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by

Warn Nuarpear Lekfuangfu

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INTENSIVE AND EXTENSIVE MARGINS OF LABOUR SUPPLY IN THAILAND: DECOMPOSING THE PATTERN OF WORK BEHAVIOURS

WARN NUARPEAR LEKFUANGFU*

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Abstract

The paper highlights the important differences between the extensive margins (participation) and the intensive margins (hours-of-work) of labour supply, in the case of Thailand. We use Thailand's Labour Force Survey to explore the evolution of labour supply at both margins over the past three decades. We show that Thailand's extensive margins of labour supply follow the conventional life-cycle pattern of an inverted U-shape along the age distribution. However, for the intensive margins, occupation types and education levels play significant roles in dictating the shape of hours-of-work along the life-cycle. We employ a pseudo-cohort analysis to allow us to track the same representative age-gender sample across their life time. While we find that men supply more mean hours *per capita* than women, we do not find much marriage premium on the intensive margin among those who worked. Marriage premium is highly noticeable along the extensive margin. At all ages, women have smaller extensive margins. Female workforce also reduce the margins more strongly when they reach older ages than men. In our statistical exercise combining a decomposition approach with forecasting, we find that a policy targeting raising participation rates work more effective than a policy on intensive margins, in increasing the total hours-of-work of the working age population.

Keywords: labour supply, hours of work, intensive margin, life-cycle, ageing

JEL classifications: J21, J22

*Chulalongkorn University and Centre for Economic Performances, LSE.

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I. Introduction

It is of important interest to know how labour supply responds to various socio-economic factors over the years. One key issue is to learn how different individuals adjust their decision to join the labour market or change their hours of work in reaction to changes of plethora of incentives. This paper begins by exploring the evolution of labour supply behaviours in Thailand across 30 years. In particular, we aim to highlight key differences between the extensive margins of labour supply (the decision to participate in the markets) and the intensive margins of labour supply (hours-of-work among workers).

The distinction of both margins of labour supply is crucial to underpin responses by individuals and households as a result of many policy interventions, for example changes of personal income tax, family subsidies or minimum wage hike (Saez *et al* 2012, Meghir and Phillips 2010). Moreover, labour economists have acknowledged that the relative importance of the extensive and intensive margins varies according to individual and family background, in particular age, gender and family status (Heckman 1974, Blundell and MaCurdy 1999, Laroque 2005).

Following Blundell, Bozio and Laroque (2011, 2013), our research looks at the evolution of labour supply in Thailand at both margins over the past three decades. We rely on the Thailand's Labour Force Survey (LFS) as the main statistical source to generate a number of stylised facts. We disaggregate the patterns of these margins by age, gender, marital and work status. In addition, we compare the characteristics across three separate decades of the dataset. Studies of labour supply margins in developed economies suggest three stylised behaviours: (i) a decline in employment especially among older age men, (ii) rising trends of female labour supply, and (iii) a decline in youth employment in recent birth generations (Blundell 2012). For Thailand, however, female participation rates remain stable over time. There has been a small decline of total hours-of-work for both men and women since 1985. Reflecting the expansion of education opportunity, the data shows smaller participation rates among the youths of more recent generations.

To more fully comprehend the life-cycle pattern of labour supply in the repeated cross-section data, our analysis tracks labour supply behaviours within a representative birth cohort in the LFS across the ages (Browning, Deaton and Irish 1985, Blundell, Browning and Meghir 1994, Warunsiri and McNown 2010). This approach permits us to see labour supply responses in a more dynamic framework- whereby individual workers adjust their labour supply decisions inter-temporally.¹ There is a considerable display of labour supply variation over the life cycle for each birth cohort. The life-cycle of the extensive margin displays an inverted-U shape. During the early-career age period, both men and women share similar steepness the change in the extensive margins. Across all birth generation, the stabilised participation is reached by aged 30 for women and by aged 25 for men. And the plots begin to decline approximately 10 years earlier for women (at aged 45) than men (at aged 55). This points that the life-span of

¹ This allows for further analysis of the Euler condition of inter-temporal utility maximisation (Blundell and Neves 1993).

full market participation (female: 80% versus male: 95%) is 15 years for women and 30 years for men.

For the intensive margin, while we observe an inverted U-shape of hours-of-work from the non-pseudo plots, the life-cycle of hours-of-work within the same birth cohort look less so. Across birth cohorts, at the same age, the data shows that older birth generation works, on average, more hours annually than more recent cohorts. Moreover, older workers begin to decrease their total hours at earlier age for the more recent generations.

Within the same birth generation, married men and women supply comparable total hours along the ages. In contrast, there is a persistent gap between single men and single women. The hour gap looks to converge at older ages. Most of all, none of our plots of life-cycle intensive margins- with the pseudo cohort approach- display an inverted U-shape- which is a stark difference from the plots with repeated cross-sectional LFS.

The last section employs the decomposition method used in Blundell, Bozio and Laroque (2011, 2013) to tackle some policy relevant exercises. We compare the role played by changes of demographic structure and changes of labour supply behaviours (the extensive and the intensive margin) in raising the total labour supply under an aging society. Without any changes in both margins at all ages, a reduction of the share of prime-age person results in a decline of total hours. Nevertheless, for a given age structure, allowing the extensive margin of under-participated group in Thai labour markets (female and elderly) raises total hours per person much more than a similar change at the intensive margin.

This paper is structured as the following: the next section explores the pattern of Thailand's labour supply at the extensive margin and the intensive margin. This section describes Thailand's Labour Force Survey and analysis the data series in a repeated-cross section format. Section 3 displays various stylised facts of labour supply margins under a life-cycle structure. Section 4 describes a decomposition analysis and provides some policy relevant counter-factual exercises. And Section 5 concludes.

II: Understanding the extensive and the intensive margin in Thailand

1. The data and the decomposition of the labour supply margins.

We define the extensive margin of labour supply, p_{it} , as whether a working-age individual has participated in a labour market or not in a given reference period². Therefore p_{it} takes the value of 1 if she indicates that she is in the labour force and zero if she is out of labour force³. The intensive margin of labour supply, h_{it} , is measured by the self-reported number of hours

² In BBL (2013), the extensive margin is alternatively defined as the fraction of the individuals, in a given period, who is either employed or self-employed. So this calculation reflects a measure of employment.

³ Based on the official definition in Thailand's Labour Force Survey, we classify "out-of-labour-force" is a working age individual (aged 15-65) who are not in work because of a number of reasons: students, too young or too old, disabled, discouraged, house carers.

worked in the same reference period⁴. The total number of hours of work of an individual I in period t is H_{it} and its decomposition is shown in Equation 1.

$$(1) \quad H_{it} = p_{it} \times h_{it}$$

In this analysis, we define the reference period as the calendar year. Our core data is the Thailand's Labour Force Survey (LFS), which are the main source of labour market behaviours across Thailand. We focus on the 3rd quarter of the LFS, for the period from 1985 to 2015. This is a long repeated cross section data series of micro-data. Our individuals are observed in a particular week and they report the hours of work in the main job and other jobs (if exist) in that week. We calculate annual hours-of-work equals to total hours in the reported week times 50⁵. In an individual is of working-age (15-65 years old) and is a part of the labour force, we classify that she is a participant of the market. She is a non-participant if she is not working or seeking jobs during the past 7 days during the interview. In additional, for a given labour market participant, if she is in an employment or seasonally out of the job, she is employed.

2. The extensive margin of labour supply

We begin the section by exploring the evolution of labour market participation rates across the three decades of the Thailand's LFS data series. Figure 2.1 shows a familiar pattern with higher male extensive margin than female. For Thailand, over time, we observe a relatively stable rate of participation at 90% of working-age population for men and 70% for women. The data captures some effects of the late 1990s financial crisis where we see a mild drop in the overall participation rates. Compared to developed economies, for example the UK or the US, Thailand's labour market shows a much higher rate of labour participation and without much fluctuation over time.

Next, we begin disaggregate overall trend of market participation by decomposing the labour supply behaviours into age and gender. Figure 2.2 plots the labour participation rates from the LFS, separately for each gender and each 10-year period (1985-1995, 1996-2005, 2006-2015). Note that the data presented here is a pooled cross-section. While each point represents an age-specific extensive margin, each plotted line does not represent the same birth cohorts. Here, the pattern of labour participation at prime ages looks consistent across the three decades for both women and men. Nearly 100 percent of all men at prime-age participate in labour markets. On the other hand, even during prime ages, female participation rate peaks at 80 percent at most, (around aged 30-45).

Notice that participation rates of youths (especially aged 16-25) were at 50 percent during 1985-1995 for both genders. The rates have declined in later years to 30 and 37 percent of

⁴ It must be acknowledge that the duration span of the reference period directly influence the classification of these labour supply margins. The shorter the duration (daily, weekly), the smaller the extensive margin for the same individual (Blundell, Bozio and Laroque, 2011, 2013).

⁵ As noted in Blundell, Bozio and Laroque (2013), if the reference week is representative of the year's average of work pattern, this calculation is unbiased. For Thailand LFS, researchers opt for Quarter 3 because this quarter is least affected by seasonality of harvest nor holiday seasons. Therefore, hours of work from this Quarter series is less likely to be biased as a measure of usual hours of work.

women and men aged 20 in the 2000s, respectively. Across most years during this time span, female participation rates seem to begin its decline once a person reaches age 45 years old. For men, we observe a similar decline around aged 55 and above. By aged 65 (5 years after the contemporary official retirement age), over 60 percent of men remain active in the labour market, in contrast to approximately under 40 percent for women.

For three decades, employment rates among those in the labour force have always been exceptionally high in Thailand. As seen in Figure 2.3, for both male and female workers, the employment rates fell during the 1997 Financial Crisis. Nevertheless, during the normal years, the average unemployment rates never exceed 2 percent. But once the rates are decomposed into age and gender (Figure 2.4), it reveals that the situation of near-full employment is valid only among those aged 30 and above. Among young labour force, employment is higher during 1985-1995. In the past 20 years, youth unemployment rates fluctuate around 5-10 percent. For older workforce (up to aged 65), the employment is as high as the prime age counterparts.

Figure 2.5 decomposes the extensive margin further by marital status for female and male working-age population in the past 30 years. Gender gap of extensive margin is observed among married individuals. Only 6 in 10 of married women under 25 years old participate in the labour market vis-à-vis 9 in 10 of married young men. Moreover, the participation rates of young married women seem to mildly decline over the years.

Participation rates among prime-age singles are gender-neutral. Interestingly, single young persons have lower extensive margin than the young married ones. This may be due to the higher rate of student status among non-married young individuals. We will return to this observation in Section 3. Figure 2.6 disaggregates individuals by highest qualification obtained. Averaging across all birth cohorts (where specific ages are available), we notice a gradual drop of labour participation among men with primary school qualification. For women with primary school and middle school, their extensive margin start to decline by 15 percentage point before the official retirement age (60 years old). In contrast, college graduates have relatively stable extensive margin of labour supply during their working ages (up to aged 60). After the official retirement, we observe a sharp, drastic drop of their extensive margin. College women aged 61 and above participate at 17 percent, compare to 30 percent among the male equivalent.

Notice that even after the retirement age, over half of middle school men remain active in the labour force. Moreover, workers with primary school education stay on the labour force in the highest proportion, in comparison. Over the life cycle, their labour participation adjust relatively mildly upon reaching the official retirement age. 76 percent of primary school men aged 61-65 reported to stay on. And only just over 50 percent of women aged 61-65 leave the labour market.

Over all, when discussing the *extensive margin* of Thai labour force, we obtain a high value for both men and women. Older age workers participate less, with smaller rate among female workforce. But if they participate, their employment is almost guaranteed. On the other hand, younger workers participate much less. And among those who participate, their employment

opportunity is smaller than other ages. And this reduction is higher during the last 2 decades. All in all, Thai labour force has a relative high extensive margin on their labour supply.

3. The intensive margin of labour supply

The trends of hours of work in Thai labour force across the thirty-year period reveal less stability over time. Figure 2.7 shows that there has been a slowly declining mean annual hours of work *per worker* for both men and women. In 1985, an average annual hour for men is 2,700 hours and for women is 2,575 hours. In 2015, these numbers are at 2,176 and 2,150 hours respectively. A potential contributing factor is a structural shift of the sectoral composition with fewer workforce working in farming and more in manufacturing and service-base occupations.

Figure 2.8 explores if there are systematic differences in the intensive margins across the decades. Notice that an average worker of the 1985-1995 series worked more hours. Among prime age workers, those in the 1995-2005 worked approximately 150 hours annually less than the earlier decade (mean hours at 2,630). Moreover, workers in the recent years supply over 300 hours fewer. According to the plots, there is little age effect on hours-of-work toward older ages. However, the age gap of hours-of-work is observed in the youth workforce.

Figure 2.9 plots the intensive margins of working-age population by gender and marital status. The age ranges focus at aged 30-65. The LFS from the 1985-1995 indicate a stable trend of hours per worker across the ages for both men and women. Comparing across three decades, the plots confirm that workers in more recent years have fewer mean hours than earlier years. We observe minimal marriage premium among men. For women, the marriage premium is largest among the 2005-2015 data and across the age range.

Next, we examine hours of work per worker by work status. Figure 2.10 shows that for private employees, self-employed and unpaid family workers status, hours-of-work is higher in earlier decades. On the contrary, government employee (including quangos employee) see the mean annual hours remain stable across age and calendar years. That might be due to the most rigid employment contract in term of flexible hours throughout the history (average of 37 hours per week). Note also that because of age-limit hiring age and fully imposed retirement age at 60, we do not observe hours of work among those over 60 years old under the government employee status.

The inverted U-shape relationship between hours-of-work and age cohort is observed most noticeably among the self-employed. This reflects the nature of adjustable hours within this type of labour market. Similarly, we can observe the similar inverted U-shape among unpaid family workers. Mean work hours of private employees look age-independent. Workers from earlier survey years supply more hours, on average. However, the absolute difference is not significant (mean weekly hours in 1980s, 1990s and 2000s are 50, 46 and 45 hours respectively). In comparison, self-employed and private employees work the longest hours (44 and 45 hours per week in the 2000s). Unpaid family workers work 42 hours per week whilst official employees supply 39 hours (2005-2015 series).

Alternatively, workers can be classified into the routine and non-routine occupation⁶. Over three decades, the intensive margins among highly routinised occupations are relatively stable (Figure 2.11). On the other hand, we observe the reduction of average hours among the non-routine occupations over this period. Until 1996, workers in the non-routine occupations have higher hours than the routine. In the last decade, the average pattern of work hours between routine and non-routine occupations have started to converge. Along the ages, we observe only mildly decline in annual hours-of-work along older ages. On the whole, the trends are relatively flat across all ages.

In so far, the trends in working hours tell only mean total hours among those who participate and with non-zero hours. Therefore, the flat line of intensive margin across the age range indicate that non-zero hour workers do work the same hours regardless their ages. As an alternative, Figure 2.12 plots the mean hours annually *per working-age* capita. Therefore, the revised denominator now includes all working-age individuals, including unemployed and out-of-labour force persons. With almost full participations, mean hours *per working-age* capita among the prime-age is at the same level as total hours per worker. However, due to the different participation rates among the youth and the elderly, we obtain an inverted U-shape plot of the total hours *per working-age* capita. For the 1985-1995 series, the mean hours begins to plateau by aged 22. For the past two decades, each intensive margin plot begins to plateau at slightly later age (aged 25 for the 1996-2005 and 5 years later for the 2006-2015).

III. A pseudo-cohort for the life-cycle labour supply, but different groups

A drawback of using repeated cross-section data is that we are unable to track same individuals through time. Therefore, the interpretation for intertemporal adjustment of labour supply can be limited and biased by generational effect. In this section, we begin by constructing an aggregated pseudo panel of birth cohorts (Browning, Deaton and Irish 1985, Blundell, Meghir and Neves 1993, Warunsiri and McNown 2010) from the LFS. We identify the birth year of individuals in our data series and group them into 10-year birth cohorts, separately for men and women. Our LFS sample provides five birth cohorts⁷. We also exclude other older or younger birth cohorts with too few observations. This approach allows use to track, on average, the same representative individuals, over their life cycles.

Figure 3.1 explores the life-cycle of the extensive margin of labour supply for women and men. It shows that during the early-career age period, both men and women share similar steepness the change in the extensive margins. Across all birth generation, the stabilised participation is reached by aged 30 for women and by aged 25 for men. And the plots begin to decline approximately 10 years earlier for women (at aged 45) than men (at aged 55). In sum,

⁶ For fuller details, see Autor and Dorn (2013). We use the classification constructed in Lekfuangfu and Lerkcivilize (2017). It is built upon Autor, Katz and Murphy (2008) and Autor and Dorn (2013) and task compositions are based on the US's O-NET classification.

⁷ They are those born in 1940-1949, 1950-1959, 1960-1969, 1970-1979 and 1980-1989. We omit both earlier and later birth cohorts due to small cell size.

the mean life-span of a full market participation (female: 80% versus male: 95%) is 15 years for women and 30 years for men.

Figure 3.2 displays differences in the extensive margin across marital status among the Thai workforce. Young, married women participate in a smaller number than their single counterpart. However, this pattern is reversed when comparing women aged 30-45. During these ages, married women participate more in the labour markets than the single women. Towards the later part of the life cycle, older married women reduce their extensive margin more than the older single women. By aged 60, only 48 percent of married women stay on whilst over 60 percent of single women do. Similarly, the same pattern is found when comparing older men of different marital status. 70 percent of single men remain active in the market by aged 60 whereas there are only 50 percent of the married men. Notice that among younger age workers, earlier generations have higher extensive margins than the recent generation.

Figure 3.3 explores patterns of the life-cycle of the extensive margin between different education levels. The life cycle of primary school graduates look plateau throughout their working ages. Older generations has higher extensive margin during the earliest working life. By aged 65, the participation rate remains high at above 50 percent. For middle school graduates, the life-cycle of the extensive margin of labour supply depicts an inverted U-shape. The margin increases with a sharp rate during the ages of 15-30 years old. The rate remains stable at 85 percent across the prime ages. We observe a sharp downward adjustment of labour participations from aged 55 onwards. At the official retirement age, around 50 percent of middle school graduates stay on in the labour markets.

For college graduates, around 20 percent of them work by aged 20. By aged 25, the extensive margin reaches 90 percent. This rate is constant among those aged 35-50. The life-cycle plots of college graduates show a sharp decline of labour participation 5 years before the official retirement age. By 65 years, only 20 percent of college graduates report themselves as active in the labour markets. Types of occupation can be a factor contributing to the difference in the extensive margins at the older ages by education level. Fewer primary school graduates are in formal employment with social security and pension. Thus, their persistent rate of market participation after aged 60 might reflect the necessity of employment, rather than a choice.

Turning to the life-cycle pattern of the intensive margin, Figure 3.4 shows mean annual hours-of-work *per worker* across 5 defined birth cohorts. Again, we can observe inverted U-shape pattern of labour supply across the life cycle. At the same reference age (for instance, aged 30-40), earlier generation of Thai population work more hours. Average workers start to reduce hours-of-work at around aged 50. By age 65, the hours-of-work is reduced to just over 60 percent of the full hours during the prime age.

Figure 3.5 displays the life-cycle intensive margins of women and men separately. Both men and women share similar pattern of the labour supply over the life cycle, with men enjoying more hours per year than women in all birth cohorts. In comparison, across all ages, we observe that older generations supply more hours than the subsequent birth cohorts. Older generation (born in 1949-1950) supplied more hours at all ages than later cohorts. To check if

marital status is determinant to the variation of life-cycle patterns of work hours (Chiappori 1988, Blundell *et al* 2007), we plot the intensive margins individually for married women, single women, married men and single men. As previously found, Figure 3.6 finds fewer hours supplied by younger generations across all marital status and gender. For older generations (for instant, the Post-War generation), hours-of-work begins to decline at around aged 45. Cohorts of the 50s and 60s, their hours-of-work begin to decline earlier, around aged 40. In addition, married women see declining hours of work since early prime age. The trend is similar across birth generations. Among those who work, there is no significant difference of hours of work across marital status for female workers.

Next, we look at potential differences across marital status. Figure 3.7 puts together men and women by their marital status, separately for each birth cohort. First, across all generations, single men work more hours than single women. However, there is no gender premium of work hours among men and women who are married. Hours of work for married men and married women track closely with one another along the age distribution. Only in the birth cohorts of the 40s and the 50s that we observe inverted U-shaped pattern of the life-cycle plots of their intensive margins. Again, we see that older generations (the 40s) reduce their work hours from its peak almost five years later (at aged 46) than the 50s birth cohorts (at aged 51). Once plotting separately, we notice that hours-of-work for the 60s and the 70s reflect the U-shape to the least extent. In fact, the plots of work hours per worker among these generations have downward sloping patterns- without a peaked age.

Next, we check the intensive margin pattern across education groups. Figure 3.8 shows inverted U-shape of hour-of-work only for the lowest education workers. This may suggest a decline of labour productivity along the age distribution. In contrast, Figure 3.8 shows a flat, age-independent pattern of hours-of-work for both middle school graduates and college graduates. College graduates work fewer hours on average than other education levels. And this pattern is consistent across birth generations in the LFS.

To provide more comprehension of roles played by education attainment on Thailand's labour supply, we calculate the proportion of individuals with student status at each age. Figure 3.9 plots this proportion along the working-age distribution. The plots present a stark difference of the proportion between each birth generation along the adolescent age distribution. For the generation born in the 1980s, over 80 percent of the 15-year old remain in education. Twenty years ago, the number was at 30 percent, approximately. That is, by aged 22, just under than 10 percent of the 1960s and 1970s birth cohorts maintain their student status. In contrast, over 20 percent amongst the 1980s cohort remain in education and therefore, by construction, are not active in the labour force. One key factor explaining this generational difference is the changes of Thailand's compulsory school laws. Individuals born in the 1980s had been exposed to the increase of the compulsory education to Year 6 of primary school Year 6 (the Basic Education Act of 1980). In addition, the expansion of higher education institutions can be another factor to the larger share of late adolescent' student status among the 1980s birth cohort than in earlier generations (the Rajabhat University Act of 2004).

IV. Decomposition and a small calibration analysis of changing demographic composition

From the previous section, we have observed that the overall average hours worked differ by an individual's characteristics. First, the long spanned LFS shows strong variations of extensive and intensive margins of labour supply by age of a person. Second, there are differences of labour supply behaviours from one birth generation to others. In this section, we will use a statistical decomposition method (BBL, 2011, 2013) to understand some mechanisms behind the changes of population-averaged labour supply. In particular, we investigate potential effects on labour supply trends due to (i) a change in the age composition of the population and (ii) evolution of labour supply behaviours among different birth generations.

Let

$$H_t = \sum_J a_{jt} H_{jt}$$

where a_{jt} is a proportion of an age group j in the population in a given time t . H_{jt} is average hours-of-work among the persons aged j at time t . Therefore, H_t represents the overall average hours-of-work per working age capita at time t . Built on Equation 1 in the previous section, H_{jt} depends on two key factors: the rate of participation (p_{jt}) among the group and the average hours-of-work of workers in the group who work non-zero hours (h_{jt}). Therefore,

$$(2) \quad H_{jt} = p_{jt} h_{jt}$$

To account for the marginal effect of the demographic structure change on H_t , we can show that if the proportion of age group changes from a_{jt} to a'_{jt} , the alternative population-average hours-of-work can be written as:

$$(3) \quad S_t = H_t - H'_t = \sum_J a'_{jt} H_{jt} - \sum_J a_{jt} H_{jt}$$

Similarly, the change of total hours due to the change in labour supply behaviours, holding the age composition constant, can be derived via two margins: (i) behavioural difference at the extensive margin and (ii) behavioural difference at the intensive margin of labour supply. Note that both changes can occur in isolation or simultaneously.

$$(4) \quad \widehat{H}_t = \sum_J a_{jt} \widehat{H}_{jt}$$

where there are three alternatives for \widehat{H}_{jt} as the following:

$$(5.a) \quad \text{Extensive margin change: } \widehat{H}_{jt} = \widehat{p}_{jt} h_{jt}$$

$$(5.b) \quad \text{Intensive margin change: } \widehat{H}_{jt} = p_{jt} \widehat{h}_{jt}$$

$$(5.c) \quad \text{Simultaneous changes: } \widehat{H}_{jt} = \widehat{p}_{jt} \widehat{h}_{jt}$$

To conduct the statistical calculation described above, we obtain the information of labour supply behaviours (extensive and intensive margins) from the LFS for each demographic group (defined by gender and age). We calculate the average participation rate and the average total hours worked for a given gender-age group (aged 15-24, 25-50 and 51-65)⁸. For the age composition of Thai population, we obtain the data from the UN Population Forecast⁹. We calculate the share of each age group among the working age population (defined as aged 15-65). The H_t is equivalent to an average total hours for a working-age person, with weight equals to the actual corresponding year's demographic composition.

In the first exercise, we want to forecast how total works may change as a result of aging demography forecasted over the next 80 years¹⁰. To do this, our calculation substitutes the actual contemporary age composition of working-age population by a series of estimated trend. This is done separately for female and male. Note that constant intensive and extensive margins of labour supply for a given age are assumed throughout this analysis.

Figure 4.1 shows effects of changes in age structure on total labour supply (total hours per working-age capita). Most of these changes are due to a decline of prime age persons for an average woman and man. From the base year (2010), the demographic evolution toward an aging society, *ceteris paribus*, would reduce female hours-of-work by 50 hours per capita per year. At the same time, hours of men would shrink by 20 hours per capita. The difference of the reduced hours is due mainly to a much smaller volume of labour supply (at both margins) of the elderly vis-à-vis the prime-age women. In contrast, the elderly Thai men participate only marginally less than the prime-age men.

To find the effect on total hours due to changes in labour supply behaviours, our next calculation replaces the original labour margin(s) for a particular gender-age group by a selection of alternatives. In this exercise, we assume a constant demographic structure (at 2010 level). There are 3 sets of labour supply margins which we will replace: (a) extensive margin, (b) intensive margin and (b) both margins simultaneously. Within each set, we test three counter-factual scenario: (i) equating labour supply only of the elderly (aged 50-65) to the prime-age (aged 25-49) (ii) equating labour supply only of female elderly to male elderly and (iii) equating labour supply only of female prime-age to male prime-age.

In detail, first we check how total hours per working-age capita may have differ had the Thai elderly (aged 50-65) shared the identical extensive margin as the prime-age counterpart. Second, we replace only the rate of elderly women by the elderly men while keeping other groups' rate constant. Next, we replace the extensive margin of prime-age women by the prime-age men. The last two exercises are equivalent to a policy which would elevate labour market participations of female working-age population. The next set of the counter-factual exercise focuses on the changes of intensive margin (annual hours of work per worker). We substitute

⁸ This is identical to the data presented in Figures 1.4 and 1.8.

⁹ See <https://esa.un.org/unpd> for recent data forecast on population by different demographic background.

¹⁰ Appendix Figure A1 shows the demographic evolution among working age population according to the UNDP forecast model.

work hours of selected groups in the same order as our analysis with the extensive margin. Identically, both extensive and intensive margin are replaced in the final exercise.

Figures 4.2.A- 4.2.C depict total hours-of-work for an average woman under different scenario where counter-factual levels of labour supply margins are used. Figure 4.2.D shows total hours for an average male when each margin of an elder male is substituted by the prime-age equivalent. In comparison, an increase in the extensive margin raises more total hours-of-work per working age woman than an increase in the intensive margin (hours). A rise in the participation rate of elderly to equal that of prime-age raises female hours by 110 annual hours per person. Equating participation rate of elderly women to elderly men raises a similar level. Most of all, by equating prime-age female participation rate to the male raises annual hours from 1,550 to 1,710 hours. In contrast, changing the intensive margin of labour supply behaviour has a limited contribution of the total hour of an average working-age woman. Total hours rises but by 20 annual hours at most across all scenario.

Counter-factual policies that may change labour supply behaviours across both margins are strongest at pushing up the total hours-of-work. Using a statistical decomposition approach, in Scenario 1, intensive margin accounts for 23 % whilst extensive margin accounts for 77%. For Scenario 2, intensive margin equals 14% and extensive margin equals 86%. For Scenario 3, extensive and intensive margin account for 36% and 64% respectively.

V: Discussions and conclusions

So far, evidence from the LFS across 30 years shows that on the one hand, labour participation rates of Thai working-age population have been stable over the decades. The extensive margins for men are broadly higher than women across all ages, in comparison. On the other hand, hours-of-work is higher in the earlier years than the recent. And this pattern is true across gender, education and work status, excluding government employee. Thai government employees see the same mean annual hours-of-work since 1985 and the level is flat across all ages.

Interestingly, when looking at the role of marital status, we find that the marriage premium (in favour of *single* status) is not significantly large among women at the intensive margin. Working married women and working single women supply similar annual hours throughout the decades. The stark difference in their labour supply behaviour is the extensive margin-whether or not married women would join the labour force at all. At prime ages, over 90 percent of single women are a part of the labour force whereas 80 percent of married women are. Note that this rate is relatively high in comparison to the global average (World Bank Statistics). But with the comparison to an average Thai marriage male, their participation rate is near 100 percent, up until age 50.

To draw upon some policy recommendations, we do some back-on-the-envelope calculations to account for the “lost annual hours” of female labour force for being married. The first calculation ask the “lost annual hours” if an average female at a particular age group

were to participate at the same rate as her male equivalent but with her own annual hours-of-work. The second calculation replaces both the extensive margin and the intensive margin of age-dependent married female by the male equivalent. Figure 5.1 shows age-by-age lost annual hours of a married woman under both calculations.

To quantify the lost hours in monetary value, we first summary mean income at each age along the life-cycle age distribution for wage earners by gender and age (Figure 5.2). Then, we calculate potential earning loss as a result of marriage premium by multiplying annual hours in Figure 5.1 (both calculations) with married female monthly earning at each age. Figure 5.3 shows the value of marriage premium occurring to married women, in comparison to married men in term of monetary earning. In sum, if a representative woman were to be married by aged 20, she would lose in total of approximately 25,000 lifetime hours-of-work, which equates to over THB 700,000 worth of lifetime earnings¹¹. If she were to delay her marriage to aged 40, she would lose 13,000 hours and cost her under THB 450,000 lifetime earnings, in comparison to her married male counterpart.

The combination of gaps in hours-of-work hours and in earnings earning above indicates a significantly high marriage premium for married women. However, this value is a lower-bound of total value loss as it excludes plethora of cost of fertility e.g. hours loss during pregnancy, child care and child-rearing hereon (for example Baker *et al.* 2008; Attanasio *et al.* 2008; Blundell *et al.* 2016). Potential policy attempts to encourage higher fertility among professional women may need to consider such big trade-offs when formulate incentives or interventions. Evidence from Thai labour markets presented in this research has emphasised that marriage premiums on female workforce are not negligible when evaluated under a life-cycle perspective.

¹¹ We assume that she works until aged 65 and there is present discounted value in our lifetime calculation here.

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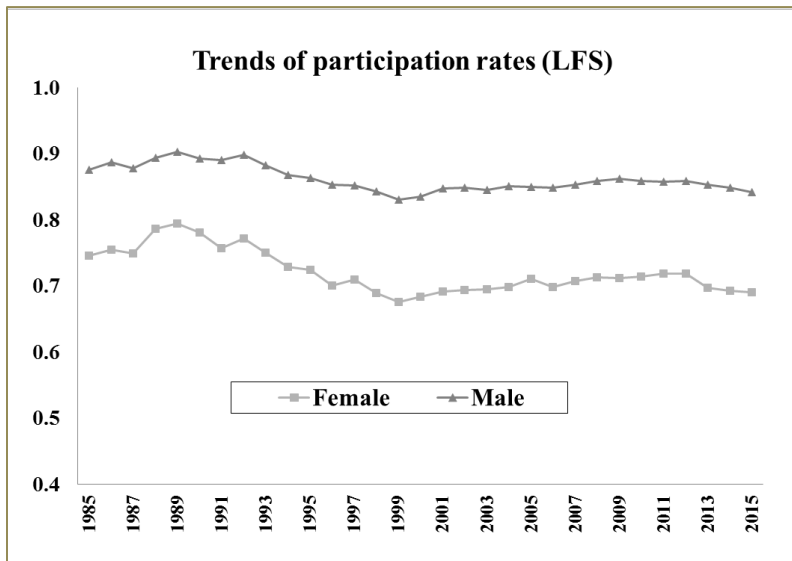
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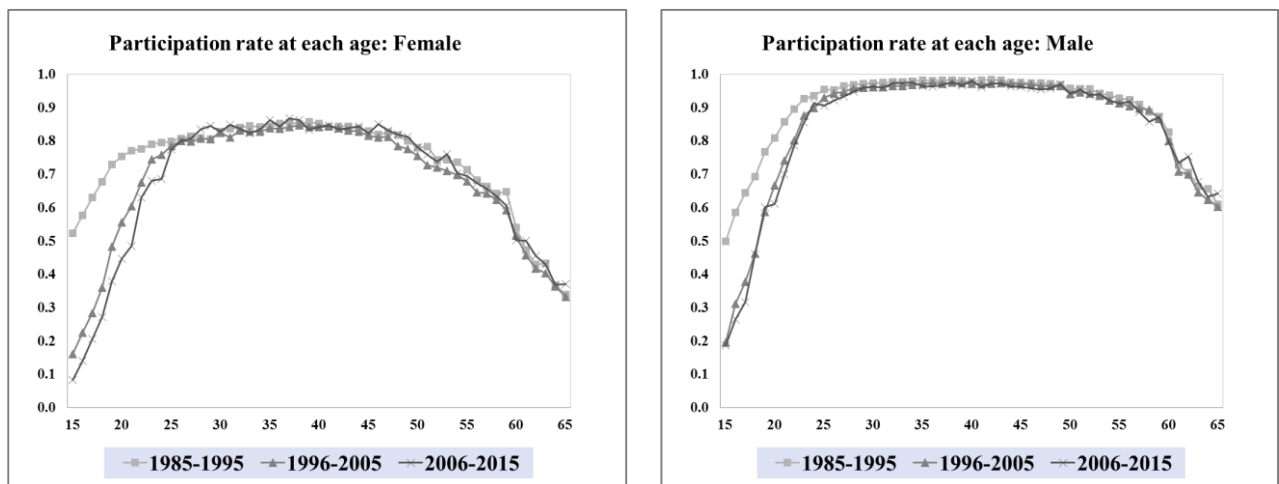
Figures

Figure 2.1



Note: The data source is the LFS (1985-2015, Quarter 3). Participate rate equals to one if an individual is at working age and either work or intend to seek job in the market. It equals zero if working-age individual does not seek job nor currently working.

Figure 2.2: Labour participation at different ages over the three decades



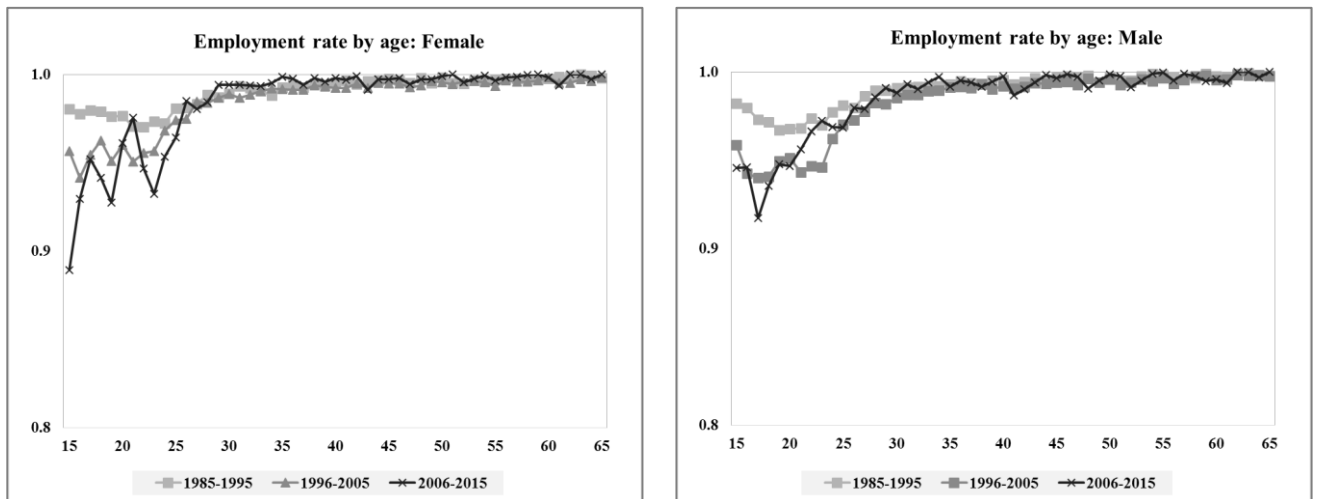
Note: See Figure 2.1.

Figure 2.3: Employment rates among participants



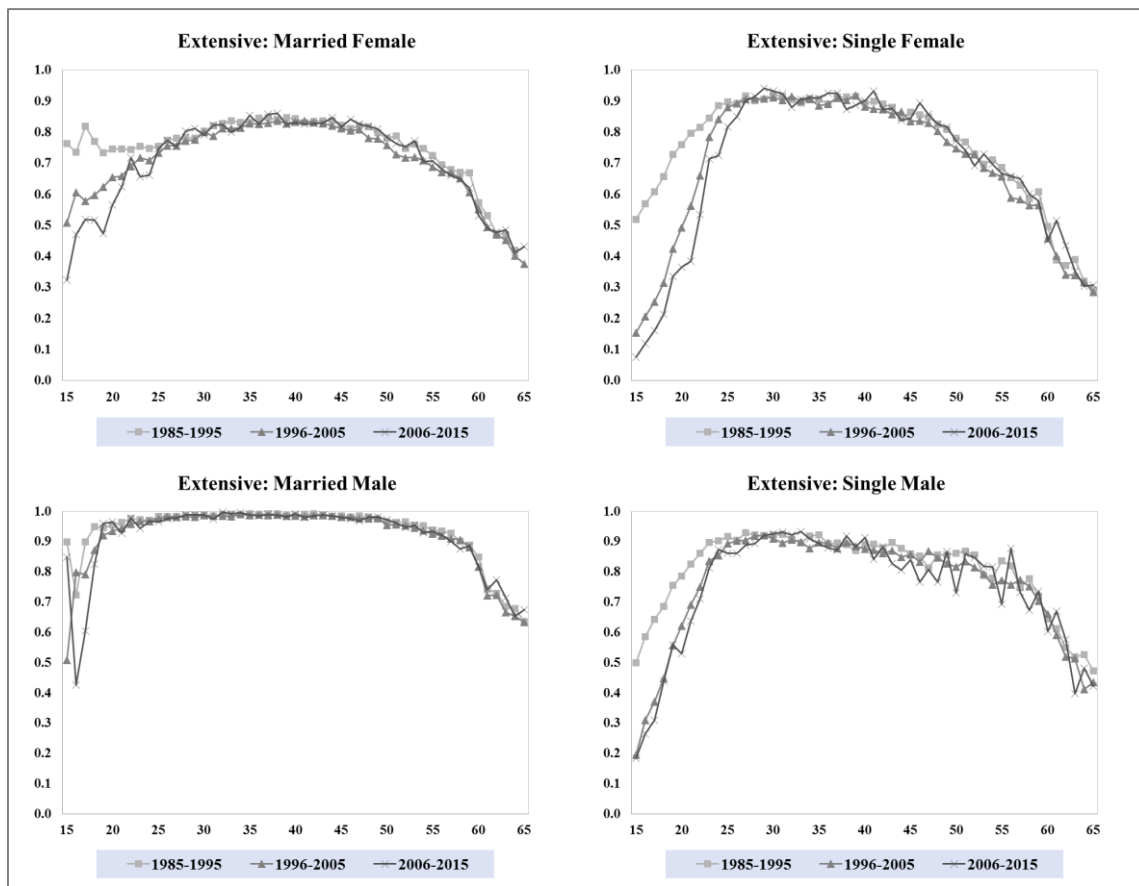
Note: The data source is the LFS (1985-2015, Quarter 3). An individual is employed if either she has a job, out-of-job but will go back or seasonally out-of-job. She is unemployed if she participates in the market but has not job.

Figure 2.4: Employment rates at each age across the three decades



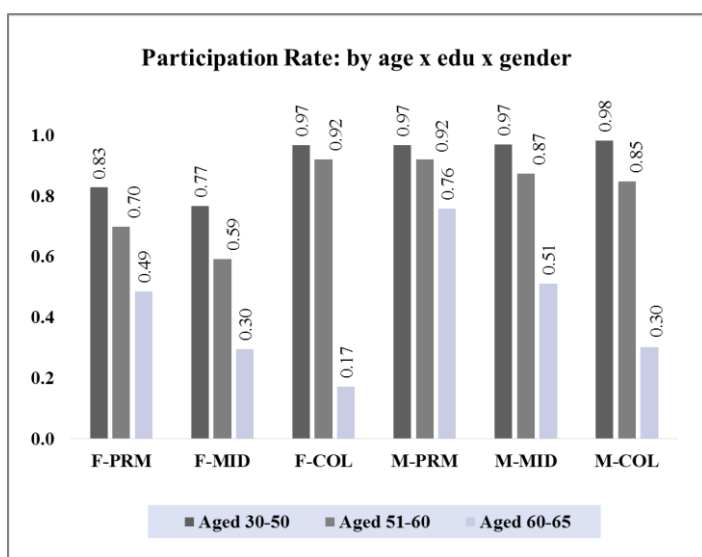
Note: See Figure 2.4.

Figure 2.5: Participation rates by different marital status over the ages



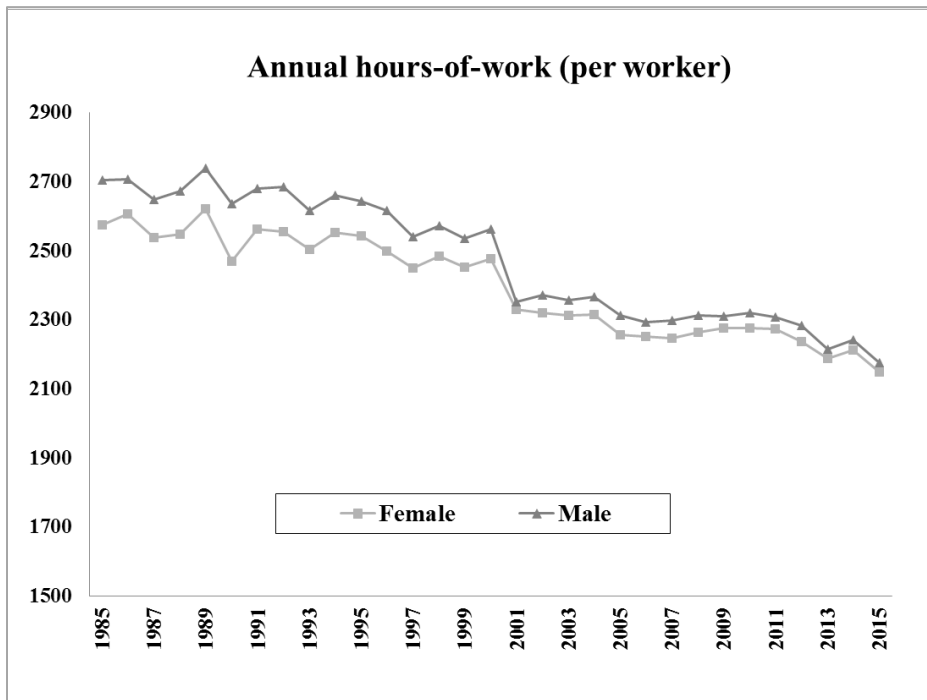
Note: See Figure 2.1. An individual is single if she identifies as single, divorces, separated or widow.

Figure 2.6: Extensive margin of labour supply by education status, over the ages



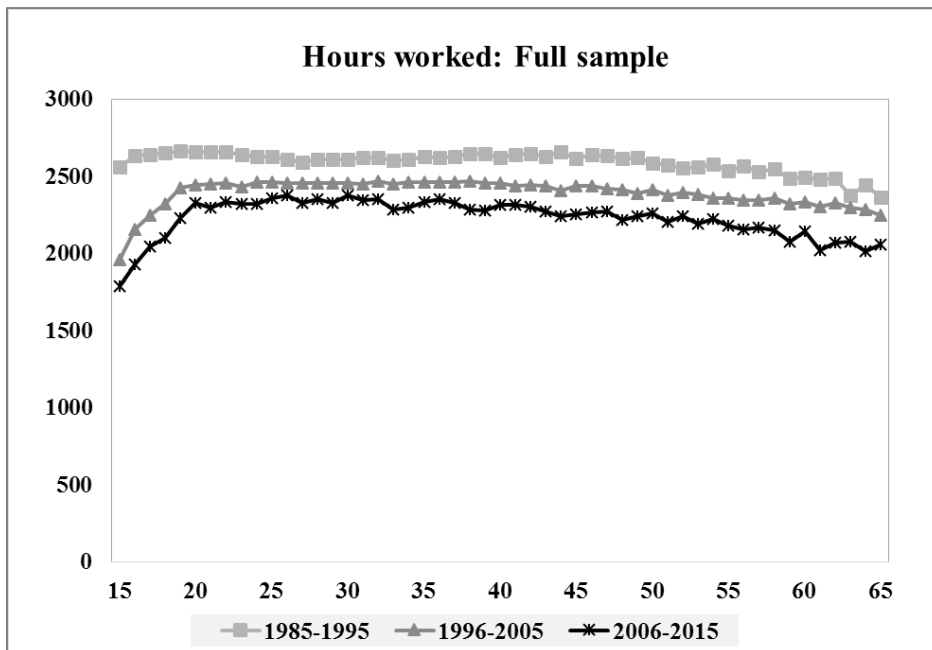
Note: PRM is those with primary school or lower. MID is those with at most high-school qualification, both academic and vocational field. COL is those with at least college degree. F stands for women and M for men. The data is LFS of 1985-2015.

Figure 2.7: Trends of annual hours of work per worker



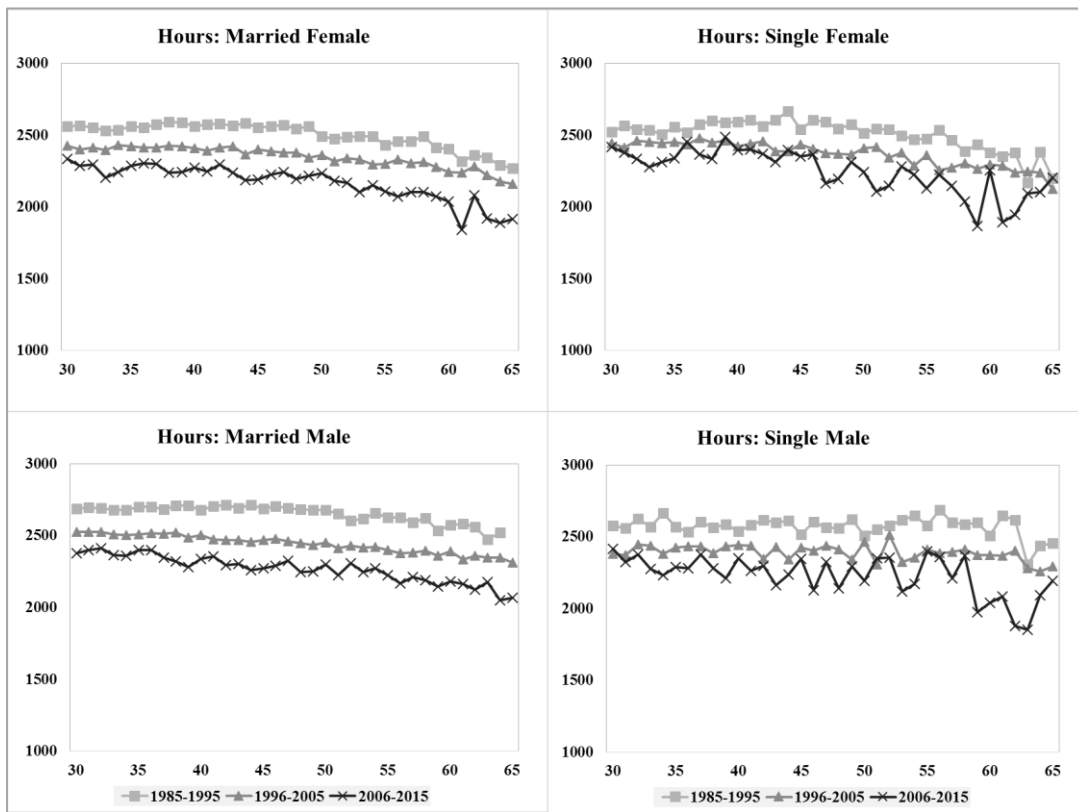
Note: Annual hours per worker in an average of indicated work hours among employed individuals who indicate non-zero hours.

Figure 2.8: Hours of work across three decades for each age



Note: See Figure 2.9.

Figure 2.9: Hours of work by marital status of aged 30-65



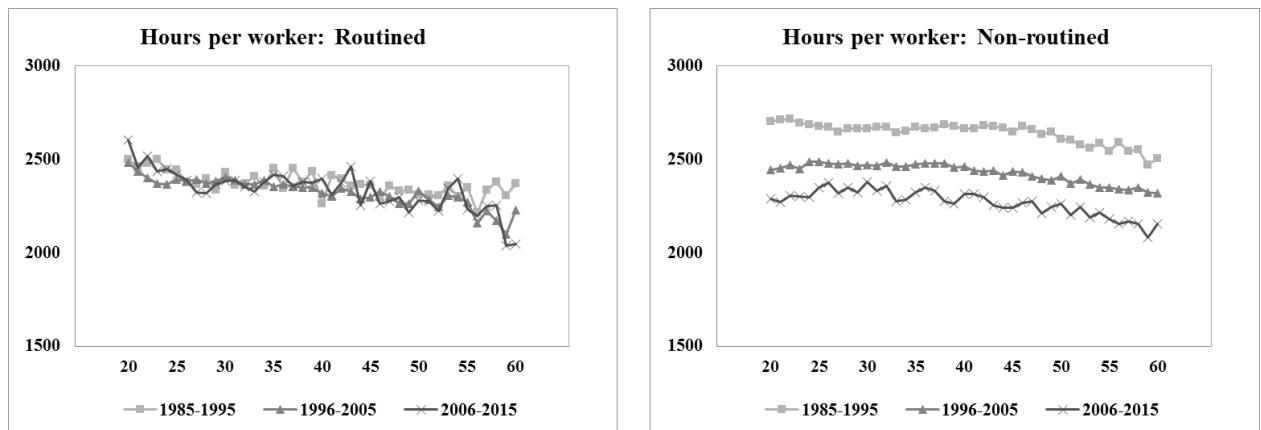
Note: See Figure 2.9.

Figure 2.10: Hours of work by work-status



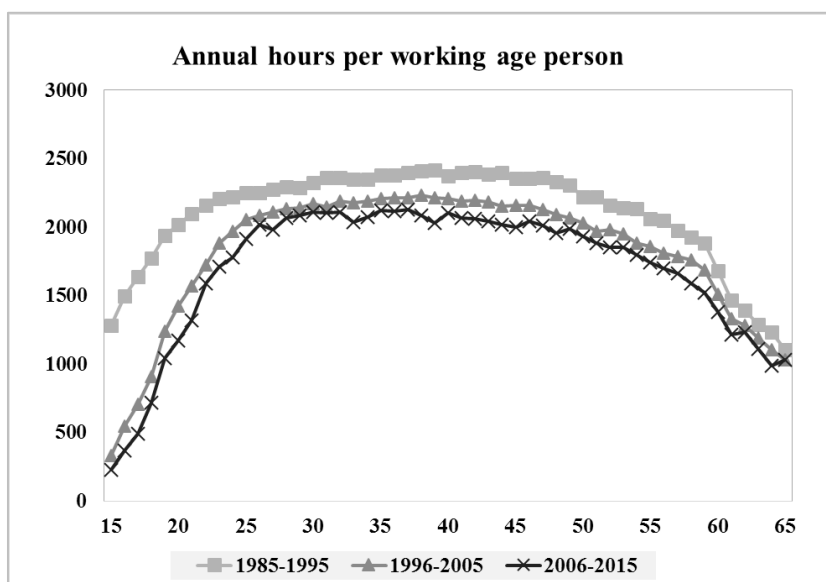
Note: See Figure 2.9.

Figure 2.11: Hours of work of routine and non-routine occupations



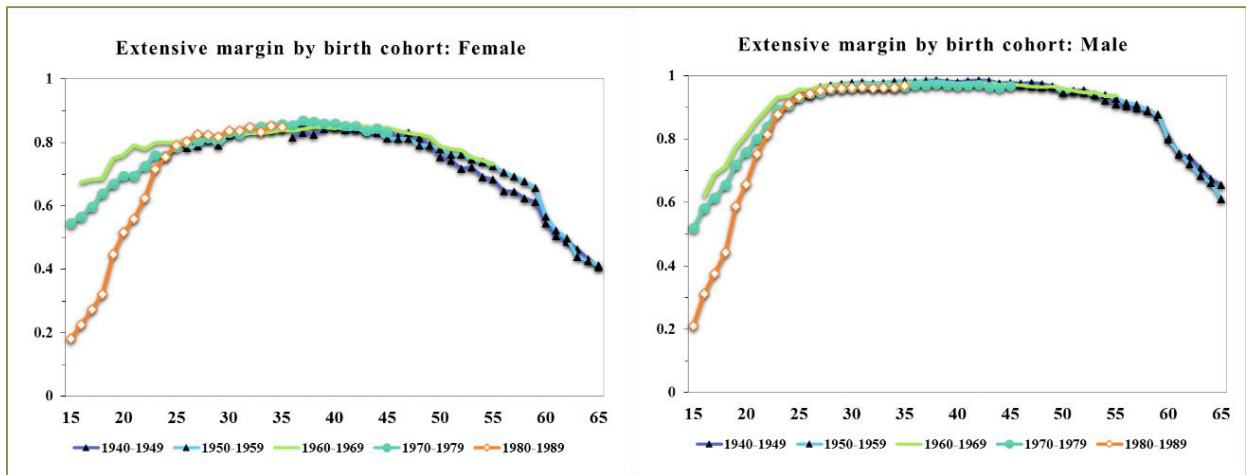
Note: See Figure 2.9. The classification of routine and non-routine occupation is derived from Autor and Dorn (2013) and Lekfuangfu and Lekcivliz (2017)

Figure 2.12: Hours of work per working-age capita



Note: See Figure 2.9. Hours of work is an average across all individuals of a given age group in a given survey year. Therefore, the denominator includes unemployed and non-participants in the labour market.

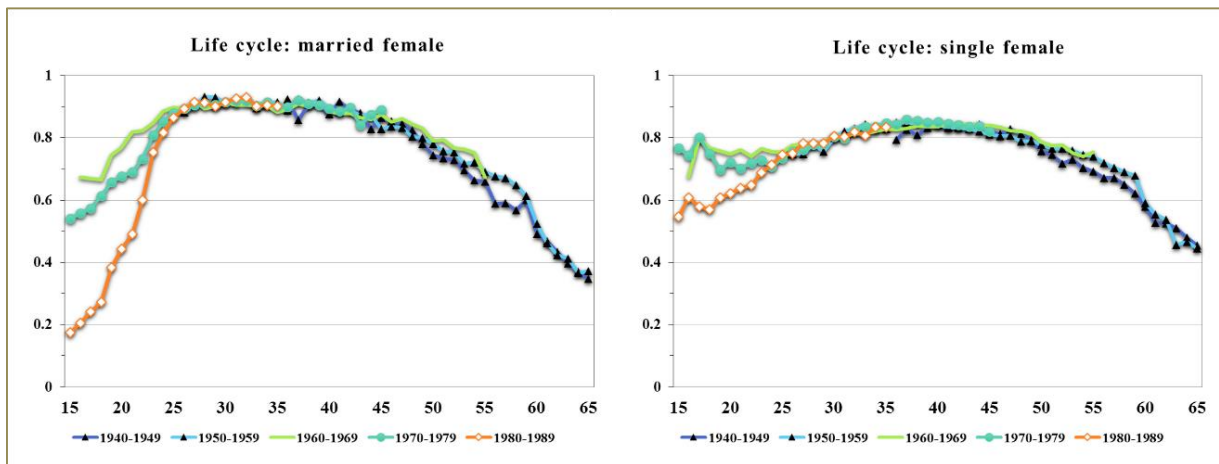
Figure 3.1: Participation by birth cohort



Note: Birth cohorts are grouped into a 10-year interval from the LFS (1985-2015).

Figure 3.2: Life cycle participation by marital status

Female



Male

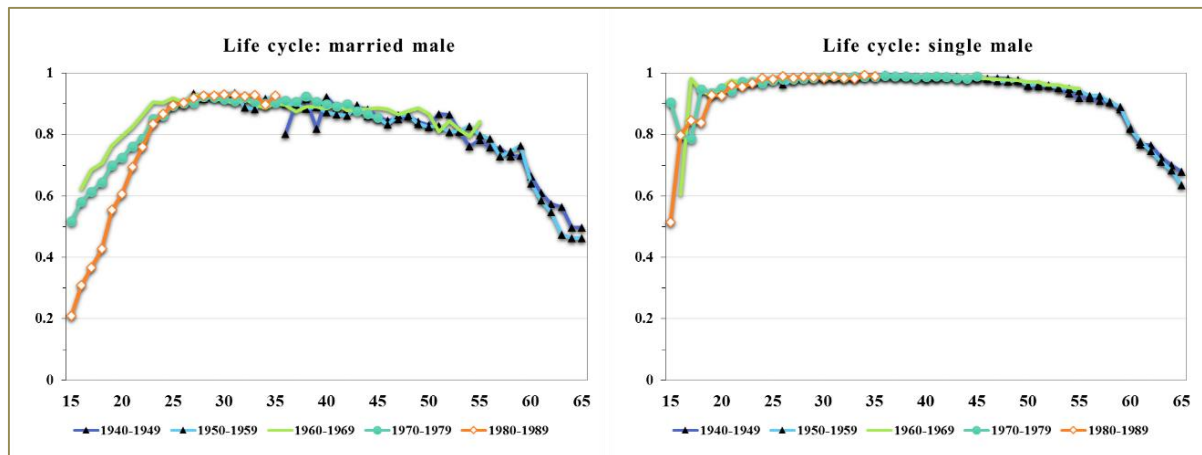
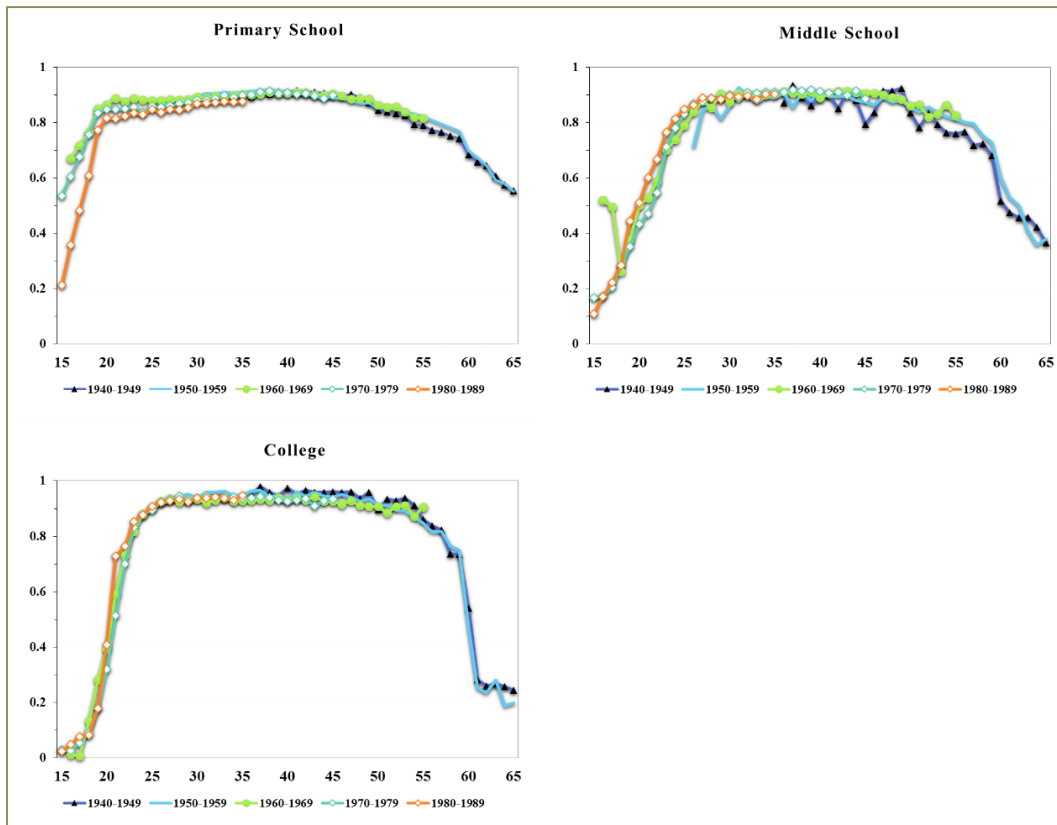


Figure 3.3: Participation by education for each birth-cohort



Note: Primary School are those with primary school or lower. Middle School are those with at most high-school qualification, both academic and vocational field. College are those with at least college degree. F stands for women and M for men. The data is LFS of 1985-2015.

Figure 3.4: Hours-of-work per working over the life-cycle

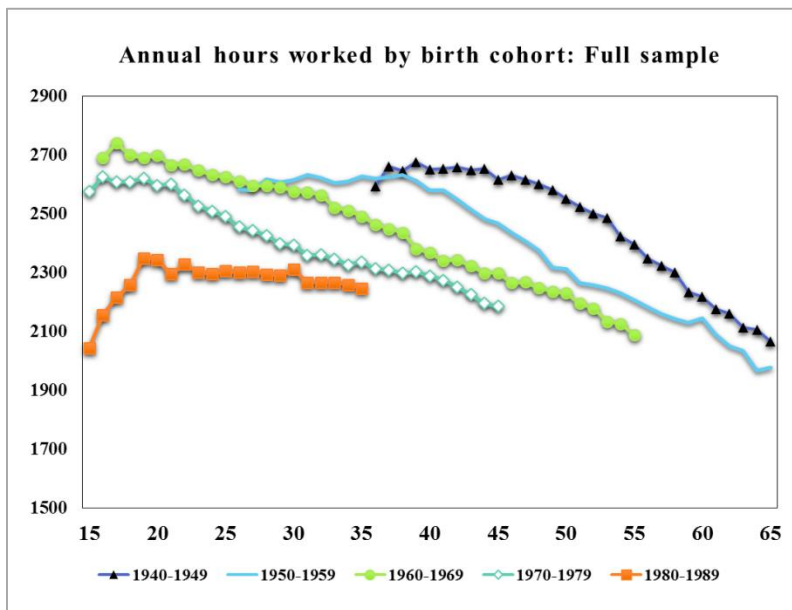


Figure 3.5: Life-cycle intensive margins by gender and birth cohorts

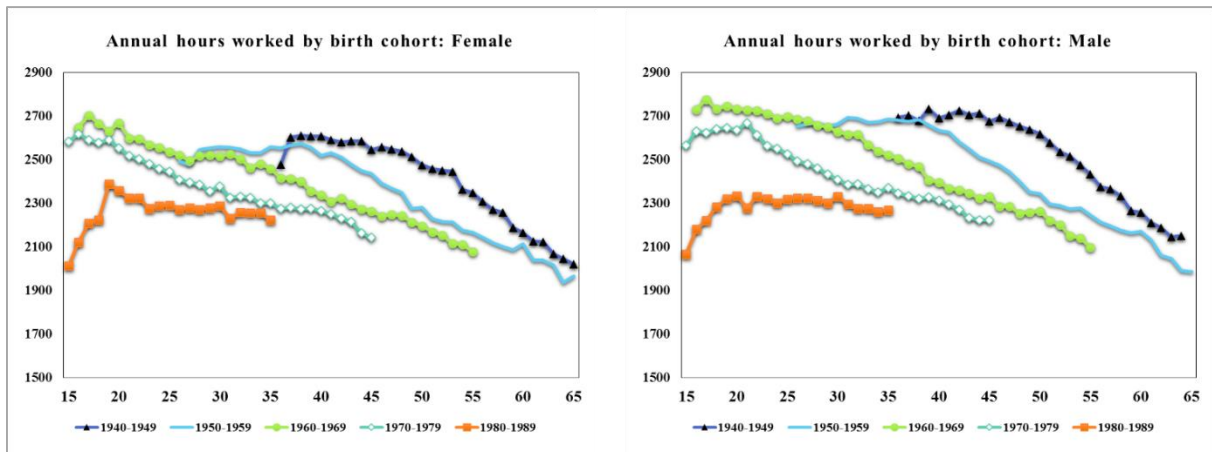
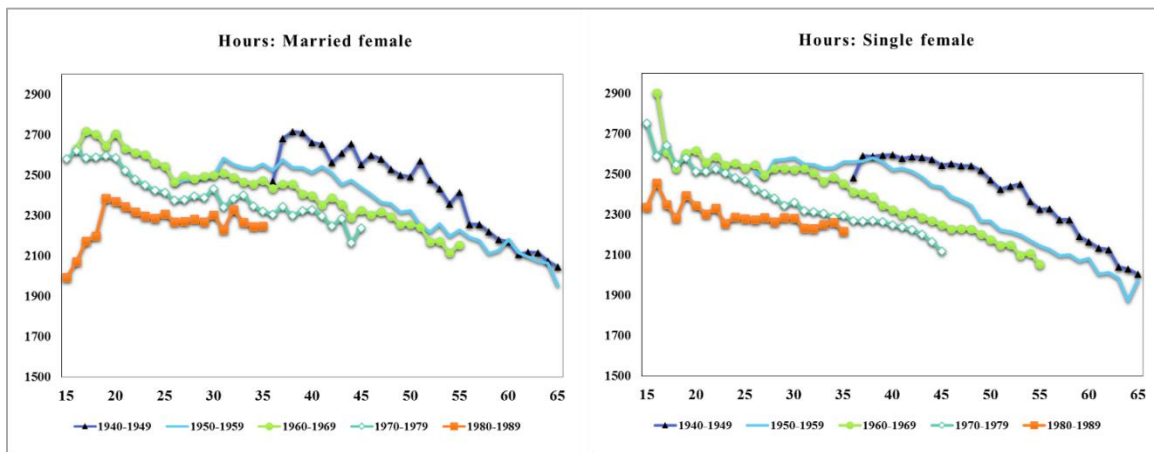


Figure 3.6: Life-cycle hours by marital status and gender

Female



Male

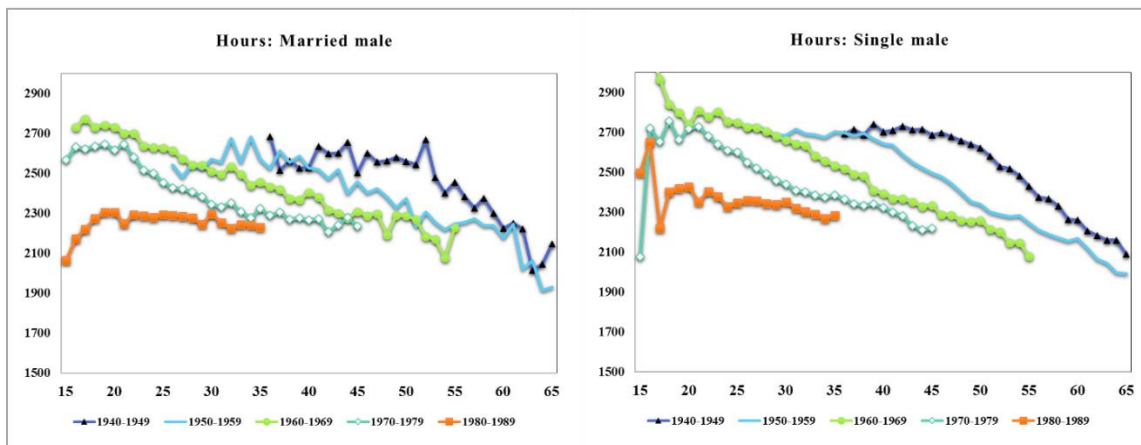


Figure 3.7: Hours worked by marital status for each birth-cohort

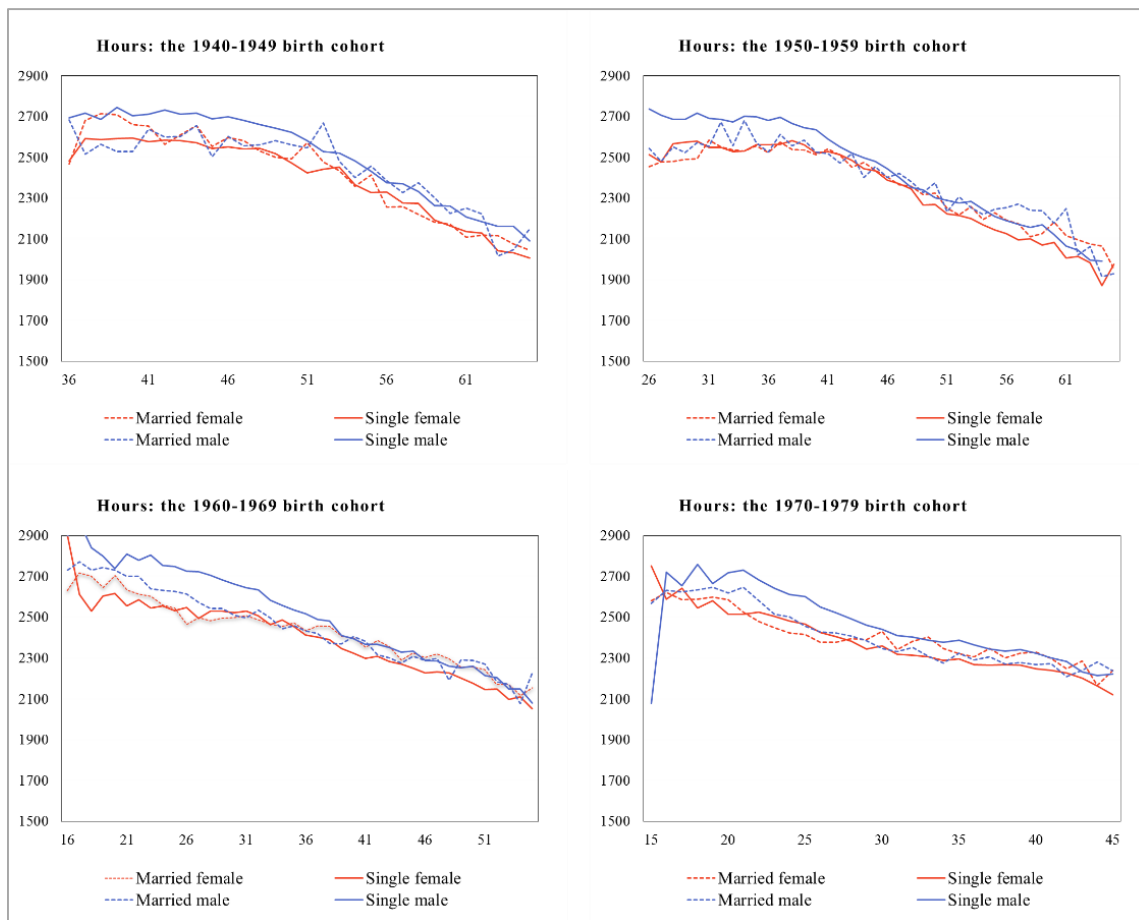
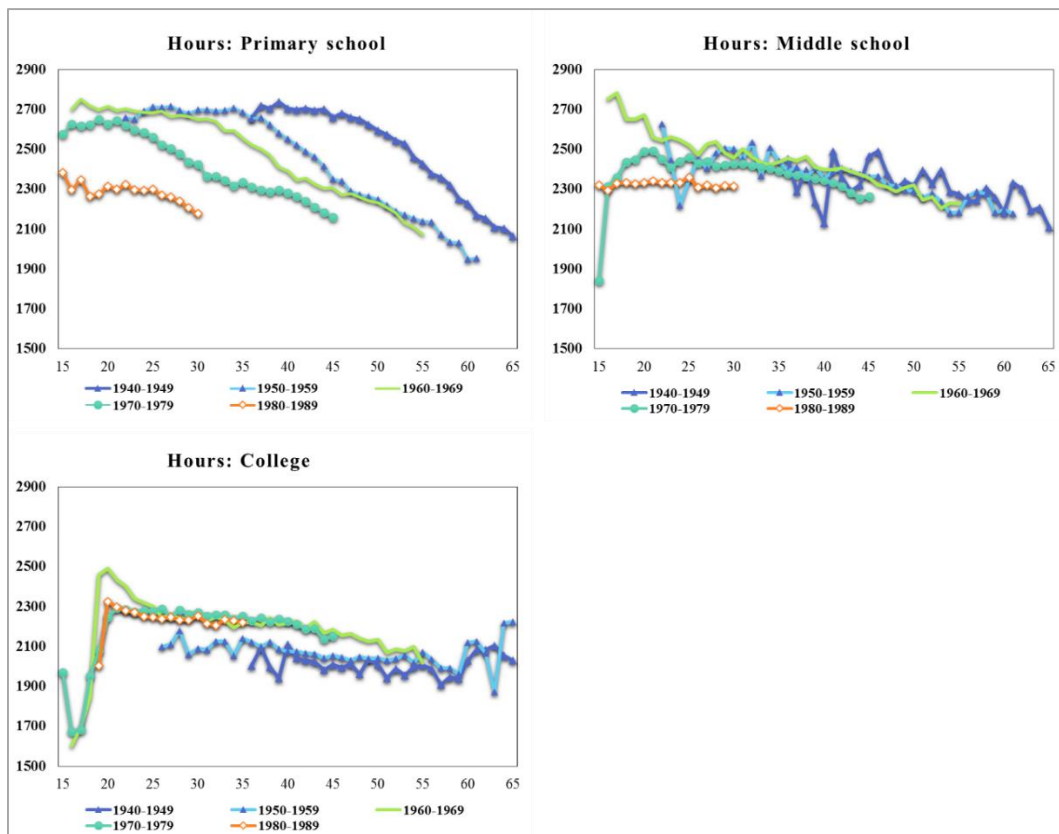
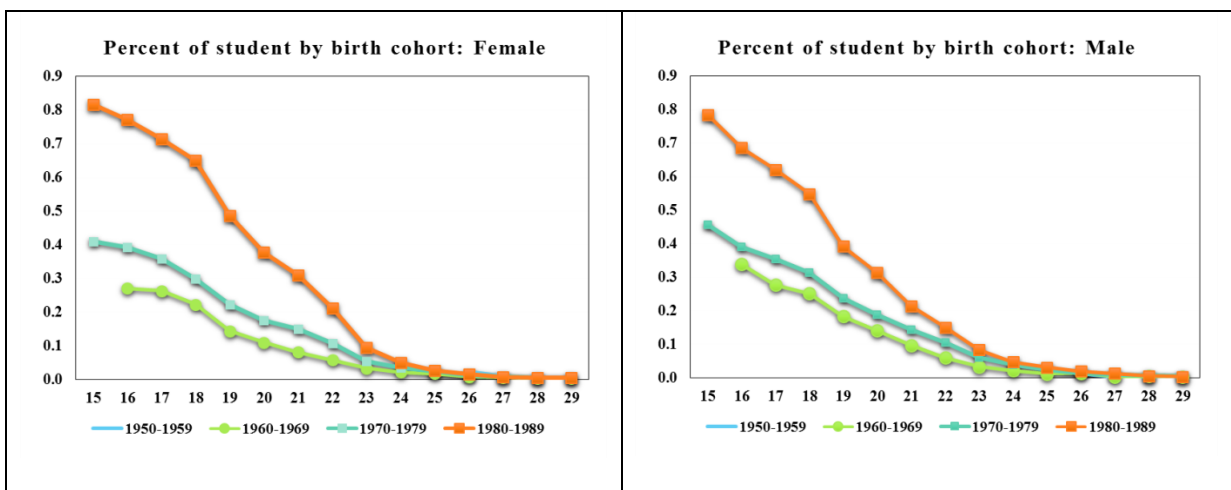


Figure 3.8: Hours worked by education for each birth-cohort



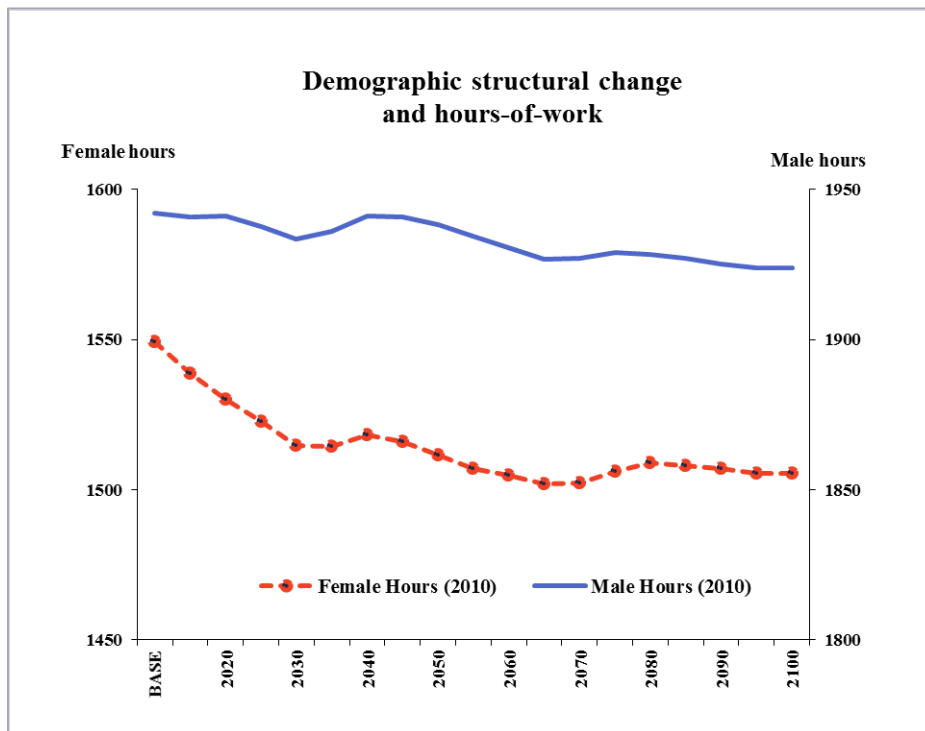
Note: See Figure 3.3

Figure 3.9: Percent of students-to-population by generation



Note: In the LFS, *student* is identified in 2 ways. They are individuals who are attending school during the survey. And they are those who select being a student as a reason of their non-participation.

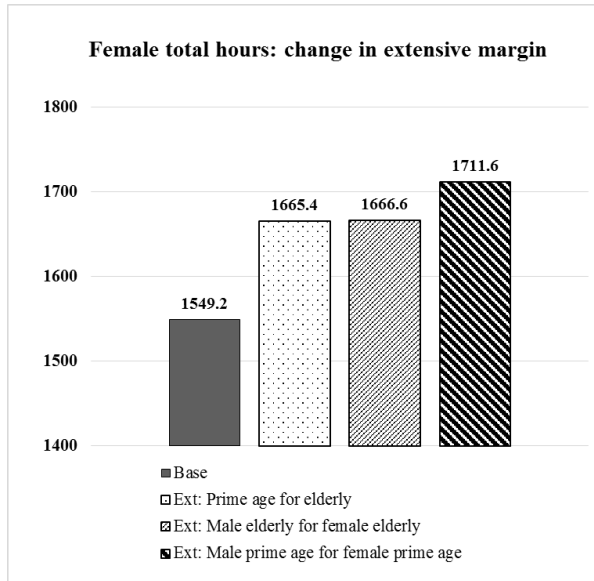
Figure 4.1: Effects of changes in age structure on total labour supply



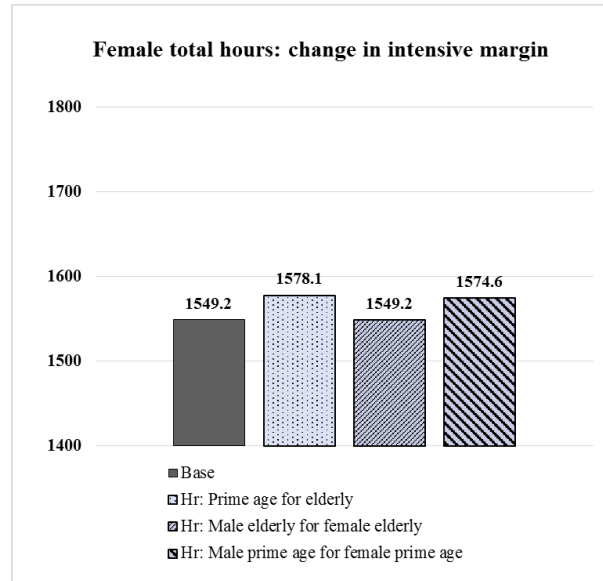
Note: Data on demographic composition forecast is taken from the UN Population division. The calculation uses the share of population by age-group. The magnitudes of work hours shown here is calculated based on the forecast age-distribution with the mean hours of each age from the LFS. The calculations are done separately for women and men.

Figures 4.2.A- 4.2.D: Counter-factual calculation of annual work hours under 4 scenario

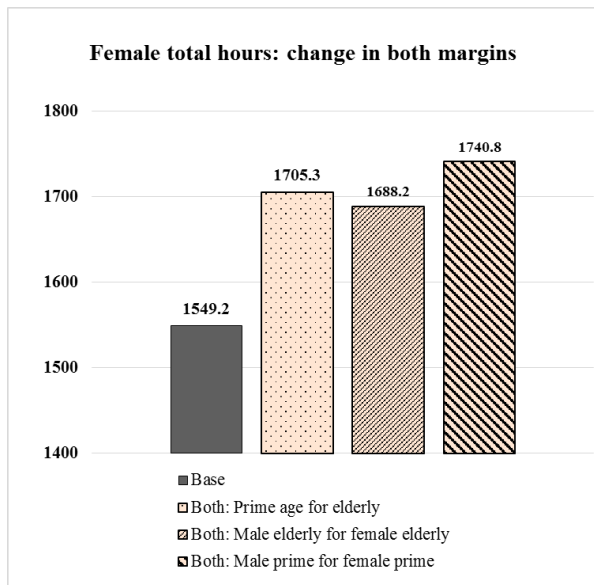
(A)



(B)



(C)



(D)

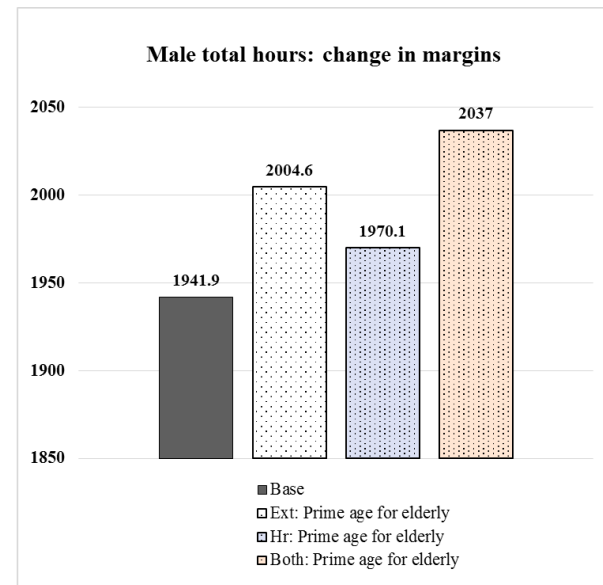
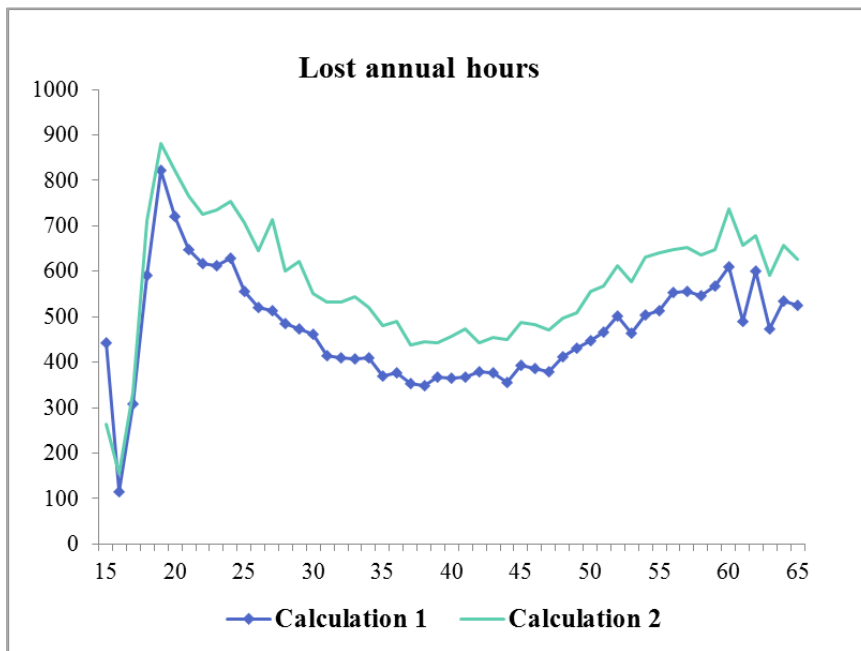
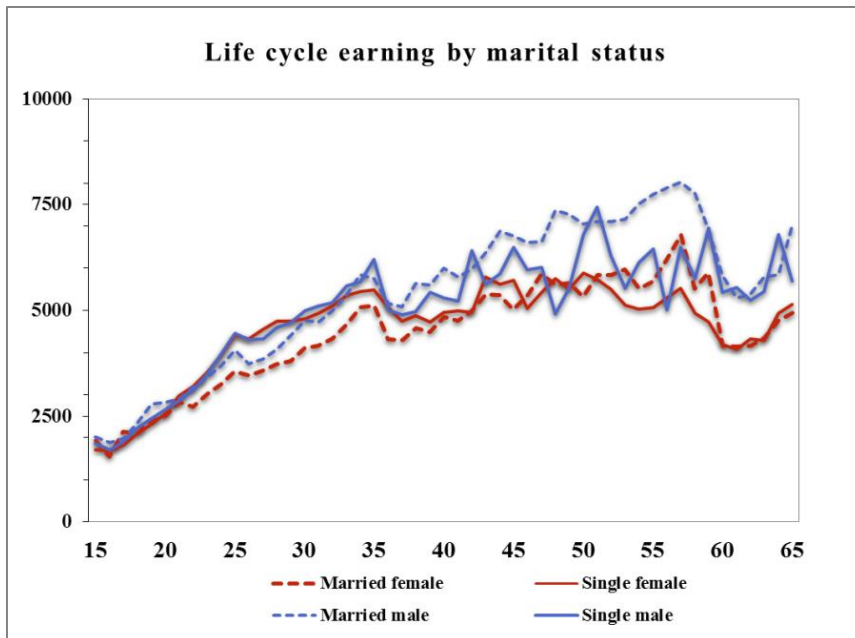


Figure 5.1: Lost annual hours of married women



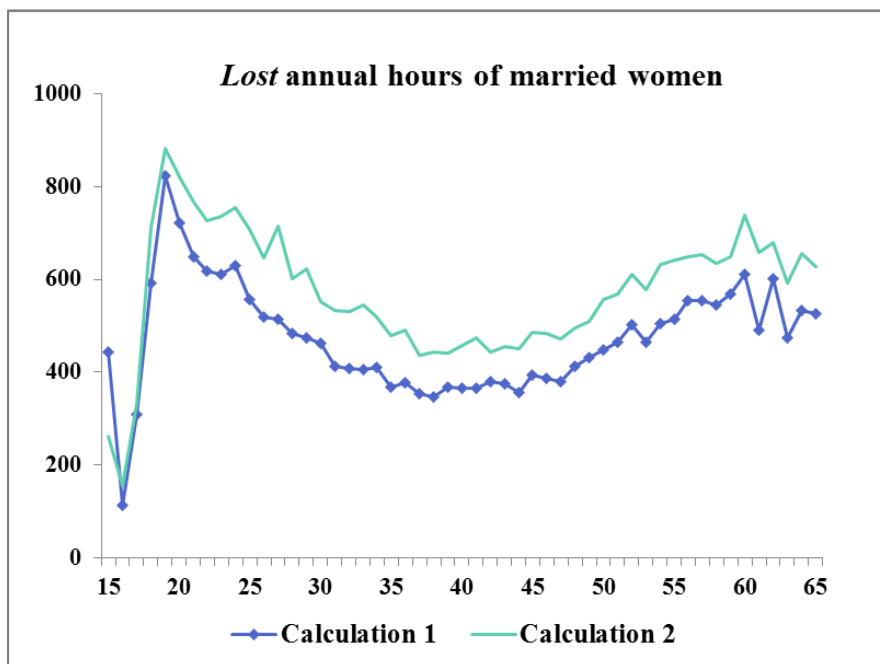
Note: Author calculation from LFS 1985-2015. Calculation 1 replaces participation rates of married women by married males. Calculation 2 replaces both the participation rates and hours-of-work of married women by married males.

Figure 5.2: Life-cycle mean monthly earning by gender and marital status (LFS 1985-2015)



Note: Author calculation from LFS 1985-2015. Each plot shows mean monthly income along the life-cycle, averaged across all four 10-year birth cohorts (1950-1989).

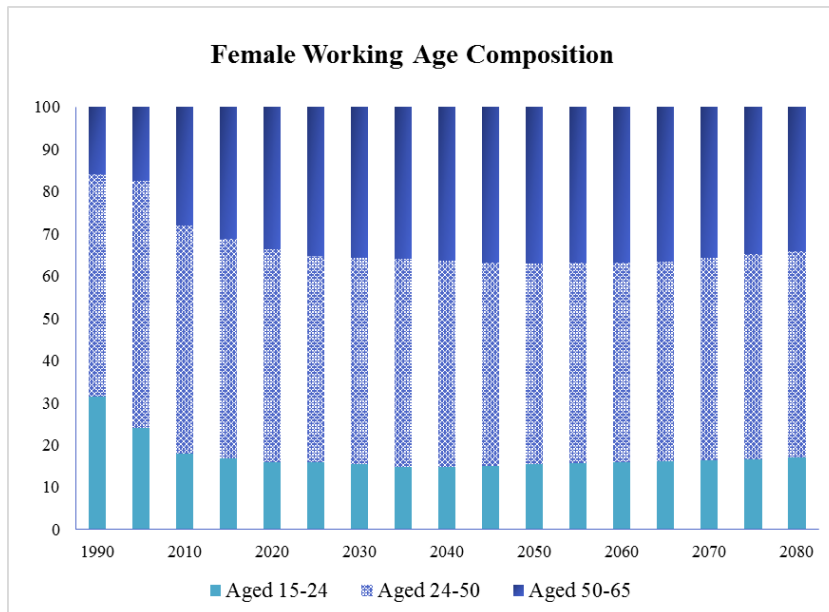
Figure 5.3: Lost annual earnings of married women



Note: Author calculation from LFS 1985-2015. Calculation 1 replaces participation rates of married women by married males. Calculation 2 replaces both the participation rates and hours-of-work of married women by married males. Both calculations are based on married women monthly earnings at each age along the life cycle (average across all birth cohorts).

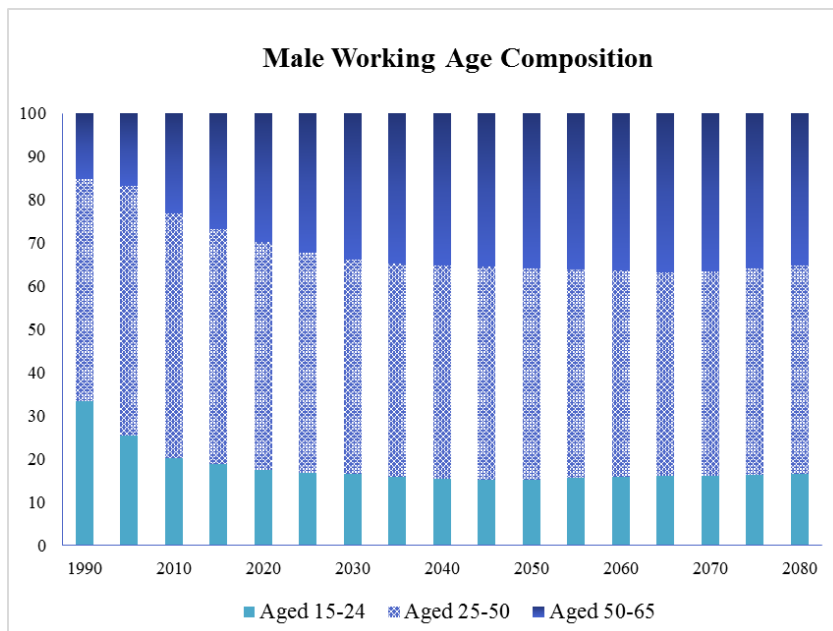
Appendix Figure

Figure A.1: Forecast of age composition for Thai women



Source: UNDP Estimated Population Composition (2017)

Figure A.2: Forecast of age composition for Thai men



Source: UNDP Estimated Population Composition (2017)