles in 2006, and large increases in *market work* for the two lowest income quartiles. In 1986, there was a tendency for those who earn higher incomes to work longer hours, but this casual observation suggests a reversal in that tendency in 2006. A similar trend can be also observed for weekday samples (Figure 6(2)). Until 2001, there was a positive relation between weekday *market work* and annual income. In 2006, however, it was the bottom two income quartiles who increased their *market work* significantly. Both the Saturday and Sunday samples showed a negative correlation between hours worked and annual income. This negative correlation seems to

[18] The 1981 survey does not have detailed information on annual income, therefore we limit this analysis from 1986 to 2006. Since information of annual income is given in discrete choices (a million yen increments), we take mean values of annual incomes.

become slightly stronger in 2006, since the decrease in hours from 1986 to 2006 was largest in the top income quartile.

To summarize, the correlation between income and *market work* among full-time male employees in their thirties used to be positive in 1986, but turned negative in 2006, even though the average hours of *market work* did not change over those 20 years. This suggests that wage rate inequality may have become greater since 2001 in Japan, once hourly wages are calculated based on actual hours worked.

5. Trends in Leisure -- adjusted for demographic changes

5.1 Definition of home production and leisure

In this section, we measure trends in leisure over the three decades ending 2006. We classify time as either home production or leisure based on the categories in Table A-1. Although it is difficult to distinguish between home production and leisure, the recent literature using time-use surveys (including Aguiar and Hurst [2007] and Burda, Hamermesh and Weil [2007]) has followed Reid (1934), which defines time that is substitutable with capital or a third party's time as home production, and this paper basically does too. We define *home production*, as the total of time spent on *housework*, *child care*, and *caring and nursing*.[19] We define *total work* as sum of *market work* which we have looked upon in the previous sections, plus *commuting time to and from work* and *home production*.

[19] Recognizing that some components of childcare may have utility, it would be worthwhile to also try a definition of home production that excludes childcare. However, in STULA, child care was included in house work until 1981, which makes it difficult to exclude when using long time series. We note, however, that enjoyable time spent with the family is categorized within "rest and relaxation," and thus some of the time spent with children that directly produces utility would be included in those items and not in childcare.

For leisure, we consider here three types of leisure. *Leisure A* is leisure time narrowly defined, and the total of time spent *watching TV, listening to the radio, reading newspapers or magazines, rest and relaxation, hobbies and amusements, sports,* and *social life*. *Leisure B* is *Leisure A* plus time spent for *sleep, meals,* and *personal care*. These three items are regarded as activities generating direct utility as well as necessary inputs to produce other activities (Hamermesh [1993]). *Leisure C* is a broader definition that adds to those items in *Leisure B* time spent on *shopping, volunteer and social activities, moving to different places* (other than commuting time), *studies and researches,* and *other activities*. Although much of the recent literature classifies time spent *shopping* as *home production,* STULA classifies all shopping, including window shopping and shopping for clothing, entertainment items, and other merchandise besides groceries, in a single shopping category. Based on this, we include *shopping* under *Leisure C* in this paper.

5.2 Trends in total work and leisure

Table 7 shows *market work, total work,* and *Leisure A, B* and *C* per full-time employee by sex, holding constant the demographic change over the past 30 years.

This shows that the *total work* of males increased 4.44 hours from 1976 to 1986, and has remained unchanged since 1986. On the other hand, the *total work* of females increased 2.38 hours from 1976 to 1986, followed by a 3 hours decline from 1986 to 2006. Comparing full-time females' *market work* and *total work,* it is apparent that one should look not only at trends in *market work,* but also at *home production* or *leisure,* in order to measure welfare. From 1986 to 2006, full-time females' *market work* did not change, whereas *total work* decreased considerably.

It is interesting to note that female workers' hours spent on *total work* used to be much longer than that of males, but the gap between the sexes has narrowed as a result of the large reduction in *total work* for females in recent years.[20]

The third to fifth row of each case shows the trends in *Leisure A*, *B* and *C*. For male employees, even though *total work* has remained unchanged for the past 20 years, *Leisure A* and *B* decreased 1.48 and 1.83 hours, respectively, from 1986 to 2006, and all the losses in *Leisure A* and *B* were offset by gains in *Leisure C*. This suggests that time allocation among leisure pursuits may change even though the total time for leisure remains constant. On the other hand, female full-time employees had an increase of 1.34 hours in *Leisure A*, 1.66 hours in *Leisure B* (albeit with low statistical significance), and 3.09 hours in *Leisure C*.

In Figure 7, we decomposed changes in *Leisure A* to *C* into each category for the past 20 years. Looking at these figures, time spent for *rest and relaxing*, *hobbies*, *personal care*, *shopping*, and *moving* have increased since 1986 for both males and females. For males, however, time spent on *watching TV*, *sports*, and *social life* has decreased, offsetting the time increases in other categories.

Another notable trend common to both males and females is that time spent on *sleep* has decreased since 1986, even though *market work* and *total work* remained unchanged for males and *total work* for females had decreased by 3 hours, during that period. To examine this more closely, we calculated the trends in hours of *sleep* per week, weekday, Saturday and Sunday in Table 8. The Table shows a continuous decreasing trend in *sleep* for the past 30 years; 4.14 (2.48+1.66) hours reduction for males and 2.86 (1.81+1.05) hours reduction for females, per

[20] Using time-diary data from 25 countries, Burda, Hamermesh, and Weil (2007) demonstrate that there is a negative relationship between real GDP per capita and the female-male difference in *total work* per day.

week. For males, the downward trend in *sleep* on weekdays (0.7 hours reduction per day over the past 30 years) seems somewhat correlated with the consistent upward trend in *market work* observed in Table 5 (1) (recall that a 1.1 hour increase in *market work* per weekday was observed). For females, however, *total work* per weekday increased 0.33 hours from 1976 to 1986, and has been unchanged since 1986 (not shown in tables). Therefore, the additional decreases in time for *sleep* from 1986 to 2006 (0.22 hours per weekday) cannot be explained by changes in *total work* per weekday. For Saturday, *sleep* increased by 0.15 hours for males, and 0.21 hours for females from 1986 to 2006. We assume people received the benefit of extra sleep on Saturday from shortening the work week from 6 days to 5 days, but such extra sleep on Saturday is at the most 10 percent of the total extra time gained by the decrease in total work.[21] The decreasing trend in time spent on sleep may have something to do with rising incidence of mental illness currently being observed in Japan. A more thorough examination is needed to explain this downward trend in *sleep*, a topic worth future research.

6. Market work and leisure time for full-time employees: comparison with a US time-use survey (adjusted for demographic changes)

In this last section, we see whether Japanese work longer hours in an international context. As shown in Figure 1, according to OECD, Japan was overtaken by the US in *market work* in 1998. In section III, however, we showed that actual time spent on *market work* in Japan is much longer

[21] From 1986 to 2006, *total work* on Saturday declined by 1.71 hours for males and by 2.22 hours for females. This implies that the percentage of the gains in extra time on Saturday used for extra sleep was only 8.58 percent (=0.15/1.71) for males and 9.27 percent (=0.21/2.22) for females.. It is interesting to note that Hamermesh (2002) found, using Dutch time-budget data, that the majority of the windfall hour resulting from the resumption of standard time (from day-light savings time) was used for extra sleep.

than the hours reported by the *Monthly Labor Survey*, which is the original source for data on Japan used by the OECD for its international comparisons. Similarly, in the US, some groups of workers are exempt from the Fair Labor Standards Act's overtime provisions (the *white collar exemption*), making it difficult to accurately gauge *market work* when these exempted individuals are included (see Mitchell [2005] for an examination of overtime regulations in the United States).

In this regard, we use micro data from the US time-use survey analyzed by Aguiar and Hurst (2007) to compare time allocation between Japan and the US, looking specifically at full-time workers.[22] In a Japan-US comparison, there is also a need to adjust for differences in demographic and lifestyle changes. Taking this into account, we first calculate weights for the US sample and use the same weights for STULA as well to adjust for Japan-US demographic differences.[23] Since STULA uses rough classifications to accommodate the pre-coding method, its data do not match up perfectly in comparisons with US data, which use the after-coding method, although *market work*, *Leisure A* and *B* and *sleep* are very similar to the classifications used in Aguiar and Hurst (2007).

Table 9 shows the average weekly *market work*, *market work + commute time*, *Leisure A* and *B*, and *sleep* for Japan and the US. Because of their different business cycles, Japan-US comparisons must be viewed quite broadly, but a simple Japan (2001) - US (2003) comparison shows a gap in *market work* between the two countries of 8.6 hours for males and about 6.5 hours

[22] Both the Japan and US samples comprise workers aged 22 to 65 years, including self-employees, but excluding students, the unemployed, and retirees. We use samples comprising those who answered "usually work more than 35 hours a week" for Japan and those who answered "usually work more than 30 hours a week" for the US to define full-time workers. One should note that the American Time-use survey is taken throughout year, whereas STULA is only taken in October. Comparisons of the two need to keep this in mind.

[23] To calculate weights, the samples were categorized based on Aguiar and Hurst (2007); Sex X Age (in 10-year increments) X Education level (four levels: less than high school, high school, some college, and college degree or more) X Having a child less than six years old. For samples of people over 60 years old, we ignore the difference of having a child.

for females. This gap becomes wider when we look at *market work + commute time*. The gap narrows to 3.9 and 3.1 hours for Leisure *A* and *B* for males, however, a difference that can be attributed to US males allotting more time to home production. Regarding time for *sleep*, it is interesting to note that only Japan has a decreasing trend in *sleep*, while the US has a slightly upward trend.

7. Conclusion

Recently, a variety of literature has been published to explain differences in hours worked among OECD countries. OECD (2004) categorizes Japan as part of the group of OECD countries that had a significant decline in work hours over the past several decades; annual hours worked for Japan has dropped at least 15 percent since the 1970s, and it dropped below that of the US at the end of 1990s. Some literature suggests that this large decline in hours worked is due to the amendment of Japan's work week regulations in the late 1980s, and that this large reduction in hours worked was the main cause of Japan's severe and prolonged recession during the 1990s (*Japan's lost decade*). Taking the opposite view, there have been some controversial papers arguing that full-time workers' work hours in Japan have actually increased recently.

This paper, using micro data from the *Survey on Time Use and Leisure Activities* (STULA) taken by the Japanese government every five years since 1976, measures trends in hours worked (*market work*) and leisure for Japanese over the past three decades. The main findings of this paper are as follows.

First, holding demographic changes constant, the average weekly hours worked per worker increased from 1976 until 1986 by about two hours, and has been relatively stable for the

subsequent two decades. Comparing 1986 and 2006, which are *before* and *after* Japan's lost decade, the difference in average hours worked is statistically insignificant, suggesting Japan's average hours worked did not change over those 20 years. This implies that there is a wide discrepancy between the actual hours worked and official statistics reported in OECD data. When dividing samples into weekdays (Monday through Friday) and weekends (Saturday and Sunday), however, some notable characteristics have emerged during the three decades of observation. Average hours worked per weekday among full-time males increased by more than an hour over those 30 years. On the other hand, there has been a significant decline in hours worked on Saturday, suggesting that people shifted their hours worked from weekends to weekdays after the five-day work week replaced the six-day work week at the end of the 1980s. This suggests that even though the hours worked per week remains unchanged, a major shift in the allocation of time within the week has taken place over the 20 years ending 2006.

Second, although average work hours remained relatively constant for the last two decades, we found that work hours increased the most for the lowest income group while work hours for the highest income group have declined since 2001. This implies that once hourly wages are calculated using actual hours worked, wage inequality in Japan may have become greater since 2001.

Third, although the average hours worked for female full-time employees remained constant for the past 20 years, commuting time and home production declined by 3 hours. This indicates that the average hours of leisure increased for females even though time spent on market work remained the same. Interestingly, however, time spent on *sleep* had declined consistently since 1976, resulting in a 3-4 hour reduction per week for both male and female full-

time employees. Lastly, a comparison of the Japanese and US time-use data suggests that Japanese full-time workers work much longer than their American counterparts.

Since there has been a slight increase in Japan's marginal tax rates since 1970, and there has been a significant level of unpaid hours in Japan over the past 30 years, the trends in hours worked observed in this paper seem to be inconsistent with previous hypothesis presented in the literature to explain differences among countries in hours worked. As pointed out by Nickell (2006), it has so far been impossible to identify specific factors capable of providing a straightforward explanation of cross-country differences in market hours worked, and the results of this paper further reinforce the difficulty of identifying the factors that lead to substantial differences from one country to another.

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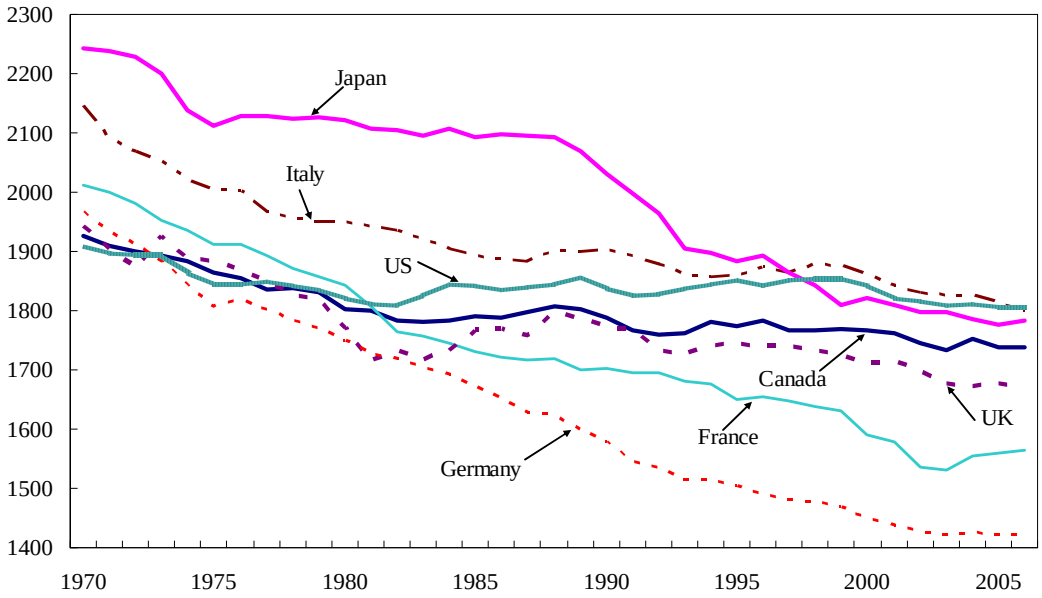
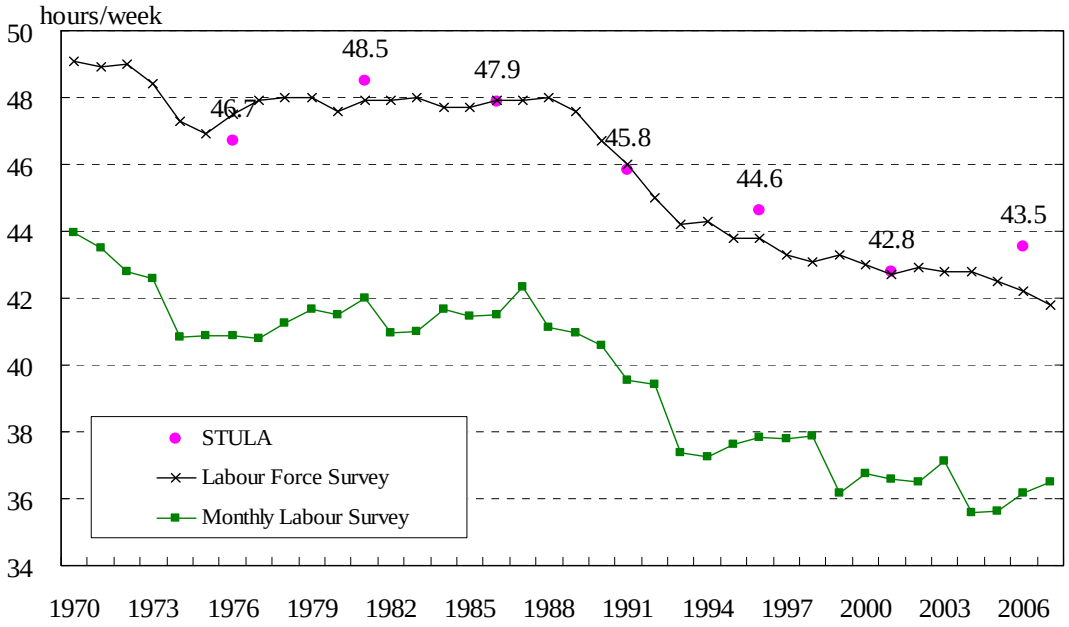
Tables and Figures

Figure 1: Annual hours worked per person in total employment (G7 countries)



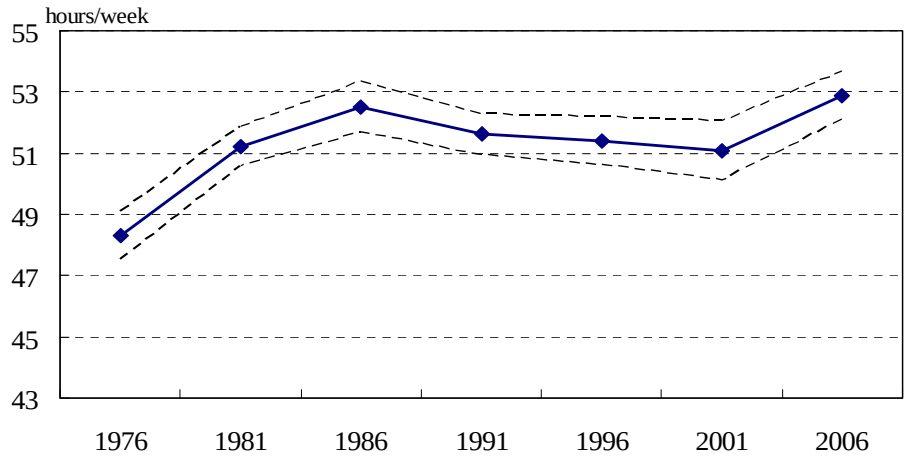
Source: OECD Labour Statistics

Figure 2: Weekly hours worked per employee



Source: STULA (MIAC), Labour Force Survey (MIAC), Monthly Labour Survey (MHLW).

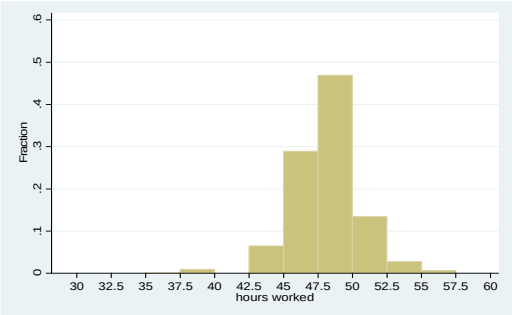
Figure 3: Weekly hours worked per full-time male employee (demography fixed)



Note: Dashed lines indicate 95 % confidence interval.

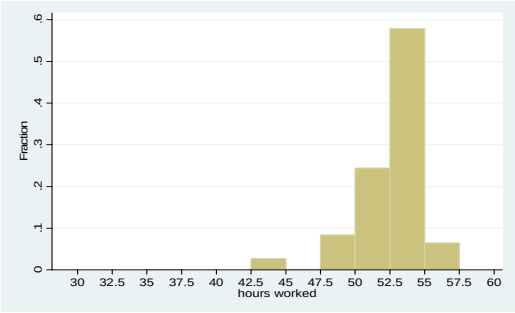
Figure 4: Histogram of Weekly hours worked per full-time male employee (demography fixed)

(1)1976



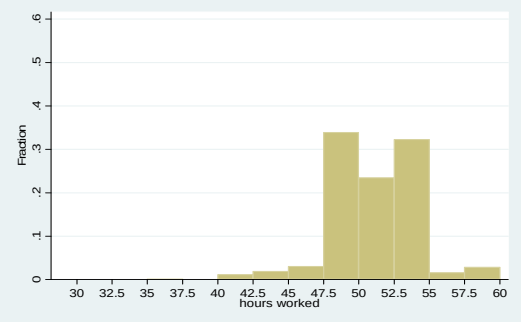
[Mean] 48.322 [Std. Dev.] 2.418

(2)1986



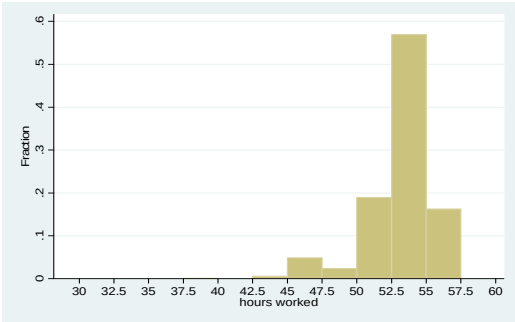
[Mean] 52.518 [Std. Dev.] 2.532

(3)2001



[Mean] 51.073 [Std. Dev.] 3.030

(4)2006



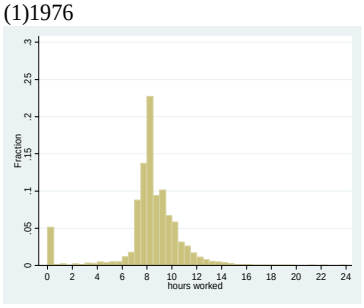
[Mean] 52.863 [Std. Dev.] 2.438

Note: 78 cells used in Table 2 are used to draw the histograms.

Figure 5: Hours worked per weekday, full-time male employee (demography unfixed)

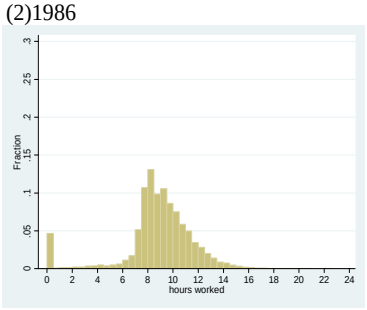
(1) Weekday

(1)1976



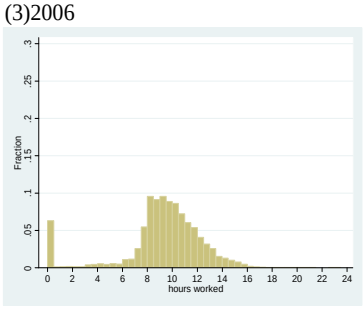
[Mean] 8.087 [Std. Dev.] 2.532

(2)1986



[Mean] 8.735 [Std. Dev.] 2.811

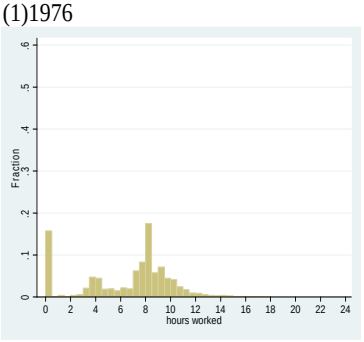
(3)2006



[Mean] 9.148 [Std. Dev.] 3.248

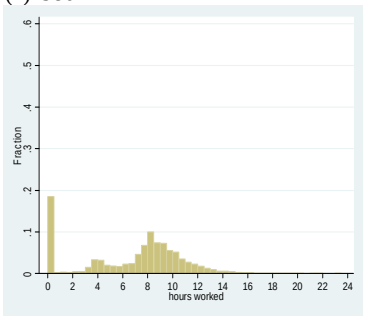
(2) Saturday

(1)1976



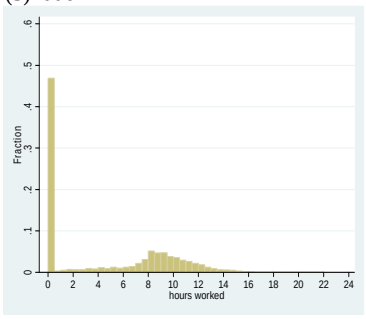
[Mean] 6.430 [Std. Dev.] 3.585

(2)1986



[Mean] 6.683 [Std. Dev.] 4.009

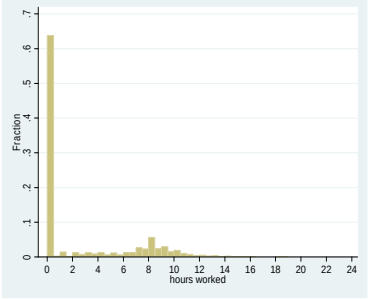
(3)2006



[Mean] 4.597 [Std. Dev.] 4.864

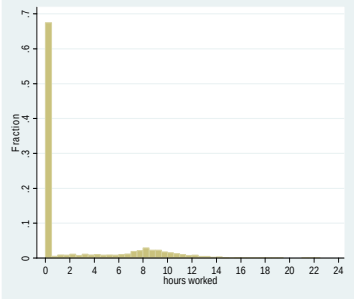
(3) Sunday

(1)1976



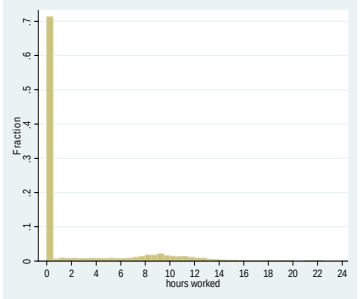
[Mean] 2.639 [Std. Dev.] 3.955

(2)1986



[Mean] 2.410 [Std. Dev.] 3.980

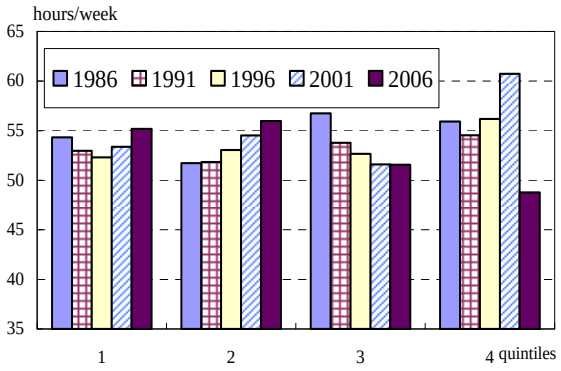
(3)2006



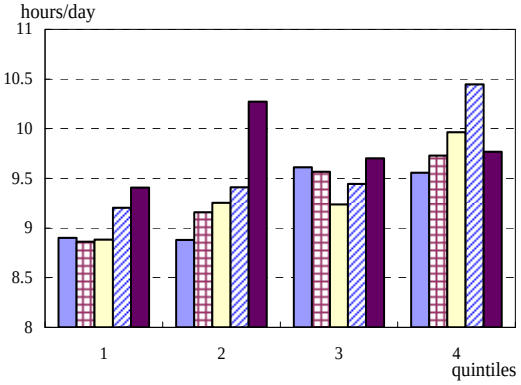
[Mean] 2.264 [Std. Dev.] 4.093

Figure 6: Income distribution and hours worked per week (full-time male employees)

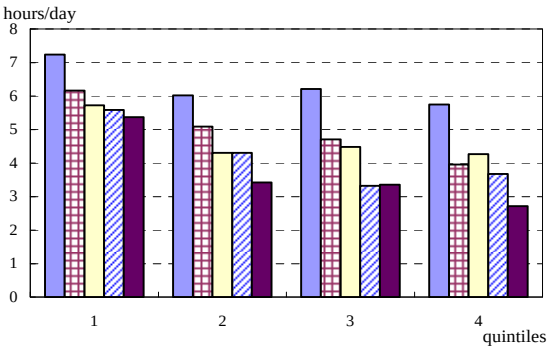
(1) 30s (Week)



(2) 30s (Weekday)



(3) 30s (Saturday)



(4) 30s (Sunday)

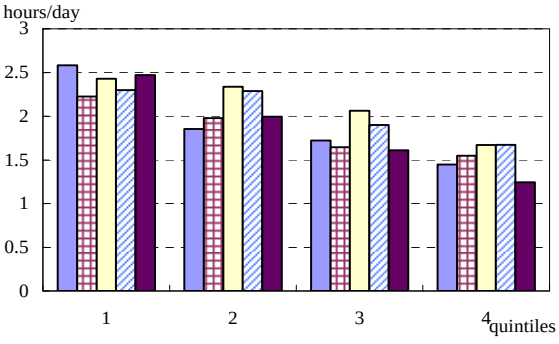
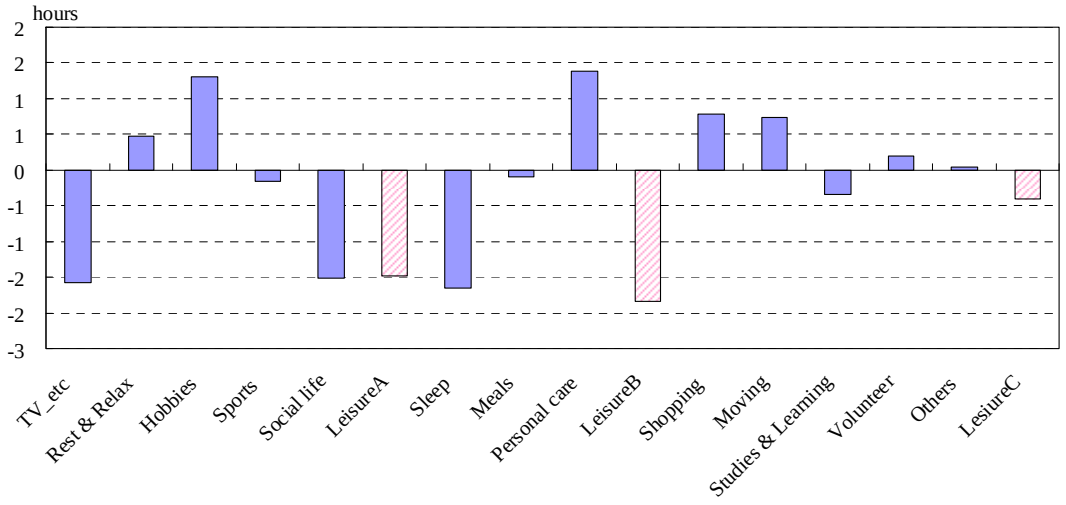


Figure 7: Decomposition of changes in Leisure A to C per week from 1986 to 2006, full-time employees (demography fixed)

(1) Males



(2) Females

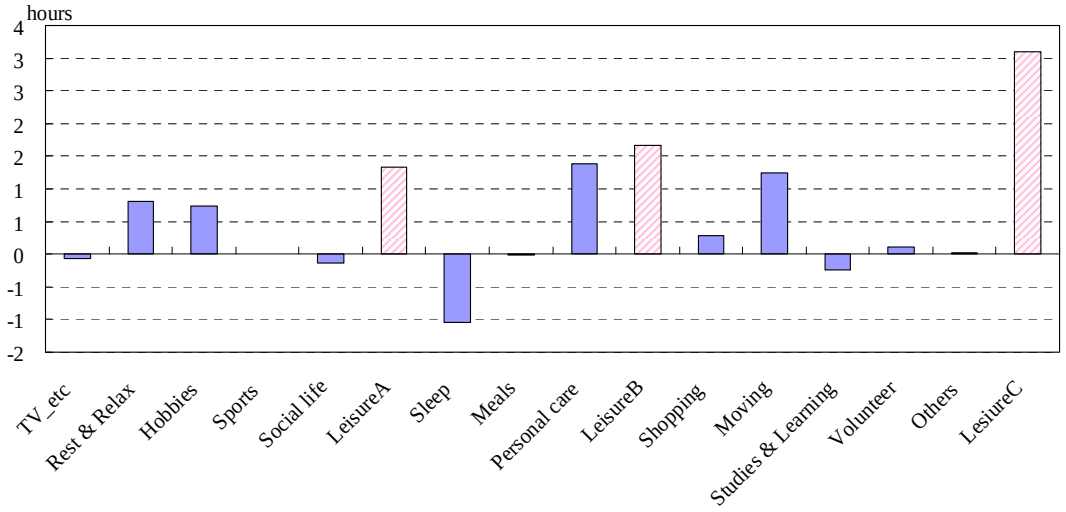


Table 1: Demographic and compositional changes since 1976

(1) Male

		1976	1981	1986	1991	1996	2001	2006
Marrital status	(married=1)	0.82	0.82	0.80	0.77	0.73	0.72	0.70
Age	22-29	0.22	0.17	0.17	0.17	0.19	0.18	0.15
	30-39	0.26	0.29	0.29	0.23	0.21	0.23	0.26
	40-49	0.26	0.25	0.24	0.27	0.26	0.22	0.21
	50-59	0.17	0.21	0.21	0.22	0.22	0.25	0.26
	60-65	0.09	0.08	0.08	0.11	0.12	0.12	0.13
Education	Junior high or less	0.46	0.37	0.28	0.23	0.20	0.16	0.13
	High school	0.37	0.42	0.43	0.46	0.46	0.46	0.45
	College or vocational school	-	0.05	0.07	0.06	0.07	0.08	0.10
	University or Graduate School	0.17	0.16	0.21	0.25	0.27	0.30	0.33
Having a child	(a child less than six=1)	0.29	0.26	0.19	0.14	0.14	0.14	0.14
Self employed	(self employed=1)	0.29	0.25	0.22	0.19	0.16	0.15	0.14
Work status	full-time (>=35h)	0.97	0.97	0.96	0.96	0.96	0.94	0.92
	part-time (<35h)	0.03	0.03	0.04	0.04	0.04	0.06	0.08
Samples sizes		124,956	75,118	169,432	169,908	161,706	112,371	104,214

(2) Female

		1976	1981	1986	1991	1996	2001	2006
Marrital status	(married=1)	0.80	0.80	0.80	0.77	0.75	0.73	0.71
Age	22-29	0.22	0.18	0.17	0.18	0.19	0.18	0.15
	30-39	0.25	0.27	0.28	0.22	0.21	0.22	0.25
	40-49	0.24	0.24	0.24	0.27	0.26	0.21	0.21
	50-59	0.19	0.21	0.21	0.22	0.22	0.26	0.26
	60-65	0.09	0.09	0.10	0.11	0.12	0.13	0.13
Education	Junior high or less	0.51	0.40	0.30	0.24	0.20	0.15	0.11
	High school	0.42	0.47	0.48	0.52	0.52	0.51	0.49
	College or vocational school	-	0.09	0.17	0.17	0.20	0.23	0.26
	University or Graduate School	0.07	0.03	0.05	0.07	0.08	0.10	0.14
Having a child	(a child less than six=1)	0.29	0.25	0.19	0.13	0.14	0.13	0.13
Self employed	(self employed=1)	0.51	0.42	0.35	0.28	0.24	0.18	0.14
Work status	full-time (>=35h)	0.81	0.79	0.76	0.73	0.69	0.64	0.61
	part-time (<35h)	0.19	0.21	0.24	0.27	0.31	0.36	0.39
Samples sizes		142,164	82,545	184,581	184,020	174,618	120,645	113,228

Notes: (1) “not married” includes divorced and widowed.

(2) 1976 survey includes “College or vocational school” samples in “University or Graduate school”.

Table 2: Market work per week (demography fixed)

	1976	1981	1986	1991	1996	2001	2006	change (demography fixed)			change (demography unfixed)		
								76→06	76→86	86→06	76→06	76→86	86→06
All samples													
per worker	44.88	47.15	46.97	46.03	45.24	44.23	46.27	1.39 +	2.08 **	-0.70	-1.48 **	1.21	-2.69 **
								[0.08]	[0.01]	[0.38]	[0.00]	[0.12]	[0.00]
per employee	44.78	47.30	47.64	46.67	46.20	45.51	47.29	2.51 **	2.86 **	-0.35	-1.75 +	1.45	-3.20 **
								[0.01]	[0.00]	[0.71]	[0.06]	[0.12]	[0.00]
per full-time employee	46.79	49.76	50.09	49.14	48.84	48.31	50.12	3.33 **	3.30 **	0.04	1.94 **	2.37 **	-0.43
								[0.00]	[0.00]	[0.96]	[0.00]	[0.00]	[0.52]
Males													
per worker	49.24	51.62	52.58	51.77	51.15	50.35	52.49	3.24 **	3.33 **	-0.09	0.57	2.19 **	-1.48 +
								[0.00]	[0.00]	[0.69]	[0.27]	[0.00]	[0.05]
per employee	48.15	50.81	52.22	51.38	51.09	50.58	52.42	4.27 **	4.07 **	0.20	2.11 **	3.25 **	-1.14 *
								[0.00]	[0.00]	[0.51]	[0.00]	[0.00]	[0.05]
per full-time employee	48.32	51.21	52.52	51.61	51.40	51.07	52.86	4.54 **	4.20 **	0.35	3.07 **	3.43 **	-0.36
								[0.00]	[0.00]	[0.56]	[0.00]	[0.00]	[0.50]
Females													
per worker	38.71	40.82	39.02	37.92	36.87	35.56	37.45	-1.26	0.31	-1.57	-4.03 **	-0.48	-3.55 **
								[0.25]	[0.78]	[0.15]	[0.00]	[0.65]	[0.00]
per employee	39.28	41.58	40.17	38.98	38.22	37.24	38.91	-0.37	0.89	-1.26	-5.36 **	-1.08	-4.28 **
								[0.79]	[0.51]	[0.35]	[0.00]	[0.44]	[0.00]
per full-time employee	43.53	46.67	44.92	43.89	43.41	42.43	44.30	0.77	1.39 *	-0.62	0.07	0.31	-0.23
								[0.23]	[0.03]	[0.33]	[0.91]	[0.62]	[0.69]

Notes: (1) *p*-values of significance test for the difference in two years are reported in parenthesis.

(2) "**", "*", and "+" denote that the differences are statistically significant in 1, 5, 10 percent levels, respectively.

Table 3: Hours worked per week, per full-time male employee (demography fixed)

	1976	1981	1986	1991	1996	2001	2006	76→86	86→06
by Education									
College or more	46.43	50.09	52.27	51.64	51.77	52.02	52.88	5.84 ** [0.00]	0.62 [0.57]
High School	48.60	51.38	52.59	51.70	51.25	50.69	52.99	3.99 ** [0.00]	0.40 [0.63]
Junio High or less	50.90	52.73	52.78	51.37	51.10	50.31	52.57	1.88 * [0.04]	-0.22 [0.81]
by Age									
20S	48.50	51.85	54.41	52.32	52.15	51.97	53.49	5.91 ** [0.00]	-0.92 [0.25]
30S	49.40	52.30	53.99	53.17	53.15	53.44	53.77	4.58 ** [0.00]	-0.22 [0.71]
40S	48.15	50.78	52.52	51.91	52.16	51.11	54.21	4.37 ** [0.00]	1.69 + [0.08]
50S	47.26	50.14	50.07	49.72	48.78	48.64	50.90	2.81 ** [0.00]	0.83 [0.35]
60S	46.69	48.96	46.34	45.96	45.21	43.71	46.26	-0.35 [0.83]	-0.08 [0.96]

Note: See Table 2.

Table 4: Fraction of Hours worked per day, full-time male employee (demography unfixed)

		1976	1981	1986	1991	1996	2001	2006
Weekday	0 h	0.052	0.036	0.047	0.058	0.065	0.072	0.063
	0<h<=8	0.287	0.289	0.222	0.200	0.177	0.176	0.139
	8<h<10	0.490	0.476	0.421	0.416	0.404	0.380	0.371
	h>=10	0.171	0.199	0.310	0.326	0.354	0.372	0.427
Saturday	0 h	0.158	0.154	0.184	0.307	0.411	0.449	0.467
	0<h<=8	0.369	0.347	0.313	0.254	0.193	0.195	0.170
	8<h<10	0.348	0.360	0.302	0.265	0.225	0.187	0.184
	h>=10	0.125	0.139	0.200	0.174	0.171	0.168	0.180
Sunday	0 h	0.638	0.571	0.674	0.708	0.721	0.721	0.712
	0<h<=8	0.174	0.211	0.160	0.136	0.130	0.125	0.125
	8<h<10	0.125	0.148	0.092	0.083	0.071	0.070	0.072
	h>=10	0.063	0.071	0.074	0.073	0.078	0.084	0.091

Note: “4 days” includes 1.5 day holidays per week samples.

Table 5: Hours worked per day, per full-time male employee (demography fixed)

(1) Weekday

	1976	1981	1986	1991	1996	2001	2006	76→86	86→06
All samples	8.02	8.34	8.70	8.70	8.80	8.79	9.12	0.68 ** [0.00]	0.42 ** [0.00]
by Education									
College or more	8.01	8.42	8.93	9.01	9.20	9.23	9.52	0.92 ** [0.00]	0.59 ** [0.00]
High School	8.01	8.33	8.63	8.64	8.67	8.64	9.04	0.62 ** [0.00]	0.41 ** [0.00]
Junio High or less	8.06	8.21	8.48	8.34	8.39	8.40	8.63	0.42 * [0.01]	0.15 [0.34]
by Age									
20S	8.09	8.45	9.00	8.86	8.94	8.81	9.08	0.91 ** [0.00]	0.08 [0.62]
30S	8.23	8.57	8.94	8.95	9.09	9.23	9.36	0.70 ** [0.00]	0.43 * [0.01]
40S	8.05	8.32	8.78	8.78	8.93	8.86	9.40	0.72 ** [0.00]	0.62 ** [0.00]
50S	7.75	8.04	8.25	8.38	8.36	8.42	8.77	0.50 ** [0.00]	0.52 ** [0.00]
60S	7.49	7.83	7.59	7.61	7.60	7.47	7.93	0.11 [0.54]	0.34 + [0.05]

(2) Saturday

	1976	1981	1986	1991	1996	2001	2006	76→86	86→06
All samples	6.10	6.47	6.64	5.76	5.19	4.88	5.03	0.54 * [0.01]	-1.62 ** [0.00]
by Education									
College or more	5.18	5.71	6.03	4.76	3.97	3.93	3.82	0.85 ** [0.00]	-2.21 ** [0.00]
High School	6.37	6.61	6.76	5.99	5.41	5.11	5.24	0.39 * [0.02]	-1.52 ** [0.00]
Junio High or less	7.11	7.49	7.46	6.98	6.82	6.03	6.66	0.35 [0.12]	-0.80 ** [0.00]
by Age									
20S	6.22	6.70	6.95	5.63	5.13	5.26	5.49	0.73 + [0.08]	-1.46 ** [0.00]
30S	6.03	6.44	6.85	5.93	5.45	5.02	4.97	0.82 + [0.09]	-1.88 ** [0.00]
40S	6.04	6.45	6.52	5.84	5.19	4.84	4.96	0.48 [0.30]	-1.55 ** [0.00]
50S	6.08	6.31	6.33	5.63	4.91	4.50	4.84	0.25 [0.67]	-1.49 * [0.02]
60S	6.41	6.47	6.15	5.48	5.06	4.33	4.54	-0.26 [0.68]	-1.61 * [0.01]

Table 5: Hours worked per day, per full-time male employee (demography fixed)

(3) Sunday

	1976	1981	1986	1991	1996	2001	2006	76→86	86→06
All samples	2.31	2.99	2.39	2.23	2.17	2.20	2.38	0.07	-0.01
								[0.56]	[0.95]
by Education									
College	1.48	2.34	1.86	1.80	1.77	2.00	2.13	0.38 **	0.28 *
or more								[0.01]	[0.05]
High School	2.44	3.04	2.54	2.36	2.36	2.35	2.45	0.09	-0.09
								[0.40]	[0.41]
Junio High	3.47	4.03	2.96	2.67	2.44	2.23	2.65	-0.51 **	-0.31 +
or less								[0.00]	[0.07]
by Age									
20S	2.15	2.92	2.60	2.18	2.14	2.60	3.01	0.46 *	0.40 +
								[0.03]	[0.06]
30S	2.21	2.81	2.43	2.30	2.33	2.22	2.35	0.21	-0.07
								[0.33]	[0.73]
40S	2.35	2.85	2.15	2.22	2.21	2.10	2.11	-0.19	-0.04
								[0.48]	[0.87]
50S	2.48	3.40	2.39	2.14	1.96	1.94	2.17	-0.08	-0.22
								[0.82]	[0.55]
60S	2.71	3.42	2.41	2.37	1.98	2.05	2.14	-0.30	-0.28
								[0.51]	[0.54]

Note: See Table 2.

Table 6: Results of matching estimation

	1986		1991		1996		2001		2006	
	simple	matching	simple	matching	simple	matching	simple	matching	simple	matching
diff	-2.21 **	-0.39	-2.24 **	-0.99	-1.29 *	-1.31 +	-0.21	1.98 *	-1.36	0.30
std.err.	(0.42)	(0.60)	(0.50)	(0.71)	(0.54)	(0.78)	(0.65)	(0.94)	(0.65)	(1.00)
p-value	<0.00>	<0.51>	<0.00>	<0.17>	<0.02>	<0.09>	<0.74>	<0.04>	<0.74>	<0.77>
wife	not working	working	not working	working	not working	working	not working	working	not working	working
sample sizes	12,972	10,871	9,417	8,856	9,079	7,793	5,481	6,616	4,760	6,821

Notes: (1) "diff" = "average hours worked of full-time males whose wives are not working" minus "average hours worked of full-time males whose wives are working".

(2) **, *, and + imply 1, 5, 10% statistically significant respectively.

Table 7: Total work and Leisure A, B and C per week, per full-time employee (demography fixed)

		1976	1981	1986	1991	1996	2001	2006	76→86	86→06
Male	Market work	48.32	51.21	52.52	51.61	51.40	51.07	52.86	4.20 **	0.35
									[0.00]	[0.53]
	Total work	56.29	59.32	60.73	60.00	59.25	59.05	61.27	4.44 **	0.54
									[0.00]	[0.38]
	Leisure A	30.70	29.90	30.71	31.69	30.88	30.76	29.23	0.02	-1.48 **
									[0.97]	[0.01]
	Leisure B	104.18	103.65	101.10	101.78	101.38	101.01	99.26	-3.08 **	-1.83 **
									[0.00]	[0.01]
	Leisure C	111.05	108.38	106.85	107.60	108.37	108.62	106.44	-4.21 **	-0.41
									[0.00]	[0.50]
Female	Market work	43.53	46.67	44.92	43.89	43.41	42.43	44.30	1.39 *	-0.62
									[0.03]	[0.33]
	Total work	63.13	66.52	65.51	64.47	62.44	61.12	62.50	2.38 +	-3.01 *
									[0.07]	[0.02]
	Leisure A	22.88	22.55	24.01	25.17	25.05	25.71	25.35	1.13	1.34
									[0.19]	[0.12]
	Leisure B	95.80	95.07	94.96	95.83	96.66	97.24	96.62	-0.84	1.66
									[0.50]	[0.19]
	Leisure C	104.17	101.17	102.03	103.10	105.14	106.37	105.12	-2.13	3.09 *
									[0.11]	[0.02]

Note: See Table 2.

Table 8: Trends in Sleep, per full-time employee (demography fixed)

		1976	1981	1986	1991	1996	2001	2006	76→86	86→06
Male	per week	56.58	55.71	54.09	53.37	53.34	52.84	52.44	-2.48 **	-1.66 **
									[0.00]	[0.00]
	weekday	7.92	7.82	7.57	7.43	7.40	7.31	7.22	-0.35 **	-0.35 **
									[0.00]	[0.00]
	Saturday	7.97	7.95	7.66	7.71	7.81	7.82	7.81	-0.31 **	0.15 **
									[0.00]	[0.00]
	Sunday	8.96	8.66	8.57	8.53	8.54	8.48	8.51	-0.40 **	-0.06
									[0.00]	[0.22]
Female	per week	53.61	52.79	51.79	51.17	51.35	51.02	50.75	-1.81 **	-1.05 **
									[0.00]	[0.01]
	weekday	7.50	7.43	7.25	7.13	7.12	7.06	7.04	-0.25 **	-0.22 **
									[0.00]	[0.00]
	Saturday	7.62	7.52	7.34	7.40	7.57	7.60	7.55	-0.27 **	0.21 *
									[0.00]	[0.02]
	Sunday	8.44	8.13	8.18	8.11	8.18	8.15	8.05	-0.27 **	-0.13
									[0.00]	[0.15]

Note: See Table 2.

Table 9: Japan-US comparison on time allocation per week (full-time employee; demography fixed)

(1) Japan

		1981	1986	1991	1996	2001	2006
Market work	Males	52.17	53.44	52.17	51.94	51.56	53.32
	Females	46.54	44.65	43.97	43.30	42.09	44.52
Market work	Males	58.62	59.85	58.65	57.65	57.65	59.57
+ commute time	Females	51.55	49.39	49.10	48.21	46.88	49.60
Sleep	Males	55.73	54.23	53.49	53.40	52.91	52.45
	Females	52.71	51.64	50.99	51.21	50.91	50.58
Leisure A	Males	29.70	30.62	31.56	30.87	30.84	29.33
	Females	22.38	23.39	24.58	24.55	25.58	25.26
Leisure B	Males	103.62	101.36	101.95	101.60	101.34	99.59
	Females	94.77	94.21	95.11	96.10	97.07	96.37

(2) US

		1975	1985	1993	2003
Market work	Males	41.77	41.19	44.01	42.92
	Females	34.52	32.02	36.34	36.18
Market work	Males	45.99	45.93	48.32	46.85
+ commute time	Females	37.67	35.67	39.93	38.95
Sleep	Males	55.27	53.92	55.68	56.58
	Females	56.77	54.61	56.92	58.18
Leisure A	Males	31.53	32.82	34.25	33.24
	Females	27.20	30.11	31.49	28.46
Leisure B	Males	103.05	103.28	103.97	102.73
	Females	100.41	101.73	104.16	100.84

Sources: Japan (STULA), the US (American Time-use survey data used in Aguiar and Hurst [2007]).

Appendix: Details on Survey on Time Use and Leisure Activities

Survey on Time Use and Leisure Activities (The Ministry of Internal Affairs and Communications; STULA) is a time-use survey recording the activities of individuals in 15 minute increments over a 24-hour period. The Japanese government took its first survey in 1976, and has interviewed approximately 200,000 Japanese citizens every five years since then. The most recent survey was conducted in 2006. This paper uses micro data from the seven surveys, taken in 1976, 1981, 1986, 1991, 1996, 2001, and 2006. [24]

STULA is taken every five years in the year following the *Population Census* (MIAC). It is a large-scale survey that first selects approximately 6000 survey districts from those established for the *Population Census*, out of which it selects approximately 70,000 to 100,000 households with about 200,000 to 270,000 household members who are at least 10 years old (at least 15 years old for those surveys taken in 1976 and 1981). Except for the survey taken in 1981, the survey covers a consecutive two-day period that is set for each survey district, within an overall nine-day period during October (in some years, survey was conducted from late September to early October). The sample size is therefore approximately twice the number of household members. The survey covers every day of the week from Monday through Sunday, so that assuming a sufficient number of samples, the averages can be interpreted as the hours spent on those activities per week.[25]

[24] Another time-use survey in Japan is the Japan Broadcasting Corporation (NHK)'s *National Time Use Survey*. This survey, which predates the STULA, has been conducted by NHK every five years since 1950, on approximately 30,000 people. NHK's survey differs from the STULA in that it does not survey every day of the week, but does provide more detailed categories on the time spent with mass media.

[25] The 1981 survey covered only three days that year, October 1st (Thursday), 3rd (Saturday), and 4th (Sunday), and each household only answered questions regarding one of those days. The analysis here, treating the answers for Thursday as representative for all weekdays, uses the sum of Thursday multiplied by five, Saturday, and Sunday to estimate the time spent on activities throughout the week. (This same method is used for calculating weekly time spent on activities in the official aggregate data from the STULA)

STULA uses a pre-coded method in which the respondent chooses the applicable item from a list of activities. The respondent fills in the activity for each 15-minute increment from the list of 20 items shown in Table A-1 (as written in the note to Table A-1, there are fewer items from 1976 until 1986). Other questions asked of respondents in addition to their activities include basic information: age, years of education, marital status, number of persons in household, number of children in household, household annual income, number of employees at workplace, usual work status, and length of usual work hours per week.[26]

[26] Several caveats must be noted in regards to time-use surveys: (1) they provide no information on activities that take less than 15 minutes; (2) when two activities are pursued at the same time, only the primary activity is recorded; (3) there is a possibility that different respondents may categorize the same activity differently, owing to the roughness of category definitions. Regarding this last point, STULA has used two methods, pre-coding and after-coding, since the 2001 survey. Although after-coding has the advantage of providing information on activities outside of the initially established categories, because a certain level of arbitrariness is unavoidable owing to the fact that the data compilers must ultimately categorize the activities according to some standard, and because of the small sample size, we chose to use only data based on the pre-coding method in our analysis.

Figure A-1: Decomposition

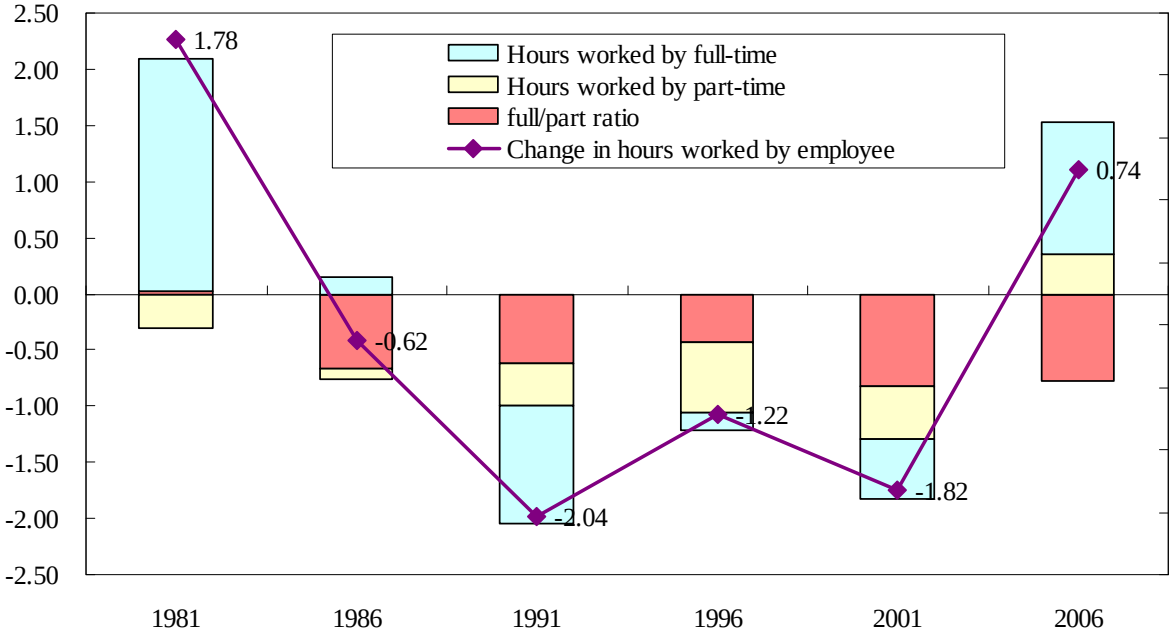


Table A-1: Kind of Activities

Activities	Examples and/or notes
1.Sleep	Time from going to bed till getting up
2.Personal care	Washing face, bathing, dressing, hair-dressing, etc.
3.Meals	Includes drinking before or after meals. If the main purpose is socializing, included "18. Social life".
4. Commuting to and from school or work	Going to work or school and returning
5.Work	Work for pay or profit Includes helping family business. Rest between work time should be classified according to the activity actually done.
6.Schoolwork	Studying by students at school, such as high school, college and university Homework is included.
7.Housework	Cooking, table setting, cleaning house, caring for family members other than little child, keeping the family account, visits to the public office on personal or family matters
8.Caring or nursing	Helping family or related person to have a meal, take a bath, dress, move, and to do other
9.Child care	Caring for little child(ren) Including activities concerning education of the child(ren).
10.Shopping	Purchase of food, clothes, or other goods Includes window-shopping.
11.Moving	Moving other than "4. Commuting to and from school or work"
12.Watching TV, listening to the radio, reading newspapers or magazines	Includes watching TV programs recorded on videotape
13.Rest and relaxation	Conversation with family, office colleagues, etc.
14.Studies and researches	Studies and researches other than "6. Schoolwork" Those as a part of work are included in "5. Work".
15.Hobbies and amusements	Seeing a movie or a play, playing or listening to music, caring for pets, gardening, flower arrangement, chess, mahjong, etc.
16.Sports	Athletic amusements such as baseball, volleyball, tennis, etc. Includes light exercises and outdoor leisure such as jogging, hiking, etc.
17.Volunteer and social activities	Voluntary activities or other social activities to promote social welfare by providing one's effort, skill and time without pay
18.Social life	Seeing friends, taking with neighbours, attending meetings, funerals, wedding, receiving friends at home, etc.
19.Medical examination or treatment	Stay in bed due to illness, seeing a doctor for treatment, etc.
20.Other activities	Activities not classified elsewhere

Source: Statistics Bureau, MIAC (http://www.stat.go.jp/english/data/shakai/2001/kodobua.htm)

Notes: (1) 1976 survey combines “School work” and “Studies and Researches.”

(2) 1976 and 1981 surveys do not have separate items for “Child care” and “Caring and Nursing.” 1986 survey does not have item for “Caring and Nursing.” For these survey years, these items were included in “Housework.”